

The Internet commons: towards an eclectic theoretical framework

Justyna Hofmokl
Institute of Philosophy and Sociology, Polish Academy of Sciences,
justyna@hofmokl.pl

Abstract: Recent developments in communications technologies, in particular, the advent of the Internet and its widespread applications in all spheres of human activity, have posed a serious challenge to the mainstream neo-institutional theory of the commons (common goods) and, especially, common pool resources theory (CPR). Although the term ‘new commons’ has been coined to describe a new area of study, previous attempts to analyze Internet goods within the framework of CPR theory have not been successful, as they have not been able to capture the important new characteristics of the Internet commons. Based upon an empirical analysis of over 20 Internet goods, the author argues that Internet goods do not fall within the common pool category of goods. In addition to the key characteristics used so far within mainstream theory – excludability and subtractability – other attributes of a “commons” such as sharing potential, joint use in production rather than only in consumption and non-hierarchical governance of production definitely are relevant, and should be included in any analysis of Internet commons. The neo-institutional approach retains its explanatory power with respect to the Internet commons if one emphasizes the path-dependent evolution of the Internet and the role of informal and formal rules shaping its operating environment. Yet the approach does not capture the direct impact of major breakthroughs in information and telecommunication technologies (ICT) on the Internet commons.

A more eclectic theoretical framework is proposed as a step aimed at grasping the complexity of the Internet commons. It attempts to integrate new concepts developed in various disciplines of social sciences (economics, sociology, history, anthropology) with the mainstream theory of the commons, which developed from the neo-institutional perspective. Among those new concepts and theories, the most important are general purpose technologies (GPT), network externalities, positive

free riding, the concept of shareable goods, the architecture of participation, peer production, and the gift economy.

Keywords: Common pool resources, information technology, Internet, neo-institutionalism, new commons

Acknowledgments: I would like to express my deepest gratitude to Professor Jerzy Cieslik (Kozminski University, Warsaw, Poland), who also happens to be my father, without whose expertise, motivation and encouragement I would not be able to finalise this article. I would also like to thank my supervisor, Professor Andrzej Rychard (Polish Academy of Sciences), for his guidance and support throughout the whole process of writing the PhD dissertation, on which this article is based. The article is a revised version of a paper given at the 12th Biennial Conference of the International Association for the Study of Commons, Cheltenham, England, July14–18, 2008. It was awarded the association’s prize for the “Paper that does the most to improve understanding of governance issues.”

1. Introduction

‘Is There Anything New Under the Sun ...?’ was the title of a paper by Charlotte Hess, presented at the Eighth Biennial Conference of the International Association for the Study of Common Property, held in 2000 in Bloomington, Indiana (Hess 2000). She raised this provocative question with respect to the new phenomenon – technology-driven, human made commons, including the Internet. Based upon a review of the rapidly growing body of literature on this subject, she pointed out apparent weaknesses in current research. Many contributions were lacking methodological rigor, particularly reflected in ambiguity as to the meaning of ‘commons’, which made it very difficult to position the growing literature on the ‘new commons’ relative to mainstream commons theory, which predominantly focuses on common-pool resources (CPRs). In conclusion, Hess emphasized the need to promote high-quality research, particularly on the Internet commons, which can overcome some of the weaknesses recognized at the initial stage.

This paper attempts to contribute to the current theoretical debate on the Internet commons by addressing the following questions:

1. To what extent do the Internet commons demonstrate the two principal characteristics (bio-physical attributes) that have been utilized widely in the analysis of traditional commons: excludability and joint consumption?
2. Which new intrinsic characteristics of the Internet commons make them a distinct category, thus calling for expansion of the theoretical framework to include these characteristics?

The neo-institutional framework is the principal platform used in the construction of the mainstream theory of commons.¹ The neoinstitutional approach has been attractive for the analysis of commons for two reasons. First, the core argument that ‘institutions matter’ is particularly relevant to CPR goods, where the classic market mechanism cannot function in an efficient way. Second, neoinstitutionalism offers a powerful base for promoting proactive analysis and research, leading to the design of specific institutional arrangements, thereby enabling the more efficient production and consumption of particular CPRs. I refer, for example, to the Institutional Analysis and Development (IAD) framework (Ostrom et al. 1994). Consequently, a third research question is:

3. Does the neoinstitutional approach retain its explanatory strength and usefulness in the investigation of the Internet commons?

In this article, I will adopt the definition of commons that has prevailed in the CPR literature, which emphasizes the crucial role of the key biophysical attributes of goods: non-excludability and non-rivalrous consumption, differentiating common goods from private goods. It is because of these characteristics that the classic market mechanism for the production and exchange of common goods largely becomes inefficient. The tension between individual and group rationality has been exemplified in the formulation of social dilemmas – the tragedy of commons, the prisoner’s dilemma, and the logic of collective action (Olson 1965) being the key conceptual pillars of the mainstream theory of commons.

Although the categorization of various goods using the two characteristics mentioned above was initiated by economists in the context of the public goods debate (Samuelson 1954), its refined formulation by E. Ostrom and V. Ostrom has laid down the foundation for what I refer to as the mainstream theory of commons (Ostrom and Ostrom 1991) in social sciences.² It has largely concentrated on one category of goods – common-pool resources (CPRs) – in which case, the difficulty in excluding unauthorized beneficiaries coincides with rivalrous consumption after reaching a certain degree of exploitation of a given resource. Other non-private goods with alternative combinations of key biophysical attributes – like pure public goods and so-called ‘club goods’ (toll goods) – have received much less attention from scholars. A broader framework, including all combinations of

¹ While referring to the mainstream theory of commons, I have in mind research conducted by the scholars associated with the Bloomington Workshop in Political Theory and Policy Analysis. The formulation of the key concepts in this field can be found in the works (publications) of E. Ostrom, V. Ostrom, C. Hess, R. J. Oakerson, E. Gardner, and J. Walker.

² I do not here address the broader meaning of commons as a ‘public space’ – originally a town square, village green, etc. This does not mean that I consider it less important. Just the opposite, I believe that the Internet adds a fundamentally new dimension to the concept of commons as a public space. However, its detailed analysis would call for addressing a different set of research questions and using different tools and methodologies, which is beyond the scope of this paper.

excludability and subtractability or types of goods, is called for in examining the case of the Internet, which is characterized by a conglomerate of goods and internal diversification. This, in turn, calls for a broader definition of commons to include pure public goods and club goods as well as CPRs. Such a broad concept has been reflected in E. Ostrom's recent definition of the commons: "A general term that refers to a resource shared by a group of people and often vulnerable to social dilemmas" (Ostrom 2007, 349).

The rest of the paper is organized as follows. First, I look at the rise and evolution of the Internet from the neoinstitutional perspective – testing general explanatory strengths and the applicability of its specific concepts and methodologies. Next, I conduct an empirical analysis of the characteristics of the Internet, focusing on its key biophysical attributes (non-excludability and non-rival consumption). In order to draw some general conclusions, I will investigate, in greater detail, the principal characteristics of individual Internet goods. The adoption of an analytical perspective where the Internet is being "decomposed" into specific goods identified within its holistic framework can be justified by its diversified structure and the existence of its three basic layers: hardware, software, and information content.³

Identifying new and important characteristics of the Internet commons that are not adequately captured within the mainstream theory of commons, in the context of Internet goods, leads to the proposal for an eclectic framework, wherein new concepts from other disciplines are incorporated, thereby broadening the research perspective. Key findings are summarized in the final section.

2. Internet and the neoinstitutional approach

Although the origins of the neoinstitutional approach in economics are reflected in the early work of Ronald Coase (Coase 1937), the methodological framework and analytical apparatus, as well as the extension of its scope to other social sciences – like sociology, law, and political science – is of recent origin, all having taken place since 1960. This happens to coincide with the rise of the Internet – a new phenomenon which, despite a very short history of less than 50 years, has brought about fundamental changes in practically all aspects of human life – economic, social, cultural, educational, political, etc. (Abbate 1999). Neoinstitutional analysis can be helpful in understanding this development.

2.1. Path dependency

Path dependency is one of the key concepts of neoinstitutional analysis. It reflects the situation wherein outcomes are "shaped by a previous sequence of decisions" (Ostrom and Hess 2007, 351). These decision sequences can be incidental; on the

³ The "decomposed" way of analysis may be conducted in the case of other common goods like lakes or forests. Due to the internal complexity of the Internet, its adoption seems to be particularly relevant here.

other hand, they may result in enduring patterns, procedures and standards. The persistence of the QWERTY keyboard despite the availability of ergonomically superior alternatives is a classic example of the path dependent phenomenon. During the short history of the Internet and particularly, its formation period in the 1960s, there were numerous examples of path-dependent sequences of events.

The initial impulse and funding for the Internet came from the government military sector. However, from the very beginning, members of the academic community enjoyed great freedom while helping create the Internet, and that freedom has remained as a major source of path dependency, as seen in the following shaping principles and operating rules of the Internet:

- The lack of a central command (co-ordination) unit. Instead, a democratic procedure based on consensus has been introduced to define detailed operational procedures;
- The principle of network neutrality, which implied that the Internet network, as such, shall be as simple as possible, whereas all specialized elements (network intelligence) shall reside at the level of user-end stations;
- The open access principle reflected in the determined effort by the Internet founders to establish a technical infrastructure allowing local networks, both in the United States and abroad, to join the emerging global Internet structure.

In the short history of the Internet, one can point out other instances of path-dependency resembling the classic QWERTY case (Liebowitz and Margolis 1990). One is the system of allocating domain names to the end-users based on a 'first come, first served principle'. Although there are obvious deficiencies with such an allocation mechanism combined with the oversimplified categorization of domain names, this has remained basically unchanged, as accumulated experience and tradition made changes difficult to implement.

Moreover one cannot neglect the path-dependent outcomes of the initiatives taken by Bill Gates in the mid-1970s. At that time, open access to software programs and operating systems was standard; making the source code freely available was quite logical as it facilitated the elimination of certain flaws and the configuration of computers to satisfy individual needs. In 1976, Gates, at that time a renowned if very young IT specialist and nascent entrepreneur, challenged the open access principle. In his 'Open Letter to Hobbyists', he laid down key arguments in favour of proprietary software, pointing to the detrimental effects of the free access principle for software providers, and spurred the development of the software industry in general (Gates 1976).

The initiative taken by Gates was a turning point in the development of the software retail market, which began to operate independently from the computer hardware market. The success of Bill Gates and his company Microsoft as a founder and key player in the emerging software industry was aided by Gates'

affinity for institutions – contracts, laws and regulations, introduced in order to protect software providers against the unauthorized use of their products. At the same time, Gates' initiative paved the way for consolidation of the open source community, which initially relied exclusively on unwritten rules and practices established during the formation period of the Internet. The visible outcome has been a variety of formal institutions related to the open source initiatives.

2.2. Informal rules

Neoinstitutional analysis also emphasizes informal as well as formal rules. The experiences of the 1960s – during the early 'formation period' of the Internet – were crucial for shaping informal rules which became the pillars of 'Internet culture'. Networking was the key coordinating mechanism in the implementation of initial projects (Himanen 2001; Castells 2003). According to Frances et al. (1991) efficient functioning of networks largely depends upon the spirit of cooperation, loyalty and trust among network members. This, in turn, generates social capital, defined as a set of informal values and norms shared by group members (Fukuyama 1999). In the community of early Internet enthusiasts, there was a very favourable climate for building such capital and facilitating efficient network coordination. First, the people involved in the early stage projects (such as Network Working Group, ARPANET, USENET) had similar occupational backgrounds, coming mostly from academic circles. Secondly, they represented an emerging IT profession that was considered highly complex and, therefore, hermetic to outsiders. This helped to forge internal ties between project team members.

The informal norms and values guiding the implementation of early-stage Internet projects included a decentralized philosophy, encouragement for bottom-up initiatives, respect for minority views, and strong efforts to reach consensus (accepting, however, non-unanimous voting). This may sound like an essentially egalitarian, socialist orientation typically demanding some sacrifices with respect to efficiency and quality. However, this definitely was not the case during the Internet's formation period, which was strongly influenced by the cult of professionalism, based on merit and not on formal criteria. As a result, the best professionals were invited to join project teams, irrespective of their formal education, status, age, nationality sex or race.⁴

The mutual trust based on the accumulated social capital within the network was crucial in shaping, from the very beginning, a broader, global vision of the Internet. It was so powerful that it overshadowed the orientation that initially had been pursued by the government agencies focused on building specific military applications.

⁴ P. Himanen compares the above set of values characterizing founders of Internet and later embodied in the so-called hackers ethic to the protestant ethic, which has been argued as the basis for modern capitalism (Himanen 2001).

2.3. The convergence of informal and formal rules

The issue of convergence (or lack thereof) between formal and informal rules represents one of the interesting subjects tackled within neoinstitutional analysis in sociology (Nee 2005). Convergence is reflected in the close-coupling of formal and informal rules. However, when the formal rules are at odds with the informal norms and values of the network community, this gives rise to a decoupling through opposition norms.

Processes of close-coupling and de-coupling can be seen in the evolution of the Internet. Although the rise and early development of the Internet has been governed mostly by informal rules, formal rules (laws and regulations) have emerged as the Internet space has been increasingly used for commercial activities, in order to protect the economic interests of parties involved in market transactions. The extension of existing intellectual property protection regimes, to include software and, later, information content stored electronically, can be mentioned as the primary examples of this trend. In addition, commercialization of important segments of the Internet space has resulted in formalized restrictions relating to source codes and information content, thus reflecting close-coupling between said laws and regulations and the core set of capitalist values emphasizing profit motives.

Simultaneously, however, these processes have clashed with the norms and values of open access which emerged during the formation stage of the Internet. The advocates of 'free access' not only resisted the emerging formal infrastructure facilitating commercialization, but actively embarked on setting up some formal regulations that instead were 'close-coupled' with open access norms and values. What has emerged, as a result, has been a dual structure within the Internet, of commercial and free access segments.

3. Characteristics of Internet goods

The Internet is a complex, heterogeneous good that can be alternatively defined accordingly to its different functions. In this paper, I shall adopt the wide definition of the Internet, viewed as a system of communication between users (Benkler 2000; Solum and Chung 2003). Similar to other systems of communication, such as language, the Internet consists of three distinct layers: physical, logical, and content (Benkler 2000). The physical layer enables communication by providing physical equipment; the logical layer is responsible for maintaining the code; and the content layer is the final message that is transmitted from sender to recipient. This categorization constitutes the basic axis of the following analysis.

In order to determine whether the term commons is applicable to Internet goods, I shall conduct first an analysis of the key biophysical attributes of excludability and subtractability, in line with the methodology adopted in the mainstream theory of commons. Additionally, I shall identify features which differentiate Internet commons from traditional common goods. Analyzing the

technical aspects of the Internet is beyond the scope of the present paper, so I will restrict references to technical aspects to a minimum (See Lemley and Lessig 2000; Clark and Blumenthal 2001).

3.1. The physical layer

The physical layer consists of all the physical tools and equipment that enable the process of communication. These include computers (the equipment to produce and send information), and tools that enable communication between computers – routers, wires, cables and wireless networks. Recently, a wide range of mobile devices – such as mobile phones, handhelds and mp3 players – have been added, which also facilitate communication. Following the terminology used in the mainstream theory of commons, the key hardware components are pure private goods (excludability combined with rivalrous consumption). However, a closer look points to a somewhat diversified picture.

3.1.1. Telephone cables

In order to connect to the Internet, the user needs a computer connected to a telephone network, cable line or some other device that can receive a wireless signal (like a router). Cables that transmit the signal to the end user belong to telecoms or cable operators. These are private goods, which are extremely expensive due to the high costs of building and maintaining the cable infrastructure. Therefore, ownership of the cables usually belongs to big telecommunication companies, who generate profits by leasing the cables to smaller operators. The dominant and often monopolistic position of the telecoms results in very strict policies related to sharing access to cables. These relations also are monitored and controlled by specified governmental agencies. Therefore, the cable infrastructure falls into the category of regulated private goods.

3.1.2. Wireless networks

Wireless networks are an alternative source of Internet connection. These networks have distinctive features, making them an interesting object of analysis. Until recently, due to the high level of radio wave interference, consumption of the radio spectrum was steeped in rivalry, thereby falling within the CPR category. This spectrum was considered to be a scarce resource that needed to be regulated by the authorities. Moreover, alternative governance structures were based either on restricted access to specialized government agencies (collective goods) or the privatization of specific frequencies through concession systems (private goods).

Recent technological developments have enabled smart receivers to distinguish signals from different sources, thereby allowing the sharing of certain frequencies (Benkler 2006). Consequently, multiple users can use the same frequency with very little or no decline in the quality of service. For that reason, modern wireless

networks are becoming an open alternative to closed broadband networks. Therefore, in this case alone we find different forms of “goods”:

- Commercial networks owned by telecommunication companies or private corporations, to which access is granted to subscribers or designated members fall into the club goods category;
- Municipal networks built by local governments, to be freely used by citizens or visitors can be classified as public goods – the costs of providing the good are covered by the local government, and access usually is free to all citizens or users in range of the network;
- The most interesting category of wireless networks is comprised of open, bottom-up networks, usually set up by individuals who allow anyone to connect to their transmitters. These so-called social WiFi networks or mesh networks generally fall within the public goods category.

Technological developments in wireless communications also have given rise to the widely spreading concept of an ‘open spectrum’. Open spectrum proponents call for decision makers to deregulate and free up the radio spectrum (Benkler 1998). They claim that, as a result of recent technological developments, radio waves have become public goods. Consequently, they appeal to regulators to create a friendly, institutional environment, facilitating and encouraging bottom-up civic initiatives.

To summarize, wireless networks are in the midst of major changes. New institutional arrangements that allow for the transformation of classic private goods into club or public goods are particularly interesting. The informal networks serve as a primary example of the impact major technological developments in the ICT field have had on the common character of specific goods that comprise the physical layer of the Internet structure.

3.1.3. Computer hardware

Computer hardware should be easy to classify as private goods, owned by individuals or organizations. What is interesting, however, is that they can change their purely private character once the equipment is connected to the Internet. This is because personal computers hooked to the network can share excessive processing power or disk storage. Since this involves practically no additional costs to the owner, this paves the way to the provision of extensive processing power free of charge to perform certain socially valuable initiatives, as in distributed computing projects like SEITI@home and peer-to-peer networks.

It should be noted that individuals share their resources with a community of strangers, having often little or no knowledge about the way the resources will be used. Therefore, a certain duality with respect to private versus common becomes an essential characteristic of some Internet goods.

Moreover, private goods that are jointly used within a network – becoming common goods – can in turn become valuable resources for commercial activities. One of the most profound examples is Skype, the company that offers free VoIP

calls. Skype uses the power of computers connected to the network to establish VoIP connections. When the user installs and runs Skype on his computer, he joins the community of users that form a peer-to-peer network. The network enables free Internet calls (benefitting users) but also affords opportunities for revenue to the private company. Here, the private goods (computers) shared for free are being commercialized by a private company while benefitting a community of users, who are often unaware that their computers are taking part in such an exchange, due to the complexity of the system.

3.2. The logical layer

The goods that constitute the middle, or logical, layer are Internet protocols, technical standards and software that enable the process of communication.

3.2.1. Technical standards

Technical specifications and protocols define the rules of communication between computers. The choice of a technical standard not only influences the basic operations of the computer system, it also has vital implications for the hardware industry, Internet providers and end-users. Standards are a form of control not only over technology, but also over the user (Abbate 1999).

Technical standards can be either open or closed as far as ownership and availability are concerned. The Internet has been built on non-proprietary protocols, such as the TCP/IP suite of protocols, which were defined as common property of the whole Internet user community (Solum and Chung 2003) and which have the property of public goods. Tim Berners-Lee, the inventor of the World Wide Web, has deliberately kept the HTTP protocol and HTML programming language open, i.e. available to the general public and developed via collaborative process, in order to maintain the innovative character of the network for as long as possible (Berners-Lee 1999). Such standards are non-rivalous resources, free for everyone to use without access restrictions.

Proprietary standards owned by private entities fall into the category of private goods or club goods. While the network technical standards responsible for the seamless cooperation of different networks and devices are, to the great extent, open, many technical specifications and file formats are proprietary and closed, protected by copyright or patent law. These formats are designed by companies which want to have exclusive rights to produce specific software. Among the examples of proprietary formats are the following types of files: .doc (text files), .pdf (text files), .gif (images), flash (animation), and .mp3 (music). One is not allowed to tinker with the formats without the copyright holder's consent, and access to specific tools is granted only to licensees.

3.2.2. Domain name system

Among the most important resources within the logical layer are IP addresses and domain names. These are private goods governed by the dedicated organization

called the Internet Corporation for Assigned Names and Numbers (ICANN). The right to use a certain Internet domain name is granted to a person or organization who rents the domain for a limited period of time (with priority to extend that time, if wanted). Although the process of domain names allocation is complex and includes systems for dispute resolution, the first-come, first-served rule is applicable to new and previously-unknown domain names. Otherwise, a person or organization must prove that it should be granted exclusive rights to use a certain domain.

3.2.3. Applications and software

Applications and software comprise the largest group of resources within the logical layer. Software enables computers to perform productive tasks for users – it translates content and commands from machine language into human language and vice-versa. Among software, we can list operating systems, programming tools, and applications (word processors, email applications, video software, games, etc.). Although computers can work perfectly well without an Internet connection, more and more software is designed to work within the network. Therefore, I do not make a distinction between Internet and non-Internet software.

Bill Gates' 1976 initiative resulted in the division of the software market into two segments: proprietary and open source. In the case of proprietary software, the source code is closed as well. Such software can be distributed either for free (Internet Explorer, Adobe Acrobat Reader) or licensed to the individual or multiple users (Microsoft Office). Open source software is characterized by free access to source codes and a wide range of freedom for the user. The majority of open source software distributions are given away for free; but there also are versions of the software that are distributed on a commercial basis.

Computer software is an intangible good in digital form. Software code can be copied almost for free (the cost of a recordable CD is negligible) and without any loss of quality, and therefore without limiting the consumption potential of other users. Therefore, computer software, both non-proprietary and proprietary, belongs to the category of non-rivalrous resources. In the case of proprietary software, the owners restrict the access by specific licensing arrangements. Once obtaining the licence and subject to some limitations within its scope the user can freely decide about the intensity of software "consumption". Thus, proprietary software falls into the category of club goods. On the other hand, open source software is both non-rivalrous and difficult to exclude. Therefore open source software can be classified as a public good.

3.3. The content layer

The resources in the content layer of the Internet are intangible. These are human intellect products in digital form – information, ideas, knowledge, music, text, videos and images. Information is a key resource that is a basis for all the other goods in the content layer.

CPR scholars have recognized that informational resources are of a different nature than tangible, material goods. Hess and Ostrom stressed that analyzing information is much more tenuous than natural resources, because “*Information ... often has complex tangible and intangible attributes: fuzzy boundaries, a diverse community of users on local, regional, national, and international levels, and multiple layers of rule-making institutions*” (Hess and Ostrom 2004, 132). They distinguish three forms of informational resources: artefacts, facilities and ideas. “*An artefact is a discreet, observable, nameable representation of an idea or set of ideas (for ex. articles, research notes, books, databases, maps, computer files, and web pages. [...]) A facility stores artefacts and makes them available. [...]) The ideas contained in an artefact can be understood to mean the creative vision, the intangible content, innovative information, and knowledge. Ideas are the non-physical flow units contained in an artefact*” (Ibid, 129–130).

Technological developments, especially digitization, have redefined the environment of informational goods. In the ‘analogue’ era, artefacts were physical and mostly private goods, and the infrastructure – like libraries and archives – that made these resources available to the public either were club goods or public goods. Ideas always were a common good and remained as such within the digitalized environment.

Although traditional artefacts in physical form belong to the category of classic private goods, digital artefacts, promoted by the Internet, represent a wider range of goods. One of the most distinguished features of digital artefacts is the possibility of copying without the loss of quality and at almost no cost. This makes digital artefacts non-rivalrous goods, as one person’s use of a digital file does not subtract from another person’s capacity to use it. Free copying – and technical difficulties preventing it – changes the whole process of distribution, enabling the immediate delivery of digital artefacts.

Additionally, new technologies entering the market have facilitated the collective production of informational goods, so that they have become common property. Thanks to collaborative website creators, such as *wiki*, the users can edit and share information easily with others, best exemplified by Wikipedia. In addition, authors have new tools for managing their copyrights, licenses that enable copyright holders to grant some of their rights to users while retaining other rights. Examples of new licensing models include Creative Commons licenses or GNU Free Documentation Licenses. The digitization of artefacts and the whole electronic environment for producing information has fundamentally altered their basic attributes. On one hand, their consumption has become non-rivalrous. As for access, the existing arrangements range from full exclusion of unauthorized users to free and open access with some intermediary solutions. Consequently, digital artefacts fall within various categories of common good, depending upon the degree of exclusion as the licenses allow the authors to choose different freedoms granted to users.

As far as the information infrastructure is concerned, one also may note a visible shift to digital forms. Digital repositories and databases typically fall within the category of club goods (they are open only to authorized users), but there is a

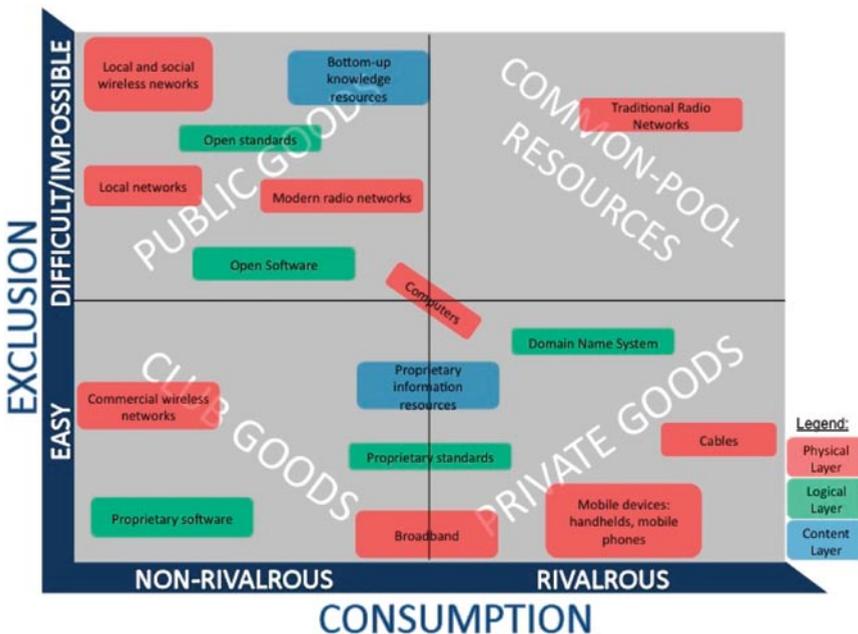
growing number of digital open access archives that gather informational resources which are free for anyone to use. Therefore, one may conclude that, within the realm of informational goods, one can observe very interesting changes corresponding to the radical innovations being developed in information technologies, which are shaping entirely new conditions for the production and exchange of such goods.

4. Internet commons – towards an eclectic framework

4.1. The need for an eclectic approach

Based upon the analysis presented in the preceding sections, I will now summarize key findings in the context of the research questions formulated in the Introduction. Definitely, there is a merit in applying the notion of commons to individual Internet goods, but also to the network as a whole. At the same time, however, the Internet adds new dimensions to the overall concept of commons, so that the question raised by Charlotte Hess back in 2000 – “Is there anything new under the sun?” definitely can be answered in the affirmative.

With respect to the two classic biophysical attributes, excludability and subtractibility or consumptive rivalry, I have noted great diversity in Internet goods (see Figure 1).



Source: Author's presentation

Figure 1: Internet goods classified according to key biophysical attributes.

Many Internet goods fall within the pure public goods category. This is especially visible in the case of the logical layer (open standards and open source software) and the content layer (open informational resources). A large group of Internet goods can be categorized as club goods (non-rivalrous consumption and excludability). Examples are broadband Internet access, proprietary software, and closed databases.

The most striking evidence of ‘novelty’ in the context of the mainstream CPR theory is the virtually empty ‘CPR quadrant’? With the exception of traditional radio waves, it is difficult to identify any other Internet good which would fall within the CPR category. A “common pool resource,” the focus of the mainstream theory of the commons, is defined in terms of a particular set of biophysical attributes: non-excludability combined with rivalrous consumption. This combination of the key biophysical attributes is almost non-existent in the case of Internet goods.

Hence, there is an obvious need for extension of the existing theoretical analysis of commons to encompass particular features of Internet goods. This will not be an easy task, particularly due to their diversified but, at the same time, interrelated structure. We need to develop new methodological tools to investigate how the key biophysical attributes used in mainstream theory of commons interact at the level of individual Internet goods and affect the functioning of the Internet as a composite structure.

An additional important feature of Internet goods is their duality. The same goods can, with different institutional arrangements, fall into either the public, private or club goods category. Duality can be observed in cases of open or closed computer software or open and proprietary information resources, or privately owned hardware that changes attributes when working within a network. A stand-alone piece of hardware like a portable computer represents a classic private good; but once it is connected to a network, it can take on features of a club or semi-public good.

The rise of the Internet gives a new impulse for incorporation of other than CPR common goods, categorized with the use of non-excludability and joint consumption criteria; namely, the (pure) public goods and club goods. Pure or semi-pure public goods features of the Internet include open standards and open access software, electronic repositories of freely available information and knowledge, etc. Free access to information in the electronic format by millions of Internet users, combined with the active involvement in the generation of said information and knowledge, already has affected human civilization in all important spheres: economic, technological, socio-cultural, and political. We need to study these new Internet goods, which calls for revisiting the concept of public goods in various disciplines within the social sciences.

The Internet commons also open new perspectives with respect to club goods. Club goods (easy exclusion combined with non-rivalrous consumption) have been treated as quite rare and predominantly local (country clubs, subscribed theatre services). This has changed radically with the Internet. Contemporary ‘clubs’, which gather users of proprietary software and subscription-based proprietary

databases, can have millions of members all over the world. Classic club goods used to be treated in academic analysis as impure private goods, whereas the key characteristics of Internet club goods render them closer to pure public goods, as in the example of electronic repositories of scientific journal articles, which are accessible to scholars on the basis of subscriptions paid by their university. From the individual scholar perspective, such service can be viewed as a pure public good, as she/he is not confronted directly with restrictions in their use (except that the access code needs to be provided).

This expansion of common goods to encompass public and club goods as well as CPRs can be incorporated within the existing neoinstitutional framework for studying the commons. However, other features of the Internet commons call for a more fundamental change in the overall framework by incorporating new, interesting concepts outside the mainstream theory of commons. Some elements of a more eclectic theory of the Internet commons are discussed below (Figure 2).

4.2. General purpose technologies (GPT) theory

Although the history of civilization can be seen as a stream of continuous innovations in all spheres of human activity, according to general purpose technologies (GPT) theory, technical progress and growth over centuries has been driven by certain ‘great leaps’ in innovation affecting entire economies at the national and global level. The list of such general purpose technologies is subject to vivid debate, but the most often quoted examples include the steam engine, electricity, and information and communication technologies (ICT). ICT and

OPEN/ UNRESOLVED ISSUES/ RESEARCH DIRECTIONS	RESEARCH DIRECTIONS/ RELEVANT CONCEPTS
Mainstream Theory of Commons - Internet not a CPR good, but more often a pure public or club good - Internet as a ‘composite good’ - Duality of Internet goods	These novel issues need to be researched within the extended theory of commons, encompassing Internet-specific issues.
Technological breakthroughs not adequately covered within neoinstitutional theory commons	General purpose technologies theory
Sharing potential of Internet goods	- Network effects - Positive free riding - Shareable goods
Non-hierarchical involvement in the production of Internet goods	- Architecture of participation - Peer production - Gift economy

Source: Author’s presentation

Figure 2: Internet commons: proposed eclectic theoretical framework.

related Internet technologies share key features of the great technological leaps, as identified in the GPT literature:

- The use of general purpose technologies spreads wide across key sectors of the economy and social life;
- GPT represent a great scope of potential improvement over time;
- GPT facilitate innovations generating new products and processes,
- GPT show strong complementarities with existing and emerging new technologies (Bresnahan and Trajtenberg 1995; Helpman 1998).

What is crucial in the context of the Internet commons debate is that GPT theory emphasizes the broader complementarily effects of the Internet as the enabling technology changing the characteristics, as well as the modes of production and consumption of many other goods. If we take the book as an example, in the standalone paper form available in the bookstore, it is a classic private good. Once it becomes freely available over the Internet in an electronic form, it becomes a pure public good. When an access charge is imposed for its electronic version, it becomes a club good. But, at the same time, we may observe a radical transformation in the entire publishing industry resulting from the wide application of ICT in the production and distribution of books in the traditional format (digital printing, and distribution via the Internet, e.g. Amazon.com). Less revolutionary, but very important for many users, is the availability of digitalized versions of books distributed through the traditional bookstores alongside their paper versions. There are other examples of the Internet as an enabling technology, some of which have been noted in previous sections. Thus, the concepts and key findings of GPT theory seem to be very useful for extending the scope of the mainstream theory of commons not only to include the specific characteristics of Internet goods, but also to illustrate the wider implications of Internet technologies for the common character of other goods.

4.3. Theoretical concepts reflecting the ‘sharing potential’ of Internet goods

An important attribute of the Internet commons is its ‘sharing potential’, which reflects the broadly-defined efficiency of joint consumption (use) of a given good, often by a very large and expanding number of users. Such joint use does not substantially diminish a good’s value. Quite often, such value increases with the number of consumers. This contrasts with the characteristics of classic CPR goods, where exceeding a certain number of users causes consumption to become rivalrous. The useful concepts which might be helpful for explaining the sharing potential of Internet goods are network effects, sharable goods, and positive free riding.

4.3.1. Network effects

The network effects concept was introduced to the economic literature in 1985 by M. L. Katz and C. Shapiro, who used the term ‘network externalities’. They

noted that, in the case of many products, “the utility that a user derives from consumption of the good increases with the number of other agents consuming the good” (Katz and Shapiro 1985). This concept was later refined by S. Liebowitz and S. Margolis, who argued that network effects, in their pure form, do not need to coincide with externalities; i.e. positive or negative effects on parties not involved in a given transaction (Liebowitz and Margolis 1994). The added value of existing and new customers results from direct interactions between the users of a given good, as well as from the increased availability of complementary products and services.

Back in the 1980s and 1990s, when the network effects concept was introduced and refined, traditional telephone systems were viewed as the primary exemplification of these effects. Nowadays, with the rapid development of information technologies, the ICT sector is believed to demonstrate the most significant network effects, i.e. the World Wide Web, where new essential functionalities were added once the number of Internet users increased. The same goes for websites facilitating exchanges via the Internet (eBay) or dedicated portals used for social networking. The developments taking place within the Internet spectrum clearly contrast with the classic CPR scenario. Specifically, the network effects increase radically once the number of users of a given Internet good reaches a certain threshold. For CPR goods, the increased number of users results in the excessive exploitation of a given resource.

There are negative implications as well, shown in the so-called ‘locked-in situations’, exemplified in the market for professional software applications that is presently dominated by Microsoft. The providers of alternative applications, often of superior quality, have faced major obstacles convincing potential clients to shift from Microsoft Office. The clients were reluctant to lose obvious benefits derived from network effects: compatibility with the applications used by their business partners, standard installations on purchased hardware, access to auxiliary services, additional combatable applications, etc.

4.3.2. Positive free riding

The so-called ‘free-riding problem’ is a social dilemma, a conflict between individual self-interest and the community. In a classic CPR scenario (costly exclusion and rivalrous consumption) the provision of common goods normally would call for voluntary contributions from community members. However, this is in conflict with the maximization of individual benefits among community members who, following homo oeconomicus logic, are not willing to pay for goods which are otherwise freely accessible. But there are diverse non-pecuniary motives among people involved in the consumption and production of Internet goods (Stiglitz 2000). Even so, one might see the open source, free operating system Linux to be an ‘impossible public good’; i.e. having characteristics making it impossible to materialize if the classic free riding social dilemma is all there is (Kollock 1999). Positive or passive free riding, situations in which free riders do not diminish value and may actually add value to the final product, may

be characteristic of the Internet: *“Internet reduces the cost of free riding... each free rider actually adds value to the final product. If the free rider is completely passive, she adds value by adding market share (and thus increasing the space for reputational returns to contributors). If she is just a little bit active, the free rider becomes a de facto tester and might just report a bug or request a new feature. The Internet reduces the communication costs of doing all that to just about zero”* (Weber 2000, 36). There are obvious inter-linkages between positive free riding and the network effects discussed earlier. This is because network effects materialize with the increased number of users, including passive free riders (Weber 2004).

4.3.3. Shareable goods

The shareable goods concept refers to intrinsic characteristics of some private goods (computers, wireless transceivers, Internet connections) which facilitate sharing with other users (Benkler 2004). The key argument behind this concept is that some goods available on the market are ‘lumpy’; i.e. they are produced in discrete sizes and represent varying capacities. Typically, available capacity is fully utilized only in specific time intervals; otherwise, it remains partially underused. Such idle capacity of some Internet goods can be shared with other users at practically no additional cost to the owner. Notable examples of capacity sharing are distributed computing projects and peer-to-peer networks.

It should be noted that the issue of available excess capacity is not restricted to Internet goods. However, with the Internet sharing is much easier and more efficient. To share excess storage capacity in a warehouse located on the company premises would call for a set of additional logistic arrangements (controlled access to the warehouse, separate storage space, sharing additional costs of monitoring and insurance, etc.). Such problems are practically non-existent when sharing excess computer processing capacity via the Internet network, although one has to consider other Internet-specific limitations: trust among the network participants, privacy and the general security of systems participating in the distributed processing.

The shareable goods theory can be extended to include the increased shareability of certain other private goods, once sharing is accomplished via the Internet, just to mention carpool (especially for long distance travel) and apartment-sharing systems. On the other hand, the simplified, practically cost-free sharing opportunities that exist on the Internet may provide additional powerful stimuli to accelerate the production of specific goods, as profoundly demonstrated by the success of the YouTube exchange of short amateur movies.

4.4. Non-hierarchical involvement in the production of Internet goods

The concepts presented above help to explain the sharing potential of Internet commons, basically confined to the consumption process. But, even more important are those attributes of the Internet commons which facilitate sharing resources

in various joint production undertakings. The issue of joint production should not be separated from the particular organizational forms of such production and the motives of those involved in large collaborative undertakings, particularly IT professionals. The recently-formulated concepts of architecture of participation, peer production and the gift economy seem to be particularly relevant here.

4.4.1. Architecture of participation

The key argument behind the 'architecture of participation' concept is that the rules and principles laid down by the founders of the Internet during its early formation period established a very favourable and encouraging environment for joining the network, even by non-experienced users, and subsequent engagement by those most active in various collaborative undertakings. The silent feature of Internet architecture is that web activities that are intended to satisfy individual, egoistic interests, irrespective of their intentions, contribute finally to the increased collective value (O'Reilly 2004).

Among the basic rules that shape the participatory structure of the Internet is the end-to-end principle (Saltzer et al. 1984). This states that the network, as such, should remain as simple as possible, whereas all specialized elements (network intelligence) should reside with the computers of end-users and their software programs and applications. Second, efficient data transfer has been achieved with the help of an open TCP/IP network protocol, under which neither diverse operating systems nor computer brands were discriminated by the network. Everyone was allowed to use and exchange data with others, because the protocols were made to share, not to exclude. One also shall point out the simplicity of the HTML language and the open HTTP protocol, allowing for the flexible and unrestricted creation of new websites, and for the expansion and updating of their contents, even by the users with very limited experience.

The participatory architecture of the Internet has been further reinforced by its new technological platform, called Web 2.0. New tools and technologies are meant to enhance the exchange of information and flexible engagement in various collaborative efforts and events. These new developments within the Internet spectrum can be seen as the exemplification of an emerging complex social phenomenon, coined by H. Jenkins (2006) as participatory culture. It reflects an ongoing process whereby fans and consumers are effectively encouraged to participate in the creation and exchange of new media content (Jenkins 2006). The participatory culture largely contradicts the traditional notion of 'audience', which implied the generally passive, static role of the recipient of information and cultural goods. Needless to say, the Internet network plays crucial role as an 'enabler', making such cultural participation and exchange possible on a massive scale, with maximum flexibility and efficiency.

4.4.2. Peer production

The concept of 'peer production' (Benkler 2002) challenges the neoclassical 'team production' theory formulated by Alchian and Demsetz (1972). They argued that,

under conditions where it is very costly to ascertain the contribution of each team member to the value of the product, there is the risk of shirking or free riding. To avoid this, the system of hierarchical control within the firm must be put in place. However, within the space of Internet many complex, collaborative undertakings – like the development of the open source software – are being successfully implemented without the degree of hierarchical control that is required for projects of similar size performed within large, offline corporations.

Benkler (2002) claims that neither the market nor the hierarchical structure of a firm can provide an efficient coordination mechanism for the provision of goods in an information commons. Such efficiency can be achieved under the alternative, third production model called ‘peer production’, which occurs when the coordination of large, complex projects is accomplished largely without formal hierarchical control, but team members are motivated, not by financial incentives, but by a range of non-pecuniary motives, including the professional satisfaction derived from creating something new and bringing value to the community (Benkler 2002). The implementation of large-scale, open-source projects, involving thousands of programmers, and the Wikipedia phenomenon are primary examples of a peer production coordination mechanism.

Benkler points to four key characteristics which render team production particularly efficient with respect to information goods in a pervasively network environment:

- Information is a purely non-rivalrous good, both as an output and as an input to the production of other information goods;
- Major technological breakthroughs in the ICT field have contributed to a radical decline in the costs of information production.
- Creative talent, being the primary input in the production of information, is much more variable than traditional labour and material inputs;
- The radical decline in the cost of exchanging information combined with the increased efficiency of such exchanges within a network economy facilitates the effective coordination of widely-dispersed resources (Benkler 2002).

The above list of the key attributes of the information commons demonstrate that the basic foundations of the peer production concept are embedded in general purpose technologies theory. It is clear that the recent major breakthroughs in the ICT field were instrumental, as the key enablers for the effective implementation of a peer production coordination mechanism.

What is particularly interesting and, in fact, unique in the peer production concept is the analysis of alternative non-hierarchical methods by which to coordinate complex undertakings. This includes, *inter alia*, the following procedures: the self-allocation of tasks, the widespread use of peer-review for evaluation, and bottom-up initiatives, aimed at identifying best candidates (both among existing and new team members) to perform specific tasks. The

educational background and the professional culture of software programmers seem to play important roles here. However, the evident success of the NASA Clickworkers project suggests that professionalism may not be that important. The Clickworkers project has attracted over 85 thousand volunteers involved in identifying (marking) craters on Mars. Its key source of success can be attributed to the project's organization, which allowed for great flexibility as to the scope and timing of individual engagements (Benkler 2006).

4.4.3. The gift economy

The gift economy is distinguished from the 'exchange economy' in being a social system wherein goods are given to (shared) to the community by its members without explicit assurance of personal return. This typically occurs within small communities which attach high value to the stable, robust relationships between community members, based upon sharing, collaboration, honour, trust, scalability and loyalty (Bollier 2001). The socio-economic system of gift exchange has been studied by anthropologists in the context of traditional societies (Levi-Strauss 1969; Mauss 1974). Although many examples point to the apparent vitality of a gift economy within the contemporary capitalist system, the rise of the Internet has renewed interest in this concept as a way to explain primary motives for sharing of information and undertaking various collaborative efforts within a networked economy.

The rapid expansion of a networked information economy paves the way for broadening the spectrum of gift giving behaviours, eventually challenging the currently predominant 'exchange economy'. The Internet spectrum offers particularly favourable conditions, enabling and, in fact, encouraging the proliferation of gift-sharing attitudes. First, the cost of sharing information is practically negligible. Second, there is great flexibility in the gift-giving process, in terms of the size and timing of the donation. Third, the effects of gift giving, in terms of added social value, can be recognized easily without additional effort. Even if the sharing of information, as such, is not driven by the expectation of reciprocal rewards, the visible effects can serve as a strong incentive for continuing said behaviours in the future.

At the same time, Internet commons represent a totally different framework for gift sharing than that of small communities with established direct relationships and shared values between members. Information shared via the Internet typically is offered to a much larger and unknown set of recipients. Kollock points out that such a 'general exchange system' is more generous; but, at the same time, it is riskier than a traditional gift exchange. The absence of direct social links may elevate the temptation to free ride (Kollock 1999). On the otherhand, 'cyber-anonymity' may enhance the gift sharing behaviours that exist among Internet users, provided that an effective organizational framework ensuring anonymity is in place. The functioning of Internet-based discussion groups may offer interesting insights to this issue. Most of the participants probably hesitate to share their

experiences in person or through telephone conversations. At the same time, they are most willing to provide comprehensive valuable advice via the Internet where they retain anonymity.

5. Conclusion

The rise of the Internet creates a fascinating ground for a revitalization of the theory of the commons. This is because the object of the study – the Internet commons – is expanding at an unprecedented pace. Simultaneously, its role in the global economy is increasing exponentially, affecting all key spheres of human interaction. As exemplified in the preceding analysis, the structure of the Internet commons is complex and highly diversified, thus calling for scientific exploration of its modalities and dimensions.

Considering the state-of-the-art of the theory of commons and the challenges connected with the rise and expansion of the Internet, the development of a single theoretical framework encompassing the whole diversity of the Internet commons may not be feasible. At this stage an eclectic route seems to be more promising, particularly as interesting new concepts with direct relevance to the Internet have emerged in various branches of the social sciences. The proposed format (Figure 2), which identifies both open questions and the sources of theoretical inspiration, is by no means exhaustive and serves merely as an initial platform to facilitate discussion and thereby help refine ways of understanding and explaining the Internet commons.

Finally, a word of caution shall be offered. Researchers of the Internet commons are confronted, on one hand, with the limited timeframe of the analysis which results from the very brief history of the Internet. On the other hand, expansion of the Internet brings fundamental changes that affect practically all spheres of human interaction. This expansion calls for immediate reaction from the academic community. However, the former points to the significant risks of concentrating research endeavours on issues of a transient, nature while neglecting other, significant, long-term tendencies. Obviously, such limitations do apply to the analysis contained in the present article, as well.

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