

# Tragedy of the Commons in the Production of Digital Artifacts

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**Abstract**—Commons based peer production of digital artifacts such as open source software and online content creation platforms such as wikipedia are plagued by the tragedy of the commons scenario. Issues such as participation inequality, which is a small percentage of the population creates and the rest consume and others have led to this scenario. The aim of this paper is to examine and debate the various ethical dilemmas and issues leading to the tragedy of the commons in the realm of commons based peer production of digital artifacts.

**Index Terms**—Commons, Peer Production, Open Source, Open Source Governance, Digital Ethics.

## I. INTRODUCTION

As described by Hardin, Tragedy of the commons [1] is a dilemma caused by the scenario where numerous individuals acting rationally on their own and focused on their self interest ultimately exhaust or destroy a finite resource that is shared by all, despite the understanding that it is counter to everyone's interest in the long term for such a scenario to occur.

Commons Based Peer Production is a model of production of digital artifacts that is fueled by the mass availability of digitally networked environments such as the Internet.

The actors who participate in CBPP projects are neither influenced by market pricing of their goods or services nor bounded by organizational hierarchies of coordination.

Some of the successful examples of CBPP are online encyclopedias such as Wikipedia, peer to peer file sharing networks such as Bittorrent and open source software such as the Linux operating system.

Most CBPP projects are plagued by the tragedy of the commons scenario. Various ethical dilemmas challenge the sustenance of the CBPP model as a mode of production of digital artifacts, some examples of this is the participation inequality in CBPP projects, vandalism of content in platforms such as Wikipedia, the threat of hackers introducing malicious code in open source communities and others.

This research examines the various dilemmas in the realm of CBPP that leads to the tragedy of the digital commons.

## II. COMMONS BASED PEER PRODUCTION OF DIGITAL ARTIFACTS

One of the first successful projects that laid the foundation for the mass acceptance and rapid proliferation of the CBPP model of production was open source software such as the Linux operating system and Apache web server. The foundation of CBPP which is leveraging the crowd or the masses via the internet to create goods and services is today prevalent in almost every industry: the film industry uses CBPP as a model to create scripts, build computer animation and special effects, raise money through crowd funding and manage other production activities of the film [5].

Arduino a digital circuit board manufacturer in Italy designs and builds entire circuit boards for various digital devices through the CBPP model [6], MIT has created the open courseware project for sharing courseware with the rest of the world, BitCoin a new digital peer to peer currency enables decentralized creation and sharing of money for electronic commerce [7] and there are many other examples where CBPP is used as a model for production today. Commons based peer production of digital artifacts such as software is strictly governed by strong ethical codes, which are implemented through licenses such as the Gnu Public License (GPL) and other forms of copy left licensing. These ethical codes are often observed to be opposite to non-CBPP based (proprietary) modes of production. Following are some of the ethical guidelines that govern the production and management of free software.

- “The freedom to run the program, for any purpose (freedom 0).
- The freedom to study how the program works, and change it to make it do what you wish (freedom 1). Access to the source code is a precondition for this.
- The freedom to redistribute copies so you can help your neighbor (freedom 2).
- The freedom to distribute copies of your modified versions to others (freedom 3). By doing this you can give the whole community a chance to benefit from your changes. Access to the source code is a precondition for this [8].

Many CBPP projects adhere to these freedoms in one form or the other and these ethical guidelines have helped some of these projects flourish but have also caused various issues that have led to a Tragedy of the Commons scenario.

## III. DILEMMAS LEADING TO THE TRAGEDY OF THE DIGITAL COMMONS

The typical case of the Tragedy of Commons involves a conflict for resources between individual interests and the

common good. Examples of these are destruction of forests for wood that eventually lead to climate catastrophes and over fishing by certain companies that lead to the demise of certain types of fish species. Tragedy of commons in the physical world has different properties from that of the digital world.

Ostrom describes a framework for understanding the properties of a tragedy of the commons scenario and for the better governance of these resources [4]. Under the common pool resource theory, resources can be viewed in terms of their controllability and rivalry. A rival good is one whose consumption by one individual prevents simultaneous consumption by other individuals, on the other hand a good is considered non-rival if the consumption by one individual does not prevent it to be consumed by another.

TABLE I: COMMON POOL RESOURCE CLASSIFICATION

	Excludable	Non Excludable
Rival	Private Goods (Food, clothing, Cars)	Common Goods (TC) (Fish stock, timber, Coal)
Non Rival	Club Goods (Patented medicine, cinemas)	Public Goods (TDC) (air, radio signals, roads)

Excludability of a good or service deals with the ability to control access to a specific resource. A good or service is excludable when it is possible to deny people who have not paid for it from having access to it, and non-excludable is when it is not possible to do so.

Tragedy of the commons of physical goods occurs due to the exploitation of rival and non-excludable resources, that is resources that deplete when it is consumed and these resources are often unregulated in some countries such as fishing in the ocean and cutting trees for wood in rain forests.

Most digital goods that are produced under CBPP are non-rival as the marginal cost of reproduction is almost zero because the cost of downloading free software from the internet is almost zero and they do not deplete when they are consumed, these goods are non-excludable as they are often owned by the community.

The tragedy of the commons scenario in the realm of digital commons occurs not due to over consumption of these commons but due to the lack of consumption of these products or services, examples are the failures of various open source projects because of the lack of participation in the development of the product and the end users not using the product, which eventually leads to the demise of the product. The following sections looks at the tragedy of the commons of digital artifacts and discusses various dilemmas.

#### A. Dilemma of Participation Inequality

Commons based peer production of digital artifacts relies on voluntary participation of individuals and on the sharing of their expertise for the development of the project. Hence the success of a CBPP project depends on the community involvement in the project. Over 90% of the CBPP projects

are unsuccessful due to a lack of participation, Deshpande et al describe that on SourceForge, the leading open source project hosting service, there are more than 150,000 projects registered but most of these projects are inactive [9]. Daffara estimates that as there are only about 18,000 active open source projects in the world [10].

One of the key problems in the commons based peer production of digital artifacts is participation inequality or the 90–9–1 rule [3], which is 90% of users in a project are free loaders who use a product or just observe and 9% of users contribute infrequently to the development of the project and only 1% of users are key contributors to the project. This often leads to inactivity or to the failure of these projects. Most open source projects and commons based content platforms such as wikipedia are plagued by participation inequality.

There are various reasons for participation inequality in digital commons but the key ones are the lack of incentives for participation, ease of contribution and poor governance of communities. Developing digital commons such as open source software or digital hardware design is a complex affair and requires a certain amount of skill to contribute, which often leads to only a few experts in the field contributing to such projects. Some communities are also structured in a way that they don't allow inexperienced users to participate in projects; this would be a problem if most of the first time entrants in a community participate to learn about a digital artifact through collaboration. Such strict regulations for participation add to participation inequality in these projects.

Contributing to the development of digital artifacts often requires spending a lot of time and resources. In organizations the motivation for work is the reward of recognition within the organization and a future career growth for that individual but in a commons oriented community developing digital artifacts, the reward is often self-satisfaction for performing a task.

A lot of users do not contribute consistently because of a lack of recognition of their work by the community members or lack of other tangible incentives that would drive them to contribute actively. Many open source projects have also been criticized for being run by geeks for geeks, a new entrant is expected to find his own way into the community.

These projects lack proper documentation and help structures, which often leads to the frustration of new entrants who enter a community.

The geek culture in some of the open source communities focus on coding a specific application and consider other activities such as user interface design and documentation as a secondary activities, as a result UI designers and documenters are ignored or not respected within the community. This leads to the end products becoming designed for geeks by geeks and unusable by a wider audience when compared to their proprietary equivalent [11]. One of the key threats of participation inequality is that it can make the digital artifact unrepresentative of the wishes of the overall community.

#### B. The Ethics of Consumption of Digital Commons

Most of the commons based peer production projects are

often started by a few individuals with little or no funding. Internet companies such as Google and yahoo use advertising as a source of revenue. But projects such as Wikipedia adhere to strong ethical guidelines and do not promote advertising in their website and hence refrain from a major source of revenue. Hence such digital commons projects solely rely on the community to fund their activities. Some of the projects require regular funding to maintain the existing activities and plan for future growth, an example is the digital commons such as Wikipedia, that require the community members or end user to donate for bandwidth and other maintenance costs. A lack of funding causes poor service quality or shutdown of these products or services. Most Internet users have been used to the era of the free, this is facilitated by peer 2 peer file sharing networks and competing services that offer goods and services for free online.

As described by Chris Anderson, most of the organizations offering digital commons based artifacts give away goods for free and derive revenue from services around that product [11]. But digital commons such as open source software are often replicated (forked) into multiple versions and sold by third parties, large companies that make use of these products do not offer donations to the foundation or community that develops and manages these products. Hence some of these projects raise funding through donations from the community and end users. The problem with fund raising is two fold; lack of motivation for the individual to pay and the lack of easy payment methods.

Digital commons based products do not actively seek funding and hence the end users are less motivated to donate, most pages in hosting sites such as Sourceforge offer a donate button but do not highlight the donors and provide other incentives for people to donate.

Most people who use the product would like to donate small sums of money but might not own a credit card, hence a system to make micro payments as small as a few dollars could motivate more people to donate, but these systems are non-existent in most digital commons communities.

### C. Ethical Behavior in Participatory Digital Commons

Digital commons is founded on trust between individuals that collaborate with each other from different ends of the world to create goods or services. Unlike traditional organizations, the communities allow volunteers to contribute based on implicit trust. Projects in the realm of digital commons are often vulnerable to vandalism; an example of this is the creation and editing of false or malicious content in Wikipedia. Some sensitive pages are auto protected by Wikipedia and editing is controlled and

some pages are semi-protected; “edit wars” are commonplace in semi-protected and un-protected pages that occur when two opposing sides revert each other’s change.

There have been various occasions where individuals have introduced malicious code into open source projects that have led to the failure of large scale open source systems and the businesses that have depended on these systems. Hence digital commons requires a greater level of peer review and checks and balances to avoid the tragedy of the commons scenario.

## IV. CONCLUSION

While physical commons and digital commons differ in some basic ways they both demand a certain level of altruism from their consumers for their sustenance. Tragedy of the digital commons can be avoided through a clever arbitrage between an individuals needs and the long term interests of the community, making participation and knowledge sharing easier and through proper checks and balances such as peer review strategies.

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