The Nature of Information in the 21st Century: Conundrums for the Informatics Community?

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Abstract:

Purpose of this paper	*The proliferation of electronic information via the Web has witnessed the unique characteristics of information distend yet further. With such seismic developments occurring in such a short period of time, it seems prudent to once again consider the very nature of information and to assess whether this accelerated growth has implications for the work of the informatics community and our information society.*
Design/methodology / approach	*The paper begins by revisiting and refreshing the unique characteristics of information via a reappraisal of the relevant literature. These characteristics are then contextualised within the New Economy and traditional economic theory. Once these unique characteristics have been examined, the author discusses how the nature of information in the 21st century presents the informatics community with new and difficult challenges.*
Findings	*The challenges posed by the unique nature of information demand a definite response on the part of the informatics community, including the creation of innovative new models to accommodate and check information's inherent characteristics. Additionally, as the nature of information evolves yet further and ICT innovations accelerate, evermore adaptable skills will be required by the end user in order that value be derived from information.*
Practical implications (if applicable)	*Outcomes and conclusions addressed in the paper may inform the informatics community generally, but will specifically inform the practice of information managers and librarians, and may assist them in arriving at holistic decisions with respect to service provision.*
What is original/value of paper	*The paper is a contribution to the debate on the precise nature of information and offers new perspectives on how the informatics community should view information in the 21st century.*

Introduction

Little over 10 years since the first widely available Web browsers, the volume of information available to end-users has grown exponentially and, as Duff (2003) notes, the World Wide Web, despite only being generally available since 1993, has thoroughly trampled all existing information media in its path to become one of the primary information delivery mechanisms. Related tools, designed to facilitate access to existing information via the Web have similarly experienced lofty growth and have instilled a tenuous attitude amongst the informatics community that everyone, to a certain degree, 'is now a librarian' (Nicholas *et al*, 2004a). With such seismic developments occurring in such a short period of time, it seems prudent to once again consider the very nature of information and to assess whether this accelerated growth has implications for the work of the informatics community and the future trajectory of our information society generally.

The New Economy and the Fourth Resource

It is questionable whether Friedrich Engels, writing in the 1880 work 'Socialism: Utopian and Scientific' as a proponent of the materialist conception of history, could have possibly anticipated the emergence of information as the 'fourth resource' (Engels, 2003). Land, labour and capital were the spirit of capitalism and the sure foundation of political economy. Eager to illustrate the numerous conflicts and inherent contradictions of capitalism that would eventually lead to its expiration and deliver socialism into the hands of the proletariat, it would seem that Engels inadvertently captured the essence of modern day capitalism, even if its expiration is far from realised. The emergence of information as the effectual fourth resource has 'turned upside down' traditional economic conceptions and has revealed various conflicts within these. That is not to state that information does not share characteristics with traditional resources as it does share many, from possessing an inherent value to maintaining a life cycle. Yet that information behaves uniquely as a resource is beyond question also. And herein resides the exceptional nature of information.

As modern civilisation enters the 21st Century it is now commonly recognised that a post-industrial age is upon us delivering with it the so-called 'New Economy' whereby information not only constitutes the very foundations of most industrial sectors, but more significantly has now transformed into a primary tradable resource or commodity. Such views have been liberally expounded in the relevant literature by the likes of Cleveland (1982; 1985), Burk and Horton (1988), Tapscott (1996) and Boisot (1998). Many, particularly

those in the LIS sector, have become thoroughly desensitised to the loaded nature of the term, 'New Economy'; the inference being that information should be conceptualised adjacent to the three traditional economic resources of land, labour and capital. Given the current relative socio-economic importance of information, this interpretation remains wholly justified.

Based on the premise of scarcity, land, labour and capital can be succinctly defined as follows: 'land' encompasses the inputs required for production as provided by nature, 'labour' refers to the human input required by production, and 'capital' typically consists of machinery and plant, or those inputs of production origin (Sloman, 2001). Yet these parameters, typical of mainstream economic thought, are effectively a product of the industrial era and are in many ways incomparable with information whilst immediately rendering any comparative analysis problematic. New Economy guru Don Tapscott illustrates the essence of these difficulties by simply placing New Economy firms under classical economic scrutiny. "When evaluating the assets of Microsoft, it is ludicrous to contemplate old-economy questions such as the following: How much land does the company own? What is the value of Microsoft's manufacturing facilities – its plants? How great is its stock of raw materials?" (Tapscott, 1996, p.39).

The Nature of Information

Ultimately information behaves in a unique manner when compared to other resources because it essentially represents the genesis of human thought, and is heterogeneous and intrinsically intangible. The laws of thermodynamics are of little consequence to the existence of information. If we accept the definition that information is effectively the input and output processes of the mind, then information can only exist in the human mind. Therefore, unlike traditional resources of land, labour and capital, information rarely yields any physical output. Microsoft may produce physical items by virtue of using disks. Still, the true output of Microsoft products is not the disk itself but the information encoded therein.

Perhaps more importantly, and as Cleveland (1982) noted in his seminal article for the 'Futurist', information also differs from traditional resources in that it is expandable, compressible, substitutable, transportable, diffusive and sharable. In addition to these attributes, information is entirely context dependent and harbours atypical value properties in that it does not necessarily diminish with use (Oppenheim *et al*, 2001).

The term 'resource' is one fraught with ambiguity. Traditional resources of land, labour and capital are all governed by the premise of scarcity. This is reflected in traditional economic thought which dictates that because the world has only a limited number of resources there is a limited amount of goods and services that can be produced (Sloman, 2001). By definition therefore, the term 'resource' implies something of finite origin. Yet far from being finite, information is infinitely expandable. It is not depleted with use, but more with age, and hence contravenes laws of scarcity. Information expands with use and procures further utility the more it is used. This obviously creates an anomaly in the perception of 'information as a resource', and questions whether information actually qualifies as a resource and whether this anomaly is attributable to pedantic semantics or the failings of modern conceptual tools. Perhaps it is more

applicable to consider data as the resource, since 'information' is data that has been refined via the human mind. Alternatively, a resource can be considered as that which has value in use (Eaton & Bawden, 1991). This latter interpretation is preferable for the ensuing discussion, but it is noteworthy that the lack of scarcity 'turns upside down' the precepts of economic thought.

Notwithstanding the infinitely expandable characteristics of information, information can, ironically, be easily compressed. Unlike traditional resources information can be concentrated, compiled, consolidated and summarised to facilitate easy management. By means of example, a paper based company database consuming rows of shelf space can be compressed into the contents of a single CD. This compressible attribute of information is obviously conducive to transportation. A single CD can be transported in the palm of one's hand. With the help of telecommunications technologies, information can be transported at the speed of light, an attribute denied to other resources by the laws of physics.

These traits stimulate the diffusive and sharable characteristics of information. By virtue of being intangible, expandable and easily transportable, information is wholly diffusive and tends to resist all forms of straitjacketing. Burk and Horton (1988, p.20) are more specific: "It tends to leak – and the more it leaks the more we have. Information is aggressive in striving to break out of the unnatural bonds of secrecy". This leakage endorses the sharability of information. Indeed, the non-appropriability of information exemplifies its unique nature. Unlike land, labour and capital, information is not conducive to exchange transactions and can only engage in transactions characterised by sharing. "If I give you a flower or sell you my automobile, you have it and I don't. But if I sell you an idea, we both have it" (Cleveland, 1985, p.33).

Earlier we recognised that information shares the concept of value with traditional resources. However, this value behaves uniquely. Whilst land, labour and capital are traditionally hoarded to increase value and inhibit scarcity, information shared is commonly considered to enhance and increase its value (Oppenheim *et al*, 2001; Cleveland, 1985). Moreover, information has no set value and has to be utilised before value can be attributed. Equating information resources with commodities, Shapiro and Varian (1999, p.5) convey the essence of this reasoning: "How do you know whether today's Wall Street Journal is worth 75 cents until you've read it? Answer: you don't". Additionally, land, labour and capital command a specific value irrespective of context due to their generic and standardised position within the parameters of market economics. As many in the literature have conversely emphasised, information as a resource is wholly dependent upon context consumption (Burk & Horton 1988; Eaton & Bawden, 1991; Boisot 1998; Madden, 2000; Oppenheim *et al*, 2001; Bogdanowicz & Bailey, 2002; Corbitt, 2004). Consequently, information contained within the pages of the Financial Times may be highly valuable to a London stockbroker, but of negative value to a Derbyshire tree surgeon or bus driver.

Of course, the affinity of information with traditional resources should not be ignored. This affinity is, after all, what has delivered us into an era where information

can actually be considered a 'resource'. With information there resides value. Naturally this value infers that information can also be attained at a cost and is hence measurable, albeit in rudimentary monetary terms and within industrial asset parameters. Such views are further expounded by Burk and Horton (1988). As we have seen, such value is not intrinsic, nor readily quantifiable. Even so, this unquestionably places it adjacent to land, labour and capital, as similar *means* of valuation can be applied. It is now humdrum to engage in the trading of information in a manner not dissimilar to that of traditional resources. An organisation seeking a competitive advantage may once have invested in cutting edge capital but may instead seek information as another means of achieving this end. In addition, once information has been acquired the deployment of that information can be for immediate enrichment or be capitalised. In this respect information is no different to the resource of land whereby a similar choice awaits the effective management of raw materials.

Whilst some are more circumspect (Eaton & Bawden, 1991; Bogdanowicz & Bailey, 2002), others recognise that accounting techniques typically associated with the management of traditional resources - although presenting certain anomalies - can be applied in an effort to determine and control information costs (Burk & Horton, 1988; Koenig, 1997; Oppenheim *et al*, 2000). What is more, information shares with traditional resources a life-cycle which could largely be described as a progression entailing creation, acquisition, cataloguing / identification, storage, preservation and access (Hodge, 2000). Life-cycles entail a form of recognised resource management to aid the efficient and effective use of that resource, and numerous management paradigms, such as "The 7 R's of Information Management", have emerged to facilitate information resource management (IRM) (Rowley, 1999). The only major difference is that information can experience multiple life-cycles, should it be re-appropriated and re-packaged.

An integral trait of traditional resources, and the production process with which they are associated, dictates that resources encompass development and refinement qualities. Few would argue that information holds these properties and is wholly conducive to being processed and later refined. Raw materials, as an expression of land, may yield various metals that are, through labour and capital, eventually refined to deliver a motorcar. As Burk and Horton describe, "Information has the capacity to be processed and refined, whereby raw materials (e.g. databases) are transformed into finished products (e.g. published directories)" (1988, p19).

Additionally, information substitutes are available for specific information requirements, and this in turn presents the management of information with questions of opportunity cost pertaining to the varying grades, the nature, the cost and the general usability of the information. Obvious comparisons can be made with land, labour and capital whereby substitutes are widely available. This reasoning, conventionally affiliated with the traditional resources, is wholly applicable to information. Yet, the substitutability of information simultaneously differentiates it from traditional resources. Information is capable of replacing land, labour or capital in most economic processes (Cleveland, 1985). Tapscott (1996) recognises that in the New Economy

labour is 'highly variable' and that there is virtually no labour in the traditional economic sense. Meanwhile information, as an abstract concept, is heterogeneous and is non-divisible in use and thus cannot be *arbitrarily* measured like raw materials (Monk, 1989).

Taming the 'Information Beast': conundrums for the informatics community

Evidently, the expandable nature of information clearly raises issues of information management. After all, how do you manage a resource that grows infinitely? The expandable properties of information mean that it is simultaneously burdensome whilst liberating. 'Information overload' bears testament to this. The 21st century has ushered in an era of 'information saturation', where the existence of Google functions as a 'calming tonic' against the infinitely expanding information chaos exemplified by the Web (Wallis, 2003). Instead, the limits to expansion are governed by the time that minds have to absorb and analyse this information. Though information overload has always presented problems for management, the past decade has witnessed an information explosion and a further rise in the phenomenon (Boyd, 2004). This rise is partly attributable to a lag in the effective and efficient means by which to manage this information. Unfortunately, this overload often compels users to oversimplify what is before them thus discarding and ignoring altogether pertinent and wholly valuable information. The function of information management is to facilitate a means whereby expandability is checked and to ensure that only information pertinent to the desired use is delivered.

Management in this respect may entail compression, which causes its own dilemmas. The compressibility of information has positive connotations for easy management and facilitates information retrieval and simpler user research. Yet, though information is in many cases inherently compressible, most instances necessitate that it be distilled in order to be compressed (Cleveland, 1982). This presents information managers with a perplexing conundrum as some information is destined to go missing through compression. What is lost may be deemed valuable or it may be deemed insignificant; the distinction is largely context dependent and is hence entirely subjective.

Though entirely context dependent, it is clear that with information resides some sort of value. As we have seen, value underpins of traditional resources and is inextricably related to the scarcity and output of these resources. As the value of information as a resource becomes paramount in our New Economy, so does our need to valuate it. The value of information is directly correlated to its utility, which is, and will always be, determined by its context. The emerging conundrum for the information manager - or those staff spearheading the modern and industrial adjunct of information management, 'Knowledge Management' - is therefore to recognise these difficulties and to apply appropriate criteria for determining the value of information within these contexts and to expedite a knowledge sharing environment, as demonstrated by various scholars (Bogdanowicz & Bailey, 2002; Burstein & Linger, 2004; Squier & Snyman, 2004). As Oppenheim *et al* note, "every organisation has data in some format, but identifying what data if any has value or indeed potential value creates difficulties" (2000, p.56). In this respect it is clear that information managers are increasingly being

presented with an absurd and near impossible challenge: to value a resource that has no means of quantification or evaluation when out of context. Improvements in ICT have made this task slightly less arduous, as has the emergence of conceptual tools for the valuation of information assets (Oppenheim *et al*, 2002). Other conceptual tools of direct relevance to library and information services have been pioneered also. For example, Kantor and Saracevic have researched and developed a particularly useful taxonomy, capable of measuring users' assessment of value for a given library, to assist in the measurement of library value (1997a; 1997b).

Despite the available tools, the implications for information managers will always present gargantuan obstacles. Information managers have to govern a resource that, to some extent, resists governance. Seemingly resisting all forms of secrecy, intellectual property and confidentiality, the inherent 'leak ability' of information ensures effective management will forever be an uphill battle. Consequently, the ability to enable strategic policy and to initiate relevant controls in order to stave the 'aggressive and imperialistic' tendencies of information is intrinsic to modern effective information management. In actual fact, a sizable degree of information permeating organisations is inconsequential to others and constitutes an issue of overload management rather than anything else. The fact remains that it is now simply too difficult *not* to create mountains of information. The proliferation of ICT in public and private sector services over recent decades (but particularly the 1990s) has perpetuated an abhorrent scenario whereby countless, and often entirely meaningless, information transactions and entities are recorded. Not because some utility might be derived from this information, but simply because modern ICT constitutes a vehicle for the imperialistic and effortless gathering of such information. Thus, information deemed sensitive increasingly finds itself permeating an organisation.

One element of information management is therefore depicted as a peculiar juggling act whereby the object is to ensure such an abundant and diffusive resource obeys secrecy legislation. Meanwhile, information managers have to harness these information assets for competitive advantage or staff / user enrichment. In this respect the implication for information managers is the adoption of an 'information police' role. To manage information's diffusive qualities so that it remains accurate, incorruptible and retains utility, but also to ensure that it does not leak into the laps of users with questionable or illegal motives. The implications of security for the management of information are more pertinent now than ever before.

Obviously the management of information has to facilitate a sharing culture, as opposed to a hoarding culture; penalties for hoarding information in the 21st century can be severe. This is particularly true for business communities, but it is also true for almost every information user. Such truths are epitomised by recent high profile examples. A simple lack of information sharing by US scientists led to confusion between imperial and metric units, culminating in the loss of the NASA Mars Climate Orbiter (Sommerville, 2000). Lienhard encapsulates the essence of this conviction:

"So the flow of information is changing us at a far deeper level than we realise. Knowledge was once power. Now it's becoming freedom. If knowledge were power we'd have good cause to be secretive. But secrecy isn't only becoming impossible. It's proving dysfunctional as well. We begin to see how much better our decisions are when we work together, openly" (Lienhard, 1997).

Be that as it may, it is imperative that the effective management of information encompasses a differentiation between what information resides with the organisation and what does not, and that a necessary definition of this is disseminated amongst all parties concerned. The former has to protect any information assets and the latter should not be denied an intellectual and human right, as enshrined in the Berne Convention (WIPO, 2004). Effective and responsible management simply dictates that intellectual property and copyright laws be respected as this underpins the most basic of human rights. Yet as we have seen, information is a 'public good' and in this sense an owner can never be truly identified. Now, using the Web as the principal vehicle for imperialism, the expandable and diffusive nature of information has found a friend in the Internet. The Web itself constitutes one large reprographic copying machine with scant respect for national boundaries or local legislation pertaining to intellectual property rights (IPR). As is always the case with momentous technological innovation, law lags behind when it comes to keeping it in check, and establishing a bona fide legal apparatus capable of upholding IPR in the 21st century remains unforthcoming. Indeed, Cleveland (2000) considers IPR in our modern times to be nothing but an 'oxymoron' and that it remains for the informatics community to devise innovative new ownership models that leave significant incentives for creativity, but do not rely on moral, economic, legal rights normally associated with IPR.

The solution is no longer to protect the un-protectable, but, in many cases, not to protect at all. Rather, the new information environment demands that managers gradually instigate a culture whereby information is continually updated, restructured and repackaged, whilst simultaneously observing the pillars of IPR and data protection where appropriate, thus rendering older information defunct. According to Eaton and Bawden (1991), Koenig (1997) and Oppenheim *et al* (2001), information is a dynamic resource demanding constant upkeep and maintenance to ensure the integrity and consistency of intellectual capital. Re-packaging and/or re-interpretation should therefore be considered in tandem with regular maintenance and the new principium of the 21st century information manager. As mentioned previously, information, unlike traditional resources, is not depleted with use, but is rendered increasingly extraneous the longer its life-cycle continues. Such administrative steps simultaneously refresh the life-cycle of the original information entity and, if undertaken appropriately, can increase utility for the end user.

For example, Microsoft have discovered that total protection of its intellectual property is only achievable through disseminating 'cutting edge' information, manifesting itself in those countless software upgrades professing to offer new solutions, or to defend against the most pernicious forms of cyber-crime. Microsoft's

software might be 'new', but it will invariably constitute a restructured and repackaged manifestation of existing software. Such corporate behaviour is exemplified by their recent decision to issue Windows XP Starter Edition (XPSE), a new version of Windows XP for emerging markets in South-East Asia (Glover, 2004). Such steps on the part of Microsoft represent a clear attempt to stem rampant IPR theft in the region and, as Foley (2004) notes, to dislodge the supremacy Linux enjoys in the Thai market place.

Information: a 21st Century Human Right?

The major difficulties confronting the 21st century informatics community lie in the behaviour of the digital information user (or consumer). The proliferation of electronic information, especially via the Web, has increased user *access* to information in its various permutations by removing barriers. The undeniable benefits associated with such developments for learning, economic and social regeneration and government are now self-evident and are well documented in the literature as case studies, investigations or literary expositions (Chandler, 1998; Himmelfarb, 1999; Dittemore & McMillan, 2000; Tian, 2001; Komito, 2001; Evans & Fan, 2002; Salter, 2003).

However – and perhaps more alarmingly - the expansion of information over the past decade or so has entirely extricated information from the concept of value. If getting information users to understand the potential value and cost of information before the early 1990s was difficult, the prospects are now extremely pessimistic. The childish flurry of enthusiasm for mounting a plethora of information for 'free' via a new medium during the 1990s has, as Bell (2000) and Slowinski and Bernuth (2001) note, simply fuelled an existing user perception that the creation of information incurs no costs and that high-quality information should always be available for free. The expansive nature of information has simply contributed to this phenomenon as users continue to apply traditional economic models of scarcity, to such a degree that they have surpassed traditional quality concerns. Regrettably, total access and speed of delivery are the new yardsticks for information users. Nicholas *et al* (2003, p.30) eloquently summarise the absurdity of this disastrous scenario; "Could you imagine a world in which supermarkets gave their produce away for free and the councils charged you for access to the roads that led to the supermarkets? No, well that is the situation we have in cyberspace".

In point of fact, the 'information strategies' of many leading companies and publishers are simply 'haemorrhaging' money as they continue to provide their expensive information for free. The hope that costs can be recaptured through advertising is wholly misplaced as research continues to reveal the promiscuous nature of the digital user, a development bolstered by user inability to recognise information value and an unwillingness to pay for information (Nicholas *et al*, 2003; 2004b). This damning indictment of 21st century information users is further compounded by their misinterpretation or disrespect for IPR, commonly evidenced by those users equating 'publicly available' with 'in the public domain' (Gadd *et al*, 2004). As Gadd *et al* (Ibid.) concede even those purveyors of open access works have had to recognise that although restrictive copyright may not always be necessary, some protection is clearly needed for static information entities. The emergence of the

Creative Commons Initiative is certainly one manifestation of this reasoning (Creative Commons Initiative, 2004). Such careless user behaviour simply stems from low information literary skills and a consequent inability to recognise the value of those intellectual assets needed to create information entities. Ultimately, it is a continuation of an historical perception of information: "if you can't hold it in your hand, it's not real" (Vickers, 1985, p.152).

As suggested by Slowinski and Bernuth (2001) – and tacitly recognised within the informatics community - responsibility for this scenario lies largely at the feet of government agencies, professional societies and government funding streams. Government departments and agencies continue to mount and distribute value added reports, documents, legislation, health advice, community information and news coverage, all for free via the Web**.** Such behaviour is far from subsiding, as evermore ambitious information strategies are deployed. The recent roll-out of the UK digital health services initiative, for example, is an elaborate combination of several information platforms: the Web, touch-screen kiosks and digital interactive television (Nicholas *et al*, 2004b). At the same time, governments across the globe have injected vast funds directly, or indirectly, into large information creation and digitisation projects, the fruits of which are also being made freely available, often globally. Admirable though these developments are for the information impoverished, the continued provision of free high quality information resources capable of fostering social development and lifelong learning is unsustainable if current business models persist, and particularly when taxpayers assume the financial burden.

Unsound business strategies have already befallen the Web via those disastrous excursions into 'e-commerce', potently exemplified by the Dot.Com crash of 2000 (Halper, 2002). The Dot.Com crash embodied the dramatic failure of 'optometry economics': that user eyeballs gracing a website would by some means eventually generate revenue. Of course economic meltdown is not applicable in the context of free information provision; however it is lacking a sound business strategy conducive to longevity. Nielsen (2000) has already noted that the genesis and subsequent evolution of Web-based information has been completely bereft of a sound business strategy. The corollary dictates that such independent information services will either: a) continue to offer free, but poor quality, information and therefore will be incapable of supporting education and lifelong learning, or, b) will, as a consequence of user perceptions, be unable to charge for information, wither and then die. Both scenarios would unquestionably have detrimental implications for our global information society.

Himmelfarb (1999) suggests that the Web is an 'equal opportunity resource'. This is certainly true as, like national boundaries or national legislation, the Web pays scant regard to user status, ethnicity or social class. But we would be ill advised to confuse this *egalitarianisation* of information access with the *egalitarianisation* of information itself. As many information providers and brokers will attest, adding value to information in order that it can be easily appropriated by the user is an expensive process. Metadata creation alone is extremely costly (Crystal & Land, 2003). This cost goes some way to explaining why the problems highlighted by Thomas and Griffin (1998) remain largely unrecognised

by the non-informatics community and have yet to be satisfactorily resolved seven years on. Yet, for the scholar or the New Economy businessman, such value added information is key to uncovering, not surprisingly, valuable information (Tenopir, 2000). It is simply untenable to assume that government should bankroll the creation and maintenance of information. Information providers, whether public or private, have to recapture costs and this, *ultimately*, can only be achieved by a concerted effort on the part of providers to instantiate innovative new charging models, however unpopular they may be.

That is not to state that no information should be available for free. The library - the true stalwart of information - will continue to fulfil its historical mission to provide free access to information for everyone, and low grade free information will inevitably continue to be delivered via the Web. Small pockets of high quality information will continue to be made available as a result of legal demands imposed by government legislation, such as that of the UK Freedom of Information Act (HMSO, 2000). And of course, much will be available through open access initiatives.

The dreadful 'journals crisis', as depicted by Manna (2003), is only (and gradually) being addressed through the increasing emergence of open access journals. Such developments are necessary, positive and noble, and seek to balance grievances libraries have had with respect to the lack of competition and the spiralling subscription costs within the journals market. Unlike the creation of most other information entities, academic papers or articles are produced with minimal cost to the publisher, with academic departments, institutions or public funding bodies absorbing the cost. Björk and Hedlund (2004) estimate that as much as 90% of the cost(s) of producing a typical referred journal paper are assumed by those conducting the research. Reasoning is simple: if publishers are receiving content for free, then why shouldn't everyone? The arguments are compelling and have been expounded in the literature (Van Orsdel & Born, 2004; Tenopir, 2004;), with libraries and information associations often providing guidance and leadership on the issue (Morrison, 2004).

Yet, open access is far from a panacea and it is unlikely to entirely supersede conventional 'pay for' models. Loss of information value, as well as the inevitable loss of quality resulting from information mis-management by those lacking the necessary information handling skills, will always ensure that the 'pay for' model remains significant. The 10% paid for by subscriptions is critical in providing 21st century users with the quality and added value information they have come to expect. 'Repackaging' undertaken by publishers is now deemed totally indispensable by the modern user and it remains unclear as to how open access will absorb such costs in the long-term without a slump in added value. Even those open access initiatives that have experienced nominal success have benefited from large start up funding or are increasingly subsidised by authors themselves (Van Orsedel & Born, 2004).

Conclusion

The unique nature of information, and the similarity it has with traditional resources, is increasingly being realised in the 21st century. Nevertheless, the essence of 21st century management of information is not to apply strict principles which have been applied to traditional resources. Rather it is to allow information's unique behaviours to distend within a *controlled* environment, using innovative checks and balances devised by the informatics community. As we have seen, this may create peculiar challenges - some of which are irrepressible - but it is through these traits that the true value of information in its various permutations can be harnessed.

The informatics community would be wise in the 21st century to regularly revisit the nature of information, if only to formulate new models for coping with the ever evolving nature of the beast. Defining clear boundaries governing the 'open' and 'closed' state of information is imperative, not only in an effort to preserve and ensure information quality or integrity, but to inform information creators and providers so that they arrive at truly holistic decisions regarding the best form of dissemination. Related to this, the informatics community needs to be more aggressive in communicating the importance of information literacy skills to their user-groups, as neglect in this area will gradually dilute and then annihilate the very essence of information, from value to IPR. A welcome themed issue of Library Review entitled, 'European Approaches to Information Literacy' (Virkus, 2003), at the very least demonstrates the increasing importance education institutions and governments are placing on information literacy skills. And this is essential, if only to ensure that the 21st century user can distinguish between what Himmelfarb (1999) amusingly refers to as, 'Peanuts and Shakespeare'. The importance of information literacy skills can never be understated. As the nature of information evolves yet further and ICT innovations accelerate, evermore adaptable skills will be required by the end user in order that value be derived from the fourth resource.

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