COMMONWEALTH GRANTS COMMISSION

DISCUSSION PAPER CGC 2003/8

IMPACT OF TECHNOLOGY ON ASSESSMENTS

Prepared for the Commission's 2003 Conferences

JULY 2003

CONTENTS

IDENTIFYING AND MEASURING THE IMPACT OF TECHNOLOGY ON STATE COSTS

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1. This discussion paper seeks comments from the States on staff understanding of the access to, and use of, Information and Communication Technology (ICT) by the States in delivering government services. It also seeks views on the proposals for measuring the impact of ICT on State costs and reflecting that impact in the assessments.

2. During the Review, States have made conflicting arguments about the direction of impact of ICT on State budgets.

(i) Victoria has argued that new technology and innovation enables governments to change the way they provide services and to increase cost efficiency. They argued that disabilities such as dispersion should be reduced accordingly.

(ii) Others said that greater use of ICT primarily increased the quality of services (especially in remote and rural areas) but did not reduce total costs. Some also said ICT did not reduce unit costs because investment in ICT is expensive, particularly when diseconomies of small scale apply.

3. There is much evidence that the use of ICT in the provision of government services is increasing and becoming more widespread — albeit at different rates across regions. This results in increasing direct costs of employing technology (such as costs of procuring and installing hardware and software, and associated use and maintenance charges). It has also causes changes in other costs through ICT's impact on the use of other inputs because costs of some inputs such as communications have fallen.

Key concepts

4. The inclusion of data for the most recent year in the annual updating process and the inclusion of updated data in the 2004 Review will capture many of the effects of the increasing use of technology. At the broad level some effects will be captured by the changes in the composition of the equalisation budget and by changes in the size of expense components within expenditure categories. More detailed changes will be reflected in the 2004 Review through:

(i) updating the dispersion disability'[1] for changes in the relative importance of the various dispersion-affected costs and the effect of distance on the price of some services;

(ii) changes in the level of fixed costs that may arise from extra policy and planning requirements[2]; and

(iii) changes in the level of resources required to provide services in remote areas as reflected in the service delivery scale assessments[3].

5. This discussion paper focuses on the direct costs related to technology and the other cost effects that are not readily captured by existing methods.

6. Staff considered that a better understanding of how technology may lead to changes in the mix of inputs used to provide services was important. The availability of technology can change the cost of providing a unit of service because it allows:

(i) the substitution of ICT for other more expensive inputs, which can reduce costs (substitution effect); and

(ii) increases in the quality of service, which usually implies more of all inputs (scale effect). The increase in the quality of the service can also lead to a demand for more services.

7. Differences in the perception of how the substitution and scale effects affect the mix of inputs underlie the conflicting arguments of the States on the impact of ICT.

8. Both effects would eventually be felt in the urbanised and the remote areas, albeit with differences between regions and services in the pace and impact of each effect. Those different effects would arise because of economic and non-economic aspects of the adjustment processes, including the need to manage complex and widespread changes to the way governments deliver services and the resolution of technical issues.

9. Staff concluded that the changes would probably be slower to materialise in the remote areas and in areas of socio-economic disadvantage.

10. A full understanding of those effects required detailed data on the costs, and use of technology and other inputs, in selected locations across States. Staff sent a draft questionnaire to the States to seek their comments on the scope and the feasibility of getting information on:

(i) policy and practices in the States;

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1 The Dispersion assessment allows for differences in costs of providing services to dispersed populations.

2 The Administrative Scale Factor allows for higher fixed costs incurred by small States in central office functions.

3 The Service Delivery Scale Factor allows for differences in real resources per unit of service required in the remote areas.

(ii) availability of ICT infrastructure on a regional basis, and detailed data on the type and cost of ICT infrastructure used by service providers in selected localities and for selected services[4]; and

(iii) cost information from selected locations on the inputs used in government services.

11. In their responses to the draft questionnaire, most States said that they were generally able to provide some information on (i) and (ii). However, they could not provide the detailed cost data sought in (iii) with sufficient quality and comparability.

12. Detailed data on costs were critical to a full examination of the differential impact of technology across regions.

13. Staff therefore excluded questions relating to detailed cost data from the questionnaire. They noted that the consequences of doing so were that:

(i) the Commission would not be able to rigorously examine all the effects of ICT on State budgets; and

(ii) allowances for the effects of ICT would have to be based on judgments about the direction and size of the substitution and scale effects — supported by conceptual logic if not by rigorous evidence.

Analysis of technology environment

14. ***The role of governments.*** The Commonwealth has the main institutional role in creating the policy environment for telecommunications services. It is still considering cost-effective ways of promoting high performance telecommunication services on an equitable basis[5].

15. By contrast, the State and local governments' have limited ability to direct the provision of telecommunication services and infrastructure. However, some States have directly invested or promoted investment in infrastructure in recent years, sometimes piggybacking on their utility (for example, rail and power) infrastructure networks.

16. ***Private demand shapes availability.*** In the past, public investment in telecommunications infrastructure concentrated on voice communication. It mostly followed the population settlement pattern. In low population density regions, investment decisions tended to reflect community service obligations and were often funded by cross-subsidies.

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[4] In keeping with the exploratory nature of this exercise, staff told the States that the work would concentrate on three services — Secondary School Education, Hospital Services and the Administration of Justice.

[5] For example, refer to *Connecting Regional Australia: The Report Of The Regional Telecommunications Inquiry, 2002 (the Esten Inquiry)* and *Australia's Broadband Connectivity, Broadband Advisory Group's Report to Government, 2003*.

17. The recent changes in the institutional and broader market environments have resulted in shifts to private provision of telecommunications services, cost based pricing, and increasing data and multimedia communication based on newer technology platforms. Those developments imply that costs of telecommunications services have become a much more important criterion for investment decisions. Private demand, therefore, increasingly determines the nature, pattern and volume of investment in new infrastructure, which results in most competitive investments being made in the more populated areas.

18. ***Bandwidth and its implications.*** A key feature that determines what ICT based services can be provided is 'bandwidth' (that is, how fast data and information can be transmitted from one location to another). Different technology platforms have different feasibility (due to cost, distance and/or other technical limitations), performance and cost implications.

19. Narrowband applications, accessible through dial-up or Integrated System Digital Network (ISDN) networks that are close to universal, are widely used because access prices are comparable in different regions and the applications they support (e-mail, internet browsing) are popular. Nevertheless, the availability of different technology platforms varies. For example cable modem services are available to around 35 per cent of homes, ADSL is available to over 70 per cent of the population, ISDN services are available to over 96 per cent and satellite services are available nationally. In addition, though list prices look similar, speed adjusted prices could be up to four times higher in some areas when compared with the capital cities. Technical issues can also result in performance and reliability varying widely across areas.

20. On the other hand, applications requiring higher bandwidth typically use newer technology platforms that are available only in the more populated areas — for example, capital cities, eastern Australia, some major rural and regional areas of New South Wales and Victoria, and the coastal centres of Queensland. They are also expensive and their use is more limited.

21. Price and demand level differentials for high-bandwidth communication services are therefore sharper between the major cities and the remote and outer regional areas than is the case for the narrowband counterparts.

22. ***Infrastructure availability is not uniform.*** The availability of infrastructure in most rural and outer regional areas is patchy. There are often gaps even within short distances of some major regional centres. This is because in most instances 'the last mile' has to be bridged by the copper network.

23. The terrestrial telecommunication networks (like the power, rail and road networks) derive their efficiency from volume of demand because they generally require high levels of upfront and lumpy investment. In sparsely settled areas, the feasible options for advanced applications are satellites. Unfortunately, these have technical limitations. All this implies that there is a high price-low demand trap that is not easily broken in areas of sparse settlement.

24. ***Summary.*** Notwithstanding the technical and economic constraints, there have been significant increases in non-voice communications in government administration and service delivery. Moreover, the State governments are moving away from first generation 'narrowband' platforms and towards second generation 'broadband' platforms.

25. Staff also concluded that, the environment is more market oriented with greater service availability in the more populated areas. However, within all the technical constraints, the common element that provides comparability across the different technology platforms and therefore regions is the cost of accessing them — not so much what is available[6].

26. Further details of the technology environment in which State services are delivered is in Attachment A.

Geographic availability

27. One of our main tasks was to map the geographical availability of telecommunications infrastructure, because it is a major determinant of service delivery options available to the States in different areas and hence their relative costs.

28. Staff classified Australia into six 'technology regions' using a set of criteria based on publicly available information and feedback from the States. The 'technology regions', which are listed below, were used as the basis for generalised conclusions on access to infrastructure and how the assessments could be changed.

(i) ***Region 1.*** Locations that have dense and continuous population settlement patterns, wide and high capacity infrastructure options, are well connected and meshed and can cost-effectively support a wide range of applications.

(ii) ***Region 2***. Locations that have continuous population settlement patterns, good but limited infrastructure options, good interconnectedness but with patchiness in access in the surrounding areas, and can support a range of applications cost effectively.

(iii) ***Region 3***. Locations that have identifiable but non-continuous population settlement patterns with major non-government economic activities, are connected through identifiable infrastructure corridors and can potentially support some applications cost effectively.

(iv) ***Region 4***. Locations that are not directly covered by major infrastructure corridors but are within reasonable distance of service delivery points and thus have access to a range of services similar to those for Region 3.

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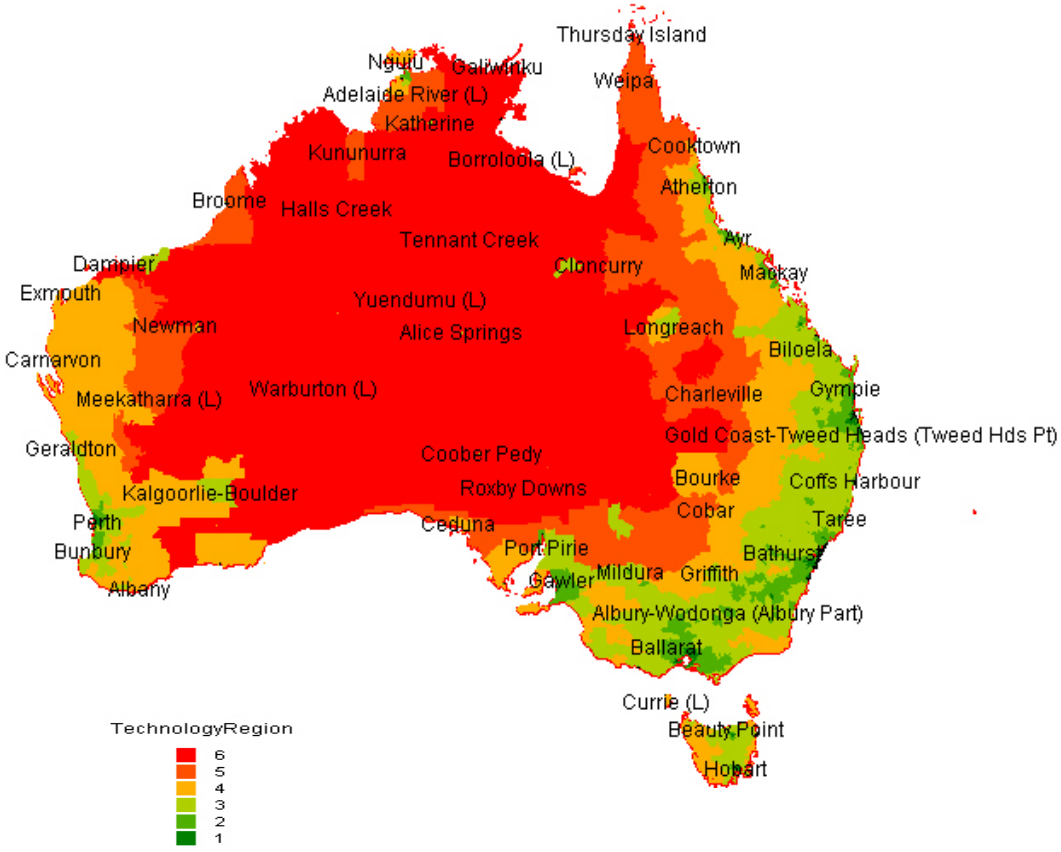
6 'Price rather than availability is the major impediment' is a major conclusion of the *Connecting Regional Australia, The Report of the Esten Regional Telecommunications Inquiry*.

(v) ***Region 5.*** Locations that have no continuous population settlement patterns, patchy interconnectedness through low-end services that can support a limited range of lower end applications but whose general cost-effectiveness is doubtful.

(vi) ***Region 6.*** Locations that are very remote with sparse and unconnected population settlements, with no or very poor access to services and which are not cost effective.

29. State comments on the proposed technology regions were generally positive, with support for the criteria and some suggested changes to the proposed regions. Full details of the six technology regions are in Attachment B and the current map of technology regions is in Figure 1.

Figure 1 TECHNOLOGY REGIONS[7]



[7] We can provide a concordance between ABS Collection Districts and Technology Regions on request.

30. The mapping process for the 'technology regions' suggested that:

(i) the metropolitan and the main regional centres (region types 1 and 2) with good or very good access to high bandwidth communication infrastructure that is broadly affordable can be distinguished from the more remote areas (region types 5 and 6) which have limited choice of communication infrastructure and affordability; but

(ii) some small and medium-sized urban areas (region types 3 and 4) that the Commission previously treated as remote might have become 'less remote'.

31. Thus technology is changing the traditional concept of 'remoteness' based on distance. Some small and medium-sized urban areas appear to have become 'technologically enabled', implying they are now 'less remote' than they were before. These areas might need to be treated differently in our assessments.

Issues that affect ICT use

32. ***Economic and non-economic issues affect ICT use.*** State governments are purchasers of fully managed telecommunication services, and face similar technology and pricing options as other large organisations. They also acknowledge, articulate and promote the need for intensive use and investment in ICT on a whole-of-economy basis.

33. In doing so, they appear to maintain two distinct foci: one on ICT as an efficiency input to general competitiveness and economic growth, and the other on fairness of access and equity to government services as far as practicality allows and without holding back regions where advanced services could be provided.

34. The planning and management issues relating to provision of extensive ICT based government services go beyond technology and pricing per se. They also include addressing and overcoming economic and non-economic impediments to its use.

35. The main economic issue associated with ICT is its cost. This is much more than just the cost of communication. It includes the cost of purchasing, installing and maintaining hardware, developing applications and contents, providing support and training to people, and the affordability of available technology platforms. Moving to higher bandwidth platforms also involves higher prices.

36. The early adoption and higher use of more advanced platforms in the more populated centres results in increased average costs of communication services in those areas. Cost is also high in sparsely population locations, despite lower intensity of use, because of higher costs of services, and lack of economy of scale and competition.

37. The main non-economic impediments to ICT use are inadequacies in the level of awareness, appreciation and skills needed to fully utilise the benefits of technology. There are usually extra impediments in remote areas.

38. Progress on these issues is likely to be evolutionary, and will differ across States and services (because of different circumstances). It will also be dictated by the need to explore alternative models of ICT based services and to build on that experience.

39. ***State economic and demographic environments affect ICT use.*** Aggregation of demand across agencies, and possibly across levels of governments and communities, is likely to progressively become a standard strategy. However, it will be easier in States where there are relatively more areas with high population density and a high level of pre-existing private demand. By contrast, it will be more difficult to generate an adequate level of demand at an affordable price in areas of low socio-economic status or where the government is the sole user.

40. The environment of a State also affects the contractual arrangements it can enter with the telecommunication service providers, and the degree of volume discounts it can extract. The main determinants of favourable negotiation outcomes relate to the size and mix of the overall communication tasks it seeks to buy. However, because measurable evidence is lacking, we have not been able to take account of those scale effects.

41. ***Effective ICT use requires more than just communications technology.*** To fully exploit ICT, States need to make complementary investments in:

(i) information technology including the installation, repair and maintenance of equipment; and

(ii) extensive technical support to, and training of, employees.

42. The regional aspects surrounding the availability and cost of ICT related hardware and software appear relatively small because purchases are generally made centrally. There is also no firm evidence that the States can extract differential volume discounts on these.

43. However, differential cost issues arise from the need to install, repair and maintain equipment, and provide technical support and training to employees. Most States saw the need for local technical and user support services as a big impediment to intensive use of technology-based services in outer regional and remote areas. These have different cost consequences for the States.

44. The increasing appreciation of the value of ICT, increasing confidence among users, and improving reliability all combine to increase ICT use. However, most States thought a mix of ICT based and traditional face-to-face services would continue. Moreover, the increasing use does not appear to have translated to major cost savings.

45. Health and education services received special attention in staff analysis.

46. ***Education.*** The objectives for the use of ICT in education are reflected in the national action plan. That plan identified infrastructure (particularly bandwidth), professional development and the availability of online curriculum content as the three priority areas for implementation in schools.

47. Most States are making large ICT related investments to support advanced services in education, which could induce further investment in ICT in the remote areas.

48. Most common uses are general information exchange through internet browsing, e-mail and provision of administration, professional development and learning material through intranet/extranet access to extensive web resources.

49. At this time, growth and change areas are creation of, and access to, on-line curriculum resources, and enhancements of education content and software in the classrooms (including for student assessment) and school administrative systems.

50. Overall, most States said that, despite savings in some areas, the costs of providing education have increased due to ICT because of large expenses in starting up and maintaining the infrastructure and supporting staff.

51. ***Health.*** Major gains seem to have been made in administration and support rather than in service delivery functions, although there are examples of the latter. Relative to the education sector, videoconferencing appears to be more widely used for staff training, clinical consultation, general meetings and remote diagnosis. Administrative applications are similar to those for education.

52. Beyond this, clinical applications are limited to some medical tests, and some diagnosis and treatment. Evolution of newer telecommunication based services for direct care of patients will probably be slow.

53. ***Administration of Justice.*** ICT related progress appears piecemeal. In some States, it depends on the 'willingness of the judiciary to take advantage of the new technology'[8].

54. Video conferencing facilities exist in most main court locations. They substitute for some transportation expenses, but not for circuit courts. There are also indirect savings from the reduction in 'paper shuffling'.

55. Other uses are offender information systems (including sentencing details) and court information systems that are accessed by many agencies. Administrative applications are similar to those for education and health.

56. In summary, unlike in 1999, governments now have a set of standard ICT policies and objectives. These include:

(i) focussing on access and equity in service delivery;

(ii) adopting a strategic approach to diffusing the benefits of technology;

(iii) investing substantially in improving access to and use of technology, particularly in education;

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[8] Tasmania's response to the questionnaire.

(iv) standardising technology platforms across agencies; and

(v) aggregating demand and negotiating with the providers on a whole-of-government basis.

Proposed approach and changes to assessments

57. ***Technology primarily affects assessments of dispersion disabilities.*** Differences across States in the access to, and cost and use of, technology form the basis of the staff's proposed approach to reflecting the impact of technology on the assessments. In particular, staff considered how the short and long term substitution and scale effects of increasing use of technology, which lead to regional differences in the mix of inputs used to provide services, would arise in practice.

58. Discussions with the States and updated data collected during the 2004 Review on dispersion affected costs indicate that some of the near-term impacts have already materialised, especially in regions where many technology options were available. For example, the data collected for the dispersion disability indicate that the proportion of standard expenses accounted for by voice communication and travel expenses has fallen between the 1999 and 2004 Reviews. There was, however, no firm evidence of direct savings in staff costs.

59. Regardless of the direction of movements in costs, pressures to fulfil community expectations of higher quality services on a continuing basis were building everywhere. Indeed, they appear to have moved ahead of economic considerations.[9]

60. The dispersion disability is intended to introduce a regional dimension into the Commission's assessments. That is, it allows for the effects on the relative costs of providing State services of interstate differences in population dispersion. The staff investigations indicate that ICT has changed the costs of providing State services by different amounts in different regions.

61. As detailed in Attachment D, staff propose that the impact of technology on the regional pattern of State costs be recognised by:

(i) introducing some new expense components into the dispersion disability and amending input weights and regional weights[10] in other components of that disability to allow for explicit effects of ICT that are not captured by the existing methods; and

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[9] Little cost-benefit analysis has been done to support the initiatives undertaken so far, although the questions are beginning to be asked. For example, *'Everywhere, the same questions are being asked: What difference is ICT making to teaching and learning in schools?', ICT in Schools, Ministerial Council for Education, Employment, Training and Youth Affairs (MCEETYA), June 2002*

[10] These capture mix of inputs in different regions.

(ii) updating other aspects of the dispersion assessment using updated data on dispersion affected costs as a proportion of standard expenses and updated pricing schedules.

62. ***Explicit adjustments for technology.*** The new dispersion affected cost components relate to:

(i) sub-dividing what was previously the telephone component into voice and a non-voice elements;

(ii) allowing for expenses stemming from the purchasing and distribution of information technology equipment;

(iii) allowing for repairs to equipment; and

(iv) allowing for support and training for staff.

63. Staff propose to derive the disability relating to non-voice communication costs by using price indices for each technology region. Those indices would be based on standard indicative prices of different technology platforms and indicators of the Australian average use of those platforms in each technology region. The regional indices would be aggregated to the State level using the proportion of each State's population in each region.

64. The regional pattern of relative costs showed that some of the technology platforms in region 1 are as expensive as those available in the remote areas. As a result, after allowing for regional differences in use patterns, there were not large differences in relative costs across States.

65. The proposed assessments of disabilities for the other technology affected costs would be based on methods used in the dispersion assessment:

(i) the allowance for the purchase and positioning of technological equipment would be based on the freight cost disability because staff considered that centralised purchasing arrangements generally implied that regional differences in costs would arise only from the need to freight equipment to the localities where it was to be used — although in making this calculation, allowance would be made for Australian average differences in the per capita use of equipment across the technology regions (for example by reference to ratios of computers to students);

(ii) the disability for repairs would be based on the freight disability because staff considered equipment was generally sent to urban centres for repairs; and

(iii) the disabilities for support, maintenance and training would be based on the dispersion travel disabilities.

66. In calculating these disabilities staff also propose to:

(i) make allowances for the impact of technology on the mix of inputs used in providing services in different regions — for example, data indicated a substantial reduction in the use of voice communication in major urban regions but little change in remote areas, and a reduction in inter-regional travel outside the major urban centres;

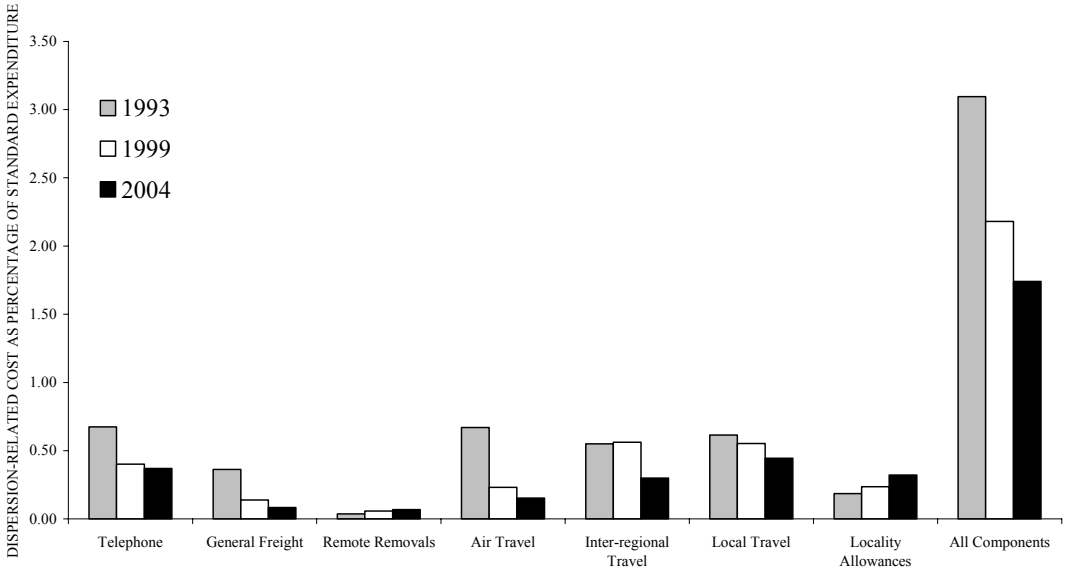
(ii) make allowances for the impact of technology on communication and travel relating to administrative and support tasks between regional centres and capital city central offices — the greater availability of higher bandwidth applications in regional and capital cities appears to have reduced the levels of voice communication and travel between them; and

(iii) make adjustments to the proportions of expenditure in each assessment category considered to be dispersion affected to ensure there is no double-counting of the technology driven and other dispersion effects.

67. The derivation of fixed costs for the 2004 Review also included some small allowances for the extra fixed costs States incur in central office policy making and administration arising from the increased use of technology in delivering services.

68. ***Updating aspects of the dispersion assessments implicitly reflects some effects of technology.*** Updating the data on some dispersion affected costs as a proportion of standard expenses and the price-distance (or price-remoteness) relationships would recognise many recent developments, including the aggregate effect of technology on the expenses States incur. For example, Figure 2 shows each of the dispersion affected costs as a proportion of standard expenses in the 1993, 1999 and 2004 Reviews. Figure 2 indicates that dispersion affected costs as proportions of standard expenses have fallen for those types of costs that States said would be reduced by technology (communication and travel costs). The figures are prepared as far as possible on the basis of comparing like with like in each review. However, the 2004 Review figures for the remote removals and locality allowances components are broader in scope than they were in the previous reviews. In addition, the comparison has not been standardised to exclude the effects of changes in the composition and settlement of population in remote areas between reviews.

Figure 2 COMPARISON OF DISPERSION-RELATED COSTS AS PERCENTAGE OF TOTAL STANDARD EXPENDITURE IN 1993, 1999 AND 2004 REVIEWS FOR EACH COST COMPONENT AND OVERALL[11]



Summary and conclusions

69. Table 1 provides indicative estimates of the impacts on State grants of the various explicit allowances and adjustments included in the dispersion assessments to reflect the growing use of technology. The figures also include preliminary estimates of the effects of updating data for the dispersion assessment and other processes that have occurred in the 2004 Review — these effects are part of what this paper calls the default settings (or the assessments that would have arisen if no explicit allowances were made for the effects of technology). Further details are in Attachment D and details of the dispersion assessments are in *Draft Assessment Paper 2003/63 Dispersion.*

[11] The 2004 Review figures for the travel components exclude the expenses for Inpatient Services travel, because they have not been finalised.

Table 1 IMPACT OF EXPLICIT VARIATIONS TO DISPERSION DISABILITY FOR THE EFFECTS OF TECHNOLOGY[(a)] BY STATE

	NSW	Vic	Qld	WA	SA	Tas	ACT	NT	Total redistribution
	$m	$m	$m	$m	$m	$m	$m	$m	$m
Differences in redistribution	-6.7	-2.7	2.0	5.9	-1.5	-0.2	-0.5	3.7	11.6

(a) The differences are changes in standardised expenditures. They are based on 2003 Update standard expenditure for each category.

70. The table suggests that the effects of technology on the 'dispersion' assessment would not be very large. This is consistent with the view that the growing use of technology has had many effects which often move in different directions. Those effects include:

(i) the use of comparatively expensive voice communication has declined in most regions but relatively more so in urban and regional areas;

(ii) increasing non-voice communication has lead to relatively higher costs in urban areas;

(iii) reductions in interregional travel have been greatest in remoter regions; and

(iv) extra freight, repair and support costs have been greatest in remoter regions.

71. The work indicates that technology will not have a large effect on the level of redistribution arising from population dispersion until it has a substantial effect on labour related costs such as locality allowances and other on-costs associated with staffing remote areas.

72. The conclusions reached in this paper are not sensitive, within reason, to any particular assumption or judgement.

73. For the final assessments, staff propose to recommend to the Commission that, the effects of technology be integrated into the dispersion assessment to keep increases in detailed calculations to a minimum. This would mean inclusion of a non-voice communication cost component, changes to input and regional weights, and a simple adjustment to the proposed repairs and maintenance component.

74. Because many changes are likely to take place over the next five years to technology options and prices in different regions, and in the classification of locations to technology regions, staff propose to recommend to the Commission that the factors and the weights for non-voice communication be closely reviewed every two years.

ATTACHMENT A

ANALYSING THE TECHNOLOGY ENVIRONMENT

INTRODUCTION

1. There is much evidence of increasing and more widespread use of ICT in the provision of services, albeit at different intensities across regions. There is evidence that developments relating to technology have seen reductions in the price of using various means of communication. There is also evidence that increasing use of technology increases direct costs relating to technology (such as communication services and information technology hardware and software), and increases or decreases other costs through its impact on the various inputs used to provide services. (For example, it may increase planning requirements[12] or reduce staffing in remote areas[13]).

2. Staff Discussion Paper *CGC 2002/7 Developments in Technology and Public Administration* outlined how the growing impact of ICT on the relative costs of providing State services might be assessed. It suggested that the impacts on the total costs of delivering a service might vary across regions:

(i) as a direct consequence of differences in the availability and cost of ICT; and

(ii) as an indirect consequence of changes in the mix of inputs used to provide services.

3. There would also be effects on other complementary services such as the development of technology based applications and the provision of support and training to staff.

4. Discussion Paper 2002/7 noted that the feasibility, pace of progress and intensity of use of ICT would differ across regions and between functions. The resultant changes to the use of technology would have an effect on, and would be captured, in the Commission's assessments in several ways.

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[12] This is covered by the Commission's Administrative Scale Factor that relates to central office type functions.

[13] This is covered by the Commission's Service Delivery Scale Factor that recognises that more real resources per unit of service may be required in the remote areas.

(i) Changes in the structure of the equalisation budget could result from shifts in the mix of labour and capital (including technology) used to provide services — for example, the standard expenditure might decrease for services where technology could be more readily substituted for labour.

(ii) Shifts could take place in the relative importance of expenditure components including that due to fixed costs — for any given service, greater use of technology could mean that wages and dispersion affected costs might fall, while depreciation, repair and maintenance of equipment, and training of personnel might increase.

(iii) Changes in relative costs of service provision across regions (urban, rural and remote) could result if technology changed the regional patterns of expenses that are affected by dispersion and service delivery scale disabilities.

5. Updating financial data in each inquiry to include the latest financial year means that changes to (i) and (ii) would be reflected in the assessments. Changes to (iii) usually would be captured only during a review.

6. In general, differences in costs across regions (reflected mainly through dispersion affected costs) depend on differences in both unit costs and the use of inputs. However, the 1999 Review method, generally concentrated on differences in unit costs.

7. Fully reflecting the impact of technology in the assessments required a better understanding of the mix of inputs used to provide services and how technology might affect that mix.

8. In general, decreasing unit costs of technology may result in total costs of providing a service:

(i) decreasing because of the substitution of ICT for other, more expensive, inputs (substitution effect) — for example, increasing use of ICT might result in depreciation costs increasing but wages, communication or travel costs falling with an overall reduction in the cost per unit of service; but

(ii) increasing because of increases in the quality of services and hence quantity of all inputs (scale effect) — for example, ICT might allow governments to improve existing services or commence services previously not possible, thereby employing more of all types of resources and possibly increasing unit costs.

9. The differences in the perception of how each effect impacts on the mix of inputs underlie why States have presented conflicting arguments about the direction of changes to total costs arising from differential access to and use of ICT.

10. Both the substitution and scale effects would eventually be felt in the urbanised and the remote areas. But, there would be differences in the pace and impact of each effect across the urban and remote areas. Those differences would reflect economic and non-economic aspects of the adjustment processes. Understanding how and whether relative unit costs in urban and remote regions would converge or diverge in the short term (2004-2008) was of particular interest.

11. Apart from cost considerations, the full benefits of technology will be realised only gradually. Introducing ICT-based services requires managing complex and widespread changes to the way governments deliver services, and overcoming some non-economic barriers.

12. These issues affect each State as a whole. However, they are likely to result in changes being introduced more slowly in the remote areas or in areas of socio-economic disadvantage.

13. A key aim of the work was to understand whether the substitution and scale effects would be adequately captured by the existing methods given that the use of ICT was increasing and becoming more widespread, but at different rates across regions.

ANALYSIS OF TECHNOLOGY ENVIRONMENT

14. As a first step to understanding the impact of technology, staff reviewed aspects of the broader environment in which telecommunications services are provided and used, including:

(i) aspects of the national settings;

(ii) types of technology platforms;

(iii) geographic availability of technology infrastructure; and

(iv) issues and trends relating to State government services.

Elements of the national settings

15. The development of the telecommunications industry in Australia has been dominated by the needs of a population congregated in cities separated by long distances. Typically this required linking the cities with high capacity trunk services, while reaching the remote areas with basic services.

16. Public investment in telecommunication infrastructure has catered mainly for voice communication. That investment occurred over many decades and followed mostly the settlement pattern of population.

17. In areas of low population density, investment decisions reflected a degree of community service obligation. The cost was generally met by cross subsidies across products and regions.

18. Since deregulation in 1997, the market has experienced a period of rapid growth and increased diversity of telecommunication products and services. This happened because of:

(i) the removal of certain carrier and technology restrictions to make way for a more competitive market environment; and

(ii) the increasing integration and interdependence of telecommunications and information products and services.

19. With the focus shifting to commercial provision of services, cost based pricing, and to increasing data and multimedia based communication based on newer technology platforms, costs of services have become a much more important criterion for investment decisions. Therefore, the nature, pattern and volume of private demand have increasingly determined the nature, pattern and volume of investment in newer infrastructure. Unsurprisingly, investment has taken place mostly in the more populated areas of the eastern seaboard, capital cities, and some of the major regional centres.

20. Because it owns of much of the telephone network, Telstra remains the main, and in most outer regional and remote areas the sole, provider and the main agency responsible for technical quality of communication.

21. The Commonwealth has the main institutional role in creating the policy environment for the provision of telecommunications services. The Commonwealth plays this role mainly through:

(i) regulation and promotion of competition in the marketplace;

(ii) provision of funding to and by the carriers to contribute toward a range of Universal Service Obligations (USOs)[14,15] and digital data service obligations (DDSO) that include improving access to services in regions with less equitable access;

(iii) mandating customer service guarantees (CSG)[16]; and

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[14] Federal Government funding of $150 million was provided for infrastructure upgrading to provide untimed calls at local call rates, access to an ISP at local call rates, preferential rate calls and other telecommunications services to the extended zones.

[15] 'Legislation ensures that all Australians have reasonable access to certain telecommunications services, regardless of where they live or work'. USO subsidies are funded through a levy on carriers and, if prescribed, CSGs.

[16] The most prominent legislative consumer safeguards for the fixed phone network are the Customer Service Guarantee (CSG) with provision of compensation for non-compliance. It includes connection right to the standard telephone service, enhanced call handling features and timely rectification of faults.

(iv) provision of funding to a range of programs to improve aspects of access to, or use of services.

22. Appendix 1 provides details of some of the Commonwealth initiatives in recent years.

23. It appears that the Commonwealth Government is still in the early stages of considering cost-effective ways of promoting use of high performance communication services on an equitable basis[17]. In particular, it is considering ways to do so in the outer regional and remote areas, where lack of concentrated demand and lack of competition generally mean services would not be provided on a fully commercial basis.

24. The States' ability to direct the provision of services and infrastructure is limited. However, in some instances, they have directly invested or promoted investment in infrastructure in recent years, sometimes piggybacking on existing State-owned infrastructure networks such as those of rail and power.

Types of technology platforms

25. A key characteristic of the ICT infrastructure that determines what services can be provided is 'bandwidth' — that is how fast data and information can be transmitted from one location to another. There is a range of technology platforms with different feasibility, performance and cost implications.

26. Figure A-1 shows bandwidth requirements for different applications.

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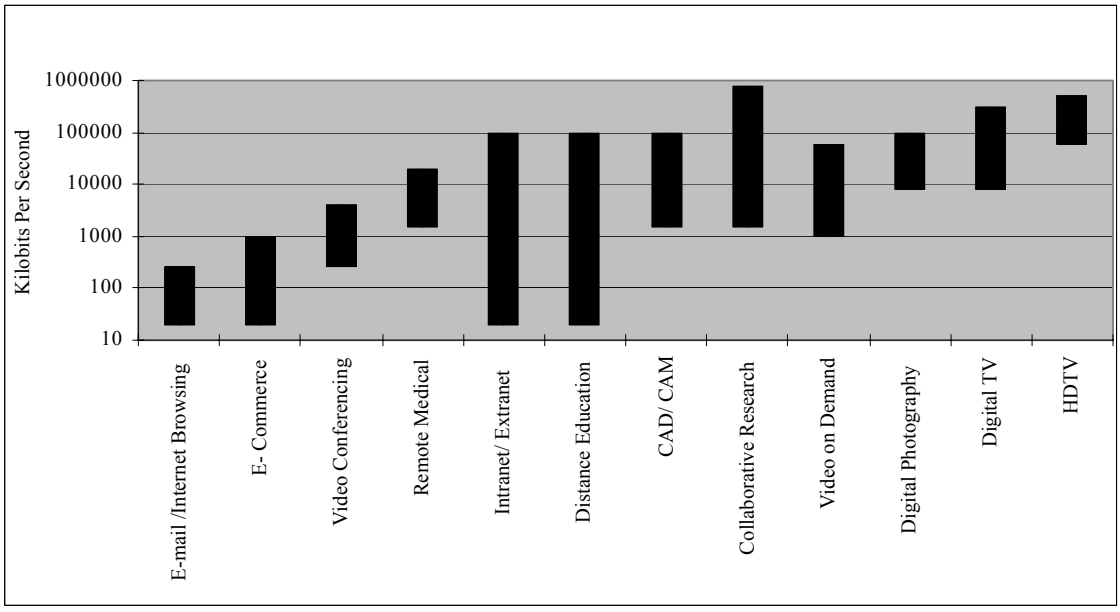
[17] For example, refer to Connecting Regional Australia: The Report Of The Regional Telecommunications Inquiry, 2002 (the Esten Inquiry) and Australia's Broadband Connectivity, Broadband Advisory Group's Report to Government, 2003.

Figure A-1 BANDWIDTH REQUIREMENT FOR DIFFERENT APPLICATIONS



Source: Adapted from *Telecommunications Infrastructure Strategy for Brisbane City and South East Queensland*.

27. Narrowband applications are those that can support the lower end of applications such as e-mail and internet browsing at reasonable speed (those that could be reasonably supported at a speed of 33 - 50 kilobits per second). In reality, speeds of no more than 19.2 kilobits per second are experienced in some areas — implying that exchange of text-based e-mail is possible, but online content delivery is not.

28. By contrast, high bandwidth applications are those requiring a higher capacity. These applications could be grouped as:

(i) midband applications (say, requiring between 64 kilobits per second and 150 kilobits per second); and

(ii) broadband applications (requiring more than 150 kilobits per second with really high-end applications starting at 1000 kilobits per second).

29. Examples of these in increasing order of requirement for capacity are intensive e-commerce, video conferencing and remote medical diagnosis.

30. The applications that can be supported depend on the physical characteristics of the network. A network could also be classified as forming either the 'backbone' (common parts of the network that carry a large number of communication slices simultaneously) or the 'last mile' (connection from individual premise to the local exchange or the 'backbone').

31. The National Bandwidth Inquiry[18] found that there was sufficient 'backbone' network[19] capacity in and between major centres, particularly on the east coast. However, there were few spurs off the main backbone into regional areas and the 'last mile' connection was generally expensive in the regional areas.

32. The narrowband applications are generally supported through dial-up public switched networks or dedicated data networks such as Integrated System Digital Network (ISDN) up to 64 kilobits per second.

33. Access to higher bandwidth services is currently available through:

(i) ISDN in multiples of 64 kilobits per second;

(ii) more recently, versions of Digital Subscriber Line (xDSL) (most notably, Asymmetrical Digital Subscriber Line (ADSL)[20]) in the range of 1.5 to 5 megabits per second;

(iii) cable up to 2 - 10 megabits per second;

(iv) at the high performance end:

- fibre-to-the-curb (FTTC) up to 30 megabits per second; and
- fibre-to-the-building (FTTB) up to 100 megabits per second.

34. Over short distances, terrestrial wired connections are the norm, although newer broadband wireless technologies such as Multipoint Distribution Systems (xMDS) could provide connections in a radius of 15-30 kms.

35. Over longer distances covering sparsely populated areas, wireless networks (such as microwave up to 35 megabits per second)[21] and satellites (up to 1 megabit per second) are used. Appendix 2 provides a brief description, general uses and some comparison of different technology platforms.

36. The availability of different technology platforms varies. For example cable modem services are available to around 35 per cent of homes, ADSL is available to over 70 per cent of the population, ISDN services are available to over 96 per cent and satellite services are available nationally. Of these, ISDN and satellite services have been around for some time. However, 2-way satellite communications are increasingly being preferred to 1-way satellite communication because it is independent of terrestrial uplinks which can be of poor quality in remote areas and provide more reliable interactivity. ADSL and cable modem services are more recent and are still being deployed.

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18 Conducted in 1999 by the Australian Information Economy Advisory Council, Department of Communication, Information Technology and the Arts.

19 The backbone network, which links major cities, is mainly a fibre optic cable network.

20 The uplink speed of ADSL is slower than the downlink.

21 This is mostly used as a 'backbone' network.

37. Narrowband applications are widely used. Three factors have led to their widespread use.

(i) Use of e-mails and internet/intranet have acted as 'killer' applications that have generated the volume that is so important for economically exploiting network-based technology.

(ii) Access through dial-up (99% of population[22]) or ISDN network (96% of population[23]) is close to universal.

(iii) Prices for accessing dial-up narrowband applications to private users in different regions are similar to, and sometimes cheaper than, voice communications.[24]

38. However, the performance and reliability of the network can vary widely across areas. For example, though list prices look similar, speed adjusted prices could be four times higher in some areas when compared with the capital cities.[25]

39. The situation is quite different for midband and broadband applications. They typically require technology platforms that are relatively new. Some platforms can be and are supported through direct connections to optical fibres, modifications to the telephone exchanges (generally limited to a distance no more than 3-5 kms from the exchange, and the quality of the copper wire and other technical problems might inhibit their widespread expansion in the short term) or local wireless options.

40. There is substantial investment in the more populated areas of eastern Australia in newer terrestrial infrastructure offering large capacity, well in excess of the current level of demand. There is also substantial capacity in some major rural and regional areas of New South Wales and Victoria, and the coastal centres of Queensland.

41. While the capital cities, particularly the CBD areas, are well catered for, the availability of capacity in most rural and regional areas is patchy. There are gaps in availability often even within short distances of some major regional centres. This is because in most instances 'the last mile' has to be generally bridged by copper network. Local wireless options provide an alternative to this, but they feed off high density, require allocation of spectrum, are relatively expensive and have a limited range of 15-30 kms.

42. The terrestrial telecommunication network (like the power, rail and road networks), derives its efficiency from volume of demand because it generally requires a high level of upfront and lumpy investment. This creates a high price-low demand trap that is not easily broken in areas of sparse settlement.

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22 Telstra's submission to the Esten Inquiry.

23 Ibid.

24 Under a USO initiative, the Commonwealth government ensures similar levels of affordability across Australia (eg allowing internet access for the cost of a local call).

25 Queensland response to our questionnaire.

43. In sparsely settled areas, the only currently feasible option for supporting high-bandwidth applications is one-way and two-way satellites. Unfortunately, this involves the problem of latency, susceptibility to weather condition and electromagnetic interference, making it inappropriate for some high-end applications.

44. Within these technical constraints, the common element that provides comparability across different types of technology platforms and therefore regions is the cost of accessing them, rather than what is available[26].

45. Even in areas of high population density (for example, the eastern seaboard) that have few capacity constraints, the general uptake of high bandwidth applications has been lower than in comparable countries (USA, Canada, Korea and most Scandinavian countries). Compared with narrowband applications:

(i) potential consumers have not been convinced that there is enough value to justify the additional cost of broadband services —charges are often high compared with those for narrowband applications, and they vary enormously between the urban, regional and remote areas depending on what technology platforms are available;

(ii) there are currently no 'killer' applications that could generate a mass market;

(iii) general lack of awareness of benefits and available applications;

(iv) the lack of widespread availability of appropriate infrastructure has limited the availability of broadband services and some consumers are unable to access the services regardless of willingness to pay — high-level capacity is generally limited outside the eastern seaboard and some regional areas.

46. Accordingly, price and demand level differentials for high-bandwidth application are much sharper between the major cities and the remote and regional areas than is the case with narrowband applications.

47. In keeping with this trend, there have been significant increases at least in non-voice narrowband communications in government administration and service delivery. For example, the State governments until recently extensively employed first generation 'narrowband' platforms such as dial up modems and standard ISDN links to connect users such as students and teachers in schools to the Wide Area Network (WAN) and the internet.

48. There are clear trends now towards using second generation 'broadband' platforms such as higher-capacity ISDN, xDSL, cable modems and high performance satellite data connections. While these are significant steps, 'there are those who argue that true third generation 'broadband' based services should only apply to connection speeds of 10 megabits per second (Mbps) or greater on the basis that it is only at these speeds that

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[26] 'Price rather than availability is the major impediment' is a major conclusion of the *Connecting Regional Australia, The Report of the Esten Regional Telecommunications Inquiry*.

broadband becomes something more than a faster version of today's Internet services'[27]. As New South Wales put it, the current platforms represent an 'interim solution … until fibre optics link become available'[28].

49. Bringing third generation services (10 Megabits per second or more per site) involves issues that go beyond exploiting existing infrastructure. There is no clear indication that third generation services will be available in the outer regions and remote areas in the foreseeable future. For example, New South Wales said, 'it is … envisaged that the provision of advanced telecommunications services to some schools in remote rural areas of NSW will not proceed at the same rate as that for schools and TAFE colleges in the more populous areas of the State. This issue will not be readily resolved within the foreseeable future'[29].

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27 *Broadband Advisory Group's Report to Government, 2003.*

28 NSW Response to the Special Data Collection for Education, 2002.

29 ibid.

ATTACHMENT B

GEOGRAPHIC AVAILABILITY OF TECHNOLOGY INFRASTRUCTURE

1. Understanding whether the States operated in a level playing field was important to the assessments. Thus, one of our main research tasks was to map geographical availability of telecommunications infrastructure, because it is a major determinant of service delivery options available to the States in different areas.

2. Unfortunately, there was little systematic information on availability of infrastructure. The publicly available information is broad-brush, hard to use in a systematic way, and not specific about what is available in smaller regions and towns. For example, there is no existing map that superimposes infrastructure availability onto geographic regions used by the ABS, such as Statistical local areas, local government areas or other statistical regions.

3. Using publicly available information for analysis is further complicated because access to ICT infrastructure depends critically on distance, and often small distances[30]. For example, a town centre may have access to high capacity infrastructure, but a nearby area, say, 5 kms away may not. Even in some metropolitan areas there are problems of access to particular broadband technologies[31]. For example, access to ADSL is frequently prevented by distance from the exchange, or other technical considerations.

4. This means that a reliable mapping of infrastructure would have required information at a small-area level. Even so, what applications could be supported in practice might depend on detailed technical information such as type of technology employed[32], or the age and quality of copper cables in place.

5. For our purpose, such detailed information was not essential. We were interested in telecommunications infrastructure for government services such as school education, hospital services and administration of justice. These services generally have a presence at the centre of towns and have a large catchment area. This allowed some broadbrushing of information on the availability of infrastructure.

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30 For example ADSL has a rage of 2.5 to 3.5 kms, ISDN about 20-25 kms, LMDS and MMDS about 15-30 kms.

31 For example, the Gungahlin area of the ACT.

32 For example, ISDN is better suited to videoconferencing than is ADSL.

6. To assist interstate comparisons, staff classified Australia into a number of 'similar' technology regions using:

(i) publicly available information[33];

(ii) density and settlement patterns of population, including ARIA; and

(iii) State's responses on 'technology regions' in the questionnaire.

7. Staff created a map and a list of the 'technology regions' (Table B-1) by State. We used the following criteria to categorise the regions.

(vii) ***Region 1.*** Locations that: are well connected and meshed; have dense and continuous population settlement patterns; have wide and high capacity infrastructure options (such as optic fibre, HFC cables and/or high performance DSL or ISDN (128K or more) or local wireless connections); and can cost-effectively support a wide range of applications.

(viii) ***Region 2***. Locations that: have continuous population settlement patterns; have good but limited infrastructure options (such as ISDN (128K) and some ADSL enabled exchanges); have good interconnectedness but with patchiness in access in the surrounding areas; and can support a range of applications cost effectively.

(ix) ***Region 3***. Locations that: have identifiable but non-continuous population settlement patterns; have major non-government economic activities (eg mining); are connected through identifiable infrastructure corridors (that support effective dial-in-access, ISDN 64K or patchy DSL, possibly complemented by satellite based communication); and can support some applications cost effectively.

(x) ***Region 4***. Locations that are not directly covered by major infrastructure corridors but are within reasonable distance of in-scope service delivery points and thus have access to a range of services similar to those for Region 3.

(xi) ***Region 5.*** Locations that: have no continuous population settlement patterns; have only patchy interconnectedness through low-end microwave trunk network or dial in access or ISDN 64K; are generally complemented by satellite services; and can support a limited range of lower end applications but whose general cost-effectiveness is presently doubtful.

(xii) ***Region 6.*** Locations that are very remote with sparse and unconnected population settlements; have no or very poor dial-in-access because of

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[33] For example, 'Telecommunication Infrastructure in Australia 2001' prepared by BIS Shrapnel (prepared for ACCC).

use of repeaters; or have access perhaps solely by satellite or other wireless technology; and/or suffer poor or slow or no interactivity to wide area network.

8. With some exceptions[34], the States generally concurred with the criteria for the regions, and suggested changes which have been considered. As such, staff consider that the suggested 'technology regions' provide a good basis for generalising conclusions on the access to infrastructure. However, they will be refined following further comments by the States, and some refinements staff plan to examine.

9. The mapping process for the 'technology regions' suggested that:

(iii) the metropolitan and the main regional centres (region types 1 and 2) with good or very good access to high bandwidth communication infrastructure at high but acceptable prices can be clearly distinguished from the more remote areas (region types 5 and 6) which have limited choice of communication infrastructure and high prices; but

(iv) some small and medium-sized urban areas (region types 3 and 4) that the Commission considered remote in the past and treated in the same way as other remote areas (although different costs applied) might have become 'less remote'.

10. That is, technology is changing the traditional concept of 'remoteness' based on distance. Some areas in regions 3 and 4 appeared to be 'technologically enabled', implying they are now 'less remote' than they were before. These areas might need to be treated differently in Commission assessments.

11. Examples of locations in region type 3 and 4 in each State are given in Table B-1.

[34] Queensland Health in their response to our questionnaire did not agree with the suggested regions.

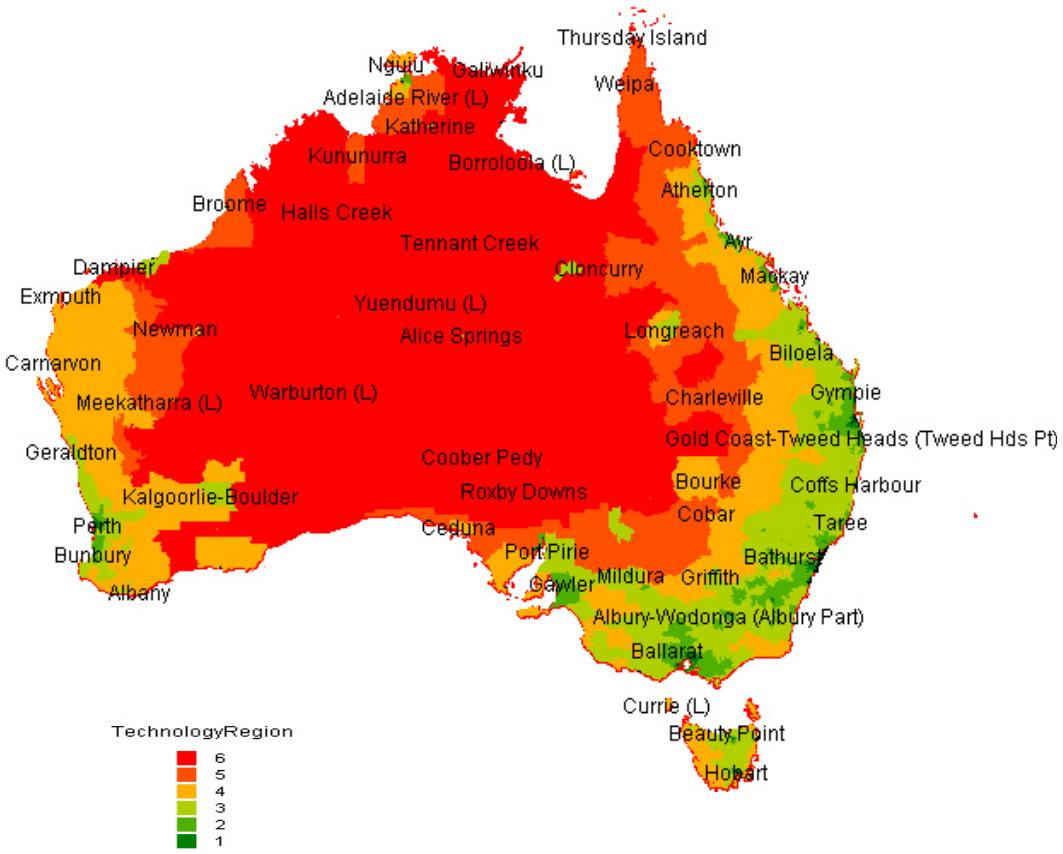
Table B-1 EXAMPLES OF LOCALITIES IN REGION 3 AND 4

NSW	Vic	Qld	WA	SA	Tas	ACT	NT
Balranald			Carnarvon				
Berrigan			East Pilbara	Barmera			
Bogan			Exmouth	Ceduna			
Brewarrina		Atherton	Irwin	Coober Pedy			
Broken Hill	Alpine	Charters	Katanning	Flinders Ranges	Burnie		Alice Springs
Cobar	Buloke	Cook (excl. Weipa)	Manjimup	Goyder	Clarence		Bathurst-Melville
Far West	Campaspe	Eacham	Morawa	Kangaroo Island	Devonport		Coomalie
Griffith	Gannawarra	Emerald	Narrogin	Mount Remarkable	Flinders		Cox-Finniss
Hay	Mildura Part B	Goondiwindi	Northam	Northern Areas	George Town		Jabiru
Leeton	North Grampians	Johnstone	Perenjori	Paringa	King Island		Katherine
Parkes	Wangaratta South	Longreach	Port Hedland	Peterborough	Latrobe		Litchfield, Part B
Shoalhaven	Yarriambiack	Mount Isa	Roebourne	Roxby Downs	Launceston - Part C	ACT except Canberra	Tennant Creek
Wentworth		Roma	Upper Gascoyne		West Tamar		
Windouran		Stanthorpe	Yalgoo				

12. These places are a mix of traditionally remote and not-so-remote areas. These localities may have cost structures that are different from locations that are at similar distances from regional centres and use patterns of inputs that differ from localities in both remote and more populated areas.

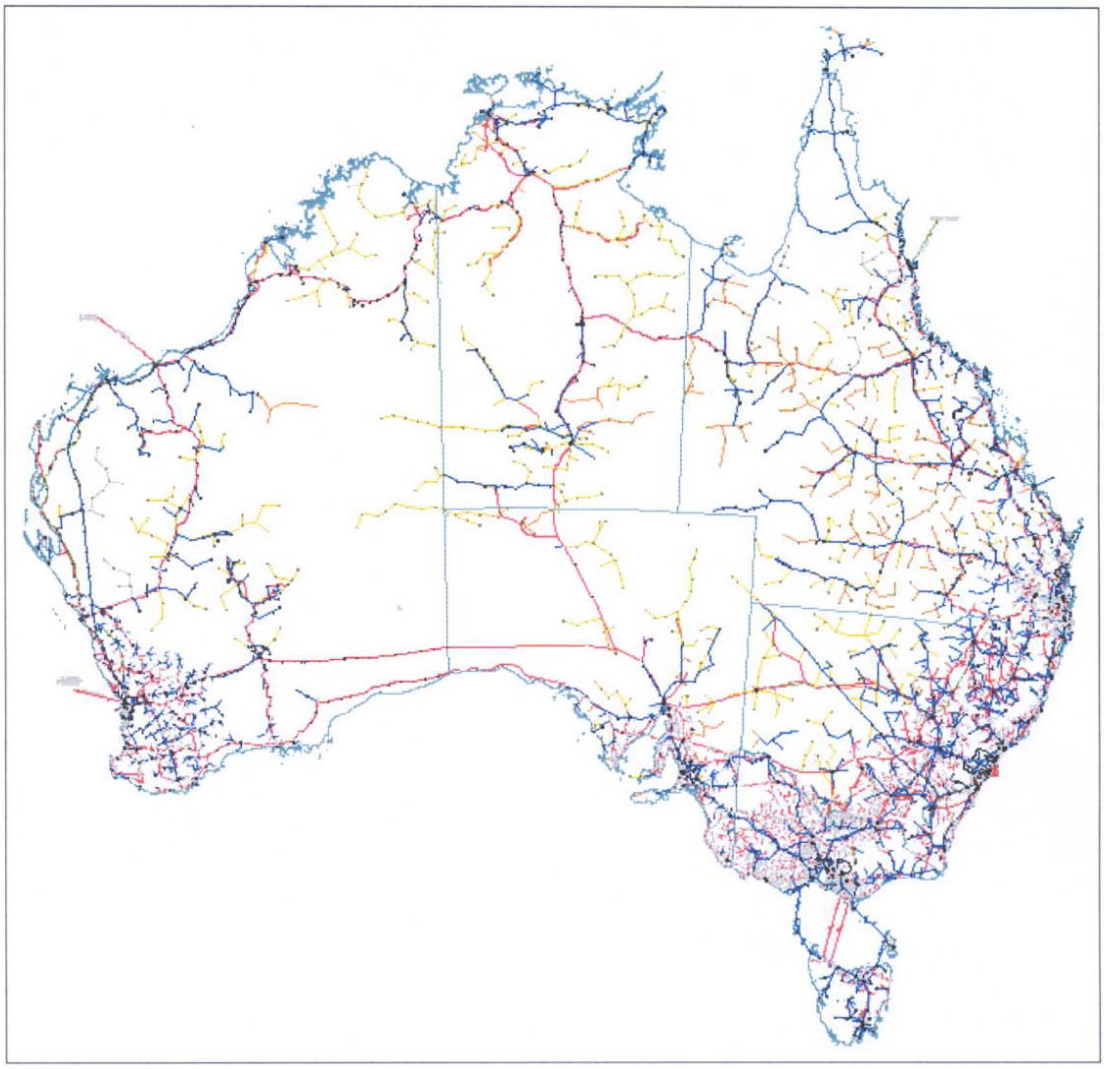
MAPS OF AVAILABLE TECHNOLOGY

MAP 1 TECHNOLOGY REGIONS[35]



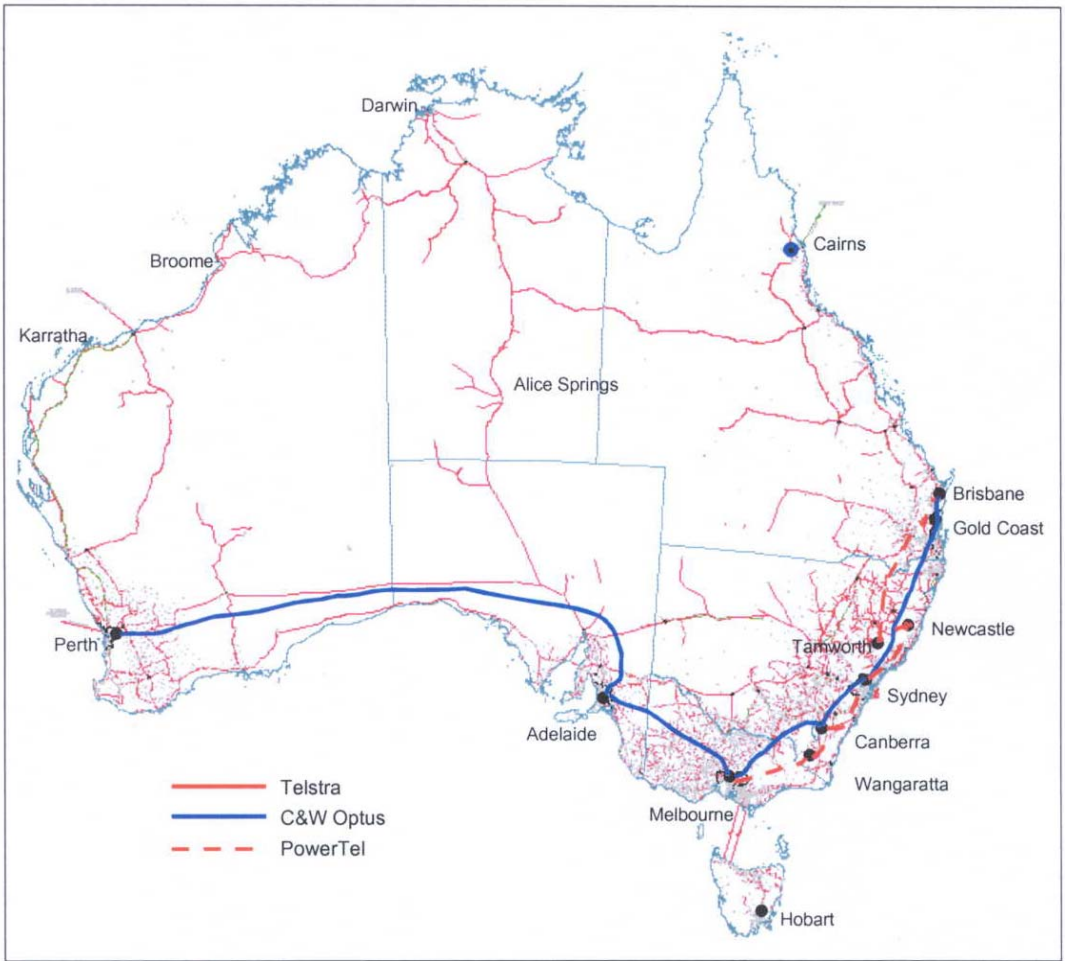
[35] We can provide a concordance between ABS Collection Districts and Technology Regions on request.

MAP 2 TELSTRA'S PUBLIC SWITCHED TELEPHONE NETWORK (PSTN) COVERAGE



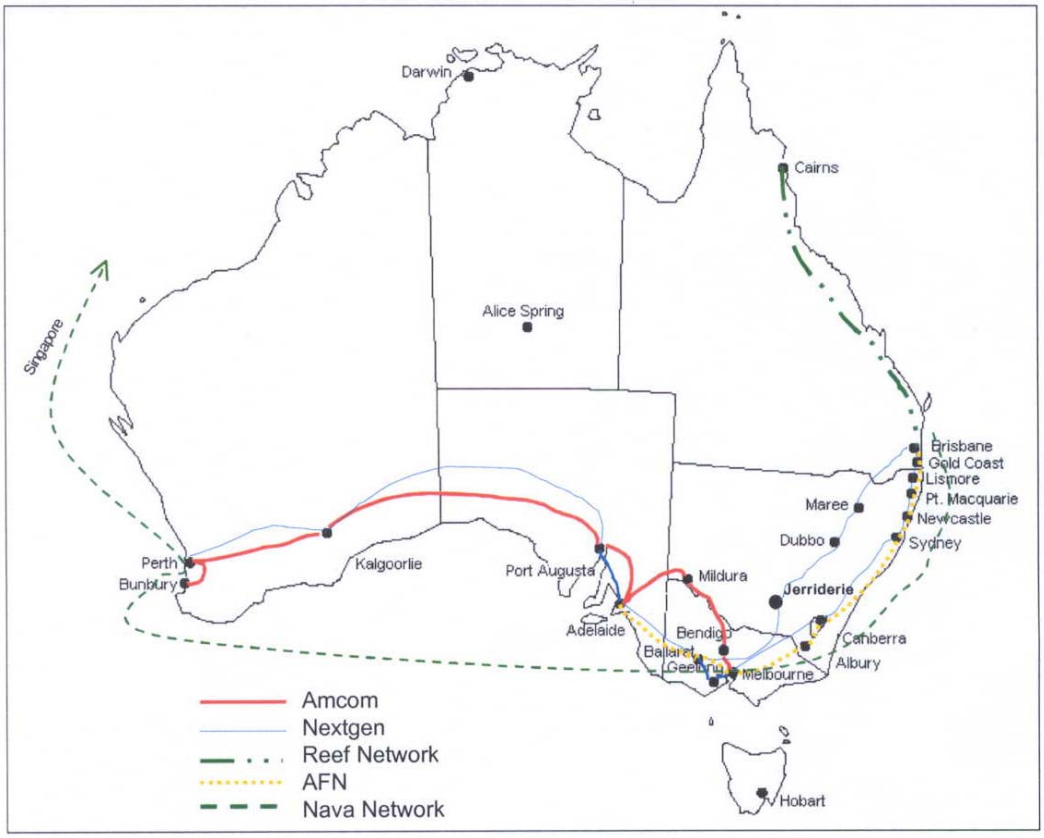
Source: Telecommunications Infrastructure in Australia, 2001, BIS Shrapnel

MAP 3 BACKBONE FIBRE OPTIC NETWORK – INCUMBENT OPERATORS (TELSTRA, C&W OPTUS AND POWERTEL)



Source: Telecommunications Infrastructure in Australia, 2001, BIS Shrapnel

MAP 4 BACKBONE FIBRE NETWORK – NEW OPERATORS (AMCOM, NEXTGEN, AFN, REEF NETWORK AND NAVA NETWORK) SINGAPORE



Source: Telecommunications Infrastructure in Australia, 2001, BIS Shrapnel

ATTACHMENT C

ISSUES RELATING TO STATE GOVERNMENT SERVICES

1. ***The role of State governments.*** Generally, State governments are purchasers of fully managed telecommunication services and face the same technology and pricing options as other large organisations. State governments also have a role in acknowledging, articulating and promoting the need for intensive use and investment in ICT on a whole-of-economy basis.

2. In doing so, States appear to maintain two distinct foci.

   (i) When they are seeking to promote the general use of, and investment in, ICT, they focus on ICT as a means of improving general competitiveness, economic growth and, in turn, standards of living.

   (ii) By contrast, in the context of service delivery, they see ICT as a way of improving access and equity, without holding back regions where advanced services could be provided.

3. All States have whole-of-government workgroups planning for or promoting ICT on a whole-of-economy basis, including government services. Those bodies work across agencies in a catalytic role and attempt to:

   (i) initiate changes by developing acceptance and highlighting the benefits of technology;

   (ii) formulate strategies and coordinate efforts;

   (iii) pursue standardisation of information and telecommunications platforms;

   (iv) encourage new business processes necessary to develop ICT based service delivery between and within agencies;

   (v) encourage aggregation of demand across agencies;

   (vi) find cost-effective solutions to the State's communication needs in an overall framework;

   (vii) promote negotiation with service providers as a single user with substantial demand; and

(viii) maximise the value and utility of the investments already made.

4. Individual agencies, in particular the health and education agencies, often have their own workgroups to complement those efforts. Overall, governments have invested large amounts of financial and management resources in the physical infrastructure and the technical support and training required to fully obtain the benefits of technology.

5. The planning and management issues States confront when considering the provision of extensive ICT based government services go beyond technology and pricing. They include the need to overcome:

(i) economic issues, such as finding the funds for the initial investment and for follow-up recurring services and devising cost-effective solutions in the context of the State; and

(ii) non-economic impediments to technology use, by changing organisational culture and business processes at the whole-of-government and agency level.

6. ***Economic issues.*** The main economic issues associated with ICT are the costs of purchasing, installing and maintaining hardware, developing applications and contents, providing support and training to people, and using the systems. Moving to higher bandwidth platforms also involves higher prices.

7. In relation to communications, the main issue is relative costs of accessing technology platforms. Generally speaking, higher bandwidth platforms cost more as does providing services in sparsely population locations. As a result, the average cost of communication services:

(i) increases in the more populated centres, because of the earlier adoption of more costly platforms and higher usage in these areas; and

(ii) increases in sparsely population locations, despite lower intensity of use, because of higher costs of services, the lack of economies of scale and the lack of competition.

8. For any specific service, policy neutral cost measures can be calculated for each region (as we do later for education[36]) by weighting the relative costs by use weights for each region and type of technology. Because governments employ services against confidential cost contracts with providers, actual costs incurred are not widely known. We have nevertheless made a comparison across regions and platforms using some data we could access and some assumptions.

9. ***Non-economic issues.*** The main non-economic impediments to technology use are inadequate levels of awareness, appreciation and training among service planners, providers and the communities to fully utilise the benefits of technology. In the remote

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[36] Because these relative costs are very different from those for standard voice communications, a 'non-voice' communication component has been introduced into the assessment.

areas, there are extra impediments like low levels of IT literacy and lack of IT planning capabilities. Even with centrally managed satellite communications, use can be impeded by other technical issues such as unreliability of power supply, lack of secure and air-conditioned premises or poor quality telephone cables used for the uplink.

10. Progress on these issues is likely to be evolutionary and will differ across States and types of services. The pace of progress will also be dictated by the need to explore alternative models of ICT based services, and build on that experience.

11. The overall impact of technology on government budgets is affected by several influences.

12. ***Generating adequate levels of demand for technology-based services depends on regional issues.*** The potential for success in promoting ICT based services (in particular high bandwidth based services) will depend on the situations in each State. For example, given a common policy of aggregating demand across agencies, levels of governments and communities, generating an adequate level of demand at an affordable price will be:

- easier in States where population density and pre-existing private demand are high and widespread; than it is
- in areas of low socio-economic status or in areas where the government is the sole user.

13. ***State based issues affect the price of using telecommunications.*** The general contexts in which a State operates also affects the contractual arrangements it can enter with the telecommunication service providers, and the degree of volume discounts it can extract. The main determinants of favourable negotiation outcomes relate to the size and mix of the overall communication tasks it seeks to purchase[37]. For example, Queensland said that, although it is a large consumer, its contribution to Telstra's revenue from the State is small because of its diversity and low demand. As such, its ability to influence the provider is limited.

14. ***Costs of using technology are only part of the total costs of technology-based services.*** If States are to deliver services using technology, they must make complementary investments in:

(i) information technology equipment (including cables, routers, other data components, workstations, applications softwares and contents);

(ii) maintenance and repairs to that equipment and software; and

(iii) technical support to and training of employees.

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[37] NSW response to the questionnaire suggests that 'the majority of providers were willing to provide discounts for volume purchases'. ACT's response was similar.

15. The expenses arising from those matters are usually considerably greater than the expenses for accessing and using ICT infrastructure.

16. Because information technology equipment is generally centrally contracted and purchased regional differences in its availability and costs are less important than they are for telecommunication services. There is also no firm evidence that the States can extract differential volume discounts on these.

17. However, regional differences do arise when it comes to installing and maintaining that equipment, and providing technical support and training to employees. Most States reported that the ongoing cost for maintaining and upgrading technology, and developing/training staff, has been substantial and would remain so if the tools were to be used effectively. They saw the need for local technical and user support services as a big impediment to intensive use of technology-based services, with the issue being greatest in the areas where population density is sparsest.

18. Some States also reported turnover of trained staff, tentativeness of customer groups particularly among Indigenous population and lack of the ability to fully utilise technology based services, lack of community awareness and education as important issues. In many instances, customers prefer face-to-face services.

19. Despite those impediments, the use of ICT is growing as the appreciation of its value, confidence among users, and service reliability increase. However, those developments do not appear to have translated into major cost savings. More importantly, most States doubted that technology will ever replace face-to-face services (for example, teaching in the secondary school environment) and said that a mix of traditional and ICT based services will be the norm going into the future.

20. Within these constraints, health and education services have received special attention from all State governments. There is evidence of large investments in technology-based services taking place in the education sectors across all States, which could act as a catalyst for further investment in ICT in the remote areas. Some examples are given below.

21. ***Education.*** The objectives for the use of ICT in education are addressed by national action. In March 2000, the Ministerial Council for Employment, Education, Training and Youth Affairs (MCEETYA) endorsed the school sector strategic blueprint for the implementation of ICT in teaching and learning: Learning in an Online World: the school action plan for the information economy.

22. The Action Plan identified infrastructure (particularly bandwidth), professional development and the availability of online curriculum content as the three priority areas for implementation if schools are to take full advantage of ICT in teaching and learning.

23. The NSW government in 1999 started connecting schools to its wide area network using ISDN 64 kilobits per second network services which provided more reliable Internet connections at fives times the speed of the previous dial-up services. The services at more than 1,650 schools were upgraded to 128kbps during 2002.

24. Because of technical limitations with accessing ISDN services, 165 predominantly regional and remote schools in 2002 were connected to the two way satellite services, at a projected cost of $4.5 million over two years.

25. The 2002-03 New South Wales State Budget provided an additional $247 million over four years for the Department of Education and Training (DET) to increase the capacity of its network infrastructure to enhance Internet access and support e-learning initiatives. Under this project, bandwidth for schools, TAFE colleges and other departmental facilities throughout NSW will be upgraded progressively, using a range of telecommunications services and technologies. DET plans for all sites to receive their first substantial increase in bandwidth (beyond 128 kilobits per second) by the end of 2003. Most sites will likely have services of 2Mbps or better by the end of 2004.

26. Victoria spends $200 million annually on school infrastructure and departmental ICT services. All Victorian Schools have had access to the Internet via the VicOne Wide Area Network since October 1999. The network links all schools with extensive local area networks with over 140 000 points. Most schools are connected via 64 kilobits per second links.

27. In Queensland, all primary and secondary schools are connected to a state-wide integrated data communications network that provides access to administrative and curriculum resources, including intranet and internet services. Most schools connect using ISDN or ADSL[38].

28. In Western Australia, the majority of schools are connected to 64K links. About 80 schools in the metropolitan and regional areas are connected through higher capacity links (512K or higher). Some schools in remote areas are not connected at all.

29. The government is investing $90 million over three years to connect all schools to broadband infrastructure. This includes 10 megabits per second connections for metropolitan schools, 512K or higher for regional schools and 2 way satellites for 39 remote schools.

30. In South Australia, all schools have been provided with either 128 or 256Kbit ISDN connections with the exception of several remote locations with satellite access and a small number of schools with broadband connections.

31. The South Australian School of the Air provides an example of innovative broadband application use. The school used $325 000 from the Networking the Nation (NTN) program to pilot a virtual classroom to service 20 of the most isolated families in the state. It uses laptop computers connected via satellite to allow students to interact and work collaboratively on projects through features including a virtual whiteboard and provides

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[38] For example, Aspley State High School (Chermside), Ipswich State High School, Roma Middle School, Cairns State High School and North Rockhampton State High School use ADSL 256K; Longreach State High School, Western Cape College (Weipa), Thursday Island State High School use ISDN 128K; Spinifex State College - Senior Campus (Mount Isa), Thargomindah State School, Winton State School , Mornington State School and Birdsville State School use ISDN 64K.

students with a quality of service not previously possible using two-way radio and allows the teachers to engage the students as a group.

32. The Tasmanian Government has a single, whole-of-Government contract, called Networking Tasmania, for the purchase of data telecommunications services[39]. These are available to all areas within Tasmania and to mainland capital cities, and provides a highly secure, fully managed data network underpinned by a number of technologies including ISDN, PSTN, ADSL and fibre-based services.

33. The Government as at January 2003 has been able to provide 210 schools with connections in the range 64 kbps to 256 kbps, and just 37 schools with connections between 512 kbps and 1M. A further 36 schools are connected only via dial-up services. The Department of Education has estimated that the average school needs about 4 Mbps connectivity to enable the provision of email and Internet, e-learning applications and access to administrative systems.

34. In the ACT, most schools are connected through ISDN 64K or 128K. All schools will be progressively connected to the local broadband network VDSL at (5 mbps/512 kbps) operated by TransACT.

35. Most common learning-orientated applications are internet browsing, E-mail for general information exchange and Intranet/ Extranet to support an extensive web resource for administration, professional development material for teachers and learning material for students.

36. A wide variety of student management and administrative applications are used. Examples are data warehouses on students including monitoring of progress on an individual basis and curriculum planning tools for teacher, and the more traditional human resources and payroll management systems.

37. At this stage, videoconferencing and on-line education delivery in real time to remote areas are relatively limited. Growth and change areas are creation of and access to on-line curriculum resources, and education content and software in the classrooms (including for student assessment) and streamlining of school administrative systems. To achieve this end, Australian governments and the Government of New Zealand have established The Learning Federation — a $68 million initiative — to develop appropriate on-line content as a key driver in education.

38. Evidence from most States indicates that the costs of providing education have increased due to ICT. Although there are savings in some cost areas, the costs of starting up and maintaining the infrastructure and supporting (as well as training) staff to use this vital 'new' tool, have been large.

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[39] To share the benefits, and also to maximise the Government's buying power, this contract is open to, and widely used by, other community service deliverers including government businesses, local government, Commonwealth Government offices in Tasmania, private schools and private hospitals.

39. ***Health.*** In Health, major gains seem to have been made in the administrative and support functions rather than in service delivery[40], although examples of the latter are by no means rare[41].

40. Examples of use of ICT in support functions include conciliation and exchange of patients' record and clinical information across health care facilities and carers, seeking second opinion and professional development for carers. Many of these are still evolving. Relative to the education sector, videoconferencing appears to be more widely used for staff training, clinical consultation, general meetings and remote diagnosis.

41. Administrative applications are similar to those for education. Examples are assets, human resources and payroll management systems.

42. Beyond this, clinical applications are limited to medical tests such as radiology and pathology, psychiatry services and some diagnosis and treatment. Evolution of telecommunication based newer services for direct care of patients will probably be slow[42]. Some legal considerations such as privacy issues act as additional impediments.

43. ***Administration of Justice.*** The progress in this area is somewhat piecemeal. Because of the independence of the judiciary, a major driver, in some jurisdiction, seems to be predicated on the 'willingness of the judiciary to take advantage of the new technology'[43]. The extent of the use of ICT, including videoconferencing, involves accordingly a degree of predisposition.

44. Video conferencing facilities have been installed in most main court locations, substituting for the transportation costs for witnesses, specialists and defendants (such as for bail applications or in-custody or parole board hearing), and providing family contact to prisoners. Some court activity such as sentencing however requires the prisoner to be in court. Other examples are offender information systems (including sentencing details) and court information systems that are accesses by appropriate agencies.

45. These facilities are less available on circuit courts.

46. Administrative applications are similar to those for education and health. Examples are assets, human resources and payroll management.

47. New South Wales also reported that better use of online services via the intranet for internal users had resulted in cost savings from the reduction in 'paper shuffling' and approval times. However they acknowledged they were still very much in the early days of necessary applications' environment.

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40 Queensland Health response to the questionnaire.

41 For example, South Australia reports they have had the opportunity to introduce a tele-renal service between The Queen Elizabeth Hospital (TQEH) and Pt Augusta Hospital which is located in the North of South Australia. The service provides dialysis services for up to 40 rural patients and utilises the IT infrastructure of OACIS (clinical information system) and video tele-medicine.

42 The Northern Territory response to the questionnaire stated that '(t)ele health approaches are being explored but to date, have been limited by the cost and skills required to operate remote diagnostic equipment (and) the cost of the high capacity data communication links ... (t)his is unlikely to change ...

43 Tasmania's response to the questionnaire.

48. While there are instances of savings due to less travel[44], cost savings in some cases have accrued to the public rather than directly to the government.

49. In summary, unlike in 1999, governments now have a set of standard ICT policies and objectives. These include:

(i) focussing on access and equity in service delivery;

(ii) adopting a strategic approach to diffuse the benefits of technology;

(iii) investing substantially in improving access to and use of technology, particularly in education;

(iv) standardising technology platforms across agencies; and

(v) aggregating demand and negotiating with the providers on a whole-of-government basis.

50. However, the cost and use implications of technology are different across States. These differences form the bases of our proposed approach to reflecting the impact of technology on the assessments.

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[44] South Australia reported that its 'Bushlink' project — funded by NTN, and based on the theme of providing better access to their services for remote, rural and regional communities by way of video conferencing technology — reduced costs associated with travel particularly, air, inter-regional and local travel.

ATTACHMENT D

APPROACH TO ASSESSMENT

1. As stated earlier, impact of technology would be captured in the assessments in many ways. The main focus in this attachment is on assessing additional explicit expenses attributable to technology, and the indirect impacts over and above those that are readily captured in the assessments. Where there were overlaps with other assessments, staff have made adjustments to remove double counting.

Indirect effects of technology

2. Staff concluded that that the additional impacts of technology on the assessments would differ across regions. Differences across regions in the access to, and use of, technology might lead to regional differences in the mix of inputs used to provide services. Staff therefore considered how the short and long term substitution and scale effects of increasing use of technology would arise in practice and whether those effects should be reflected in the assessments.

3. Staff thought the likely short and some long term effects would arise in the following ways:

(i) higher short-term costs as investment in technologically enabled services increases and some quality improvements are realised;

(ii) lower short-term costs in some cost components through ready substitution of one input for another — such as voice communication and long distance travel;

(iii) higher long-term costs as quality and availability of services continue to improve requiring generally more resources; and

(iv) lower long-term costs in some cost components through substitution between inputs — for example, staffing and associated costs because the manner in which services are delivered might change radically.

4. Discussions with the States indicated that some of the near-term impacts have already materialised, and pressures to deliver higher quality services on a continuing basis are building. But the longer-term substitution impacts through direct savings in staff

costs have not materialised. Staff time freed up by ICT appears to be redirected to improving other aspects of service delivery[45].

5. Indeed, pressure to fulfil community expectations appeared to have moved ahead of financing considerations. Little cost-benefit analysis has been done to support the initiatives undertaken so far, although the questions are beginning to be asked[46].

6. All this convinced staff that it was necessary to consider patterns of plausible savings achieved in the short-term through costs reductions in voice communication and long distance travel[47]. However, it appeared to us that it would be more so in regions where many technology options were available.

7. Communication and travel costs are already reflected in the dispersion assessments. The underlying reasons why technology might cause those costs to differ across regions are similar to those for other dispersion effects. Staff therefore concluded that the impact of technology could be taken into account by modifying and/or extending the scope of the dispersion disabilities. Those modifications could include changes to input weights and regional weights, such as:

(i) adjusting the disabilities for some dispersion affected costs to reflect the indirect impact of technology such as through changes to input and regional weight; and/or

(ii) introducing extra dispersion affected cost elements into the calculation of that factor that are directly attributable to technology.

Technology related components

8. The staff examination of expenses States incur in delivering ICT based services, indicated that the assessments should recognise the following cost components:

(i) information technology equipment — including network components, workstations, applications softwares and contents;

(ii) communication access and use charges for:

- voice; and

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45 For example, South Australia stated that technology 'frees up time for staff who are then able to undertake other tasks within their area, rather than allowing staff numbers to be reduced'.
Also, Tasmania's Department of Justice stated that 'staff are seldom only involved in the provision of information and therefore their time freed up by the new technology is often absorbed by other activities to further improve services'.

46 For example, *'Everywhere, the same questions are being asked: What difference is ICT making to teaching and learning in schools?', ICT in Schools, Ministerial Council for Education, Employment, Training and Youth Affairs (MCEETYA), June 2002.*

47 For example, Tasmania's Department of Health and Human Services (DHHS) stated that '(t)he Telehealth project has delivered quantifiable savings in travel… for specialists and for patients, (but these) … are not a significant sum in proportion to the cost of establishing the service.

- non-voice;

(iii) repairs and maintenance; and

(iv) support and training.

9. Staff grouped the cost elements in the above way because the underlying regional cost patterns between groups were dissimilar. For example, the 'non-voice' component was added because the price patterns are very different from those for voice communications.

10. Costs included in element (i) in paragraph 8 basically reflect the use of capital. They would normally be assessed under depreciation (and debt charges). While most States referred to the high costs of acquiring equipment and developing contents[48], many individual pieces of a network and equipment are of low value[49]. It is likely that they are accounted for as operating expenditure in the GFS. Moreover, States generally buy these items centrally, implying the cost would be similar regardless of where in the State they are used. The only difference would arise from the costs of freighting them to the point where they are used and installation costs. Staff therefore concluded this cost element would be better assessed as a part of the freight cost component of the dispersion disability.

11. However, before doing so, staff considered whether there were differences across regions in the intensity with which technology was used. If there were, the disability factor should allow for the effects on costs of both distance and the volume of freight. Similar issues arose for the other potential cost elements in paragraph 8.

12. To see whether there were regional differences in the intensity of use of technology, staff examined data, dissected by region, on:

(i) the ratio of workers to workstations in the hospital and Administration of Justice categories; and

(ii) the ratio of students to workstations in secondary schools.

13. Only Queensland provided relevant data on this. The data, summarised in Table D-1, suggested there was a trend for the ratio of students to computers to fall as remoteness increased, but not so trend in the ratio of users to computers for hospitals.

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[48] For example South Australia stated that 'substantial costs have also occurred in the development/modification of education courses (both school and post school) so these can be delivered in a virtual environment'.

[49] It was defined narrowly to include workstations, cabling, network and other physical components, applications and content.

Table D-1 COMPONENT WEIGHTS

Regions	Schools (Student To Computer Ratio)	Hospital (User To Workstation Ratio)
1	4.54	1.74
2	5.31	2.56
3	5.39	2.51
4	3.75	2.26
5	4.00	2.72
6	3.10	1.00

14. The data trend is similar to the service delivery scale factor[50] used in the secondary schools assessments. Staff concluded that any effect on costs would be reflected in that factor other than the extra costs of freighting equipment to schools.

15. Staff did however consider whether it would be necessary to adjust the disability factors for other expenses for regional differences in the intensity of use. The conclusion was that adjustments for regional differences in the intensity of use of technology would be appropriate for the schools categories only. Thus the freight allowance for schools included an adjustment to allow for the greater per capita level of equipment sent to remote areas. This conclusion would be revisited if further data becomes available.

16. Proposed assessments for cost components (ii), (iii) and (iv) in paragraph 8 are more closely aligned with the general method for dispersion as described below.

PROPOSED CHANGES TO ASSESSMENTS

17. This paper estimates the effects of only the proposed explicit adjustments to the dispersion assessment to allow for the effects of technology on the differences between States in the costs of providing services. It does so on the basis that there are no other changes in method or scope in the dispersion assessments. Full details of the dispersion assessments for the 2004 Review are in *Draft Assessment Paper 2003/63 Dispersion*.

18. To construct the assessments, staff:

(i) reviewed the changes over time in the data on each dispersion affected cost as a proportion of total standard expenditure;

[50] This is calculated using the teacher to student ratios in schools. Similarly, for hospitals, any other effects arising from the greater use of technology in remote regions are likely to be reflected in the hospital costs disability.

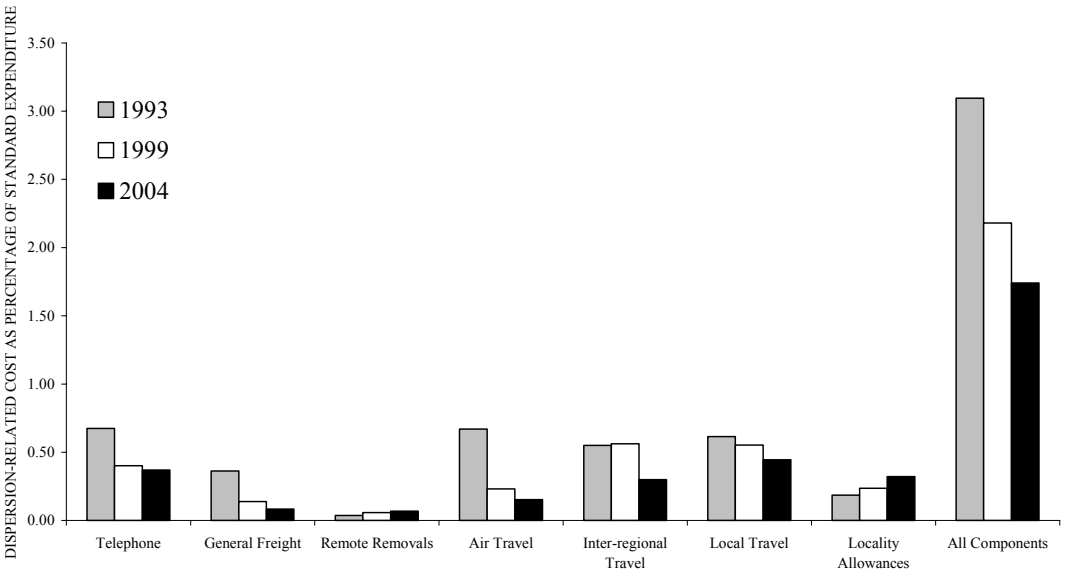
(ii) identified the dispersion affected costs whose use intensity by region would be very different because of technology;

(iii) dissected the communication costs into voice and non-voice components and considered how each component might be assessed.

Comparison of changes to the dispersion components

19. Figure D-1 compares the size of each dispersion affected cost component (expressed as proportion of total standard expenditure) from the 1993, 1999 and 2004 Reviews.

Figure D-1 COMPARISON OF DISPERSION RELATED COSTS AS PERCENTAGE OF TOTAL STANDARD EXPENSES IN 1993, 1999 AND 2004 REVIEWS[51]



20. It is clear that the proportion of dispersion related expenses declined for most components and overall. As far as possible the range of expenses included in each component has been held constant for each review, although the 2004 Review figures for the remote removals and locality allowances components cover a broader scope[52].

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51 The travel components for 2004 exclude the expenses for Inpatient Services, because they have not been finalised.

52 See *Draft Assessment Paper 2003/63 Dispersion*.

21. However, the comparison in Figure D-1 is partial because it relates to recurring costs only of the components that are common between the 1999 Review and the 2004 Review. Other effects (such as increased expenses on capital costs) were not readily captured. Also the comparison has not been standardised to exclude the effects of changes in the composition and settlement of population in remote areas between reviews.

22. The figures are consistent with our and many States' view that high bandwidth communication might have reduced voice communication and long-distance travel expenses.

23. Moreover, given that a sizeable and increasing proportion of the reported expenses in the 'telephone' component is due to non-voice communication, the data suggest a strong substitution of non-voice for voice communication. Staff think that this effect has been greater in the more populated areas (regions 1 and 2) where there are more non-voice technology options.

24. Overall, the figures confirm our view that technology and other developments have changed the level of dispersion affected costs.

Use intensity of inputs by region

25. The dispersion disability allows for the impact of regional differences in the cost of dispersion affected inputs (telephone, freight and travel).

26. While there are some exceptions, the disability is generally based on the assumption that, regardless of location, a fixed quantity of each input is used for each unit of service delivered. The exceptions are the telephone, travel and freight components, where allowances were made for the greater use of those inputs in the remote areas.

27. Because the dispersion disability is based on a generally observed hierarchical service delivery system (involving central office, regional offices and individual service outlets) it also contains some regional weights. In effect those weights split the expenditure, for each dispersion affected cost component, into expenses incurred in dealings between the:

- central office and regional centres; and
- regional centres and specific localities.

28. A logical consequence of increasing ICT based services, particularly in the capital cities and the major regional centres, is that the mix of inputs used in providing services and the costs incurred might have changed more than they have in the remote areas. Since regions 3 and 4 are technologically much better served now than in the past, it is likely that the structures for some dispersion affected costs now more closely resemble those in the major urban areas.

29. By contrast, the penetration of high bandwidth based services in the relatively remote areas has been limited (for technology as well as non-technology reasons). Underlying cost structures may have changed much less in those areas.

30. As stated before, there is evidence that the near term impacts of high bandwidth applications have changed some dispersion components — voice communication, general freight and long distance travel. There is little evidence that the other dispersion affected costs (local travel, locality allowances and remote removals) have changed.

31. In the absence of detailed data, judgement has been used to set input and regional weights that reflect the direction and approximate size of those changes. The proposed weights are supported by data supplied by Queensland on costs in some localities — comparable data have not been received from other States.

32. Table D-2 summarises, by types of regions and cost elements, the cost data supplied by Queensland for a selection of hospitals[53]. The data were used as the basis of judgements on how expenses might be shift over time.

[53] Major Regions 1 and 2: Chermside, Cairns and Rockhampton; Inner Areas 3 and 4: Roma, Longreach, Mount Isa; Remote Areas 5 and 6: Thargomindah, Weipa, Winton, Thursday Island and Mornington Island.

Table D-2 DISTRIBUTION OF EXPENDITURE BY COST COMPONENTS AND REGIONS

Technology Regions	Item	Year	Cost Components						
			Communications	Freight	Air-Travel	IR Travel	Labour	Repairs	Total
Major Regions (1 and 2)	Total Expenses ($)	2000-1	1620821	561543	2306542	1325869	229028539	6186400	241029714
		2001-2	1237675	896546	2257318	1453656	236777415	6549569	249172179
	Proportions	2000-1	0.7%	0.2%	1.0%	0.6%	95.0%	2.6%	100.0%
		2001-2	0.5%	0.4%	0.9%	0.6%	95.0%	2.6%	100.0%
	Percentage Change Between Years		-23.6%	59.7%	-2.1%	9.6%	3.4%	5.9%	3.4%
Outer Areas (3 and 4)	Total Expenses ($)	2000-1	218004	200018	2077068	371323	31240502	1085399	35192314
		2001-2	362603	255863	2586144	339467	33663076	1192702	38399855
	Proportions of Expenses	2000-1	0.6%	0.6%	5.9%	1.1%	88.8%	3.1%	100.0%
		2001-2	0.9%	0.7%	6.7%	0.9%	87.7%	3.1%	100.0%
	Percentage Change Between Years		66.3%	27.9%	24.5%	-8.6%	7.8%	9.9%	9.1%
Remote Areas (5 and 6)	Total Expenses ($)	2000-1	112463	107724	1956368	36554	6056635	187950	8457694
		2001-2	135733	128211	2211111	31365	6611635	464188	9582243
	Proportions of Expenses	2000-1	1.3%	1.3%	23.1%	0.4%	71.6%	2.2%	100.0%
		2001-2	1.4%	1.3%	23.1%	0.3%	69.0%	4.8%	100.0%
	Percentage Change Between Years		20.7%	19.0%	13.0%	-14.2%	9.2%	147.0%	13.3%
	Total Expenses ($)	2000-1	1951288	869285	6339978	1733746	266325676	7459749	284679722
	Proportions of Expenses	2000-1	0.7%	0.3%	2.2%	0.6%	93.6%	2.6%	100.0%
	Total Expenses ($)	2001-2	1736011	1280620	7054573	1824488	277052126	8206459	297154277
	Proportions of Expenses	2001-2	0.6%	0.4%	2.4%	0.6%	93.2%	2.8%	100.0%

Source: Queensland response to the CGC questionnaire on 'technology'.

33. The table shows that, relative to labour costs, expenses on other inputs generally increase as the regions become more technologically remote. The dispersion disabilities seek to reflect those differentials. The data were also examined to see whether they suggested that various inputs were used at different rates in different regions.

34. ***Communication costs.*** There is a large fall in communications expenses in the major regions (relative to labour costs they fall by 27%). By contrast, there are increases in the other regions. The fall in the major regions seems to be partly due to substitution of non-voice communication (through e-mails, the internet/intranet, department's web resources etcetera) for voice communications. This substitution is so stark in the major regions possibly because more technology options are available. The

existence of the substitution is consistent with the responses of some States to the Commission's questionnaire.[54]

35. To capture the falling intensity of voice communications in the major regions relative to other regions, staff assigned an input weight of less than 1 to the major regions. If the observed fall in communication costs in major areas was due entirely to substitution of non-voice for voice communication, the input weight would have been 0.73 (calculated as one minus 0.27). But staff considered that unlikely. On the other hand, the data reflected two successive years only and may not fully reflect the underlying trend. An input weight of 0.75 was determined on the basis of judgement.

36. The existing input weights for voice communications for other regions were considered sufficient to reflect the effect of the relatively greater importance of communications in delivering services. Those weights were 4 for very remote regions and 3 for remote regions[55].

37. ***Air travel expenses.*** Similarly, there was a fall in the air-travel expenses in the major regions of 5.5 per cent relative to the labour costs. By contrast, there were large increases in the other regions.

38. The fall in major regions may be partly due to substitution of communication including video conferencing for travel. This observation is generally consistent with the responses of States to the Commission's questionnaire. No differential use of air-travel is however reflected in the dispersion assessment.

39. Staff propose to reflect this effect in the assessment by assigning an input weight of less than 1 to the major regions because this is where the effects would be greatest. An input weight of 0.95 (calculated as 1 minus 0.055 and rounded)was assigned to region types 1 and 2. As for the communication component, this weight reflects a judgement that the effects of the various limitations of the data broadly offset each other.

40. ***Local and inter-regional travel.*** There was also a large fall in local and inter-regional travel expenditure outside the major regions. Relative to the labour costs it fell by 16.4 per cent and 23.4 per cent respectively in the inner and the remote areas. By contrast, there was a large increase in the major regions.

41. Those falls appear to be partly due to substitution of communication such as e-mails and internet for local and inter-regional travel in remoter regions. This was consistent with the increases in the communications expenditure in these areas.

42. Staff considered assigning an input weight of less than 1 to other than the major regions to reflect these changes. However, the data did not allow the effects to be allocated between local and inter-regional travel. The observations made by the States in

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[54] For example, South Australia said that 'while voice communication has had some savings (ie it has been estimated that no longer faxing sites has resulted in a 1/2 million pa saving), the additional costs of providing ITC far outweigh these savings'.

[55] See *Draft Assessment Paper 2003/63 Dispersion*.

their response to the questionnaire were less clear on the effects of technology on travel costs than they were in relation to voice communication[56].

43. The nature of activities undertaken through local travel suggest that the fall in travel costs was unlikely to be caused primarily by reductions in local travel. Instead, staff decided to assign the changes wholly to interregional travel. That was done by assigning an input weight of 0.85 (calculated as 1 minus 0.164 and rounded) for region types 3 and 4, and 0.75 (calculated as 1 minus 0.234 and rounded) for region types 5 and 6.

44. ***Freight.*** No adjustments to freight expenses were proposed because the changes to freight expenses were large in all regions. This is consistent with South Australia's response[57].

45. In summary, the input weights proposed to allow for the effects of 'technology' are listed in Table D-3. As noted above these weights are based on limited data and would be revised in the light of additional information provided by the states. The weights that would be used if no adjustments were made for the effects of technology are also shown (called the default settings).

Table D-3 INPUT WEIGHTS

Cost components	Region type 5 and 6[(b)]	Region type 3 and 4	Region type 1 and 2
Voice Communications			
Default Input Weights	3/4	1	1
Proposed Input Weight	3/4	1	0.75
Non-voice Communications			
Default Input Weights	Did not apply in the 1999 Review.		
Proposed Input Weight[(C)]	1	1	1
Air Travel			
Default Input Weights	1	1	1
Proposed Input Weight	1	1	0.95
Interregional Travel			
Default Input Weights	1	1	1
Proposed Input Weight	0.75	0.85	1

(a) Region Type 5 roughly equates to most remote areas as defined in 'dispersion'.
(b) Region Type 6 includes many rainfall affected and isolated islands as defined in 'dispersion'.
(c) Because of the way the factors are calculated, input and regional weights are within it as described later.

[56] For example, South Australia said '(n)o savings in travel has been realised as video conferencing is still in it's infancy. … At the current levels of technology it is not considered feasible for specialists to undertake examinations remotely (ie without being in the presence of the patient). However, they report possible savings for clients because '(p)reviously patients who have required this level of service (renal services) would have had to relocate to the metropolitan area and/or made the decision of having no treatment'. They also report 'all input costs associated with travel particularly, air, inter-regional and local travel have been reduced through the implementation of (Bushlink) project'.

[57] For example, South Australia said '(t)here is no apparent effect on Freight …'.

46. Changes are also proposed for the regional weights[58]. The changes are based on the premise that use of high-bandwidth applications is greater in regional centres and capital cities, and this reduces the relative use of voice communications and long distance travel between them. The proposed and default weights are shown in Table D-4.

Table D-4 REGIONAL WEIGHTS

Cost components	Current weights 1999 Review	Proposed weights 2004 Review
Voice communications	0.25	0.2
Air travel		
Administration of Justice	5	4
Secondary Schools	5	4
Hospitals	0.25	0.2
Inter-regional travel		
Administration of Justice	1.00	0.9
Secondary Schools	1.00	0.9
Hospitals	0.5	0.6

ASSESSING THE EFFECTS OF TECHNOLOGY ON DISPERSION DISABILITIES

47. The following paragraphs describe how staff propose to adjust the dispersion disabilities to allow for all the effects of technology.

Communication costs

48. ***Redefinition of communication cost components.*** In the 1999 Review dispersion disability, a single communication component (the 'telephone' component) was assessed using:

(i) an estimate of the average proportion of standard expenses attributed to communication costs;

(ii) a distance based cost schedule for a typical telephone call; and

(iii) an input weight that allowed for the higher use of telephones in remote areas relative to urban areas.

49. Allowing for the effects of technology requires that method to be modified for two reasons:

[58] See *Draft Assessment Paper 2003/63 Dispersion*.

(i) non-voice communication presently constitutes a high percentage of overall communication costs; and

(ii) there are differences in the price differentials across regions for voice and non-voice communications, especially for high bandwidth communication.

50. Accordingly, staff propose replacing the old 'telephone' component with two separate communications components:

(i) a voice component; and

(ii) a non-voice component (that would include non-voice narrowband components because they are generally covered in one contract for non-voice communication).

51. For the analysis in this paper, staff split the 'telephone' component weights (estimated using data collected from the States as in Table D-5), into voice and non-voice components partially by judgement.

Table D-5 PROPOSED PROPORTION OF EXPENDITURE ON VOICE AND NON-VOICE COMMUNICATIONS

Proposed communication components	Secondary Schools	Hospitals	Administration of Justice	Other services
Default				
Voice (%)	**100**	**100**	**100**	**100**
Proportion of standard expenses (%)[59]	0.76	0.50	0.99	(a)
Proposed				
Voice (%)	**40**	**75**	**80**	**90**
Proportion of standard expenses (%)	0.30	0.38	0.80	(a)
Non-Voice (%)	**60**	**25**	**20**	**10**
Proportion of standard expenses (%)	0.46	0.12	0.19	(a)

(a)These are different for each category.

52. ***Assessment of communications factors.*** The default settings for input weights, regional weights and component weights are in Table D-3 and Table D-4 and Table D-5, assuming communication related wholly to voice communication.

53. To reflect the effects of technology, communication costs have been assessed in two components:

(i) the voice component which was assessed using the proposed 2004 Review methods[60], but with a reduced input weight as in Table D-3,

[59] See *Draft Assessment Paper 2003/63 Dispersion*.

[60] Ibid.

the inclusion of regional weights as in Table D-4 and reduced component weights as in Table D-5; and

(ii) the non-voice component as outlined below, with component weights as in Table D-5. The way the price index was constructed meant that a regional weight was not necessary.

54. ***Calculation of factors for non-voice communication.*** As a first step, staff constructed representative price indices across different technology platforms and regions. We did so using price data that could be accessed and the indices were relative to the prices for ISDN 64 Kilobits per second communication in region type 1. Confidentiality considerations prevent publication of absolute cost levels or the data sources.

55. The price indices are summarised in Table D-6.

Table D-6 REPRESENTATIVE PRICE LEVEL OF DIFFERENT TECHNOLOGY PLATFORMS RELATIVE TO ISDN 64K IN REGION 1[(a)]

		xDSL			ISDN[(b)]			Satellite[(d)]	
Region	Cable, 2 mbps	1.5MB/512K	512 K/128 K	256K/64K	128K	64K	Dial-up[(c)]	1-way (uplink at <56Kbps)	2-way (uplink at 64Kbps)
1	2.14	2.11	1.54	1.33	1.44	1.00			
2	2.14	2.11	1.54	1.33	1.44	1.00		1.50	2.10
3					1.62	1.10	0.5	1.50	2.10
4					1.62	1.10	0.5	1.50	2.10
5					2.12	1.37	0.5	1.50	2.10
6							0.5	1.50	2.10

(a) Covers only recurrent charges and include internet access.

(b) Assuming standard LAN connection services and Point of Presence (POP) as follows: Region 1 and 2 – less than 12 kms; Region 3 and 4 – less than 25 kms; Region 5 – less than 50 kms.

(c) Assuming dial-up PSTN option providing 'on-demand' connections to Wide Area Network for a limited number of personal computers. It includes internet usage and a loading of about 30% for call charges.

(d) This represents the price for one school, assuming 165 schools sharing downlink bandwidth of about 10 Megabits per second. 2-way satellite is assumed to cost 40% more than 1 way satellite.

56. The next step was to establish use patterns across technology platforms and regions. Ideally, use patterns would be considered for each type of service, because patterns of use may differ from service to service. However, the resulting calculations would be complex. In any case, detailed comparable data on use of technology were generally not readily available for each type of service.

57. As a practical step, staff considered using patterns of use of technology in schools as a proxy. Data for schools[61], while not exhaustive, provided a reasonable basis for establishing use patterns.

58. Table D-7 provides estimated standard proportions for the use of different technology platforms in each technology region for schools across the whole of Australia.

Table D-7 ESTIMATED PROPORTIONS OF SCHOOLS BY TECHNOLOGY PLATFORMS AND REGIONS

		XDSL			ISDN			Satellite		
Region	Cable 2 mbps	1.5mbps /512 kbps	512 kbps /128 kbps	256 kbps /64 kbps	128 kbps	64 kbps	Dial-up [(a)]	1-way 64kbps /<56Kbps	2-way 64kbps /64Kbps	Total
1	10.3	0.4	1.2	14.9	38.4	34.8				100
2	1.3		1.5	7.9	55.8	30.4		3.2		100
3					43.1	53.8		3.1		100
4					9.5	60.6	10.8	2.1	17.0	100
5					3.0	32.3	0.9	27.7	36.2	100
6							48.4	32.6	19.0	100

(a) Schools, where not connected to any non-voice links, were deemed to have only dial-up connections.

59. While the data sources for both prices and use data are reliable, they are not exhaustive. As such, staff seek comments from the States, in the light of their experience, on the representativeness of the constructed standards.

60. To obtain a relative price measure for each region, staff weighted the price level of different technology platforms in each region by the standard proportion of schools in that region, and added the elements. These are presented in Table D-8.

[61] They include States responses to Special Data Collection and the 'technology' questionnaire. Here, a schools rather than number of students is the basis for weighting.

Table D-8 RELATIVE PRICE MEASURES

Region	Relative Price Measures
1	1.35
2	1.31
3	1.34
4	1.29
5	1.69
6	1.37

61. The rationale for the pattern of calculated price indices is that some of the technology platforms used in region 1 are relatively expensive and are used in higher proportions, with the result that the price measure for that region is relatively high. Lower use of these expensive options reduces the measures progressively. The price measure however increases for the remote areas (region 5), because use of more relatively expensive satellite communication increases. However, in very remote areas (region 6), many schools appear not to be connected at all and lower average use causes the measure to fall.

62. The factors for each State shown in Table D-9 are derived by applying these measures to the population distribution as for the general dispersion method for voice communication.

Table D-9 FINAL FACTORS

Cost components	NSW	Vic	Qld	WA	SA	Tas	ACT	NT
Non-voice	0.99826	1.00012	1.00021	1.00372	1.00023	0.99853	1.00437	1.00898

63. Comparisons of the proposed technology adjusted and the unadjusted (default) factors for communication costs are in Table D-10.

Table D-10 COMPARISON OF FACTORS, COMMUNICATION COSTS

Cost components	NSW	Vic	Qld	WA	SA	Tas	ACT	NT
Default communications factors, all categories								
Voice	0.97719	0.88092	1.15615	1.10837	0.92275	0.91639	0.41694	2.23668
Proposed communications factors								
Voice	0.96071	0.84929	1.16273	1.19477	0.90213	0.97845	0.38138	2.62067
Non-voice	0.99826	1.00012	1.00021	1.00372	1.00023	0.99853	1.00437	1.00898
Proposed aggregated communications factors by types of service[(a)]								
Secondary Schools	0.98324	0.93979	1.06522	1.08014	0.96099	0.99050	0.75518	1.65365
Administration Of Justice	0.96822	0.87946	1.13023	1.15656	0.92175	0.98246	0.50598	2.29833
Hospitals	0.97010	0.88700	1.12210	1.14701	0.92666	0.98347	0.53713	2.21774
Other services	0.96447	0.86438	1.14648	1.17566	0.91194	0.98046	0.44368	2.45950

(a) These are calculated by combining voice and non-voice communications factors using category-specific component weights specified in Table D-5.

ICT related repairs

64. There were several references to ICT related repair costs in the States responses to the 'technology' questionnaire[62]. States indicated there were two main ways repairs could be done — on site or by despatching equipment to nearby towns or regional centres. If it were the former, the repair and maintenance disability factors the Commission is considering assessing in dispersion would be appropriate. If the latter, disability factors based on freight costs should apply.

65. The most common policy in remote areas appears to be to send the malfunctioning units to the nearest centres for repairs. Therefore, staff applied the general freight factors to this component. The exception was the factors for the schools categories where extra allowance was made for the relatively greater presence of technology related equipment in remote schools. The allowance was made by adjusting the disabilities by the standard ratio of students to workstations in each region. Table D-11 summarises the factors calculated on these bases.

Table D-11 PROPOSED FACTORS, ICT RELATED REPAIRS

Item	NSW	Vic	Qld	WA	SA	Tas	ACT	NT
Proposed Factors								
Secondary Schools	0.89305	0.96676	1.21323	1.16474	0.68452	0.78025	0.11581	3.80331
Others (AOJ, Hospitals)	0.92015	0.98305	1.20585	1.10970	0.69140	0.83941	0.12207	3.05074

62 South Australia said '(r)epairs and maintenance has obviously increased as yet another tool has been integrated into education curriculum, and this tool requires extensive support to implement and maintain'.

ICT related support, maintenance and training

66. Most States said the introduction of technology resulted in higher costs for technical support, including training. These activities generally take place on site. Staff therefore considered using the inter-regional travel factors for each function as the measure of this factor. In the schools category the factor would be adjusted by the standard ratio of students to workstations to reflect the greater per capita need for support in remote areas.

67. However, staff modified the method for calculating the inter-regional travel factors[63] to reflect the general practice of using resources from the nearest major regional centres to conduct the training and support. Table D-12 summarises the factors calculated on these bases.

Table D-12 PROPOSED FACTORS, ICT RELATED SUPPORT, MAINTENANCE AND TRAINING

Proposed Factors	NSW	Vic	Qld	WA	SA	Tas	ACT	NT
Secondary Schools	0.92638	0.67966	1.15182	1.65221	0.92090	0.53970	0.22973	4.61344
Other (AOJ, Hospitals)	0.98593	0.71702	1.14708	1.46591	0.92238	0.57796	0.23132	3.61265

ICT related capital costs

68. As stated earlier, staff applied the dispersion freight factors to this component. However, in the education categories an allowance was made for the greater per capita use of computers in remote area schools. That allowance was made by modifying the freight factors for the schools categories by the student to computer ratio for schools.

69. The resulting factors which are in Table D-13 are identical to those calculated for ICT related repairs in Table D-11.

Table D-13 PROPOSED FACTORS, ICT RELATED FREIGHT

Proposed Factors	NSW	Vic	Qld	WA	SA	Tas	ACT	NT
Secondary Schools	0.89305	0.96676	1.21323	1.16474	0.68452	0.78025	0.11581	3.80331
Others (AOJ, Hospitals)	0.92015	0.98305	1.20585	1.10970	0.69140	0.83941	0.12207	3.05074

[63] In dispersion, the method is more general purpose and includes the effect of distances between the capital cities and the nearest regional centres and a different treatment for rainfall affected areas (as if air-fares alone applied to these areas). We removed both effects so that for each location freight charges to the regional centres by road alone mattered.

Impact on inter-regional travel factors

70. The proposed factors were derived by the methods applied to calculate inter-regional travel factors for the dispersion factor, except that the technology adjusted input and regional weights shown in Table D-3 and D-4 were applied instead of the unadjusted (default) weights. The proposed technology adjusted factors and the unadjusted (default) factors are shown in Table D-14.

Table D-14 COMPARISON OF FACTORS, INTER—REGIONAL TRAVEL

Cost Components	NSW	Vic	Qld	WA	SA	Tas	ACT	NT
Default Interregional Factors								
Administration Of Justice	1.07961	0.87967	0.90794	1.00468	1.01978	2.00410	0.14309	1.75620
Secondary Schools	1.07961	0.87967	0.90794	1.00468	1.01978	2.00410	0.14309	1.75620
Hospitals	1.17099	0.94462	0.94451	0.69919	0.99434	1.67595	0.10235	0.55878
Proposed Interregional Factors								
Administration Of Justice	1.09571	0.89446	0.90860	0.95093	1.01362	1.96474	0.15627	1.51242
Secondary Schools	1.09571	0.89446	0.90860	0.95093	1.01362	1.96474	0.15627	1.51242
Hospitals	1.17484	0.96059	0.92360	0.66124	0.99770	1.81666	0.10003	0.46169

Impact on air travel factors

71. The proposed factors were derived by the methods applied to calculate air travel factors for the dispersion factor, except that the technology adjusted input and regional weights shown in Table D-3 and D-4 were applied instead of the unadjusted (default) weights. The proposed technology adjusted air travel factors and the unadjusted (default) factors are shown in Table D-15. The differences between the default and the proposed settings for this component are due to the different input and regional weights.

Table D-15 COMPARISON OF FACTORS, AIR-TRAVEL

Cost Components	NSW	Vic	Qld	WA	SA	Tas	ACT	NT
Default Air-Travel Factors								
Administration Of Justice	1.08549	0.14733	2.39401	0.99993	0.18066	0.00368	0.00000	2.37584
Secondary Schools	1.08549	0.14733	2.39401	0.99993	0.18066	0.00368	0.00000	2.37584
Hospitals	0.77385	0.10032	2.46806	1.44549	0.62862	0.04849	0.00000	4.42064
Proposed Air-Travel Factors								
Administration Of Justice	1.08407	0.14713	2.39591	1.00045	0.18042	0.00459	0.00000	2.38512
Secondary Schools	1.08407	0.14713	2.39591	1.00045	0.18042	0.00459	0.00000	2.38512
Hospitals	0.72599	0.09312	2.48038	1.51300	0.69604	0.05580	0.00000	4.73468

Component weights

72. Combining the factors assessed for each dispersion affected cost required component weights (expenses in each component as a proportion of total standard expenses). The indicative weights (expressed as a proportion of standard expenditure) shown in Table D-16 were based on judgement, informed by the limited information on ICT expenses gathered in from the 'technology' questionnaire. States are invited to comment on the suitability of these weights.

Table D-16 ICT RELATED COMPONENT WEIGHTS

Cost components by selected category	Proportion of ICT expenditure	Proportion of standard expenditure
	%	%
Secondary Schools		
Capital assets	38	0.90
Freight on assets	2	0.045
Communication	20	0. 45
Repair	20	0. 45
Support, maintenance and training	20	0. 45
Administration of Justice		
Capital acquisition	38	0.40
Freight on assets	2	0.02
Communication	20	0.20
Repair	20	0.20
Support, maintenance and training	20	0.20
Hospitals		
Capital assets	38	0.24
Freight on assets	2	0.012
Communication	20	0.12
Repair	20	0.12
Support, maintenance and training	20	0.12

73. These weights were used to calculate the technology adjusted factors. They were also the basis for offsetting adjustments to the weights used in the general dispersion assessments to avoid double counting. The repair and maintenance component weight the Commission is considering assessing in the dispersion disability was adjusted downwards

because the data provided by States did not distinguish between repairs of technology equipment and other repairs[64].

74. Similarly, the interregional travel components in the general dispersion assessment were reduced to allow for the travel associated with support and training activities associated with technology. On the basis of the assumed technology expenses shown in Table D-16, the adjustment was 20 per cent of the ICT costs.

75. The adjustments to the component weights used in default settings are shown in Table D-17.

Table D-17 ADJUSTMENTS TO DISPERSION COMPONENT WEIGHTS TO EXCLUDE ICT EFFECTS

Services	Repairs & maintenance	Inter-regional travel	Total
Secondary Schools	-0.0001	-0.0010	-0.0011
Hospitals		-0.0012	-0.0012
Administration of Justice		-0.0004	-0.0004

Updateability

76. Our review of the impact of technology on the assessments, suggests that many changes are likely to take place over the next five years in the use of ICT. In particular, there will be changes in the use technology options and their prices, and in the classification of locations to technology regions.

77. Given that, staff propose to recommend to the Commission that the factors, especially those for non-voice communication, be reviewed every two years.

SUMMARY AND CONCLUSIONS

78. As stated earlier, many changes — including some that reflect the indirect effects of technology — arise from the updating of the dispersion assessment. Examples are the reduction in freight and travel costs between the 1999 Review and the 2004 Review. These are accounted for as part of the normal review processes.

79. To reflect these changes, Table D-18 presents preliminary details of the redistributive impacts for the components of the dispersion factor assessed in the 1999

[64] The adjustment was comparatively small because of differences in the conceptual bases of the technology and the general repairs and maintenance allowances. The proposed general repairs and maintenance allowances relates to remote area repairs only whereas the technology repairs relate to repairs anywhere in the State.

Review and the proposed 2004 Review. The comparison is based on 2003 Update standard expenditure. Further information on the dispersion assessment and of the changes to it is in *Draft Assessment Paper 2003/63 Dispersion*[65] It includes indicative estimates of the impact on State grants of introducing the various weights and adjustments suggested in this paper to allow for the specific effects of the growing use of technology.

[65] Figures in *Draft Assessment Paper 2003/63 Dispersion* were calculated after those in this paper and therefore may differ from those in this paper. Figures in this paper should be treated as indicative.

Table D-18 EFFECT OF TECHNOLOGY ON REDISTRIBUTION BY STATE, AS MEASURED BY STANDARDISED EXPENDITURE

	NSW	Vic	Qld	WA	SA	Tas	ACT	NT	Total Redistribution
	$m	$m	$m	$m	$m	$m	$m	$m	$m
Redistribution in the 1999 Review									
Costs affected by technology									
Voice Communications	-11.6	-20.2	17.8	11.6	-2.8	-0.7	-3.2	9.0	38.4
Air travel	-9.2	-42.0	46.5	10.2	-10.1	-4.5	-3.1	6.1	62.8
Inter-regional travel	6.1	-9.6	-10.3	1.6	3.4	11.0	-6.0	3.8	25.9
Local travel	-18.9	-26.4	0.7	31.6	-3.6	-2.7	-0.6	19.9	52.2
Other dispersion affected costs not affected by technology	-52.8	-54.8	47.5	55.3	-14.3	-5.8	-5.1	29.9	132.8
Total	**-86.4**	**-153.0**	**102.1**	**110.4**	**-27.3**	**-2.7**	**-18.0**	**68.9**	**281.3**
Redistribution Under the Proposed 2004 Review Default 'Dispersion' Settings									
Costs affected by technology									
Voice Communications	-3.5	-13.4	13.9	4.9	-2.8	-0.9	-4.4	6.3	25.1
Air travel	-4.3	-55.7	71.6	4.9	-12.6	-6.1	-4.3	6.5	83.0
Inter-regional travel	16.1	-8.7	-5.7	-5.2	0.2	8.1	-5.7	0.9	25.3
Local travel	-9.0	-8.8	-3.9	15.3	-4.8	-4.3	-4.2	19.6	34.9
Other dispersion affected costs not affected by technology	-143.5	-124.6	67.4	127.4	-3.5	-7.9	-11.4	96.0	290.9
Total	**-144.2**	**-211.1**	**143.2**	**147.2**	**-23.5**	**-11.1**	**-29.9**	**129.5**	**419.9**
Redistribution Under The Proposed 2004 Review Technology Adjusted Settings									
Costs affected by technology									
Voice Communications	-5.0	-14.0	11.9	7.2	-2.9	-0.2	-3.8	6.8	25.8
Non-voice Communications	-0.05	0.00	0.00	0.03	0.00	0.00	0.01	0.01	0.05
Air travel	-5.8	-55.8	71.8	5.5	-12.1	-6.1	-4.3	6.9	84.2
Inter-regional travel	15.2	-7.9	-5.7	-5.1	0.2	7.8	-5.3	0.8	24.0
Local travel	-9.0	-8.8	-3.9	15.3	-4.8	-4.3	-4.2	19.6	34.9
Repairs, Technology	-1.8	-0.4	2.2	0.8	-1.3	-0.3	-0.8	1.5	4.5
Training	-1.2	-2.6	1.6	2.2	-0.6	-0.4	-0.7	1.7	5.5
Other dispersion affected costs not affected by technology	-143.3	-124.4	67.4	127.3	-3.5	-7.9	-11.4	95.8	290.5
Total	**-150.9**	**-213.8**	**145.3**	**153.1**	**-25.1**	**-11.3**	**-30.4**	**133.2**	**431.5**
Differences in Redistribution	**-6.7**	**-2.7**	**2.0**	**5.9**	**-1.5**	**-0.2**	**-0.5**	**3.7**	**11.6**

80. Table D-18 suggests that the changes due to each explicit individual effect of technology are small. Even when individual impacts are combined, they remain small (about $12 million) because they act in opposite directions. This is consistent with the view

that there are different dominating influences in the more urbanised and the more dispersed States.

81. For example, changes arising from the introduction of the non-voice component (with a flat pattern of factors as in Table D-9), the disaggregation of the communication costs into voice and non-voice components as in Table D-5, and the use of input weights from Table D-3 and regional weights from Table D-4 change the amount redistributed by only $1.2 million (25.8 + 0.05 – 25.1). Moreover, they tended to increase the measured needs for two most dispersed States (Western Australia and the Northern Territory).

82. The results are consistent with the conclusion that high-performance communication systems will lead to greater substitution effects and greater cost effects in the more populated regions.

83. A broad conclusion is that large changes in the total amount redistributed by the dispersion disability will not arise until technology has a substantial effect on direct labour related costs such as locality allowances, and on-costs such as remote removals.

APPENDIX 1

COMMONWEALTH INITIATIVES[66]

1. Specific Commonwealth Government initiatives, and reported progress in implementing these initiatives, are set out below.

(i) Networking the Nation (NTN). A five-year $460 million Regional Telecommunications Infrastructure Fund helped bridge gaps in telecommunications services, access and costs between urban and non-urban areas, including computer training, public Internet kiosks and increased online services. It funded not-for-profit organisations to support activities and projects to address a range of telecommunications needs in regional, rural and remote areas, keeping the local context in view.

State governments generally reported positive outcomes from this initiative.

In June 1999, the Commonwealth Government added additional elements. These included the $70 million 'Building Additional Rural Networks' (BARN) initiative to promote ongoing, sustainable improvements in regional telecommunications services. BARN funds will be released after guidelines have been developed[67].

(ii) The $158 million Building on Information Technology Strengths (BITS) program. It aims to build the strength and competitiveness of the Australian information industries sector, including fostering strong commercial links with R&D organisations, provision of $40 million for the Advanced Network Program to fund test-beds, experimental networks and other information infrastructures, and the creation of clusters of ICT businesses.

(iii) National Communications Fund. A $50 million package to assist in the rollout of the infrastructure and applications to enable high-speed telecommunications networks to deliver education and health services

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66 This section is mostly reproduced from *Connecting Regional Australia: The Report Of The Regional Telecommunications Inquiry, 2002* (the Esten Inquiry).

67 South Australia's response to the 'technology' questionnaire.

in regional Australia. It is a competitive grants program, with program funds available in 2002–03 for three years.

Its aim is to particularly encourage projects that improve telecommunications services more generally in regional communities. Contributions are sought from applicants including equal funding from State and Territory agencies.

The eight projects funded under the NCF are as follows.

- Network Western Australia—$8 million.
- The Grampians Rural Health Alliance Network (Victoria)—$8 million.
- Health and Education Information Access for Rural and Regional NSW (NCF $5.5 million, NSW $3.5 million), which aims to provide "last mile" telecommunications access infrastructure to 60 health and education sites in 18 NSW regional towns. The project envisages benefits to education in the form of either higher speed or cheaper broadband services to 38 of its sites, including 20 school sites.
- Northwest and New England Broadband Telecommunications Network (NCF $5.5 million, >$5 million consortium contribution). This project, involving the New England Area Health Service, the University of New England and the New England Institute of TAFE, will provide broadband telecommunications services for 33 health and tertiary education sites in 23 towns in the North Western and New England regions of NSW.
- New South Wales and Northern Territory Interactive eLearning Initiative (NCF $8 million, >$9 million consortia contribution). It established a shared broadband interactive distance learning communications infrastructure for small rural communities and isolated homesteads, using satellite technology to provide students with interactive video sessions from distance education studios and two-way audio between teachers and up to two students simultaneously. Terrestrial services are used to connect the distance education studios, DET network core and Optus earth station. The service became operational in March 2003.
- Outbacknet@qld—$8 million.
- Regional Network Delivering Education Services (South Australia) — $6 million.
- Broadband for Regional Tasmania Project—$3 million.

(iv) The $2.1 million Broadband Content Fund. It provides seed funding for Australian content producers to pursue opportunities in new broadband applications.

(v) Long Term Strategy for the ICT Industry (Framework for the Future). Through an advisory group focusing on Australia's capacity for innovation and research, the Federal Government is joining with the information and communications technology (ICT) sector, wider industry and the research and educational community to analyse and scope the future development of the ICT sector over a five to ten year timeframe.

(vi) Wireless Broadband Technologies Standing Committee. House of Representatives Standing Committee on Communications, Information Technology and the Arts is inquiring into current and potential uses of wireless technologies (wireless LAN, 3G, Bluetooth, LMDS, WLL etc.) to enhance broadband connectivity.

(vii) The Creative Industries Cluster Study. It analyses Australia's strengths and capabilities in producing digital content and applications.

2. Telstra announced a $50 million package to stimulate broadband uptake, including $10 million over two years to the creation of a Broadband Development Fund. This fund, with further contributions from industry, could see up to $60 million contributed to new content and applications to help drive broadband take-up.

3. A Senate Inquiry investigated the capacity of the Australian telecommunications network to deliver adequate services (including broadband) to all Australians, particularly in rural and regional areas. This included a review of current investment patterns and future investment requirements.

4. Finally, there are numerous other activities in a range of portfolios and jurisdictions, such as the work of Ministerial Council on Education, Employment and Youth Affairs (MCEETYA) and the Australian Health Ministers Council (AHMC).

Improved Service Connection Times

5. On 15 October 2001, the Commonwealth Government announced it would reduce maximum telephone service connection times in remote areas from 12 to six months and improve the availability of interim services — thus ensuring no one need wait more than 30 working days to access a telephone service.

Mobile Coverage

6. The Commonwealth Government announced a three-year program for extending terrestrial mobile coverage to towns with a population of 500 or more, subject to community need and ongoing viability. Contributions were to be sought from communities as for the Networking the Nation (NTN) program. Contributions were also sought from

carriers and from States and Territories (equal funding). Under this program $2.1 million has been allocated to a satellite phone subsidy program to ensure that mobile services are available to all by December 2003. Funding has also been provided to improve coverage in 55 towns with populations under 500 and spot coverage along 34 major highways.

7. Telstra has been awarded the contract. The first towns have already received improved mobile phone services.

8. The Commonwealth is also providing $7.0 million towards the Wireless West project to improve mobile phone services in the south-west areas of Western Australia, with it already providing increased coverage. A program to address a mobile blackspot in the Australian Capital Territory will also be implemented.

Internet Assistance Program (IAP)

9. The Commonwealth Government announced establishment of the IAP in collaboration with Telstra, to operate for three years. Its aim is to help users maximise Internet speeds and achieve at least 19.2 kilobits per second over Telstra's fixed network for web and email applications. It includes online help and technical support service.

10. Operating in all regional areas since 3 September 2001 and in metropolitan areas since 4 March 2002, Telstra reports that to date the IAP has dealt with more than 74 000 inquiries, with the majority coming from regional areas. An independent advisory panel has been established by the Government to ensure the IAP is competitively neutral and, where relevant, helps consumers with other issues such as dispute resolution.

Other internet initiatives

11. The Commonwealth Government announced it would direct the Australian Communications Authority (ACA) to request an industry code of practice setting out Internet service provider responsibilities for providing information and optimising data speeds including equipment requirements.

12. The ACA has investigated and reported to the Government. The Commonwealth Government has agreed to the ACA recommendation for a voluntary code or 'guidelines', which have now been issued.

Community information campaign

13. The Commonwealth Government, in response to low levels of awareness in regional, rural and remote Australia, announced it would conduct a community information campaign to increase awareness of:

(i) the benefits and opportunities available through existing Commonwealth communications funding programs;

(ii) the availability of commercial communications services; and

(iii) consumer safeguards and rights.

14. The campaign included funding to provide ongoing online information resources on regional communications issues. It commenced in early September 2001 and ended in October 2001.

Funding for consumer representation

15. The Commonwealth announced a four-year program, starting from 1 July 2002, to fund consumer representation and research in telecommunications. This included greater priority to representation for people with disabilities and in regional areas.

16. The Commonwealth announced increases in funding for disability groups in consumer representation grants in July 2001. The successful applicants for funding in 2002-03 have now been announced.

Enhanced payphone services for remote Indigenous communities

17. The Commonwealth Government announced it would enhance the availability of payphone services for remote Indigenous communities under the USO. The initiative, which required close consultation with Telstra and Indigenous communities, was the first step in improving service levels pending development and implementation of a comprehensive long-term strategy.

18. Following extensive consultation, more accurate data has now been gathered and priorities identified, and a work plan and a reporting process is now in place. Further development of this initiative has been integrated into the Telecommunications Action Plan for Remote Indigenous Communities (TAPRIC) — the wider Government response to remote Indigenous telecommunications needs.

Telecommunications needs of remote Indigenous communities

19. The Commonwealth Government announced a major study into telecommunications requirements of remote Indigenous communities.

20. The study has been completed following extensive consultation with remote Indigenous communities, their representatives, and other key stakeholders. The Government has now announced a Telecommunications Action Plan for Remote Indigenous Communities (TAPRIC), which is supported by a funding package of $8.3 million over three years in five separate program areas.

Training in use of teletypewriter (TTY) equipment

21. A new framework for additional TTY training has been agreed by DCITA, the ACA and NRS provider (Australian Communications Exchange (ACE)) for the assessment of longer term options for meeting needs of the speech and hearing disabled.

Information for consumers on availability of certain services

22. The ACA is implementing measures to improve information dissemination, such as amendments to the *Telecommunications (Standard Forms of Agreement Information) Determination 1999.* The Commonwealth imposed strict priority assistance requirements on Telstra through a licence condition, requiring it to provide eligible priority customers with connections, fault repairs or interim services within 24 hours, or 48 hours in remote areas.

Reviews of USO contestability

23. The Commonwealth Government announced it would continue to monitor the effectiveness of USO contestability and review it after 12, 24 and 36 months of operation. This would allow regulatory arrangements to be finetuned and help to determine whether USO contestability should be extended to additional areas. The review of USO contestability pilots in 2002 includes an examination that up-front incentives should be offered to potential alternative universal service providers in return for their commitment to supply substantial improvements above the legislated minimum.

24. The USO contestability pilots commenced on 1 July 2001. DCITA commenced the first of three annual reviews in July 2002.

Review of telecommunication specific competition regulation

25. The Commonwealth Government announced it would direct the Productivity Commission to consider in its review the implications of developing telecommunications competition across the country, particularly in regional Australia, and to consider the current Pay TV programming arrangements. The Commonwealth also announced ongoing reviews of telecommunications-specific regulation would be required to consider the regulatory impact on competition development in regional, rural and remote areas.

26. The Productivity Commission submitted its final report to the Government on 21 September 2001. The Commonwealth responded to the report on 24 April 2002.

Reliability standards and improved quality of service reporting

27. The Commonwealth Government announced that it would:

(i) implement reliability standards, and monitoring and enforcement arrangements for services provided under the USO;

(ii) improve the quality of service reporting for major service providers to allow consumers to make more informed decisions on price and quality; and

(iii) direct the ACA to adequately monitor faults and investigate extreme cases of failure to meet CSG standards.

28. The Minister for Communications has accepted the ACA's reports on these matters. A key outcome of the reports has been the establishment of the Network Reliability Framework, which will see the ACA monitor and review Telstra's CSG services at three levels. These include at the exchange service area and individual service levels, with the objective of upgrading poorly performing exchanges and services to a much higher level of reliability.

Review of the CSG

29. The Commonwealth Government has accepted the ACA's report on existing CSG arrangements and announced that the CSG will continue to apply to all providers of fixed telephone services. The review assessed the need for changes to reflect the increasingly competitive telecommunications market where services are delivered through an increasingly diverse range of technologies. An investigation is underway to assess how the CSG arrangements can be streamlined to minimise any undue impacts on service providers.

APPENDIX 2

COMPARISON OF TECHNOLOGY PLATFORMS

Table 2 - 1 TYPES OF TECHNOLOGY INFRASTRUCTURE

Technology Type	Physical Medium	Use
Wired	PSTN Copper	Access and Backbone
	ISDN	Access
	Conditioned PSTN Copper (DSL)	Access
	Optic Fibre	Access and Backbone
	HFC(Hybrid Coaxial Cable)	Access
Wireless	Cellular Mobile	Access
	Microwave	Backbone
	Broadband Wireless	Access
	(LMDS and MMDS)	
	Satellite	Access and Backbone

Table 2 - 2 COMPARISON OF TECHNOLOGY INFRASTRUCTURE

Access Bandwidth	**Short E-mail**	**Average Web Page**	**4 Minute MP3 music file**	**4 Minute video clip**	**Standard90 Minute movie**	**HDTV 90 minute movie**
	1 KB	50KB	4MB	11. 5 MB	260 MB	520 MB
28.8Kbps Dial Modem						
Time taken	< 1 sec.	15 sec.	Approx. 18 mins	Approx. 1 hour	Approx. 20 hours	Approx. 40 hours
Advantages	Mature technology Ubiquitous – covers 99% of the Australian population cost for optimisation and improvement relatively low					
Disadvantages	low speed not readily suitable for high-speed data and multimedia applications					
56Kbps Dial Modem						
Time taken	< 1 sec.	9 sec.	Approx. 9 mins	Approx. 27 mins	Approx. 10 hours	Approx. 20 hours
Advantages			Same as above			
Disadvantages			Same as above			

Table 2 - 3 COMPARISON OF TECHNOLOGY INFRASTRUCTURE (Continued)

128Kps ISDN						
Time taken	< 1 sec.	3 sec.	Approx. 4 mins.	Approx. 12 mins	Approx. 4.5 hours	Approx. 9 hours
Advantages	Mature - widely available, covers 96% of Australia population					
	Global interoperability					
	Supports a multiple of services					
	Unlike DSL, not distance sensitive technology					
Disadvantages	Distance sensitive costs and prices.					
	High equipment cost with expensive customer premises equipment					

Table 2 - 4 COMPARISON OF TECHNOLOGY INFRASTRUCTURE (Continued)

ADSL 512Kbps						
	< 1 sec.	< 1 sec.	63 sec.	Approx. 3 mins	Approx. 1 hour	Approx. 2 hours
ADSL1.5Mbps						
	<1 sec.	< 1 sec.	22 sec.	Approx. 1 min	Approx. 24 mins	Approx. 48 mins
Advantages of ADSL	High bandwidth up to 1.5Mbps, able to support high-speed Internet and video services.					
	No new wiring as it works on existing copper/fibre lines.					
	Multiplexer and modem are installed at the supplier and user sites.					
	unlike cable architecture, DSL user has a dedicated copper connection and receives only the information they request.					
	Scalability and cost effective – unlike HFC, MMDS, and optic fibre, which must be installed on an area wide basis, DSL installation require a modest investment to equip serving centres with multiplexers.					
Disadvantages of ADSL	Require access to the tail ends or exchanges of incumbent operators that involves time, interconnection and cost.					
	Performances of some DSLs (ADSL and VDSL) are distance sensitive. Limited range (2km to 5km from the exchanges).					
	Sharing the copper medium which restricts technology and speeds, and issues relating to interference					
VDSL 6Mbps						
	<1 sec.	< 1 sec.	6 sec.	15 sec.	Approx. 6 mins	Approx. 12 mins.

Table 2 - 5 COMPARISON OF TECHNOLOGY INFRASTRUCTURE (Continued)

HFC (Cable Modem)						
Advantages	768Kbps to 30Mbps bandwidth					
	'Always on' service using cable TV lines.					
	Cost effective – a single pipe for the delivery of all services (voice, data and TV video).					
	Unlike wireless technology, there is little susceptibility to weather condition and minimal interference because it is buried underground.					
	Able to support network speeds comparable to those of DSL.					
	Being a broadcasting technology, the network speed upstream to Internet will be slower than downstream to the home or office.					
Disadvantages	Unlike some DSL services with dedicated local bandwidth, cable modem share local bandwidth. Hence performance will depend on the number of user in a particular local area.					
	High deployment cost – digging trenches and laying cable required.					
	Costs of building the network are sunk before any users are connected.					
	Slow deployment – applying for access duct, council permit and work involved in laying cable are time consuming. Hence, a slower return on investment.					
FTTC 30Mbps	<1 sec.	1 sec.	1 sec.	3 sec.	90 sec.	Approx. 3 mins
FTTB 155Mbps	<1 sec.	<1 sec.	<1 sec.	<1 sec.	17 sec.	34 sec.
Advantages	With 10Gbps to 100Gbps bandwidth, it is a long-term solution for the superhighway society, unmatched by other technology.					
	Scalability and capacity – with enabling technologies like SDH and DWDM, capacity can be increased without laying new fibres.					
	Unlike wireless technology, there is little susceptibility to weather condition and minimal interference in cable technology as it is buried underground.					
Disadvantages	High deployment cost – digging trenches and laying cable involve high					
	costs in terms of material and labour.					
	Costs of building the network are sunk before any users are connected.					
	Slow deployment – applying for access duct, council permit and work involved in laying cable are time consuming. Hence, a slower return in investment.					

Table 2 - 6 COMPARISON OF TECHNOLOGY INFRASTRUCTURE (Continued)

Cellular	
Advantages	Wireless, 9.6Kbps bandwidth, provides communications on a mobile basis.
	Cellular technology can provide a large capacity service in an area (30km) compared to other wireless technology.
Disadvantages	Low data capability rate (9.6Kbps).
	Cellular is designed mainly for voice with limited capability for high-speed data and video application.
	High deployment cost, as it must be installed on an area wide basis to provide service coverage
Microwave	
Advantages	Wireless, 35Mbps bandwidth
	Mature technology
	Greater scalability – unlike wired technology where capital costs of building the network are sunk before any users are connected, cost only incurred until the user is connected in a wireless network.
	Lower cost of deployment than wired technology in terms of materials and labour.
	Speedy deployment – faster network deployment than wired technology without the need to duct tranches and lay cable. Hence, a rapid return on investment
	Flexibility – equipment can be redeployed if customers change their services.
Disadvantages	The need of line of sight means coverage is dependent on geography, weather and the density of building.
	Poor weather condition (rain and snow) could affect performance.
	Performance is distance dependant, to increase network reliability; stronger transmitters need to be located closely.
	Customer misconception that the performance of wireless technology is inferior to fixed technology.
	Compared to fibre (10Gbps), it has a low bandwidth of about 35Mbps to 155Mbps.

Table 2 - 7 COMPARISON OF TECHNOLOGY INFRASTRUCTURE (Continued)

Broadband Wireless (LMDS and MMDS)	
Advantages	High bandwidth which is able to provide up to 100Mbps
	Lower cost of deployment than wired technology in terms of materials and labour.
	Speedy deployment – faster network deployment than wired technology without the need to dig trenches and lay cable. Hence, a rapid return on investment. A new user site can be connected within 10 days.
	Ease of deployment – unlike wired network, it requires minimal infrastructure consists of an antenna and NIU which are installed on the user's rooftop. It requires no rewiring and has minimal impact on user sites.
	Greater scalability – unlike wired technology where capital costs of building the network are sunk before any users are connected, cost only incurred until the user is connected in a wireless network.
	Flexibility – equipment can be redeployed if customers change their services.
Disadvantages	Line of sight means coverage depends on geography, weather and the density of building.
	Antennas require professional installation, significantly increasing cost.
	Customer misconception that the performance of broadband wireless is naturally inferior to wired technologies.
	Cost involved in spectrum license acquisition could be high.
	Being a new technology, the equipment cost could be high due to the lack of mass production
	Poor weather condition (rain and snow) could affect performance.
	Limited range (about 5 km) and the distance is dependence on geographical and climatic condition.
	New and unproven technology which lack test bed result, international standard and reliability.

Table 2 - 8 COMPARISON OF TECHNOLOGY INFRASTRUCTURE (Continued)

Satellites	
Advantages	Wireless, 0.6Gbpsbandwidth
	Greater coverage with the potential of covering 100% of Australian population.
	Unlike DSL and LMDS, its performance is not distance dependant and its suitable for rural or remote areas.
	Dedicated connection – unlike cable architecture, user has a dedicated connection and speed won't drop when others use it at the same time.
	Greater scalability – unlike wired technology where capital costs of building the network are sunk before any users are connected, cost only incurred until the user is connected to the satellites network.
Disadvantages	High deployment cost.
	Low bandwidth – 0.6Gbps, compared to fibre (10Gbps).
	As a broadcast technology, it is not designed for 2 ways communications. Satellite access generally requires an extra line and modem for outgoing traffic.
	It is suitable to provide access services to users 20km beyond local exchanges.
	Satellite is more expensive to deploy in metro areas than other technologies.