大数据时代的科技资源共享

——COINFO 2013 论文集

Sharing of Scientific and Technical Resources in the Era of Big Data

The Proceedings of COINFO 2013

中国科学技术信息研究所
武汉大学信息管理学院　编
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内 容 简 介

本书重点对科技资源管理与服务、信息质量与数据治理、语义信息组织与检索进行深入的研究与探讨。内容涉及科技资源开放共享与评价、科技资源增值利用与服务创新、科研项目知识产权管理、科学数据管理开放共享、信息质量管理、科技成果信息开放获取以及语义信息组织与检索的技术与方法等方面。本书力求体现科技资源管理领域的最新研究成果，具有一定的学术性与参考性，适合广大科技资源管理者和研究者阅读。

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Preface of COINFO 2013

COINFO conferences have been organized by the Institute of Scientific and Technical Information of China (ISTIC) in collaboration with Chinese and overseas universities and approved by the Ministry of Science and Technology (MOST) of China since 2006. Now in its 8th year, COINFO attracts senior officials and industry leaders as well as experts from Germany, UK, Spain, Belgium, Canada, Australia, USA and China. It has now become a high-end international platform for academic exchanges in information sharing.

This, the 8th International Conference on Cooperation and Promotion of Information Resources in Science and Technology (COINFO 2013) is organized by China's national research agency, the Institute of Scientific and Technical Information of China (ISTIC), in collaboration with Wuhan University and renowned universities and organizations from around the world.

The theme of COINFO 2013 is **Sharing of Information Resources in the Era of Big Data**. Along with the fast development of Internet and Internet of Things (IOT), Big Data technologies are already operating behind the scene delivering benefit to many organizations through massive power for data analysis. The impacts are still unknown, but the capacity to analyze trends including individual consumer behavior are both exciting and daunting. It will be critical to identify and manage issues so that we can enjoy the many benefits of Big Data; issues to be explored include:

- The challenge to management in the era of Big Data
- Social impacts – privacy/security
- How to release results of data analysis that might have impacts on individuals and groups
- How to successfully adopt and how to equip managers to realize the benefits of Big Data

68 papers have been selected from all the submissions, which have been reviewed by at least two reviewers. And the conference research topics have been classified into five general tracks or areas of research as follows:

(1) Management and service of Sci-Tech Resources

(2) Information Quality and data governance

(3) Semantic Information Organization and Retrieval

COINFO'2013 provides a unique forum for engagement around this conference theme, as well as other common interests of the participants, who may have different frames of reference in which to deploy what they learn at the conference. All the international participants of COINFO'2013 would come to share their experiences, benchmark, learn best practices, and find out about emerging trends.

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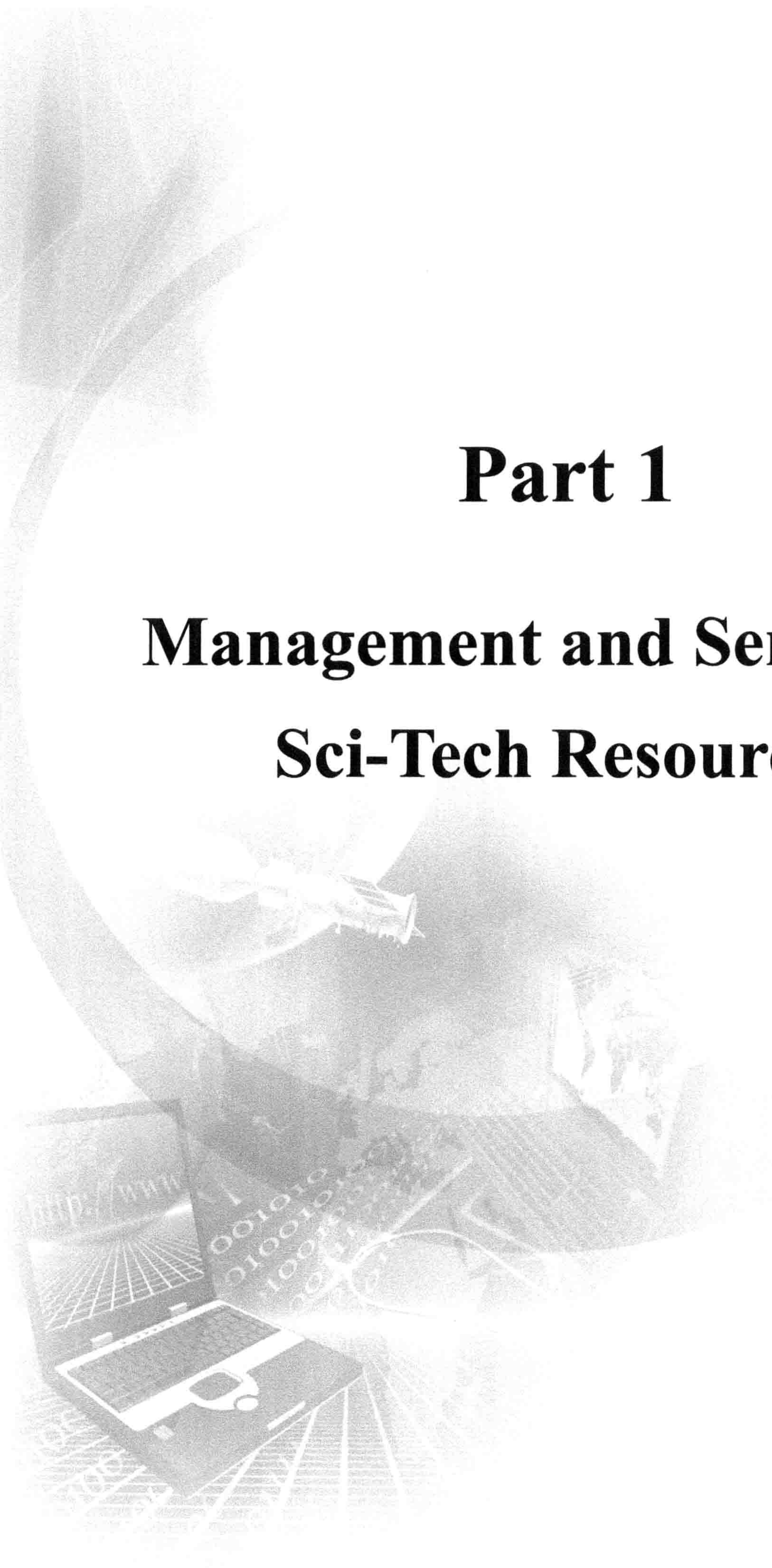
Part 1

Management and Service of Sci-Tech Resources



Analysis of Science and Technology Resource as Public Goods

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Abstract—This article examines the three key properties of science and technology resource as a kind of knowledge and also a typical item of public goods and some socially effective mechanisms to maximize the value of these resources. In particular, we emphasize government's role in the sharing system of S&T resources.

Keywords—science and technology resource; public goods; government's role

I. THREE KEY PROPERTIES

In a broad way, science and technology resources include all material, people, and information and so on that are associated with science or technology in society. Typically, science and technology resource is classified into four main kinds: human resources, financial resources, material resources and information resources. In this article we pay main attention to the knowledge behind these kinds of resources like scientific literature, high-tech equipment, scientific data, natural resources, experiment base and professional techniques. In this way, we can clearly see that these scientific and technology resources are of some similar properties to public goods—nonexcludability, nonrivalry and cumulativeness.

A. Nonexcludability

Science and technology resource is a nonexcludable public good, and it is difficult to make it excludable or to control it privately. It is a fluid and portable good. Of course, science and technology resource can be kept secret with a granted patent, for example, yet as soon as it is revealed it slips out of one's grasp. In that respect, it is a good that differs from jewels that one wears.

Science and technology resource continuously spillover from the entities producing them, and can thus be used freely by rivals, which is also called "positive externalities" if the impact on third parties is positive. Science and technology resource can leak out in multiple ways and the spillover can be very fast. For example, information on R&D decisions is known to rivals within six months, while technical details are known within a year. As we know, however, the harnessing of knowledge by other firms also depends on their learning capacity.

B. Nonrivalry

The nonrivalry of science and technology resource derives from its inexhaustibility, because the use of existing resource by an additional party does not imply the production of an additional copy of that resource. The innovator does not have to produce an additional unit of knowledge every time it's used. It is a nonrival good insofar as people do not have to compete for its use. Thus, the transmitting of knowledge is a positive sum game that multiplies the number of owners of that resource indefinitely (as opposed to transmitting an item of commodity which is a zero-sum game). Some researchers also use term "infinite expansibility" to denote "nonrivalry". Since the marginal cost is nil, economics cannot comply with the rules of cost-based pricing. According to those rules, the use of science and technology resource is free, and it would be impossible to compensate financially for the fact that an item of science and technology resource is used many times.

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C. Cumulativeness

Science and technology resource is cumulative and progressive since it is an intellectual input possible to spawn new ideas and new goods. This means that externalities not only enhance consumers' enjoyment but also, and above all, promote the accumulation of science and technology and collective progress; it is the possibility for some to "stand on the shoulders of giants." In other words, what spreads and can be used an infinite number of times is not only a consumer good (for instance, an item of equipment) but essentially an intellectual input likely to spawn new goods that will also be usable for infinite times. In an era of rapid technological progress, many types of knowledge are strongly cumulative, such as computer technology, intelligence techniques and patent. These stand in contrast with noncumulative ones, such as experimental facilities.

II. Issues Regarding Value

It is the nonexcludability, nonrivalry and cumulativeness threesome that is at the origin of the huge size of the potential spillovers associated with the production of science and technology resources. Value of such resources is maximized in the process of transmitting and sharing, which is the weak chain of market mechanism. Thus, a sharing system of science and technology resources is needed to be launched by government.

A. Value in Science and Technology

The multiple forms of value in science and technology resources lie in its essence as capitals, commodity and scarcity of resources.

With the development of society and economics, the demand for science and technology resources is growing strongly in various industries. Not only are a large number of science and technology resources required but also higher-tech ones are needed. However, the progress of science and technology has a long way to go. In contrast, the reality is tough especially in rapidly developing countries such as China. For the majority of industries, development methods should be changed from the traditional one that depends heavily upon human and resources advantages to what is more efficient, economical and environment-friendly. In order to achieve this kind of transformation, a wide range of science and technology resources are necessary. However, the lack in education and innovation support leads to the shortage of these resources in various fields. In this circumstance, the value of science and technology resources is extremely high. Meanwhile, the uneven allocation and asymmetric information of these resources makes them "scarcer" in some areas.

Science and technology resource is a kind of capital since it is fluid and can bring in the increase in value probably more than the value of itself. The value of this sort of resource is achieved in the process of production, transformation, utilization and allocation.

From the standpoint of commodity, we know that science and technology resources have huge value in a range of industries, and the value can be different to different entities or individuals with different capabilities. Its production is motivated by the demand of it. The value of these resources is achieved in the process of trading.

From these three aspects above, it is obvious that the value of science and technology resources is presented in the progress of transforming and sharing. In other word, the flow of science and technology is also a flow of value and increase of value. Its value is the motivation of the allocation and sharing, so much has to be done in these two vital steps to realize the maximum value of these resources.

B. Realization Process of Its Value

Value in science and technology resources is realized in the form of fluxion. However, the amount of realized value in the same resource varies greatly among different entities and individuals who own and utilize them. Thus science and technology resource is an all-around one and only by using it in various areas by different entities or individuals in lots of forms can we achieve its most potential value and make it socially efficient.

In a specific chain of its management, the inner and potential value is fixed to some extent, but in current conditions we cannot realize its value sufficiently. With the complexity of science and technology and differentiation of its functions, the realization form and the value realized can be different. This point can be analyzed in horizontal and vertical aspects.

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