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Re-intermediation in the Republic of Science: Moving from intellectual property to intellectual commons [1]

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Abstract. Public research is largely an open, communitarian, and cooperative system. It is founded on freedom of inquiry, sharing of data, and full disclosure of results by scientists whose motivations are rooted primarily in intellectual curiosity, the desire to influence the thinking of others about the natural world, peer recognition for their achievements, and promotion of the public interest. Although this normative and value structure of public science predated the revolution in digitally networked technologies, it makes it ideally suited to experiment with and exploit those new technological capabilities, which themselves facilitate open, distributed, and cooperative uses of information. It is no coincidence, therefore, that the emergence and early institutionalization of many new paradigms of virtual knowledge-based communities and related information activities have occurred in public science. Examples include open journals, open archives, federated data management networks, community-based open peer review, collaboratories for virtual experiments, and virtual observatories, among others. Taken together, these emerging capabilities represent aspects of a broader trend toward both formal and informal peer production of information in a highly distributed, volunteer, and open environment. Such activities are based on principles that may be more accurately characterized as intellectual commons, rather than intellectual property, and that reflect the communitarian ethos of the republic of science. This presentation will describe several new models of information production, management, and dissemination in public science, and analyze some of the key factors and conditions for their success.

1. Introduction

Initially, I was requested to provide a summary of the Symposium on the Role of Scientific and Technical Information in the Public Domain, which was held in Washington, DC in September 2002. I am currently in the process of editing the proceedings from this symposium. Covering over 600 pages, the idea of summarising this material was daunting, if not impossible. I therefore will present a brief overview of the Washington event and review the topics to be covered by a follow-up international symposium that will be held at UNESCO headquarters in March 2003. I will then address a subset of related issues, which I have decided to call "re-intermediation in the Republic of Science, moving from IP to IC".

2. STI in the public domain

The body of scientific and technical data and information (STI) in the public domain is massive and contributes broadly to global intellectual and social progress. The September symposium defined "public-

[1] The views expressed in this article are those of the author and not necessarily those of the National Academies. A more comprehensive version of this article, tentatively entitled *New Models of Information Production and Management in Public Research: Legal, Economic and Science Policy Considerations*, will be published by the Organisation for Economic Co-operation and Development (OECD) later this year.

domain information" as sources and types of data and information whose uses are not restricted by intellectual property or other statutory regimes, and that are accordingly available to the public for use without authorisation or restriction. Recently, however, there have been growing legal, economic and technological pressures that diminish the public domain. Therefore, it is important to review the role, value and limits of public-domain STI.

New laws have broadened, deepened and lengthened the scope of intellectual property rights. Increasing economic pressures on government and university producers have also limited STI in the public domain. Finally, advances in digital rights management technologies pose some of the greatest potential restrictions to the availability of public-domain information. In response, public archives, libraries and an increasing number of open Web sites exist in the government and university sectors. Different groups in the scientific, educational, library and legal communities are developing innovative institutional models promoting open access (OA) to otherwise proprietary information. As the amount of information in the public domain shrinks, OA becomes an increasingly essential mechanism for furthering the broad diffusion of information.

Due to these major developments in information policy and management, the US National Academies have initiated a series of symposia to examine these issues. In September 2002, the first symposium was held in Washington DC, focusing on US policy only. The second symposium will be held in Paris on 10 and 11 March in conjunction with CODATA, ICSTI, ICSU and UNESCO, and will build on the issues raised at the first meeting, but in an international context. We are also planning at least two further symposia in this area. The first one, in Washington DC in May, will symposium in 2004 will focus on the legal, economic and institutional factors underlying new models of volunteer, distributed peer production of scientific information on digital networks.

The remainder of my presentation will focus on the underlying values and norms supporting open access to scientific information produced by government and academia. I will then discuss how they intersect with the capabilities of global digital networks and the emergence of new models of peer production in this environment.

3. Justifications for domain information and OA in the public sector

There are many legal, economic and other public policy reasons to support OA to government information as public goods in the public domain. Firstly, a government entity requires no incentives from intellectual property laws to produce information. Secondly, such information has been produced at the taxpayer's expense as a public investment, not as a private good. Thirdly, democratic values and government transparency are undermined by restrictions on access and reuse. Furthermore, citizens' rights of freedom of expression are compromised by use restrictions, particularly on factual information. It is no coincidence that the most repressive political systems impose the greatest restrictions on information. Finally, OA promotes a broad range of positive externalities and network effects on the Internet, extending to social, educational and cultural spheres.

All OECD countries provide some level of OA to government information, although the scope of such access may vary. However, they also apply restrictions to access under competing considerations of national security, and protection of privacy, confidentiality and intellectual property rights.

4. Information norms in the Republic of Science

Publicly funded research itself provides a vast array of information. In this regard, scientific information is both directly influenced by and independent of larger public information trends. The specialised nature of scientific research, however, facilitates a separate approach. Research institutes and researchers themselves enjoy substantial freedom of self-regulation. The nature of scientific research promotes the existence of a strong set of norms and structural relationships within public science. The general values of the public science sector differ considerably from those of information producers in the private sector. Scientists in the public sector are largely motivated by intellectual curiosity, peer recognition and the promotion of the public interest rather than by private economic gain. In many ways, public-sector science operates outside the mainstream economy, although its findings are used to facilitate the downstream innovations in the private sector. The fact that public funding dominates certain research fields demonstrates insufficient certainty for direct investment by the profit-driven private sector.

As Michael Polanyi noted some 40 years ago, what he called the Republic of Science is organised along lines similar to, but separate from, the market economy. It is composed of a large number of independent actors that are nonetheless co-ordinated and inter-related. Just as the invisible hand of pricing guides the market, the invisible hand of research results guides the research community; the researcher's currency is the extent to which his or her ideas influence others. The outputs of public research constitute public goods and increase in value with usage. Although competition for intellectual primacy among scientists forms a positive motivating factor in the Republic of Science, it remains much less important on the economic plane. Instead, the open disclosure of results provides motivation for further research. Therefore, the research community ethos is compatible with the legal, economic and policy reasons for OA to public information more generally.

Although the production of scientific data and information is not primarily conducted to make money, it is nonetheless important to emphasize that scientists seek recognition and require guarantees of integrity and authenticity for their work. Typically, this recognition is provided by copyright. Unlike publishers, however, they do not use copyright as a barrier for access, nor usually for economic gain.

Even though this normative value structure predated digital technologies, it ideally suits the exploitation of these technologies, which themselves facilitate open, distributed, and co-operative uses of information. It is no co-incidence, therefore, that the emergence of many new models of virtual knowledge-based communities and related means of information projection on an open basis have occurred in public-sector science.

5. Factors that facilitate the volunteer, distributed peer production of scientific information

The traditional model for the production and distribution of goods and information is based on the principles of market economics and on formal, hierarchical institutional mechanisms. The success of both requires well-defined and enforceable property rights. The advent of digital network information, however, has challenged the control and enforceability of those rights. In particular, low-cost dissemination of information has allowed unscrupulous individuals to misappropriate proprietary information. Consequently, publishers have sought to reassert more control over their information.

At the same time, we have witnessed the emergence of a parallel trend based on business models that operate on reduced control over proprietary information. For example, millions of free and open Web sites have appeared that contain enormous amounts of proprietary information. Indeed, many companies

now give away more information for business needs than they may have done before the existence of the Internet. The costs of this information may be offset by advertising revenues from the web sites or by sales of related products or services. Although most of these production and dissemination activities do not and cannot replace the traditional model of commercial publishing, the public tends to believe that information on the Web should be free.

The most interesting development in the context of this presentation, however, is the new forms of information production, management and dissemination based on non-market, non-corporate, and non-proprietary principles. Referred to as volunteer "peer production" of information, these approaches use the distributed interconnections of the Web and alternative incentives that are not dependent on direct economic returns or intellectual property protection for their success. They are based instead on non-economic incentives or indirect economic benefits, and on a voluntary system of community-based actions that operate like an intellectual commons.

According to recent work done by Yochai Benkler, and Charles Schweik and J. Morgan Grove, there are several other key factors that make peer production of information a more efficient and better form of organization than the traditional market-based, hierarchical model. These include:

- A sufficiently compelling common objective that serves as an incentive to attract enough volunteer labor to make it work. This of course will vary depending on the nature of the problem to be addressed and on the other factors below.
- The establishment of the requisite amount of trust among the minimum set of participants.
- Shared norms regarding the production, dissemination and use of the specific information product.
- Rules of engagement that are consistent with or reinforce the shared norms and the establishment of trust.
- An information product with sufficient modularity and granularity that makes it amenable to highly distributed, minimally managed production.
- Costs and other barriers to integration that are sufficiently low.

Examples may be found in all phases of the information chain. They include collaboratories for virtual experiments, the construction of virtual observatories in astronomy, the production of open-source software, open journals, hybrid web sites, open peer review processes, and federated data management networks and open data archives. Taken together, these capabilities constitute a broader trend toward both formal and informal peer production of information, both within the research community and beyond, in a volunteer, distributed and open networked environment.

6. Conclusion

In closing, I would like to emphasize that the communitarian ethos of the Republic of Science, when combined with the interactive and integrated capabilities of global digital networks, are enabling exciting new opportunities for collaborative production, management and open dissemination of scientific information. These opportunities are leading to a re-intermediation of scientific information outside the hierarchical institutional frameworks and market-based mechanisms of the *ancien regime*. Although many such activities have begun to proliferate, the underlying functions remain poorly understood. The September and March symposia, as well as the one here today are helping to illuminate this true paradigm shift in scientific information activities.