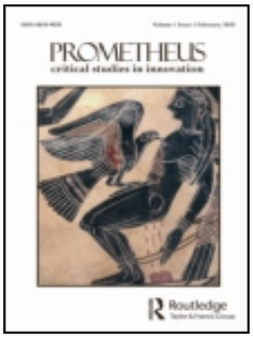

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RESPONSE

Minerva's owl. A response to John Houghton and Charles Oppenheim's 'The economic implications of alternative publishing models'

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Introduction

> Like Hegel's owl of Minerva, scholars are arriving at the realization of the existence of the knowledge economy after dusk. (Drahos and Braithwaite, 2002, p. 39)

Houghton and Oppenheim's cost–benefit analysis of different forms of scholarly publishing is a major contribution in considering the case for open access and for open institutional repositories as a standard resource in publicly-funded universities. Understanding these issues through empirically-informed profiles of national systems of research and innovation is a significant advance, but to focus only on this is to be distracted from significant and more general issues about the ways in which knowledge is produced, particularly in universities, and the requirements and opportunities for such work in the contemporary knowledge economy. As with Hegel's owl of wisdom, the true meaning of major new ways of doing things can only be appreciated later in the day, when both the innovation and its implications are clearer.

Written almost a decade after Drahos and Braithwaite's searing critique of the new political economy of knowledge, Houghton and his collaborators' work has stimulated intensive debate. Much of the fury of the debate, and particularly responses from the publishing industry, has been about the detail of the inputs into a complex cost–benefit model. The extent to which the cost–benefit analysis approximates reality is without doubt important.

In what follows, I will draw out some specific aspects of Houghton and Oppenheim's cost–benefit analysis in order to explore these wider issues. I will start with Houghton and Oppenheim's 'scholarly communication lifecycle model', a complex and extensive flow diagram that tracks the evolution of knowledge from conception to publication and dissemination. While this model is primarily used as the basis for the cost–benefit analysis, is it an adequate proxy for the ways in which knowledge 'works' in a wider sense?

In giving substance to some wider implications of scholarly communication, I will pick up on one aspect of Houghton and Oppenheim's cost–benefit analysis which seems to me to be underemphasized in both their analysis and in some of the rebuttals

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by publishers' lobbyists. This is the substantial, but informal, public investment in the present system of scholarly publication. I am not here concerned with the ethics of public funding that results in private shareholder benefit (although this is certainly an issue in its own right). My question is rather whether the present form of public investment into scholarly publishing is the best way of ensuring returns for the wider knowledge economy.

Seen from this perspective, the core problem with subscription publishing may not be that it is more expensive than open access, but rather that publishers extract rent – 'tolls' in Houghton and Oppenheim's model – at points in the lifecycle of scholarly knowledge production where they work against some of the key qualities that make knowledge potent in changing the world. In contrast, open access publishing is a return to the long established 'invisible colleges' of knowledge creation and distribution that link scholars through research collaboration, conferences and publication. It is reasonable to predict that future opportunities for commercial publishers include providing specialist knowledge aggregation services that offer the full strength of evolving information and communication technologies, rather than restricting the use and distribution of knowledge through subscriptions enforced by legal protections.

Public subsidies, private benefits

Houghton and Oppenheim's analysis is built on Björk's scholarly communication lifecycle model (Björk, 2007) extended by Houghton and his colleagues, and available dynamically at http://www.cfses.com/EI-ASPM/SCLCM-V7/. The model is built around five key stages, each with its own inputs and outputs: fund research, development and communication; perform research and communicate results; publish scientific/scholarly works; facilitate dissemination, retrieval and preservation; study publication and apply knowledge.

This is a work in progress, originating in Björk's founding structure and in continuing development online. In its current form, the model includes both specific inputs and outputs which underpin the cost–benefit analysis, and also the general incentives and flows of ideas which constitute the worldwide networks of collaboration that define academic life. Thus, the first key stage in the model – funding research and development and communication – has the specific inputs of block and competitive grant funding, contract funding from commercial and government agencies and NGOs, and donations and philanthropic grants. But the same set of activities is also informed by general incentives and determinants: 'society needs', 'commercial needs', 'norms of science/scholarship'. Similarly, the next key stage – performing research and communicating the results – has as inputs 'economic incentives', 'scientific/scholarly curiosity', 'existing knowledge' and 'scientific/scholarly problems'. For the purposes of the discussion that follows, it is useful to differentiate between calibrated inputs and outputs, which provide the basis for Houghton and Oppenheim's cost–benefit analysis, and the more general descriptors of aspects of academic work. Following Latour (2005), we can call the former 'objects' (data sets, contracts, patents, rule sets, etc.), and the more general descriptors 'agencies' (actions, perceptions, figurations, incentives, etc.). I will argue that future iterations of the scholarly communication lifecycle model will need to differentiate more clearly between objects and agencies if the intentions of this analytical approach are to be fully realized.

Houghton and Oppenheim's use of the scholarly communication lifecycle model focuses almost entirely on the properties of its objects. Here, the key finding is the contrast between the averaged cost of a journal paper sold as a subscription by a commercial firm, and the costs of the same paper published on an open access platform. For electronic-only publication, Houghton and Oppenheim estimate the direct costs at £2335 for subscription publishing and £1525 for open access publishing – a 35% saving. In the second step of their analysis, Houghton and Oppenheim estimate the full economic cost of production by taking into account all the key phases of the scholarly communication lifecycle; the history of an idea from its point of origin through until its dissemination as a formal and codified expression of new knowledge. The full economic cost for subscription publishing and open access publishing is, respectively, £8295 and £7485 – a difference of about 10%.

Most challenges to these conclusions are against the inputs rather than against the model itself. As Houghton and Oppenheim observe, 'criticisms fall into two broad groups. The first is that certain costs have not been taken into account in the model; the second is that some of the figures in the model are incorrect'. For example, Steven Hall, writing on behalf of the publishing industry and against the full JISC report, contests the veracity of a considerable number of objects; author-side payment processing costs, sales administration and online user management costs, rights management costs, marketing costs, online hosting costs, library savings, savings in authors' fees, estimated returns for research and development (Hall, 2009). These criticisms have, in turn, been answered to the extent that this is possible, given that commercial journal publishers do not release the details of costs and benefits on their side (JISC, 2009).

Given the assumptions that must be built into a generalized model such as the scholarly communication lifecycle, it is possible that the differential between subscription and open access publishing could be argued further, and perhaps reduced to an approximate parity. Would this be the end of the case for open access publishing? Put another way, Houghton and Oppenheim estimate that the 10% differential between open access and subscription publishing cost the UK's research and development system £80m in 2007. But if the differential had been zero, would this have been the end of the issue?

The answer must be no. This is because, at parity between subscription and open access publishing, the scholarly communication lifecycle is kept afloat by a substantial amount of public investment. Much of this public spending is via block research grants (based on the outcomes of the last Research Assessment Exercise) and Research Council grants made to universities and research teams working in universities. A fully commercial model for scholarly publication would need to show how the investment of public funds as subsidy for private companies can give a better return than if these same public funds were used to enable open access publishing and institutional repositories.

To understand this better, reference needs to be made to the full report of this work (Houghton *et al.*, 2009, Tables S-I and S-II). This analysis estimates the total cost of the scholarly communication system in the UK in 2007 both nationally, and to the higher education system. For universities, such costs include the time spent by academic staff reading relevant materials, direct writing time, preparing and reviewing research grant applications for the major research councils and the Wellcome and Leverhulme Trusts, time spent writing peer reviews for publishers, unremunerated

editorial board activities and direct charges by publishers. Summing these costs suggests that scholarly publishing system activities may have cost UK higher education around £4.8 billion during 2007. To this direct investment was added the benefits from the surrender of commercial rights over these outputs, and the cost to universities of buying back access rights to publications via institutional subscriptions. Profits made by commercial publishers were passed to shareholders via dividends.

If full economic cost recovery were to be applied to these scholarly activities, using Higher Education Funding Council principles of transparent costing, then it could be argued that this outlay should be recovered from commercial publishers, perhaps through a form of aggregate arrangement similar to that long used by publishers to charge universities for copying journal papers for use in student course readers. This would probably have the effect of destroying the current settlement, either by driving up journal subscription charges (which have long tended to increase above the general level of consumer inflation) to levels unaffordable by universities, or by reducing profit margins to an unacceptably low level for shareholder accountability.

The point here is that, contrary to some of the counter-arguments from the publishing industry, it is neither a complete justification nor an adequate rebuttal to show that open access publication is cheaper than subscription publishing – or that the two approaches cost much the same. This is because the public investment made via universities contributes both to the narrower inputs (to the objects in the model) and at the same time enables the more general benefits – the agency effects, such as responses to social and commercial needs, scientific curiosity and the dissemination of knowledge. A true comparison between the system of open access publishing and repositories and the for-profit, subscription model of publishing would require that the investment in public funding was either factored out, or corrected by means of a return on the investment through profits from sales. This would require that subscription publishing was at least £5 billion cheaper than open access across the UK's scholarly output system as a whole.

Intangible capital

What about the broader variables in Houghton and Oppenheim's model – those that, for convenience, I have designated agencies? These are currently placeholders in the model, redolent with unrealized potential. Expanding on these possibilities requires some consideration about the properties of knowledge and the nature of the knowledge economy.

Houghton and Oppenheim describe the knowledge economy as one in which

> the generation and exploitation of knowledge has come to play the predominant part in the creation of wealth. It is not simply about pushing back the frontiers of knowledge; it is also about the more effective use and exploitation of all types of knowledge in all manner of economic activities.

This, though, is to miss the essential presence of 'intangible capital'. In Dominique Foray's invaluable *Economics of Knowledge*, a knowledge-based economy is one in which 'the share of intangible capital is greater than that of tangible capital in the overall stock of real capital' (Foray, 2004, p. ix). The key element of intangible capital is inherent, but underdeveloped, in the agency aspects of Houghton and Oppenheim's

model. Inputs and outputs such as 'existing knowledge' and 'new knowledge', 'society needs', 'scholarly curiosity' and 'improved quality of life' have the potential of connecting the scholarly communication lifecycle model – Houghton and Oppenheim's Figure 1 – with our increasing understanding of how far broader academic networks are contributing to, and constituting, the knowledge economy.

As intangible capital, knowledge has particular properties. First, it is 'partially nonexcludable and nonrival' (Foray, 2004, p. 15), meaning that it is difficult to restrict and control in the manner of conventional commodities, and that it may be used by many at little or no additional cost and without being used up, as in Thomas Jefferson's observation that 'he who receives ideas from me, receives instruction himself without lessening mine; as he who lights his taper at mine receives light without darkening me'. Secondly, knowledge gains in value through being cumulative, and through 'combinatorial explosions'. This means that the more freely available knowledge is, the more likely that paradigm-breaking conjunctions will occur as, for example, in the advances in modern medicine that have followed from the conjunction between the biological sciences and the properties of binary code: 'the properties of nonexcludability, nonrivalry, and cumulativeness have features akin to quasi-infinite increasing returns' (Foray, 2004, pp. 16–17).

A key factor enabling the knowledge economy is the growth of the ability to codify knowledge – to express knowledge independently of the person holding it, allowing the multiplication of copies. Here, of course, academic outputs in the form of journal articles and monographs are a classic manifestation of both codification and formal verification of quality. Codification leads in turn to spillovers, or knowledge externalities: 'any original, valuable knowledge generated somewhere that becomes accessible to external agents' (Foray, 2004, p. 91). This creates positive externalities – widescale benefits to others. And, of course, the technological platforms for contemporary, intangible capital are new, and ever developing, information and communication technologies. Together, the growth in intangible capital and the development of information and communication technologies have 'spawned a unique economy, characterized essentially by an increase in the number of agents capable of producing, diffusing and absorbing knowledge, and a substantial decrease in the marginal costs of information and knowledge processing' (Foray, 2004, p. 35).

Drahos and Braithwaite (2002, p. 198) capture both the nature and potential of the intangible capital that the knowledge economy generates:

> if you came to own a patent in a genetically engineered cow that produces twice as much milk as existing cows, you had an asset that was equal in value to all the herds of all the world's dairy farmers. And a more liquid asset than all that milk and all those cows.

To restrict discussion and debate around the scholarly lifecycle communication model to the objects that constitute the cost–benefit analysis is to risk disassociation from the far wider properties and possibilities of the knowledge economy carried by the agency factors in the model. Rather than just measuring the costs and benefits of a dairy herd, the knowledge economy offers the possibility of restructuring the cow, making all previous approaches to milk production redundant. Should, then, public investment be used to subsidize the dairy farmer, or to enable the scientific community to have the best possible access to the knowledge it needs to transform the genetics of food production?

Knowledge tolls and rents

A distinction which is important to the knowledge economy is that between private returns on investments that can be channelled to designated beneficiaries (such as shareholders in publishing companies, or scientific societies that retain surpluses from publishing) and public, or open, returns that have wider and far more diffuse benefits. Foray (2004) shows that returns on investments in the production of knowledge are likely to have far more substantial 'open' benefits than private advantages. This stems from the characteristic of non-excludability – the difficulty of keeping knowledge to yourself, and the diminishing value of your asset as you try to do so. This, of course, is also a fundamental property of the lifecycle of scholarly knowledge; once you have discovered something, or have reinterpreted an aspect of your field of expertise, the whole point is to get it published and to reap the benefit of your peers attributing the insight to you by means of the conventions of citation. The benefits of non-excludability are amplified by the fact that knowledge is not exhausted through use (non-rivalry) and cumulative effects.

There are many situations in which the net private marginal gain is less than the net open marginal gain because services are available to a third party from whom payment cannot be obtained (Foray, 2004). Again, this general point can be illustrated from the specifics of scholarly publication. While commercial publishers attempt to limit the numbers of readers who will have access to a subscribed e-journal through prohibiting downloads by those who are not employees or registered students, in practice there is substantial spillover. Where institutions post post-prints in open access institutional repositories, the gain from private users (paying subscribers) may be far less than the open gain from those who are walk-in library users, or who log into an institutional repository:

> it is basically the uncontrollability, nonrivalry, and cumulativeness threesome that accounts for the importance of social returns to research and innovation, and that makes these activities an essential basis for growth. Measurement of social returns to research generally give extremely good results. (Foray, 2004, p. 114)

Armed with these additional aspects of the knowledge economy, we can return to Houghton and Oppenheim's model of costs and benefits in the scholarly communication lifecycle, and in particular their Figure 2. This compares the subscription and open access publishing models on a time trajectory. Open access publishing (coupled with self-archiving and pre-print availability) provides almost immediate access to newly codified and verified knowledge. In contrast, access to subscription published knowledge is time constrained and restricted, because the onus of gaining access rests with the user. Figure 2 shows this gateway as managed via the legal constraints of licensing and copyright permissions, and the financial constraints of affordability. To re-appropriate the old metaphor, these three interlinked dimensions – time to use, cost to use, and freedom to use – serve as ways of describing the topography of knowledge superhighways. A knowledge highway rider starting a journey with free, immediate and unrestricted access to knowledge knows that there is an open road ahead. A rider who sets off without these permissions secured knows that, at various points, there will be delays while licences to continue are obtained and fees are paid.

In this respect, Houghton and Oppenheim's characterization of subscription publishing as a 'toll' is apt. A toll is a form of relational rent (Kaplinsky, 2005) taken

on a value chain, in this case of the scholarly communication lifecycle. Such relational rents in the publishing industry are distinct from the return on the knowledge resource itself. This is because copyright licensing, the basis for deriving the toll (or rent), is only the vehicle through which knowledge is presented or distributed (the printed form of the journal, or book, or the electronic version of the final product) and not the knowledge itself – a key distinction that permits post-prints to be lodged in institutional repositories without legal consequences.

As such, rents recovered on knowledge via subscription publishing are a sub-set of the more general returns on media distribution, including music and film, so ably critiqued by Drahos and Braithwaite almost a decade ago. As they point out, the particular value of copyright as a source of revenue is that rights over reproduction are constantly renewed resources, offering the opportunity of perpetual income (in the form of rents) with negligible renewal or transactional costs. Information

> could be endlessly recycled, repackaged and, provided the rules were properly defined, endlessly charged for. In this world every information transaction would attract a fee of some kind and the transaction would be repeated as many times as possible. In this world, unlike the commodity markets, the consumer could never actually own the information, but merely pay for its use. (Drahos and Braithwaite, 2002, pp. 58–59)

To summarize: based on Houghton and Oppenheim's cost–benefit analysis of aspects of the scholarly communication lifecycle, which we can now see as a standard form of value chain that produces intangible capital for the knowledge economy, there is an annual investment of £5 billion in public funds (based on 2007 costs). Knowledge resources characteristically have very high up-front costs; the return comes from the ability to move around large amounts of data at minimal expense (the contribution of ever-developing information and communication technologies). The return also comes from the inherent qualities of knowledge itself, particularly its non-rivalrous nature (it can be used infinitely without being consumed), spillover effects (many side benefits) and exponential tendencies – the cumulative effect that leads to knowledge explosions, such as the convergence of binary digital code and the biological sciences. Subscription publishing, as with media industries more generally, provides diminishing service additions (because electronic publishing removes much of the friction of printing, distribution and marketing) and is becoming more like a simple form of relational rent, enforced legally through copyrights.

Invisible colleges

Despite the friction that the tolls from subscription publication seem to impose on the value chain of the development of scholarly knowledge capital, is open access publishing founded in a viable alternative system that enhances the essential qualities of knowledge in the knowledge economy? Is it the case that the services offered through commercial publishing, even if they are a diminishing proportion of the value proposition, are still a better alternative?

Some defenders of subscription publishing (such as Hall, 2009) assume that, with open access publishing, the principles of market competition will still apply. In this interpretation, open access publishers will compete with one another to attract both authors and readers, necessitating the mechanisms and expenses of marketing at conferences, publicity, web-based marketing, and so on. But would this necessarily be so? As already mentioned, one strength of open access publishing is that aspects of

the model are a return to pre-commercial forms of scholarly exchange. In this system, the emphasis is on giving away codified knowledge, validated by means of peer review, in return for reputational benefits.

This set of conventions has been mapped by Paul David, in the context of the dynamics of the knowledge economy (David, 1998, 2003). Building on Merton's classic sociology of knowledge, David shows how an open science system is at the core of the university as a knowledge enterprise. This is based on sophisticated and well-established reputational incentives. Openness abets rapid validation of findings, and reduces excess duplication of research efforts. Wide sharing of information places knowledge in the hands of those who can put it to uses requiring expertise, imagination and material facilities not possessed by the original discoverers and inventors. This system – which operates through peer reviewed publications, conferences, professional associations, awards and recognition systems in general – works because it builds on two of the essential qualities of knowledge that were earlier noted: the spillover effect, and the exponential, cumulative effects that can follow when codified research results are built up successively on one another. In addition, and critically, the principle of priority of publication defines the reputational capital on which academic careers are built, and which universities use as the basis for appointment, promotion and – usually – remuneration.

David has characterized this pre-commercial knowledge system as a set of invisible colleges. These are often – although not necessarily – organized around disciplines or particular research interests. Invisible colleges tend to be fluid and comparatively unstructured, international and reliant on face-to-face interactions at conferences and professional meetings, as well as on electronic communication. Nested within them are local networks that organize the tacit aspects of academic work:

> within the more restricted ambit of a researcher's local network will be circulating many bits of crucial knowledge, about experimental procedures, equipment functioning, data analysis routines – all of which very often escape being codified and described with complete clarity in published accounts of research procedures and findings. (David, 1998, p. 124)

While many participants in invisible colleges may, with justification, see their motivation as a principled search for truth, this academic knowledge system is also a highly structured resource distribution network that provides its participants with benefits as long as they work hard to make their contributions to new knowledge known to as many as possible. In this respect, the scholarly communication lifecycle model on which Houghton and Oppenheim base their cost–benefit analysis has inherent market-like properties independent of the market features of subscription publishing. While there will be continuing debate about the role of for-profit companies in the knowledge work of universities, the point here is that there is no inherent dependency on commercial publishing. As the work of David and Foray has shown (2003), invisible colleges have been around since the Renaissance and have thrived when research results were circulated in the proceedings of non-profit scientific societies. New information and communication technologies have not made invisible colleges redundant, but have rather expanded – massively – their operational potential.

Aligning Houghton and Oppenheim's scholarly communication lifecycle model with more general work on the knowledge economy and with the concept of the invisible

colleges that organize academic work shows the considerable potential in further expanding the agency factors in Houghton and Oppenheim's work. Variables such as existing knowledge, scientific problems, scholarly curiosity, and new knowledge and greater awareness currently serve as placeholders. A next stage in this line of enquiry could be to expand these placeholders into a rich set of concepts in the sociology of knowledge, connecting with other fields of enquiry, such as Latour's actor–network theory (Latour, 2005). This could provide a continuum of understanding that connects the object details of costs and benefits with the agencies that constitute the global reach of academic networks and inquiry.

Minerva's owl

The complexity and richness of the issues raised by the JISC report, and by Houghton and Oppenheim's paper in picking up some of its key themes, show us the wisdom of Minerva's owl in keeping silent until late in the new day. Although the key transitions to the information age were mapped out more than a decade ago (Castells, 1996, 1997, 1998), the constraints and opportunities for specialized areas of work have taken much longer to become clear. The detailed work of Houghton and his associates puts this appreciation into the empirically-informed framework that will be essential for the development of the most appropriate policies and practices.

Sensibly, perhaps, Houghton and Oppenheim eschew speculation about the future, merely noting that 'one key question is whether there are new opportunities and new models for scholarly publishing that might better serve researchers and more effectively communicate and disseminate research findings'. But despite their reticence, their work provides some valuable signposts. This can be seen by returning again to their Figure 2, and to the analogy of the topography of the knowledge superhighway.

I argued earlier that the tolls for the use of knowledge in the subscription publishing model are a form of rent that works against the inherent benefits in the properties of knowledge. Tolls may also be inappropriate private profit taking against the substantial investment of public funds into knowledge production via universities, but this does not mean that there is no place for private, for-profit investment in the scholarly communication lifecycle (and in the wider frame of the knowledge economy, an argument for the exclusion of for-profit interests would be clearly risible). Indeed, the alternative approach has been before us since IBM made the decision in 1998 to rebuild its business model around the Linux operating system and to make its profits from adding services to an open source platform, and in open innovation and customer innovation approaches to building new forms of business models (Von Hippel, 2005; Chesbrough, 2006). Rather than exacting tolls – rents – through roadblocks along the highway, public investment in the production of scholarly knowledge may best be situated in optional, value-add user services that are easily accessible during the journey.

Rather than market services (advertising, promotion, sales, presentation) which may become less important if peer-validated, codified knowledge becomes widely and easily available through open access and self-archiving, these services are likely to be specialized forms of knowledge aggregation, working beyond the reach of the algorithms of generalized search engines. This need will be created by two key aspects of evolving information and communication technologies – rapidly expanding, low priced and ever accessible data storage (enhanced by cloud computing) and the

exponential aspects of knowledge accumulation, some generated by machines using existing knowledge as raw material, experienced in terms of speed.

Such specialized services will need to address a core problem in the revival of the pre-commercial system of invisible scholarly colleges mapped out by Paul David (2004). In Merton's seminal formulation of the sociology of knowledge, conventional citation and research methodologies involve tracking systems of reference back through bibliographies, re-enacting through thousands of every-day research activities the principle of primacy of citation (Merton, 1973). But the cumulative properties of knowledge accumulation make this impossible to sustain, to the desperation of academic researchers who are only too aware of being constantly out of date. Knowledge aggregation services will collect, collate and verify portfolios of sources and open access data sets against complex and specialized sets of criteria. The best outcome of the current debate around the JISC report and Houghton and Oppenheim's paper would be to move beyond arguments about the veracity of data used in the cost–benefit analysis, to consideration of new and differently-located forms of public investment in the development of new knowledge.

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