Dear Sir/Madam,

I wish to request the following records under the FOI Act 2014:

1) Any cost benefit analyses, audits, value for money reports, or other investigations/reviews carried out by the Department (or by people on their behalf) in relation to the Metropolitan Area Network (MAN) scheme.

2) Any reports issued to EU institutions in relation to the Metropolitan Area Network (MAN) scheme, including but not limited to, accounting for the expenditure of ERDF grants.

I wish to receive the documents in digital format.

Kind regards
FOI Request Reference: FOI/2015/16

Dear

I refer to your request which was received by this office on 18/02/2015 which you have made under the Freedom of Information Act 2014 for records held by this FOI body. Your request sought:

1) Any cost benefit analyses, audits, value for money reports, or other investigations/reviews carried out by the Department (or by people on their behalf) in relation to the MAN scheme
2) Any reports issued to EU institutions in relation to MAN scheme, including but not limited to, accounting for the expenditure of ERDF grants.

The decision maker handling your request is Ms Breda Holly, Telecommunications Market Contracts and National Digital Strategy Division, Department of Communications, Energy and Natural Resources and they can be contacted at 01 6782393. A final decision on your request would normally be sent to you within 4 weeks, where a week is defined as 5 working day excluding the weekend and public holidays. This means that you can expect a decision letter to issue not later than 19/03/2015.

There are some limited situations under the FOI Act which could mean that the period for a final decision may be longer than this 4 week period. If this occurs in the case of your request, you will be advised promptly in writing setting out the reason and the new decision date.

Should our final decision not reach you on time, please feel free to contact the decision maker named above to discuss any problems that may have arisen. If you have not heard from us once the allotted time has expired, you are automatically entitled to appeal for a review of the matter. This review proceeds on the legal basis that the initial request is considered to be refused once the specified time for responding to it has expired. The review is a full and new examination of the matter carried out by a more senior member of staff.

In the event that you need to request such a review, you can do so by writing to FOI Unit, Department of Communications, Energy and Natural Resources, Elm House, Earlsvale Rd, Cavan, Co Cavan or alternatively by sending an e-mail to FOLUNIT@dcenr.gov.ie. You should state that you are seeking this review because an initial decision was not sent to you within the time allowed for a response. In that event, you would normally have 4 weeks (after the initial decision should have been sent to you) in which to make the appeal. Consideration will be given to late applications in appropriate circumstances.

Should you wish to discuss the above, please contact me by telephone at 01 6782903.

Yours sincerely,

Carmel Conaty
FOI Unit

Fáiltitear roimh comhshreagras i nGaeilge

Teach Leamhán,                        ☏ +353 1 6782000                        Elm House,
Bóthar Ghléann an Iarla,              LóGhlaio 1890 44 99 00 LoCall          Earlsvale Road,
An Cabhán                               Fenics +353 1 6783057 Fax              Cavan
Dear

Re: FOI request 2015/16

I refer to the request which you made under the Freedom of Information Act 2014 for records held by this body:

1) Any cost benefit analyses, audits, value for money reports, or other investigations/reviews carried out by the Department (or by people on their behalf) in relation to the Metropolitan Area Network (MAN) scheme.

2) Any reports issued to EU institutions in relation to the Metropolitan Area Network (MAN) scheme, including but not limited to, accounting for the expenditure of ERDF grants.

I have now made a final decision to refuse your request on 11 March, 2015.

The purpose of this letter is to explain that decision. This explanation has the following parts:

1. a schedule of all of the records covered by your request;
2. an explanation of the relevant findings concerning the records to which access is denied, and
3. a statement of how you can appeal this decision should you wish to do so.

This letter addresses each of these three parts in turn.

1. Schedule of records

A schedule is enclosed with this letter, it shows the documents that this body considers relevant to your request. It describes each document and refers to the sections of the FOI Act which apply to prevent release. It also gives you a summary and overview of the decision as a whole.

2. Findings, particulars and reasons for decisions to deny access

The sections of the Act which can apply to deny access to documents are known as its exemption provisions.

In relation to Item 1 of your request, you will note that Section 15(d) of the FOI Act 2014 provides that documents already in the public domain may be refused on the basis that they are already available. The only documents that I can find in which a review of the MANs were carried out are itemized in the attached Schedule and I attach copies of two of these documents for your convenience. The other records are available on the C&AG website.

With regard to Item 2 of your request, this Department does not hold these records. Reporting to the EU on the MANs Programme and related expenditure was carried out by the two Regional Assemblies i.e. Southern Regional Assembly and Northern and Western Regional Assembly. You should contact the FOI Officer at those organisations for information. Some material may be available on the relevant
Any investigations/reviews carried out by the Department in relation to the MAN scheme 2) Any reports issued to EU institutions in relation to MAN Scheme, including but not limited to accounting for the expenditure of ERDF grants

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Value for Money and Policy Review of the Metropolitan Area Networks (Phase 1)

Department of Communications, Energy and Natural Resources
Roinn Cumarsáide, Fuinnimh agus Acmhainn Nádúrtha

June 2008
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Executive Summary

This is a Value for Money and Policy Review (VFMPR) of Phase 1 of the Metropolitan Area Networks (or MANs) programme. This programme was rolled out by the Department of Communications, Energy and Natural Resources in the period 2003-2005. In short, MANs are loops of fibre optic cable located within cities and towns, designed to link local access networks (or the 'local loops') to national telecommunications networks.

The review covers the 27 MANs built in Phases 1 and 1A. This programme was completed by 2005 at an expense of €78m (Central Exchequer funds). In particular, the review closely examines the MANs built in Cork, Galway, Athlone, Tullamore, Mullingar and Ballina. These were chosen as exemplars of MANs of different sizes in order to provide a more detailed perspective on the operation of various MANs.

This review was begun in September 2006, and formed part of the Department of Communications, Energy and Natural Resources 2004-2008 Scheme of Reviews. It was coordinated by a Steering Group chaired by Ms Úna Nic Giolla Choille (PO).

Terms of Reference

Draft Terms of Reference were drawn up using the revised template circulated by the Expenditure Review Central Steering Committee (ERCSC) in July 2003, and approved by the Departmental Steering Group. These finalised terms of reference (TOR) are set out below.

This review will:

1. Identify the objective(s), (original and revised) of the MANs programme (Phase 1) funded through the Department of Communications, Energy and Natural Resources,
2. Examine the current validity of those objectives in the light of developments/trends since 2002 and their compatibility with the overall strategy of the Department of Communications, Energy and Natural Resources,

3. Identify the level and trend of costs and staffing resources associated with each programmes and thus comment on the efficiency with which it has achieved its objectives,

4. Examine the extent to which each programme's objectives have been achieved, and comment on the effectiveness with which they have been achieved,

5. Define the outputs associated with each programme activity and identify the level and trend of those outputs,

6. Evaluate the degree to which the objectives warrant the allocation of public funding on a current and ongoing basis and examine the scope for alternative policy or organisational approaches to achieve these objectives on a more efficient and/or effective basis,

7. Specify potential future performance indicators that might be used to better monitor the performance of MANs programmes. Also to assess whether or not the indicators currently being measured sufficiently measure the effectiveness of the programme,

8. Make recommendations in relation to efficiency, effectiveness and value for money insofar as the MANs programme is concerned.

Scope of the Review
The review also sought to establish the following items of information:

1. Whether the programme was delivered on time and on budget,
2. The levels of use of each MAN,
3. The characteristics of towns that make some more "attractive" for take-up,
4. The cost, per population coverage and per corporate customer. In addition the resources and costs incurred by the Department and local authorities will be considered.
5. The impact of the scheme on competition in the broadband market and the degree to which government intervention was justified.
6. Suggested amendments, if any, to the scheme.

Findings
The review found that the MANs programme made a significant but not unqualified contribution to the development of telecommunications infrastructure in Ireland at a time when there was an identified market failure on the part of telecommunications operators regarding investment in network assets. The immediate take up on the MANs, the uses to which they are being put and the impetus provided to competition in the sector shows the justification for and the value of the State intervention. Moreover, while regulatory developments were critical in and of themselves in this process, the MANs facilitated and enabled many of these regulatory decisions, and provided a critical open access route for competitors to gain access to local markets.

Importantly also, the IDA are unequivocal in their view that the MANs have provided their client customers with much greater choice, service and better prices when it comes to broadband (and telephony) connectivity. On that basis, the MANs have contributed significantly to the competitiveness of regional centres in Ireland and thus their attractiveness to international foreign direct investment, both new and existing. The networks continue to experience growth in use, and have been found to result in significant cost saving to operators, and to have introduced an important degree of competition in the market.

However, this review also finds that the MANs intervention seems less suited to smaller urban centres, whether defined either in terms of outright population or in terms of the level of economic activity. For example, 5 of the phase 1 MANs, located among the smallest of the towns selected, are without a client. The reasons for this seem to revolve around the fact that there is a significant cost to operators to connect
to the MAN and, without a critical mass of population, operators tend to choose not to use the MAN. This does not mean that residential broadband services are not available in these centres. In all cases, such services are now available by means of alternative technologies. Nor does it mean that broadband investment, including MANs are never justified in these locations (see below).

In that context, the ongoing rollout of Phase 2 MANs, mainly in smaller towns (often less than the 9,000 population threshold figure identified in the review) is called into question. This review recommends that the rollout of MANs in those towns for which Phase 2 MANs are planned but which have not yet started work (or have not yet entered legally binding contracts), should be halted pending a formal case by case evaluation. This evaluation should be conducted on the basis of the Capital Appraisal Guidelines from the Department of Finance, and include either a Multi Criterion Analysis or Cost Benefit Analysis, and set out Key Performance Indicators for any future projects. From this evaluation of Phase 1, suitable indicators include the market need, forecast vs actual development cost, forecast vs actual infrastructure delivered, operating costs and revenues, numbers of contract customers on the MAN, and ideally, the effect on the price of connectivity in the given centre. It should also take into account the National Broadband Scheme and the choice of the most appropriate technological solution.

From the development agencies' perspectives, the towns for priority investment are those identified in the National Spatial Strategy (NSS) and the key county towns. Of the towns identified in the NSS as Hubs and Gateways, Tralee and Killarney have been included in Phase 2. Of the county capitals, Trim/Navan and Longford are also included. At the completion of Phase 2, five NSS towns will not have had a MAN constructed: Tuam, Ennis, Shannon, Castlebar and Mallow.

While there may not be an immediate economic argument for the provision of a MAN in these towns on the basis of their size now, there is however a longer term argument that providing this investment now will ensure the provision of high quality services and ultimately secure sustainable economic growth in these towns as they achieve a critical mass of population and economic activity in the future. It is also possible that more suitable solutions may be found for those smaller settlements not judged to
have, or be likely to attain, sufficient scale to require a MAN. The rollout of the National Broadband Scheme will ensure that broadband access is available in all parts of the State.

The review also found that the planning and selection process behind the MANs were less than fully comprehensive. While there was a substantial amount of analysis behind the concept (analysis that was borne out by the effectiveness of the MANs in certain circumstances), the selection process used in deciding which town would receive a Phase 1 MAN was not sufficiently thorough. The Review recommends that future projects be subject to the full rigours of the Capital Appraisal Guidelines, and that robust selection criteria are drawn up before beginning the process of selecting the towns.
Recommendations
As discussed above, the MANs programme proved itself to be a cost effective and appropriate way of delivering infrastructure. The technology solution chosen was appropriate, and it made a significant contribution to inducing competition and greater availability of services within the sector. Equally, the programme caused no apparent difficulties or undue distortion with regard to competition in the market. However, analysis conducted for all post project and expenditure reviews should as a matter of course generate recommendations that serve to improve and streamline policy development and programme design. While some of the recommendations made in this case relate specifically to the MANs programme, others apply, in a general sense, to all capital projects or interventions in the market.

1. While the administration of the scheme has been appropriate and cost effective, the prioritisation of urgency, while understandable in the context of the time, over proper planning at the outset has had a number of important consequences for the project. It should be reiterated that it is standard practice for any such intervention to proceed only after the full application of the Capital Appraisal Guidelines, including full needs analysis, options analysis and documented decision, design and planning stages and that these requirements need to be observed in all policy development instances.

2. The lack of appropriate baseline data, and the nature of the selection procedure for the Phase 1, and particularly for the Phase 1A, MANs, meant that a number of inappropriate locations were selected. Future projects in this sector require a more rigorous planning phase before construction can commence.

3. The lack of a formal review after the completion of the first phase of the MANs, and before the inception of the second, meant that some of the difficulties experienced were overlooked. While the situation was difficult, dynamic and pressurised, such a review would have contributed greatly to the later operation of the scheme. In the case of future such iterative schemes, such a review is highly advisable.
4. Despite the timing difficulties, the Gateways and Hubs selected by the NSS should have received greater and more systematic attention from the MANs programme and this should be the case in any future similar intervention in the communications area.

5. It is clear that, even in the case of the towns selected for Phase 1A, the MANs model is not always the optimal solution. Any future such programme should examine all technical options as part of the assessment process.

6. The telecommunications market is significantly more mature at this point (Q3, 2007) than previously, and certainly more so than at the time of the decision being taken to go ahead with the MANs; the MANs intervention model is no longer considered appropriate in all circumstances. A significant argument exists for new MANs in those remaining NSS Gateway and Hub towns that are destined for significant future development. Consideration could also be given to towns of a significant size and level of economic activity, subject to a clear and comprehensive evaluation process, as set out above. The Department should fulfil its legal obligations with respect to Phase 2 towns but not proceed with any towns for which there is no contract in place until such a time as a full evaluation has been carried out.

7. The fact that MANs exist and have considerable spare capacity should not become a driver of future communications policy and the development of associated programmes in and of itself. While it is logical that this investment be leveraged if possible, further investment directed solely at ‘making use’ of the MANs would not be wise.

8. Measuring the impact or outcomes of the intervention proved to be difficult as the outcomes are a function of a wide range of factors. However, it was further complicated by the fact that there was insufficient data collected at the planning stage against which progress could be monitored. Consequently, for
future projects in this policy area, more attention should be paid to collecting key baseline data at the planning stage of the project.

9. The lack of a coherent pre project assessment also meant that ongoing monitoring of the scheme was very difficult, if not impossible, in a real sense. Any future project in this sector should have a set of clear and transparent Key Performance Indicators set out at its inception to allow for ongoing monitoring of the programme.

10. The lack of pre planning, and interim reviews in relation to the MANs programme were important oversights. However, even if such controls were in place, the Department must have the facility to terminate the programme if the intervention is judged to no longer be required on the basis of a rational analysis, or indeed in the face of more pressing priorities elsewhere in the communications sector. Any future programme should have an open and transparent mechanism by which it can be closed with a minimum of legal and financial implications for the State, even if that involves a mid life termination clause in contracts,
Chapter 1

This chapter sets out the background and the terms of reference to this Value for Money and Policy Review of Phase I of the Metropolitan Area Network (MANs) projects conducted under the auspices of the Department of Communications, Energy and Natural Resources.

1.1 The Department of Communications, Energy and Natural Resources

The Department’s mission statement with regard to telecommunications, as set out in the Statement of Strategy, is to “promote the sustainable development, management and regulation of the communications, energy, marine and natural resources sectors in support of national economic and social policy objectives”.

The core goal of the Department with regard to Communications is “to contribute to sustained macro-economic growth and competitiveness and to ensure that Ireland is best placed to avail of the emerging opportunities provided by the information and knowledge society, by promoting investment in state-of-art infrastructures, by providing a supportive legislative and regulatory environment, and by developing a leading edge research and development reputation in the information, communications and digital technologies sectors.”

The Department has identified four strategic objectives for the communications sector:

- To place Ireland on a competitive par with key comparator OECD economies in terms of key Internet and communications benchmarks, including price, quality and choice.
- To create a legislative framework that provides for strategically focused, competitive and commercially-aware regulation of the communications sector

1 All future references to ‘Department’, unless otherwise stated, refer to the sequence of government department with responsibility for communications policy – from the Department of Public Enterprise (1997-2002) through the Department of Communications Marine and Natural Resources (2002-2007) and finally the Department of Communications, Energy and Natural Resources (Oct 2007-).
and a flexible legal environment to meet business and public service requirements.

- Promote increased Information Society inclusion at both the regional and community-based levels.
- To support the creation of a research entity and a vibrant digital media content industry based around DMDL (Digital Media District Ltd).

In the recent past, for a variety of economic and geographical reasons, the market had not delivered the desired levels of investment in the telecommunications sector in an appropriate timeframe and consequently Government intervention was required by means of a series of interventions in the marketplace. This is a Value for Money and Policy Review of one such intervention: Phase 1 of the Metropolitan Area Network programme under the National Development Plan 2000-2006. This programme was funded via the E-Commerce and Communications measure of the Regional Operational Programme of the National Development Plan.

Metropolitan Area Networks (MANs), are, as the title suggests, networks of high capacity fibre optic cable laid in urban areas. They act as an intermediate loop, providing a physical link to the national network from local nodes on the MAN via backhaul. The programme to invest in fibre optic metropolitan area networks was announced in March 2002. Construction commenced in 2003 with the last MAN of phase 1 was completed in 2005. The first phase included Exchequer investment of €78m over the years 2003 - 2005. The Department has already commenced construction of a second phase of the MANs at a projected cost of €121m in 92 towns (€74m contractually committed at end 2007). An evaluation of the first phase has been deemed critical in determining whether or not a third phase of MANs should commence, and to suggest amendments to the programme were such a phase to go-ahead. Although a number of reviews have been conducted on the MANs, this will be the first VFMPR.

1.2 VFMPR Framework
The Public Service Management Act 1997 and the Comptroller and Auditor General (Amendment) Act 1993 set the background for Value for Money Reviews (VFMRs).
The objectives of a VFMPR are to analyse Exchequer spending in a systematic manner and to provide a basis on which more informed decisions can be made. It is one of a range of modernisation initiatives aimed at moving public sector management away from the traditional focus on measuring inputs to more holistic perspective, examining the efficiency and effectiveness with which interventions operate. VFMPR topics are proposed by each Department and Office, in consultation with the Department of Finance, and are subject to the approval of the Government for each three-year cycle of Reviews.

1.3 Review Team
As required by the Department of Finance guidelines for the review process, a Departmental Steering Group has been established in DCENR since the establishment of the Department in its current form in 2002. The membership of this group is as follows:

Una Nic Giolla Choille, Principal, Energy Planning and Co-ordination Division
Niall Kelly, Head of Internal Audit
Kieran Duffy, Assistant Principal, Communications (Development) Division
Susan McCarthy, Corporate Finance & Planning
Richard A. Browne, Assistant Principal, Staff Development
Thomas Wickham, Value for Money Unit (Secretary)
John Rice, Assistant Principal, Communications (Postal & Regulatory) Division

The Steering Committee held its first meeting in September 2006. Terms of reference were agreed in consultation with the Public Expenditure Division of the Department of Finance. The process is overseen by the Central Steering Committee on Programme Evaluation, the chairman of which comes from the Department of Finance.

1.4 Terms of Reference

Draft Terms of Reference were drawn up using the revised template circulated by the Expenditure Review Central Steering Committee (ERCSC) in July 2003, and
approved by the Departmental Steering Group. These finalised terms of reference (TOR) are set out below.

This review will:

9. Identify the objective(s), (original and revised) of the MANs programme (Phase I) funded through the Department of Communications, Marine and Natural Resources.

10. Examine the current validity of those objectives in the light of developments/trends since 2002 and their compatibility with the overall strategy of the Department of Communications, Energy and Natural Resources.

11. Identify the level and trend of costs and staffing resources associated with each programmes and thus comment on the efficiency with which it has achieved its objectives

12. Examine the extent to which each programme’s objectives have been achieved, and comment on the effectiveness with which they have been achieved

13. Define the outputs associated with each programme activity and identify the level and trend of those outputs

14. Evaluate the degree to which the objectives warrant the allocation of public funding on a current and ongoing basis and examine the scope for alternative policy or organisational approaches to achieve these objectives on a more efficient and/or effective basis

15. Specify potential future performance indicators that might be used to better monitor the performance of MANs programmes. Also to assess whether or not the indicators currently being measured sufficiently measure the effectiveness of the programme.
16. Make recommendations in relation to efficiency, effectiveness and value for money insofar as the MANs programme is concerned.

1.5 Scope of the Review
The review covers the 27 MANs built in Phases 1 and 1A. This programme was completed by 2005 at an expense of €78m (Central Exchequer funds). In particular, the review closely examines the MANs built in Cork, Galway, Athlone, Tullamore, Mullingar and Ballina. These were chosen as exemplars of MANs of different sizes in order to provide a more detailed perspective on the operation of various MANs.

The review also sought to establish the following items of information:

7. Was the programme delivered on time and on budget.
8. The levels of use of each MAN
9. The characteristics of towns that make some more “attractive” for take-up.
10. The cost, per population coverage and per corporate customer. In addition the resources and costs incurred by the Department and local authorities will be considered.
11. The impact of the scheme on competition in the broadband market and the degree to which government intervention was justified.
12. Suggested amendments, if any, to the scheme

1.6 Methodology
The review contextualises the programme in terms of Government policy and developments in the sector. A background literature review was conducted, examining relevant reports and other documentation and analysing expenditure for the period under review. Secondary data sources were supplemented by ongoing consultation with the Communications (Development) Division, eNet (the managers of the MANs), Magnum Opus (consultants to the Department) and the Central Statistics Office (CSO). A number of the external stakeholders key to the success of the project were also consulted, including communications companies and corporate customers. The Commission for Communications Regulation (ComReg) also acted as a source of
market and trend data such as broadband penetration across time as well as wholesale
and retail broadband prices.

A critical methodological problem experienced throughout this review however, is the
fact that the MANs are long term investments. The programme is still at a relatively
early stage in its life cycle, therefore measuring ultimate outcomes, such as net
contribution to economic growth in a particular region, is not possible at this stage.
The review therefore concentrates on the inputs, outputs and interim outcomes with
the aim of providing an indication of the success, or otherwise, of this programme,
with a view to informing future decision making in this sector.

Programme Logic Model:
Inputs: Central government funding for the capital works, local authority funding, the
department’s consultancy costs and own staff costs associated with this programme.

Activities: Number of grants aided projects identified and funded.

Outputs: Fibre kilometres, drop connections, duct space, timing of project delivery
vis-à-vis projections and budget.

Interim Outcomes: The review looks at the number of operators (new to the town)
on network (measuring competition), revenues generated by the management services
entity (MSE) and the amount of new traffic. The review also considers the trends in
broadband penetration and price.

Format of the Review
Chapter 1: Context, Terms of Reference and Focus of Review.
Chapter 2: Background: Policy Environment, Markets and Context (TOR 1&2)
Chapter 3: Programme Progress, Efficiency and Effectiveness (TOR 3)
Chapter 4: Outcomes and Impacts. (TOR 4&5)
Chapter 5: Conclusions, Recommendations and Lessons Learned (TOR 6,7&8)
Chapter Two: Objectives

2.1 Introduction
This chapter sets out the context within which the programme under review came into being, the origins of the programme and its aims from the outset. In doing so, the chapter addresses items 1 and 2 of the Terms of Reference. It is set out as follows. Firstly, a brief examination of the benefits of advanced ICT infrastructure is provided, followed by a review of the situation with regard to the telecommunications sector in Ireland at the time of the genesis of the MANs. This is then followed by an examination of the theoretical underpinnings used to justify the MANs intervention (the objectives of the programme in other words), followed in turn by an examination of the current validity of the objectives.

2.2 Benefits of Advanced ICT Infrastructure
Advanced ICT infrastructure is a basic requirement for states wishing to compete on, and integrate with, global markets. Forfás, the state development agency, has in a number of its reports from 1998 to the present, identified advanced telecommunications services as being of critical importance to the country if it is to continue to attract foreign direct investment – a central tenet to the State’s industrial policy. It is also identified as being of importance for the promotion and development of indigenous industry.

Furthermore, the agency identified a number of ways in which broadband may enable higher productivity. It does so by:

- “Allowing firms to cast their net wider when looking for suppliers or seeking new market opportunities to increase their customer-base;
- More effectively linking business functions e.g. sales, design, manufacturing, supply chain, stock control, accounts; and
- Empowering employees in the field to add more value for clients in a shorter time.”
A number of “societal” benefits of broadband have also been identified by Forfás, namely:

- Improving the efficiency, availability and reach of public sector services in areas such as health, education and other government services;
- Enhancing the quality of life for consumers, through economic, social and cultural development; and
- Enabling for economic and social inclusion for smaller communities

In 1998 Forfás recommended that, in addition to telecommunications liberalisation, up to IR£150m be invested in fibre optic cable to provide an intermediate network, linking national backhaul to local access networks over the next five years and that failure to do so could result in significant job losses and an underperformance in terms of GDP. Conversely, Forfás suggested that by investing to address this infrastructure gap, the economy’s GDP could increase by €5.1 billion by 2010. A number of international studies\(^2\) would appear to support these findings.

This review concerned with the efficiency and effectiveness with which the delivery of broadband services has been aided by means of the MANs initiative.

2.3 The Telecommunications Sector in Ireland 1998-2002

From shortly after the foundation of the state, the telecommunications sector in Ireland was dominated by a state owned monopoly. Until 1984, this was part of a Government Department (Posts and Telegraphs). However, in parallel with other developed economies, the State moved progressively towards a liberalised, regulated, market during the 1990s, with the telecommunications operator established as a state owned company (Telecom Éireann) in 1984. The telecommunications market was fully liberalised in late 1998, over a year later than in some other EU countries. This delay proved critical, as is shown later. The state owned monopoly, now called Eircom, was privatised in July 1999.

A dramatic international downturn in the technology sector from late 2000 as a consequence of what became known as the ‘dot-com bubble’, meant that further

\(^2\) Such as “Measuring Broadband’s Economic Impact”, US Department of Commerce, 2006
investment was limited in the early part of the next decade. This was a particular problem in Ireland given that liberalisation itself had been delayed, allowing other comparable countries a head start with regard to private sector investment. Importantly, in the years before this, there had been very significant investment in fibre optic cabling and other network infrastructure across the developed world. In Ireland, this investment was largely limited to Dublin. However, after the dot com bubble burst, many of the companies that had invested heavily in fibre went out of business, leaving their assets to be picked up at a significant discount. This meant that fibre access became extremely cheap, very quickly, as these written down assets were put to use by their new owners. However, in Ireland, this cheap access was limited to Dublin, as very little fibre had been laid outside the capital.

This problem was compounded by the fate of Eircom, still by far the largest telecommunications operator in the Irish market. ‘Re-financing’ by new owners meant that the company was unable or unwilling to significantly invest in its networks. This led to a situation whereby the penetration of high speed residential broadband in Ireland was far lower than in other OECD states in 2002-3, due in part at least to the fact that the service was simply unavailable in large parts of the state.

This infrastructure deficit was highlighted by a number of organisations, such as Forfás in its benchmarking studies. In its 1998 report “Broadband Telecommunications Investment in Ireland” noted that “where there is evidence of market failure in the provision of required infrastructures, the government should develop strategies to ‘pump prime’ the required infrastructures in conjunction with the private sector.” In its 2002 update report Forfás commented that “the desired outcomes of world class broadband services and coverage at prices among the most competitive in the OECD still remain to be achieved”. It also stated that SMEs and companies located outside of Dublin did not have a positive experience in term of availability and price of broadband services. There was also a lack of competition in the provision of services in the regions and these factors, when combined resulted in Ireland’s poor international ranking among OECD competitor countries.

The table below, dating from June 2001, shows Ireland’s performance with regard to other OECD countries at that time.
Table 2.1 Broadband Penetration in OECD Countries, 2000-2001

<table>
<thead>
<tr>
<th>Country</th>
<th>% Increase in DSL</th>
<th>Total Broadband Penetration</th>
<th>Rank (out of 30)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Korea</td>
<td>53</td>
<td>13.91</td>
<td>1</td>
</tr>
<tr>
<td>Canada</td>
<td>51</td>
<td>6.22</td>
<td>2</td>
</tr>
<tr>
<td>Sweden</td>
<td>190</td>
<td>5.52</td>
<td>4</td>
</tr>
<tr>
<td>USA</td>
<td>37</td>
<td>3.24</td>
<td>3</td>
</tr>
<tr>
<td>Netherlands</td>
<td>547</td>
<td>2.74</td>
<td>6</td>
</tr>
<tr>
<td>Austria</td>
<td>79</td>
<td>2.36</td>
<td>5</td>
</tr>
<tr>
<td>Denmark</td>
<td>164</td>
<td>2.33</td>
<td>8</td>
</tr>
<tr>
<td>Belgium</td>
<td>114</td>
<td>2.27</td>
<td>7</td>
</tr>
<tr>
<td>Germany</td>
<td>290</td>
<td>1.03</td>
<td>15</td>
</tr>
<tr>
<td>France</td>
<td>177</td>
<td>0.59</td>
<td>16</td>
</tr>
<tr>
<td>Spain</td>
<td>251</td>
<td>0.47</td>
<td>20</td>
</tr>
<tr>
<td>Italy</td>
<td>108</td>
<td>0.44</td>
<td>19</td>
</tr>
<tr>
<td>UK</td>
<td>150</td>
<td>0.28</td>
<td>22</td>
</tr>
<tr>
<td>Ireland</td>
<td>0</td>
<td>0.01</td>
<td>25</td>
</tr>
</tbody>
</table>

Forfás 2002DSL Coverage: households in 2001

Source: OECD 2001, Analysys (reproduced by Forfás)
In this report, Forfás estimated that, due to the changed economic climate at the time, the investment required in broadband would only happen over three to four years in “core” areas and over a longer period in the regions. It suggested that a combination of private sector investment, Public Private Partnerships and state intervention would likely be required. It also highlighted the need for a “certain and conducive regulatory telecommunications environment for broadband investment” and the need for demand side programmes.

The origins of the MANs stem therefore from a Government desire to accelerate provision of and access to broadband services outside of Dublin. The diagnosis was that the critical problem arose from an infrastructure deficit providing access to local networks. In other words, while alternatives to Eircom’s national fibre loop existed, there was no competing network available to provide access to these competing systems from the local exchanges or other local nodes. This infrastructure deficit (between national and local) had been identified as a barrier to entry to competitors to Eircom and had resulted in the Ireland’s poor performance in terms of broadband availability when compared to other developed countries. The Department, in a submission to the European Commission, stated that “there appears to be an embedded reluctance on the part of the larger players in the market to invest in the requisite infrastructural, marketing, sales and support initiatives, even at entry level DSL.” The submission went on to say that “a mere 233 of the incumbent’s 1,166 exchanges” had been DSL enabled. (2004) DSL was available in only 40 towns out of a total of 140 with populations in excess of 1,500.

2.4 Government Funding of Communications Infrastructure before the MANs
As mentioned earlier, the communications sector in Ireland was fully liberalised in late 1998, meaning that the provision of communications infrastructure and services was primarily the responsibility of the private companies in that sector. However, through a series of initiatives, the Department co-funded private sector telecommunications companies to the construct of communications infrastructure through the Economic Infrastructure Operational Programme (1994-1999) and the National Development Plan 2000-2006 in cases where it was of the belief that the private sector would not deliver of its own accord. A first call for proposals under the NDP in 2000 was intended to allocate approximately €55m to private companies in
the anticipation that the total investment would amount to approximately €160m. The level of grant aid was set at up to 40% for companies in the Borders Midlands and Western Region and 20% for the Southern and Eastern Region. However, due to the difficulties faced by the global economy and the telecommunications market in late 2000 to 2001, a number of the companies due to receive funding went out of business and others were unable to complete their projects. In total, of the thirteen projects selected under the first round of the NDP, seven were never completed and one was significantly re-negotiated from its original scope and design. This resulted in an under-spend of approximately €20m.\(^3\)

A further call for proposals issued in mid 2001, on behalf of the Department of Public Enterprise, for communications/electronic commerce infrastructure projects aimed at promoting the development of the Information Society in Ireland, to be part-funded under the National Development Plan, 2000 – 2006 (See Annex 1 for a summary of the call for proposals). In addition to other programmes, a number of Local Authorities proposed local urban networks, which subsequently came to be known as Metropolitan Area Networks or MANs. These were to act as alternative high capacity fibre loops in urban areas, with access to the fibre being offered on a wholesale basis to private operators to link their national access (or ‘backhaul’) to local loops (or large business clients).

All proposals were evaluated by independent evaluators Norcontel (Ireland) Ltd in association with its partners, Peter Bacon & Associates, Philip Lee Solicitors and CO-COM. On the basis of the proposals received, Norcontel recommended both the concept and the networks proposed by a number of Local Authorities. The nature and quality of the responses meant that money originally ring-fenced for private sector projects was directed to funding the Local Authority projects. This was due partly to the low number of such private sector proposals (due to the difficulties the sector was in) or to perceived shortcomings in those private sector projects, and partly to the opportunity offered by these local access networks. The Department engaged in a

\(^3\) Annex 1 outlines a history of previous investment interventions by the State in the communications sector
discussion process with a number of Local Authorities on the benefits of these local access networks, and how they might be constructed.

The Government decision of March 2002 to proceed with the MANs was supported by the work and report of the Interdepartmental Working Group on Telecommunications. Established in September 2001, this group issued its report and set out the Government's guiding vision for the Information Communications Technology sector in March 2002.

The group noted that:

"The Government wants to see the widespread availability of open-access, affordable, 'always on' broadband infrastructure and services for businesses and citizens throughout the State within three years, on the basis of utilisation of a range of existing technologies and broadband speeds appropriate to specific categories of service and customers. We wish to see Ireland within the top 10% of OECD countries for broadband connectivity within three years".

It went on to say that the State's role should be to provide seed capital because "Government is not in the telecommunications business". There would also be a requirement that Government intervention would attract "the optimum level of private sector involvement and result in open-access and pro-competitive solutions".

While Government approval in March 2002 was premised on the analysis set out by the Interdepartmental Working Group, the report of that Group did not name or select the 19 towns, instead making a reference on the basis that the investment should "enable gateways identified under the forthcoming National Spatial Strategy to achieve a critical mass of development". The 19 towns approved by Government were proposed on the basis of the analysis set out in the Norcomtel Report.

Further investment was made contingent on the successful implementation of Phase 1. Following dialogue with local authorities in the northeast this was subsequently expanded to incorporate a total of 27 towns or locations, with an announcement made
in April 2004. The additional 8 MANs were also approved by Government at a later date.

The 19 Phase I towns proposed by local authorities and confirmed by Government for the construction of Metropolitan Area Networks were Cork, Limerick, Galway, Carlow, Kilkenny, Wexford, Waterford, Dungarvan, Clonmel, Athlone, Mullingar, Portlaoise, Tullamore, Roscommon, Ballina, Letterkenny, Carrick-on-Shannon, Manorhamilton and Gaoth Dobhair. Phase 1A included 8 additional MANs which will be included in this review: Dundalk, Drogheda, Carrickmacross, Monaghan, Cavan, Kingscourt, Kiltimagh and Sligo.

The decision to involve local authorities in the process to provide advanced communications infrastructure was considered by the Department and its advisers to be the most appropriate government intervention for a number of reasons:

1. local authorities have responsibility for local planning and needs analysis.

2. local authorities control the roads, access to the roads being the most the most difficult and costly part of building a broadband network.

3. provision of open-access networks is contrary to traditional operators' exclusivity of network, and allows for competition in a way that has not happened before.

4. this model is successfully deployed in other countries (e.g. StockAB in Sweden which the Department had visited, and Palo Alto in the USA).

5. the intervention falls short of government re-entering the actual provision of telecommunications services, leaving this to the private sector.

2.5 Market Failure in the provision of broadband in Ireland
In a liberalised market and in light of the reports produced by Forfás, a legitimate question relates as to whether or not there was market failure in the provision of broadband in Ireland and if there was, should it be addressed, and by what means.
Economic consultants⁴ advising the Department identified two separate sources of market failure in the communications sector that may require attention by Government.

At lower levels of output larger firms (for whom broadband access is mandatory or central to their operations and who may be able to obtain internal economies of scale in the usage of the technology) pay high prices for access. This correlates with situation in Ireland in the very late 1990s. Broadband was available, but at a price that could only be justified by commercial operations.

However, at slightly higher levels of demand, the price at which companies (and particularly a monopoly company) would be willing to supply services remains too high for potential customers. This leads to a “broadband gap” - or deficit - stemming from an under investment by the private sector in the provision of broadband services, with the consequence that customer demand is not met. At higher output levels, the cost to the supplier and therefore the price at which the service is supplied, provided competition is sufficient, is at or below the price level required to stimulate demand, and growth in broadband provision occurs.

The consultants concluded that there was risk that investment would not take place without State intervention to bridge that broadband gap - either by reducing the level of risk through reducing the cost of the investment that is required or to reduce the “over cost” of supply access to the services at all level below this output. The consultants concluded that finding a solution to overcome this gap required public intervention.

The consultants argued that there were considerable economies of scale facing a services provider if the market grew with very low marginal costs, meaning that the price of access could fall considerably as take-up increases. This, they argued, means that the infrastructure has characteristics akin to a public good and consequently there may be an underinvestment in infrastructure. This is particularly important given the fact that use of the technology is itself an important factor in encouraging further use.

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⁴ Peter Bacon & Associates, December 2002
In other words, firms do not realise the full potential of broadband until they have started to use it. This heightened risk means that a market failure could materialise that would prevent the growth of the industry even if the difficulty of a lack of competition were overcome. They concluded that access costs needed to be reduced in order to encourage demand and uptake, but that this would not happen until uptake was sufficient to allow for the economies of scale to arise.

From their assessment, the advisers concluded that “private sector provision of the infrastructure will be restricted to areas where there is a sufficient number of large users who are prepared to pay the high prices”. This would mean that investment would become targeted primarily in the larger cities, with obvious consequences for the regional balance of employment and economic growth. Additionally they conclude that whilst “adequate competition – either through market competition or more likely in the Irish case through regulation to enforce the theoretical outcome that competition would produce – is required to reduce prices” that this in itself was not enough to ensure an adequate level of investment to make low cost provision of services viable for users throughout the state.

The second market failure identified by the consultants was seen to arise due to the central role that broadband infrastructure could play in the development of Ireland along a “desirable path” and the existence of positive externalities meaning that important social benefits would not accrue to private developers, since they could not be charged for. This would also lead to a sub-optimal investment in broadband.

The consultants advised that the MANs programme (Phase 1) addresses the source of the market failure “by providing the infrastructure in areas where the market is unwilling to invest.”

In less technical terms, the Telecommunications Working Group Report of March 2002 concluded that “the primary problem is not at the national or regional level. The key deficit is in local access (sic) broadband networks. This results in a lack of availability of affordable ‘always on’ local level access to high-speed data transmission services”. Though not explicitly identifying the problem as a market
failure *per se*, the report sets out a clear case for intervention in these ‘middle mile’ solutions, namely that while there were a number of alternative national fibre loops available, there were no alternative means of connecting these to the ‘local loops’, save the network in the hands of the incumbent, Eircom.

2.6 Objectives of the MANs
Critically, there were no single set of specific objectives drawn up for the MANs at this point, rather the problem was comprehensively analysed and the MANs arrived at as the most suitable solution. The Interdepartmental Report set out the Overall Strategic Objective however as being *“Telecommunications are the key to the future and if Ireland moves fast, we have an opportunity to position ourselves to become one of the richest per capita countries in the world by 2020.”* The report then sets out the reasoning behind investing as being that a comprehensive and affordable broadband network would:

- Promote internationally trading, technology-based start ups in new economy areas
- Enhance our attractiveness for new foreign direct investment in the ICT area
- Enhance our capacity to retain existing such investment by giving Irish-located companies the potential to remain internationally competitive.
- Protect ongoing productivity growth and competitiveness in Irish industry by reducing costs. Use of broadband and related ICT applications is capable of reducing total costs significantly for industry.
- By stimulating demand, enhance the capacity of existing investment in backbone infrastructures to make a return.
- Disperse low-cost, always-on broadband Internet access across all regions and thereby support Government regional development policy.
- Help create a knowledge and information-based society
- Increase international access to and demand for Irish Internet sites and content on the internet and hence commercial opportunities for eCommerce in Ireland.

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5 The report refers to what became MANs as 'local access' solutions, however they are more commonly referred to as 'middle mile' or intermediate network solutions.
• Bring about real competition amongst telecommunication service providers, reduce consumer costs and enhance choice and consumer control

• Enable gateways identified under the forthcoming National Spatial Strategy to achieve a critical mass of development to support their regional development role in the NDP 2000-2006

• Work towards a fully inclusive information society.

MANs therefore were part of the chosen methodology to bring about the benefits identified above, under a number of different measures (There were a number of other interventions also set out in the Report, including regulatory changes). On the basis of the Interdepartmental report and the subsequent Government Decision, the objectives of the MANs can therefore be summarised as being to;

• Promote investment in ICT infrastructure in regions where the market investment will be insufficient

• Promote the acceleration of the Information society and e-Commerce

• Promote competition in the communications sector

• Improve Ireland’s international standing in terms of broadband connectivity

• Address deficit in access to local networks.

One of the most important factors to be considered is that the programme was aimed at larger corporate customers and (on a wholesale basis) telecommunications companies and was not intended to directly provide residential broadband services. Government had also identified balanced regional development as a public policy goal under the National Spatial Strategy (NSS). Government policy identified broadband as a one of a "number of specific elements within these factors, whose
assembly at strategic locations in a targeted manner is vital to foster a wide range of enterprise activity and employment creation\(^6\).

The NSS came into being to provide an agreed spatial framework for policy development in the state, and identified a number of urban settlements that should be targeted for development. In this regard, and as outlined previously, advanced telecommunications services were identified as comprising a critical component in Ireland’s efforts to attract foreign direct investment, for the development of indigenous industry, the promotion of the knowledge economy and as being of critical importance in enabling Government to achieve its regional policy objectives. However, and as discussed later in this review, the NSS was published after Phase 1 (but not 1A) towns and cities of the MANS had been selected.

There was no Cost Benefit Analysis carried out before the inception of the MANs programme, although the Interdepartmental Report does clearly identify the rationale behind the programme, and the expected benefits to accrue from same. The benefits were expressed in a qualitative rather than quantitative manner however. A formal analysis of the expected costs and benefits of the programme was carried out after it had begun, by private consultants.

2.7 Objectives of the MANs and their Validity and Compatibility with overall Department and Government Strategy

The first term of reference for the review requires a review of the objectives of the MANs. A key question in this regard is whether or not there was a rationale for the State to intervene in the provision of communications infrastructure in a fully liberalised market?

The strategy statement for the Department has as one of its high level goals the objective of optimising the contribution of the communications sector to “growth, competitiveness, innovation, environmentally sustainable and regionally balanced development, and social inclusion.” It additionally has set a target of cost effective

\(^6\) Page 36 of the National Spatial Strategy
provision of national and regional infrastructure priorities. Therefore it can be concluded that the objectives of the MANs were also valid and consistent in the context of the Department's overall policy direction.

Public expenditure on ICTs, including the MANS, was identified as being consistent with the objectives of the National Development Plan (2000-2006)\(^7\). It was also postulated in the NDP that investment in ICT would help continue sustainable economic and employment growth, consolidate and improve Ireland's international economic competitiveness, foster regional development and promote social inclusion.

The objectives of the MANs programme are therefore consistent with an attempt to address a clearly identified need – the provision of broadband in response to an identified market failure - and furthermore the programme was identified as being consistent with general Government policies. The validity of these goals for future policy makers, taking into account market developments since the launch of the first phase, will be dealt with in Chapter 5.

\(^7\) The Department conducted a review of its capital expenditure programmes in 2005
Chapter Three

This chapter examines the inputs and outputs of the project with a view to commenting on the efficiency and economy with which the project was run. Consequently, this chapter will address term of reference 3.

3.1 Departmental Resources

In consultation with the Communications (Development) Division it was established that the first phase of the MANs is estimated to have relied on the following department staff resources:

- 0.25 of a Principal Officer (PO)
- 0.75 of an Assistant Principal (PO)
- 1.0 Higher Executive Officer (HEO)
- 1.50 of an Executive Officer (EO)

These figures represent a "best guess" estimation of the staff resources used by the Department. As shall be seen later, the staff costs constitute a relatively small proportion of the total project costs (capital and current).

The Department did not have a detailed breakdown of the resources it used in managing the projects on a per-town basis so these costs were allocated on a pro rata basis according to the length of the MAN construction. For the purposes of the review, the total staff costs relating to these personnel were calculated from the fourth quarter in 2001 when the programme was being initially scoped and designed until the beginning of the first quarter 2005 when the work of the division switched its focus to the second phase of the MANs programme. It is assumed for the purposes of this exercise that the following annual staff salaries were incurred: PO at €82,066, AP at €62,058, HEO at €42,893 and EO equivalents at €31,153. For simplicity's sake, it is assumed that all staff have five years service in the grade and salaries are calculated from the Department of Finance Circular 17/2004 of July 2004.
The administration costs were estimated using the Department of Finance formula, which for this purpose calculates that the total staff cost is 187.31% of direct salary cost. This makes allowance for employers PRSI, imputed pension cost and overheads. Consequently, the aggregate figure is €953.816. This works out as €35,326 per MAN or €1,809 per kilometre installed. The capital grants paid for the first phase amounted to €78.25 million and therefore the Department’s staff costs amount to 1.22% of the capital grants paid.

3.2 Consultancy Costs

The consultancy costs for the design and construction of Phase 1 amounted to €3,044,910 or equivalent to 3.89% of the total grant paid. These consultancy fees relate to the pre-competition phase, the design of the tender process, the design of contract templates to be used across the various local authorities, the design of the drawdown contracts for the pieces of infrastructure that would be common across all networks, technical advice in relation to the design of the Metropolitan Area Networks and the administration of the payments process.

These costs can be broken down over the following categories:

<table>
<thead>
<tr>
<th>Category</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Legal</td>
<td>230,269</td>
</tr>
<tr>
<td>Economic/Market Analysis</td>
<td>28,812</td>
</tr>
<tr>
<td>Technical/telecommunications consultancy</td>
<td>2,415,352</td>
</tr>
<tr>
<td>Administration/certification</td>
<td>370,477</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>€3,044,910</strong></td>
</tr>
</tbody>
</table>

The department spent an additional €1.8 million on consultants in relation to establishing the Management Services Entity (MSE) to manage access to the 27 Phase 1 towns. Whilst not strictly speaking within the terms of reference of the review, the MSE and its operation are integral to the operation of the MANs and consequently these set-up costs can legitimately be incorporated into the analysis.
Taking this into account the total consultancy costs in relation to the project amount to €4.84 million. Of this, €827,000 related to the management of the infrastructure on an interim basis before this function was taken over by e1Net.

In total, therefore the administration of the project cost approximately €4.97m or 6.35% of the capital grant paid. On a per town basis, this amounts to €184,000 or €9,432 per kilometre constructed. It was not possible to establish with any degree of accuracy, the actual cost incurred per MAN and so the reviewer has apportioned these costs on a per kilometre basis.

**Summary of Costs**

- Capital grant, 1st Call: €78.25 million
- Departmental Staffing Costs: €953,816
- Consultancy Costs: €4,012

The total grant amounted to €78.25m. The total cost of administering the scheme has come to €4m (excluding the €827,000 spent on interim management). The total cost of the programme, including capital expenditure and total administration costs is therefore €83.25 million.

### 3.3 Outputs of the scheme

**Table 3.1 MANs by location and length**

<table>
<thead>
<tr>
<th>City/Town</th>
<th>Date of Contract Signing</th>
<th>Original Contract Duration (Weeks)</th>
<th>MAN Certification</th>
<th>Original Route Length (km)</th>
<th>Completed Route Length (km)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cork</td>
<td>10.02.2003</td>
<td>48</td>
<td>13.02.2004</td>
<td>54.00</td>
<td>58.70</td>
</tr>
<tr>
<td>Galway</td>
<td>03.02.2003</td>
<td>52</td>
<td>21.04.2007</td>
<td>44.00</td>
<td>51.70</td>
</tr>
<tr>
<td>Letterkenny</td>
<td>20.10.2003</td>
<td>43</td>
<td>11.08.2004</td>
<td>18.00</td>
<td>19.50</td>
</tr>
<tr>
<td>Gweedore</td>
<td>03.08.2003</td>
<td>26</td>
<td>09.07.2004</td>
<td>4.40</td>
<td>4.50</td>
</tr>
<tr>
<td>Carrick-On-Snn</td>
<td>06.08.2003</td>
<td>36</td>
<td>01.06.2005</td>
<td>9.00</td>
<td>10.00</td>
</tr>
<tr>
<td>Manorhamilton</td>
<td>05.08.2003</td>
<td>36</td>
<td>01.06.2005</td>
<td>5.00</td>
<td>5.10</td>
</tr>
<tr>
<td>Ballina</td>
<td>04.04.2003</td>
<td>29</td>
<td>05.03.2004</td>
<td>17.30</td>
<td>19.90</td>
</tr>
<tr>
<td>Killilmagh</td>
<td>04.04.2003</td>
<td>29</td>
<td>21.11.2003</td>
<td>3.50</td>
<td>3.50</td>
</tr>
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34
<table>
<thead>
<tr>
<th>Location</th>
<th>Date</th>
<th>Code</th>
<th>Date</th>
<th>Days</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Athlone</td>
<td>23.05.2003</td>
<td>38</td>
<td>18.08.2004</td>
<td>20</td>
<td>20.50</td>
</tr>
<tr>
<td>Roscommon</td>
<td>23.05.2003</td>
<td>38</td>
<td>18.08.2004</td>
<td>11.10</td>
<td>12.20</td>
</tr>
<tr>
<td>Tullamore</td>
<td>23.05.2003</td>
<td>38</td>
<td>18.08.2004</td>
<td>14.00</td>
<td>14.55</td>
</tr>
<tr>
<td>Mullingar</td>
<td>23.05.2003</td>
<td>38</td>
<td>18.08.2004</td>
<td>19.00</td>
<td>20.90</td>
</tr>
<tr>
<td>Portlaoise</td>
<td>23.05.2003</td>
<td>38</td>
<td>18.08.2004</td>
<td>14.50</td>
<td>15.25</td>
</tr>
<tr>
<td>Limerick</td>
<td>19.05.2003</td>
<td>27</td>
<td>20.04.2005</td>
<td>45.00</td>
<td>63.00</td>
</tr>
<tr>
<td>Carlow</td>
<td>04.11.2003</td>
<td>27</td>
<td>11.11.2004</td>
<td>10.00</td>
<td>13.50</td>
</tr>
<tr>
<td>Clonmel</td>
<td>04.11.2003</td>
<td>27</td>
<td>28.10.2004</td>
<td>15.50</td>
<td>19.30</td>
</tr>
<tr>
<td>Dungarvan</td>
<td>04.11.2003</td>
<td>27</td>
<td>03.09.2004</td>
<td>9.00</td>
<td>9.50</td>
</tr>
<tr>
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<td>27</td>
<td>25.11.2004</td>
<td>13.00</td>
<td>15.26</td>
</tr>
<tr>
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<td>27</td>
<td>11.10.2005</td>
<td>22.00</td>
<td>28.70</td>
</tr>
<tr>
<td>Kingscourt</td>
<td>09.12.2004</td>
<td>30</td>
<td>07.11.2005</td>
<td>4.50</td>
<td>4.50</td>
</tr>
<tr>
<td>Gavan</td>
<td>09.12.2004</td>
<td>30</td>
<td>07.11.2005</td>
<td>13.00</td>
<td>13.90</td>
</tr>
<tr>
<td>Monaghan</td>
<td>09.12.2004</td>
<td>30</td>
<td>05.12.2005</td>
<td>17.00</td>
<td>18.50</td>
</tr>
<tr>
<td>Sligo</td>
<td>10.11.2004</td>
<td>25</td>
<td>02.11.2005</td>
<td>20.00</td>
<td>24.00</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>459</td>
<td>527</td>
</tr>
</tbody>
</table>

Source: Magnum Opus Consultants

The eventual outputs in terms of kilometre of network constructed compares favourably to budget. In terms of the length of time taken to complete the networks the performance was less favourable with a number of very significant time overruns. These time overruns can be partially explained by the increased lengths and scale of the networks with some MANs being increased significantly beyond that originally planned for. The network constructed in Limerick ended up being 40% longer than originally contracted for but took approximately 48 weeks to complete instead of the 27 weeks originally forecast. Gweedore was originally forecast to take 26 weeks to complete but eventually took 48 weeks to complete. The increases in route length of the networks generally came about at the behest of the local authorities involved, as they reconfigured their individual projects. In general, these reconfigurations delivered longer MANs, with no significant effect on cost. While costs did not rise significantly however, the time taken to complete the individual projects, in some cases at least, did.
The Department, in order to ensure that there would be a uniformly high and consistent standard of raw materials used in each of the networks arranged that there would be central procurement for key pieces of network infrastructure: duct, sub-duct, fibre optic cable, collocation centres, chamber covers, optical distribution frames and fibre enclosures. This ensured that the Department could take advantage of economies of scale, and pass these on to local authorities and thereby ensure that the unit costs for these inputs did not vary across each network, as would invariably have been the case had the procurement been arranged on a per-MAN basis.

There were a number of variances across these in terms of the quantities delivered to each local authority and those installed although these were deemed by the Department’s technical advisers not to be material or could be explained by technical rationale. For example a total of 582 kilometres of fibre were delivered and 556 of these were installed. The advisers explained that contractors for the local authorities ordered additional fibre coils and would then fit them into chambers to facilitate future customer connections.

Table 3.2 Variance in details per MAN

<table>
<thead>
<tr>
<th>LOCAL AUTHORITY</th>
<th>MAN Town</th>
<th>Length of MAN</th>
<th>Original Length</th>
<th>Requested Grant</th>
<th>Actual Grant</th>
<th>Grant/Km</th>
</tr>
</thead>
<tbody>
<tr>
<td>CORK</td>
<td>Cork</td>
<td>58.70</td>
<td>54.00</td>
<td>11.45</td>
<td>10.97</td>
<td>186,882.</td>
</tr>
<tr>
<td>DONEGAL</td>
<td>Letterkenny</td>
<td>19.50</td>
<td>18.00</td>
<td>3.44</td>
<td>3.25</td>
<td>166,666.</td>
</tr>
<tr>
<td></td>
<td>Gweedore</td>
<td>4.50</td>
<td>4.40</td>
<td>0.48</td>
<td>0.54</td>
<td>120,000</td>
</tr>
<tr>
<td>GALWAY</td>
<td>Galway</td>
<td>51.70</td>
<td>44.00</td>
<td>8.39</td>
<td>8.97</td>
<td>173,500.</td>
</tr>
<tr>
<td>WESTMEATH</td>
<td>Mullingar</td>
<td>20.90</td>
<td>19.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Athlone</td>
<td>20.50</td>
<td>20.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LAOIS</td>
<td>Portlaoise</td>
<td>15.25</td>
<td>14.50</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ROSCOMMON</td>
<td>Roscommon</td>
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<td>11.10</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LEITRIM</td>
<td>Carrick-on-Shannon</td>
<td>10.00</td>
<td>9.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Manorhamilton</td>
<td>5.10</td>
<td>5.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Leitrim (total)</td>
<td></td>
<td>3.01</td>
<td>2.81</td>
<td>186,092.</td>
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</tr>
<tr>
<td>LIMERICK</td>
<td>Limerick</td>
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<td>45.00</td>
<td>6.15</td>
<td>6.2</td>
<td>98,412.7</td>
</tr>
<tr>
<td>MAYO</td>
<td>Ballina</td>
<td>19.90</td>
<td>17.30</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Kilnamack</td>
<td>3.50</td>
<td>3.50</td>
<td>4.19</td>
<td>4</td>
<td>170,940.</td>
</tr>
<tr>
<td>----------</td>
<td>-----------</td>
<td>------</td>
<td>------</td>
<td>------</td>
<td>---</td>
<td>---------</td>
</tr>
<tr>
<td>NORTH EAST</td>
<td>Dundalk</td>
<td>17.70</td>
<td>16.50</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Drogheda</td>
<td>17.75</td>
<td>17.50</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Carrickmacross</td>
<td>4.90</td>
<td>4.90</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Monaghan</td>
<td>18.50</td>
<td>17.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cavan</td>
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<td>13.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Kingscourt</td>
<td>4.50</td>
<td>4.50</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NE (Total)</td>
<td></td>
<td></td>
<td></td>
<td>12.1</td>
<td>11.07</td>
<td>143,300.</td>
</tr>
<tr>
<td>SOUTH EAST</td>
<td>Carlow</td>
<td>13.50</td>
<td>10.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Kilkenny</td>
<td>15.26</td>
<td>13.00</td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td>Clonmel</td>
<td>19.30</td>
<td>15.50</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dungarvan</td>
<td>9.50</td>
<td>9.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Waterford</td>
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<td>16.90</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Wexford</td>
<td>28.70</td>
<td>22.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE (Total)</td>
<td></td>
<td></td>
<td></td>
<td>15.34</td>
<td>15.97</td>
<td>149,784.</td>
</tr>
<tr>
<td>SLIGO</td>
<td>Sligo</td>
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<td>20.00</td>
<td>4.15</td>
<td>3.81</td>
<td>158,750.</td>
</tr>
<tr>
<td>Totals</td>
<td></td>
<td>527.17</td>
<td>459</td>
<td>79.88</td>
<td>78.25</td>
<td>148,434.</td>
</tr>
</tbody>
</table>

Source: Magnum Opus Consultants

As can be seen in the table above the average grant paid per kilometre of network produced over the entire first phase was €148,434. What the above table also highlights is the significant variances in the cost per kilometre across the various networks and local authorities. Limerick required the lowest levels of grant aid per kilometre at €98,413 whereas Cork at €186,882 per kilometre required the highest levels of grant aid in terms of network build. There are a number of reasons behind these variances in cost per km. For the most part these refer to the differing cost of laying fibre on different surfaces. For example, Magnum Opus report that the cost per meter of fibre laid on carriageway was as much as three times the cost of doing so on a verge. In other cases, ‘special engineering conditions’ such as river crossings, crossing railway lines or remedial works added to the cost.

The contracts also provided that a total of 2,792 chambers would be completed over the 27 networks or an average of 6.08 chambers per kilometre constructed. A total of 3,523 such chambers were eventually completed or 6.69 chambers per kilometre
constructed. The increase in the chambers can therefore largely be explained by the increase in the network length over that forecast in the original contracts.

The one element of the networks where the output was less than originally provided for in the contracts was that of customer or ‘drop connections’ (i.e. the means of connecting end customers to the network). The contracts originally provided that a total of 2,371 such connections would be incorporated into the network designs. The actual output was 1,063 drop connections, which is 55% lower than the original target. As regards the impact that this significant variance would have on the project, the advisers to the department counselled that the resources would be more effectively channelled into extending the reach of the networks across the towns as even in the event of drop connections being in place there would still be significant costs to be incurred in actually connecting to the customer. However, eNet the company managing access to the first phase MANs has contended that the high cost of drop connections means that it is facing difficulties in attracting customers to the MANs. It should be noted that it also contends that the connections built after the initial build was completed have proven to be no cheaper to deliver than standard connections so the “under” construction of the connections as against the original target may not have been such a significant issue.

3.4 Efficiency of the Scheme

A significant element of the administration and consultancy costs of the MANs programme was upfront – designing the programme and agreeing the technical specifications of the MANs. Consequently, the administrative costs as a percentage of expenditure of on a per kilometre basis should be expected to fall in future phases of the programme.

The project was run efficiently and the outturns exceed those budgeted for at no additional cost and indeed at a modest cost saving, despite the time delays, as noted earlier.
3.5 Economy of the Programme

The programme’s total consultancy costs amounted to approximately €4 million, which involved administering grant aid of €78.25 million. This was done via contracts with ten contracting agents representing a total of 27 towns.

As noted earlier, €827,000 of the consultancy costs were incurred in order to manage access to the networks on an interim basis between the completion date of the first MANs until the establishment of the MSE. The first handover was in October 2004. The handover was handled on a phased basis and Cork, although one of the first to be completed, was handed over to the MSE in April 2005 – a full six months after the first handover. It would not be unreasonable to assume that this or at least a significant proportion of it could have been avoided had the model of managing access to the networks been established in a more co-ordinated manner with the design and construction phase of the project.

Approximately €370,000 was spent on administration and certification of expenditure for the period concerned or the equivalent of one fulltime HEO and EO for three years. There is probably scope for the Department to conduct some of this work in-house, particularly the certification of claims by local authorities.8 All other input costs were administered utilising competitive tenders and the centrally procured elements ensured that the economies of scale that the Department could avail of were passed on to the local authorities. In one instance one of the suppliers had difficulty holding its prices for the three-year period of the contract and sought approval to amend them. The Department declined this application.

Crucially, the Department insisted that the local authorities have fixed price contracts with the works contractors and the grant levels to be paid by the Department to the local authorities were based to a large extent on these fixed price contracts. The Department did not pay any grants in excess of the grant levels set out in the contracts with the local authorities.

8 The procedures have been amended slightly for the 2nd phase projects and the Department has streamlined some of the processes and assumed some work, particularly in relation to amendments to grant agreements that had previously been undertaken by consultants.
Chapter 4

This chapter examines the interim outcomes of the programme and specifically the success or otherwise of the programme in meeting its objectives – whether explicit or inferred. From this examination key learning points emerge for future (communications) infrastructure interventions. Specifically Term of Reference 4 and 5 are addressed in this chapter.

4.1 Outcomes

As set out in chapter 2, the implicit objectives of the MANs programme were that the MANS and successful use thereof would:

• Promote investment in ICT infrastructure in regions where the market investment will be insufficient

• Promote the acceleration of the Information society and e-Commerce

• Promote competition in the communications sector

• Improve Ireland’s international standing in terms of broadband connectivity

• Address deficit in access to local networks.

In order to assess the effectiveness of the project in meeting its objectives, the agreed terms of reference for the review set out that valid performance indicators for the project would include price trends, improved availability and access and competition. Also to be incorporated in the assessment should be Ireland’s international ranking in terms of broadband availability.
As regards the measurement of the project outcomes, it is too early to comprehensively and definitively measure the ultimate outcome of Phase 1 as the last of the first phase towns were only completed in late 2005. This programme was designed for the medium to the long term and consequently the impact will only become clear over a similar length of time. By way of example, the evolving and dynamic nature of these projects may be seen in that there has been a considerable increase in terms of the number of customers of the MANs since completion and for example 16 new (or a 27% increase) customers were added in the first three months of 2007. It is, however, still possible to identify emerging trends and learning points at this juncture.

Given that it was not, for commercial and practical reasons, possible to establish the number of residential and company “end customers” that were receiving broadband services from communications companies using the MANs, a proxy for end customer activity on the networks has to be found. For the purposes of this review, the number of communications service providers that utilise the MANs is used as just such a proxy. This is done notwithstanding the fact that different communications companies use the MANs for different purposes and not all use them to directly access end-customers - some utilise the MANs infrastructure to fill gaps in their own communications networks e.g. a mobile phone operator such as Vodafone uses some MANs for part of their backbone and to increase the capacity of its network cells. Consequently two locations with the same number of MAN customers does not necessarily mean that the two locations have the same level of competition in the communications sector, or that the same proportion of capacity on each MAN is used.
Table 4.1 Customer Contracts per MAN

<table>
<thead>
<tr>
<th>MAN Town</th>
<th>Grant (€m)</th>
<th>Length (Km)</th>
<th>No of Customers</th>
<th>Grant per customer (€,000)*</th>
<th>Km per Customer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cork</td>
<td>10.97</td>
<td>58.7</td>
<td>14</td>
<td>783.5</td>
<td>4.19</td>
</tr>
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<td>Letterkenny</td>
<td>3.25</td>
<td>19.50</td>
<td>5</td>
<td>0.65</td>
<td>3.90</td>
</tr>
<tr>
<td>Gweedore</td>
<td>0.54</td>
<td>4.50</td>
<td>0</td>
<td>N/a</td>
<td>N/a</td>
</tr>
<tr>
<td>Galway</td>
<td>8.97</td>
<td>51.70</td>
<td>9</td>
<td>996.6</td>
<td>5.74</td>
</tr>
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<td>918.9</td>
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</tr>
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<td>2</td>
<td>1,351.9</td>
<td>10.25</td>
</tr>
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<td>Roscommon</td>
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<td>1</td>
<td>1</td>
<td>1,919.0</td>
<td>12.20</td>
</tr>
<tr>
<td>Tullamore</td>
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<td>14.55</td>
<td>2</td>
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<td>3</td>
<td>602.3</td>
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<td>5.10</td>
<td>1</td>
<td>949.1</td>
<td>5.10</td>
</tr>
<tr>
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<td>6.2</td>
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<td>13</td>
<td>475.9</td>
<td>4.84</td>
</tr>
<tr>
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<td>1</td>
<td>1,700.9</td>
<td>8.65</td>
</tr>
<tr>
<td>Kiltimagh</td>
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<td>3.50</td>
<td>0</td>
<td>N/a</td>
<td>N/a</td>
</tr>
<tr>
<td>Dundalk</td>
<td>17.75</td>
<td>6</td>
<td>1</td>
<td>422.7</td>
<td>2.95</td>
</tr>
<tr>
<td>Drogheda</td>
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<td>1</td>
<td>2,543.6</td>
<td>17.75</td>
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<td>Carrickmacross</td>
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<td>0</td>
<td>N/a</td>
<td>N/a</td>
</tr>
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<td>Monaghan</td>
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<td>0</td>
<td>N/a</td>
<td>N/a</td>
</tr>
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<td>3</td>
<td>498.0</td>
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</tr>
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<td>963.6</td>
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<td>Waterford</td>
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<td>1</td>
<td>762.4</td>
<td>5.09</td>
</tr>
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<td>28.70</td>
<td>5</td>
<td>859.8</td>
<td>5.74</td>
</tr>
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<td>Sligo</td>
<td>3.81</td>
<td>24.00</td>
<td>5</td>
<td>762</td>
<td>4.80</td>
</tr>
</tbody>
</table>

*TThe grant per customer will obviously change over time as the total number of customers fluctuates. In addition the figures for the Midlands, Leinster, the Northeast and Southeast were calculated on a pro rata basis based on the length of the MAN as each of these areas had single contracts covering multiple MAN locations.
It is difficult, at this stage, to infer any long-term conclusions from these figures but they do provide some insight as to how effective the intervention has been in the short term in meeting one of its objectives of promoting competition in advanced communications services. As of April 2007, in total there were 26 different customers of the MANs with a total of 92 individual contracts. In the period under review, only one customer was lost.

The top 6 MANs in terms of customer uptake account for 55% of the customer accounts: Similarly, the top 6 locations, in terms of population, account for 51% of the customer numbers.

<table>
<thead>
<tr>
<th>Location</th>
<th>Population</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Cork</td>
<td>(190,384)</td>
</tr>
<tr>
<td>2. Limerick</td>
<td>(90,757)</td>
</tr>
<tr>
<td>3. Galway</td>
<td>(72,729)</td>
</tr>
<tr>
<td>4. Dublin</td>
<td>(35,085)</td>
</tr>
<tr>
<td>5. Sligo</td>
<td>(19,402)</td>
</tr>
<tr>
<td>6. Wexford</td>
<td>(18,163)</td>
</tr>
</tbody>
</table>
4.1.1. Customer Trends

Figure 4.1 Customer Trends Over Time on the Phase I MANs

For table setting out customer trends since the first completion date in Phase I see Appendix 4.

Figure 4.2 Customer Trends on 6 of the Phase I MANs

Figures 4.1 and 4.2 illustrate the differing rates of uptake across the MANs. In turn, this demonstrates the difficulty in inferring the long-term outcome in terms of how the MANs have developed competition. In terms of Cork and Galway, the two largest urban centres in the above subset, it would appear that the MANs tapped into
significant latent demand, as evidenced by the rapid early growth in customer numbers.

Notwithstanding that the customer base is likely to increase there is quite a significant range in the cost per customer in terms of the grant paid. Dundalk, at €422,300 per customer is the cheapest. Leaving aside the five MANs with no customers, the most expensive MAN(s) per contract is Drogheda, which amounts to a grant of €2.54 million per customer contract. There is consequently quite a significant variance in terms of the cost of developing competition across the various MANs. It should be noted that none of this money was or will be paid to the MAN customers but is merely the cost incurred by the state to introduce competitors expressed on a per-competitor basis across the different MANs.

4.2 Explaining Differential Outcomes

The tables above clearly demonstrate that substantial variations exist in the degree to which the MANs in Phase 1 (including 1A) are currently being utilised. Following a series of interviews with customers and prospective customers of the MANs, the single most critical factor identified by the telecommunications operators in their decisions as to whether or not to use the MANs, all things being equal, is the population of the city or town in question.

Notwithstanding different business models and different cost bases, operators focusing on the residential end of the broadband market (using the MANs to provide “middle mile” networks) identified towns with typically 9,000 active telecommunications lines as being borderline in terms of making a business case in the short term. A town the size of Portlaoise was identified by a number of the consulted companies as a town that would be marginal in terms of population to establish a business case to launch services. A number of the towns selected for a MAN were below that threshold. It should be noted that, in terms of residential customers, the vast majority of Eircom exchanges that meet this “criterion” are

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9 It should be noted that this will vary across operator depending on the particular business model being pursued and the relative importance of the residential market to the operator.
located in Dublin – approximately 50% of exchanges with working lines in excess of 7,000 working lines are located in County Dublin.

The relationship between a town’s population and the number of communications companies that utilised the MAN, can be displayed by graphing the correlation between population and the number of customers using the MANs. The next two graphs illustrate those relationships and indicate that there is indeed a strong relationship between a town’s population and the number of customers on its MAN. The relationship also holds true, not surprisingly, between the number of households and the customer numbers.

The examination of the data to date finds that there is a strong correlation of 0.85 between the number of households in a given town and the number of telecommunications companies utilising the MANs and a correlation of 0.86 between MAN customers and the population of a particular town. This examination is based on 2002 household data and 2006 population data as the 2006 household data is not yet available. This analysis also excludes towns for which household or population data was unavailable. These include Gweedore and Kiltimagh in the case of population and household numbers as they are too small to be identified separately in the CSO data. Additionally, there was no separate household data available for Manorhamilton, Monaghan and Kingscourt.
This correlation between population and uptake means that, generally speaking, the bigger the town, the larger the number of potential customers on the MANs. This correlation or relationship of course does not mean that there is a direct causal relationship between the population of a town and the uptake of the MAN by communications companies. A valid alternative explanation could be that the population may be more closely related to the level or type of economic activity in the town and it is this economic/business activity that attracts customers to the MANs and drives the levels of communications competition. In addition, the average number of “connections” to the MANs in the top four MANs is 84. The average for the 12 smallest towns is 4. This once again confirms the importance of scale to the effectiveness or otherwise of a MAN network in terms of developing competition.

This outcome appears to support Forfás’ prediction that the take-up of broadband would be concentrated amongst large corporate users and in larger urban centres. While this prediction was based on a scenario where there was no government intervention, it is clear that, even when intervention does take place, economies of scale for providers still ensures that more densely populated or larger urban centres experience higher uptake. It is likely also of course that these larger centres have greater demand due to issues of demography and economic geography. For the moment however, it suffices to say that, while there is widespread broadband uptake,
the uptake of high-end fibre broadband on the MANs would appear to be concentrated in the larger urban centres. The MANs did, however, have the marked effect of immediately bringing down the population threshold at which providers were willing to enter local markets.

Based on the data to date, there would appear to be a number of exceptions to the above population/uptake relationship however. The Cavan MAN (population of 3,954) has four customers or one per thousand of population, whereas Monaghan town (population of 6,250) has no customers on its MAN. The fundamental difference between the two is that the Cavan has a single large company operating in the services sector with a demand for high quality bandwidth. This was confirmed in a conversation with one of the operators offering services in the town. That operator also confirmed that once it had established a presence in the town, it was then in a position to offer residential services because the location of a large commercial user in the town justified the operator’s initial investment, after which point the marginal cost of extending telecommunications services to residential customers was then low enough to be justified even in the context of the limited size of the town. Without the MAN and the “anchor tenant” or a single large customer the rollout of these services would not have been economically justifiable for the operator. Similarly, Carrick-on-Shannon, population 3,163 and 850 households, has three communications companies using the MANs to deliver services to end customers, with a large bandwidth end customer also present. Similar situations exist in Clonmel and Letterkenny. In each case, multiple IDA clients are located in the towns.

As at time of writing, there are five towns from Phase 1 and 1A that have no customers on their MANs. These are Monaghan, Kingscourt, Carrickmacross, Kiltimagh and Gweedore.

The Northeast towns were either completed in November or December 2005, almost two years after the completion of the first towns in Phase 1. Kiltimagh was completed in November 2003 and Gweedore was completed in July 2004. It is worth noting also that 4 of these 5 towns were included via Phase 1A, a matter returned to in Chapter 5. Importantly, the relatively late completion date of the MANs in these towns does not however adequately explain why they have been unsuccessful in attracting customers.
to the MANs, given that two other towns in the same area (Dundalk and Drogheda) now have customers.

One possible explanation is that none of these five towns had alternative backhaul providers other than Eircom until late 2006. Leaving aside Monaghan, this may have more to do with the populations of the towns – some of which (Kingscourt, Gweedore and Kiltimagh) are too small to be recorded separately in the 2006 Census, with the population of Carrickmacross recorded as 4,387. This will also be discussed in further detail in the next chapter. Monaghan, since late last year, has an alternative backhaul provider – Bytel via the Armagh-Monaghan Digital Corridor co-funded under Interreg IIIa. So far there have been no customers on this MAN. Monaghan does, however, have seven DSL providers in the town and one wireless provider of broadband.10

Clearly, demand for residential and small scale business broadband in the town has been met by the market, and dramatically reduced (or removed) the demand for access to the MAN by alternative providers.

The five MANs with no customers cost €5.222 million in grants or 6.67% of the total grants paid in Phase 1. The breakdown is as follows:

€(000)
- Gweedore 540
- Kiltimagh 683.7
- Carrickmacross 702.2
- Monaghan 2,651.1
- Kingscourt 644.9

In addition to the towns that have no customers, five other towns have one customer each:

**Population**
- Dungarvan 8,362
- Drogheda 35,090
- Kilkenny 22,179

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8 Source: www.broadband.gov.ie
• Manorhamilton 1,651
• Roscommon 5,017

The total grants paid for these towns amounts to €9.121 million or 11.66% of the grant total for Phase 1. Of these, Drogheda and Kilkenny, by virtue of their scale, would appear to be the more likely to attract further customers.

On the basis of the above summary and based on existing cost structures, it appears that a clear profile can be drawn of successful MAN towns, albeit on a preliminary basis. Such towns are generally large, with a minimum of 9-10,000 people, or have a large anchor tenant. Where MANs have been built in circumstances other than these, there is a strong likelihood that they will remain unused for the foreseeable future.

4.2.1 The Financial Performance of the MANs to Date
While this is not a review of the MSE, e-Net, and how it has performed against its targets, some of the data relating to its performance to date proves to be instructive in terms of the effectiveness of the MANs themselves and would support the earlier assessment in terms of customer numbers.

Whilst the number of customers gives a reasonable indication of the level of uptake on each MAN by telecommunications service providers, each customer will be putting the MAN to different uses and consequently, it may not be possible to infer from raw customer numbers the impact that each MAN has had on the development of competition and the scale of that competition. However to complement the data in relation to the customer numbers, another indicator of the development of competition as a result of the MANs is the revenue generated by the management services entity on each MAN.

As with the customer numbers, it is no surprise that the cities and larger towns are the more important in terms of revenue generation. In 2005/2006 the top four MANs in terms of population accounted for 80% of the total revenue generated over the 27 MANs. In 2006/2007 the four cities accounted for approximately 67% of the revenue generated with Cork at 28.75% and Limerick at 23.4% accounting for significantly
more than the others. However, Letterkenny was the fourth largest MAN in terms of revenue generated (4.75%) – as well as an Institute of Technology it is also home to a number of IDA supported companies operating in the tech sector. Once again, this demonstrates the importance of the business make-up of the town to the success or otherwise of attracting customers to a MAN and indeed to the rationale for MAN investment.

In support of this point, e-Net has claimed that the drop connections are loss-making or have no margins for it, as only companies with a relatively high telecommunications expenditure are likely to consider the MANs as part of their communications solutions. An analysis of the potential customers by e-Net found that 89% of these customers in towns with MANs fall into the SME category. The relatively high cost of gaining access to the MAN obviously has a clear impact on uptake, something that is more serious in those smaller centres that lack a major commercial customer to offset this cost for communications service providers. Critically however, broadband access is now available in a number of these smaller urban centres that lack customers on their MAN. The issue of cost, and the relative scale of those towns chosen, are clearly central to the success, or otherwise, of the MANs, and are returned to later in this chapter.

As of yet, the cost of running the MANs exceeds the revenues that they generate. The company is performing better than budgeted in terms of its operating losses however revenues are not as robust as projected. This may partly be explained by the fact that a number of MANs have only attracted customers in the last financial year and five of the 27 MANs in Phase 1 (and 1A) are still without customers.

e-Net has cited a number of reasons it believes explains the company’s performance to date and its failure to meet the budgeted targets for revenue:

- It asserts that the MANs were on average handed over to e-Net 9 months later than had been agreed.
• Its revenue model was predicated significantly on offering products that could secure Government business and LLU business gaining traction. It argues that neither of these has happened. However, with respect to the Government business it claims that Eircom has reduced its prices to match any MAN-based competition which in of itself is a benefit of the MANs not explicitly reflected or quantified in the assessment.

• It claims that the loss making nature of drop connections and the insufficient numbers of them has also contributed to the underperformance of the company to date.

4.2.3 The Importance of Backhaul to Customer Uptake

At the earlier stages of the project, the issue of backhaul – or access from the local network to a communications backbone and onwards to Dublin - was examined as to its impact on the effectiveness of the MANs. All MANs have access to backhaul but some stakeholders were of the view that the lack of alternative backhaul providers to Eircom was hampering the uptake by communications companies of certain MANs.

Certainly, communications companies consulted expressed most satisfaction with the MANs that had more than one backhaul provider, satisfaction which obviously implies or can be associated with higher takeup of these MANs. Where alternative backhaul providers (mainly ESB Telecom network or BT network) were not available to a MAN and Eircom consequently faced no competitive challenge, the result has generally been that the MAN is under-utilised or not utilised at all.

The solution to a backhaul problem - if indeed one such exists - may include regulatory as well as investment interventions. There would appear to be merit in further examination as to whether or not regulation is required or feasible. In the absence of other networks, customers of the MANs will at some stage need to route their traffic over the Eircom network; therefore resolving the broadband situation.
on a piecemeal basis runs the risk of merely displacing the monopoly issue to different parts of the network.

4.3 The Impact of the MANs
While it may not be possible to determine the precise impact of Phase I of the MANs in terms of meeting its objectives, it is possible, through a variety of means, to assess a number of impacts the programme has had and to surmise from these the potential contribution made by the MANs. In brief, these impacts include the contribution made by the MANs to competition in the domestic broadband market, the impact on price, and the impact in terms of regional uptake in broadband.

4.3.1 MANs, Broadband Uptake and Prices
In simple terms, the situation “pre-MANs” was that local loop unbundling was effectively non existent outside of Dublin. Before 2003, only one exchange had been unbundled outside the capital.\(^{11}\) There are now approximately 70 exchanges unbundled with active operators. Half of these are located in Dublin, but of the rest, 19 are connected to MANs\(^ {12}\). Between Q1 2005 and Q2 2007 the number of Broadband subscriptions in Ireland grew from 152,000 to 698,000. In the same time period, the number of ‘Narrowband’ (dialup and ISDN connections) fell from 664,000 to 403,000.

In a sector this fluid, it is of course almost impossible to prove causality. The MANs went live at a time of great dynamism and change within the ICT industry in Ireland, and in such a changing marketplace, it is very difficult to single out the impact of one intervention. However, the research carried out for this review has revealed that a large number of those companies operating on the MANs have confirmed that, in the absence of the MANs they would not be offering services in those particular towns at all, for the simple reason that the fibre was simply not being made available by the

\(^{11}\) Per e.Net

\(^{12}\) Some MANs have more than one exchange unbundled and connected

\(^ {13}\) It is worth noting that, out of the total of 1,200 exchanges, the top 70 exchanges account for over 40% of the active lines in the country. The top 250 exchanges account for over 70% of lines. This gives some idea of the centralisation of telecommunications infrastructure within the state – itself of course a direct consequence of the centralisation of population.
incumbent. One of these companies referred to above is now offering services in five locations outside of Dublin. Another company stated that of its 170 corporate customers, 100 of them were on MANs, with the remainder in Dublin. Unsurprisingly, 65% of the customers outside Dublin were located in Cork and Galway.

It is clear that the MANs have made a significant contribution to the development of the sector. The question remains, however, as to how significant this contribution has been in terms of price. Figure 4.1 sets out a chart illustrating the movement in the price of DSL services and charts significant regulatory and investment developments in the sector over the past five years. It also charts the increase in the number of subscribers to DSL services. In determining the impact of the MANs on prices, it should be kept in mind that the price of broadband has been affected by a number of different factors including regulation, the wider economic performance of the country, and competition in the provision of infrastructure. Critically also, the development of services and content on the internet play an important role in driving uptake, but are fundamentally difficult to determine, let alone measure (See Figure 4.1 on the following page for an illustration of the impact of various factors on the price and uptake of DSL broadband services – source ComReg).

For large corporate customers and other service providers, the impact on the cost of access to Eircom’s network is similarly difficult to ascertain, as Eircom does not publish a list of prices. The reviewer has therefore had to rely on a series of interviews with stakeholders to gain their perceptions of the impact of Phase 1 on price and competition.
DSL price changes have driven subscriber growth here

Figure 4.1
Source: ComReg
As can be seen in the figure above, DSL take-up is affected by the price Eircom charges both at retail and at wholesale level as well as other variables such as the investment actions of its competitors and regulatory interventions. The following is a narrative of significant events over the period relating to the first phase.

- The announcement to build the MANs was made in March 2002.

- Construction began on the MANs on a phased basis in April 03 and by end of Q2 of 2003 work had commenced on Cork, Galway, Limerick, the Mayo towns and the five Midlands towns.

- The price of Eircom’s entry-level DSL product was significantly reduced in the second quarter of that year (2003).

- In December 2003, Eircom announced that it would deploy broadband to every town in Ireland with a population greater than 1,500 people by March 2005 and specifically stated that it would be achieved two years ahead of the Government’s plan. It also claimed that its phase two roll-out of broadband will mirror and go beyond the towns identified in the Government’s National Spatial Strategy. Eircom also, through a press release asked the Government to focus its structural funding on those rural areas where economically the roll-out of broadband is “unfeasible”.

- The first MAN, Cork, was completed in February 2004 and Galway and Limerick, the next two biggest towns had theirs completed in April 2004.. The MSE was established in 2004 and assumed the management of the MANs in that year.

- Eircom formally announced in February 2004 that it had launched its trigger programme and that it would launch DSL in 150 towns with a population less than 1,500 where there was sufficient demand.
• The Government announced its intention to proceed with the second phase of the MANs (which are outside the scope of this review) in June 2004.

Whilst it is difficult to say with any degree of certainty that Eircom responded directly to the introduction of the MANs in specific locations, or more precisely the competition that the MANs would facilitate, it would appear that the MANs did contribute to the company’s decisions with respect to DSL rollout. By reacting to the threat of competition and rolling out DSL services quicker than anticipated in towns with MANs, some Local Authorities feel that Eircom may have sated some of the latent demand for broadband within those towns and impacted upon the customer take-up on the MANs in the short term. While the response by the dominant player to the ‘threat’ of the MANs did help advance the aims of the MANs, and did further the State objectives in the sector, the question remains as to whether or not the same outcome could have been brought about by means of regulation. This issue is discussed in the next chapter.

In terms of the impact that MANs may have had on prices to large communications companies, one company has achieved a price reduction of 76%, equivalent to several hundred thousand euro by using the MAN. This is evidence of the available efficiency gains that could be realised, taking into account the number of different operators in a broad number of regional locations. In an interview with the IDA, the agency confirmed the effect the MANs have had on prices, and expressed the view that the MANs have been a key driver of competition for communications services and consequently improved its clients’ options in terms of price and choice.

4.3.2 Impact on the Price of Broadband for Government.

One sector where it has been possible to get firm information on prices is the public sector. Before the introduction of the MANs, Eircom charged approximately €13,000 for a 2Mb/s link to areas such as Sligo and approximately €11,000 for similar links to Cork and Limerick. The price per megabit has come down significantly since the introduction of the MANs. The Civil Service Training and Development Centre (CSTDC) was of the view that the construction of the MANs has introduced new

14 In discussion with CMOD
players to the market and has enabled operators other than the incumbents to compete for government contracts where previously this was not the case. Examples of the uses to which Government agencies are putting the MANs include HEAnet’s provision of 10Gb/s broadband to UCC and CIT in Cork and one company is providing 1Gb/s broadband to hospitals in the city. The view was also expressed that an end customer would need to be demanding 10Mb/s or above to make it worth while to connect to the MANs.

While, for large customers, according to CSTDC, access to broadband has never been an issue, price and resilience has. This, CSTDC contends, has been partly addressed by the introduction of the MANs. A significant impact of the MANs has been that they have facilitated companies to compete for Government telecommunications business where otherwise they would not have had the necessary infrastructure. They have had an impact on the price of the broadband communications. They have also posed a competitive threat to Eircom.

In a consultation with the communications industry, some companies expressed the view that the price of access to fibre on the MANs was expensive compared to the prices that they would expect to pay for similar products in Dublin. They expressed the view that a fibre pair on a MAN costs in the region of 40 to 150% more than in Dublin. Specifically, one company cited that it could access fibre at €1 per metre on certain networks in Dublin (the T50) whereas the cost of fibre on a MAN costs €2.54 per metre.

A number of operators have also expressed an opinion that further investment in the existing MANs by extending the reach of the networks nearer to the potential customers would be of greater benefit than proceeding with constructing MANs in the smaller towns. While there may well be a potential benefit in this idea, it also has the potential to crowd out private sector investment and there are possible EU State Aid issues that may arise from such an approach. In and of itself however, that is not sufficient reason to rule it out – the delivery of benefits of this type being the point of these networks in the first place.
4.4 Impact of MANs on Regional Development

As mentioned previously, an implicit objective of the Phase I MANs was to address regional market failure in broadband provision in Ireland, 'pump priming' by creating alternative middle mile networks, linking local exchanges to alternative backhaul in 27 locations around the country. As already noted, the programme has met with considerable but not unqualified success. This section takes the following format. Firstly, the results of a series of interviews with development agencies and companies operating in areas outside of Dublin are presented. Secondly, the relative congruence of Phase I of the MANs with the NSS is examined, and lastly, the issue of the less successful MANs are discussed.

The development agencies have been and continue to be very supportive of the programme. The IDA is aware of a number of its clients, currently located in towns with MANs, that would not have located there in the absence of the networks. In the experience of the IDA, companies looking to locate investment abroad would typically look at a number of locations around the world, and compare each on the basis of a number of factors, not least infrastructure. In many cases, the absence of resilient and redundant communications networks means that locations are not even considered for investment.

Therefore, the IDA regard high quality and resilient broadband services not as a 'selling point' per se, but a prerequisite – its clients and prospective clients expect that there will be competitively priced alternative providers of broadband services available to them. Additionally, the MANs also facilitate some of its clients to expand their businesses; the IDA cited a company in Mullingar as an example of this. Importantly however, a brief sample of larger towns, currently without MANs, shows that in each case, there are now seven different DSL providers offering broadband to residential and business customers. Castlebar, Tuam, Ennis, Mallow, Killarney and Shannon are each without a MAN, but seem to have overcome the initial market failure in terms residential broadband at least. This issue is also returned to in Chapter 5.

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15 Essentially, many information driven industries require two independent broadband connections in case one suffers a fault.
According to the IDA the benefit of the MANs for its business is evident in the overall attractiveness of the respective regional locations and the associated increase in service offering and capabilities. It has identified a number of specific deliverables that the MANs deliver for it;

- They help to establish regional locations on a level footing with the large urban centres with respect to availability and resilience of the telecommunications product offering. The agency contends that prior to the MANs initiative there was only limited capacity and bandwidth (single lines) into regional locations, which hampered social and economic development in many of these centres;

- The MANs support the development of IDA’s existing client base into additional functions and activities that have high bandwidth requirements. Prior to the construction of the MANs, the development to this type and level of activity could not be supported from many regional locations. As previously mentioned, the MANs enable IDA client companies to expand their activities in Ireland and support the development helps support ongoing efforts to attract and retain high value added ICT and knowledge economy jobs in regions that companies may not otherwise even consider.

- MANs, according to the IDA, have facilitated improved and more competitive backhaul offerings in regional locations and there has been significant improvement in the use of backhaul to regional locations due to the provision of an alternative middle mile link, arising from the provision of the MANs:

- MANs have facilitated and advanced the service offering of regional locations to potential new Foreign Direct Investment clients. By doing so, it has increased the options open to IDA and its clients. The availability of the MANs in regional locations has resulted in the establishment of new Telecom providers with enhanced service and product offerings regionally.
The IDA did emphasise the need to continually evaluate the MANs infrastructure “against the latest available infrastructure” with a view to ensuring that it is in a position to facilitate the provision of the next generation telecommunications technology. In addition, the continued rollout and efficient management of this infrastructure is essential for regional locations to further develop the knowledge economy.

As already noted, the National Spatial Strategy (NSS) was published after the 27 towns in Phase I of the MANs had been named. The relationship between the two is shown in the table below. Seven towns or cities identified in the National Spatial Strategy as locations for future development (as either ‘hubs’ or ‘gateways’) did not have a MAN constructed in the first phase of the project (Dublin being one). Furthermore, of the 27 towns covered by the investment, twelve are not NSS towns.

Table 4.3 National Spatial Strategy and MANs Phase 1

<table>
<thead>
<tr>
<th>Gateway Towns</th>
<th>MAN Town?</th>
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</thead>
<tbody>
<tr>
<td>Letterkenny</td>
<td>Yes</td>
</tr>
<tr>
<td>Sligo</td>
<td>Yes</td>
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<tr>
<td>Dundalk</td>
<td>Yes</td>
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<tr>
<td>Dublin</td>
<td>No</td>
</tr>
<tr>
<td>Galway</td>
<td>Yes</td>
</tr>
<tr>
<td>Limerick/Shannon</td>
<td>Yes/No</td>
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<tr>
<td>Waterford</td>
<td>Yes</td>
</tr>
<tr>
<td>Cork</td>
<td>Yes</td>
</tr>
<tr>
<td>Athlone/ Mullingar/ Tullamore</td>
<td>Yes</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Hub Town</th>
<th>MAN Town?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monaghan</td>
<td>Yes</td>
</tr>
<tr>
<td>Cavan</td>
<td>Yes</td>
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<tr>
<td>Ballina</td>
<td>Yes</td>
</tr>
<tr>
<td>Castlebar</td>
<td>No</td>
</tr>
<tr>
<td>Tuam</td>
<td>No</td>
</tr>
<tr>
<td>Ennis</td>
<td>No</td>
</tr>
<tr>
<td>Kilkenny</td>
<td>Yes</td>
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<tr>
<td>Wexford</td>
<td>Yes</td>
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</tbody>
</table>
The towns named in the NSS, but not due to have a MAN built under Phase 1 were as follows;

<table>
<thead>
<tr>
<th>Town</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tralee</td>
<td>No</td>
</tr>
<tr>
<td>Killarney</td>
<td>No</td>
</tr>
<tr>
<td>Mallow</td>
<td>No</td>
</tr>
</tbody>
</table>

- Dublin (Greater Area) 1,045,769
- Castlebar 11,891
- Tuam 6,885
- Ennis 24,253
- Tralee 22,744
- Killarney 14,603
- Mallow 10,241

The NSS was published after the investment in Phase 1 had been announced. The reasoning behind the decision to proceed with Phase 1 as originally conceived was that either contractual arrangements had been entered into, or the design was at an advanced stage. In each case, amending or adding to the scheme would have substantially slowed the roll out. It should be pointed out however, that while Phase 2 involves the construction of MANs in several more of the NSS towns, there remain several towns without a planned MAN, even after Phase 1A and Phase 2 are taken into consideration.\(^\text{16}\) Perhaps more pertinent for this report is that the Phase 1A MAN towns were selected after the NSS was published, but yet only 4 of the towns selected in 1A are either Gateways or Hubs in the NSS.

In sum, it is clear that there are two central lessons from this review for the MANs and regional development. Firstly, as set out above, a number of the Phase 1 MANs remain without customers. One of the key narratives to emerge from the analysis has been the importance of an “anchor tenant” or an end customer in a town, whose

\(^{16}\) See Annex 4 for an illustration of how Phase 1 complements the National Spatial Strategy and a list of the principal colley towns and their status vis-à-vis the first phase of MANs.
demand for high quality broadband provides economies of scale for telecommunications companies wishing to also serve the domestic market. These large customers have the ability to act as a magnet for telecommunications companies and can justify the business case for operators to roll out services in towns that would otherwise not meet the criteria for investment. Equally, the selection of a town with sufficient scale in the first place can deliver a similar effect. In other words, the MANs are successful where they meet a critical mass of population and economic activity. In those cases they have, and can continue, to make a real contribution to pushing competition in the ICT market, and there appears a real prospect that demand will continue to exist in the future for other prospective uses to which these loops can be put.

Secondly, it is also clear that the MANs, in and of themselves, cannot deliver universal broadband access. In reality, they appear more successful when viewed as enabling infrastructure to promote development in regions that have already achieved critical mass. Recent census figures (2006) bear this out. These figures support the argument made at the inception of this process that larger urban settlements, and regions in their hinterland, would experience little difficulty in accessing broadband services once the market matured. However, those regions of the state characterised by smaller urban settlements, relatively greater reliance on declining primary productive sectors and an older demographic structure have yet to see the levels of broadband penetration (and availability) that other parts of the State have experienced. The fact that Phase 1 MANs have experienced significant difficulty in attracting customers in smaller settlements draws into question the wisdom of attempting to use them as regional development tools in these circumstances in the first place. The underlying structural or geographic problems which prevent or dissuade the private sector from providing a service can also apply to a MAN. Conversely, as has also been shown, should sufficient demand exist in the first place, the private sector will now provide a broadband connection, whether a MAN exists or not. In these circumstances, high end architecture like the MANs are clearly not the appropriate solution (or are even required) to ensuring connectivity in all cases. The forthcoming National Broadband Strategy appears a much more suitable means of extending broadband availability in the type of region, and the size of town, where the MANs have experienced significant difficulty.
4.5 Conclusion

The lessons learned with respect to the first phase of the MANs are, first and foremost that scale is important to the successful uptake by communications service provider. Consequently, notwithstanding the relatively early stage of the project in terms of measuring its impact and the fact that the MANs could potentially be put to use in ways not currently envisaged by policy makers, the first phase would appear to have been a mixed success. In those larger urban centres, the four cities and larger towns, the MANs appear to have provided a vital boost to the market at a critical time. In terms of takeup and the promotion of communications competition – the largest four cities account for approximately 70% of the revenue generated on the MANs by the management services entity. Importantly also, the IDA are unequivocal in that the MANs have provided their client customers with much greater choice, service and better prices when it comes to broadband (and telephony) connectivity. They have contributed significantly to the competitiveness of regional centres in Ireland and thus their attractiveness to international foreign direct investment, both new and existing.

Conversely, there are five MANs with no customers. There is a distinct possibility that at least some of these will never be used, not least in the context of a still rapidly developing market offering new technical solutions to overcome the network issues, such as wireless and 3G broadband. In addition, another five towns have only one service provider using the MAN – calling into question whether or not an entire MAN was required for such towns or whether there was an alternative solution that would meet the demand.

This immediately calls into question the process that was used to select these towns. It is already clear that the MANs were not the ideal solution for all settlements, a matter discussed in greater detail in the next chapter. However, it is also clear that the MANs continue to play an important role in the delivery of broadband services to customers in a range of urban centres across the country. In that context, another critical issue dealt with in the next chapter is the future of the MANs intervention with regard to the methods to be used to select future candidate towns. While the Interdepartmental report sets out, in great detail, the reasoning behind the construction of the MANs and
a variety of methods to be pursued to keep costs to a minimum, it does not engage with the choice of towns, which has proven to be a central issue.

Lastly, it is also unclear that, having chosen the MANs solution, sufficient care was taken to ensure that the design could be, and was, rolled out as efficiently and effectively as possible despite the use of fixed price contracts. It is precisely these oversights that the Capital Appraisal Guidelines were drawn up; careful application of these in the future would prevent many of the issues that have arisen with regard to the MANs.
Chapter 5 Conclusions, Lessons Learned and Recommendations

This chapter sets out the conclusions and key lessons learned with respect to the first phase of the MANs programme. Specifically, it addresses term of reference 6, 7 and 8. It also makes a number of recommendations to be considered in light of the above findings.

Before considering these issues however, two related themes require exploration in order to provide context for same. These relate to broader developments in the sector, and to the role and changing powers of the regulator.

5.1 Communications – A Rapidly Evolving Sector

As already mentioned, the communications sector in Ireland experienced dramatic changes in the period in question. The sector was characterised in the main by late uptake in residential broadband and a substantial deficit in investment by comparison with other OECD countries. The success, or otherwise, of the MANs can only be judged in this context. The nature of the sector and of the MANs intervention means that proving causality in an absolute sense is almost impossible. In introducing the programme the Department ran the implicit risk that if the MANs were successful (and the private sector, on achieving initial success, reacted by investing elsewhere in the sector), the argument could easily be made that the MANs were not, in fact, necessary at all. In other words, the nature of the MANs intervention, supporting competition in an oblique way (by creating a link between alternative national backhaul and local networks) meant that the MANs, if successful, would work in such a way as to occlude the underlying reasons for the growth of the sector.

There have been a series of important developments in the communications sector in Ireland since the launch of Phase 1 of the MANs programme however. The Irish economy has continued to grow and the incumbent, Eircom, has responded to competitive threats such as the investment programme of competitors such as NTL (now UPC) and the MANs programme. There is now widespread availability of DSL-type services in most towns in Ireland from a number of different providers serving
the residential, SME and corporate sectors. The availability of broadband would not appear to be the problem it was perceived to be in 2001/2002 in that there are a number of competing companies offering broadband services in a wide range of locations throughout the country.

As of the second quarter of 2007 the number of broadband subscribers in Ireland currently stands at 698,000, which is equivalent to approximately 16.5 subscribers per 100 population (June 07). The EU average, by the same calculation stands at 18.5 subscribers per 100 (for end March 07 – Irish figure for same period is approximately 14.3 per 100). Of these, 27% are classified as business customers. According to the latest data from ComReg, the basic ADSL product in Ireland compares favourably with other European countries and Ireland is ranked in 5th place in the DSL basket - that is 5 places less expensive than the EU average.

5.2 Role of Regulation
As well as the general investment environment, the regulatory environment of the communications sector has evolved considerably since the launch of the MANs programme. A key concern, publicised both by Comreg and by a number of concerned groups, was the relatively limited powers Comreg had to penalise those industry players that were found to be in breach of various directives.

The regulatory framework for telecommunications is set out principally in the Communications Regulation Act of 2002, and a series of Telecommunications Directives which were transposed into Irish law by statutory instrument in 2003. The telecommunications framework is based on principles of competition law and economics whereby the sector has been divided into a series of fixed and mobile markets and, using competition tools, the regulator must determine whether a market is competitive or whether one or more operator has significant market power. It lowered the barriers to entry to the sector by replacing the existing system of telecommunications licences with a new general authorisation system and changed the way significant market power of operators is determined and regulated. Where a determination of significant market power is made, the regulator is obliged to impose remedies to ensure that the dominant operator does not abuse a dominant position.
Eircom has been found to be dominant in the fixed line market and arising from this a number of remedies have been imposed on the company.

One of the most significant obligations on Eircom is the requirement to open the local loop (that part of the network between the home/premises of the consumer and the local exchange) to competitors. In other European countries this has been a key driver of broadband rollout. Despite the legal obligation to do so, progress by Eircom in opening its network to competitors was slow. This has had a negative impact on the development of competition during the period in question.

In terms of effective regulation, enforcement is a key element and appropriate remedies and sanctions are essential to secure regulatory compliance. Both ComReg and the European Commission had cited the lack of adequate enforcement measures as an obstacle to the implementation of the regulatory regime. It was in this context that the enforcement provisions of the Communications Regulation (Amendment) Act 2007 were considered. The powers of ComReg have now been substantially strengthened by the enactment of this Act in April 2007. The Act provides for the creation of new summary, indictable and continuing offences by way of secondary legislation for breaches by operators of obligations imposed by ComReg. A range of penalties is provided for, from relatively minor penalties for minor infringements to more serious penalties of up to €5 million or 10% of turnover where companies commit serious violations of the regulatory framework. The aforementioned secondary legislation was enacted in June, 2007. The Act also confers on ComReg competition law powers, similar to those of the Competition Authority, which will allow it to investigate and prosecute anti-competitive behaviour or abuse of dominance in the electronic communications sector. It is worth noting also that Eircom has changed its approach and agreed to new LLU arrangements in September 2007.

5.3 MANs and Market Failure
In 2001 and 2002 the evidence at hand was that the private sector was unwilling or unable to invest in the rollout of broadband services, even with the inducement of State grants. The sector had seen a number of high profile bankruptcies in preceding months, and investment levels in the area were low. The recently privatised owner and
operator of the national telecommunications infrastructure was going through a series of refinancing deals and changes of ownership, and investment in the network was very limited. There was evidence that there was a "gap" in middle mile telecommunications infrastructure and that, without infrastructure competition, many locations around the country would be hampered in their ability to attract FDI reliant on broadband access. Ireland's international ranking in terms of broadband availability and uptake was very poor, and the situation showed little sign of improvement. These circumstances meant that urgency was a key element in any intervention; rapid delivery was prioritised, along with the creation of a sense of momentum in the local telecommunications market regarding broadband.

The fundamental question facing this review is therefore, as follows. Would the problems identified above have addressed themselves through the market, or was state intervention required? Furthermore, if the answer to the previous question was positive, was MANs the most suitable intervention? The evidence gathered above suggests that while the market has certainly embraced the communications sector in recent years, the MANs made a very significant contribution at a critical stage in this process, and continue to do so in a less obvious way. Certainly, the MANs programme – the construction of "middle mile", open access, fibre optic networks - would not have been replicated by the market. Indeed all high end national telecommunications infrastructure constructed in the period in question were built with State assistance. The immediate take up on the MANs and the uses to which they are being put, even in the 4 cities alone, shows that there was a market failure in place in the period in question, and that some state intervention was justified. If a MAN was required for broadband to become available on a widespread basis in a city the size of Cork (c190,000 people), then the likelihood of the market rolling out services in any workable timeframe to much smaller towns can only be said to be remote. The evidence shows also that the market has responded to competitive challenges including those posed by the first phase of MANs (and indeed the announcement of Government's intention to proceed with Phase 2), changes in the regulatory environment and the investment decisions of private sector. While the regulatory developments were critical in and of themselves, the MANs facilitated and enabled many of these regulatory decisions, and provided a critical open access route for competitors to gain access to local markets. In this context, the reaction of the
dominant player in the sector, Eircom, is noteworthy in many ways. The evidence gathered for this review uncovered a number of situations whereby the incumbent operator had actively promoted its DSL services before the completion of the MAN in a particular location. Interestingly, a recently published review of the Group Broadband Schemes found similar incidences with regard to that scheme.

It is also clear, however, that there have been a number of difficulties with regard to elements of the MANs project. There are a number of towns in Phase 1 with live MANs with no operators using them. On this basis, it should be noted that the selection criteria for towns and cities in Phase 1 were less than ideal in that the candidates were, to a degree at least, self-selecting, rather than emerging from a structured analysis carried out on the basis of clear criteria. It is clear from the evidence and analysis presented here that the factors determining the success of individual MANs, such as the size of the town or city or the availability of competitive backhaul, were all capable of being modelled and predicted in advance. Equally, the lack of congruence with the NSS is also notable. Perhaps the most notable outcome however has been that even towns in Phase 1 with no MAN customers have broadband services and competition. As already mentioned, the contingent factors at the time of the inception of the MANs meant that particular emphasis was laid on the urgency of implementation at the acknowledged expense of planning. A formal assessment and detailed selection procedure could have prevented investment in MANs that now have no customers. It is important to point out, however, that there are circumstances in which a MAN is justified even in the (current) absence of a critical mass of population or economic activity. As is dealt with in a later section, regional development policy is often predicated on ‘front loading’ infrastructure in areas designated for future development. MANs, as high end infrastructure, clearly have a role in these circumstances.

It is therefore clear that the MANs, at least in some cases, have made a very significant impact on broadband roll out in urban settlements outside of Dublin, along with the already discussed impact on the industrial sector. However, the programme has not been without its issues. Having established that there was a market failure at play, and that the MANs are an effective means of redressing this, providing
beneficiary towns had a case, either now (via critical mass of population or business) or in the future (due to selection as NSS towns), the question remains as to whether MANs were the most appropriate response in all cases.

5.4 The MANs; One size fits all?
The evidence presented in this review shows that the MANs have clearly played an important role in the development of the market for broadband in the State. However, it also shows that considerable issues have arisen over the past number of years with regard to the uniformity of the effect of the MANs, not least in those cases where MANs lie dormant in towns that have several broadband suppliers. This begs the question as to whether or not the MANs were required at all or whether the market would eventually have provided a solution at no direct cost to the taxpayer.

Clearly also, part of this success is down to the regulatory environment created by Comreg. It is very difficult to surmise, however, even with the benefit of hindsight, what the effects of these regulatory decisions would have been in the absence of the MANs. At the very least, it is safe to say that (a) the roll out of Broadband would have been significantly slower in the absence of the MANs, and (b) that the MANs made a very significant contribution to the delivery of services in a large number of the States’ cities and towns.

While a case can be made that the private sector would inevitably have dealt with the problems in the broadband market (ie, supply would have risen to meet demand), this has serious problems in this instance. Firstly, in the time that it would have taken for the private sector to bridge the ‘broadband gap’, the State would have been falling further behind competitor countries in terms of the availability of an increasingly vital service. It is all very well to suggest that the ‘private sector would get there eventually’, if ‘eventually’ is at a cost of significant lost FDI, GDP growth and lost employment. The second problem with the case for non intervention is that of coverage. As evidenced by the research completed to support the National Broadband Scheme, there are still areas of the State in which it is not possible to access broadband by means of fixed line, wireless or mobile internet. There is a substantial case to be made that, without MANs, the access map would be even more canted in favour of the more densely populated areas than it is now.
However, in terms of the effectiveness of the programme on the basis of customer take-up a number of learning points emerge. It is quite clear now that the scale of the town in terms of population provides a very good indicator as to the degree to which the infrastructure will be utilised – certainly in the short term. The most successful towns in terms of MAN customer uptake, and hence those towns where a MAN has been more immediately effective, have been the 4 cities or larger towns in terms of both population and business activity. Consequently, it is not unreasonable to infer that the business population in a particular town, and the mix of end customers with a need or a demand for high quality broadband has a significant impact on the attractiveness or otherwise of a MAN to its potential customers (namely communications companies and larger corporate broadband customers). This is because the average cost of a customer connection (or drop connection) to a MAN remains high, meaning that only the larger customers can justify incurring the expense of utilising the MAN directly. This leads to the conclusion that, all things being equal, scale or the urban centre’s size is a, if not the, critical factor in predicting whether or not a MAN will be effective in terms of facilitating the delivery of high quality services and promoting competition. A MAN constructed in a town with few or no large end customers is not likely to promote competition and in fact could remain unused were that critical mass not to appear at a later stage. The most notable instances where such scale could be expected to appear would be in regard to those hub towns set out in the NSS.

Therefore, in terms of the effectiveness of the programme in meeting one of its key targets - that of promoting competition in the communications sector - the evidence to date would suggest that it is significantly less successful in towns with smaller populations and no key corporate customers. Indeed four of the five MANs with no customers are very small in terms of population and the other town (Monaghan) only recently obtained an alternative backhaul, suggesting that the business activity in the towns and the demand for high quality broadband was insufficient to justify the construction of alternative networks in the first place. This may explain the difficulties in attracting operators to use this particular MAN. Allied to this, Monaghan currently has both DSL and fixed wireless access providers that may have satisfied much of the latent residential and SME demand for broadband.
As mentioned previously in the review, due to the medium to long term objectives of the programme it is too early to definitively judge whether or not the programme was a success in terms of meeting those objectives or indeed to assess the future uses to which the infrastructure may be put and any future economic benefits that may be derived from such uses. In fact the MANs, by design, are technically specified to very high standards with the aim of being future-proofed to meet the expected growth in demand for ICT services – and a fibre network was assessed as being the optimal means to ensure this for many years into the future. However it is clear that the MANs model has limitations when it comes to smaller settlements and that in a small number of cases, they would appear for the moment at least to be a stranded asset. Moreover, the State’s telecommunications market is significantly more mature now than it was when the MANs were first considered. The case for MANs being used in all situations is therefore very weak. As set out in Chapter 4, the MANs appear to have a very limited role to play in regions and settlements where critical mass of population and economic activity does not already exist. The MANS, as high end network architecture, are clearly not required solely to ensure broadband connectivity in smaller settlements given that the private sector now seems willing to provide broadband services in these cases. Equally, the forthcoming National Broadband Scheme (NBS) appearing a much more cost effective and appropriate means of extending broadband availability in cases where the market has not already done so (such in less populated rural areas). The MANs do have a significant role to play in larger settlements however, in driving down costs for employers, in providing significantly future proofed infrastructure and in maintaining the attractiveness of these cities and towns to international firms looking for locations for FDI.

As set out in the conclusion to the previous chapter, the failure to carry out a full needs and options analysis resulted in the universal prescription of the MANs as a remedy in all cases. The question of whether the differing scales of settlement involved had varying reasons for a lack of broadband connectivity does not seem to have received appropriate consideration. A key recommendation of this review is that any future such intervention receive such analysis, including the full application of the Capital Appraisal Guidelines.
There are two other ancillary points that bear brief attention at this juncture also. The first of these is that the external success factors determining the success (or otherwise) of MANs do not seem to have received adequate attention in the planning of the individual projects. These factors include, centrally, the availability of competitively priced backhaul. The second ancillary point relates to the ongoing monitoring of the MANs project in the context of the Departments larger role in the sector. It is clear that, particularly with regard to Phase 2, ongoing developments in the sector obviated the need for some of these projects. As dealt with in the recommendations, future such interventions require a facility that would allow them to be terminated at an identified point, were it decided that they were no longer required. The most obvious time for such a review would be at the mid point of a project, although circumstances may dictate a different approach.

5.5 Regional Policy Lessons

National regional development and the policy in this regard needs to be considered in the context of MANs spend. While this may appear to be labouring the scalar issues associated with the MANs, there is a critical point to be made about the alignment of such public infrastructure projects with the National Spatial Strategy. The NSS is premised on the concept of the State intervening to redress infrastructure deficits in certain locations, selecting them above others so as to encourage the formation of a critical mass of economic activity. In regional development terms, this works to ensure the increasing returns to scale, external economies of scale and general agglomerative benefits associated with urban settlements above a certain size. The logic behind the NSS is that, if critical mass is to develop in these select areas, investment is targeted in a smaller number of locations rather than diluting the impact over a large number of locations.

The MANs are only one form of State intervention; similar interventions exist in a variety of other fields (from education to transport). Obviously however, these interventions need to be co-ordinated across government agencies and departments. Such concentrated and complementary investment would lead to a greater efficiency and indeed effectiveness in terms of infrastructure deployment and usage and would facilitate the development of clusters of activity and would help the development of regional hubs and gateways.
Certainly the first phase, in terms of feeding into a coherent programme of regional development, was not assisted by the publication of the National Spatial Strategy coming after the announcement of the programme. Despite this, Phase 1 did manage to incorporate all Gateway towns (with the exception of Dublin which was deemed not to require a MAN) and all but 6 Hub towns. As an aside, the findings of this review support the premise behind the NSS, suggesting that targeted State investment in a small number of centres does in fact represent a more appropriate use of its resources. Spending money on relatively large and expensive pieces of infrastructure for which there may not currently be demand (actual or ‘revealed’ as opposed to stated demand) does not represent an optimal use of resources. One of the lessons of the MANs has been that they have been utilised more in larger centres of business and population. However, the inescapable conclusion is that the MANs should have been aligned with the NSS at the earliest possible opportunity so as to provide maximum return on investment. Granted, the timing of the publication of the NSS significantly complicated matters; however a reframing of the MANs was obviously possible in the context of the Phase 1A towns, which begs the obvious question as to why the same did not occur after the publication of the NSS.

Moreover, a substantial case emerges for a more nuanced policy framework for State intervention in settlements of differing sizes. This has already been recognised in that the MANs and Group Broadband Scheme are aimed at different size settlements, however it is clear that the characteristics of the MANs limits their effectiveness in settlements below a certain size, or which do not have a large anchor tenant. In some cases, clearly, fibre optic MANs are an effective solution, and should certainly be considered for all towns designated for considerable future development or of a given scale (particularly NSS towns and their immediate hinterlands – see below). In other cases however, particularly those urban settlements of smaller size that already have broadband services, careful evaluation is required to determine which type of intervention is required, if any. This evaluation should take into account the size of the town, the level and type of economic activity, proximity to larger urban centres or NSS towns, demand by existing Service Providers for a MAN, and the availability of backhaul capacity. Equally, if MANs are to be constructed in smaller settlements that
currently lack an anchor tenant, then that decision should be taken in concert with IDA location decisions.

5.6 The Future of the MANs
The question as to whether or not the Government needs to continue funding fibre optic open-access metropolitan area networks needs to be considered. Certainly broadband and the ICT sector remains an important element of industrial and regional policy and the MANs continue to be relevant in terms of overall Government policy of promoting regional development and service competition in the communications sector.

Normally, a key question to be addressed by a VFMPR relates to the future of the scheme. In this instance, it should be noted, to a certain extent the question is moot. In December 2003, a Government decision was made to provide additional funding of €105m for 2005-2007 to carry out the Broadband Action Plan which would entail the construction of open-access broadband infrastructure to over 90 towns with a population in excess of 1,500. This “Phase 2” which in effect is a continuation of the initial phase has already commenced and at the time of writing €50 million has been spent with legal commitments to spend an additional €24m. It is expected that these MANs will be completed during 2007 and 2008. It should be noted that this cost relates only to the capital expenditure on the projects and does not include any expenditure incurred on consultancies or department staff and overheads. As stated previously, this second phase falls outside the scope of this review.

Notwithstanding this, post-Phase 1, there are fewer towns now that would appear to be able to, in the short term at least, justify investment in MANs in terms of population bases. Added to that is the fact that broadband is widely available in terms of residential and SME customers – most towns now have a choice of DSL/broadband provider. This means that potential customers of the MANs would be entering markets where demand for DSL products has been met or partially met leaving a smaller residual market for the new entrant to target.

One of the selection criteria for the second phase towns was that the towns must have had, according to the 2002 Census, a population in excess of 1,500 but be without
DSL broadband. The findings of this review raise a real question over whether or not there is still a gap in terms of (high quality and volume) broadband availability for which the MANs were originally designed and whether or not there is competition failure as a result of an infrastructure deficit that the installation of fibre optic networks would address. For example in the instance of one of the towns in Phase 2, Longford has an alternative cable provider, Crossan Cable - incidentally co-funded by the Department under the NDP 2000-2006. A legitimate question to ask would be whether or not that cable provider could meet the communications needs of the one big corporate client in that town— the Irish Prisons Services? Or was it necessary to proceed with a MAN to meet this demand?

In that context, two critical questions remain that require resolution. The first is that one must ask whether or not there is still a problem of market failure in “middle mile” communications infrastructure, the second being whether precisely the same problem (if one does exist) exists in every urban location in the country and whether a single type of intervention mechanism remains appropriate in the future?

The analysis suggests that the number of towns that do not currently have a MAN in Phase 1 but that could possibly justify such an investment - where the construction of a MAN would be “effective” in terms of meeting its objectives- is quite limited. As mentioned previously, excluding Dublin only six Hub towns were not covered by Phase 1. Given the population distribution and the nature of the urban hierarchy in Ireland, there are few settlements that can be considered ‘Metropolitan’ in a real sense, let alone ones still without a MAN. In that context, the likelihood that further MANs in settlements other than NSS towns, or very large towns not previously covered, would unilaterally equate to good value for money is remote.

Given the very different levels of populations of the locations in Phase 1, (and indeed subsequent phases) it would appear intuitive that different problems, if any, would manifest themselves across different towns and that consequently different solutions would be required or would be appropriate. Not all towns will have the same business mix and consequently not all towns will or can justify an open access fibre optic metropolitan area network. The review suggests that it is simply not a case of building smaller MANs for smaller locations because without the business demand for
broadband the business case will not exist for a service provider to use the MAN in the first instance – the cost of access to the MAN being the same irrespective of the size of the MAN.

In other words: the key question that must be addressed is whether or not the selection criteria for MAN locations are still valid, or whether the market has moved on? The industrial development agencies have a role in continuing to advise the Department in this regard, however the number of towns remaining that do not have MANs but that could possibly justify one are very limited at this stage. One of the key lessons with regard to Phase 1 has been that inadequate planning, and the lack of a mid term review, mean that inappropriate locations were selected in some cases. There is a very real possibility that similar problems may exist within the Phase II MANs programme. If the criteria do not justify continuing with the second phase in its entirety, then policy makers may need to reconsider or target investment elsewhere. The clear prioritisation should be on those remaining NSS towns, with consideration then turning to larger remaining settlements, on the basis of a clear and explicit evaluation of needs. On that basis, consideration should be given to halting the rollout of MANs in those towns for which Phase 2 MANs are planned but which have not yet started work (or have not yet entered legally binding contracts), pending such an evaluation.

Such an evaluation should be conducted on the basis of the Capital Appraisal Guidelines from the Department of Finance, and include either a Multi Criterion Analysis or Cost Benefit Analysis, and set out Key Performance Indicators for any future projects. From this evaluation of Phase 1, suitable indicators include the forecast vs actual cost, forecast vs actual infrastructure delivered, numbers of contract customers on the MAN, and ideally the effect on the price of connectivity in the given centre.

From the development agencies' perspectives, the towns for priority investment are those identified in the National Spatial Strategy, and the key county towns. As can be seen in Appendix 5, of the towns identified in the National Spatial Strategy as Hubs and Gateways, Tralee and Killarney have been included in Phase 2. Of the county capitals, Trim/Navan and Longford are also included. At the completion of the second phase, four NSS towns will not have had a MAN constructed: Tuam, Ennis, Shannon and Mallow. While there may not be an immediate economic argument for the
provision of a MAN in these towns on the basis of their size now. there is however, a longer term argument on the basis that providing this investment now will ensure the provision of high quality services as these towns achieve critical mass of population and economic activity in the future. More suitable solutions may be found for those smaller settlements not judged to have, or be likely to attain, sufficient scale to require a MAN. The rollout of the NBS will ensure that broadband access is available in all parts of the State.

If it can be accepted that governments can or should plan regional development then the argument to go beyond these towns in terms of MANs infrastructure in the short to medium term is not convincing at present. This does not necessarily rule out other forms of State investment/intervention in other locations but suggests that MANs are not appropriate to, or desirable for, all locations.

5.7 Future of the Phase 1 MANs and Communications Policy
A question that must be considered is what should the State do, if indeed anything, with the MANs constructed in the first phase? They were designed to address a local access or middle mile infrastructure deficit and they have been of mixed success as evidenced by the differing take-up rates. The risk could arise whereby policy makers attempt to maximise the utility of the MANs and shape communications policy around the MANs in an attempt to further justify the initial investment.

As discussions progress in relation to other sectoral developments such as "next generation" networks there could be a temptation to shape policy around the infrastructure already in place – i.e. the State has these assets and how does it use them in the context of future policy formulation?

The MANs when originally devised were seen as a long term infrastructure investment to help deliver services over 20 years or more. The fibre optic network design was selected on the belief that demand for broadband services was going to increase (exponentially) and the broadband required per user was also going to grow. In this regard a fibre network was seen as the best medium to meet this demand as it has the capacity to deliver the highest volumes of data. Certainly, it is possible that the Phase 1 or 2 MANs, or at least some of them, could play a role in future “next
generation” networks. However, it is critical that future government policy in this regard is not shaped solely by the existence of the MANs - they can be part of the solution to a policy objective but the policy objectives in the communications sector should not be defined by the future uses to which the MANs could be put. Attempting to justify the initial investment by means of further investment is not a wise use of public funds. The cost incurred in constructing Phase 1 should be considered sunk in the context of future policy decisions in the sector.

The review has concluded that the objectives remain valid, however there is less evidence to support the continuation of the programme in further locations and consequently, the ultimate recommendation is to fulfil its legal obligations with respect to Phase 2 towns but not to proceed with any towns for which there is no contract in place pending a full and formal review of the suitability of a MAN for each town involved, and of the remaining NSS towns not already scheduled to receive a MAN.
Recommendations

1. While the administration of the scheme has been appropriate and cost effective, the prioritisation of urgency, while understandable in the context of the time, over proper planning at the outset has had a number of important consequences for the project. It should be reiterated that it is standard practice for any such intervention to proceed only after the full application of the Capital Appraisal Guidelines, including full needs analysis, options analysis and documented decision, design and planning stages and that these requirements need to be observed in all policy development instances.

2. The lack of appropriate baseline data, and the nature of the selection procedure for the Phase 1, and particularly for the Phase 1A. MANs, meant that a number of inappropriate locations were selected. Future projects in this sector require a more rigorous planning phase before construction can commence.

3. The lack of a formal review after the completion of the first phase of the MANs, and before the inception of the second, meant that some of the difficulties experienced were overlooked. While the situation was difficult, dynamic and pressurised, such a review would have contributed greatly to the later operation of the scheme. In the case of future such iterative schemes, such a review is highly advisable.

4. Despite the timing difficulties, the Gateways and Hubs selected by the NSS should have received greater and more systematic attention from the MANs programme and this should be the case in any future similar intervention in the communications area.

5. It is clear that, even in the case of the towns selected for Phase 1A, the MANs model is not always the optimal solution. Any future such programme should examine all technical options as part of the assessment process.
6. The telecommunications market is significantly more mature at this point (Q3, 2007) than previously, and certainly more so than at the time of the decision being taken to go ahead with the MANs; the MANs intervention model is no longer considered appropriate in all circumstances. A significant argument exists for new MANs in those remaining NSS Gateway and Hub towns that are destined for significant future development. Consideration could also be given to towns of a significant size and level of economic activity, subject to a clear and comprehensive evaluation process, as set out above. The Department should fulfil its legal obligations with respect to Phase 2 towns but not proceed with any towns for which there is no contract in place until such a time as a full evaluation has been carried out.

7. The fact that MANs exist and have considerable spare capacity should not become a driver of future communications policy and the development of associated programmes in and of itself. While it is logical that this investment be leveraged if possible, further investment directed solely at ‘making use’ of the MANs would not be wise.

8. Measuring the impact or outcomes of the intervention proved to be difficult as the outcomes are a function of a wide range of factors. However, it was further complicated by the fact that there was insufficient data collected at the planning stage against which progress could be monitored. Consequently, for future projects in this policy area, more attention should be paid to collecting key baseline data at the planning stage of the project.

9. The lack of a coherent pre project assessment also meant that ongoing monitoring of the scheme was very difficult, if not impossible, in a real sense. Any future project in this sector should have a set of clear and transparent Key Performance Indicators set out at its inception to allow for ongoing monitoring of the programme.

10. The lack of pre planning, and interim reviews in relation to the MANs programme were important oversights. However, even if such controls were in
place, the Department must have the facility to terminate the programme if the intervention is judged to no longer be required on the basis of a rational analysis, or indeed in the face of more pressing priorities elsewhere in the communications sector. Any future programme should have an open and transparent mechanism by which it can be closed with a minimum of legal and financial implications for the State, even if that involves a mid life termination clause in contracts.
### Annex 1 – Summary of Second Call for Proposals under NDP 2000-2006

<table>
<thead>
<tr>
<th>Programme line</th>
<th>Title</th>
<th>Description</th>
<th>Eligible Tenderer</th>
<th>Available funding^1</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Commercial Broadband Rollout Projects</td>
<td>Commercial Broadband Rollout projects, similar to those currently supported under the NDP programme, aimed at providing commercial broadband services.</td>
<td>Any organisation</td>
<td>£20 million</td>
</tr>
<tr>
<td>B</td>
<td>Commercial DSL rollout Projects</td>
<td>This programme line is aimed at addressing geographical deficits in the availability of DSL services.</td>
<td>Any organisation</td>
<td>£15 million</td>
</tr>
<tr>
<td>C</td>
<td>Public Broadband Rollout Projects with economic development objectives</td>
<td>Public bodies (Local Authorities, Government Agencies, Health Boards, etc.) may now seek support for broadband infrastructure projects. Additional funding may be available for these projects subject to the public service nature of the project. These projects are aimed at the facilitation of public service delivery or economic development.</td>
<td>Non commercial Public Body (as defined in section 1.5.3)</td>
<td>£20 million</td>
</tr>
</tbody>
</table>

**Total** £55 million
Annex 2 - Details of previous Government Investment Interventions

In 1999, under the National Development Plan 1994-1999 and Interreg II, €26 million was made available to support the roll-out of broadband to the regions. 13 broadband related projects were rolled out nationwide to a value (both public and private funding) of €70 million euro, and are now completed. These projects were as follows.

**Advanced Communications Infrastructure Projects**

**Economic Infrastructure Operational Programme**

*(National Development Plan 1994-1999)*

<table>
<thead>
<tr>
<th>Tenderer</th>
<th>Project Description</th>
<th>€M</th>
<th>€IO P</th>
<th>Aid rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cablelink</td>
<td>Deployment of fibre optic cable from the Cablelink headend at Terenure to a node at Belgard Road in order to serve SME's in the Tallaght area</td>
<td>2.2</td>
<td>1.0</td>
<td>45.5%</td>
</tr>
<tr>
<td>CMI</td>
<td>Design and construction of a hybrid fibre coaxial infrastructure in Castlebar</td>
<td>1.65</td>
<td>0.78</td>
<td>47%</td>
</tr>
<tr>
<td>Eircom</td>
<td>Development of high capacity fibre optic infrastructure in 75 towns along the West coast from Sligo to West Cork. Eircom state that the percentage of rural customers with access to the national broadband network in the region will increase from 50% to 70% as a result of this project.</td>
<td>13.4</td>
<td>5.72</td>
<td>42.6%</td>
</tr>
<tr>
<td>Eircom</td>
<td>Provision of optical fibre cable along a 32 km link on a route connecting Galway and Castletown (linking Westport, Aille, Ballinrobe, Kilconly, Kilmaine, Tuam and Claregalway) and a 40 km link between Birr and Tullamore improving access to broadband infrastructure and services</td>
<td>1.69</td>
<td>0.80</td>
<td>47%</td>
</tr>
<tr>
<td>Esat Telecom</td>
<td>Roll-out of fibre optic cable in urban areas including Cork, Galway, Dundalk, Thurles, Carlow, Tralee, Athlone, Sligo, Maynooth, Letterkenny &amp; Limerick</td>
<td>4.2</td>
<td>1.9</td>
<td>45.2%</td>
</tr>
<tr>
<td>Esat Telecom</td>
<td>Extension of Esat’s national fibre optic network to Mayo, Roscommon and Sligo covering the towns of Athlone, Ballina, Claremorris, Roscommon, Castlerea, Ballyhaunis, Sligo and Collooney.</td>
<td>5.0</td>
<td>1.9</td>
<td>38%</td>
</tr>
<tr>
<td>Esat Telecom</td>
<td>Extension of Esat’s national fibre optic network from Cork to Little Island to Carrigtwohill (21 kms)</td>
<td>1.22</td>
<td>0.57</td>
<td>47%</td>
</tr>
<tr>
<td>HEAnet</td>
<td>HEAnet is a not-for-profit organisation delivering managed broadband services to over 30 educational/research institutions throughout the State. HEAnet will redesign and upgrade it’s network infrastructure, to provide an all-Ireland architecture, on a par with other EU countries.</td>
<td>2.22</td>
<td>1.0</td>
<td>45%</td>
</tr>
<tr>
<td>Irish Multichannel</td>
<td>To provide 114 km of optical fibre network linking the towns of Ennis, Shannon, Limerick, Kilmallock, Charleville, Mallow and Cork enabling the delivery of broadband services in these areas</td>
<td>7.74</td>
<td>1.14</td>
<td>14.8%</td>
</tr>
<tr>
<td>--------------------</td>
<td>--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>------</td>
<td>------</td>
<td>-------</td>
</tr>
<tr>
<td>Ocean</td>
<td>Construction of a high capacity fibre optic digital corridor linking Dublin, Athlone, Galway and Shannon and 30 locations enroute.</td>
<td>17.5</td>
<td>6.0</td>
<td>34.4%</td>
</tr>
<tr>
<td>Suir Nore Relays</td>
<td>Hybrid Fibre Co-axial cable upgrades and Digital MMDS upgrades in Clonmel and Kilkenny</td>
<td>4.41</td>
<td>2.0</td>
<td>45.4%</td>
</tr>
</tbody>
</table>
| Suir Nore Relays | Proposal to upgrade and extend existing cable network in Thurles to provide broadband infrastructure and services addressing business, educational and residential sectors  
It is also proposed to develop an SME broadband Centre in Thurles to stimulate the demand for broadband services in the area) | 2.72 | 1.14 | 42% |
| **Total investment** | **63.9** | **23.9** | **37.5%** |
Under the National Development Plan 2000-2006, the figure allocated to telecommunications initiatives was approximately €200 million. The intention was to use this funding under the Communications and E-Commerce Measure of the NDP to leverage and accelerate investment in competitive advanced information and communications infrastructure and services to enhance the potential for the development of electronic commerce facilities and enable the electronic provision of public services, including education services, virtual libraries, welfare and health services.

**First Call NDP 2000-2006**

<table>
<thead>
<tr>
<th>Project</th>
<th>Company</th>
<th>Project Cost (€ million)</th>
<th>Funding sought (€ million)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wireless Local Loop for Broadband Services</td>
<td>Esat Telecom</td>
<td>2.82</td>
<td>1.13</td>
</tr>
<tr>
<td>National Fibre Optic Network</td>
<td>ESBI</td>
<td>49.2</td>
<td>16.6</td>
</tr>
<tr>
<td>Accelerated xDSL</td>
<td>Esat Telecom</td>
<td>25.18</td>
<td>10.1</td>
</tr>
<tr>
<td>BMW Broadband Corridor</td>
<td>Chorus</td>
<td>17.8</td>
<td>5.9</td>
</tr>
<tr>
<td>SW Cork Digital Link</td>
<td>Esat Telecom</td>
<td>6.63</td>
<td>2.65</td>
</tr>
<tr>
<td>Broadband Infrastructure Longford</td>
<td>Crossan Cable</td>
<td>0.73</td>
<td>0.29</td>
</tr>
<tr>
<td>SE Broadband Comms Corridor</td>
<td>Chorus</td>
<td>50.3</td>
<td>13.7</td>
</tr>
<tr>
<td>Kerry Broadband Comms Corridor</td>
<td>Chorus</td>
<td>4.62</td>
<td>1.85</td>
</tr>
<tr>
<td>Regional e-Commerce hubs</td>
<td>Neveada tele.com</td>
<td>10.9</td>
<td>4.34</td>
</tr>
</tbody>
</table>
The ESB fibre wrap project consisted of the creation of a 1,300 kilometre optic fibre trunk network along the main electricity transmission grid, using the cables to carry the fibre. The network extends in two loops, the Southern loop serving Counties Limerick, Cork, Waterford, Wicklow, Dublin, Kildare, Laois, Offaly and Tipperary, while the Northern loop passes through Clare, Galway, Sligo, Leitrim, Cavan, Monaghan, Louth and Meath and also extends as far as Buncrana in Co. Donegal.

Esat BT completed a number of projects under the previous NDP 1994-1999, including the rollout of national and urban fibre networks and the construction of a high-capacity digital corridor linking Dublin, Athlone, Galway and Shannon, serving 30 locations en route. Under NDP 2000-2006 the company upgraded its digital link from Cork to Clonakilty, and enabled 40 telephone exchanges for delivery of broadband by Digital Subscriber Lines.

The grant agreement with Eircom provided for upgrades to telephone exchanges for the provision of DSL services. Fourteen exchanges were enabled.

Smaller grant agreements were signed with Crossan Cable and Nevadatele for upgrades to local networks and regional switches. Chorus did not complete its projects. Another company, Formus, had been offered contracts but ceased trading before the contracts could be executed.

In the light of the private sector’s inability to fund any more projects, and in order to achieve the Government’s targets for broadband penetration, the emphasis was shifted to the Metropolitan Area Networks programme, in partnership with the local and regional authorities, where a higher level of funding (90%) could be made available and the infrastructure would remain in public ownership.
Annex 3 - Customer Trends on the MANs

<table>
<thead>
<tr>
<th>LOCAL AUTHORITY</th>
<th>MAN Town</th>
<th>Customer numbers 04/05</th>
<th>Customer numbers 05/06</th>
<th>Customer numbers 06/07</th>
<th>Customer numbers April 2007</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cork</td>
<td>Cork</td>
<td>3</td>
<td>11</td>
<td>13</td>
<td>14</td>
</tr>
<tr>
<td>Letterkenny</td>
<td>Donegal</td>
<td>2</td>
<td>3</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Gweedore</td>
<td>Donegal</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Galway</td>
<td>Galway</td>
<td>2</td>
<td>6</td>
<td>8</td>
<td>9</td>
</tr>
<tr>
<td>Mullingar</td>
<td>Westmeath</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Athlone</td>
<td>Westmeath</td>
<td>0</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Portlaoise</td>
<td>Laois</td>
<td>0</td>
<td>4</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Roscommon</td>
<td>Roscommon</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Tullamore</td>
<td>Offaly</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Carrick-on-Shannon</td>
<td>Leitrim</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Manorhamilton</td>
<td></td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Limerick</td>
<td>Limerick</td>
<td>3</td>
<td>6</td>
<td>10</td>
<td>13</td>
</tr>
<tr>
<td>Ballina</td>
<td>Mayo</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Kiltrimagh</td>
<td></td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Dundalk</td>
<td>North East</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>Drogheda</td>
<td></td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Carrickmacross</td>
<td></td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Monaghan</td>
<td></td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Cavan</td>
<td></td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Kingscourt</td>
<td></td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Carlow</td>
<td>South East</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Kilkenny</td>
<td></td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Clonmel</td>
<td></td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Dungarvan</td>
<td></td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Waterford</td>
<td></td>
<td>1</td>
<td>3</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Wexford</td>
<td></td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>Sligo</td>
<td></td>
<td>1</td>
<td>2</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td><strong>Totals</strong></td>
<td></td>
<td><strong>16</strong></td>
<td><strong>44</strong></td>
<td><strong>69</strong></td>
<td><strong>92</strong></td>
</tr>
</tbody>
</table>
Context Statement for the Value for Money and Policy Review (VFMPR) of Phase I of the Metropolitan Area Networks (MANs) Programme

The Department of Communications, Energy and Natural Resources is currently implementing the Government's Metropolitan Area Networks (MANs) Programme. The construction of the MANs by local and regional authorities is co-funded by the European Regional Development Fund under Ireland's Regional Operations Programmes 2000 - 2006. In the period 2003 to 2005, 27 networks were constructed under Phase I of the Programme and it is expected that Phase II will have delivered MANs in a further 66 towns by mid-2008.

MANs are State owned, underground telecommunications networks that are located in regional cities and towns. They consist of carrier-neutral duct and fibre rings linking the main commercial and public buildings to "co-location centres" where service providers locate their telecommunications equipment and access the network. The MANs make these state-of-the-art facilities available to service providers to enable them to offer high-speed broadband to their retail customers without having to build their own networks.

Since mid-2004, the Phase I MANs have been managed, operated and marketed by eNet. The Department is currently tendering for a Management Services Entity (MSE) for the Phase II MANs.

As the MANs are a long-term (20–30 year) investment in Ireland's telecommunications infrastructure it is not surprising that the networks generating most custom in the earlier years of the investment are those built in the cities and larger towns where the high-speed connectivity offered by the MANs is currently most in demand. Nevertheless, after less than four years, the networks have enabled 32 service providers to establish presences in
regional towns and to offer and compete for broadband services over a range of platforms.

The telecommunications sector is very dynamic and needs to respond to new technologies to thrive. In 2002, when the Government first decided to provide the sector with open access infrastructure through its MANs Programme, broadband availability in the regions was negligible and less than 4,000 subscribers had broadband services. There are now about 1,000,000 broadband customers across 6 different platforms (DSL, wireless, cable, mobile, satellite, and fibre). The MANs have directly and indirectly provided the competitive impetus to drive that impressive rollout of broadband.

The sector's new challenge is to respond to future demands for next generation broadband services. As demand grows for higher bandwidths to deliver these products, fibre optic networks will increasingly be a favoured infrastructure platform, particularly in urban areas. The availability by mid 2008 of over 1,000 km of high-specification MANs infrastructure in more than 90 Irish cities and towns will facilitate service providers to compete with each other to deliver next generation broadband over fibre optic technology. The MANs will also be used by service providers to support the rollout of next generation wireless services.

The Department is currently preparing a Next Generation Broadband (NGB) Paper which will review policy options in relation to the optimal role for Government in the evolution to next generation broadband. In anticipation of this VFMPR and the draft policy paper on NGB, the Minister decided in December 2007 to suspend the commencement of construction of any further MANS. Further investment in broadband infrastructure will be guided by this VFMPR, the policy paper on NGB (when finalised after public consultation) and other analysis currently underway.
It is likely that proposals to build additional MANs will, in accordance with the recommendations of this report, prioritise National Spatial Strategy and other larger towns in the first instance.

Communications Development Division
June 2008
Final Report

Cost Benefit Analysis of Proposed Investment in Broadband Infrastructure under the MANs Programme

10 December 2002
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Peter Bacon & Associates

Economic Consultants
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Executive Summary

1. High speed internet access using broadband technologies has been identified as an important requirement of modern economies both in terms of their competitiveness and productive capacity and the consumption possibilities available to residents.

2. The issue of Ireland's broadband infrastructure has been examined in a number of reports and it can be concluded that there is a deficit emerging in terms of the provision of access to services. The reason has been identified as a market failure caused by the need for prices to fall faster than the economies of scale that can be accessed. The result is that service providers have an incentive to provide limited opportunities for access in areas of high concentration at high prices. Risk is also an important factor with the result that service provision and access will not reach the desired level without intervention. The MANs programme has been developed to address this problem.

3. Research in many areas leads to the conclusion that the use of broadband will be supply driven. This means that potential consumers may not perceive the benefits that they can derive from broadband in terms of the services that can be accessed. However, surveys indicate that a flat rate access fee of €40 per month would maximise revenues and would lead to the growth of the industry. The calculation of benefits in the appraisal undertaken in this report adopts this figure.

4. A model for the appraisal of the MANs is developed. This model is suitable for application to each of the projects proposed under the programme and the results can also be generalised to indicate overall benefits to the economy.

5. A time profile of demand growth over 20 years is assumed in the model and benefits are assessed over this period. It is projected that household connections to broadband in this period will rise to about 90% which is about the current penetration of colour televisions. It is also assumed that 5% of households will access the service in the first year after the year in which the investment takes place. The calculation is then redone on the assumption that it takes 2 years following the investment before revenues are earned.

6. A cost benefit analysis is undertaken by applying this model to the proposal for investment in Galway City and in Tullamore. The cost values contained in the proposals are used along with the time profiles indicated. Demand is based on the application of the assumed growth rates to population data and projections for these two areas.

7. Benefits are assessed primarily under three headings:
   - Increased consumer surplus as a result of the greater consumption opportunities that are available;
   - Increased productivity in industry
   - Multiplier effects arising from investment induced
   The former is the most important in terms of the measurement system that is adopted but this should not be interpreted as an insight into the forces that drive
growth in the economy. However, the results do underline the importance of ensuring adequate competition and appropriate pricing in consumer markets.

8. The central benchmark assumptions for the CBAs return positive net benefits from the proposed MANs investments in both Galway City and Tullamore. The investment in Galway returns a positive net benefit with an expected NPV of €13.465 million. Allowance for displacement at the national level would reduce this benchmark estimate by €387,000. The Tullamore project provides a positive net benefit with an expected NPV of €1.89 million. Displacement at the national level would reduce this benchmark estimate by €167,000.

9. The results are sensitive to broadband achieving a high take-up rate in households and to the size of the populations within the area to be served. In both cases, a penetration rate of 60% reduces the overall benefits considerably. Delaying the provision of access by two years instead of one reduces the net returns by about 10%. The Galway appraisal shows positive net benefits under all assumptions contained in the sensitivity analysis but the Tullamore appraisal suggests that under a pessimistic scenario these returns are eliminated. In assessing this outcome it should be remembered that CBA does not include certain projected positive effects where monetary values cannot be assigned. In the current case, these would include the contribution of broadband availability to delivering of a better regional distribution of economic activity.

10. The two main roles of indicators are to reduce time lags between action and outcomes and to reduce the risks and uncertainty associated with policy implementation. In addition, they must be easily observable without excess cost, reliable and understandable. The following indicators are recommended to provide feedback on progress with the programme of development:

**Resource Indicators**

- Agreement of detailed timelines with proposers on the basis of information in the proposals before start date
- Assess actual expenditure against indicative expenditure based on information in the proposals
- Assess expenditure against progress in physical implementation
- Monitor progress towards formulation of plans for the extension of the infrastructure to hinterland with a start date of 3 years following start of phase 1.

**Supplier Activity Indicators**

- Number of applications for infrastructure work by private firms
- Number of firms involved in such applications
- Agreements between operators regarding interconnection
- Provision of flat rate access within 6 of completion of investment in an area
- Progress towards access at €40 per month for basic access within 1 year
- Number of suppliers in the area
- Number providing flat rate access
- Variability of packages on offer
- Price variation within an area
- Proportion of households with access if desired
- Proportion of businesses with access
- 100% access for all schools and public buildings
**CBA of Proposed MANs Investment in Broadband Infrastructure**

- Review regulation against best international practice
- Ensure application of EU directives within time period.
- Comparison between prices in different parts of Ireland
- Comparison between prices in Ireland and in the UK

### Customer Response Indicators
- Comparison of number of customers against projections used in this appraisal
- Types of customers accessing the network: private firms, households, etc.
- Proportion of businesses accessing by size of business
- Proportion of households accessing
- Sales of peripherals in connected areas
- Proportion of households continuing to use dial-up connection
- Mixture of activities for which broadband is used
- Socio-economic profiles of users

### Feedback Response
- Committee to monitor information received, assess its implications and forward recommendations to relevant agencies.
Part 1: Wider Sectoral Impacts of Proposed Investment

1.1 Role of Broadband Technology

Broadband technology encompasses telecommunications infrastructure and services that enable the flow of data, voice and image communications simultaneously at very high speeds. While technical definitions of what constitutes broadband vary, a generally accepted norm is that for a service to be considered broadband it must be able to handle 256 Kbps downstream and either 64 or 128 Kbps upstream. However, the term is commonly used simply to denote high speed internet access, and many of the proposed applications of broadband will require considerably faster speeds than this if the technology is to be competitive in the marketplace.

The recent Forfás report on investment in broadband technology in Ireland placed the economic role of broadband technology in context: \(^1\)

The ability to create, distribute and exploit knowledge and information is the main source of competitive advantage, wealth creation and improvements in quality of life ... World class broadband telecommunications infrastructure and services are essential to the development of a knowledge-based economy.

This reflects the earlier assessment by the National Competitiveness Council that ‘broadband services are now key determinants of competitiveness’. \(^2\)

It is clear that while Forfás inevitably places the emphasis on the role of broadband technology in enhancing the productive side of the economy, the potential to add to the quality of life is also noted. This aspect of the technologies has been given considerable emphasis by the EU which has placed a major emphasis on introducing the initiatives that will place the EU at the forefront in the development and exploitation of these new technologies in production and in other aspect of economic and social life. Following on from the initial eEurope 2002 Plan, the European Council held in Barcelona in March 2002 called on the EU Commission to draw up an eEurope action plan focusing on the widespread availability and use of broadband networks throughout the Union by 2005. To this end, the Commission has produced an action plan, eEurope 2005. The aims of this plan are that by 2005, Europe should have widespread availability of broadband access at competitive prices and a secure information infrastructure to ensure modern online public services and a dynamic e-business environment. The approach adopted places considerable emphasis on the use of broadband technologies in enhancing the quality of life of EU citizens in areas additional to the competitive gains that the technology offers to producers.

Estimates of Worldwide e-Commerce growth vary considerably as shown in Table 1.1, but there is unanimous agreement that it will continue to grow quickly into the foreseeable future despite the current economic slowdown.

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Peter Bacon & Associates
Economic Consultants
Table 1.1: Estimates of Worldwide e-Commerce (US$ billions)

<table>
<thead>
<tr>
<th></th>
<th>2000</th>
<th>2001</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
</tr>
</thead>
<tbody>
<tr>
<td>eMarketer</td>
<td>226</td>
<td>449</td>
<td>841</td>
<td>1,542</td>
<td>2,775</td>
</tr>
<tr>
<td>Forrester Research</td>
<td>604</td>
<td>1,138</td>
<td>2,061</td>
<td>3,694</td>
<td>6,335</td>
</tr>
<tr>
<td>Gartner Group</td>
<td>403</td>
<td>953</td>
<td>2,180</td>
<td>3,950</td>
<td>5,950</td>
</tr>
<tr>
<td>IDC</td>
<td>354</td>
<td>634</td>
<td>1,153</td>
<td>1,871</td>
<td>3,144</td>
</tr>
<tr>
<td>Goldman Sachs</td>
<td>357</td>
<td>740</td>
<td>1,304</td>
<td>2,088</td>
<td>3,201</td>
</tr>
<tr>
<td>Ovum</td>
<td>218</td>
<td>345</td>
<td>543</td>
<td>858</td>
<td>1,400</td>
</tr>
</tbody>
</table>

Source: Industry Canada (2002) Indicators on ICT Infrastructure, Use and Content

As a result of this multi-dimensional role, this report assesses the role of broadband technology from a number of aspects. These are the wealth creating and welfare enhancing impact of broadband technology in terms of its impact on:

- Competitiveness, as a result of reductions in production costs and/or increases in production possibilities.
- Improved living standards, through the impact of better quality more cost-effective telecommunications services on household welfare.
- Human capital creation, as a result of improvements in the scope of education services.
- The spatial distribution of economic activity, leading to more balanced geographical development.
- Social inclusion.

This report is divided into four parts. Part 1 of the report aims to address the following questions:

- What is the current situation in Ireland in relation to the availability of access to broadband technology? How has this changed in the past few years and what is the situation in relation to other EU countries?
- What are the barriers to improved access and usage?
- What is the nature of the link between broadband access and competitiveness?
- How does broadband access impact on community and household welfare particularly in marginalized and remote settings?
- What is the impact of broadband on research and education?
- Will the MANs programme achieve the potential of broadband access?

This is a prelude to addressing the central question of Parts 2 and 3 which is to uncover the extent to which these benefits can be quantified in order to facilitate comparison with the costs that are incurred in investing in the infrastructure leading to a recommendation regarding the rationale for the investment. Part 2 outlines a model for the appraisal and identifies appropriate parameters from the international literature and research that has been undertaken in Ireland. This shows the importance of consumer benefits, although the assignment of benefits between consumers and producers should not be taken to indicate the relative importance of increased consumption and production to wealth creation. The third part of the report applies this model to place monetary values on the costs and benefits of implementing the proposed investment in two areas: Galway City and Tullamore. These two proposals are taken respectively as examples of the returns in a large urban centre and in a smaller centre with a large rural hinterland.
This investment has been identified as a major economic policy intervention to prepare Ireland for the next stage of development. However, the extent of the programme, the time lags involved and the fact that the infrastructure in itself does not create wealth if not utilised means that it is important that the implementation of the programme is monitored on an on-going basis and policy as implemented is adjusted accordingly. The final section of the report sets out indicators for undertaking this task with an emphasis on the need to ensure that the knowledge gained by observance of these indicators is used within this programme as well as leading to learning to be used in the formulation of policy in this and related areas.

1.2 Assessment of Broadband Development in Ireland

An assessment of Ireland’s infrastructure in a comparative context was undertaken in National Investment Priorities for 2000-2006. In relation to telecommunications this contains a number of important observations. These include the following:

- “In a growth-theoretic context, Bourgeais and Demetriades (1996), formally test the relationship between both the road network and telephone infrastructure with output growth for a cross section of countries including Ireland. They find that Ireland has a length of road network that optimises the equilibrium growth rate but a number of telephone lines per population that falls well short of what is required for optimisation of the equilibrium growth rate.”
- “Overall, Ireland occupies a medium ranking among the indicators of quality and availability.............The National Competitiveness Council (1998), identifies the local access network as being a serious infrastructure bottleneck. The relatively low proportion of fibre optic cable is beginning to cause problems in terms of capacity availability and price.”
- “Telecommunications costs affect both the cost of output and the ability of firms to take advantage of new technology. In spite of significant reductions in prices over the last decade, the increasing pace of liberalisation internationally means that costs in Ireland are fairly high compared to many countries, especially for leased lines.”

These observations and others contained in the Report indicated that Ireland in that period was lagging behind its competitors and did not possess the telecommunications infrastructure required to avail of the new technologies that were coming on-stream. If this assessment is still valid, then there may be considerable scope for improvement in Ireland’s telecommunications infrastructure with associated improvements in economic competitiveness. Furthermore, given the direct contribution that access to enhanced telecommunications can make to economic welfare and its role in promoting more balanced economic development, as recognised in the National Development Plan 2000-2006, there would be additional gains through these developments.

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4 Infrastructure Specialisation and Endogenous Growth, Keele University Working Paper No. 95/15.
There was general awareness among policymakers of this potential in 1998. In an assessment of the state of development of broadband in Ireland in 1998 and of the potential gains from new infrastructure, Forfás found that investment in broadband would lead to considerable economic gains for Ireland. This report found that there was a large and widening gap between the facilities that were available in Ireland and those provided in a range of other countries, many of which are competitors with Ireland for trade and inward investment. Regulatory reforms, investment in infrastructure and initiatives to promote use of new technologies were deemed necessary to overcome the gap. The analysis concluded that a failure to do this would result in job creation in manufacturing and trading forms falling 25,000 short of the targets that had been set for 2010. This shortfall would arise due to the loss of competitiveness in industry and would be only part of the lost opportunities for Ireland.

It assessed the benefits that would accrue from an investment programme and identified the relationships between investment in broadband and macroeconomic variables such as economic growth, aggregate employment and the balance of payments. The work estimated elasticities for the major variables and found that broadband investment of £200 million (€254 million) along the lines discussed in the report would increase Irish GDP by $4 billion (€5 billion) per annum and create an additional 35,000 net new jobs by 2010. This conclusion of positive elasticities and benefits is in keeping with the conclusions reached by the ESRI report.

There has been a considerable amount of progress made in recent years in both the provision of broadband infrastructure and in measures to facilitate and promote its use, although not all the recommendations made be Forfás in 1998 have been implemented. Competition has been introduced to most parts of the telecommunications industry in Ireland although there remain deficiencies in this area in some respects, most notably in the role of the regulator and regional gaps in the coverage of operators and service providers. These issues have been explored in a more recent Forfás report along with recommendations aimed at addressing remaining problems. The international capacity provided by the Global Crossing line, as a result of a Government initiative, has meant that for larger companies in the Dublin area, good broadband access on a competitive basis is available. However, smaller companies and firms in areas outside Dublin are in a less favourable position. Furthermore, there is a clear difference in Ireland between the willingness of firms and individuals to access and use the internet and the use of broadband when compared to other EU countries. Internet penetration in Ireland at close to 48% is above the EU average of just over 40% but broadband access is very low. The price of access in Europe tends to be higher than in the US and it has been shown that internet usage is sensitive to the cost of access as illustrated in Figure 1.1.

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Forfás (1998) Broadband Telecommunications Investment in Ireland
Forfás (2002) Broadband Investment in Ireland: Review of progress and key policy requirements

Peter Bacon & Associates
Economic Consultants
Figure 1.1: Demand for Internet Use by Country

There are two factors explaining Ireland's relatively poor performance: in many areas there is a complete lack of DSL technology while for many companies the costs of access are excessive. Indeed, this final issue has received much publicity in recent times as a result of the decision of the Telecoms Regulator to reject the Eircom pricing proposal for access to its services. Currently, DSL lines are provided by the two incumbent telecommunications operators, Eir and Eircom. Both charge a sign-up fee and a flat rate charge per period. In both cases these charges exceed the rental cost of ordinary telephone lines. Furthermore, coverage has not yet been extended to many parts of the country. Currently, Ireland has the second lowest broadband penetration in Europe, next to Greece and there are fears that the wholesale charges proposed by Eircom could delay plans for service provision by private operators.

While there has been considerable progress made, Ireland was ranked only 27th out of 30 OECD countries in a 2001 survey examining broadband access availability and usage9. Some important findings from this research are shown in Table 1.2 where Ireland is compared with a number of other countries to assess the extent of progress that has been made in developing access to broadband services.

This table shows that
- there is a wide disparity of performance among the leading countries in terms of access to broadband services
- the number of DSL lines has been growing rapidly, particularly in countries that were previously lagging;
- Ireland lags well behind in terms of broadband penetrations;
- Ireland has lost ground relative to these other countries in recent years.

These results are particularly surprising given the excellent international infrastructure provided by the Global Crossing connection and provide a strong argument that action is required to translate this international connectivity into local access.

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Table 1.2: Comparison of Ireland’s International Broadband Status, June 2001

<table>
<thead>
<tr>
<th>Country</th>
<th>% Increase in DSL lines (2000-01)</th>
<th>Total Broadband Penetration</th>
<th>Rank (out of 30)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Korea</td>
<td>53</td>
<td>13.91</td>
<td>1</td>
</tr>
<tr>
<td>Canada</td>
<td>51</td>
<td>6.22</td>
<td>2</td>
</tr>
<tr>
<td>Sweden</td>
<td>190</td>
<td>5.52</td>
<td>4</td>
</tr>
<tr>
<td>USA</td>
<td>37</td>
<td>3.24</td>
<td>3</td>
</tr>
<tr>
<td>Netherlands</td>
<td>547</td>
<td>2.74</td>
<td>5</td>
</tr>
<tr>
<td>Austria</td>
<td>79</td>
<td>2.36</td>
<td>6</td>
</tr>
<tr>
<td>Denmark</td>
<td>164</td>
<td>2.33</td>
<td>8</td>
</tr>
<tr>
<td>Belgium</td>
<td>114</td>
<td>2.27</td>
<td>7</td>
</tr>
<tr>
<td>Germany</td>
<td>290</td>
<td>1.03</td>
<td>15</td>
</tr>
<tr>
<td>France</td>
<td>177</td>
<td>0.59</td>
<td>16</td>
</tr>
<tr>
<td>Spain</td>
<td>251</td>
<td>0.47</td>
<td>20</td>
</tr>
<tr>
<td>Italy</td>
<td>108</td>
<td>0.44</td>
<td>19</td>
</tr>
<tr>
<td>UK</td>
<td>150</td>
<td>0.28</td>
<td>22</td>
</tr>
<tr>
<td>Ireland</td>
<td>0</td>
<td>0.01</td>
<td>25</td>
</tr>
</tbody>
</table>

Source: Based on OECD (2001), Table 4

Table 1.2 also shows that, despite the economic slowdown, the introduction of more realistic projections regarding the future potential of telecommunications and concerns over the ability of telecommunications firms to raise investment funds, the number of new broadband connections continues to grow at very high annual rates.10 Forfás has recently reported projections that the value of e-business worldwide will grow to $3.5 trillion in 2004 from under $320 billion in 2000 despite the current economic downturn.11 For Ireland to gain a competitive share of this business, good access to broadband technology is vital. However, although adoption of new e-business technologies by companies in Ireland, including SMEs, is high, the availability of broadband needs to be accelerated from its current growth if the ‘always-on’ technologies that will be required in the future for these companies to compete are to be available. The Forfás report cites research by the Department of Trade and Industry in the UK that only 31% of Irish companies have ISDN lines with 34% connecting to the internet via standard telephone lines. This is the highest use of this low grade technology among the countries surveyed and will greatly limit their ability to grow their e-business activities in the future. Furthermore, the Forfás research found a low level of understanding among Irish SMEs of the potential of e-business seeing the internet primarily as an information source and an aid to marketing only. This finding is important since it indicates the need for supply driven development. As the availability of the new technology develops, business will begin to use it in ways that had not been foreseen. The implications of this are seen in the discussion in the next section of this report.

Research into Ireland’s competitiveness has indicated that weaknesses in this area have had a negative impact. The National Competitiveness Council (NCC) has argued the broadband access is vital to improving productivity in Ireland and would

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10 The data in Table x regarding the growth of DSL connections is clearly subject to some error and some of the international disparities may be exaggerated. However, the conclusion that growth in Ireland is much slower than in these other countries appear robust.

11 Forfás (2002) eBusiness: Where are we and where do we go from here?
also contribute significantly to reducing costs in production\textsuperscript{12}. This central role for technology was also recognised in the Programme for Prosperity and Fairness. However, in its most recent report, the NCC placed Ireland \textsuperscript{14} out of 19 countries assessed in terms of the development of the information society\textsuperscript{13}. This low ranking came about as a result of three weaknesses relative to our competitors:

- Very poor access to broadband services;
- A low level of B2B and B2C transactions; and
- A low rate of SME use of the internet.

The report concluded that:

\textit{‘There is effectively no broadband access for small users in Ireland.’} \hfill (page 60)

The result was that, particularly among SMEs, the use of the internet was restricted and the potential gains were not being realised.

This discussion highlights a key issue in assessing progress in this area. Absolute progress has been occurring and is valuable. New infrastructure adds to household welfare and community development as discussed below. However, the role of broadband in the productive and wealth creating potential of an area is a key issue. In this respect, it is the stage of development relative to competitors, not the absolute progress, that is most important. In other words, the fact that this is a dynamic and still developing technology means that there cannot yet be considered to be a stable target level of development that would propel Ireland to the forefront of technological infrastructure availability, in a manner that will give it a sustainable leading position. For this reason, many recent assessments of the development of the technology and its use in Ireland, including the Forfás reports referenced above and below, have correctly adopted a benchmarking approach that compares progress against other countries rather than in terms of the achievement of pre-set milestones.

It remains unclear at this stage to what extent the relatively high prices that were proposed reflect the lack of economies of scale that may be available elsewhere but not in Ireland, or result from a lack of competition. There would appear however to be public belief that lack of competition is a critical factor.

It is against this background that the Government formulated its New Connections strategy statement\textsuperscript{14}. This strategy recognises the fundamental importance of adequate bandwidth to achieving Information Society objectives and sets a target that within three years an open-access, affordable, always-on, broadband infrastructure will be available to citizens and businesses throughout Ireland. This is in keeping with the objectives set by the EU in its eEurope strategy.

The conclusions of the Working Group on Telecommunications were particularly influential in determining the strategy that is laid out. The Group found that the primary challenge is not at the national or regional level in Ireland, but that there is a deficit in local access broadband networks. The three year target for government

\textsuperscript{12} National Competitiveness Council (2000) \textit{Statement on Telecommunication, eBusiness and the Information Society.}

\textsuperscript{13} National Competitiveness Council \textit{Annual Competitiveness Report}, December 2001

\textsuperscript{14} \textit{New Connections: A strategy to realise the potential of the Information Society.} (Government Action Plan. March 2002)
strategy was contained within the recommendations of the Group. In achieving this, the Group noted the provision of €200 million under the eCommerce Measure of the NDP to promote investment in telecommunications infrastructure in areas where it is clear that the market will not deliver adequate investment.

The first phase of the strategy proposes the development by local and regional authorities of Metropolitan Area Networks (MANs) in the Dublin Digital Hub and 29 towns around the country. It is anticipated that construction of these MANs will be completed by end 2003.

The clear general conclusion from these reports is that there are important deficiencies in the availability of access to broadband technology in Ireland. These deficiencies are more pronounced in some parts of the country than in others with the result that the investment to date and the way in which the market for the provision of services is developing could act to further concentrate economic activity in the leading regions and effectively exclude households and smaller business from these gains. Thus, while Ireland could be in a position to offer a reasonably good telecommunications environment to larger firms, including inward investors, locating in the Dublin region, it is not in a position to realise many of the most important benefits that would arise from providing full access to these technologies. Many of the problems are related to regulatory issues, but there are also important issues arising from the economics of the industry that mean that reforms in this area, even if they result in an optimal regulatory environment, may not overcome the problems that exist. This issue is dealt with in Section 1.3.

1.3 Investment and Market Failure

There are two quite separate sources of market failure to be addressed. The first arises because there are considerable economies of scale facing a services provider if the market grows with very low marginal costs meaning that the price of access can fall considerably as take-up increases. This is a desirable situation. However, the economies of scale may be so large that the infrastructure approximates the characteristics of a public good and the growth may not come about. This is particularly important given the fact that use of the technology is an important factor in encouraging further use. In other words, firms do not see the full potential of broadband until they have started to use it. This indicates a high level of risk akin to first mover costs suggesting that there may be a market failure present that would prevent the growth of the industry even if the difficulty of a lack of competition were overcome. Put simply, access costs need to fall first to stimulate uptake, but will not do so until uptake is sufficient to allow for the economies of scale to arise. The relationship between price and the growth of usage of broadband that would lead to the adoption of a sub-optimal equilibrium that would inhibit growth is illustrated in Figure 1.2.

This figure shows the cost of providing access to each user falls considerably as the number of users rises but, over a certain level of demand, the price at which suppliers would be willing to supply services is too high for potential customers. This leads to a broadband gap where, essentially, the private sector is unwilling to invest to supply
services and the sector does not grow. Below output level A, larger firms for whom broadband access is mandatory and who may be able to obtain internal economies of scale in the usage of the technology would be willing to pay the high prices implied by output A, but their number is limited. Furthermore, consumers are excluded due to the high cost of access. At output level B and above, the cost to the supplier and therefore the price at which the service is supplied, provided competition is sufficient, is at or below the price level required to stimulate demand, and growth occurs. Indeed, there is the possibility of considerable profit for suppliers who can attain sufficient economies of scale to force down costs to these levels. The problem however, is that there are clearly high risks involved in creating the infrastructure required to bring about this situation. The existence of the broadband gap means that an equilibrium is reached so that the supplier charges a high price that is sufficient to cover costs but that limits demand to output A.

![Price and Cost of Access to Broadband](image)

**Figure 1.2: Price and Cost of Access to Broadband**

| Source: Based on Iorfs (2002) |

The development of the Irish industry to date suggests that this may be an appropriate analysis. Charges are high and take-up is low even in areas where the technology is available. Two important conclusions emerge. First, private sector provision of the infrastructure will be restricted to areas where there is a sufficient number of large users who are prepared to pay the very high prices implied by output A. Essentially this means the larger cities. Second, while adequate competition – either through market competition or more likely in the Irish case through regulation to enforce the theoretical outcome that competition would produce – is required to reduce prices particularly above output level B, it is clear that this in itself is inadequate to ensure that sufficient investment is undertaken to achieve sufficient growth in usage to make low cost provision of services viable.

Thus, there are two parts to the market failure. The core issue is the very large economies of scale that are potentially available in this market. These, when combined with the fact that demand will follow supply in this sector given the lack of familiarity that exists with these technologies and their uses, give rise under this analysis to a high degree of risk such that the investment that is required to bring these economies of scale into being may not be undertaken. The combined effect is that the
investment does not take place without intervention either to reduce the level of risk through reducing the cost of the investment that is required before output level B is reached, or to reduce the over cost of supply access to the services at all level below this output. Finding a solution requires public intervention.

The second market failure arises due to the central role that broadband infrastructure can play in the development of Ireland along a desirable path. This gives rise to important social benefits that will not accrue to private developers since they cannot be charged for. The benefits to households and firms can be included in the price that can be charged but a number of the additional benefits that are discussed in the next section imply that there are positive externalities associated with adequate investment in the development of this technology. Some of the benefits of education can be included although there are additional benefits, but a major part of the externalities arise due to the positive impact that it is believed broadband technology can have on creating a more balanced regional and social economy. These aims have been given prominence in Irish economic policy in recent years in under the regional and social inclusion programmes contained in the National Development Plan, but there is a widespread acceptance that the general thrust of Irish economic development over the past decade has tended to magnify rather than reduce the imbalances that exist. The development of broadband access in Ireland to date has further promoted these undesirable trends. Thus, while a more rapid roll-out of access to broadband is required from the point of view of maintaining Ireland’s international competitiveness, from the point of view of maximising the national benefits of having access to these technologies a different regional and social structure of the roll-out is required.

These two types of market failure are important in terms of the appraisal of the costs and benefits of investing in the MANs programme that is undertaken below. The benefits that will accrue from overcoming the market failure that arises due to economies of scale, the structure of the industry and the risk that is involved in the investment in infrastructure are direct market benefits for the most part. In other words, they are paid for by subscribers, although there may be additional knock-on effects and benefits from increasing returns to scale in the use on the new technologies. However, market prices remain the most appropriate mechanism for the valuation of these benefits. The benefits from overcoming the latter source of market failure are intrinsically different. For the most part these are positive externalities. Ultimately, these will have a market valuation in terms of a higher rate of economic growth and higher incomes, but many of the benefits of balanced regional development and enhanced social inclusion are not marketed. These include issues such as a greater choice of where to live, less lost commuting time, lower congestion in the Dublin region and the welfare gains of participation in economic activity.

The essential feature of the MANs programme is that it directly addresses the source of the market failure by providing the infrastructure in areas where the market is unwilling to invest. This allows service providers to operate and customers to avail of access. The question then is whether the gains that result from this are sufficient to offset the costs that are involved in providing this investment.
1.4. Sectoral Benefits of Broadband Access

1.4.1 Household Welfare, Human Capital and Education

The economic benefits of household broadband access arise from a number of sources, including:

- home retail shopping for goods and services;
- the ability to access digital entertainment;
- reductions in commuting costs and the revenues associated with teleworking;
- increased ability to access telephony and communications services;
- enhanced community strength;
- access to government; and
- savings and revenues associated with telemedicine and distance education.

Furthermore, there may be many new uses in the future that are currently foreseen that will be stimulated by the advent of broadband.

It is interesting to note the reasons why consumers wish to have access to broadband. By far the most important benefit consumers perceive would be the availability of greater speed. The results of a number of research studies, such as the study shown in Figure 1.3, indicate that the primary motivation for getting a broadband connection would be speed. The second most important reason to get broadband is that it would free up the telephone line, and the third is that the connection is always on. The most notable issue arising from this work is that potential broadband users don’t expect to change their internet usage patterns to any extent: they expect to continue to do what they are currently doing, only faster. The conclusion of this research is that, in the eyes of consumers, getting a high-speed connection is to transform the PC into an entertainment device is not the primary reason for investing in broadband.

**Figure 1.3: Determinants of US Household Demand for Broadband**

![Pie chart](chart.png)

Source: Arbitron Coleman, 2000

However, there are two possible interpretations of this finding. The first is that the early expectations of the home entertainment potential of this technology were overstated and, consequently, the uses and benefits will be limited. The second is that
consumers have been disappointed so far in what the available technologies have provided, primarily due to lack of bandwidth, and that broadband is required to unleash the potential of these technologies. In other words, consumers do not perceive the opportunities that are available since they expect a gradual development of the technology rather than the step-change that broadband would induce. This interpretation is supportive of the conclusion that the use of broadband, and therefore the benefits that will accrue, will be supply driven and will not arise for as long as investment takes place only in response to observed demand.

This latter interpretation and conclusion is given further support by recent findings by Nielsen Ratings in the US regarding the relative usage of the internet by households with broadband access and those without. This shows that the amount of time spent online by broadband users has exceeded the amount of time online by dial-up users for the first time in 2002, although only 20% of online users are broadband connected. Clearly there are some additional factors here and this finding – that broadband users spend over four times as much time online as non-broadband users – should not be extrapolated to the whole population. For example, it is reasonable to assume that those who are predisposed to use the internet or who have most to gain from broadband would be among the first to join since over 90% of the US population live in an area with broadband access infrastructure in place. However, it does support the conclusion that when the services become available the internet usage patterns of consumers do change in ways that they had not foreseen. It is also known that many of these additional use require speeds well in excess of what is implied by the wide definitions of broadband referred to earlier. Thus, infrastructure as proposed is required. However, the uncertainty over future use makes the prior estimation of the benefits of access particularly difficult from a socio-economic point of view, just as it introduces additional risk for potential investors in the private sector. As a result, while the analysis could try to predict what services consumers will buy, this approach is very speculative.

The internet is the single largest information resource available and the most popular activity conducted by internet users, the world over, is researching and accessing information from the internet. Apart from the potential revenue opportunities for service supplier associated with education – it is estimated that Americans spend approximately $740 billion a year on education and training – that this represents, life-long learning, and the effective distribution of information to all have been identified as important requirements for future productivity growth and social inclusion. As a result, the benefits of education afforded by investment in broadband are inextricably linked with the gains that arise as a result of greater competitiveness and social inclusion.

The National Competitiveness Council reports a 100% rate for school internet connectivity in Ireland in 2001. All other EU countries except Greece had rates above 95%. In 2000, 98% of all US public schools had internet access, according to the US Department of Education. Widespread broadband adoption represents a significant opportunity to extend this beyond the formal classroom through adult education, training and distance learning. This development has already occurred where the infrastructure is in place. Online education is a market that is a multi-million dollar business in the US. One of the leaders in this market – The University of Phoenix expects revenue in 2002 to total over $280 million and Merrill Lynch estimates that
the e-learning sector in the US will be worth over $25 billion by 2003\textsuperscript{15}. High-speed internet access also provides teachers and educational institutions with greater opportunities to provide multimedia materials. The International Telecommunication Union (ITU), reports that in South Korea, the leading country in terms of broadband access, broadband is looked upon as an important family investment.

There are four major sources of social and economic benefits from the development of e-learning. In a knowledge-based society human capital is the main source of competitive advantage. E-Learning represents a key means for advancing post-secondary education and lifelong learning. Development and maintenance of critical skills through professional upgrading is becoming increasingly popular. E-Learning can be a cost effective means of providing such services, especially in rural locations. Many adults have family and job commitments that prevent them from attending a traditionally scheduled class. Broadband provides the flexibility to take courses. Many of the skills needed by knowledge workers, such as the ability to conduct research and manage projects, are becoming increasingly dependent on computers and the internet and E-Learning can integrate the development of those skills into the learning environment itself.

The value of this can be estimated from the expressed willingness to pay for access to these services. The assumption here is that individuals can accurately assess the economic value of the service. Work undertaken in the US by Sage Research asked respondents their willingness to pay $50 per college credit to receive multimedia education from accredited schools. Among respondents, 14.3% indicated they would pay for this service. Additionally, respondents indicated their willingness to spend $5 per month for unlimited access to multimedia encyclopedias, as well as cooking, language and music education. On this basis, Sage estimated revenue for continuing college education in the US amounting to $3 billion with a further $1 billion from supporting and related materials. On a pro-rata basis, this would indicate a private valuation for Ireland of around €50 million per annum for access to education services over the internet. This evidence suggests that broadband can provide individuals and organisations with greater access to education, training and learning resources and that the private valuation placed on this is considerable. Since there are additional social benefits associated with education over and above the private gains there is a case for the public sector to invest in broadband infrastructure and services.

1.4.2 Broadband and Competitiveness

The reports by Forfás, the EU and others already cited consistently point to a major role for broadband in improving the competitiveness of industry. However, since it is also argued that the development needs to be supply driven the actual potential impact of broadband being made available in this regard is more difficult to assess. Furthermore, there has been considerable research undertaken into the so-called productivity paradox in the US, whereby investment in IT did not seem to give rise to improvements in productivity over a very long period, without a definite conclusion emerging. However, for areas that have access the results confirm that cheap rapid

\textsuperscript{15} Reported in eMarketer (2002) The Benefits of Broadband

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internet access induces major changes and introduces considerable cost savings for businesses.

The results in Table 1.3 of a survey of SMEs in the US before and after obtaining DSL connection indicate the extent of the impact. This research indicates that there is a considerable impact in the operations of small firms from broadband access. This has two implications for costs. First, since a certain proportion of firms was engaged in each of these activities before the DSL was available, there is a reduction in costs on continuing activities as a result of time savings and lower access costs. Second, the data indicate a major increase in the number of firms undertaking each activity. The question then is if this implies a more efficient way of doing business. The available research confirms the belief that not only are there competitive gains from a region having a good infrastructure but that there are also overall gains from lower production costs. The Brookings Institute has estimated annual savings at over $370 billion for the US in 2005\(^{16}\). In other research, over 90% of respondents reported that the gains resulting from increased productivity exceeded the cost of the DSL service\(^{17}\). This research also showed the 76% of respondents found improvements in productivity and 70% found improvements in customer relations when broadband services were introduced. Other benefits have also been found as a result of greater use of teleworking including higher employee satisfaction and productivity. This also gives rise to potential savings in terms of travel time and costs and reduced congestion. These have been estimated at $23 billion per annum for the US.

**Table 1.3: Change in Internet Use among SMEs in the US**

<table>
<thead>
<tr>
<th>Activity</th>
<th>% Before DSL</th>
<th>% With DSL</th>
<th>% change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Email with large attachments</td>
<td>52</td>
<td>89</td>
<td>70</td>
</tr>
<tr>
<td>Conducting research</td>
<td>65</td>
<td>87</td>
<td>34</td>
</tr>
<tr>
<td>Online purchasing</td>
<td>48</td>
<td>74</td>
<td>54</td>
</tr>
<tr>
<td>Customer services</td>
<td>28</td>
<td>46</td>
<td>65</td>
</tr>
<tr>
<td>Facilitating telecommuting</td>
<td>15</td>
<td>30</td>
<td>105</td>
</tr>
<tr>
<td>Online scheduling</td>
<td>11</td>
<td>26</td>
<td>128</td>
</tr>
<tr>
<td>Private networks</td>
<td>8</td>
<td>21</td>
<td>169</td>
</tr>
<tr>
<td>Distance learning</td>
<td>5</td>
<td>17</td>
<td>222</td>
</tr>
<tr>
<td>Outsourcing</td>
<td>6</td>
<td>12</td>
<td>94</td>
</tr>
</tbody>
</table>

*Source: Electronic Business Forum*

The research on this issue consistently indicates that there are positive impacts on productivity and competitiveness as a result of access to broadband. It has also been argued in recent years that this step is necessary for the productive capability of earlier IT technologies to be realised due to the time and cost savings that are available in the deployment of these technologies. However, it is possible that the greatest benefits may be as a result of the indirect benefits that can be realised from broadband facilitating altered working arrangements such as the growth in teleworking. Irrespective, there is a general acceptance that competitiveness requires a considerable upgrading in Ireland’s infrastructure.

\(^{16}\) Brookings Institute (2002) *Net Impact Report* in association with the University of California-Berkeley and Momentum Resources Group

\(^{17}\) Research undertaken in the US by the Yankee Group published at www.sbc.com
1.4.3 Optimal Distribution of Economic Activity and Income

In recent years, economic analysis has been criticised for not explaining the growth of cities or the apparent benefits to be found in concentration and agglomeration, particularly when such developments raise input costs for firms. On the other hand, smaller towns and rural areas, where wages, rents and service costs are typically lower than in cities appear to grow slower and are often in relative decline. The growth of the service economy has not generally reversed this trend as had been expected. The dominant theory of city formation is based on comparative advantage, which leads to trade and wealth creation. Cities lower the cost of trade if there are economies in transportation, particularly in relation to port and terminal operations. In addition, cities may lower the cost of trade between firms and workers and between firms themselves if there are economies in the provision of local public goods such as local transportation, water, gas, electricity, and communications. This means that higher input costs are more than off-set. However, this does not explain why the growth of the service economy has apparently strengthened the role of cities even when the cost of transporting the output falls.

An alternative view, that externalities may actually generate cities, has gathered considerable support in recent years. This postulates that cities exist and grow when firms and workers locate near each other to take advantage of Marshallian externalities such as technological spillovers, labour market pooling, and non-traded industry specific inputs. In this case, increasing returns from core resources become very important. This is the case with knowledge, the key resource in many modern service sectors. The reverse of this has been seen in many areas of Ireland in recent decade where local depopulation leads to a fall below some critical level that is required to support local services, although some individuals requiring these services will remain. Somewhat paradoxically, in the case of production, these effects appear to have been enhanced as a result of developments in IT and for firms in IT sectors. However, the locational aspect of this can be overcome if the increasing returns can be accesses without proximity. This is the potential of broadband technology: if it allows the positive externalities of sharing information and knowledge to be realised in terms of higher productivity and an expanded set of consumption possibilities without requiring geographical proximity, then the costs that are associated with cities can be avoided. This is also a dynamic process in that there are other important knock-on effects. For example, if population remains in an area then other services can become viable in that area, even when they are not directly dependant on broadband for their production or delivery.

This analysis shows that there is an economic basis for the idea that there is an optimal spatial distribution for economic activity and household formation in Ireland. Similar arguments lead to conclusions in relation to the distribution of income that promote the idea that there are economic gains – in excess of the welfare benefits of reducing poverty – that arise from promoting greater social inclusion. Increasing attention has been paid to achieving both these objectives in Ireland and in Irish economic policy but the evidence of the past decade is that, apart from the important contribution made in this area through the reduction in unemployment, the

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15 The limit on the size of cities in both theories can come from the costs of density associated with greater exposure to disease, fire, crime, pollution, and congestion.
development of the economy has not improved the distribution of income in the manner that might have been hoped. Just as the leading regions have gained most from growth, the stronger income groups have gained from rising prosperity.

It is clear from this that there is a great potential inherent in the development of these new technologies. However, as indicated in Section 1.3 above, accessing the value of these benefits poses problems since there are no markets in many cases or, where markets can be proxied, market prices might be inappropriate. The implication of this, as discussed in the next section, is that cost benefit analysis might be unable to capture some of the most important aspects of the potential benefits that could arise from the investment. In this case, the correct approach is to assess the proposed investments against alternative policies that could be implemented to achieve similar socio-economic outcomes.

1.5 Appropriate Comparators for Assessment

There are two distinct steps in undertaking a CBA. The first is the correct identification of the nature of the costs and benefits that arise. It is essential that all costs and benefits are included even where these may not be the intended or direct result of the action. The second step is to define estimates for these costs and benefits, usually on a per unit basis. This is often problematic and missing data are not unusual, particularly where the costs and benefits are non-market. In instances where public policy is concerned, non-market values are assumed. Techniques are available for dealing with this but some element of uncertainty is inevitably introduced.

The relevant costs and benefits in any appraisal of change are marginal costs and benefits. Since the costs and benefits arise in a situation of change, the analysis is concerned with the comparison of an existing situation with one that will exist following the implementation of the change, in this case, the investment in the infrastructure. Furthermore, the techniques that are employed in the evaluation imply the existence of a 'best possible' alternative use for the funds that are employed in the investment, against which the validity of undertaking the investment is assessed. If this is done properly then it means that all the opportunity costs of the investment — in other words, the benefits that would accrue from some alternative course of action — are fully included. The net effect is that, in theory, the project does not need to achieve some predetermined positive level of return but that the benefits must be at least as great as the costs.

This has important implications, at least in theory, since it means that if the CBA is carried out using appropriate values and assumptions then there is no need to compare it with other projects. In practice, the problem is that it is very difficult to be sure that all values are appropriate and not all opportunity costs might be included. This problem is lessened if there is a general alternative use for funds that can be assumed in all CBAs and if a margin of error is built into the results. In Ireland, it has become commonplace to adopt repayment of the national debt as the alternative use of funds. Thus, the opportunity cost of the funds is the interest that could be saved on the national debt. This is usually taken to be 5% per annum of the funds involved. This has also given rise to the acceptance that the appropriate discount rate to be used is a
real rate of 5% per annum. This is recommended by the Government\textsuperscript{19}, although it is
debatable whether this is as appropriate going forward as it was in the past.

In practice, however, difficulties in undertaking CBA mean that it is usual to accept
that the NPV must be strictly positive and the benefit cost ratio must exceed 1 by
some margin. The extent to which this is required is indicated by the returns that have
been estimated for other projects. In the context of developing this infrastructure,
investment in transport infrastructure would appear to present the most comparable
area of investment.

Information supplied by the NRA indicates that investment in roads under the
previous OP produced a return of £134,000 per annum rising to £411,000 per annum
in 2011 for every £1 million invested in 1996, a growth rate of 7.8% per annum.
Discounting at 5%, this gives a benefit cost ratio of about 2.5 to 1 for these 15 years.
If assessed over 20 years this rises to 3.5 to 1. Over the 20-year period the IRR on the
roads would be 19.5%. This is not out of line with returns estimated on a range of
CSF transport projects, across EU member countries in recent years which have
averaged about 15%\textsuperscript{20}. Generally, the IRR for rail investment does tend to be
somewhat below roads in EU supported investments. Table 1.4 shows the returns that
have been found for investment in rail in Ireland in recent years. There is
considerable variation, but in the case of the DART appraisal this may be the result of
particular underlying assumptions\textsuperscript{21}. In summary, this research indicates that there
are benefits from investment in transport infrastructure in Ireland\textsuperscript{22}.

| Table 1.4: Benefit Cost Ratios, Net Present Value and IRR for DART and LUAS |
|---------------------------------|-----------------|-----------------|------------------|
| NPV in €million | Benefit Cost Ratio | Internal Rate of Return | Source |
| DART | 13,036 | 1.27:1 | 7.0% | Iarnród Eireann, June 1992 |
| Line A | 747 | 3.27:1 | 21.3% | Steer Davies Gleave, July 1999 |
| Line B | 714 | 5.45:1 | 25.5% | SDG, Sep 1999 |
| Line B1 | 393 | 3.23:1 | 16.0% | SDG, June 2002 |
| Line C | 67 | 2.89:1 | 3.0% | SDG, Sep 2000 |

*Source: Rail Procurement Agency*

This would suggest that the investment in broadband infrastructure would need to
provide a benefit cost ratio return in the region of 3:1 with an IRR in the range of 15
to 20%. Indeed, in the case of this latter metric, the requirement is not out of line
with what might be considered to be acceptable to the private sector.

However, a word of caution is required when undertaking comparisons. CBA has
many sources of error and the way in which it has been applied in Ireland has been

\textsuperscript{19} Department of Finance (1994) *Guidelines for the Appraisal and Management of Capital Expenditure Proposals in the Public Sector*


\textsuperscript{21} In the appraisal of the DART, it was assumed that economic growth would average 1% per annum.

\textsuperscript{22} This was well below the rates assumed in the LUAS evaluations which took place after the boom of the
1990s was clear. The value placed on time saved and accident costs were also much lower in the
DART appraisal. A real social discount rate of 5% was used throughout.

\textsuperscript{23} It should be noted that these appraisals do not include the benefits that would arise from the dynamic
externalities that were discussed in the previous section.

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criticised by the CSF Evaluation Unit among others. This means that comparison does not necessarily provide fail-safe conclusions. This problem is further underlined by the fact that it is not unusual to identify costs or benefits for which no quantification is possible. As discussed above, this is the case in the current project. In some cases a proxy value may be available, but it is often the case that these items are noted but are excluded from the actual calculation. In other words, only what can be measured is ultimately included. This is not usually as serious a defect as might at first appear since CBA is a decision aiding tool. It can assist in the decision but does not claim to always provide definitive answers, although it will normally allow for a recommendation to be made. However, in the case of the current investment, these benefits are likely to be very important.

In this case, a cost effectiveness approach whereby the cost of the project is assessed against the cost of achieving the some outcome through other means can be useful. An example of this would be if it were assumed that a road improvement between two towns would reduce commuting time, congestion and accidents but that a similar outcome could be achieved through investment in very good broadband infrastructure that allowed people to work from home to a much greater extent. The cost of the broadband per Km would be only a small fraction, probably in the region of 5 to 10%, of the road and usage costs would also be lower. Thus, if the benefits are comparable it is clear that the broadband represents the better investment, although no monetary value has been placed on all the benefits that arise.

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Part 2: Outline of Appropriate Model for Appraisal

2.1 General Issues for Consideration

2.1.1 Role of Appraisal

South Korea is the clear global leader in broadband deployment and adoption at 50% of households. One of the main reasons for this has been the active involvement of the government through regulatory reform and investment of US$15 billion in infrastructure development to date, with a further $30 billion to come by 2005. This has resulted from a clear policy decision to provide broadband access throughout the country. On the other hand, an Australian government minister speaking in 2001 said that to have all Australian households broadband capable by 2006:

‘would be horrendously expensive and a costly waste of time. There’s no role for government in facilitating that roll-out.’

Clearly, one approach of these will prove extremely costly and it is important that the government is in the best possible position to determine the optimal objective between these extremes. The problem is that the only valid way to determine a solution to this problem is to provide accurate estimates of the relative costs and benefits of investment in broadband infrastructure. However, while many governments, businesses and industry associations speculate as to the benefits of widespread broadband, few are actually able to draw on data and analysis to support these views.

Estimates of the possible valuation that will be placed on access have begun to emerge. These will amount from direct revenues as a result of providing access to the network and additional demand for computer equipment as new uses for the internet become apparent. These new types of demand have the potential to provide a major boost in trade for on-line services such as entertainment, education, telemedicine, communication, teleworking, shopping and advertising. In addition, there are important applications within industries in the structure of production that hold the potential to deliver considerable efficiency savings and deliver productivity improvements. Most importantly, it has been widely speculated that the inherent efficiency gains of much IT spending to date has not yet been exploited – the productivity paradox – and is only beginning to emerge due to advances in inter-connectivity.

Most of the analysis that is available to date has been designed to aid commercial decision making through providing demand analysis. However, for Ireland, the issue is somewhat different, in that, there may be considerable economic benefits through the boost that broadband would give to competitiveness. This has been put forward as the principal reason for Ireland’s investment programme but it is important that the appraisal of this programme gives adequate importance to the benefits of enhanced

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21 Senator Richard Alston, Australian Minister for Communications, Information Technology and The Arts attacking a proposal in the Labour party’s policy statement that all homes in Australia should have broadband access by 2006 speaking in October 2001.
consumer possibilities, particularly in areas where these have been relatively underdeveloped to date.

2.1.2 Direct and Indirect Benefits

It is normal in socioeconomic CBA that some benefits will arise to persons directly involved in the transactions under consideration whereas some will arise elsewhere in the economy. Furthermore, not all benefits will arise in the context of market relationships and will not always have appropriate market valuations. Indeed, it is these facts, along with the point of observations, which distinguish CBA from commercial investment appraisal.

Investment in broadband infrastructure will give rise to direct effects in terms of the transactions that take place during its implementation and in the direct sales of access to the infrastructure when completed. However, as shown below, the much greater issues are the transactions that will occur in the future as consumers demand new products based on the use of the infrastructure and firms undertake new activities and new modes of production. In many cases it is possible to value these indirect effects on the basis of market transactions but there are further effects related to the ability of broadband to allow for a better spatial distribution of activity that, while of very great importance in Ireland, are not easily valued. In these cases, it is important that these effects are recognised and alternative approaches are adopted.

2.1.3 Local, Regional and National Levels of Appraisal

Appraisal of the MANs programme is to be undertaken in terms of individual projects. This is the basis on which proposals have been compiled. In terms of the commercial appraisal that have been undertaken, which show that on the basis of the required capital expenditure, the local revenues will be inadequate to provide a viable rate of return, the correct level of appraisal is indeed the local level. These contain projections of capital and operational costs and of the revenues that will be received from local access. This information will be accessed in the course of the socioeconomic CBA but, as outlined below, it does not provide the basis on which the benefits of this expenditure will be appraised.

There is a further important issue. The investment is being made with national public funds so the appropriate level of analysis is ultimately the national return on these funds. However, the national benefits are not equal to the aggregate to the local or regional benefits for two important reasons. First, it is projected that the availability of broadband in the regions will make them more attractive as locations for industry in relation both to other parts of Ireland, principally the Dublin region, and to other countries. While it would be legitimate to include as local benefits industries that move to a town with a broadband network, a national appraisal must exclude any activity that is not additional to the country. This will be a considerable proportion of this industry in many cases. For this reason, the national benefits would be less than the aggregate of the local benefits. Second, while there are local benefits to a
previously lagging region if the infrastructure results in its development, there are additional benefits that do not accrue to the area. The biggest element in this is the impact on congestion in the developed area of some relocation towards the lagging areas. This is another way of saying that a sub-optimal spatial distribution implies costs for both the underdeveloped regions and the congested area around Dublin. Furthermore, there are general environmental benefits through less commuting and other issues related to community development that may not be fully included in an appraisal at the local level.

2.2 Approaches to Estimating Benefits

2.2.1 Household Benefits

As discussed above, a major problem with assessing the benefits to consumers of broadband is that they may not perceive these benefits until they are available. A way around this problem is not to concentrate on evaluating the direct impact of broadband on consumers’ decisions but to evaluate the change in consumer welfare that would result from its availability. Any new product or product improvement creates benefits for both consumers and producers. Consumers gain because they are able to purchase a new or improved product that was previously unavailable. They consume it up to the point at which the marginal value of the product to them is equal to its price. However, the price at which the good is available is the marginal valuation of the marginal consumer. This, by definition, is less than all previous consumers. Thus, consumers receive welfare from consumption in excess of their evaluation of the welfare of holding on to their money. While this analysis has been criticised on many occasions, it does comply with the observed result that economic well-being rises as economic activity increases. The benefit of growth in demand and consumption is approximated by the change in the consumer surplus.\textsuperscript{25}

The approach is illustrated in Figure 2.1. With demand curve $D_1$, the quantity consumed is $Q_1$, price is $P^*$ and consumer surplus is the shaded triangle ABC. When consumption rises as a result of the availability of supply to $Q_2$, indicated by the shift of the demand curve to $D_2$, then the area of the triangle increases to $AB_1C_1$.\textsuperscript{26} The difference between the before and after measurements of consumer surplus – the area $BB_1C_1C$ – measures the benefits to consumers.

\textsuperscript{25} It is important to realise that this approach includes all benefits in the household sector generated by the new services, in addition to the savings in time and commuting that this new technology will allow, and that these should be added in.

\textsuperscript{26} For simplicity of exposition, it is assumed that economies of scale mean that the new technology can be provided at the same price as the old technology. In fact, this assumption need not be used in the appraisal of broadband benefits under the MANs since there is no current price as all demand will be additional.
Recent work shows that this alternative approach to appraising the benefits to households of broadband access, based on consumer welfare, may be more appropriate than attempting to predict the future uses of the technology. In the case of typical broadband services, consumers either subscribe to the service, or they do not. As the uses of broadband multiply, the value to subscribers, as defined under the consumer surplus approach, rises far above the monthly subscription price.

This approach requires a number of pieces of information:
1. The nature of the demand curve and its elasticity
2. The period over which the evaluation takes place
3. The rate of growth of penetration of the new technologies in this period and a projection of the price of access
4. Changes in the population

In Figure 2.1 it is assumed that the demand curve is linear and that it shifts parallel to its original position. While these are clearly simplifying assumptions, the evidence is not available to determine otherwise. Furthermore, dropping the assumption of a linear demand curve has implications regarding the use of the consumer surplus approach while the assumption of a parallel shift proves to be trivial in the evaluation of the benefits from the introduction of broadband since no demand curve really exists at present.

Regarding elasticity, Crandall and Jackson assumed elasticity of demand equal to -1 in the US. While this assumption at first appears arbitrary, it may not actually be a bad assumption to start with since, in an oligopolistic market, this represents demand where the supplier is experiencing marginal revenue equal to zero. As already stated, this industry is subject to very large economies of scale such that the marginal cost

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27 Crandall, R. and C. Jackson, The $500 Billion Opportunity: The Potential Economic Benefit of Widespread Diffusion of Broadband Internet Access, Criterion Economics. In the analysis, this consumer welfare approach actually found estimates of benefits for the US that were very close to what was obtained by placing valuations on a speculative basket of possible future services that consumers might purchase.
facing suppliers at large volumes will approach zero. This is another way of saying that the main costs are in the capital and fixed costs, and that the connection of an additional user does not place great costs on the producer. In this situation, the profit maximising condition requires that the price will fall until demand rises to a level where marginal revenue approaches zero also. This is the argument that costs for consumers will be lower when volume is high (but volume will not rise until prices fall). In summary, the assumption of elasticity equal to -1 appears valid.

Improvements in the availability of broadband will increase the proportion of households that use the Internet and thus would create larger increases in consumer welfare than can be deduced directly from current estimates of the demand for broadband alone. Moreover, the demand for broadband will increase as new applications requiring high-speed connections are developed for Internet distribution.

It has been decided that the appraisal will assume a timeframe of 20 years. This appears appropriate since the timeframe must be a balance between a sufficiently long enough period for broadband to achieve penetration rates comparable with existing communications technologies, such as telephones or television, but sufficiently concise to recognise adequately that the speed of the technology cycle has increased and there is the possibility that broadband could be superceded if a longer timeframe was adopted. It is also in keeping with the recommendations of the Department of Finance regarding investment in infrastructure projects\(^{28}\). It is not thought appropriate, although the infrastructure may still be used beyond this date, that a final residual value should be added in. Technological improvements mean that it is likely to be obsolete from the point of view of adding to the competitiveness or welfare of society.

The period for the evaluation should be a sufficient period for the technology to reach a level of penetration equivalent to currently commonly used technologies. The degree of penetration of colour television would appear to be a suitable comparator. Currently, there are in the region of 1.1 million colour television licences in Ireland. On the basis of the data for 2002 in Table 2.1 below, this suggests a household penetration rate of about 90%.

There is an additional impact also. Increasing the availability of broadband would lead to a greater household demand for personal computers and related devices because they would need faster computers with greater storage capacity to interconnect with services available at these higher speeds. The shift in demand for these products would create additional consumer surplus from uses of this new equipment that is unrelated to broadband access, but which would exist in the absence of broadband. However, the benefits of this effect, while positive in terms of consumer welfare, are probably relatively minor and no estimate for this is included in the calculations.

Finally, given the extended timeframe for the appraisal, it is necessary to include the growth in the potential market as a result of population growth. Projections of population growth are based on the CSO Population and Labour Force Projection 2001-2031 (CSO, 1999). A range of projections are contained in this publication on

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the basis of assumption regarding migration and fertility rates. National migration is taken to be an indicator of the impact of economic performance on population while fertility reflects the impact of changing cultural norms. While there may be some divergence between the national and local level over some specific time – for example, Galway has been growing rapidly while the Midlands have been lagging – it is reasonable to assume the similar overall trends will assert themselves given the arguments that a major benefit of broadband is to counteract the suburbanisation of the country and achieve a better spatial distribution of households and economic activity. The projections are based on data from the 1996 Census and use high and low assumptions for the main variables. The preliminary results of the 2002 Census suggest that the high assumptions are more appropriate given recent trends, but the projection of these over the full 20 year period could be problematic.

The CSO assumptions are:

**Fertility:**
- F1: TFR to increase from its 1998 level to 2.0 by 2001 and remain constant thereafter;
- F3: TFR to remain at its 1998 level to 2001, decrease to 1.5 by 2011 and remain constant thereafter.

**Migration:**
- M1: Immigration continuing but diminishing
  - +20,000 per annum in 1996/2001
  - +15,000 per annum in 2001/2006
  - +10,000 per annum in 2006/2001
- M2: Immigration diminishing
  - +15,000 per annum in 1996/2001
  - +5,000 per annum in 2001/2006
  - zero net migration in 2006/2011

It was also assumed that mortality rates would decline consistent with gains in life expectancy at birth from 73.0 years in 1995/1997 to 77.8 years in 2030/32 for males and from 78.7 years in 1995/97 to 84.0 in 2030/32 for females. A projection based on moderate fertility and high immigration would appear to be most appropriate: this is a combination of F3 and M1. Alternative assumptions would clearly affect the future population and demand for broadband. A further assumption is required to arrive at projections for growth in the size of the potential market. It is assumed that household formation and household size remains constant at 3.25 over the period. Since the CSO has not yet produced household data from the census it is assumed that the number of households grew in line with population in the period 1996-02 and will continue to do so throughout the period of the appraisal. Under these assumptions, population and household growth will be as given in Table 2.1.

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29 In the period 1996-02, the population of Ireland increased by 6.8%. The population of Offaly grew by 6.6% while the Tullamore Urban area rose by 11.3%. The population of Galway City rose much faster than the national average at 14.9%.

30 The CSO projection under the M1/F3 assumptions forecast a population growth rate of 1.12% per annum in the period 1996-01. The actual rate in the period 1996-02 was just below this at 1.10% per annum.
Table 2.1: Population and Households in Ireland 2002-21

<table>
<thead>
<tr>
<th>Year</th>
<th>Population (M1F3)</th>
<th>Households</th>
<th>Annual % change in preceding period</th>
</tr>
</thead>
<tbody>
<tr>
<td>2002</td>
<td>3,917,336</td>
<td>1,203,976</td>
<td>1.10</td>
</tr>
<tr>
<td>2006</td>
<td>4,068,329</td>
<td>1,250,883</td>
<td>0.95</td>
</tr>
<tr>
<td>2011</td>
<td>4,178,461</td>
<td>1,284,232</td>
<td>0.67</td>
</tr>
<tr>
<td>2016</td>
<td>4,269,074</td>
<td>1,312,081</td>
<td>0.43</td>
</tr>
<tr>
<td>2021</td>
<td>4,335,656</td>
<td>1,332,545</td>
<td>0.31</td>
</tr>
</tbody>
</table>

Note: In the appraisals of individual MANs investments, these numbers should be adjusted to allowing for the actual start and end dates of the relevant 20 year periods.

These projections indicate that the number of households in Ireland will increase by 128,569 in the period 2002-2021. This is equal to 10.7% growth over the 2002 figure. This is clearly a much slower rate of increase than has been the case for the past few years.

If penetration rises to 90% then this would indicate 1.2 million active broadband household connection in 2021. Assume a 5% connection rate in the first year of operation, equivalent to just over 60,000 connections\(^{31}\). To achieve this level of penetration would require constant annual growth of almost 17.1% per annum for the full period. However, this assumption of a constant rate of growth appears unlikely and it is more likely that after a slow start the rate of growth would accelerate before slowing as it approaches its steady level of penetration. An example of annual growth under this scenario is shown in Figure 2.3.

![Figure 2.3: Assumed Broadband Growth Life-Cycle (% p.a.)](image)

This approach is more in keeping with a typical product life-cycle than an assumption of a constant rate of growth where early adopters are attracted to the new technology but the numbers are limited. Eventually, lower prices, due to economies of scale, and the availability of richer content attracts the mass market. Then as the technology matures and the market approaches saturation the annual rate of growth falls towards

\(^{31}\) This is assumed in the benchmark appraisals in Part 3 and a sensitivity analysis is used to account for the fact that delays in the connection of consumers are possible following full implementation of the infrastructure. The use of 2003 as the starting year in these figures should not be taken to imply an assumption that revenues are necessarily earned in the first year of the project. In the benchmark appraisals, the first revenues are earned in 2003, and 1 year later in the sensitivity, but 2002 is taken to be year 1 of the appraisal and the year in which the investment takes place.
a steady state. The number of connected households in each year under each approach is shown in Figure 2.4.

![Figure 2.4: Number of Broadband Connections (000s)](image)

This life-cycle growth assumption should be used in the appraisal and has an important impact since it speeds up the rate of adoption. Given the use of discounting, this means that the present value of this growth is greater than under the constant growth assumption.

### 2.2.2 Competitiveness and Production

The potential impact of broadband availability on Ireland’s competitiveness as a location for business has been emphasised in many of the reports that were previously discussed. Indeed, much of the macroeconomic analysis of the potential benefits that was included in the 1998 Forfás report on broadband concentrated on the impact on firms. As with households, the appraisal is once again confronted with the problem that the uses to which the technology will be put are not clear in advance of the availability of access to broadband. However, an equivalent approach to the one outlined above would not be appropriate since it could involve considerable double counting of benefits.

The reason for this is not difficult to see. In a closed system, the benefits that arise from consumption account for all the benefits that are produced, apart from the producer surplus increases that would arise from additional expenditure on goods and the external benefits discussed below. This is the model used by Crandall and Jackson for estimating the benefits from broadband in the US. However, this does not appear meaningful in the Irish situation for two reasons. Firstly, the Irish economy is not a closed system and improved competitiveness is a key reason for investing in broadband. Therefore, there are potential benefits from supplying to consumers abroad, if competitiveness improves, that are unrelated to consumption in Ireland. Similarly, it cannot be assumed that there is any change in producer benefit from an increase in consumption given Ireland’s very high marginal propensity to import. Furthermore, even where domestic goods meet this demand there is no guarantee that this represents a benefit to Irish residents. Secondly, the MANs programme is designed to make regions of the country more competitive vis-à-vis the main urban centres. This underlines the conclusion that an approach that implicitly
assumes a closed system is inappropriate. Thus, a producer surplus approach would not measure the potential benefits to Ireland from increased access to broadband by producers.

The main areas of benefit that will arise are increased incomes and increased tax revenues that arise in Ireland as a result of increased production based on the improvement in competitiveness as a result of broadband infrastructure. It is important to note that the inclusion of additional incomes here, since these accrue mostly to households, does not amount to double counting when added to the benefits under the consumer surplus heading. Consumer surplus is an increase in welfare over and above to value of income that arises from the expenditure of that income. Thus, adding consumer surplus to the additional income that arises measures the total additional welfare that accrues.

Placing a valuation on these benefits requires that some estimate is available of the extent to which broadband will improve competitiveness and then the effect that this will have on the level of production in the economy. In other words, to what extent would broadband improve competitiveness and in what way would increased competitiveness translate into increased output and incomes.

In earlier years, economics tended to measure changes in competitiveness by changes in cost factors. However, this approach was overly simplistic and is clearly inadequate for the current project. A better approach involves using productivity gains as a proxy for improvements in competitiveness. While productivity improvements do not translate perfectly into competitiveness gains – such is the complexity of competitiveness as evidenced by the amount of information assessed by the National Competitiveness Council in deriving its measures of competitiveness – it provides a workable metric for assessing the gains that can be achieved.

Although for the reasons above the US is not a good comparator for Ireland, research there indicates the extent to which competitiveness gains are important. It has been estimated that a full rapid roll-out of broadband would create in the region of 1.1 million permanent jobs in the US. These arise from productivity gains and higher consumer demand. Competitive gains would add to this. The same research also showed that there are a number of aspects to the competitiveness issue. Non-access to broadband does not only lead to a competitive loss relative to others but that it will lead to absolute losses as well. This arises since download times on the internet for non-users are increasing considerably by as much as 50% in the past two years as content providers design increasingly complex sites and systems. This means that there is a good reason why businesses, even if relatively sheltered from competition, need access to broadband.

Increased employment from the deployment of a broadband network will arise from three sources:

32 Perhaps the most important underlying difficulty with this approach is that increases in productivity may accrue as wage increases rather than improved productivity. This is very important in assessing changes in competitiveness but is less important in this case since wage increases will still result in benefits in Ireland but they accrue directly to consumers.

Constructing and maintaining the broadband infrastructure
• Manufacturing the infrastructure components and customer equipment; and
• Employment from services and applications, including supporting industries, that are created once the network is deployed.

The validity of including benefits as a result of investment of this sort – that is the benefits identified under the first two headings – has been questioned by Mulreany (2002). The argument is that if the funds that are expended on this project were used elsewhere then similar benefits would arise. Thus, they are fully offset if appropriate opportunity cost estimates are used, or if adequate account is taken of displacement. This issue is a difficult one to handle and there is some validity in the opposing view that if a general opportunity cost use is identified – such as paying off the national debt and including the interest costs – or if displacement effects are removed from the calculation, then it is legitimate to include these benefits here. Furthermore, if income received in the construction of the infrastructure is included as a cost – as it will be – then the benefits received from that in Ireland should also be included. It can also be argued that this work is in itself likely to stimulate activity in lagging areas of the country, thereby aiding the redistribution of income.

Research quoted by Pociask indicates that the cost of telephone plant consists of 28% labour costs. In the absence of detailed data on employment during construction this estimate should be used and the benefits of this included with due regard to the displacement effects discussed below. There will also be indirect benefits from this expenditure and, while this will not provide major benefits given that the investment is a once-off source of employment and the opportunity cost may be high, some recognition of this should be included.

Regarding the benefits to the Irish economy that accrue from manufacturing the infrastructure components and customer equipment, no benefits should be included since there is unlikely to be any additional benefits accruing to the Irish economy. A sizeable proportion of the materials that will be used are likely to be imported thereby greatly reducing their economic impact. Where home produced equipment is used, it is likely that this would have been produced and exported so the benefits of this are not additional.

However, irrespective of whether these benefits are explicitly included, their calculation provides a basis on which the importance of the last source of employment benefits, the indirect effects, can be estimated. This is a multiplier-type effect and therefore the benefits arising from these jobs should be considered to be indirect benefits of the investment. Indirect effects of investment have accounted for an important part of the benefits that have been identified in many CBAs in Ireland, particularly prior to the mid-1990s. However, although the net benefit of these impacts in a full-employment economy will be reduced they remain particularly important in this project. There are two reasons for this. First, the reduction in unemployment does not mean that the knock-on effects of any investment are reduced, it just means that the net benefits of this are lower. This should be accounted for by using an appropriate shadow price for labour, probably in the region of 90 to 100% of the wage rate unless the impact is felt in a lagging region. Second, an

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important issue is that indirect effects of investment in advanced technology are thought to be much greater than for the economy in general. This arises because of its productivity impact in sectors other than IT where the technologies are used and applied. This raises an important issue. The main effect of broadband will not be an increase in the number of jobs but an increase in the value of the employment that is available. In many respects this equates to the objective of improved competitiveness in the future: it allows for higher value added employment rather than aiming at increased employment.

It is important that this impact of the investment is reflected in the appraisal of its benefits. Thus, the opportunity cost of labour that should be used – that is, the shadow wage – should be based on the value of employment in the absence of broadband. This provides an argument that the shadow wage of ‘new’ employment should be below the wage rate, even in an environment of full employment. The new employment might not be additional jobs, but there are higher value jobs replacing what previously existed.

This argument holds even if the investment in broadband in Ireland does not propel the economy to the forefront of the OECD in terms of connectivity but merely allows us to keep pace. However, it is difficult to say to what extent the value of the employment that will exist with broadband will exceed currently available jobs, nor the extent to which this effect will diffuse through the economy. Comparison of recent pay scale in IT with other sectors would not be an appropriate metric to apply given that most people accessing broadband facilities will not be classed as IT personnel and the major changes that have occurred in labour market conditions in this sector in recent years. International research suggests however that the impact of investment in IT is much more extensive than for the economy in general. Pociask reports that IT multiplier effects are greater than for investment in general with the multiplier effect of the introduction of Microsoft software being estimated at 6.7. This is extremely high but is indicative of the productivity impacts that are possible. However, the multiplier effect of broadband is likely to be lower because while its potential applications are very wide it is not as fundamental a technology as a basic operating system.

It does appear likely that a multiplier in the region of 4 may be appropriate. In other words, 4 indirect jobs would be created for every 1 job created directly in the investment in broadband. Once again, it is worth noting that in the labour market that exists in Ireland, this should not be interpreted as 4 additional jobs, but that additional value equivalent to what would be created through 4 additional jobs will be created indirectly in the economy for every direct job created through enhanced productivity as a result of the availability of broadband. Furthermore, this is a total effect, the net benefits being found by the subtraction of the shadow wage, in this case, the value of the current employment of these people in lower value added activities.
2.2.3 External Benefits

Crandall and Jackson estimated that the potential economic benefit of widespread diffusion of broadband internet in the US could be as much as $500 billion per year\textsuperscript{35}. This was based on broadband becoming as widely used in 20 years time as the telephone service is now. However, if broadband is only adopted by 50% of households, they estimate the potential consumer benefit to be closer to $100 billion. This research leads to two conclusions. First, the potential benefits of broadband are very great indeed. Second, the level of benefits is very sensitive to the level of adoption with a non-linear relationship\textsuperscript{36}. This indicates that the benefits are subject to considerable network effects. These relationships are difficult to manage in an evaluation such as this because they are external to consumers in the sense that the benefits of broadband can increase without any additional cost or price implications. This is particularly important at the regional and national level where the network in question is the whole system.

There is another important implication of the existence of network benefits also. Broadband may eventually diffuse through the economy, even in the absence of state involvement. Therefore, the real issue is the fact that policy initiatives will speed up the process. This has a direct impact in that it means that Ireland remains competitive with countries that are moving ahead rapidly in this area. However, it also means that network effects occur at a much earlier stage than would be the case with a slower roll-out of the technology. Since the stream of future benefits needs to be discounted, then the current value of having the growth of benefits occur much faster is very important. This would be the case even where the network effects are relatively low, but where the are as important as the Crandall and Jackson indicates it becomes a very important issue.

The problem with including these issues, although they are important, is that there are no effective methodologies for the measurement of these dynamic effects. Indeed, instances of the successful application of weights to recognise the different marginal utilities of income in areas with contrasting economic performance are rare, even where the dynamic network effects are not recognised. The result is that the CBA approach will underestimate the potential benefits of broadband in terms of its long term impact on the spatial distribution of production and households in Ireland\textsuperscript{37}.

To demonstrate these effects, in the knowledge that CBA is a decision-aiding tool rather than a decision making process, the appraisal should include comparison with alternative investments that could achieve similar results. These alternatives would


\textsuperscript{36} These ideas were not explored by Crandall and Jackson and no distinction in this regard was made. However, in the context of the need for a more balanced spatial distribution in Ireland they are of considerable relevance.

\textsuperscript{37} It is expected that broadband will promote teleworking and therefore allow for more flexible living and working patterns. This has definite benefits but these are fully included in the consumer surplus approach above. The effects being discussed here arise from externalities that can be harnessed to alter the spatial distribution away from congested areas through enhancing the competitiveness of non-urban areas.
include enhanced transport and utility infrastructure in rural areas. Table 2.2 shows relative costs for some alternatives.

**Table 2.2: Infrastructure Costs per Km. (US$)**

<table>
<thead>
<tr>
<th>Infrastructure</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roads</td>
<td>550,000</td>
</tr>
<tr>
<td>Water</td>
<td>195,000</td>
</tr>
<tr>
<td>Electricity</td>
<td>145,000</td>
</tr>
<tr>
<td>Gas</td>
<td>85,000</td>
</tr>
<tr>
<td>Fibre Optics</td>
<td>22,000-35,000</td>
</tr>
<tr>
<td>Coaxial Cable</td>
<td>12,000-20,000</td>
</tr>
<tr>
<td>Copper</td>
<td>7,000-15,000</td>
</tr>
<tr>
<td>Wireless</td>
<td>3,500-15,000</td>
</tr>
</tbody>
</table>

Source: Canadian Broadband Taskforce

This indicates a very clear conclusion. Building a broadband infrastructure is expensive and return on investment is strictly long term. However, when compared to other infrastructure costs such as roads, water and electricity, broadband infrastructure is far less expensive by a factor of 10 and more in the case of most relevant alternatives. As a result of this huge discrepancy, it would appear safe to conclude that in terms of accessing these external benefits, this type of investment is potentially much greater than for alternatives that are required for economic development.

2.3 Costs

2.3.1 Direct Costs

The direct costs of each project will be based on the submissions and proposals that have been prepared in relation to each MAN. All costs should be included. This is done because the approach taken to the calculation of benefits includes all benefits that arise irrespective of whether they arise in the public or private sector. Where the costs are borne over a period of time, appropriate discounting should be used. A further important point for consideration in this regard relates to an appropriate value to apply to the social cost of public funds. This refers to the fact that public funds ultimately arise from taxation and taxes tend to be distortionary. These distortions mean that the cost of raising a given value of funds in terms of the overall welfare of the economy will, on average, exceed the monetary value of the funds that are raised. This should be recognised but it is unclear to extent this impacts on overall costs.

In the 1980s it was calculated that the social cost may be as high as 2 i.e. for every £1 raised there was a cost to the economy of a further £1. In this environment, it was necessary that the benefit cost ratio exceeded 2 before any net benefits were received, unless this social cost was explicitly included in the calculation. The availability to Ireland of EU funds during the 1990s meant that the proportion of public funds used in investment could be valued at their monetary value since their expenditure did not

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imply matching taxation in Ireland. There is no doubt that this situation has changed radically. Taxes are now less distorting in Ireland and the public finances are in a much stronger position. The combination of these two elements means that the funds that are investment could be borrowed by the state at preferential interest rates and paid back from future taxation. Given the potential increase in productivity it can therefore be argued that the distortions that result, and thus the social costs of the funds over their monetary value, will be quite low. Furthermore, given that the appraisals will take place in terms of individual local investments, it can be argued that these costs will fall elsewhere in the economy. As a result of these points, it appears appropriate that public funds should be valued at or close to their monetary value. Where social value is deemed to differ from the market value then a similar procedure should be applied to provide a social valuation of any taxation revenues that arise from the investment.

2.3.2 Additional Costs

It is important to recall that the investment in developing a broadband infrastructure does not, in itself, confer benefits on the economy beyond any benefits that may arise as a direct result of this expenditure. As explained above, these are likely to be relatively minor. Rather, the main benefits arise as a result of the efficiency and consumption possibilities consumers gain through the use of this new facility. This is important since it means that there will be a change in the way in which production takes place and consumers spend their income. This will result in transactions costs as customers change over to using the new infrastructure. Many of these costs will be borne by service suppliers who will invest in new services to make profits.

An important associated cost element for supplier is that the infrastructure that is proposed under the MANs programme does not, in general, deliver broadband directly into premises but to a close-by node. Thus, service providers will have to provide these local linkages. Clearly, this is a cost item but the inclusion of this cost in this appraisal is not appropriate. The purpose of this appraisal should be recalled. It is to provide a decision making aide to policy makers. The decision is whether the benefits exceed the cost of supplying the infrastructure. This does not include the local connection. This is a separate decision to be made by suppliers on the basis of the conditions that they will face. The MANs programme certainly hopes to influence this decision through the provision of regional infrastructure, but the remaining decision for service providers regarding the local connection is separate. It is a commercial decision to be based on expectations of private returns. These service profits and revenues are not included as benefits of the MANs investment, so there is no need to include these costs. To do so would require a restructuring of the appraisals. In effect, this would amount to a combination of costs and benefits from two separate decisions. A much better approach, and the rationale underlying the final part of this report, is to assume that service suppliers will react positively to the regional provision of the infrastructure. If not, then the indicators must be in place to recognise this and policy must be reformed to recognise which impediments continue to be important and react accordingly. However, the MANs programmes have been formulated on the basis that the proposed investment will bring forth the private
sector involvement. This is a quite separate issue from the decision being discussed in this report.

Customers will also experience costs in changing over to the new technologies. The benefits that these customers will gain are included, as consumer surplus in the case of household and as productivity gains in the case of producers, so it is correct that some recognition is taken of these costs. Indeed, these costs might be considerable for some businesses. Failure to recognise the costs of adapting to new technologies in production may be one of the reasons why the productivity gains of IT investments were very slow to appear in the results obtained by researchers in industrial economics.\textsuperscript{39} The problem is that there is no reliable information available for these costs. As a result, indicative estimates are included in the appraisals.

2.3.3 Opportunity Costs

A CBA should always include all opportunity costs associated with the project. This requires the specification of a counter-factual. In the case of the current project, the obvious counterfactual is that the investment does not take place and either Ireland remains without a broadband network indefinitely or slowly develops one as the private sector invests. In fact, these two options might not be all that different because a long delay will mean that Ireland would lose its competitive position – which might not be regained by belated and uncoordinated investment – and also the delay would greatly reduce the benefits as a result of discounting. This counterfactual would have two cost implications. First, the public funds involved would be available either to return to tax payers or use for some alternative purpose. In either case, the use of a social cost of funds as discussed above means that this opportunity cost is already fully included in the calculation.

The second implication is that the labour that would be used in either the implementation of the infrastructure or in the new employment created from its use would be available for use elsewhere. Thus, the cost of this labour must be included in terms of its opportunity cost rather than its wage value. As argued above, the full employment labour market in Ireland means that the shadow wage approaches its wage rate in most cases. However, there may be reasons to believe that the productivity gains resulting from the availability of broadband mean that equality of these two variables should not be assumed.\textsuperscript{40}

There has been much debate on the appropriate shadow wage in Ireland. Honohan has presented arguments that indicate that there is little basis in most cases for assuming any divergence between the two. However, Irish CBAs have commonly assumed values well below the wage rate and have been criticised for this.\textsuperscript{41} As a

\textsuperscript{39} Stiroh, K. (2002) \textit{Investing in Information Technology: Productivity Payoffs for U.S. Industries}, Federal Reserve Bank of New York identifies a number of reasons why this might have been so but presents evidence the eventual payoff when the technology is integrated and employed is considerable.

\textsuperscript{40} See, for example, Honohan P. (1998) \textit{Key Issues of Cost Benefit Methodology for Irish Industrial Policy}, Dublin: ESRI

\textsuperscript{41} CSF Evaluation Unit (1997) \textit{Cost-Benefit Analysis in the Community Support Framework: a Critical Review
working rule, the Department of Finance have recommended that an argument should be presented for any use of a shadow wage below the wage rate and that a rate below 80% should not be used. On this basis it is concluded that the shadow wage for labour employed in constructing the infrastructure should be valued at 100% of the wage rate, unless the investment is taking place in an area where there is good reason to suppose that this labour would be otherwise underemployed, or where the people involved would have to travel a long distance to find equivalent work. For example, there would appear to be little validity in assuming a low shadow wage in Galway City, but greater consideration should be given to this in areas where the project is led by Udarás na Gaeltachta or other recognisably lagging or underdeveloped regions.

However, the conclusion regarding indirect employment as discussed above is different and recognition must be taken of the fact that higher value employment will be created. Thus, it is appropriate that a shadow wage below the wage rate should be used. A shadow wage below the wage rate should be applied but, in keeping with the Department's recommendations, sensitivity analysis should be conducted at 100% of the wage rate also.

2.4. Calculation of Results

2.4.1 Discounting

A social rate of discounting should be applied to all future costs and benefits. In line with recommended practice, the appraisal will be undertaken using a real 5% rate of discount. This does not include any premium for risk which should be assessed separately.

This 5% rate has been commonly used and in the context of the very low global interest rates that pertain at present – given that there are believed to be sound theoretical reasons why the social rate should be less than the private rate as approximated by the rate of interest – it may be the most appropriate. However, over the longer term, interest rates are likely to rise and there are reasons to believe that this rate might be too low. One of the strongest reasons is given the fact that alternative uses for funds have changed in Ireland. Previously, repayment of the national debt was taken to be the general alternative and with an interest rate on debt in the region of 5% this could be argued to support the case for a social rate at this level. However, this is no longer a major issue in Ireland, and it is not the case that a faster repayment of national debt would be the most desirable use of public funds. In other words, the social valuation of the possible use of these funds is greater than the 5% interest that could be saved by earlier repayment. This argument is possibly given its strongest validation by the creation of the National Pensions Reserve Fund where the returns sought are likely to approximate the returns on investment in the private sectors. These would be greater than 5%. To allow for this uncertainty, it is recommended that the estimation should be undertaken at 8% to assess the sensitivity of the results to this variable.
2.4.2. Geographical Benefits and Displacement

As pointed out above, an important issue arises in this appraisal since while the evaluations are to be carried out on investments in individual area networks the correct level for the evaluation is at the national level. The reasoning is that as the funds that are to be invested are national funds then the returns must be appraised in terms of national returns. The key issue in this regard is to ensure that the results are presented in a manner that provides an explicit assessment of the extent to which the benefits that are identified are additional to the country as well as being additional to the local area. This means that assumptions in relation to displacement will be important.

The approach to appraisal that is outlined above is concentrated on the local level. The 1998 Forfás report on broadband provides a quite different approach to estimating the potential benefits of broadband by concentrating on identifying the relationship between investment and broad macroeconomic variables such as economic growth and national employment. While this is an inadequate approach to provide an appraisal of the returns that would be earned from the investments, it does provide an estimate of the national impact of investment in broadband against which the local impacts can be appraised. In this way, some indication of the displacement that is occurring may be available.

The Forfás analysis identified that the investment that was envisaged in the report would lead to an annual rise in GDP of £4 billion (€5.1 billion) by 2010 – it indicated that this would equate to about 5% of GDP but the more recent projection for GDP growth in the medium term suggest that this would be about 3.5% and an additional 35,000 jobs. However, more importantly, it also provided estimates for the elasticity of various variables with respect to this investment. For example, the report estimated that each €1 invested in broadband would result in additional investment of €7 elsewhere in the economy. The elasticities that were estimated indicated that for a 1% increase in GDP resulting directly from the investment in broadband there would be 1.3% increase in GDP from indirect investment induced growth and a 0.5% increase from net exports. This gives an investment to GDP growth multiplier of 2.8. In addition, there would be 0.53% increase in employment.

These estimates are based on national macroeconomic data so all displacement is already accounted for. It is notable that the relationship of direct to induced indirect investment at 1 to 7 is not out of line with the Microsoft impact referred to above. In addition, the overall multiplier is also considerably in excess of 1 suggesting that while displacement is an issue, there are likely to be net gains from productivity improvements. These results provide some measures against which the results of the appraisal can be compared to assess the magnitude of the displacement that might be taking place. In doing so it will be important to remember that higher displacement would actually mean that the investment was achieving one of its aims which is aiding a better spatial distribution of economic activity. However, it will not be possible to quantify some of the most important benefits of this.

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4 For the most part, this issue arises with regard to the benefits from productivity improvements. Consumer benefits will not be subject to displacement in this manner although there may be additional consumer benefits arising if a better spatial distribution of household location was to be promoted by the nationwide availability of broadband connectivity.
2.4.3 Treatment of Non-quantifiable Benefits

The discussion above indicates that there will be some very important non-quantifiable benefits, along with some probably smaller non-quantifiable cost. As is the correct practice with CBA the results will be presented without these being included. However, they should be recognised. Cost effectiveness analysis can help in this matter, but it will remain that the output of the CBA will always be less than a definitive decision if marginal net benefits are found.
Part 3: Application of the Model: Tullamore and Galway City

3.1. Parameters and Values Used in the Appraisal

3.1.1 Values for Benchmark Appraisal

Costs

The proposals provided by the West Regional Authority and the Midland Regional Authority provide the main information on direct costs that will arise. These are supplemented where necessary by data from other sources. All funds are valued at market rates and the shadow price of all labour employed in construction is set at 100% of the wage rate. There are also additional indirect costs that will arise before the benefits can accrue and must therefore be included. These arise from two main sources: changeover costs for users of the networks and costs arising from the need to upgrade the network nationally to facilitate its new extended usage. To meet this requirement, it is assumed that every household connection to the broadband implies a net cost of €250 at the time of the connection. No cost is assumed for business connections since the pace of technological change means that ongoing investment in new IT infrastructure has been a feature of businesses over the past decade or more, and will continue to be irrespective of the arrival of broadband.

Data has recently become available for work undertaken by Ovum consultants in relation to the upgrade of the network that will be required. This work is not directly comparable to the current appraisal as it concentrated on the country as a whole rather than individual areas. However, it concluded that in general the available backhaul and backbone infrastructure is good and would be able to handle the growth in the use of broadband with only moderate levels of investment. To provide a 5Mbit/s system, incremental investment of €42 will be required over the country as a whole. Although this investment will not be needed evenly in all areas, it is appropriate that the cost of funding this should be applied evenly across users. Thus, in 2002, there are just over 1.1 million households in Ireland, meaning an average cost per household of €37.63. Since 19,932 of these are in Galway, a cost of €750,000 is incurred. The 3,119 households in Tullamore imply a cost of €117,000. It is assumed that all these costs are incurred in year 1 and they are added to the local estimates of costs from the proposals that have been submitted.

Benefits

Data from a recent survey of consumer demand for broadband are used to construct a demand curve for access. It is worth noting that this may provide demand estimates

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43 Galway City and County Broadband Infrastructure Proposal Stage 1: Galway Metropolitan Ring (DPE2001-116), Western Regional Authority; and Tullamore Metro Ring (DPE2001-117), Midland Regional Authority
44 Assuming that household size has remained constant since 1996
45 Consumer Demand for Broadband: Survey Findings. MRBI and ODTR, September 2002

Peter Bacon & Associates
Economic Consultants
that are somewhat on the low side since, as has been shown previously, growth is likely to be supply driven with demand evolving as consumers realise the potential benefits and uses of access. However, it may be best to err on the side of caution in this respect. The survey results on which the demand curves for each area are drawn are shown in Table 3.1. From these data it is also possible to identify total revenue.

Table 3.1: Household Demand for Broadband (% of respondents)

<table>
<thead>
<tr>
<th>Monthly Fee</th>
<th>€70</th>
<th>€60</th>
<th>€50</th>
<th>€40</th>
<th>€30</th>
<th>€20</th>
<th>€10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extremely likely</td>
<td>2</td>
<td>3</td>
<td>8</td>
<td>15</td>
<td>26</td>
<td>38</td>
<td>55</td>
</tr>
<tr>
<td>Very likely</td>
<td>3</td>
<td>6</td>
<td>8</td>
<td>11</td>
<td>11</td>
<td>13</td>
<td>7</td>
</tr>
<tr>
<td>Fairly likely</td>
<td>14</td>
<td>12</td>
<td>14</td>
<td>13</td>
<td>15</td>
<td>10</td>
<td>6</td>
</tr>
<tr>
<td>Fairly unlikely</td>
<td>12</td>
<td>13</td>
<td>11</td>
<td>9</td>
<td>5</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Not very likely</td>
<td>16</td>
<td>17</td>
<td>14</td>
<td>11</td>
<td>7</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Not at all likely</td>
<td>45</td>
<td>40</td>
<td>34</td>
<td>30</td>
<td>25</td>
<td>21</td>
<td>17</td>
</tr>
<tr>
<td>Don’t know</td>
<td>8</td>
<td>10</td>
<td>10</td>
<td>12</td>
<td>11</td>
<td>10</td>
<td>11</td>
</tr>
</tbody>
</table>

*Source: MRB1 and OD1R (2002)*

In each appraisal below, it is assumed that the first three answers at each price level indicate demand while the bottom three indicate that there will not be demand. Furthermore, to remain consistent with the growth profiles identified in the earlier work, it is assumed that this level of demand is reached in the 10th year of the appraisal. It is further assumed that 50% of the ‘Don’t Knows’ will translate into demand at each price level. This provides the simple demand curve shown in Figure 3.1.

**Figure 3.1: Household Demand Curve for Broadband Access**

Finally, it is assumed that demand will have an elasticity of -1 in the long run. This information is combined with Census data on the number of households in each area to provide an estimate of household expenditure on access in each year according to the growth projections contained in Section 2.1. Since household data are not available from the 2002 Census, it is assumed that the number of persons per household has not changed since 1996.

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46 In summary, this is because at this level, marginal revenue is equal to zero. Since marginal costs will also be low relative to the total costs of supplying broadband — assume also equal to zero — the price level that provides this level of demand will maximise profits.

47 This may be an underestimate of the number of households in 2002 since the increasing propensity for single people to live in apartments plus the known decline in the birth rate in the 1980s would both suggest that the number of persons per household may have declined somewhat in this period.
In the appraisals below, these demand projections are applied to populations in Galway and Tullimore for the period of the evaluation, assumed to be growing at the rates shown in Table 3.2. It is assumed that household size remains constant throughout the period.

<table>
<thead>
<tr>
<th>Table 3.2: Projected Population Growth Rates, 2002-22</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year</td>
</tr>
<tr>
<td>2002-06</td>
</tr>
<tr>
<td>2006-11</td>
</tr>
<tr>
<td>2011-16</td>
</tr>
<tr>
<td>2016-22</td>
</tr>
</tbody>
</table>

The benchmark estimate of the benefits that arise as a result of improved competitiveness are based on an investment multiplier of 4. This means that for every unit invested in the infrastructure, there are an additional 4 units invested elsewhere in the economy. This is extended by the assumption that this multiplier also applies to employment that is created. In the first instance, it is assumed that this all takes place at the local level, but this is relaxed in the discussion on displacement where the point of reference for the appraisal is the impact on the whole economy.

The debate in relation to the shadow wage has been discussed earlier. The benchmark appraisal adopts a shadow wage of 80% for employment indirectly created as a result of the infrastructure being available. However, there is not a valid argument that employment in the installation of the infrastructure should be valued below the wage rate in the two areas under consideration.

*Discounting*

All identified costs and benefits are discounted to 2002 prices. The first year for which revenue will be earned is 2003. Thus, 2002 is taken to be the first year in which costs will be incurred, although it is recognised that the logistics of actually undertaking the investment might mean that this is too soon. However, this does not affect the calculation of net benefits as all costs and benefits would be put back by the same length of time. In accordance with the recommendation of the Department of Finance a real discount rate of 5% is used.

*Avoidance of Double Counting*

One final issue that has been referred to earlier but it worth noting is the danger of double counting, particularly of benefits. This is probably the most common mistake in CBA and can also be among the most difficult to rectify. In the current appraisal, the clearest possibility of the problem arising is that both benefits from consumption and production are included. It can be argued in many appraisals that because welfare ultimately depends on consumption that this alone should be included in the identification of benefits. However, the particular approach that has been adopted in this case means that double counting is avoided.

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"For example, it is not uncommon for appraisals to include benefits such as increased employment, increased incomes and balance of payments effects as though these are separable and can therefore be aggregated. In fact, they are often different manifestations of the same benefits arising."
The main reason that this arises is because broadband is essentially an enabling technology that allows for enhanced opportunities for consumption and production. Thus, the benefits to households are their willingness to pay for this technology, not the willingness to pay for the content that may actually be the ultimate consumption desire. This also explains why the cost of supplying online content or operating the system is not included as a cost of the investment. Production benefits are included since these will ultimately, through the generation of wealth, lead to consumption possibilities that may or may not be related to broadband\(^49\). This argument would be a lot less important in a closed economy where it could be argued that most of the additional production would be displaced, but this is not an issue in Ireland given the openness of the economy and the emphasis on competitiveness. In any case, these benefits are wholly additional to the benefits that arise from consumers having access to the technology, although the technology may in some cases assist in realising these consumption possibilities\(^83\).

A second reason why these production benefits are additional is that, even in sectors that are not tradable such as local services, broadband will reduce production costs even where the service is not delivered over the network. If there is competition then this will be passed on to consumers as an additional benefit in the form of lower prices or enhanced quality, if not then it will be captured by producers. Since these services are not related to the willingness of consumers to pay for access then they are not captured in the calculation of household benefits and are additional.

**Displacement**

An important issue that has been discussed in earlier sections of the report is that the benefits that are identified have been calculated as accruing at the local level. However, the expenditure involved relates to national funds. As a result, for a valid comparison of costs and benefits to be undertaken, it is necessary to ensure that the benefits that are identified are wholly additional from a national point of view. The problem is that the accrual of benefits in some areas may just mean that they have been displaced from some other part of the economy\(^51\).

This is not a problem in relation to the benefits to consumers in households that are identified. Consumer benefits as a result of consumption in one area of products such as those transmitted by broadband do not diminish in any manner the benefits that can arise in other areas. Thus, there is no displacement. However, there is an important issue in relation to the benefits that have been identified in production as a result of

\(^{49}\) The appraisals below assign much greater benefits arising from consumer surplus than from production. However, this should not be translated as saying that the benefits of broadband to Ireland’s productive capacity or competitiveness are relatively unimportant. As a simple indication of this, consider that the opportunities for increased consumption could not be availed of if the wealth is not created in Ireland, through enhanced production, to create the income that will be required to pay for this consumption. The assignment of benefits in this report is not an argument in relation to the dynamics of the economy but merely a way of measuring the benefits that arise.

\(^{51}\) If they do happen to be associated with the availability of broadband.

\(^{51}\) This is a quite different issue from opportunity cost where expenditure in one part of the economy means that an opportunity for its expenditure elsewhere, and thus the opportunity for benefits elsewhere, is foregone. Displacement must be estimated after all opportunity cost have been included.
improved competitiveness. The easiest way to see this is to assume that only a small number of the proposed MANs were implemented. In this case, it is arguable that these areas would provide competitive locations for new firms and that the additional benefits from expanding the number of networks to other parts of the country would not lead to a proportionate rise in the benefits from enhanced national competitiveness that arose as a result of the original networks. In a sense, the new additional networked areas are competing as much with areas within Ireland as with areas outside Ireland. Thus, there is an important element of displacement.

Actually placing a figure on this is problematic. While the displacement will be considerable, it will not be 100%. There are a number of reasons for this. First, there is a valid argument that having broadband access extended to all areas of the country provides a strong signal to prospective external investors that Ireland is serious about connectivity. In other words, it backs up the image and reputation of an economy that is geared from the information age in a serious way. Thus, there is an additional boost to competitiveness from extending the network. Second, there is a spatial advantage since household location is determined by employment opportunities as well as consumption opportunities. As a result, there is an addition to welfare in Ireland from having investment spread to all areas although the spreading might not increase the aggregate level of output or economic activity. Finally, some of the benefits are not related to international competitiveness but are related to the increased productivity of sectors such as local services as a result of having access to the internet. The delivery of professional medical treatment would be an example. Clearly, there is no displacement involved in this case.

Since the actual level of displacement of gains from the enhancement of competitiveness is therefore important but not total it is necessary to identify some appropriate proportion. However, there are no data available to allow for an estimate so it is necessary to assume some values. In the calculation below, the estimates are provided under the assumption that 30% of the benefits from enhanced competitiveness are merely displaced and would have accrued elsewhere in the economy even if the particular investment under review had not taken place. Allowance for displacement means that the aggregate of the identified net benefits after displacement from each appraisal, if all the proposed MANs were evaluated, would equal the total national benefits from the whole programme.

3.1.2 Values for Sensitivity Analysis

Sensitivity analysis of the benchmark appraisal is undertaken for 4 variables. The results are presented individually for each variable on a ceteris paribus basis and are also combined into an optimistic and a pessimistic scenario to provide a range for the overall estimate of net present value. In addition, the results are recalculated under the assumption that there is an addition time lag of 1 year before services are provided i.e. for investment under the MANs programme in 2002, revenues are earned beginning in 2004 and for investment in 2003 the first year of revenues is 200552.

52 Once again, it is worth noting that all value are expressed in 2002 values, since this is the base year, but does not imply that all or any of the revenues are earned in that year.
Household penetration of access to the internet is a key variable that will influence the benefits that accrue. One the basis of the earlier paper, the benchmark appraisal assumes that penetration will reach 90% over twenty years with a growth profile that is appropriate for a maturing technology product. To test the sensitivity of the results, this assumption is changed to give a profile whereby the technology is much slower to mature. Under this analysis, penetration reaches only 60% of households in the 20 years of the appraisal and the growth profile is altered to reflect the slower development by assuming a constant rate of growth of 14.6% over the whole period.

The social cost of indirect employment arising as a result of the availability of broadband i.e. as a result of the improvement on productivity and competitiveness has been valued at 80% of the wage rate. In line with Department of Finance recommendations, the calculation is redone by applying a shadow wage of 100% of the wage rate in respect of this employment. As will be seen, this effectively removes the benefits accruing to users other than householders from the calculation. A shadow wage of 100% is used for all employment associated with the construction of the network but employment in later years in the management of the network is given a shadow wage of 90%.

On the other hand, the benchmark appraisal was based on a multiplier of 4 for investment in this infrastructure. However, as discussed earlier, research in the US and in Ireland suggests that the multiplier might be as high as 7. The calculation is redone using this higher value.

The fact that almost all costs are upfront but the benefits will accrue only over an extended period of time means that the results produced will be sensitive to the discount rate that is adopted. As argued in the earlier paper, the assumption of the 5% discount rate may be worthy of further examination given the considerable changes that have occurred in the Irish economy in recent years. While interest rates remain at their present levels this is probably not too great an issue but this cannot be assumed to be typical of the full period of this appraisal. To accommodate this uncertainty, the calculations are redone using a real discount rate of 8%.

The results of the CBA can now be presented under 4 scenarios:

- The most likely outcome as described by the benchmark appraisal;
- An optimistic scenario described by the benchmark appraisal modified by the assumption that the impact of the investment on competitiveness and productivity in Ireland is profound and leads to an investment multiplier of 7;
- A pessimistic scenario described by the benchmark appraisal but modified by the assumption of:
  - Household penetration of only 60%;
  - A shadow wage of 100% of the wage rate for all employment created; and
  - A social discount rate of 8%.
- An assumption that uptake of the services by consumers is delayed until 2 years after the initial investment to allow time for other supporting infrastructure to be put in place and for the market to adjust.

This format allows for consideration of the possible impact of the considerable uncertainty that exists in relation to future developments. However, in the opinion of the consultants, the benchmark scenario is the best prediction. Indeed, there are good
reasons to suggest that only under extreme assumptions would a shadow wage of 100% be justified in this project, while a social discount rate of 8% is very high by comparison with other appraisals. Furthermore, the survey by MRBI for the ODTR suggests that take-up could be faster than the growth profile that is assumed in the benchmark appraisal.

3.2 CBA of Galway City Network

3.2.1 Outline of the Proposal

The proposal in relation to Galway City is the first step in a strategy to upgrade telecommunications in Galway City and County and in the wider Western Region. It aims to create a broadband triangle in the region linked to major population centre in the area via local regional loops. The proposal is focussed on providing the required infrastructure in the Galway urban area but states that a secondary objective of the tender is to create a revenue stream to fund the further roll-out of broadband to the wider region. The proposal is consistent with existing and proposed infrastructure related to the internet backbone and will be fully integrated with these structures.

The project will be managed by Galway City Corporation and Galway County Council. As well as creating the infrastructure, the proposal sees considerable benefits since the investment will promote the entry of new competitors into the sector.\(^{53}\)

The timetable states the work will begin in summer 2002 and the entire project will be completed by March 2003. It is assumed in the appraisal that connection will begin in the first year after the investment when 5% of households in the area will be connected. The benchmark appraisal proceeds on the basis of this timetable and adopts 2002 as the base year, but the sensitivity allows for delays in earning of revenues. If the investment is delayed that the base year can be assumed to be one year later with no overall impact on the net benefits that are returned. The infrastructure will also connect with the IDA Business Parks at Dangan, Mervue and Parkmore, the new business park at Knocknacarra, the campuses of NUI Galway and GMIT, schools and public offices, and the city’s two major hospitals.

The proposal estimates that the area has a workforce in the region of 35,000 with over 50 IT businesses close to the ring. These activities stand to gain since the infrastructure will overcome deficiencies in the area that had been previously noted by Forfás and will reduce prices for access to existing services. Finally, the investment is seen as an essential first step towards improving telecommunications infrastructure in the region.

\(^{53}\) The role of competition was dealt with in the general discussion of the market structure of telecommunications in Part I of this project. However, the appraisal in this paper implicitly assumes that competition is introduced. This arises as a result of the assumptions I regarding the price of access and the level of demand that firms are likely to want to achieve.
The proposal argues that this investment will be additional and that displacement will be very low given the dearth of broadband infrastructure in the area. Further, it states that the economics of the project mean that no operator would undertake this project alone without state intervention so the risk of deadweight is very low. This conclusion is backed up by the analysis that was presented in an earlier part of this report.

3.2.2 Projected Costs

Direct Costs

Table 3.3 contains a summary of the financial projections in the proposal. Of the total investment, 88.5% will occur within the Galway City Corporation Area.

<table>
<thead>
<tr>
<th>Table 3.3: Investment Summary of Galway MAN (€000)</th>
<th>2002</th>
<th>2003</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Investment</td>
<td>5,365.8</td>
<td>2,349.5</td>
<td>7,715.3</td>
</tr>
<tr>
<td>Total net of VAT</td>
<td>4,471.5</td>
<td>1,957.9</td>
<td>6,429.5</td>
</tr>
<tr>
<td>Grant Aid Sought</td>
<td>4,829.3</td>
<td>2,114.5</td>
<td>6,943.8</td>
</tr>
<tr>
<td>Aid net of VAT</td>
<td>4,024.4</td>
<td>1,762.1</td>
<td>5,786.5</td>
</tr>
<tr>
<td>Matching Funds</td>
<td>536.6</td>
<td>234.9</td>
<td>771.9</td>
</tr>
<tr>
<td>Matching Funds net of VAT</td>
<td>447.2</td>
<td>195.8</td>
<td>643.0</td>
</tr>
</tbody>
</table>

Source: DPE:2001-116, page 10

This analysis means that a funding rate of 90% is sought with matching funds accounting for the remaining 10%. For reasons discussed in an earlier paper, all funds being invested are valued at their market rate so this distinction is not important for the remainder of this appraisal. In addition, since the appraisal is ultimately being done from the point of view of the Irish economy, the cost of the investment net of VAT is the correct cost estimate to use.

The breakdown of costs for the Galway project is given in Table 3.4.

<table>
<thead>
<tr>
<th>Table 3.4: Costs for Galway MAN, 2002 values (€000s)</th>
<th>Total Value</th>
<th>Labour %</th>
<th>Capital Cost</th>
<th>Labour Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design</td>
<td>169.4</td>
<td>75</td>
<td>42.3</td>
<td>127.0</td>
</tr>
<tr>
<td>Build</td>
<td>4,702.8</td>
<td>28</td>
<td>3,386.0</td>
<td>1,316.8</td>
</tr>
<tr>
<td>Project Management</td>
<td>458.4</td>
<td>100</td>
<td>0</td>
<td>458.4</td>
</tr>
<tr>
<td>Supervisors</td>
<td>190.2</td>
<td>100</td>
<td>0</td>
<td>190.2</td>
</tr>
<tr>
<td>Overheads</td>
<td>24.4</td>
<td>0</td>
<td>24.4</td>
<td>0</td>
</tr>
<tr>
<td>Sub-duct &amp; Fibre</td>
<td>2,145.8</td>
<td>28</td>
<td>1,545.0</td>
<td>600.8</td>
</tr>
<tr>
<td>Ongoing management</td>
<td>2,569.3</td>
<td>75</td>
<td>642.3</td>
<td>1,927.0</td>
</tr>
<tr>
<td>Provisioning</td>
<td>173.9</td>
<td>28</td>
<td>125.2</td>
<td>48.7</td>
</tr>
<tr>
<td>Total</td>
<td>10,434.2</td>
<td></td>
<td>5,765.2</td>
<td>4,668.9</td>
</tr>
</tbody>
</table>

44 It is therefore being assumed that matching funds and grant aid funds are spent simultaneously and that the matching funds would have been invested in the regions in any case, although not necessarily in this project.

Peter Bacon & Associates
Economic Consultants
All figures are given in 2002 values having been discounted at 5%. The table also includes assumed percentages for each cost activity that show the costs arising from labour.\textsuperscript{55} The final two columns show the resulting values to be attributed to capital and to labour costs.

Most capital costs arise in 2002 and 2003 but there are some capital related costs arising in later years also. Although the proposal only identifies these up to 2011, it is assumed that they are constant throughout the 20 years of the appraisal. The NPV of all these costs in 2002 is €5.77 million when discounted at 5% per annum.

Labour costs amount to €4.67 million but require some disaggregating. This cost is actually a benefit to the economy in terms of the additional incomes and taxes that its payment implies. The cost arises due to the shadow wage that arises i.e. the cost to the economy of supplying this labour for use in this project. As explained previously, the shadow wage for labour employed in installing the infrastructure is assumed to be 100%. However, for labour employed in the ongoing maintenance and management of the project a shadow wage of 80% is assumed. This is based on the argument that the infrastructure will increase the productivity of the economy so the opportunity cost of the labour is the productivity of that labour in the absence of the infrastructure. However, for labour employed in the initial construction it is assumed that this labour would be fully employed elsewhere in the economy.

Not all labour costs accrue as income, some are paid as taxes. Assume that the average tax take is 30%.\textsuperscript{56} Thus wages amount to €3.27 million in total and taxes to €1.4 million. However, not all this tax revenue is additional. The same arguments apply as in the case of the shadow wage. Since this labour would be engaged and taxes paid, the tax arising in the initial installation phase is 100% displaced while the tax arising in later years is 80% displaced.

This provides the following outcomes:
- The social cost of labour in installation is €1.89 million
- The social cost of labour employed in maintenance is €1.11 million
- The total cost of tax displaced is €1.28

The benefits that arise from this employment are calculated below.

Other Costs

Change over costs are assumed to be €250 per household. This cost is incurred at the time of the connection. This amounts to €2.75 million in Galway. The cost to be assigned to residents of Galway as a result of the need to upgrade the national backbone and backhaul systems has a NPV of €750,000. Therefore total costs for inclusion in the appraisal are €14.95 million.

\textsuperscript{55} The assumption of 28% labour costs for installations is based on Pociask (2002) as discussed in the Task 2 paper.
\textsuperscript{56} In fact, given the assumption that public funds are valued at their market rate the actual level of tax assumed makes no difference to the final calculation.
3.2.3 Benefits

Households

The 1996 Census showed that there were 3.3 persons per household in Galway City. The 2002 Census showed Galway City with a population of 65,774, an increase of 8,533 (14.9%) over the 1996 figure. On the assumption of a constant household size, this indicates that there are 19,932 households in the area, an increase of 2,598 since 1996. Based on the demand projections in Table 3.1 above this gives the household demand and revenue for 2010 shown in Table 3.5, if it is assumed that population remains steady at its current level57.

Table 3.5: Broadband Household Demand in Galway (in 2010)

<table>
<thead>
<tr>
<th>Monthly Access Price</th>
<th>€70</th>
<th>€60</th>
<th>€50</th>
<th>€40</th>
<th>€30</th>
<th>€20</th>
<th>€10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demand (Households)</td>
<td>4,584</td>
<td>5,182</td>
<td>6,976</td>
<td>8,969</td>
<td>11,461</td>
<td>13,155</td>
<td>14,650</td>
</tr>
<tr>
<td>Annual Revenue (€000s)</td>
<td>3,851</td>
<td>3,731</td>
<td>4,186</td>
<td>4,305</td>
<td>4,126</td>
<td>3,157</td>
<td>1,758</td>
</tr>
</tbody>
</table>

This information is shown graphically in Figure 3.2. This shows that although demand falls continuously as price rises – indeed demand grows by 63% when the price of access falls from €40 to €10 per month – revenue peaks at €40 per month. Thus, for the reasons outlined, €40 per month for household access would appear to be the most likely price in the market.

Figure 3.2: Household Demand and Annual Revenue, Galway City, 2010

The appraisal assumes that population and household numbers grow as outlined and that broadband penetration growth occurs as outlined in the earlier paper. Data for these variables are shown in Table A1 in the Appendix. A constant price of €40 per month for access to the network is assumed. As shown in Table A1 this gives annual revenue of €482,880 in 2003 as a result of the assumed 5% penetration in that year (or whichever year is the first year of operation) rising to €9.7 million in the 20th year. Applying a real discount rate of 5% per annum to this gives a net present value (NPV)

57 This assumption is dropped in the subsequent appraisal. The year 2010 is chosen as penetration reaches the 43% level that was found in the MRBI survey in this year under the growth projections that are being used in this appraisal.
of €42.09 million for this revenue stream. This of course is not the value of the benefits that are created. The analysis in Section 2 is applied to the level of demand in Galway in Figure 3.3 to illustrate this. 58

![Figure 3.3: Consumer Surplus and Total Revenue](image)

Total revenue, the present value of the aggregate of which amounts to €42.09 million, is identified by the area of the rectangle ABCO. Consumer surplus as a result of the investment is the triangle ABD. Because all the revenue generated is additional, the whole of this triangle arises because of the investment. Demand is represented by point B. Since elasticity at this point is -1 – this assumption has been discussed previously while the assumption of a straight line demand curve is justified by Figure 3.1 above – then point B is exactly half-way along the demand curve. As a result, the distance AD is equal to the distance AO. Obviously therefore, the area of triangle ABD is half the area of rectangle ABCO.

This means that the consumer surplus arising as a result of household usage of broadband in Galway has a NPV of €21.05 million.

**Commercial Benefits**

Employment is created in Ireland as a result of the improvement in competitiveness and productivity brought about by the availability of broadband connectivity throughout the economy. In this section, and throughout this appraisal, the discussion of employment created should not be read as meaning that an absolute additional number of jobs is created. Rather, it means that addition labour to the value indicated is undertaken. Thus, even in a full employment economy, the investment may increase ‘employment’ as defined here through increasing the payment to labour as a result of higher productivity. This is in keeping with the discussion of the shadow wage elsewhere in this report. It is also consistent with the recommendations in

58 See Section 2.1, Figure 2.2 above.
Honohan (1998)\textsuperscript{59} and with the more recent work of Barry et al. (2002)\textsuperscript{60}, although it is expressed in slightly different terminology as required by the different projects under consideration.

The investment in capital of €5.77 million (in 2002 values) is assumed to have a multiplier effect of 4 times this throughout the economy. This investment of €23.1 million arises because the Irish economy has become a more productive and more competitive place to do business for firms that will use the broadband infrastructure but who are not necessarily engaged in IT industries. If Pociask's finding\textsuperscript{61} that 28% of this will be related to wage costs is applied then this indicates an increase of €6.46 million in incomes as a result of this infrastructure. However, there is a cost to be applied here. A shadow wage of 80% is applied, which means that the net benefit of this impact is €1.29 million\textsuperscript{62}.

Direct Employment Benefits

At the construction stage, €2.69 million of total expenditure is associated with wage costs (see table 4 above). It was assumed that 30% of this accrues as taxes. This is a benefit with a value of €0.81 million. Incomes create a benefit to the economy of €1.88 million\textsuperscript{63}.

The value of permanent full-time jobs created in managing the infrastructure were estimated at €1.98 million. With tax revenue at 30%, this gives a benefit of €0.59 million in taxes and €1.39 in incomes.

External Benefits

The importance of external benefits was discussed in Section 2. These arise from a number of factors:
- The impact of the infrastructure on the location of industry;
- Its impact on household location with benefits emerging as a result of people being able to live in the parts of the country that they may wish to while preserving a desired standard of living and thereby reducing costs in congested areas;

\textsuperscript{59} Honohan, P. (1998) \textit{Key Issues of Cost-Benefit Methodology for Irish Industrial Policy}. Dublin: ESRI
\textsuperscript{61} See Section 2.2
\textsuperscript{62} This certainly seems small when compared to the benefits from consumer surplus. However, leaving aside arguments in relation to the appropriate shadow wage it is important to remember exactly what this represents. It is not an estimate of additional output but represents the discounted value of the addition to welfare that arises from the extra incomes that will be earned in the Galway region because it is now a more productive economy.
\textsuperscript{63} Although there is no overall net benefit from this activity given that a shadow wage of 100% was applied for employment created in the installation and tax displacement of 100% was assumed, it is important that these benefits are included here since the social costs of this labour and displaced taxation are included above.
• Network effects due to the role that each MAN will play in the overall network: and
• Environmental benefits since people will be able to adopt more environmentally friendly ways of communicating and working. Indeed, this infrastructure could have a major effect through reducing the environmental impact of economic growth.

The spatial effects could be very important for Galway if the impact was sufficient to reduce the impacts of relative remoteness of areas to the West of the city. The impact of the networking variable could be very important given the fact that it is now believed that the real benefits of IT investment in recent decades are only emerging as the hardware becomes interconnected. There are also benefits as a result of the additional uses to which the equipment that is required to run the internet can now be put. However, since there are reliable ways to estimate these benefits they are not included.

3.2.4 Appraisal Summary

Net Benefits

On the basis of this calculation, the following costs and benefits arise in Galway. All values are present values expressed in year 1, i.e. 2002, prices.

| Table 3.6: NPV of Benchmark Costs and Benefits in Galway (€000s) |
|---------------------------------|-----------------|
| Capital Installation Costs      | 5,765           |
| Social Cost of Labour           | 3,000           |
| Tax Displacement                | 1,280           |
| Other Costs                     | 3,500           |
| **Total Costs**                 | **13,545**      |
| Household Consumer Surplus      | 21,050          |
| Competitiveness Gains           | 1,290           |
| Incomes from Direct Employment  | 3,270           |
| Taxes from Direct Employment    | 1,400           |
| **Total Benefits**              | **27,010**      |
| **Net Benefits**                | **13,465**      |

This excludes the spatial and network benefits that have been discussed above and in an earlier paper and additional benefits that may arise in firms and households from the usage of the associated equipment for IT tasks that do not involve the use of the internet. These spatial benefits are likely to be very important and could conceivably be of a magnitude similar to the benefits that have been evaluated. However, since there is no reliable methodology available to quantify the effects they are noted but are not included in the calculation.

This calculation shows total benefits from the proposed Galway MAN with a net present value of €13,465,000 and gives a benefit cost ratio of approximately 2 to 1.
Displacement at National Level

As discussed earlier, these benefits do not wholly accrue at the national level. In addition to the tax displacement that was included above, which occurs at the local level, there is a further impact that must be considered. This is relevant in respect of the competitiveness gains only and is not an issue in relation to consumer surplus. Indeed, it is arguable that displacement of consumer surplus if it implied a relocation of persons from congested areas would in itself be a benefit. However, this argument would be overly optimistic if applied to the competitiveness gains, although it is true for a proportion of these gains. If a displacement factor of 30% is applied to these benefits that the total benefits will fall by €387,000. This has a marginal effect only on the overall gains and no meaningful impact on the benefit cost ratio.

3.3. CBA of Tullamore Network

3.3.1 Outline of the Proposal

The proposal for the Tullamore MAN places the investment in the context of a wider investment to bring broadband infrastructure to the midlands. Tullamore is seen as one town among a number that should be provided with access in advance of its gradual extension to other population centres and areas with lower population density. Table 3.7 contains a summary of the financial projections in the proposal.

| Table 3.7: Investment Summary of Tullamore MAN (€000) |
|-----------------|------|------|
|                 | Year 1 | Year 2 | Total |
| Total Investment| 2,040  | 532   | 2,573 |
| Total net of VAT| 1,700  | 443   | 2,144 |
| Grant Aid Sought| 1,836  | 478   | 2,316 |
| Aid net of VAT   | 1,530  | 399   | 1,930 |

Source: DPE:2001-117, section 2

The project is not internally viable but when the applied for aid is included it returns a positive internal NPV with an internal rate of return of 19%. The grant aid sought is 90% of the total investment. The timetable outlined assumes 2002 as the first year of the investment with completion early in 2003. The project is to be managed by an external consultant.

As with Galway, the need for greater competition in the provision of telecommunications services is emphasised in the proposal. Currently, there is only one operator and no other operator has plans to construct an infrastructure. Thus, there is no prospect of any improvement in the situation regarding competition in service provision in the absence of the proposed investment. In addition, the proposers see the infrastructure as a key element in attracting new investment away from the Dublin area. The proposed infrastructure will have connection to all the main business areas, offices and schools in the town.
3.3.2 Projected Costs

Direct Costs

As in the case of Galway, most capital costs arise in 2002 and 2003 but there are some additional costs in later years. The NPV of these costs in 2002 is €2.12 million when discounted at 5% per annum. Assuming a 28% labour cost in this estimate gives a capital cost of €1.53 million and a labour cost in installation of €594,400. On the basis of similar assumptions to those used with the Galway appraisal, this implies a social cost of labour of €416,000 and tax displacement of €172,000 in the installation phase.

There are also on-going costs related to management, maintenance and provisioning. These amount to €135,000 in 2004 and are projected to grow by 5% per annum. It is assumed that this is an inflation rate and does not imply and real increase in costs. Thus, since this appraisal is being undertaken in real terms it is assumed that this is constant over the 20 years of the evaluation. The NPV of these costs in 2002 is €1.48 million. Assuming a 75% labour cost in this value (€1.11 million), this indicates that the social cost of this labour will be €622,000 with displaced taxes amounting to €266,000.

This means that total capital costs associated with the investment have a NPV of €1.9 million.

It is worth noting, however, that the proposal has estimated these management costs on a stand alone basis and that, since the maintenance could be undertaken on a part time basis, there would be considerable economies of scale to be achieved if a number of MANs were installed in the Midlands area. The consultants conclude that this is a relevant and realistic expectation and that this should be noted in the evaluation.

Other Costs

Changeover costs are again assumed to be €250 per household. This cost is incurred at the time of the connection. The NPV of this cost is €134,000 in Tullamore. The cost to be assigned to residents of Tullamore as a result of the need to upgrade the national backbone and backhaul systems has a NPV of €117,000. The total NPV of these costs in 2002 is €251,000

3.3.3 Benefits

Households

The 1996 Census showed that there were 3.29 persons per household in Tullamore. The 2002 Census showed Tullamore with a population of 10,260, an increase of 1,039 (11.3%) over the 1996 figure. On the assumption of a constant household size, this
indicates that there are 3,119 households in the area, an increase of 318 since 1996. Household demand and revenue for Tullamore in 2010 are shown in Table 3.8 if it is assumed that population remains steady at its current level\(^6\).

**Table 3.8: Broadband Household Demand in Tullamore (in 2010)**

<table>
<thead>
<tr>
<th>Monthly Access Price</th>
<th>€70</th>
<th>€60</th>
<th>€50</th>
<th>€40</th>
<th>€30</th>
<th>€20</th>
<th>€10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demand (Households)</td>
<td>717</td>
<td>811</td>
<td>1,092</td>
<td>1,404</td>
<td>1,793</td>
<td>2,059</td>
<td>2,292</td>
</tr>
<tr>
<td>Annual Revenue (€000s)</td>
<td>603</td>
<td>584</td>
<td>655</td>
<td>674</td>
<td>646</td>
<td>494</td>
<td>275</td>
</tr>
</tbody>
</table>

This information is shown graphically in Figure 3.4. As with Galway, this shows that although demand continues to fall as price rises above €10 per month, revenue peaks at €40 per month making this the most likely price in the market.

![Figure 3.4: Household Demand and Annual Revenue, Tullamore, 2010](image)

On the basis of similar assumptions for population and connection growth – the results are shown in Table A2 in the Appendix – a constant price of €40 per month for access to the network gives annual revenue of €75,000 in 2003 rising to €1.5 million in the 20\(^{th}\) year. Applying a real discount rate of 5% per annum to this revenue stream gives a NPV in 2002 of €6.52 million. On the basis of the model used for Galway, consumer surplus will be equal to half this value giving a benefit with a NPV of €3.26 million.

**Commercial**

Assuming that the capital investment with a NPV of €2.49 million contains a wage element of 28% and an investment multiplier of 4 is also used, then applying these ratios means that there is an additional €2.79 million in wages created through competitiveness gains in the economy. If a shadow wage and tax displacement rate of 80% is applied then the net benefit to the economy is €558,000.

\(^6\) As in the case of Galway, this assumption is dropped in the subsequent appraisal.
Direct Employment Benefits

On the basis of the cost estimates above, incomes in the installation phase will have a value of €416,000 with tax revenue amounting to €172,000. Permanent full-time jobs created in managing the infrastructure give rise to €1.11 million in gross labour costs. After tax wages account for 70% of this expense giving a benefit of €777,000 with tax revenue amounting to €333,000.

3.3.4 Appraisal Summary

These costs and benefits are summarised in Table 3.9.

Table 3.9: NPV of Benchmark Costs and Benefits in Tullamore (€000s)

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Capital Installation Costs</td>
<td>1,898</td>
</tr>
<tr>
<td>Social Cost of Labour</td>
<td>1,038</td>
</tr>
<tr>
<td>Tax Displacement</td>
<td>436</td>
</tr>
<tr>
<td>Other Costs</td>
<td>251</td>
</tr>
<tr>
<td><strong>Total Costs</strong></td>
<td><strong>3,623</strong></td>
</tr>
<tr>
<td>Household Consumer Surplus</td>
<td>3,260</td>
</tr>
<tr>
<td>Competitiveness Gains</td>
<td>558</td>
</tr>
<tr>
<td>Incomes from Direct Employment</td>
<td>1,193</td>
</tr>
<tr>
<td>Taxes from Direct Employment</td>
<td>505</td>
</tr>
<tr>
<td><strong>Total Benefits</strong></td>
<td><strong>5,516</strong></td>
</tr>
<tr>
<td><strong>Net Benefits</strong></td>
<td><strong>1,893</strong></td>
</tr>
</tbody>
</table>

This summary shows that the project returns a net benefit of €1.9 million and a benefit cost ratio of 1.52. This is below the return margin achieved in Galway. However, as in the case of Galway, this excludes the spatial and network benefits that are likely to be very important since there is no reliable methodology available to quantify them. Indeed, these may be particularly important in an area such as Tullamore given the Midlands has generally under-performed the national average in recent years. While Galway City has served as a focal point for the development of a vibrant economy in the West, the Midlands has lacked such a core. As a result, the creation of a core for the development of the area would hold the potential to create considerable benefits.

Similar issues also arise in relation to external benefits that are not included and displacement as in the case of Galway (see above). If a displacement factor of 30% is applied to the benefits from competitiveness gains then the total benefits will fall by €167,000.
3.4. Sensitivity Analysis

3.4.1 Galway

Applying a discount rate of 8% to the benchmark appraisal reduces the NPV of revenue from household to €27.95 million and consumer surplus to €13.97 million.

Applying a shadow wage of 100% and assuming tax displacement of 100% throughout the calculation reduces benefits by €1.99 million i.e. it eliminates the benefits from direct employment and as a result of gains in competitiveness that have been included in the benchmark appraisal.

At 8%, capital costs in Galway have a NPV of €5.52 million. Changeover costs fall to €2.01 million at 8% discounting if 90% penetration if achieved. If penetration is only 60% then these costs will amount to €1.72 million at the 5% discount rate and to €1.21 million at the 8% rate.

If household penetration of only 60%, rather than the central assumption of 90%, is achieved over the 20 years of the appraisal, the NPV of household consumer revenue is reduced to €22.82 million when discounted at 5% and to €15.44 million when discounted at 8%. Consumer surplus is therefore reduced to €11.41 million at 5% and €7.72 million at 8%.

If an investment multiplier of 7 is assumed – instead of 4 – then the gains from additional competitiveness will increase to €2.26 million.

This analysis means that the range for benefits – as defined by the pessimistic and optimistic assumptions outlined in section 1.2 above – is €0.99 to €14.435 million. This large range shows the importance of achieving a high household penetration although net benefits remain positive if even with all the ‘pessimistic’ assumptions. The discount rate is also particularly important and net benefits would also be almost €5 million even with the lower penetration rate. The results are not sensitive to assumptions in relation to the shadow wage, in contrast to the situation in most other recent CBA appraisals.

Overall, the project returns a positive net benefit with an expected NPV of €13.465 million on the central assumptions. Allowance for displacement at the national level would reduce this benchmark estimate by €387,000.

3.4.2 Tullamore

Applying a discount rate of 8% to the benchmark appraisal reduces the NPV of household revenue to €4.33 million and consumer surplus to €2.17 million.

At 8%, capital costs in Tullamore have a NPV of €1.53 million. Changeover costs fall to €103,000 at 8% discounting if 90% penetration if achieved. If penetration is
only 60% then these costs will amount to €94,000 at the 5% discount rate and to €73,000 at the 8% rate.

If household penetration of only 60% is achieved over the 20 years of the appraisal, the NPV of household revenue in Tullamore is reduced to €3.57 million, giving consumer surplus of €1.79 million when discounted at 5%. The NPV of revenue at 60% household penetration falls to €2.42 million when discounted at 8% giving a consumer surplus of €1.21 million.

Applying a shadow wage of 100% throughout eliminates the benefits from employment as a result of gains in competitiveness and direct employment and reduces benefits by €683,000.

If an investment multiplier of 7 is assumed then the gains from additional competitiveness will increase to €977,000 on the basis of the benchmark assumptions.

This analysis means that the range for benefits for the Tullamore MAN is minus €390,000 to plus €2,312,000. As in the case of Galway, this outcome shows the importance of achieving a high household penetration. In addition, when compared to the results for Galway, it also illustrates the sensitivity of the overall appraisal of the MANs to the size of the population that is within the catchment area. It should also be pointed out that there may be some opportunity to reduce some of the costs that are associated with the management of the network in the context of other projects in the Midlands area and this would provide a net benefit on the benchmark assumptions. This option should be explored at the appropriate time. The discount rate is also important and a marginal return would still be achieved at the lower penetration rate if the 5% discount was used with the 'pessimistic' assumptions.

Overall, however, the project returns a positive net benefit with an expected NPV of €1.89 million. Displacement at the national level would reduce this benchmark estimate by €167,000.

3.4.3 Impact of Delays in Service Provision

This analysis has assumed that services are provided to consumers, including commercial consumers, in the year following the investment in the MANs programme. However, this is not directly under the control of the public sector and it is possible that delays could occur. Assume that no service is supplied until 2 years after the investment. This means that from investment by the public sector in 2003, no revenue is earned by private operators until 2005 when 5% of potential customers sign up for access to the services. Table 3.10 shows the impact that this has on net benefits under the benchmark assumptions.

There is no impact on costs as these are still incurred as in the benchmark appraisal. As a result, all the costs of the delay are transmitted directly to reducing the net benefits. The calculation shows that net benefits in Galway are reduced to €12,179,000 and the benefit cost ratio falls to 1.9 (from 2). In Tullamore, net benefits are reduced to €1,630,000 and the benefit cost ratio to 1.45 (from 1.5). This shows
that the benefits are reduced by delays of this kind, by almost 10% per year of delay, but that the conclusion of positive net benefits remains robust for both proposals for the delay assumed.

<table>
<thead>
<tr>
<th>Table 3.10: Present Value of Net Benefits with Delayed Provision (€000s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Galway</td>
</tr>
<tr>
<td>-------</td>
</tr>
<tr>
<td><strong>Total Costs</strong></td>
</tr>
<tr>
<td>Household Consumer Surplus</td>
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<tr>
<td>Competitiveness Gains</td>
</tr>
<tr>
<td>Incomes from Direct Employment</td>
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<tr>
<td>Taxes from Direct Employment</td>
</tr>
<tr>
<td><strong>Total Benefits</strong></td>
</tr>
<tr>
<td><strong>Net Benefits</strong></td>
</tr>
</tbody>
</table>

This delay would also impact on the range of values between the positive and optimistic outcomes in the sensitivity analysis. In Galway, the net benefits under the pessimistic scenario when a delay of this nature is also assumed fall to €420,000. In Tullamore, the lower range falls by €10,000 under the assumption that all the pessimistic assumptions hold and that there is also a delay in the provision of services to 2 years after the investment. These results indicate that while it is important that service provision takes place quickly after the introduction of the infrastructure, of greater importance is achieving a high penetration rate among households over the period of the appraisal, particularly in the early years.

### 3.5 Summary of Results

The central benchmark assumptions return a positive net benefit from these investments. However, the results are sensitive to broadband achieving a high take-up rate in households and to the size of the populations within the area to be served. In both cases, a penetration rate of 60% reduces the overall benefits considerably. The Galway appraisal shows positive net benefits under all assumptions contained in the sensitivity analysis but the Tullamore appraisal suggests that under a pessimistic scenario these returns are eliminated. The high shadow wages assumed mean that the benefits from improved competitiveness are small in comparison to the benefits from consumer surplus, although the consultants believe that these shadow wages might be too low. However, the results of the CBA are not sensitive to this variable and the values used are in line with official recommendations.

What this analysis does show very clearly is that the consumer gains from the availability of broadband should dominate debate and decisions in this area. This means in practice that competition in the area is vital to ensure that prices for access are sufficiently reduced. Indeed, the availability of welfare gains from the investment in this infrastructure will depend crucially on these price reductions. This situation is different from other major investments – such as roads for example – where utilisation could be expected with considerable certainty. If pricing structures are correct then penetration in Ireland is likely to be high among households, but this cannot be assumed with certainty in the absence of appropriate measures.
It should also be emphasised that the estimates of benefits do not include values for the external benefits that would arise as a result of the impact of the MANs on the spatial distribution of economic activity in Ireland. The potential gains from an improvement in this respect are very considerable and could be a multiple of the benefits that are quantified here. Indeed, it can be argued that these non-quantifiable benefits provide the core rationale for any state involvement in the provision of funding for investment in broadband in areas where the private sector has been unwilling to do so.

One final point in relation to external benefits not included here requires some comment. The MANs programme is designed to provide connectivity in the most economically advantageous areas in the first phase while extending the network to all regions of the country. The ultimate goal is that the revenues generated by the operation of the system in these areas will provide the funds for the extension of the network to less economically viable areas, primarily to the hinterlands of the towns that have been identified for connection in the first phase. Thus, it can be claimed that these investments facilitate this wider application. The question that needs to be considered is whether this implies additional benefits that will arise from these investments in the first phase that should be considered in this appraisal.

The conclusion of the consultants is that this does not represent an additional benefit. Whether or not this happens as planned is not the issue. Rather, it is the fact that this extension of the network will involve the expenditure of funds that will arise as revenues from these initial investments. These will arise from the subscriptions made by households and businesses connected to the network. These payments are made because, by doing so, these customers receive benefits. These benefits have been included fully in this appraisal, either directly for households as consumer surplus, or indirectly for business in terms of the impact that there will be on future incomes. At the next stage, the decision must be made whether the expenditure of these funds on extending the network should proceed on the basis of the relative costs and benefits from doing so.

The key point is that to include these future welfare gains in the current appraisal would involve double counting of the benefits that arise from the first phase. It would only be feasible to include these if the calculation of existing gains were to be reduced by the cost of the investment that will be required to extend the network. This would be an artificial and complex operation since it involves the amalgamation of the appraisals of separate investments. Therefore, there are no additional gains that should be included on the basis that this extension may proceed in the future.

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63 Indeed, the commitment to extend the network beyond the MANs may actually work to undermine some of the benefits that are identified here since it is possible that may imply a commitment to spend these funds on an investment in infrastructure that might not return a positive net benefit. However, this would require appraisal in the future before any conclusion is reached.
Part 4: Performance Indicators for the MANs Programme

4.1 Key Characteristics of Indicators

The role of economic policy is to respond to decision made by society regarding its economic objectives. The improvement of welfare can be assumed to be a generic objective of policy, although this will be subject to decisions in terms of what this might mean in effect. To bring this about it is necessary to identify some change or development in the economy that economics has identified as being capable of bringing about the improvement in welfare. In the context of the current project, the greater use of broadband is identified as this intermediate objective. The next stage is to formulate a policy programme. The decision to promote broadband is an example. This then requires a programme for the implementation of policy, this role being undertaken by the MANs programmes as formulated.

The role of this report has been to evaluate the economic lever - state provision of investment in broadband infrastructure - for the implementation of this policy and to examine the nature of the relationship between the greater use of broadband - the intermediate objective - and the final objective of increased welfare. The conclusions indicate that the implementation programme is both necessary and appropriate to implement policy and that the relationship between the intermediate use of broadband and economic welfare is not only positive but remains positive when the costs of the policy are allowed for.

This conclusion is sufficient to provide a recommendation that the policy should be proceeded with. However, there is a problem that is attendant with almost all economic interventions, that there are seldom levers under the control of the government that directly bring about the objectives. In other words, there are lags between implementation and outcome. These can take the form of time lags that affect the outcome or unforeseen effects that result in different outcomes than expected. In such cases, it is important that policy can observe these factors and can adjust to counteract the distortion that has emerged. This structure is captured in Figure 4.1. The final outcomes or objectives are distanced from the implementation stage by three stages:

1. Implementation involving the application of resources detailed in the plans. Progress here can be measured against pre-determined targets. Expenditure of resources is not an achievement in itself but only because it allows progress towards the next stage. The indicators here require a number of characteristics. The must be observable on an on-going basis, the must be responsive to policy and they must reduce the time and increase the certainty of the next stage being achieved.

2. Changes in economic activity in terms of the supply of services. Broadband services will not be directly supplied by the government but by the private sector in a commercial setting. The move between the previous stage and this stage is not only crucial but also among the most difficult to monitor. In terms of broadband, it has been determined that the private sector is not currently investing sufficiently in providing services. However, the belief is that they
will invest in this activity in the presence of the infrastructure that is being provided. Clearly, monitoring of this stage is vital and a series of indicators are required. These indicators must provide the vital link between the public and private sector but must be available sufficiently quickly to allow policy to respond.

3. The final set of indicators must be closely related to the intermediate objective. The proposition is that consumers will respond to the provision of services and that indicators of uptake provide a good indication of the likely use of broadband. The link between supply and demand is not known precisely in advance, but some leeway can be accepted here without increasing risk in the overall system since it can be assumed that, having invested, the private sector will undertake the required measures to stimulate demand. However, the level of demand sought may be below the social optimum.

Figure 4.1: Role of Indicators in Policy Implementation
In addition to providing information on progress with a particular programme of intervention, appropriate indicators can also be useful to assist in separating the impact of the specific public policy measure from other influences on the economy and society and determining whether these impacts contribute to the objectives that have been established. For this reason it is extremely important that there is clarity with respect to the chain of causality between the structural measure being applied and securing the intended objective. Simple ‘theories of action’ can be useful devices in establishing such logical chains and determining, at least in theory and at a conceptual level, what might be expected to be the impact of a particular measure and its role in securing a stated objective. They can also assist in separating intermediate outputs from ultimate impact effects.

Thus, clear a priori reasoning can assist with determining how particular measures could be expected to have a durable impact and has an important role to play in the process of selecting relevant impact indicators. However, the process has obvious limitations. For example, having determined a causal relationship on grounds of a priori reasoning, it is another matter to predict the nature of the cause-effect relationship which is involved or to isolate the impact of measures taken to influence that relationship from the effects of other variables that are at work. In practice, other empirical issues, too, can constrain the effectiveness of particular impact indicators. In particular, there may be long and variable time lags between the achievement of results and the impact on socio-economic variables, such as growth or employment.

Finally, in the context of improving the regional balance of economic activity in Ireland, indicators can be used to explore the extent to which there are significant regional variations in telecommunications quality in the BMW and SE Regions as compared with the national average. In effect this would entail establishing a basis for assessing the regional endowment of telecommunications infrastructure.

A final issue for consideration is the need for value to be extracted from the use of indicators. This will only occur if the indicators have an impact on policy, either in the formulation of future policy programmes or in the modifications of the existing programme. Learning for future projects is insufficient in the case of the programme under review and the impact of the feedback that observation of indicators implies needs to be monitored.

The two main roles of indicators are to reduce time lags between action and outcomes and to reduce the risks and uncertainty associated with policy implementation. The relative importance of these two elements can vary but all indicators must contribute. In addition, all must be easily observable without excess cost, reliable and understandable. In addition, linkages between the activity to which the indicator applies and activities at neighbouring stages of the model as described must be known and reliable. This section of the report provides recommendations for appropriate indicators at each stage of this model.
4.2 Types of Indicators

4.2.1 Implementation Indicators

Because much of the output of the public sector is not sold in markets, a general convention has been adopted that the value of the output of the public sector can be assessed from the cost of producing the services that are supplied. This has validity at the macroeconomic level, such as in the determination of national income, but there has tended to be an unjustified willingness to extend this approach to microeconomic interventions. On example of this has been a tendency to monitor progress with the implementation of policy through indicators that are essentially resources based. In other words, they measure expenditure.

However, while this approach is insufficient, it does not mean that resource based indicators do not have value. This is particularly the case in the current project. The preceding section have shown that there will be benefits to the country for the extension of broadband services but that the public sector must invest in advance of these benefits being realised. Programmes for this investment have been formulated under the MANs. Clearly, given the need for prior investment of public funds, progress with the implementation of the expenditure programmes is important. In addition, the experience of recent years in other infrastructure projects shows that the need to control cost over-runs provides additional rationale for close monitoring.

The regional proposals provide the basis for the formulation of indicators of progress. These provide details of technical requirements in each area and also of costs. In addition, they provide indicative timelines. The use of the proposals to derive indicators is also important in terms of the current project since they provide the basis on which costs have been assessed. Furthermore, as shown in the previous section, the coverage and timeliness of intervention are relevant variables in terms of their impact on the calculation of net benefits. However, this reliance also means that few general indicator values can be derived. Instead, the values against which to assess progress under each variable should be based on the details of the proposals for each area.

The following time line for the implementation of the plan was set out in the Galway City proposal[^66].

<table>
<thead>
<tr>
<th>Activity</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Planning, Tendering, Negotiations &amp; Contracts completed</td>
<td>1st January</td>
</tr>
<tr>
<td>Western Ring 50% complete</td>
<td>24th May</td>
</tr>
<tr>
<td>Eastern Ring 33% complete</td>
<td>12th August</td>
</tr>
<tr>
<td>River Crossings completed</td>
<td>23rd August</td>
</tr>
<tr>
<td>Western Ring completed</td>
<td>1st September</td>
</tr>
<tr>
<td>Eastern Ring 66% complete</td>
<td>1st November</td>
</tr>
<tr>
<td>Project completed</td>
<td>21st February (year +1)</td>
</tr>
<tr>
<td></td>
<td>14th March</td>
</tr>
</tbody>
</table>

[^66]: The proposal assumed that the project would start on the 1st January 2002. However, references to the year have been deleted from this table and references to dates should be read as indicating the time to reach each successive stage with reference to the actual starting date.

Peter Bacon & Associates
Economic Consultants
The proposal also includes details of other expenditure such as the marketing programme and the management of the project. The provision of funds should be preceded by precise costing of the money to be spent on each element of this programme. In addition, the contract with the infrastructure developers should explicitly include these, or equivalent, project management dates with appropriate penalties for any over-runs.

The first indicator required is a timeline for the development of proposals. As mentioned, the Galway proposal is based on a start date of January 2002, but there have been delays in getting the policy into action. The Department should assess, on the basis of past experience how long it takes from permission to action in the case of spending programmes such as this. The optimal would indicate that, on the basis of the Galway timeline, permission for the programme of expenditure to proceed should be adopted as the start date and the proposers notified accordingly. This is the recommendation of the consultants.

The information in the proposals provides the second and most important indicator in this stage. This the time line for the expenditure of the funds that have been allocated. The indicative outline would be easy to construct on the basis of the agreed time profile with each proposer and the actual progress can be measured against this.

This generic indicator should be supplemented by project specific indicators that would assess progress at more detailed level against the original contracts, but would be dependent on the specific details of each project.

The final indicator in this regard relates to the development of the infrastructure to outlying areas. This is provided as one rationale for the design of the MANs programme and so it should be included. On the basis of the information provided for Galway City and assumptions in the text, revenues should begin to accrue about 2.5 years after the initial starting date. Thus, it seems appropriate that date of about 3 years following the original start should be adopted as the starting date of the second phase of development.

While these recommendations have applicability across all projects, the precise values will vary according to the details of each project and so these need to be agreed with the proposers in each case.

4.2.2 Activity Indicators: Supplier Response

Since private operators and service providers play a crucial link in ensuring that the infrastructure that is provided is utilised, monitoring this side of the market is vital. This should take two forms:

- Assessing metrics in relation to market supply
- Examining the impact of regulation and the need for reforms in this area.
A key issue underlying the rationale put forward for the MANs and a vital requirement for their success will be the extent to which the number of firms supplying services increases and the impact that this has on competition. A simple measure of the number of firms is useful, but is not necessarily a good measure of competition provided the number is at least two. The analysis in the first part of this report, which identified the existence of both a low equilibrium for firms that may be preferable form their point of view given the risks that exist in this market and a high equilibrium that is definitely superior from the point of view of society, indicates that the number of firms is not a sufficient measure since all might be tempted to aim for the low equilibrium.

The first variable that would be available would be investment by firms in an area. Since this will require some work on public properties – roads, etc. – applications for access should be monitored. The coverage of such applications within an area and the number of firms involved are key indicators.

The price of access is a key variable. The analysis in this report is based on the availability of access at a flat rate of €40 per month. This is an obvious metric to apply and the indicator should access the provision of this within a relatively short period, at most 1 year, following completion of the MANs programme in each area.

More extensive indicators of market power and the potential for its abuse to limit the uptake of broadband, and thus the returns to the investment are required. Indicators of competition would include:

- The extent of roll-out of competing broadband delivery routes;
- Measures of the availability of broadband services at home, work and other public sites such as schools and libraries;
- Suppliers willingness to meet consumers and businesses’ reasonable expectations in terms of price, quality and range of products available;
- Comparisons between the prices of services in Ireland and prices offered in a competitive market as indicated by prices in countries such as the UK;
- An assessment of the availability of clear and readily accessible information on the nature of services and choices available to consumers and businesses.

Undertaking this requires access to market research and consumer attitude studies to assist it in assessing the extent to which these measures – as indicators of effective competition - are being achieved. It should be noted that this approach is essentially at a macro or market wide level of analysis and as such it would be additional to and examinations of the supply of broadband services and the behaviour of specific market players. Together, this should enable conclusions regarding the extent to which operators have significant market power and in identifying general trends in the level of competition in a market. This is a key input into assessing the extent to which the MANs aim to encourage investment has met one of its key objectives and would also indicate the appropriate level of regulation going forward.

Of particular importance in the area of regulation is the EU Framework for Telecoms which sets the basis for the competitive development of telecommunications, including broadband throughout the EU. The new Directives, which become applicable through Irish law in July 2002, i.e. 15 months after agreement in April
2002, establish a set of procedures to ensure the harmonised application of the regulatory framework throughout the Community. The legislation aims to reduce regulation as competition becomes effective in specific markets and their adoption is expected to stimulate more competition as it will create a clear and consistent regulatory framework across the EU for all telecoms operators.

The Access and Interconnection Directive is designed to encourage competition at all levels. This will simplify rules for market entry, with new authorisation rules across the EU that remove the requirement for individual licences and provide the regulatory authorities in member states with tools to cope with evolving future technology and market changes. These require regular market reviews to ensure that the work of regulatory authorities is appropriate to the level of competition in the market and the Irish authorities need to develop guidelines based on these developments and assess compliance with these in the development of broadband.

Ireland needs to ensure that the regulations that exist are based on best international practice and that they operate to set standards that anticipate market developments. In addition, Ireland needs a set of minimum quality of service standards for the compliance of broadband access service providers. These include indicators for network quality, such as network availability and accessibility (for ADSL and cable modem access), as well as service activation time. In addition, quality standards are required for metering. As consumer expectations shift from ease of connectivity to speed of response time, this list should be extended to include additional indicators such as network latency and bandwidth utilisation. Interconnection between operators will also be an important feature and principles for interconnections between broadband operators are required.

4.2.3 Target Indicators: Consumer Response

In one sense, there is a fine line between customer response indicators and supplier indicators since they both relate to the market that emerges. However, the key difference between them in the sense of their use as indicators is that customer responses are not easily affected by policy and are very close to the intermediate objective of increased usage of broadband. Supplier activities on the other hand are more open to being influenced by regulations and are more dependent on the policy environment, while less well connected to the objectives since private and social objective may be mis-aligned. This was seen most clearly in Figure 1.2 above where commercial objectives led to the low equilibrium outcome.

Indicators for customer response are reasonably straightforward but would require resources to measure what is happening. The basic benchmark for customer response should be the projections used in this report in terms of growth profile and customer numbers. These are set out in general terms in Figure 2.3 and 2.4 and specifically for the two area plans that were appraised in the Appendix. Similar projections can be constructed for each area MAN on the basis of the CSO population projections and Census data as has been done in this report. Comparison of actual outcomes against these projections would indicate progress.
This is a very important area and the CBAs showed that penetrations rates are key variables in determining the returns that are earned. While policy cannot reliably affect this directly, the importance of appropriate pricing, based in part of competition in the market, provides the linkages between variables that may be to some extent influenced by policy and this important metric.

A number of other customer related variables are also important, in part because they may indicate reasons for any shortfall in uptake. Among these measures would be included:

- The types of customers accessing the network: private firms, households, etc.
- Proportion of businesses accessing by size of business
- Proportion of households accessing
- Proportion of households continuing to use dial-up connection
- Mixture of activities for which broadband is used
- Socio-economic profiles of users

A further source of information is the sales of peripherals in areas that have been connected to the broadband infrastructure. It is known that when broadband arrives in an area the percentage of homes with peripherals such as webcams and entertainment-related hardware increases. While it would not be possible to indicate target rates for these items, differences in sales growth between different areas would indicate household usage of broadband. In addition, penetration of services such as education and telemedicine would provide indications of the rate of development of household up-take. However, these developments would be longer term.

### 4.2.4 Feedback Response Indicators

A number of roles for indicators were identified in section 4.1. However, the most important within the context of the current project is to provide feedback so that policy can be adjusted and modified to achieve the final aims. This is most relevant with respect to the resource and activity indicators.

To ensure that this is done, it is necessary for the Department, as the policy implementation agency, to have in place a mechanism for monitoring output, assessing what this means and feeding the conclusions through into policy. In some cases this will not be policy as implemented directly by the Department but by another agency. A good example of this is the area of regulation where it is necessary for the Department to feed its information and conclusion through another authority.

It is recommended that the Department should have in place a committee for the review the information that is received and the formulation of adjustments and initiatives to remove any difficulties that may arise. This committee should also have responsibility for ensuring that this information is transferred forward to the most appropriate policy agency.
4.3 Summary

Resource Indicators
Agreement of detailed timelines with proposers on the basis of information in the proposals before start date
Assess actual expenditure against indicative expenditure based on information in the proposals
Assess expenditure against progress in physical implementation
Monitor progress towards formulation of plans for the extension of the infrastructure to hinterland with a start date of 3 years following start of phase 1.

Supplier Activity Indicators
Number of applications for infrastructure work by private firms
Number of firms involved in such applications
Agreements between operators regarding interconnection
Provision of flat rate access within 6 of completion of investment in an area
Progress towards access at €40 per month for basic access within 1 year
Number of suppliers in the area
Number providing flat rate access
Variability of packages on offer
Price variation within an area
Proportion of households with access if desired
Proportion of businesses with access
100% access for all schools and public buildings
Review regulation against best international practice
Ensure application of EU directives within time period
Comparison between prices in different parts of Ireland
Comparison between prices in Ireland and in the UK

Customer Response Indicators
Comparison of number of customers against projections used in this appraisal
Types of customers accessing the network: private firms, households, etc.
Proportion of businesses accessing by size of business
Proportion of households accessing
Sales of peripherals in connected areas
Proportion of households continuing to use dial-up connection
Mixture of activities for which broadband is used
Socio-economic profiles of users

Feedback Response
Committee to monitor information received, assess its implications and forward recommendations to relevant agencies.
Appendix: Projections for Household Connections and Revenue

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Note: in both these tables, the number of connections in 2003 is assumed to be 5% of the eligible households.
FOI Request Reference: RequestID: 791

Schedule of Records: Summary of Decision Making

Any investigations/reviews carried out by the Department in relation to the MAN scheme 2) Any reports issued to EU institutions in relation to MAN Scheme, including but not limited to accounting for the expenditure of ERDF grants

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