

## An Information Infrastructure for Development

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**ABSTRACT** *The aim of this paper is to bring the challenge of an information perspective to bear on development issues and in particular on the role of telecommunications. In a too quiet revolution, information economics has lagged in the race for popular interest behind the brash 'new economy' rhetoric which argues that the intellectual problem is one of catching up with a new technology economy, i.e. a CISCO online economy that can exist miraculously and independently of supporting non-online activities, institutions and culture, rather than coping with the deeper socioeconomic issues that have long been eroding the theoretical foundations of economic theory, its touchstone of economic efficiency, and myriad policy prescriptions.*

**Keywords:** digital divide, economic development, information economics, new economy, telecommunications.

Private information is practically the source of every large modern fortune  
(Oscar Wilde, *An Ideal Husband*, Act II)<sup>1</sup>

### An Information Perspective

It may seem unjust to indict contemporary authors for their willingness to accept both the limitations of a market system and exogeneous technological change. After all, the centrality of the market has been with us for centuries; and other professional groups have legitimized technology as a means to solve specific problems within their purview, e.g. modern medicine presents a catalog of such technological solutions: dialysis, endoscopy, the cochlear implant, the pacemaker, intensive care.<sup>2</sup> Similarly, economics has preferred to focus on ICT and has only slowly accorded recognition to the information perspective and writings that have sought to draw out flaws in the discipline's structure.<sup>3</sup>

Now, however, it is conceded that questionable assumptions about the role of information are common to most of the economics discipline's problem areas.<sup>4</sup> These problems bear on both the operation of markets and the sources and effects of new technologies. Space does not permit a complete exposition here. Instead, the potency of the challenge will be illustrated by several interwoven strands of thought. If an information society is meaningful, information should be added to

tastes and incomes as the basic building blocks. What do people know? This question should accompany the standard ones: what do people like? What do people possess?<sup>5</sup> Currently, striving for the ultimate economic efficiency has to speculate about the Internet, E-commerce, the human genome project, tele-robotics and much more. This situation requires technology assessment but it remains incomplete no matter how great the efforts. Unmet information requirements and information asymmetries have prompted the assessment that 'standard economic theory has little to say about the efficiency of the knowledge based economy'.<sup>6</sup>

Alarmed at the prevalence of falling costs, Hicks thought the 'getaway' assumption of perfectly competitive markets permissible,<sup>7</sup> but growing information-intensity of economic activity calls this into question. How much was at stake was later underlined by Samuelson who wrote that it was 'hardly an exaggeration to assert: *Increasing returns is the prime case of deviations from perfect competition*. Its corollary is this: *Universal constant returns to scale (in everything, including effective acquisition and communication of knowledge) is practically certain to convert laissez-faire or free enterprise into perfect competition*'.<sup>8</sup> The indivisibility and inappropriability of much information limits the commodification of information and creates pervasive economies of scale.<sup>9</sup> More recently, Scarf emphasized the presence of large and significant indivisibilities in production, e.g. communication networks, and suggested that understanding of the functioning of large enterprises might benefit from attention to information flows in hierarchical structures.<sup>10</sup>

Information is capital,<sup>11</sup> so consider Schumpeter's remarks:

This . . . stock of goods is neither homogeneous nor an amorphous heap. Its various parts complement each other in a way we readily understand as soon as we hear of buildings, equipment, raw materials, and consumers' goods. Some of these parts must be available before we can operate others; and various sequences or lags between economic activities impose themselves and further restrict our choices; and they do this in ways that differ greatly according to the composition of the stock we have to work on.<sup>12</sup>

He went on to emphasize that this stock at a moment of time is 'a structured quantity or a quantity that displays structural relations within itself that shape, in part, the subsequent course of the economic process'.<sup>13</sup> Too little has been done to explore these information complementarities, the constraints they impose on decision processes, and their implications for industrial organization.<sup>14</sup> Too much attention has been given to information as a public good and too little to private information.

So the arguments emerge<sup>15</sup> that: (1) economies are becoming more information-intensive; (2) there are inherent and significant information-based indivisibilities; (3) complementarities constrain decisions and actions in ways never contemplated by those who conceive of information as simply a lubricant in the economic system; (4) history matters; and (5) the more appropriate the knowledge-based economy<sup>16</sup> label, the less useful the economic efficiency test—and the less useful current official statistics that tell very little about information production and use. In short, all economies are information economies<sup>17</sup> and economics must be an information economics.

## Telecommunications and Development

Does this perspective help in addressing the role of telecommunications<sup>18</sup> in development? A major shift in the literature has to be acknowledged. Only a few years ago it was *de rigueur* to proclaim that telecommunications was *the* driver of economic growth and development.<sup>19</sup> This was not metaphor, as the telephone exchange and later the computer served as a metaphor for the human brain. It was far more. It was an article of faith to guide planning and resource allocation. It suited business, government and the relevant international agencies.<sup>20</sup> The International Telecommunication Union, for example, promoted telecommunications investment and modernization as the engine of growth and produced detailed estimates of funding requirements that very largely ignored the wide-ranging complementary investments needed to make the communications systems functional. Not surprisingly, this supply-driven bonanza attracted much consultant and academic 'research' support and publication. Likewise, The World Bank was strongly inclined to this strategy.<sup>21</sup> It is, therefore, appropriate to indicate the extent of the shift in opinion by citing the findings of a recent, enlightened INFODEV Working Paper: Are Poor Countries Losing the Information Revolution?<sup>22</sup>

- All developing countries, even the poorest, are improving their access to and use of modern ICTs, some at a dramatic rate.
- The gap between rich OECD countries and the poor developing countries is growing, both in terms of ICT products as well as in terms of incomes.
- Although these new technologies appear to be improving economic performance and welfare among the user populations, the link between ICTs and society-wide economic progress has been more elusive. There is a lack of association between economic growth and use of ICTs. Perhaps their positive effects will be felt in the longer run.
- Countries with similar levels of per capita incomes and economic structures exhibit wide variation in their ICT performances. Pro-ICT policies that appear to be causing these differences in outcomes are:
  1. a climate of democratic rights and civil liberties conducive to innovation and adaptation of ICTs;
  2. respect for the rule of law and security of property rights;
  3. investment in human capital; and
  4. low levels of government distortion.
- Many of the links are complex and simple claims about progress may be 'dangerously wrong'.
- It is known that information technologies in developed countries can cause substantial increases in inequality, although this might be reversed in the long or medium run. Information is lacking on this aspect of experience in developing countries.

An index of technological progress provided in this INFODEV report is a significant achievement but it needs to be more all-inclusive of relevant 'technology'. As it is constituted, it takes in TV, fax, personal computers, Internet hosts, and mobile phones. An obvious additional candidate is the telephone. But also organizational capital is omitted, as is the knowledge base. Surely there are major implications of the US having some 40% of the world's stock of books?<sup>23</sup>

There is acknowledgement of the relevance of 'hard and soft infrastructures' and the need for 'appropriate institutions and policies'. Perhaps the Frye and Shleifer modeling<sup>24</sup> of the role of the State (invisible-hand, helping-hand, iron-hand, and grabbing-hand) could be built into the analytical framework.<sup>25</sup> Investment in education and health receive attention but there is too little elaboration. In both, but especially in education and training, the information perspective and the time sequences it imposes can be crucial—and this takes in management and so links with organizational capital. Investments in these categories may well be directed to the solution of short-run supply problems with ICT labour, but they are equally involved in maintaining and reshaping the culture that enters into choices about institutions and policies as well as about new factories.

Examination of the INFODEV Table 2: Technological Progress over Time, reveals an interesting top ranking group: (1) Finland; (2) Slovak Republic; (3) Tunisia; (4) Vietnam; (5) Australia. Surely this diversity is enough to persuade the reader that the index, praiseworthy though it be as a first try, is in no sense definitive. There is an incredible mix of explanatory factors and time mismatches involved in the processes in this group of countries. If culture, 'a living historical product of group problem solving'<sup>26</sup> in the society, is deemed relevant, it is small wonder that economic analysts and policy practitioners, like their modern medicine counterparts, set their hopes on a quick technology fix. It is simpler; it fits the general pattern by which the developing countries have been given what the developed world can give most easily and most advantageously;<sup>27</sup> and it gains support both in the market place and with governments.

On the role of foreign investment, the findings are inconclusive. Investment is good for technological progress but what causes investment? The familiar list appears: investment in human capital, low levels of government distortion, security of property rights and basic political freedoms. FDI is then put under closer scrutiny because it is thought to link with information transmission, but Rodríguez and Wilson 'find little evidence for this . . . [S]ome countries that have fared quite well in terms of technological progress (such as Tunisia and South Africa) have some of the lowest rates of FDI of our sample'.<sup>28</sup> Why? Perhaps it is because of additional factors that have not been taken into account. A market opportunity in a developing country may be most profitably pursued in disregard of the capability-creating considerations that are uppermost in the minds of policy-makers in the recipient country. Taking account of the myriad complementarities indicated by the information perspective may be too cumbersome and too costly.

Despite this, such foreign firms and their projects will still use telecommunications and modern ICTs. A question that needs to be posed is how much of the growth, especially early growth, in Technological Progress over Time is accounted for by international business? How much is accounted for by government and military activities?<sup>29</sup> Note the contrast between the top five countries in terms of the ITP and Technological Progress over Time. On the second criterion the countries ranked for ITP 1–5 take positions 2, 34, 79, 84 and 6!

### **The Digital Divide**

It has been popular for some time to claim that half the world's population has never made a phone call.<sup>30</sup> More than half the world's population live on less than US\$2 per day and half the world's labor force is still in farming. These bare bones

of economic reality should create some hesitancy about imposing the economic modeling of advanced countries on the rest of the world. Downloading of technology is ill-conceived as a solution to the digital divide because that divide is an extremely complex notion that cannot be reduced to a single dimension, be it income or Internet access. A recent comment highlights the difficulties of applying the concept in even the most advanced countries. An analysis of the 10 most watched TV programs in the US used groups: whites, blacks and Hispanics. Could this be expected to reveal the unity of the American nation? The only program in common was Monday Night Football!<sup>31</sup>

Another aspect merits high priority. Arrow forecasts 'an increasing tension between legal relations and fundamental economic determinants'.<sup>32</sup> He reasons as follows: 'Information is the basis of production, production is carried on in discrete legal entities, and yet information is a fugitive resource, with limited property rights'. He hazarded a guess that 'we are just beginning to face the contradictions between the system of private property and of information acquisitions and dissemination'. While the mix of indivisibilities and complementarities discussed earlier in this paper require some modification of the fugitive character of information, this argument retains a good deal of force, especially when the divide is between developed and developing countries. Drahos<sup>33</sup> has posed the good question in respect to intellectual property and TRIPS: how did one country persuade 100 other countries to pay more for their technology? Similarly, this is a matter for indigenous populations within developing or developed countries.

A third aspect concerns the rate of change. Judgments in support of ICTS and other technological change are very imperfect. Allowance is not made for the differential abilities of countries to cope with rapid change. This is an information problem but one that links closely to the managerial prerogative as conceived within a more or less freely operating market system. The extent to which information can become a commodity is limited by its economic characteristics<sup>34</sup> and, as David and Foray argue, 'the conditions for efficient distribution and utilization of [information] cannot be expected to arise automatically from the interplay of market forces'.<sup>35</sup> Therefore, the fortunes of both labor and suppliers are often put at risk by the ignorance of management and by organizational obsolescence or lock-in. As the information economy becomes more pervasive, it is not impossible that there should be further inroads upon managerial prerogative. Could information statements follow environmental and ethical requirements?

## **Conclusion**

The implications of the information perspective are far-reaching. Implementation requires a shift of focus from ICT to information. Only then would the real meaning of the information economy be realized, the productivity paradox resolved, and the full process of informatization of society be revealed. This is no doubt asking for the impossible—although some philosophers and computer scientists keep hoping.<sup>36</sup> Meantime an achievable step is recognition that information is a structured quantity in Schumpeter's sense, with a crucial role in the unfolding story of communications in development.

The assessment of information policy with respect to telecommunications in developing countries has relied upon measures of input or intermediate output. Statistics of teledensity, TV programs, mobile phones, and Internet hosts can be a

starting point of an investigation just as the downloading of technological information can be a first step in development activity. The literature of technology transfer is replete with stories of failures, e.g. instructions in a foreign language that nobody could read. Attention has to shift to the comprehension of messages, learning processes, and utilization of information in sequential processes of learning, questioning, unlearning, and application.<sup>37</sup> Communication patterns might well be studied to see to what extent the questions are asked in the countries where FDI originates and the answers provided by the recipient country. Herein might lie the answer to the INFODEV conundrum.<sup>38</sup>

## Notes and References

1. The author is indebted to Judith Bannister, Flinders University, Australia for this quotation.
2. See R. Horton, 'How sick is modern medicine?', *New York Review of Books*, XLVII, 17, pp. 46–50.
3. For example, G. L. S. Shackle, 'The nature of the bargaining process', in J. T. Dunlop (ed.), *The Theory of Wage Determination*, Macmillan, London, 1957, pp. 292–314; G. J. Stigler, 'The economics of information' (original published in 1961), reprinted in D. M. Lambertson (ed.), *The Economics of Information and Knowledge*, Penguin Books, Harmondsworth, UK, 1971, pp. 61–82; F. Machlup, *The Production and Distribution of Knowledge in the United States*, Princeton University Press, Princeton, NJ, 1962; K. E. Boulding, 'The economics of knowledge and the knowledge of economics' (original published in 1966), reprinted in Lambertson (ed.), *op. cit.*, 1971, pp. 21–36; *Ibid.*, pp. 7–17; K. J. Arrow, *The Limits of Organization*, Norton, New York, 1974.
4. D. Vines and A. Stevenson, *Information, Strategy and Public Policy*, Blackwell, Oxford, 1991.
5. *Ibid.*, p. 298.
6. J. E. Stiglitz, 'Public policy for a knowledge economy', [www.worldbank.org](http://www.worldbank.org) (Speeches), 2000, fn. 14.
7. J. R. Hicks, *Value and Capital*, Oxford University Press, Oxford, 1939, p. 85.
8. P. A. Samuelson, 'The monopolistic competition revolution', in R. E. Kuenne (ed.), *Monopolistic Competition Theory: Studies in Impact Essays in Honor of Edward H. Chamberlin*, Wiley, New York, p. 117.
9. K. J. Arrow, 'Information and economic behaviour' (original published in 1973), reprinted in *Collected Papers of Kenneth J. Arrow*, Vol. 4, *The Economics of Information*, Blackwell, Oxford, 1984, pp. 136–52.
10. See H. E. Scarf, 'The allocation of resources in the presence of indivisibilities', *Journal of Economic Perspectives*, 8, 4, 1994, pp. 115–16.
11. C. C. von Weizsäcker, 'The costs of substitution', *Econometrica*, 52, 1984, p. 1085.
12. J. A. Schumpeter, *History of Economic Analysis*, Oxford University Press, New York, 1953, p. 631.
13. *Ibid.*, p. 632. This links in interesting ways with, for example, the notion of 'nested' information (F. Dretske, *Knowledge and the Flow of Information*, MIT Press, Cambridge, MA, 1981).
14. D. M. Lambertson, 'Information: pieces, batches or flows?', in S. C. Dow and P. E. Earl (eds), *Economic Organization and Economic Knowledge: Essays in Honour of Brian J. Loasby*, Vol. I, Edward Elgar, Cheltenham, UK, 1998, pp. 209–24.
15. D. M. Lambertson, 'Information economics research: points of departure', *Information Economics and Policy*, 10, 1998, pp. 325–30.
16. The terms *information economy* and *knowledge-based economy* are being used interchangeably. As Machlup said, knowledge is information of indefinite tenure (F. Machlup, 'Optimum utilization of knowledge', *Knowledge, Information, and Decisions: Society*, 20, 1, November/December, 1982, p. 9).

17. Even in the bazaar economy (see C. Geertz, 'The bazaar economy. Information and search in peasant marketing' (original published in 1978), reprinted in D. M. Lamberton (ed.), *The Economics of Communication and Information*, Edward Elgar, Cheltenham, UK, 1996, pp. 78–82.
18. In the spirit of 'catching up with the economy', telecommunications is taken to include basic telephone services, data transmission and complementary activities such as the Internet.
19. See D. M. Lamberton, 'A telecommunications infrastructure is not an information infrastructure', *Prometheus*, 14, 1, 1996, pp. 31–38; 'Infrastructure: a nebulous and overworked construct?', *International Journal of Technology Management*, Special Issue, 12, 5/6, 1996, pp. 696–703.
20. Von Tunzelman adds 'the standard "Washington consensus"—get the investment right [including Foreign Direct Investment (FDI) and health/education] and get civil liberties right, and all will (eventually) be well' (N. von Tunzelman, 'Are poor countries losing the Information Revolution?', *Telecommunications Policy*, 24, 8/9, 2000, p. 800).
21. See, for example, a statement by J. D. Wolfensohn, 'New possibilities in information technology and knowledge for development in a global economy', <http://www.worldbank.org.htm/extdr/extme/jdwsp062400.htm>, 2000.
22. F. Rodríguez and E. J. Wilson III, *Are Poor Countries Losing the Information Revolution?*, World Bank INFODEV, 2000. See also the admirable review of this working paper by Nick von Tunzelman, *op. cit.*
23. P. Lyman, H. Varian *et al.*, *How Much Information?*, University of California Berkeley, <http://www.sims.berkeley.edu/how-much-info/print/html>, 2000.
24. T. Frye and A. Shleifer, 'The invisible hand and the grabbing hand', *American Economic Review*, 87, 2, 1997, pp. 354–58.
25. Similarly, international agencies remain in need of modeling (see J. Tinbergen, 'Alternative forms of international co-operation: comparing their efficiency', *International Social Science Journal*, XXX, 2, 1978, pp. 223–37).
26. J. Van Maanen and S. R. Barley, 'Cultural organization: fragments of a theory', in P. J. Frost *et al.* (eds), *Organizational Culture*, Sage Publications, London, 1985, p. 33.
27. J. K. Galbraith, *The Nature of Mass Poverty*, Harvard University Press, Cambridge, MA, 1979.
28. Rodríguez and Wilson, *op. cit.*, pp. 25–26.
29. Recent reports indicate that the failing iridium venture is finding partial salvation in the needs of a Pentagon global service.
30. The original statistic emanating from the ITU was half the world's population does not live within 2 hours' walking distance of the nearest telephone.
31. J. R. Schement, 'Issues of sovereignty, culture and content', *Asia-Pacific Conference on E-Commerce*, East-West Center, Honolulu, 2000.
32. K. J. Arrow, 'Technical information and industrial structure', *Industrial and Corporate Change*, 5, 1996, p. 651.
33. P. Drahos, 'Global property rights in information: the story of TRIPS at the GATT', *Prometheus*, 13, 1, 1995, pp. 6–19.
34. See Arrow, *op. cit.*, 1973. The information perspective advanced in this paper modifies Arrow's conclusions. The scope of indivisibilities can be extended and appropriability may be enhanced (see Lamberton, *op. cit.*, 1998, fn. 14).
35. P. A. David and D. Foray, 'Information distribution and the growth of economically valuable knowledge: a rationale for technological infrastructure policies', in M. Teubal *et al.* (eds), *Technological Infrastructure Policies: An International Perspective*, Kluwer, Dordrecht, 1996, p. 91.
36. W. Hofkirchner (ed.), *The Quest for a Unified Theory of Information*, Gordon and Breach, Amsterdam, 1999.
37. See D. M. Lamberton, 'The knowledge-based economy: a Sisyphus model', *Prometheus*, 15, 1, 1997, pp. 73–81.

38. The Canadian IDRC program is one of the few efforts along these lines. See M. Menou (ed.), *The Impact of Information on Development*, International Development Research Centre, Ottawa, 1993; P. McConnell (ed.), *Making a Difference Measuring the Impact of Information on Development*, International Development Research Centre, Ottawa, 1995. This program has sought to study events and processes. Statistical agencies worldwide need to tackle quantification of the role of the information/organization/learning nexus. As Carter warned: 'The division of labour between model building theorists and suppliers of off-the-rack data, principally from government sources, is ending. New approaches, perhaps grounded in other disciplines, must be developed to quantify knowledge variables like firm learning, know-how, adaptation' (A. P. Carter, 'Measuring the performance of a knowledge-based economy', in OECD Documents, *Employment and Growth in the Knowledge-based Economy*, OECD, Paris, 1996, p. 67).