# [FC-02-035] Openness

## Abstract

The philosophy of Openness and its use in diverse areas is attracting increasing attention from users, developers, businesses, governments, educators, and researchers around the world. The technological, socio-cultural, economic, legal, institutional, and philosophical issues related to its principles, applications, benefits, and barriers for its use are growing areas of research. The word “Open” is commonly used to denote adherence to the principles of Openness. Several fields are incorporating the use of Openness in their activities, some of them are of particular relevance to GIS&T (Geographic Information Science and Technology) such as: Open Data, Free and Open Source Software; and Open Standards for geospatial data, information, and technologies. This entry presents a definition of Openness, its importance in the area of GISc&T is introduced through a list of its benefits in the fields of Open Data, Open Source Software, and Open Standards. Then some of the barriers, myths, or inhibitors to Openness are presented using the case of Free and Open Source Software (FOSS) and FOSS for Geospatial Applications (FOSS4G).

*Keywords*: FOSS, FOSS4G, OGC, Open Data, Open Geospatial Consortium, Open Standards, Openness, OSGeo

## Author & citation

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## Explanation

1. Definitions
2. Importance and Benefits of Openness
3. Misperceptions that Hinder the Use of Open Solutions: The Case of FOSS/FOSS4G
4. Conclusion

### 1. Definitions

Openness is a philosophy characterized by an emphasis on transparency and no-cost unrestricted access to data, information, knowledge, or technologies. It also entails a commitment to sharing and to a collaborative or cooperative approach to development, management, and decision-making (Peters & Britez, 2008)

More detail and attributes are added to this basic definition of Openness in each of the many and diverse fields in which it is applied. The word “Open” is commonly used to denote an adherence to the philosophy of Openness and it is used in fields and activities such as: Open Source Software, Open specifications or standards, Open data, Open publishing, Open education, Open government, and Open innovation among others.

## 2. Importance and Benefits of Openness

The specific benefits of adherence to the principles of Openness are numerous, important, and vary depending on the area in which it is applied. The following list of Openness benefits is organized into three areas that are of particular relevance to GIS&T.

### 2.1 Open Data

Open Data is data that can be freely used, re-used and redistributed by anyone - subject only, at most, to the requirement to attribute and share alike. More detail on this definition is provided by the Open Data Handbook (2017). Open Data supports: Interoperability of data and information; transparency and democratic control; participation; self-empowerment; innovation; measurement of impact of activities and policies; creation of new knowledge by combining data sources and partners in large data volumes; improvement of efficiency or effectiveness of government services (The White House, 2009 and 2016; Lathrop & Ruma, 2010; Jenssen & Zuiderwijk, 2012).

### 2.2 Open Standards in GIS&T

Open Standards are technical documents that detail interfaces or encodings. These documents are freely and publicly available, non-discriminatory, free of license fees, vendor neutral, data neutral, and agreed to by a formal, member-based consensus process. Software developers use these documents to build open interfaces and encodings into their products and services. Ideally, when Open standards are implemented in products or online services by two different software engineers working independently, the resulting components plug and play, that is, they work together without further debugging (http://www.opengeospatial.org/standards). In other words, compliance with Open standards in the area of GIS&T enable interoperability of geospatial data, software, and technologies. The Open Geospatial Consortium (OGC) is the leading organization working on the creation of Open Standards in GIS&T. OGC is an international non-profit organization committed to making quality open standards for the global geospatial community. It includes members from the private, public, and academic sectors (OGC, 2017).

There are currently numerous OGC standards or implementation specifications that cover a wide spectrum of geospatial data, software and technologies (see http://www.opengeospatial.org/standards/specifications/list for a list and brief overview). Sigh (2014) provides a simple example of how OGC Open Standards function to enable the interoperable distribution and integration of geospatial data over the World Wide Web.

The interoperability brought about by compliance with Open Standards has the following benefits: it broadens product acquisition opportunities (i.e. mix and match components that can plug and play); avoids over-dependence on a single vendor; minimizes risks as technology changes; maximizes access, distribution, and integration of data, information and technologies; and facilitates the rapid integration and deployment of new capabilities by reusing data, information or technologies from different vendors or communities of interest (e.g. emergency response, health, resources management, military) (Percivall, 2010; OGC, 2017).

### 2.3 Free and Open Source Software (FOSS) / FOSS for Geospatial applications (FOSS4G)

FOSS/FOSS4G are software that allow their users the freedom to run, copy, distribute, study, change and improve the software. Thus, “free” is a matter of freedom, not the absence of cost (GNU Project). Also, FOSS/FOSS4G must comply with 10 criteria as specified by the Open Source Initiative. There is a mature, capable, and reliable FOSS4G for almost every geospatial need and niche (Moreno-Sanchez, 2012; Steiniger & Hunter, 2013). Brovelli at al. (2017) provide 92 literature references and over 100 links to FOSS4G resources and examples of their use in large-scale, sophisticated, mission-critical applications. In GIS&T, the Open Source Geospatial Foundation (OSGeo) was created to support the collaborative development of FOSS4G and promote its widespread use, while the GeoForAll international network of FOSS4G labs aims to making geospatial education and opportunities accessible to all. Open Source GIS and FreeGIS.org are both rich repositories of FOSS4G projects. The OSGeo has established a rigorous software incubation process to provide oversight and support the sustainable development of high quality FOSS4G. Software that graduates from this incubator process become part of the OSGeo Projects, also known as the OSGeo Software Stack.

The benefits of FOSS/FOSS4G are numerous and the reasons for their adoption vary from pragmatic to ideological, but the reasons for their adoption should not be based only on the technical merits, no-cost feature, or access to the source code that characterized FOSS/FOSS4G (Ven et al., 2008; Sui 2014). FOSS/FOSS4G should be evaluated on par with commercial off-the-shelf (COTS) software in terms of their technical features, reliability, ease of use, documentation, technical support, customizability and extensibility, costs of training, support and maintenance, and management requirements (Wang & Wang, 2001; Woods & Guliani, 2005; Steiniger & Hunter, 2013). FOSS/FOSS4G under certain circumstances can be superior alternatives to their proprietary counterparts (e.g. Moreno-Sanchez et al., 2007), and they not only provide healthy competition for proprietary solutions but also opportunities for mutual benefit and complementarity (Moreno-Sanchez, 2012). Steiniger & Hunter (2013) provide an overview of mature FOSS4G projects highlighting needs for research, development, and issues to consider when bringing them into businesses or organizations. The value, opportunities, and challenges in incorporating FOSS4G into geospatial higher education have been noted by several authors (e.g. Sui 2014; Petras et al. 2015; Minghini et al. 2017).

Specific benefits that have been identified for FOSS/FOSS4G include 1) fostering innovation and collaboration across national and institutional borders, as well as between communities of interest (e.g. emergency response, health); 2) broadening peer-review; 3) allowing the freedom to study, modify, develop, redistribute the software resulting in high-quality software; 4) reducing the risk of vendor lock-in or monopoly; 5) promoting transparency and accountability; and 6) providing low-cost or no-cost platforms to prototype new ideas and processes. Furthermore, there are mature and reliable FOSS/FOSS4G capable of supporting the creation of large, sophisticated, mission-critical applications, systems, and processes (see Brovelli et al., 2017), and they may be more appropriate for certain applications in certain technological, socio-cultural, economic, and institutional contexts (e.g. cross-national-borders systems where there are large disparities between countries). Also, the way FOSS/FOSS4G are developed, maintained, and distributed aligns with the following principles that are essential to the achievement of sustainable development: development of local capacity, self-reliance, resilience, reduction of risks, democracy, equal access, strengthening of social networks, and cooperation. A lengthy list of benefits of the use of FOSS is published by the Digital Freedom Foundation.

## 3. Misperceptions that Hinder the Use of Open Solutions: The Case of FOSS/FOSS4G

The concerns, barriers, or inhibitors to Openness vary depending on the field in which it is applied (e.g. Janssen et al., 2012 in the area of Open Data). Hence, it is difficult to generalize across the large diversity of areas where this philosophy is applied. The following issues, misperceptions, and myths about FOSS/FOSS4G illustrate points that can be found in other areas where the principles of Openness are applied.

Overall, there is a lack of awareness or understanding of the benefits and implications of Openness. For example, in the case of FOSS/FOSS4G there is limited awareness of the existence of FOSS/FOSS4G solutions and their successful implementations in large, sophisticated, mission-critical applications. Even when there is awareness, several myths and mistaken perceptions inhibit the adoption of FOSS/FOSS4G solutions. Each of these is a reason that has been identified and also debunked: 1) Open solutions are inferior, unreliable, or of poor quality; 2) it is more difficult to control and monitor the quality of data, software, or technologies; 3) it is difficult to organize, coordinate, and monitor contributions and development; 4) open no-cost alternatives or solutions cannot be better than their commercial private/closed counterparts; 5) technical support and education resources are limited or non-existent; 6) their use is more risky because they are unstable and can rapidly disappear; 7) they are difficult to learn and mostly only suitable for experts; 8) they are less secure than private/close solutions (Morgan & Finnegan, 2007; see Brovelli et al., 2017 for references discussing each). Wheeler (2015) provides a quick reference to multiple issues, myths, and concerns commonly raised about FOSS (e.g. they don't have technical support) and examples that show how these concerns are often unjustified.

Still, more studies are required in certain areas of Openness. For example, some legal, licensing, and copyright issues of FOSS/FOSS4G and Open Data are still not well understood. The factors involved in the success or failure of FOSS/FOSS4G development and adoption need to be better identified (e.g. Schweik & English, 2012), and there is need for more information on the benefits, challenges, and applications of Openness (e.g. Zuiderwijk et al., 2014 in the area of Open Data, transparency, and Open Government).

## 4. Conclusion

Results of studies and abundant experiential evidence clearly support the importance and benefits of Openness in the area of GIS&T. The technological, socio-cultural, economic, institutional, legal, and philosophical issues related to its principles, applications, benefits, and challenges for its use will continue to be growing areas of research and sometimes debate. Awareness, education, and training about Openness and Open solutions, as well as their importance as they apply to geospatial data, information, and technologies must be incorporated starting at entry level GIS&T courses.

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