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ICTs AND ECONOMIC GROWTH IN DEVELOPING COUNTRIES:

This paper is circulated as background for the POVNET meeting on 30(pm)-31 March 2004. It has been prepared by Professor David Souter, Managing Director, ictDevelopment Associates Ltd. and visiting professor of Strathclyde Business School, University of Strathclyde.

This paper reviews the existence of links between ICTs, productivity and economic growth in OECD countries, set out in "ICT and Economic Growth, Evidence from OECD Countries, Industries and Firms", 2003, and discusses the relevance of these findings for developing countries.

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EXECUTIVE SUMMARY

This report reviews the evidence for links between ICTs, productivity and economic growth in OECD countries, set out in the OECD report *ICT and Economic Growth*, and discusses the relevance of these findings for developing countries. Its general conclusions can be summarised as follows:

1. There is evidence that ICTs facilitate economic growth in OECD countries, principally by increasing productivity, though this is a long-term rather than immediate outcome of ICT investment.
2. There is little or no clear evidence that the same outcome is yet being achieved in developing countries, largely because little or no relevant research has been undertaken. However, developing countries in general, and LDCs in particular, are less well-equipped to take advantage of the potential of ICTs to stimulate growth, and so (to the extent that ICTs do stimulate growth) are likely to fall further behind OECD economies in relative terms.
3. Some of the reasons for this are to do with economic structure (for example, the preponderance of agriculture, low income levels); some to do with policy issues (restrictive regulatory environments, low levels of human capital, *etc.*).
4. Developing countries, and development agencies, also have to balance policy and investment options regarding ICTs against other socio-economic objectives (notably the development objectives set out in the United Nations' Millennium Development Goals). Poverty reduction objectives are, however, more likely to be achieved against a background of economic growth, and any synergies between the impacts of ICTs in these two areas of national policy should be exploited.
5. Governments' priorities in policy terms should, therefore, be to reduce the factors which inhibit effective use of ICTs (and any gains that may result therefrom); to take positive steps which will enable maximisation of the benefits that can be derived from ICTs; and to integrate ICT policy more effectively into overall national socio-economic development strategies.

The report concludes with recommendations for action by developing country governments that will facilitate ICT investment and positive returns on investment, focused on policy development processes, infrastructure and access, liberalisation and deregulation, and human capital.

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1. Introduction

The last decade has seen a revolution in thinking about the role of information and communication technologies (ICTs) in development. Ten years ago, most development agencies, analysts and developing country governments thought them marginal to the achievement of both national economic growth and poverty reduction. Today, ICTs are considered sufficiently central to development for governments to initiate national e-strategies and for donor agencies to mainstream them in national and international programmes; sufficiently important, indeed, for the Information Society to merit a World Summit similar to those on Sustainable Development or Social Development.¹

The speed with which scepticism of the developmental merits of ICTs has given way to enthusiasm has stimulated a good deal of innovation in development thinking, but it also carries substantial risks. ICT investment is expensive; its impact largely unresearched and easily exaggerated. Many of the assumptions underpinning current development thinking on ICTs are based on intuition rather than analysis, and on limited evidence from a narrow range of pilot projects rather than large-scale impact assessments. The danger is that, without better understanding of the real impact of ICTs on both national economies and community development, resources will be misapplied and worthwhile objectives missed through the pursuit of more ambitious but unrealistic goals. Past disappointments have not destroyed the yearning for a “magic bullet” for development, and the real capabilities (and limitations) of ICTs need to be properly understood if they are to be exploited effectively at both macro and micro levels.

Development thinking about ICTs has focused primarily on their potential for poverty reduction, especially the impact they may have on mainstream development objectives in, for example, health, education, livelihoods and empowerment. Less attention has been paid in the development community to the impact of ICTs on national economic growth – on the effect which ICTs have on productivity, for example, and on the relationship between the national economies of developing countries and the wider world. The assumption has been often made that this impact will be positive, but it has not been seen as the primary objective of development engagement with the sector. The economic debates about the macro impact of ICTs in industrial countries have largely passed the development community by, and hardly any relevant research has been done outside the OECD, almost none at all in Least Developed Countries (LDCs).

This report is concerned with the potential impact of ICTs on these large-scale economic issues, and in particular with the implications - for the different circumstances of the developing world - of recent research on the relationship between ICTs, productivity and economic growth in OECD countries. This is important for two reasons.

It is important, firstly, because, although economic growth does not necessarily lead to poverty reduction, reductions in poverty are much more difficult to achieve without economic growth. If ICTs do have a positive impact on national economic growth, that should be factored into general development policies for poverty reduction and redistribution.

¹ The definition of ICTs varies considerably within the literature, and different definitions and understanding of its meaning have caused considerable confusion. From a poverty reduction perspective, for example, ICTs generally include ‘old’ technologies such as broadcast radio and voice telephony. Analysts of the ‘new economy’ are more likely to intend only ‘new ICTs’ based on digital or computer technology. For discussion purposes, this report uses the more generic, less technology specific definition put forward by Duncombe and Heeks, 1999: ‘electronic means of capturing, processing, storing and disseminating information.’

It is important, secondly, because good policy development depends on an accurate understanding of the nature of the impact ICTs may have at national economic level and of the factors which may constrain or enhance that impact. National e-strategies developed without such understanding will, at best, miss targets that might otherwise be achieved, and could at worst prove wholly counter-productive.

This report reviews recent OECD research on the impact of ICTs in OECD countries and asks whether similar impacts should be anticipated in the different circumstances of developing countries. It considers the relationship between these findings, the 'digital divide' and the wider poverty reduction objectives of development policy, and sets out a number of recommendations to developing countries and to international agencies aimed at maximising the positive and minimising the negative impacts which ICTs may have on the national economies of developing countries in the short and medium terms.

It should be noted from the outset that the evidence base for any analysis in this area is extremely weak. The links between ICTs, productivity and economic growth in OECD countries have only recently been established, on the basis of sophisticated analysis of complex data. No similar analysis has been undertaken in developing countries, least of all in LDCs; and no comparable data are available for most. The best one can do in these circumstances is assess how the differences between developing country / LDC and OECD economies are likely to affect the impact of ICTs, as a basis for subsequent policy analysis. The need for substantive research in this area is urgent if investment commitments are to be made – by the private sector or development agencies – with any real understanding of likely outcomes.

2. ICTs, productivity and economic growth: evidence from the OECD

The nature and scale of the impact of ICTs on productivity and growth in OECD economies has long been controversial, uncertainty about it best encapsulated in Robert Solow's 1987 paradox that "you see computers everywhere except in the productivity statistics."² The positive impact which economists intuitively expected to find proved elusive, even in the United States, and it was not until the mid-1990s that a series of new studies began to discern evidence to back their intuition. It is now commonly agreed that, in OECD countries at least, ICTs have had a positive impact on productivity and growth, and indeed may well play a leading role in maintaining growth, though their impact on national indicators is slower to materialise than had been expected and is much affected by synergies with complementary factors such as the regulatory environment and the availability of human capital.

The most substantial evidence for this positive view derives from a major multi-country study undertaken by the OECD and published in its 2003 report *ICT and Economic Growth: Evidence from OECD Countries, Industries and Firms*.³ Using data from thirteen countries, and including extensive firm-level analysis, this established clearly that ICTs have acted as drivers of growth in OECD economies – firstly at the level of the firm and subsequently at national level - but that significant differences are evident in the scale of their impact in different OECD countries. According to the study, ICT investment typically accounted for between 0.3 and 0.8 percentage points of growth in GDP *per capita* during the period 1995-2001, with the United States and Canada performing significantly better than other OECD members.

The impact of ICTs in the OECD evidence can be found in three main areas:

- Firstly, in some countries such as Finland and the United States, the technological innovation and high levels of demand generated by an ICT production sector were significant. However, an ICT

² Robert Solow, article in the *New York Times*, 12 July 1987.

³ A useful summary of the report is to be found in Dryden, 2003.

production sector was not necessary for the achievement of the positive overall impact identified by the study, as strong growth rates in other countries indicated. Countries with strong ICT service sectors were also at an advantage over those in which the ICT sector as a whole was weak.

- Secondly, ICT investment has contributed to ‘capital deepening’, *i.e.* it has increased capital input per worker, enabling more efficient production that increases labour productivity.
- Thirdly, the pervasive use of ICTs throughout the value chain has contributed to improved performance at the level of the firm, in particular enabling firms to increase efficiency in combining capital and labour, or multi-factor productivity. Networking enabled by ICTs was also significant in this area, both within the firm and (as the diffusion of ICTs spreads throughout an economy) by enabling new forms of interaction between firms and other stakeholders.

The OECD evidence, therefore, indicates that investment in ICTs contributes to productivity and economic growth both by enhancing the value which can be added by other productive inputs and through its network effects.

There is an important distinction to be drawn here between improvements in performance at the level of the firm and national macroeconomic performance. Firm-level evidence in the study shows that significant benefits can be gained from ICT investment at the level of the firm, particularly by companies equipped to maximise those gains through adaptation and innovation in work processes and systems. National economic gains from ICT investment derive partly from the aggregation of these firm-level improvements in productivity, but also from ICT-based networking between firms, which reduces transaction costs and accelerates innovation. The importance of networking in unlocking the potential of ICT investment is critical, and has been greatly increased by the advent of the Internet (which has also made many services much more tradable than hitherto). The network externalities inherent in communications networks suggest that the impact of ICTs will increase at a faster rate the more widespread the use of ICTs becomes within any society/economy.⁴ There may also be a ‘threshold effect’ at play, in which ICTs only begin to have a lasting and sustainable impact at a national level when they achieve a certain level of penetration/diffusion within the economy as a whole.⁵ The increased value derived from networking is one factor which helps to explain the finding that economy-wide ICT diffusion and use are more important than ICT production in contributing to national productivity and growth.

The impact of firm-level changes on the national economy, however, is not immediate. It takes considerable time for the scale and spread of ICT investment by individual firms and networking between them to become sufficient – in conjunction with other organisational and production changes – to translate into national level outcomes. This timelag is one of the principal reasons for the difficulty earlier economists found in identifying a positive impact of ICTs on productivity and growth even within ICT-intensive economies like the United States, and is equally relevant in developing countries today.

⁴ Network externalities derive from the fact that the value of a telephone line (or similar access point for interactive communications) increases with each new subscriber by the number of potential uses rather than the number of potential users: a telephone network with two subscribers has one possible connection, a network with three subscribers three possible connections, a network with four subscribers six possible connections, and so forth.

⁵ This ‘threshold effect’ is suggested by a number of analysts, including Roller & Waverman, 1994; Bedi, 1999; and Rodriguez & Wilson, 2000.

OECD research shows that the level of diffusion and use of ICTs, and their impact on business performance, are also influenced by a number of complementary factors in the business environment. Five factors seem particularly important in this context:⁶

- The nature of the business in which individual firms are engaged. Some sectors, particularly services, can make much more extensive use of ICTs to change processes and interfaces with customers and suppliers, for example through the use of software, call centres and e-commerce;
- The extent of competition and the nature of the regulatory environment governing enterprise and relationships between companies. The more competitive and less regulated the business environment, the more likely are firms to take advantage of ICT innovation (and countries thereby to secure positive economic outcomes);
- The relative costs of ICT deployment. These include the costs of hardware and other inputs, including labour, but also indirect costs related to changes in working practices, licensing, standardisation and the usage costs of networking facilities such as telecommunications networks;
- The amount and quality of human capital available. The better skilled the workforce and the better equipped a firm is to upgrade workforce skills to take advantage of ICTs, the more likely it is to achieve higher rates of ICT-related innovation and increased productivity;
- And the ability and willingness of organisations, particularly firms, to restructure and reorganise their working methods to take advantage of the new opportunities made available through ICTs. The study confirmed evidence from elsewhere⁷ that company-level adaptability and organisational capital play a crucial part in maximising the value of ICT investment.

Without these complementary factors, the OECD research indicated, ICT investment is much less likely to have a positive impact on business performance, at either firm or (in consequence) national level. Managers in companies, therefore, need to focus on steps to maximise the return they achieve on their ICT investments.

Findings at the level of the firm do not, as noted above, translate directly into country-level outcomes. However, national policies that facilitate these complementary factors are likely to increase the capacity of firms to benefit from enhanced performance, and their cumulative gains should have a corresponding impact on national productivity and growth – as seen in the study’s aggregate results. The policy implication is that, in order to retain/enhance their countries’ relative position on economic performance, governments and businesses should act in ways which facilitate these positive impacts – by liberalising markets and reducing regulatory requirements on businesses; by promoting access to business finance and facilitating market entry and company growth; by encouraging entrepreneurship and innovation; by establishing greater trust in the efficacy and security of electronic transactions; and by promoting the development of human capital, notably through education and training.

3. ICTs, productivity and economic growth: evidence from the developing world

These findings relate to OECD economies. There is much less evidence that ICTs contribute positively to productivity improvement and economic growth in developing countries. Principally, this lack

⁶ These factors have been reordered from their presentation in the OECD report to facilitate subsequent discussion of developing country impacts.

⁷ *e.g.* Brynjolfsson, Eric & Hitt, Lorin M, 1998

of evidence is because far less research has been undertaken, but there are also indications that intrinsic differences between OECD and developing country economies, particularly those of LDCs, may lead to different outcomes. The following section of this report considers the available evidence and assesses the differences between economies that may influence this assessment.

The impact of ICTs identified in the OECD research can be divided into two broad categories:

- a) The impact of ICT production, which is significant in some but not all OECD member-countries;
- b) And the (more important) impact of ICT diffusion and use, both in individual firms and pervasively throughout the value chain.

Developing country experience in both of these areas is significantly different from that of most OECD members.

Firstly, relatively few developing countries have significant ICT production sectors; and those which do are almost all either middle-income countries (transition economies in Eastern Europe or countries in Asia and Latin America with significant established industrial/manufacturing sectors) or very large countries whose size gives them substantial domestic markets and skilled workforces that belie their overall relative levels of prosperity (most notably India and China). ICT manufacturing sectors in these countries may have been developed with import substitution or export promotion objectives, but either way have relatively few backward and forward linkages into the national economy compared with ICT production sectors in the OECD. Much the same is true of the export-oriented service sectors undertaking software development, data entry or back-office functions which have become established in India and some smaller developing countries with appropriately skilled workforces.⁸ LDCs, with very few exceptions, have neither ICT production nor export-oriented ICT service sectors.

Secondly, ICT diffusion and use is much more pervasive in the high-income economies of the OECD than it is in any developing country, enabling the economy as a whole to benefit from higher levels of ICT skill and habituation within the population, substantial domestic markets for ICT products and services, and the network externalities that arise in telecommunications markets in particular. In addition, service and advanced manufacturing sectors, which are intensive users of ICTs, dominate OECD markets, while many developing country economies, particularly LDCs, are still dominated by commodity production and (often subsistence) agriculture, in which ICT investment has much more limited value. The scale of ICT investment will therefore be much higher in proportion to national output in industrial than in developing countries – implying that any impact of firm or sector level ICT investment on national growth will be slower to materialise in the latter. This is particularly important if network externalities do lead to significant threshold effects governing this relationship.

We shall return to these points later. What they suggest *prima facie*, however, is that there are substantial inherent differences between OECD and developing economies whose effect on the outcomes of ICT investment could also be substantial; and that findings from OECD economies should not simply be extrapolated to developing countries without further research, or at least assessment of the differences between the types of economy concerned.

A key problem here is the lack of available historic and current data that can be used for cross-country comparisons. Few developing countries have such data available, especially where firm-level analysis is concerned. Very little research has been undertaken on what is available, and most of that is concerned with middle-income developing countries and/or those with ICT production sectors; almost none has been

⁸ See Joseph, 2002.

done on LDCs, which are the primary focus of the development community's interest in the value of ICTs. Nevertheless, the research which has been undertaken on middle-income countries and transition economies has value in indicating some of the factors likely to influence the outcomes of ICT investment in low- as well as middle-income contexts.

The findings of this research are less positive than for the OECD. Proven linkages between ICT investment and productivity or economic growth in developing countries are as elusive still as they were formerly in the OECD. For developing and even transition countries, Solow's paradox still seems to hold true. A recent study of transition economies, for example, finds that 'the contribution of new technologies to growth ... has been minimal, particularly when viewed from a macroeconomic perspective,'⁹ while an analysis of a substantial group of both industrial and developing countries found a marked difference between the former, experiencing strong positive links between ICTs and economic growth, and the latter, where no significant impact was identified.¹⁰

There is almost no single-country research which can corroborate or challenge these overviews. A number of factors have, however, been suggested by researchers to explain these findings. Some of these are methodological – to do with weaknesses in the data available from developing countries, the historic nature of the data (which makes it more difficult to assess the impact of very recent changes in investment patterns) and the appropriateness of existing national economic indicators for measuring the type of efficiency gains resulting from new technologies with substantial network effects. These methodological problems may well have some significance, and theoretical work to improve the quality of the analytical tools available for researching questions of economic growth in developing countries would be useful, alongside more detailed research on individual countries and cross-country studies. However, the research that is available does indicate that there are substantial social and economic factors which will influence (or are likely to influence) the impact of ICT investment in developing countries in different ways from the industrial country members of the OECD.

4. Differences between OECD and developing economies

It is, of course, self-evident that real world economies cannot be divided simplistically between industrial countries in the OECD and a broadly homogeneous group of developing countries outside. There is a continuum in types and levels of development between OECD and non-OECD countries, with considerable overlap between the two. Some countries which were considered 'developing' twenty years ago are now highly industrialised. Transition economies in Eastern Europe and the Former Soviet Union and middle-income economies in Latin America and parts of Asia share economic characteristics with both OECD and less developed regions; and their response to new economic impulses will often be much closer to those of OECD members than to LDCs (Least Developed Countries). There are also substantial differences in the economic behaviour of large low-income economies (such as India and China), which have major industrial capacity and mass markets in spite of their low levels of GDP *per capita*, and that of smaller, less well-resourced, low-income countries (such as many of those in Africa).

We will return to the typology of developing countries later in this report. The purpose of this section is to identify possible reasons for different relationships between ICTs, productivity and growth in economies with different types and levels of development. The best way to do this is to look not at the continuum of economies as a whole, but to juxtapose the characteristics of industrial/OECD countries with those of LDCs, whose economies are most different from those of OECD members.

⁹ Piatkowski, 2002

¹⁰ Pohjola, 2000

The OECD report on *ICT and Economic Growth* finds, in brief, that ICTs do have a positive impact on productivity and economic growth, but that:

1. This positive impact varies according to the economic circumstances of individual countries;
2. There is considerable timelag between ICT investment at the level of the firm and measurable outcomes at national level; and
3. The degree of impact achieved is facilitated or constrained by a number of complementary factors such as the quality of human capital and the nature of competition and regulation within the national market.

The following paragraphs look at some of the main differences between OECD and LDC economies that may affect these three groups of factors in turn. The points raised are intended to be illustrative of these differences, rather than comprehensive.

a) General economic factors

ICT investment forms a much smaller proportion of investment in LDCs than in OECD countries for a number of reasons.

1. OECD economies have large and established service and manufacturing sectors, while LDC economies are dominated by raw material production and domestic/subsistence agriculture. The service sector makes intensive use of ICTs, as does much modern manufacturing in high-income economies, but ICTs add much less value and form a much lower proportion of investment in extraction industries and agriculture (particularly small-scale agriculture). The level of ICT investment is therefore likely to be much higher in OECD economies than in LDC economies. This will be particularly true of those LDC economies where subsistence (unmonetised) production forms a significant proportion of total output.
2. Some OECD economies have substantial ICT production sectors and most have substantial ICT service sectors, which invest directly in ICT products. Very few LDCs have any significant ICT production sectors, and only those few which can offer both low labour costs and relatively high educational (including international language) skills can develop significant ICT service sectors (such as software development, call centres and back-office outsourcing). Even where they are established, such service sectors are export-oriented, depend on imported equipment and have few backward and forward linkages into domestic economies. Their networking impact will therefore be much weaker than that of equivalent sectors in industrial countries.
3. OECD economies have large mass markets for products and services, including both ICT hardware (PCs) and usage (telecommunications). These reduce the unit costs of both ICT products and services and facilitate ICT diffusion and use. They also impact positively on human capacity for ICT utilisation. With the exception of a few very large countries, LDCs lack mass markets for consumer goods and services, including ICTs (although public access telephony can be regarded as a mass market service), resulting in higher costs and lower efficiency of use by inexperienced workers and consumers.
4. Labour costs are much lower in LDC economies than in the OECD, and most LDCs have a surplus of low-skilled labour available to undertake jobs which have been automated in OECD countries. The cost savings derived by firms from substituting capital for labour in high-wage economies may

not arise in comparable firms and sectors in LDCs, irrespective of gains in individual employee productivity. In particular, the costs of workforce adaptation to new technology may outweigh the returns likely to result from higher productivity.

b) ICT-specific factors

The OECD research indicates that there is a considerable timelag between ICT investment at the level of the firm and any impact generated by this at national level. Key factors affecting the duration of this timelag are the extent of ICT diffusion within society and the development of networking between businesses and other organisations.

1. OECD economies have established high-quality communications infrastructures which are geographically universal within their own territories and interconnected with other countries in ways that facilitate high-speed communications and transactions. In many cases these include broadband networks potentially enabling near-universal high-speed Internet access. Most LDCs have poor-quality fixed communications infrastructures with limited geographical availability within their own territories and expensive poor-quality external connectivity constrained by shortages of international bandwidth. This reduces the value added by ICT investment and deters the development of domestic ICT sectors.
2. ICT investment costs are generally much higher in LDCs where almost all ICT equipment must be imported (often subject to high rates of taxation and non-tariff barriers), and where telecommunications usage charges are generally much higher than in OECD countries (especially for international and Internet connectivity). Regulatory factors such as licence fees often also add to the cost of ICT investment. The net result is that every dollar of ICT investment in an LDC buys significantly less ICT equipment and usage than in the OECD – and is therefore likely to have a significantly lower rate of return.
3. A mass market for ICT equipment in OECD countries also helps to minimise costs of ICT investment and enable firms to benefit substantially from the continually falling prices which characterise the sector. All of the historic evidence on teledensity¹¹ shows a close correlation with GDP *per capita* (or, in effect, with disposable income). OECD countries have mass markets in which almost all citizens are accustomed to interacting (networking) to conducting personal and business transactions through ICTs (the telephone and, increasingly, the Internet). A high proportion of LDC citizens, however, have no significant experience even of telephony. Adoption rates for new ICTs are likely to be much faster in societies in which citizens are habituated to older ICTs, in terms of both ownership and usage, and this has consequential effects on the pace with which the price of new ICT products and services falls and the pace with which new networking opportunities become established.

c) Complementary factors

The OECD report identifies a number of complementary factors within the business environment which influence the ability of firms and national economies to achieve productivity improvements and growth through ICT investment. These include:

- The extent of competition and nature of the regulatory environment;
- The amount and quality of human capital available;

¹¹ *i.e.* the number of telephone lines per hundred citizens or households.

- And the capacity of firms and other organisations to adapt their working processes to take advantage of new technologies.

The business environment in each of these areas is more conducive to ICT investment, diffusion and use in the OECD than it is in LDCs. In particular:

1. OECD countries generally have legal and regulatory business frameworks which facilitate or reward entrepreneurship and innovation and encourage inward investment. Licensing and standardisation requirements are generally more straightforward than in LDCs, although there may be more restrictions on labour conditions and deployment. Telecommunications markets have generally been liberalised and made subject to competition-oriented regulation, with strongly positive effects on the quality, availability and price of services. There are few if any restrictions on the role of external capital. LDC markets are often less open, as well as less attractive, to international trade and investment and have slower and sometimes more burdensome regulatory requirements especially in areas such as licensing. Although telecommunications restructuring and liberalisation are now being widely implemented in LDCs, there are still extensive areas of monopoly and regulatory bottlenecks which affect the availability and price of telecommunications services, for example restrictions on the ability of firms to use independent VSAT services for international data links.
2. OECD countries have extensive human capital available to utilise ICTs, including highly-skilled workforces benefiting from universal education – which generally includes basic ICT skills – and widespread specialist training in the ICT sector. ICT investment in such countries is often accompanied by an upgrading in average workforce skills – so-called ‘skill-based technological change’. Most LDCs have very limited pools of skilled personnel available for ICT work, while their education sectors are under-resourced and ill-equipped to provide even basic ICT training on a selective basis. Lower-skilled personnel often lack the language skills required for effective use of ICTs, especially Internet, while highly-skilled personnel are able to seek more lucrative employment in an international market for ICT-related staff. Even routine maintenance of ICT equipment is constrained by shortages of expertise, adding to costs and downtime, reducing reliability and the value ICTs can add to productive processes.
3. OECD firms benefit from the widespread availability of investment finance, from the confidence of investors in their business expertise and the low risk levels of their business environments, and from extensive experience in restructuring business operations to take advantage of new technological and management techniques. Change management, which is crucial to firms’ ability to maximise returns on ICTs, is part and parcel of business culture in the OECD, especially in larger and multinational firms. With the exception of these international businesses, companies in LDCs have much less experience of restructuring and much less access to high-quality business advice and venture capital. While there is significant dynamic activity in small and medium-sized enterprises in the ICT sector in many LDCs, it is often under-financed and under-resourced in comparison with similar enterprises in the OECD.

These ten factors illustrate some of the fundamental differences between OECD and LDC economies which are likely to impact on ICT investment and its relationship with productivity and economic growth – by making ICT investment more expensive, more difficult to implement or less cost-effective, and/or by limiting its impact on productivity or the ability of ICT-investing firms to gain advantage over their competitors. The cumulative effect of factors like these is likely to be substantial, especially in slowing the aggregate increase in productivity achieved by firms across the economy as a whole, and therefore significant in explaining the current difficulty researchers have in identifying positive national economic outcomes from ICT investment in low-income countries.

Although this discussion has juxtaposed OECD and LDC economies, many of the factors described above are also present, at least to some degree, in transition and middle-income economies and would also help to explain the difficulty in identifying positive national outcomes in their experience. It should be noted, however, that in both low-income and middle-income economies, these factors tend to inhibit, not to prevent, ICT investment. They do not suggest that ICT investment will not happen or that benefits in productivity and economic growth will not arise from it, but that ICT investment will be slower and that the benefits from it will be slower to materialise. The factors illustrated also point to ways, to which we shall return, in which businesses, governments and international agencies can act to increase the pace of ICT investment (where appropriate) and the rate at which benefits in national growth are likely to result.

It is important in this context, as in the OECD, to distinguish clearly between the relationship between ICTs and productivity/growth at the level of the firm and that found in the national economy as a whole.

The OECD findings and other evidence show that firms which invest in ICTs and in the organisational changes needed to take full advantage of them tend to gain at the expense of less efficient, less productive firms which have not given equivalent attention to ICT investment. These improvements in firm-level productivity will show through in national economic statistics when they are sufficiently widespread and (particularly) when reinforced by extensive networking between businesses (including what is generally called e-commerce). The importance of networking is likely to mean that there is a threshold effect involved, and that the rate of impact on national indicators will increase when a critical mass of ICT-investing companies and associated networking is reached.

There is no reason to doubt that the same advantages will accrue to firms in Least Developed Countries that similarly invest in both ICTs and the organisational changes required to maximise their value.¹² Policy initiatives that facilitate improvements in the business environment that will encourage effective ICT investment are likely, therefore, to be just as valuable for individual firms in LDCs as for their peers in OECD countries – and for the sectors in which such firms are congregated. For reasons described above, such firms and sectors form a smaller part of LDC than of OECD economies, and it will therefore take longer for the impact of productivity improvements to feed through into national outcomes, but that does not alter the fundamental relationship between improvements at firm and national level or reduce the importance of positive changes to the business environment. We will return to this point in the final section on policy recommendations.

5. The relationship between economic growth, development policy and the ‘digital divide’

As noted at the beginning of this paper, ICTs have become central to international thinking on social and economic development. However, the priority for development agencies is the potential of ICTs to address the Millennium Development Goals within their overall focus on poverty reduction rather than the impact which ICTs may have on business or national economic performance, with which this report is primarily concerned.

ICT applications clearly have potential to enhance the delivery of mainstream development goals (in health, education, *etc.*), regardless of whether the ICT sector or ICT investment contributes positively or negatively to national economic performance. Although the achievement of such development goals is likely to be easier in a context of economic growth, the relationship between the two is dualistic: economic growth is also more likely to be achieved in societies that are healthier and better-educated, in which individuals and communities have the skills and capacity to fulfil their potential and to develop new

¹² It should be noted that this may, however, tend to advantage multinational companies at the expense of domestic firms, since they are more likely to invest in ICTs at an early stage and can make more substantial efficiency gains through intra-company networking than their developing country competitors.

business opportunities. ICTs can play a part in improving both national economic performance and mainstream social development, where they are appropriately deployed, and this dual potential needs to be better understood by both ICT and development policymakers.

A major preoccupation in the literature on ICTs and development has been the question of the 'digital divide', *i.e.* the disparity in ICT diffusion and use between industrial and developing countries (or, indeed, between rich and poor, men and women, urban and rural areas within individual countries). It is often illustrated by data on access to particular ICTs, for example:

Although the average OECD country has roughly 11 times the per capita income of a South Asian country, it has 40 times as many computers, 146 times as many mobile phones, and 1,036 times as many Internet hosts.¹³

In many ways, this digital divide merely parallels similar disparities in access to and use of other development goods – health, education, *etc.* – which are more available to rich than poor, or in industrial countries than in developing countries. Any product, service or technology which has value is likely to be adopted first and most extensively by those individuals or countries with more resources to acquire and use it. A digital divide is, therefore, to be expected: the key questions for policymakers are to do with the extent to which it matters (in terms of equity and any spillover effects to other sectors), the extent to which it is likely to grow or diminish over time, and the identification of ways in which it might be bridged.

As with ICT policy in general, the development community's focus on the digital divide has been more to do with mainstream development sectors and with poverty reduction than with national economic growth. Opinion on the effectiveness of ICTs in poverty reduction and in delivering mainstream development goals remains divided, not least because – here as with its impact on economic growth – there is a shortage of impact assessment research to complement the findings of case studies and pilot projects. There is, however, a growing consensus that ICTs can make a valuable contribution to the delivery of mainstream development sector goals, provided that they are used appropriately and in circumstances where their potential value has been carefully assessed. There is a similar growing consensus about the impact of the ICT sector in and of itself on poor communities – for example, that telephony access is of intrinsic value to citizens of low-income communities as well as within the parameters of specific development projects. Very little research has been done on this latter issue, though what has suggests that low-income communities use ICTs, when they become available, much more extensively and dynamically than had been anticipated by policymakers and suppliers – particularly where they do not require significant new skills or resources (radio, voice telephony) and where they bypass or substitute for less effective alternatives (transport, postal services).¹⁴

A central part of discussions on the digital divide concerns the mediating role which ICTs play in facilitating the availability of information/knowledge. Modern production is increasingly knowledge-intensive; knowledge and access to information are increasingly important assets for individuals, communities, businesses and countries in competitive markets; they also facilitate basic social empowerment and opportunity for individuals and communities at all economic levels. The costs of gathering, processing and distributing information are higher in developing countries,¹⁵ and ICTs have the

¹³ World Bank, *Information and Communication Technologies: a World Bank Group Strategy*, p. 5, citing Pyramid Research. The ratio for mobile phones, at least, may now be lower.

¹⁴ See, for example, research by K. McKemey, N. Scott, D. Souter and others for the UK Department for International Development's Knowledge and Research programme on the use of telephony in low-income communities in Botswana, Ghana and Africa, 2003.

¹⁵ See Bedi, 1999

potential to extend the availability of information/knowledge - so substantially that some talk of an 'Information Revolution' equivalent to the 'Industrial Revolution' of two hundred years ago. The extent to which this 'Information Revolution' reaches into individual economies, it is argued, profoundly affects their ability to grow economically and to address social challenges – to improve their national social and economic indicators both absolutely and relative to other countries.

At this national level, where cross-country economic comparisons are required and especially where the relationship between rich and poor countries (broadly equivalent to OECD countries and LDCs) is concerned, the digital divide question is much more to do with national economic performance than with mainstream development objectives and poverty reduction. Opinion can broadly be divided into two camps:

- Digital optimists have argued that ICTs offer developing countries, including LDCs, an opportunity to 'leapfrog' stages of technological development and compete in ICT/knowledge areas with industrial countries on more equal terms than they have done in the past.
- Digital pessimists, by contrast, believe that digital divides are likely to grow over time as ICTs become increasingly pervasive in industrial countries while most developing countries, particularly LDCs, lack the critical mass – in terms of expertise and local markets – to follow suit.

Two characteristics of ICTs seem particularly important in this context.

The first is the importance of network externalities. If the value of ICTs grows more quickly the more widespread they are diffused within society, as a result of network externalities, then the social and economic gap between societies characterised by intensive use of ICTs and those with less widespread diffusion of ICTs – the digital divide - is likely to increase, at least until the latter reach any 'threshold' beyond which more rapid growth is likely to occur.

The second is the pace of change in ICT development itself, which far exceeds the rate of change in earlier technologies. Driven by the factors underpinning 'Moore's Law',¹⁶ information technology advances follow one another at enormous speed. Technologies and infrastructures that seemed advanced five years ago are already giving way to newer, better alternatives. Disappointingly for optimists, developing countries that seek to 'leapfrog' earlier stages of technological development are likely to find that their new technological base is rapidly eclipsed by further technological advances in industrial countries.

What conclusions can be drawn about these from the analysis in this report?

The general thesis set out above – that ICTs will act more effectively as drivers of economic growth in more ICT-intensive economies – clearly suggests that the gap in the dividend reaped from ICT investment by OECD countries and LDCs, at national level, will continue to widen for some considerable time to come. Better-resourced developing countries – transition economies, middle-income countries and those with significant advantages of scale – are more likely to secure national economic benefits from ICTs at an early stage than LDCs. However, they too are likely to experience a widening gap in ICT-related growth at national level in the short term at least. Complementary factors, such as the availability of human capital and the enabling environment for business performance, will have a significant impact on the

¹⁶ In 1965, Gordon Moore observed an exponential growth in the number of transistors per integrated circuit and predicted that this trend would continue. His observation has developed into a general observation of the continued rate of very rapid growth in ICT capacity.

ability of individual firms and (thereby, in time) national economies to increase the pace of ICT-related gains, but the timelag involved will also be significant and few if any countries will be able to adjust their business environment quickly enough to keep pace with the most ICT-intensive countries in the OECD.

The consultancy Analysys, in work for the World Bank and *infoDev*,¹⁷ has developed a persuasive typology of national economies grouped according to their economic and structural readiness to take advantage of ICTs. It divides developing countries into four categories:

- Group B: those, generally ‘with higher levels of development, ... liberalised networking regulations and an open approach to trade,’ which are most likely to grow quickly in a network economy;
- Group C1: those in which the outcome between growth and a widening development gap is likely to depend on the quality of policy reform and practice;
- Group C2: those requiring extensive policy reform in order to benefit significantly; and
- Group C3: ‘the poorer developing countries where the net impact of new networking is expected to be small relative to the existing sources of poverty and instability,’ which are unlikely to secure significant gains and likely to experience a widening digital divide for many years to come.

In summary, Analysys suggests in principle that:

*Part of the developing world will be projected into a turbulent period of rapid progress, but most will be left behind, locked into vicious circles of poverty and instability as the gap between rich and poor nations widens again.*¹⁸

This puts the pessimistic view of the digital future at its starkest. The evidence presented in this report suggests three points in mitigation.

Firstly, as Analysys’ typology makes clear, not all developing countries suffer the same disadvantages as LDCs. A number have successfully established ICT production sectors and some middle-income countries have experienced very high levels of diffusion of new ICTs (such as mobile telephones) within the general population. These countries, at least, are likely to be able to keep pace with many OECD countries and to catch up with them in the medium term.

Secondly, a growing digital divide between OECD countries and LDCs does not mean that the latter are failing to take advantage of digital opportunities, but that the former have advantages which enable them to take more rapid advantage of them. There is an important distinction to be drawn between the absolute and relative positions of developing countries in this context. Absolute gains in ICT diffusion, use, ICT-related growth and ICT-related poverty reduction can be made by developing countries while the relative gap between them and richer nations continues to widen. Increasing diffusion and use will, in time, enable countries to benefit from the ICT-related economic gains now identified within OECD countries; and most LDCs – as the growth in mobile telephony, for example, over the past five years demonstrates –

¹⁷ *The Network Revolution and the Developing World*, 2000.

¹⁸ The purpose of Analysys’ report, however, is to assist the World Bank and its partners to identify approaches that will enable developing countries to escape these ‘vicious circles’.

are now seeing significant increases in ICT diffusion and use. Much deeper problems will be faced by those few countries which are experiencing no growth in ICT diffusion and use – though those few countries are often already confronted by much deeper problems such as civil conflict.

Thirdly, Analysys' discussion confirms the findings of the OECD report and other evidence that the prospects of ICT-related economic growth are enhanced by policy interventions that support improvements in critical complementary factors for business performance. Governments, in other words, can act to advance absolute gains from ICT investment in such a way that their countries will be better positioned to take advantage of economic opportunities that are dependent on ICT capability; and so also advance their relative national position *vis-à-vis* other developing countries in the short term and the whole world community in the fullness of time. The final section of this report addresses these issues with a series of policy recommendations to developing country governments and development agencies.

6. Policy recommendations

This report has reviewed the evidence for links between ICTs, productivity and economic growth in OECD countries, set out in the OECD report *ICT and Economic Growth*, and discussed the relevance of these findings for developing countries. Its general conclusions can be summarised as follows:

1. There is evidence that ICTs facilitate economic growth in OECD countries, principally by increasing productivity, though this is a long-term rather than immediate outcome of ICT investment.
2. There is little or no clear evidence that the same outcome is yet being achieved in developing countries, largely because little or no relevant research has been undertaken. However, developing countries in general, and LDCs in particular, are less well-equipped to take advantage of the potential of ICTs to stimulate growth, and so (to the extent that ICTs do stimulate growth) are likely to fall further behind OECD economies in relative terms.
3. Some of the reasons for this are to do with economic structure (for example, the preponderance of agriculture, low income levels); some to do with policy issues (restrictive regulatory environments, low levels of human capital, *etc.*).
4. Developing countries, and development agencies, also have to balance policy and investment options regarding ICTs against other socio-economic objectives (notably the development objectives set out in the United Nations' Millennium Development Goals). Poverty reduction objectives are, however, more likely to be achieved against a background of economic growth, and any synergies between the impacts of ICTs in these two areas of national policy should be exploited.
5. Governments' priorities in policy terms should, therefore, be to reduce the factors which inhibit effective use of ICTs (and any gains that may result therefrom); to take positive steps which will enable maximisation of the benefits that can be derived from ICTs; and to integrate ICT policy more effectively into overall national socio-economic development strategies.

Although the evidence suggests that the short/medium-term impact of ICT investment on economic growth is likely to be less substantial in developing countries than in countries of the OECD, therefore, the policy prescriptions indicated for developing countries do not differ markedly from those advocated within the OECD, since the objective of both is to maximise the pace with which firms and other organisations can improve their productivity and so contribute to national economic growth. There is no reason to suggest that the complementary factors identified as crucial to this within the OECD will not be equally crucial within developing countries, and they therefore form the basis for the policy recommendations

below. There are, however, significant differences to their application in developing country environments which need to be addressed by developing country governments and international agencies.

a) The policymaking environment

Recent research amongst developing country ICT decision-makers has indicated important structural weaknesses in ICT policymaking in most developing countries, particularly LDCs.¹⁹ The key factors cited include:

- Lack of awareness of the potential of ICTs at all decision-making levels, and especially at senior decision-making levels;
- Lack of integration of ICT policymaking with other areas of government, in particular with Ministries of Finance and ministries responsible for development priorities;
- Lack of engagement of private sector and civil society expertise;
- Inadequate knowledge management systems;
- And lack of expertise in both technical and policy dimensions of ICT decision-making.

These problems are not universal. Some middle-income countries (such as Malaysia) have put ICT policymaking at the heart of national decision-making; some LDCs (such as Tanzania) have paid substantial attention to raising awareness and engaging diverse stakeholder groups in the policy process for ICTs. However, the evidence is that most developing countries are currently poorly-equipped to make effective policy decisions on ICT issues and priorities or to integrate these in holistic national development strategies. Weak policymaking processes are compounded by a lack of research on the real impact of ICTs in different development sectors. It is easy in these circumstances for policymakers to exaggerate their potential and to direct investment into unproductive areas.

Policymakers in developing country governments need to prioritise the establishment of a more coherent understanding of the real potential and limitations of ICTs within their national circumstances and to integrate them closely into national social and economic policy development. This is not so much a matter of national e-strategies but of incorporating ICTs in mainstream policy thinking. It requires:

- research and analysis of the real potential impact of ICTs on both national economies and mainstream development objectives;
- increased awareness and understanding of the findings of this analysis at all levels and in all departments of government;
- and a willingness to focus limited available resources on those issues which will have most impact on maximising the returns from ICT investment.

Two points in particular need to be recognised by policymakers.

¹⁹ See the 2002 report *Louder Voices: Strengthening Developing Country Participation in International ICT Decision-Making* produced by the Commonwealth Telecommunications Organisation and Panos London for UK Department for International Development and the G8 DOT Force.

Firstly, most developing countries lack the resources to place ICT-led growth, especially export-led growth, at the heart of their national development strategies. Experience shows that only very few have significant competitive advantages in ICT production or services, and there is likely to be a substantial first-mover advantage for those countries which have already taken this route. National strategies which seek to replicate the experience of Bangalore²⁰ are likely to fail; those that focus on using ICTs to increase the productivity of established sectors in which a country has competitive advantage – or on developing ICT production capacity close to such ICT-using sectors²¹ - are more likely to succeed.

Secondly, the most effective strategies for ICT development may not be those which are directly focused on ICTs but those which address the complementary factors that will facilitate ICT investment and diffusion. This is primarily because of the importance of such diffusion in unlocking the benefits of ICTs for both social and economic development. Like the steam engine, railways and electricity before them, ICTs are transformational technologies whose impact cuts across the traditional boundaries between economic sectors.²² Their most fundamental added values lie in networking and access to information/knowledge resources that were previously unavailable. Such resources can only be used effectively by those that have the necessary skills and infrastructure to take advantage of them.

Although the challenges in addressing these complementary factors vary from country to country and are not susceptible to detailed prescription without detailed attention to national circumstances, experience in OECD countries does suggest that three broad areas of government intervention are particularly productive in enhancing societies' capacity to take advantage of ICTs, or e-readiness. These are the promotion of infrastructure development and access, liberalisation and deregulation, and the development of human capital. Although these are by no means the only complementary factors susceptible to government action, the evidence suggests that by intervening in these three areas, and in particular addressing the disadvantages faced by developing countries in relation to them identified in section 4 of this report, governments can make a significant impact on the enabling environment for ICT investment and ICT-related growth in their economies. The following paragraphs comment briefly on each of these in turn.

b) Infrastructure and access

Access to infrastructure and to services using infrastructure networks is essential if ICT investment is to facilitate either community development or access to markets (both domestic and international).

Unlike OECD countries, most developing countries have very poor information and communications infrastructures. In particular, the fixed telecommunications network is often geographically limited, in need of substantial investment and poorly connected with international communications networks, especially the Internet. As electronic commerce and networking become ever more prevalent in international business, deficient national communications networks will increasingly deter foreign investment and reduce global market opportunities. Investment in upgrading national communications infrastructures to sustain national business competitiveness is therefore urgent.

Communications infrastructures, however, are not just about international business. Deficient communications networks have played a major part in limiting access to ICTs for large parts of the

²⁰ the city at the heart of India's software development and ICT-based outsourcing sector.

²¹ See Kraemer & Dedrick, 2002

²² These analogies are cited in the 2001 OECD report *The New Economy: Beyond the Hype*. It is worth noting, however, that the steam engine, railways and electricity have not yet achieved the global presence which ICT-led development requires for new technology in LDCs.

population in many developing countries, especially in rural areas. Wireless telecommunications networks are now contributing significantly to extending access to telephony (public and private) in such areas, but their coverage remains limited and their capacity to deliver Internet access is weak. In addition to geographical coverage, meaningful access also requires services to be affordable, to be delivered in formats (for example, languages) that are useable, and to offer content that is relevant. The development of mass access to communications services – through public as well as private access points – is essential to enabling a society to maximise the value of information and knowledge available to it, and to secure the social and economic benefits derived from networks. It has now been identified as a clear development objective by most developing country governments. It seems increasingly likely that the provision of widespread basic access, which facilitates innovation and entrepreneurship in previously unserved communities, is more effective in delivering development outcomes quickly than project-driven telecentre initiatives, though the latter obviously also have significant value.

ICT investment will contribute more effectively to national economic growth if ICT-investing businesses are able a) to network cheaply and effectively with international counterparts and b) to reach customers throughout domestic national markets. Governments can contribute to this process by facilitating investment in infrastructure and by stimulating the extension of networks into hitherto unserved areas.

Wherever possible, investment in infrastructure should be funded by the private sector, in order to avoid the diversion of scarce public or development agency resources. Governments should seek to make investment, including foreign investment, in infrastructure and services attractive in order to maximise the extent to which it can finance affordable coverage within their national territories. They should also consider innovative solutions to the extension of access into marginal or potentially unprofitable areas – such as the liberalisation of small-scale private resale or the use of reverse auction universal access mechanisms like those pioneered in Latin America.

c) Liberalisation and deregulation

Historically, most ICT sectors have been heavily regulated – particularly broadcasting and telecommunications. The last twenty years have seen extensive liberalisation and deregulation of communications markets in industrial countries and, increasingly also, in the developing world. Most telecommunications markets in developing countries have now been at least partially liberalised and opened up to private sector investment, including foreign investment. The impact of liberalisation and privatisation in telecommunications is generally agreed to have been positive – in terms of new investment, extended access, diversity of services and lower prices. Certainly, telecoms markets which have been liberalised offer consumers (private and business) cheaper and better connectivity, enabling them to make more effective use of ICT investments.

Governments which have not yet liberalised their communications markets could therefore benefit their ICT-investing sectors significantly by doing so. Increasingly, however, the important issue in communications policy is not liberalisation itself but the ethos of the regulatory regime established for the oversight of the competitive markets resulting from it. The ICT sector continuously generates new technologies, products and services, many of which offer alternatives to those which are already regulated or licensed. A regulatory ethos which favours openness will encourage innovation in service provision, which is likely to lower costs and add further value to ICT investment.

ICT investment and innovation can also be constrained by regulatory factors outside the telecommunications sector which increase the monetary or opportunity costs of ICT investment. Heavy customs duties on ICT hardware, for example, can put otherwise attractive ICT investments beyond the reach of smaller businesses, and certainly reduce the rate of return likely to be derived from them.

Complex or bureaucratic licensing and standardisation requirements also constrain investment. Governments which lack modern legislation on intellectual property rights or e-commerce may be tempted to restrict and control rather than allow markets to develop freely. In these areas, too, greater openness is likely to lead to more entrepreneurship, lower prices and more dynamic ICT-led businesses contributing more effectively to economic growth. Governments should look to experience with the outcomes of particular regulatory approaches in other countries before committing themselves to more restrictive approaches at home.

d) Development of human capital

The most important long-term constraint on ICT investment and ICT-led growth in developing countries is likely to be the shortage of human capital. The problem is essentially twofold:

- Most developing countries suffer, firstly, from a shortage of ICT-related skills. This is not surprising, given the low initial rate of ICT investment, but it acts as a substantial constraint at all levels of the economy: too little understanding of ICTs in government; too little awareness of ICT opportunities amongst entrepreneurs; too little relevant content and too few relevant applications; too few trainers able to pass on ICT skills to employees; too little computer literacy; too few trained computer programmers and maintenance personnel. ICT-skilled personnel in low-income countries can also usually earn much higher wages in other countries.
- The shortage of ICT-related skills is but one outcome of a general low level of basic education. Low levels of acquired literacy and numeracy in society as a whole reduce the number of people who can make effective use of ICTs, not simply in the workforce but also as consumers. Lack of international language skills combines with shortage of disposable income and access difficulties to limit exposure of most citizens to Internet and computers. All of this is underpinned by an underfunded and understaffed educational sector, in which teachers lack training in ICT-related skills and schools lack basic resources such as books and pencils, let alone computers.

Most modern ICTs require significant acquired skills, particularly literacy. Firms that invest in ICTs often experience an uplift in the educational standards required of their employees as a result of this and of the automation of low-skill roles. With very few exceptions, developing countries cannot compete with the skill resources available to firms in industrial countries. It will take a great deal of investment and a number of years before they are able to do so, because the development of skills in any one educational cohort depends on the number of teachers that can be recruited from its predecessors. Upgrading educational attainment is not, of course, a requirement only for ICTs, but a fundamental requirement for most development objectives. Governments need to ensure that ICT capability is incorporated in their educational strategies.

Human capital is not, however, solely a matter of education and training. As in the OECD, the behaviour of individual firms will be crucial to the achievement of national economic benefits from ICTs. Governments can create enabling frameworks, but firms also need to be equipped with the managerial skills and financial resources to take advantage of them. ICT investments are not inevitably successful: they need to be carefully targeted on aspects of business where they will be most productive and associated with changes in company structure and work organisation that will maximise their value. Governments can also facilitate this area of ICT readiness by encouraging inward investors to share their experience of ICT-related workplace organisation and by providing models for ICT preparedness through their own implementation of ICTs in government.

8. Sequencing and evaluation of outcomes

It would be possible to add more issues to this brief resume of complementary factor initiatives that could be taken by governments. However, the four issues identified above – better policymaking processes, investment in infrastructure and access, liberalisation and deregulation, and investment in human capital – are all fundamental to unlocking the value of ICT investment for economic growth. While each is significant alone, improvements in all of them will complement each other and generate synergies in stimulating ICT investment and enhancing returns on that investment by firms and other organisations (including government institutions). Governments that wish to maximise their value should address these synergies in a holistic approach to reforming the enabling environment for ICT investment.

The impact of these changes will only be felt over time, and this has some implications for the order in which changes might be introduced – although different national circumstances are likely to be the primary determinants of this.

- Changes in policymaking processes are an important first objective, because decisions on ICT-related issues are more likely to be effective if they are well-informed and coordinated across government, especially with initiatives to meet mainstream development goals.
- Liberalisation and deregulation are necessary to attract inward investment and to encourage entrepreneurship and innovation in ICTs by domestic businesses. The overall response to them will depend on the extent to which markets are attractive and to which confidence develops in the new regime, but a rapid response can be expected in areas which have been constrained by regulations that are newly removed. This might well be the case, for example, in the broadcast radio, VSAT and Internet sectors.
- Investment in infrastructure and access will take longer to have an impact, because of the time taken to deploy new networks, but the speed with which wireless networks have been taken up in low-income communities in Africa is encouraging, while ICT-aware businesses will be quick to take up opportunities for better international connectivity and networking.
- The slowest rate of change in these four complementary factors will occur in human capital, because the shortage of relevant skills can only be addressed through substantial increases in educational resources including training of teachers and ICT specialists. However, once the other complementary factors described above are in place, the speed with which issues of human capital are addressed is likely to be the most important factor determining the pace of ICT diffusion and the achievement of long-term benefits from ICT investment.

Finally, the importance of continued monitoring of national circumstances and outcomes should not be underestimated. This report shows clearly how little research has been done on the relationship between ICTs and economic growth in developing countries. There are also similar deficiencies in analysis of the relationship, at an aggregate level, between ICTs and mainstream development goals. Good policy results from a good understanding of the circumstances addressed. Governments and international agencies could do much of value by focusing research resources on understanding in more detail how ICTs (and other cross-cutting sectors) are interacting in practice with development objectives and so improving the targeting of national and international strategies and programmes.

9. Conclusions

This report has reviewed recent research findings on the relationship between ICT investment and economic growth in OECD countries and assessed the relevance of these findings for developing countries. It suggests that substantial differences between the economies of OECD countries and developing countries, particularly LDCs, are likely to affect the pace and extent to which firm-level improvements in productivity following ICT investment result in improvements in national economic growth. In addition to differences in economic structure, many developing countries lack the complementary advantages – such as deregulated markets and high-quality human capital – which have enabled firms in OECD member-countries to maximise the value of ICT investments in a relatively short period. The importance of networking for the effective use of ICTs also places great importance on the extent of ICT diffusion, and means that countries with existing high rates of ICT deployment (such as OECD countries) are much better placed to accelerate gains from ICT investment than those in which low levels of diffusion inhibit the growth of networking between firms and other organisations.

This implies that a ‘digital divide’ in the dividend from ICT investment between industrial and developing countries is likely to continue to grow in the short to medium term. Some developing countries – particularly transition economies, middle-income countries and larger countries which can sustain significant ICT production sectors – are likely to attain higher rates of benefit from ICT investment within a reasonable timescale, giving them the opportunity to begin to close the gap between them and industrial countries in due course. Others, however, particularly LDCs, are only likely to see firm-level improvements in productivity become sufficiently significant to impact on national growth in the medium to long term.

This does not mean, however, that ICT investment will not contribute meaningfully to growth in such countries, or that steps should not be taken by developing country governments and international agencies to promote effective use of ICTs, particularly in sectors where they have most value. On the contrary, it is clear from OECD countries that complementary factors such as human capital and deregulation play a crucial role in accelerating the benefits of ICT investment at both firm and country level, and there is no reason to suggest that the same will not be true in developing economies. Governments that facilitate improvements in such complementary factors will make their firms and citizens better-equipped to invest in ICTs and secure benefits from ICT investment, advance the rate of adoption of ICTs and ICT-based networking, and potentially improve their countries’ competitive position *vis-à-vis* their peers. Such approaches, however, should be fully integrated into broader national economic and social development policies, rather than isolated as separate sectoral initiatives.

These policy recommendations are broadly consistent with the approaches adopted by leading international development agencies, including the World Bank and, in its 2003 *E-Commerce and Development Report*, by UNCTAD. They also impact directly on the capacity of ICT sectors to deliver the mainstream development goals that are the primary concern of social and economic development initiatives. By addressing these complementary factors, governments can create an enabling environment through which ICT investment, diffusion and use become more pervasive because of the value perceived in them by businesses, citizens and consumers, rather than being driven by suppliers and/or government/development programmes. This approach is more likely to result in sustainable and productive ICT investment that will contribute to economic growth, social development and, in the long term, to diminishing the digital and other development divides.

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