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Raising the Standard of Management Education for Electronic Commerce Professionals

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ABSTRACT *The teaching of electronic commerce in universities has become a growth industry in itself. The rapid expansion of electronic commerce programmes raises the question of what actually is being taught. The association of electronic commerce as primarily a technical or information technology (IT) phenomenon has not been sufficient to constrain it to IT and information systems departments. Business schools have been keen entrants into the electronic commerce coursework race and they are developing electronic commerce programmes in an environment where there is no agreed definition of the term. This paper draws on the work of Kenneth Boulding who argued that the dynamics of change in society are largely a product of changing skills and the way these skills are arranged into roles at the organizational level. It is argued that an overly technical interpretation of electronic commerce narrows the skills being acquired as part of formal education. Universities, under pressure from the market and technological change, are changing their roles resulting in a further narrowing of the breadth of issues that is seen as legitimate to be included as electronic commerce. The outcome is that aspiring electronic commerce professionals are not being exposed to a wide enough agenda of ideas and concepts that will assist them to make better business decisions.*

Keywords: electronic commerce, management education, skills, training, universities.

Introduction

The teaching of electronic commerce has been a considerable growth area. Many leading universities in Australia and overseas now have both undergraduate and postgraduate programmes in electronic commerce—often degrees with that title. Growth has been pervasive. For example, in the past couple of years, all five universities in Perth, Western Australia, have now moved to offer teaching in electronic commerce.[1] However, identifying the teaching of electronic commerce as a growth area and making sense of that growth are two different things. Robertson[2] has explored some of the complexity of this. He reviewed electronic commerce programme offerings in a sample of several Australian and overseas universities on offer at the end of 2000, considering concepts such as scope and depth in electronic

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commerce course content. As might be expected, his analysis at aggregate level, was inconclusive. It showed that what is offered as part of electronic commerce programmes follows a breadth of issues ranging from the technical to the social, which in short, reflects the breadth of the term itself. In spite of this, the following observation by Robertson suggests a possible 'blind spot' in existing curricula:

> Relatively few units [subjects] focused exclusively on Legal, Regulatory and Policy Issues. All these topics were however covered to a lesser degree in all universities, most often as a section within an E-Business Strategy unit. Even fewer units were offered that focused on broader societal issues related to technology and EC. It is possible that, as many universities offered the degree out of their Business School, they considered learning about social issues less important than covering other core issues, more obviously related to commerce and business.[3]

The implication is that electronic commerce programmes generally emphasize technical and traditional business themes. Apparently, what is under-represented is content concerning the interaction of technology and society, how this interaction is regulated or indeed the fundamental economic underpinnings of electronic commerce. The assertion is worth examining, even if it only prompts the question of what ought to be taught as electronic commerce. In the discussion that follows, I will restrict my concerns to postgraduate electronic commerce programmes (such as a Master of Electronic Commerce or an MBA which has a specific electronic commerce specialization) in a typical business school. While information technology and information systems schools that offer electronic commerce cannot afford to be solely technical, it is more than likely that the business school will accommodate students aiming at management careers. On that latter point of the relevance of technical material, I fully accept at the undergraduate level an emphasis on more technical skills since new graduates perceive that such skills are often more highly valued by employers. Getting that first job is not easy and it is particularly hard with a general Arts degree. Undergraduates these days vote with their pockets and increasingly postgraduates are doing likewise. This has implications for what one might call education as opposed to training.

The assertion then is that at the postgraduate level there is a drift towards the offering of a vocationally oriented technical and business education in electronic commerce. Indeed, this may even border on training as opposed to education. If this is true, then it seems likely that our future business decision makers may be subjected to a view of electronic commerce that is far too narrow in its outlook. At the centre of this issue are the skills being acquired as part of education by electronic commerce professionals.

The Importance of Skills

Skills are important for two reasons. First, they are intrinsically important as part of the human condition and the process of change. Second, since it is people that make decisions, skills, especially in business, will have a major bearing on the quality of decision-making.

With respect to the first point above, I wish to emphasize the work of Boulding as a theoretically organizing structure for this paper. Boulding places particular emphasis on skills as a central feature of change:

> One may say, therefore, as a long-run tendency that the distribution of power in society is mainly a function of the distribution of skills. It is the dynamic of the distribution of skill which forms, as it were, the long swell on which the shifts of power occur as minor up and downs. Hence, the long-run dynamics of the distribution of power can only be understood as a byproduct of the more fundamental dynamics of the distribution of skill.[4]

Boulding's emphasis on skill is entirely consistent with his view about knowledge in the evolution of society. For Boulding, the skills of individuals fit into roles that are determined by organizations. It is the interplay of skills and roles that determines how well organizations adapt in the long term. A role reflects 'the process whereby political images are created and distributed among the individuals of a society'.[5] Of course, skills are also important at a more immediate economic level since modern production, business organization and competition rely vitally on human resources.[6]

Second, with regard to the quality of decision-making, Loasby (drawing on Boulding[7]), argues that people, in general, have a tendency to limit the width of the agenda (or system boundaries) they consider when making decisions.[8] For the firm, this could come at great cost, since there is a tendency of underestimating the cost of not limiting the width of decision agendas. In other words, one does not know the cost until the width of the agenda is widened. Loasby makes the distinction between operating and innovative decisions, the former requiring a degree of routine and programming, the latter, requiring a much wider agenda and sources of information. My worry, then, as far as electronic commerce is concerned, is that business schools may systematically fail to recognize the width of the agenda associated with electronic commerce. There are various institutional pressures on universities that could bring this about and I will discuss this below. However, I suspect that the width of the agenda is all too often trivialized in business schools. With the weight of technology and vendors pressing hard, business school students are being force-fed an operational agenda as opposed to an innovative one. Such an approach may, paradoxically, not suit the pursuit of innovation—a characteristic prized by electronic commerce firms—since curiosity and subversiveness do not fit the existing power structures.[9] Business schools seem more concerned with promoting the latest technological fad and conveniently ignoring the fact that traditional ways of looking at problems may be no longer adequate for the changes being presented by information and new technology.

In sum, the issue of skills goes much deeper than simply making graduates marketable to industry. It goes to the very core of the role of universities and how knowledge can assist human progress.

The Distortion of Electronic Commerce

A view of electronic commerce that places excessive emphasis on information technology as its defining characteristic is in my opinion a distortion.[10] Wigand explores this distortion when he writes:

> The term electronic commerce is poorly understood and frequently used to denote different meanings, very often depending on the individual's job function, professional orientation and background, focal point of service and type of information technology deployed. One may identify upward of 30

> different technologies that individually or mutually enable electronic commerce. Electronic commerce is, of course, more than the mere use of technology.[11]

In saying this I do not wish to downgrade what is taught in say an IT school which would naturally have an emphasis on technology and its application. My target, rather, is the business school, which ought to have a wider brief. In a sense, this distortion has a disciplinary and professional geography attached to it and indeed, deeper philosophical roots. Associated with this geography is a techno-boosterism promoting the potential impact of such technologies, a strong dose of techno-determinism, and an underdeveloped analytical framework for understanding the political, economic and social dimensions of technology. Philosophically, I suspect the distortion has its roots in the overlap and confusion of explanation about how we label social and physical phenomena. It would seem as though electronic commerce (and indeed the interface of IT with society) is beset with the same explanatory and ideological difficulties that has troubled economists[12] and psychologists.[13]

Wiredlife,[14] a recent excellent book by Charles Jonscher, critiques much of the overstated claims of IT enthusiasts and represents a response to this distortion. Jonscher's criticisms in his book go well beyond just electronic commerce. As an example of what I'm talking about, the following extract from Jonscher about the productivity paradox gives some idea of the unsubstantiated 'hope' of IT:

> Hopes are high for a network-led solution to the problem of sluggish productivity growth. The technology industry has introduced the idea that we are entering an era of 'e-business'. This encompasses a wide range if ideas from the increased use of electronically supplied information for taking business decisions to the integration onto a single automated system of the cycle from customer enquiry to order fulfillment. The talk is of a comprehensive restructuring of the distribution of goods and services around an electronic infrastructure. [15]

However, Jonscher deflates this 'hope' by placing it in a broader setting by arguing that we cannot simply think that the computer is a direct replacement for human skills and the human mind:

> The failure of information technology to produce a decisive uplift in economic productivity or in quality of consumer entertainment has taught us a striking lesson which it would be well to bear in mind during the next round of technology deployment. It is confirmation, by way of world-wide trillion-dollar trial, that it is and will be much more difficult to automate what we do with our minds than it was to automate what we do with our hands. We should see this not as a failure of technology but as a tribute to human skills.[16]

I do not wish to claim that this distortion infects all teaching of electronic commerce. When it does, it is most likely to manifest itself in a typical business school in a number of ways, for example: an emphasis on vocational training as opposed to broader education; a view that an optimistically large amount of the information aspects of business activity can be codified and easily communicated via electronic networks; a neglect of the fact that computers are a derived

demand;[17] and adherence to traditional disciplinary-bound non-technical subjects that do little to throw new light on the changing nature of business, by this I include a better understanding of the economics of information.[18] A distorted interpretation of electronic commerce gives rise to thinking that is all too familiar. The Tuesday edition of *The Australian* newspaper has for many years been a repository of so-called news stories which seem to be often based on IT company press releases. One has to look further for more reasoned analyses.[19] To the extent that such reasoned analyses are not valued by business schools, students will suffer.

I will turn my attention to some of the external pressures on universities that may limit the way electronic commerce is interpreted.

Pressures on Universities

The modern university is being pressured in many ways, including stresses from the market, a diverse range of 'clients' that are being served and broader social processes that undermine critical research.[20] So while universities contain individuals with different skills, as organizations they require individuals to play different roles. These roles, if we follow Boulding's argument, are in turn shaped by the 'image' that is adopted by the organization. Universities have been subjected, not only in Australia but elsewhere, to significant pressures that have altered their image of themselves and the image projected to the broader public, industry and government. The pressures on universities discussed below can be interpreted as subtle stresses altering the traditional image of universities and consequently the roles that individuals are being asked to play.

The market is having a range of impacts on universities and the teaching of electronic commerce. In Australia (and other countries), declining government funding has meant that full fee-paying postgraduate courses have become the norm. The notion (or image) of the 'for-profit' university is being increasingly aired by senior university managers. What might this mean for the teaching of electronic commerce? The push for income has meant that universities have followed the path of other industries and adopted ways of 'getting close to the customer'. In practice this brings with it certain risks since universities may not be fully able to appreciate the strategic implications of their actions.[21] Students paying high fees seek a quick return on their investment and so electronic commerce programmes take on a vocational feel. The IT sector, keen to sell its machines and suffering from the widely publicized 'IT skills shortage', is also seen by students as the most likely provider of hard to get jobs. The result of the nexus between universities seeking income, students seeking jobs and companies with equipment to sell has seen some universities forging links with the private sector in the provision of content. It has been estimated recently that some 100 IT companies in Australia gave more than $140 million in 'services and cash to universities, schools and TAFE [Colleges of Technical and Further Education]'.[22] While it can be argued such interactions are 'at arms length', some universities have forged close links with the private sector in electronic commerce.[23] Even at postgraduate level, students find vendor-based training attractive, first because of the promise of immediate employment and second because it introduces students to the notions of computer networking (the infrastructure of electronic commerce). Such programmes, while vocationally sound, may contribute to the unintentional furthering of distorted thinking about electronic commerce, in business schools especially, by dominating valuable time and resources in a sea of ephemera and

technicality. This point is made by John Ralston Saul in his book, *The Unconscious Civilization*:

> Basic technical training is, of course, useful. But to treat it as anything more than that is to lock students into technology that will be obsolete by the time they graduate. The time wasted will also deprive them of the basic training in knowledge and thinking that might help them adjust to the constant changes outside.[24]

Related to the potential domination of content by the private sector, one must look to the content that is being produced as part of textbooks for electronic commerce students. Of this variety there are many and it is a rapidly expanding business. However, it would seem that many such textbooks approach electronic commerce in a rather limited way and do little to add a critical and questioning perspective.[25]

Business schools are also probably contributing to a willing acceptance of a distorted view of electronic commerce.[26] According to Saul, business schools are partly to blame:

> Why is the largest and best-educated elite in that history so insistent on handing the power—which we won and entrusted to them—over to an abstract, self-destructive ideology? One possibility is that we are blocked by a combination of technocratic management and technocratic speculation. The technocratic management, produced mainly by business schools and departments of economics, is most comfortable functioning in large management structures.[27]

Under the constraints of technocratic pressures, it is possible, as Noam has argued, that universities in the future will gravitate towards two levels: either research-based institutions or accreditation-based institutions.[28] Given funding pressures, it would seem that even the best Australian universities may have difficulty in maintaining standards in a drift towards accreditation as they bid to attract student and industry dollars. In such an environment, local issues could start to dominate university curricula over more global ones, despite the fact that electronic commerce is a global phenomenon.[29] The result could well be a seedbed for the latest fads, low-grade administrative type research at the expense of critical research[30] (if there is any research at all) and corporate dominated 'off-the-shelf' content and teaching packages. Accreditation implies a relationship with industry that may run counter to the broader goals of the university. The fear that universities may compromise their important social role of promoting society with options and choices for the future in the face of creeping professionalization was highlighted by Carey years ago.[31] Such concerns have not retreated, especially in the face of on-line education[32] and seem to be conveniently ignored by proponents of the 'for-profit' university.

Skills of the Electronic Commerce Professional

If my concerns are founded, such a distortion can pose a real threat to the quality of education being offered in the electronic commerce area. Despite this, a clear understanding of the skills needed by electronic commerce professionals is

necessary if planning is to be effective. Mansfield and Joseph[33] categorized three general areas where skills planning in the global information industries could be focused: skills at the technical level; skills at the service level; and skills at the corporate level. I will review their conclusions here since I still think they have considerable relevance to today's electronic commerce environment.

Mansfield and Joseph emphasize the influence of convergence which acts to blur boundaries at the technical, service and corporate level. For example, at the technical level, it is not only necessary for professionals to understand the requirements of technology *per se* but 'competitive pressures based on quality of service, pricing, marketing, and demand considerations will require that they be acquainted with these issues in order to effectively participate in teams or projects'.[34] With respects to skills at the service level, convergence is 'making it difficult to distinguish the various information industry sectors solely on the nature of their service and how it is communicated'.[35] The implication at the service level is that cross-disciplinary skills are needed. Finally, at the corporate level, the restructuring of the global information industries implies that 'future managers will have to be conversant not only with investment opportunities but also with cultural factors and regulations at the international level'.[36] Mansfield and Joseph identify a number of major themes from their consideration of the three skill areas:

- specialist knowledge of a disciplinary area will continue to be important;
- there will be increasing pressure for professionals to have some knowledge of related disciplines;
- multi-skilling will continue to be an important feature of human resource development;
- the progress of digitization will require more widespread knowledge of technology; and
- the ability to manage projects and work in teams will be increasingly important.

In sum, electronic commerce is a field that will require skills emphasizing multi-skilling, cross-disciplinary knowledge and awareness as well as knowledge of technology. As discussed above, a distorted interpretation of electronic commerce may trivialize the important relationships that managers have to deal with. In fact, I would go as far as saying that this distortion may act to place a strong ideological slant on the relationship between technology, business and society.

Discussion: In Defence of a More General Approach to Electronic Commerce

If the assertion of this paper is correct, the closer a university tends towards an accreditation role, the greater will be its openness to a distorted view of electronic commerce. Its staff and students will be unable to make discerning judgments about new technology and its social and business impact, and even less able to appreciate why such judgments are important. In short, this reflects a narrowing of the width of the agenda in the decision-making process. For the most part, many business schools may be comfortable with the production of 'bell wethers'[37] for the next generation of electronic commerce technologies. However, there will be other business schools that may not and it is precisely these that may prosper in the long run, especially as the technology of electronic commerce becomes more ubiquitous and firms seek employees with broader skills to solve 'real world problems'.

Is it too much to expect universities to change the direction of their market-oriented images and roles? The following quote from Paul Krugman suggests that it may not be easy for either universities, business schools or the vendors of electronic commerce solutions to change:

> As H. L. Mencken once pointed out, it is difficult to get a man to understand something when his income depends on his not understanding it.[38]

However, the shallowness of narrow technical interpretations of electronic commerce may eventually be seen through. It is likely that industry is gradually seeing the value of recruiting graduates with a broader perspective, although it is far from clear how different skills should be mixed.[39] It may be that individual teaching staff, aware of the breadth of electronic commerce, may be able to introduce innovative change. Until such time that a more sophisticated appreciation of electronic commerce is accepted, such change that does not fit well with existing organizational power structures may need to be intelligently handled. Some suggestions follow.

First, the distinction between skill improvement and training may need to be sorted out in some institutions. This may depend on local culture and practices but I suspect it is tied up with the general image of universities as either research or accreditation focused. It may go deeper than this, requiring some universities ceasing to suffer from organizational hallucination[40]—where their projected image seems to have little relation to what they are actually doing.

Second, there may be value in recognizing that postgraduate education will be self-selecting.[41] In other words, students will gravitate to courses and attitudes that reinforce their pre-existing images. The following quote from a report about science, technology and society education in the UK from over 20 years ago, underlines the fact that entrenched attitudes are difficult to change:

> . . . another [student] hinting at the negative preconceptions of his colleagues suggested that a course called 'Technology and Society' would attract more students if the word 'Society' were removed from the title.[42]

A broader appreciation of electronic commerce could be achieved at either of two levels without being particularly affronting to the student's preconceptions. It could appeal to the 'employment line' where a more critical, contextual approach is valued since it could be argued convincingly that 'well-rounded people are always needed for business'. Alternatively, teachers could 'engage with students from where they are', modelling real world problems and demonstrating the need to understand 'other languages' and disciplines to solve such problems.

Finally, one of the most resistant areas may be the attitudes of existing electronic commerce teaching staff themselves. To the extent that electronic commerce has been interpreted as a technical issue, business schools have often attracted staff with a very technical outlook. If business schools are to move further away from technocratic prescriptions for electronic commerce and accreditation, staff continuing to prefer 'the inconveniently familiar to the conveniently unfamiliar' could be a real obstacle to change.[43] On this point, the words of J. K. Galbraith are an ominous warning:

> When not able to grasp an idea, practical men take refuge in the innate superiority of common sense. Common sense is another term for what has always been believed.[44]

It is precisely the commonsense nature of electronic commerce that makes it so resistant to change. It is precisely this challenge that makes educational change all the more imperative.

Notes and References

1. The five 'local' universities in Perth are: University of Western Australia; Curtin University of Technology; Murdoch University; Edith Cowan University; and the private Notre Dame University in Fremantle.
2. Grant Robertson, 'Developing a curriculum assessment framework for Masters of Electronic Commerce programmes', unpublished C612 Master of Electronic Commerce Research Project, School of Business, Murdoch University, 2000.
3. *Ibid.*
4. Kenneth E. Boulding, *The Image*, The University of Michigan Press, Ann Arbor, USA, 1956, p. 106.
5. *Ibid*, p. 103.
6. Una Mansfield and Richard Joseph, 'Restructuring of the global information industry and the resulting demand for new skills', in M. Lotstrom and D. Wedemeyer (eds), *Proceedings of the Pacific Telecommunications Council Fourteenth Annual Conference*, 12–15 January 1992, PTC, Hawaii, 1992, pp. 615–21.
7. Kenneth E. Boulding, 'The ethics of rational decision', *Management Science* (Series B), 12, 1966, pp. 161–69.
8. Brian Loasby, *Choice, Complexity and Ignorance*, Cambridge University Press, Cambridge, 1976.
9. Don Lamberton, 'Just say no: why dissent is good for your business', *Boss* (*The Australian Financial Review*), 1, 8, 2000, pp. 30–32.
10. An excellent paper which widens the interpretation of electronic commerce is R. T. Wigand, 'Electronic commerce: definition, theory and context', *The Information Society*, 13, 1, 1997, pp. 1–16. Wigand identifies five conceptual approaches to electronic commerce: transaction cost theory; marketing; diffusion; information retrieval; and strategic networking.
11. *Ibid*, p. 5.
12. Geoffrey M. Hodgson, *Economics and Evolution: Bringing Life Back into Economics*, The University of Michigan Press, Ann Arbor, 1996.
13. Leslie Brothers, *Mistaken Identity: The Mind–Brain Problem Reconsidered*, State University of New York Press, New York, 2001.
14. Charles Jonscher, *Wiredlife: Who Are We in the Digital Age?*, Anchor, London, 2000. The back cover of *Wiredlife* (a paperback) carries a reviewer's comment from the *New Statesman* that '[the book is] . . . mercifully free of the sort of cyberbollocks that infest so much writing on the subject'.
15. *Ibid*, p. 200.
16. *Ibid*, p. 209.
17. This is an economic term that reflects the fact that the demand for computers is based on the need to meet other business demands. For a fuller discussion of research issues relating to the economics of information see comments by Lamberton in House of Representatives Standing Committee for Long Term Strategies (1991), *Australia as an Information Society: Grasping New Paradigms*, Australian Government Publishing Service, Canberra, 1991, pp. 18–19.
18. In 1998 when postgraduate teaching in the Master of Electronic Commerce and Master of Science in Telecommunications Management at Murdoch University commenced, students

were given a Special Topics unit on 'The Value of Information'. Some complained that they did not understand what relevance 'the value of information' had to the degree they were taking.

19. I am referring to journals such as *Prometheus* and *Failure and Lessons Learned in Information Technology Management* which provide a more critical view. There are a growing number of books and articles that put the case for a wider agenda: Gene I. Rochlin, *Trapped in the Net: The Unanticipated Consequences of Computerization*, Princeton University Press, Princeton, NJ, 1997; S. Macdonald, D. Lamberton and T. Mandeville (eds), *The Trouble with Technology*, Frances Pinter, London, 1983; S. Macdonald, *Information for Innovation: Managing Change from an Information Perspective*, Oxford University Press, Oxford, 1998; and Anthony G. Oettinger, 'Knowledge innovations: the endless adventure', *Bulletin of the American Society for Information Science and Technology*, December/January 2001, pp. 10–15.
20. For an interesting discussion of these pressures see Ian Reid, *Higher Education or Education for Hire?*, Central Queensland University Press, Rockhampton, 1996.
21. Stuart Macdonald, 'Too close for comfort?: the strategic implications of getting close to the customer', *California Management Review*, 37, 4, 1995, pp. 8–27.
22. Patrick Lawnham, 'IT industry fills teaching gaps', *The Australian*, 22 August 2001, p. 31.
23. For example, Curtin University has links with Optus. Murdoch University is a Cisco Systems Networking Academy and has links with Microsoft also.
24. John Ralston Saul, *The Unconscious Civilization*, Penguin, Ringwood, 1997, p. 142.
25. This point is expanded in Timo Vuori, Grant Robertson and Richard Joseph, 'Towards a taxonomy of electronic commerce: implications for strategy', paper prepared for the International Telecommunications Society's Regional Conference, Perth, Western Australia, 2–3 July 2001. Examples of textbooks cited in the above paper include: Ravi Kalakota and Andrew B. Whinston, *Electronic Commerce: A Manager's Guide*, Addison-Wesley, Reading, MA, 1997, p. 3; and Efraim Turban, Jae Lee, David King and H. Michael Chung, *Electronic Commerce: A Managerial Perspective*, Prentice-Hall, Upper Saddle River, NJ, 2000. While these books are now benchmark texts in electronic commerce teaching, my concern is that they treat electronic commerce and its problems rather descriptively.
26. Saul, *op. cit.*
27. *Ibid*, pp. 123–24.
28. Eli M. Noam, 'Electronic and the dim future of the university', *Science*, 270, 13 October 1995, pp. 247–49.
29. Kenneth E. Boulding, 'The university and tomorrow's civilization: its role in the development of a world community', *Journal of Higher Education*, XXXVIII, 9, 1967, pp. 477–83.
30. Robert McChesney, 'The Internet and US communication policy making in historical and critical perspective', *Journal of Communication*, 46, 1, 1996, pp. 98–124.
31. James W. Carey, 'A plea for the university tradition', *Journalism Quarterly*, 55, 4, 1978, pp. 846–45.
32. John Palattella, 'Making cents of a market', *The Australian*, 22 August 2001, pp. 34–35.
33. Mansfield and Joseph, *op. cit.*, pp. 615–21.
34. *Ibid*, p. 618.
35. *Ibid.*
36. *Ibid.*
37. A bell wether is an old sheep with a bell around its neck that leads other sheep to slaughter. I have coined this phrase from Ian Reinecke, 'The trouble with techno speak', in Macdonald *et al.*, *op. cit.*, pp. 193–201. He refers to facilitators as bell wethers whose 'job is to facilitate the introduction of computer technology by convincing the rest of the workforce that it is in their interests not to oppose it' (p. 200).
38. Paul Krugman, *The Accidental Theorist and Other Dispatches from the Dismal Science*, WW Norton and Co, New York and London, 1998, p. 61. I am indebted to Don Lamberton for alerting me to this reference and a number of other citations used in this paper.
39. Wendy Currie, *The Global Information Society*, Wiley, Chichester, 2000, pp. 222–51.

40. Boulding, 1956, *op. cit.*, p. 101.
41. The ideas in this paragraph are based on a valuable discussion in Perth, WA, with Professor Ken Green from the University of Manchester Institute of Science and Technology (UMIST), 5 December 2001. I am indebted to him for his insights on the practical side of teaching in a business environment.
42. C. M. L. Miller, Russell Moseley and Glyn Ford, *The Impact of Science and Technology Courses in Higher Education*, University of Sussex Education Area Occasional Paper No. 7, University of Sussex, UK, 1980, p. 17.
43. Kenneth E. Boulding, 'Preface', in Kenneth E. Boulding, *A Reconstruction of Economics*, second printing, Science Editions, New York, 1965.
44. John Kenneth Galbraith, *Money: Whence it Came, Where it Went*, Andre Deutsch, London, 1975, p. 230. It is, of course, unfair, to lay the blame on technicians. Some of the most incisive recent comments on the limits of computerization have come from technically-trained people such as Jonscher and Rochlin (cited above) who have used their knowledge of technology to critique it. For many academics from non-technical disciplines, bridging the knowledge gap seems to have been a major obstacle. Unfortunately, the critical study of technology, in many academic disciplines, seems to be often relegated to a sub-theme. The exception is, of course, the interdisciplinary field of science and technology studies.