[GS-01-008] The Geospatial Information Market

Abstract

The modern geospatial information market involves traditional maps, but has evolved to include Geographic Information Systems, and an expanding array of (often digitized) geographic information. First through the advent of computers, then through the growth of the Internet, and now through GPS-enabled smartphones, the geospatial information market is increasingly global in scope, interconnected with other forms of data, and embedded in people's daily lives. While this presents enormous economic potential, it brings new risks and challenges (from surveillance to cybersecurity), requiring careful and collaborative management, governance, and regulation from private and public actors across scales and locales.

Keywords: data, geospatial information as property

Author & citation

Alvarez León, L. (2024). The Geospatial Information Market. The Geographic Information Science & Technology Body of Knowledge (2024 Edition), John P. Wilson (Ed.).
DOI: 10.22224/gistbok/2024.1.18.

Explanation

1. From Maps to Geographic Information
2. The Computer Revolution
3. From Online Maps to the Geoweb
4. Location Data, Social Media, and Regulation

1. From Maps to Geographic Information

For centuries, if not millennia, maps have played a fundamental role in the most diverse affairs of human societies (Thrower, 2008). From reference to navigation, conquest, construction, administration, and even recreation, maps are crucial tools that have simultaneously strategic, pragmatic, and often symbolic value. Considering their multiple uses, it should be no surprise that maps are often endowed with economic value as well. However, until recently, the logistical challenges of creating maps at useful scales and level detail meant that those with control over territories (from empires to nation states) played a predominant role in the cartographic enterprise. Conversely, as shown by projects from national censuses, land surveys, and cadasters, the administrative capabilities of the modern state were in turn enhanced by the intensive use of maps and geographic information. Simultaneously, technological innovations first developed by states, from satellites to Geographic Information Systems, have catalyzed new uses and applications for maps and an ever-expanding array of geographic information. Geographic information refers to any kind of (often, but not always, digital) information endowed a spatial or geographic dimension. This generally includes location data in the form of coordinates but can also encompass many other attributes that provide a richer geographic context. Geographic information has a wide variety of uses from natural resource management,

transportation and planning, surveying, climate modeling, geodemographics, cartography and data visualization, market research and analytics, among many others.

The development of new technologies , along with attendant transformations in the economic —such as the computerization and digitization of ever more products and services— and political systems —such as the deregulation of many kinds of economic activity— have led to the creation of ever more complex markets for myriad forms of geospatial information. While many key geographic technologies remain central to the sphere of government, the expansion of markets for geographic information is a phenomenon that has accelerated in the past decades, particularly with the rise of electronic and digital media. In that sense, even as the state remains a key producer of geographic information, in a digital age we must understand geographic information markets in a more expansive political economic context that considers the transformation of the state itself as well as a growing number of public and private actors, institutions, market arrangements, and technologies (Leszczynski, 2012).

The following paragraphs will review some of the key developments underlying the construction of modern geospatial information markets. Section two discusses how the emergence of computers in the middle of the 20th century revolutionized the creation of maps and, with it, the collection, representation, and management of geospatial information. Section three addresses how the rise of the Internet towards the end of the 20th Century and in the first decades of the 21st century gave way to new ways of collecting, storing, and sharing digital maps and geospatial information —whether in the online space termed the ‘geoweb’, or via social networks from Twitter/X to Facebook. Section four discusses the appearance of new ways of generating real-time location data, the new surveillance capabilities, marketing opportunities, and privacy concerns they enable, and the regulatory frameworks accompanying these developments.

2. The Computer Revolution

Since the end of the Second World War, computer use became more widespread across government agencies, putting these machines to an expanding variety of uses, starting with military and strategic affairs (Edwards, 1997). Other applications such as planning, local policy analysis, and the functioning of urban growth and city systems became central to research agendas in what became known as the ‘quantitative revolution’ in geography (Adams, 2014). In this context, land management remained among the key functions of the state, one for which maps proved to be essential tools. Innovations in cartography, as well as the development of computerized geographic information led to new tools and solutions for the problem of land management. Particularly influential was the development of the Canada Geographic Information System, created by Roger Tomlinson beginning in 1962 (Tomlinson, 1974). Implementing the idea of ‘data overlay’, analogous to placing map sheets atop one another, this system proved the viability of computers and computerized mapping to produce integrated analysis for land management, rural development, and associated policies (Tomlinson, 1969). Other developments around the same time, such as the work done by Howard Fisher and others at the Laboratory for Computer Graphics and Spatial Analysis at Harvard, expanded the possibilities for ‘computer mapping’, advancing new forms of visualization, analysis, and applications for computerized geographic information (Chrisman, 2005; Wilson, 2017). This group exerted widespread influence in academia and beyond. Notably Jack Dangermond, an alumnus of the lab, would go on to found ESRI, which would become a leading provider of Geographic Information Systems.

These episodes highlight the growing role of computers in revolutionizing the capabilities of maps and creating new markets for computer-based tools to collect, manage, and analyze geographic information. In 2023 the market for Geographic Information Systems was valued at over $14.5 billion, with a compound annual growth rate of 13%, projected to more than triple in value by 2032 (Credence Research, 2024). While the advent of Geographic Information Systems in the second half of the 20th century did much to create a market for geographic information, tools, and products, it was the appearance of the Internet that created the conditions for an even greater expansion of this market.

3. From Online Maps to the Geoweb

From its beginnings the Internet served to link government offices and researchers via computer networks. This allowed for the sharing of growing volumes of data of all stripes, among them geographic information. As the Internet expanded, it drew more users beyond government and academia, while expanding its capabilities to store and transmit different forms of data. Among these changes new forms of geographic information began to populate digital networks, from online maps to government-maintained open data repositories and, later, geotagged social media. Online maps, such as those distributed by pioneering firm MapQuest since 1996 (Peterson, 2021), offered users the possibility of getting turn-by-turn directions for travel, which could then be printed and used as navigation aids. While this service was free to the user, MapQuest's business model was supported by banner advertisements, signaling one of the key drivers of the new web-based geospatial information market. Before too long, changes in the corporate landscape of the Internet economy, as well as technological innovations, would lead to significant changes in online maps.

Leveraging its position a leading search engine company, Google entered the geospatial information market by acquiring the Australian company Where 2 Technologies. This formed the basis of Google Maps, which appeared in 2005 and revolutionized online mapping by offering interactive, rather than static navigation between point A and point B. Google expanded its footprint in the geospatial information market with products like Google Street View, Google Earth, and Google Earth Engine, among others. This expansion signals not only Google's interest in maps and geographic information, but the growing relevance of these types of data and products for the broader Internet economy. While they did not feature prominent banner ads, Google's geographic services were closely intertwined with advertisements, since they were integrated into Google's search engine, which itself relies on ads tailored to users' search terms.

Parallel to the rise in popularity of Google's suite of geo-products and other online services (e.g., Bing Maps, Apple Maps) was the expansion of many other types of geographic information on the Internet. For instance, local, subnational and national governments, as well as NGOs began to upload, curate, and disseminate online repositories of geographic information ranking from traffic and infrastructure data to environmental and economic data. At the same time, in what was often called Web 2.0, the Internet many participatory and collaborative projects became popular online, such as Wikipedia and citizen science projects like Zooniverse. In the geographic realm these participatory or 'crowdsourced' projects are often studied through the lens of Volunteered Geographic Information (VGI) (Elwood et al., 2012; Sui et al., 2013). Perhaps the most emblematic example of this type of project is OpenStreetMap, which is a collaborative map that spans the whole world, and which is updated through the contributions of users adding and editing data like place

names, roadways, and boundaries. While VGI projects are generally not for profit, they generate valuable inputs that are often recombined and integrated into geographic information products for sale in the market. For instance, large technology companies like Apple, Microsoft, and Amazon all rely on OpenStreetMap, as do more traditional GIS and mapping companies like ESRI and TomTom and social networks like Facebook and Snapchat. Thus, to understand the configuration and growth of the geospatial information market, it is essential to consider how Volunteered Geographic Information (and other forms of user generated data) feeds into the development of for-profit products and services. This is particularly the case with location data and social media networks, particularly in the context of smartphones.

While VGI and other user-generated data on the Internet constitute a vast universe, to understand the modern geographic information economy it is necessary to consider other areas of development. A key instance is the geographic information produced by satellites, a technology that catalyzed some of the original impetus to develop Geographic Information Systems (via Earth Observation imagery) and advances in digital geospatial technologies (such as the satellite-enabled Global Positioning System). As with other geospatial information technologies, while satellites were first developed by a handful of governments (with private industry in the role of contractors), in the past two decades it has been startups and other private companies who have taken the lead in expanding satellite capabilities via more frequent launches (SpaceX), and satellite constellations for a variety of purposes from near-real time remote sensing (Planet) to the provision of Internet services (Starlink).

4. Location Data, Social Media, and Regulation

A key to understanding the expansion of geospatial information markets in the digital age is the deep integration between geographic and other types of information across networks, devices, and environments. One salient instance of this is the increased importance of geolocation data, which can be obtained in a variety of ways. Sometimes geolocation data can be volunteered explicitly by users through geotagged social media content, for instance. A prominent example is online check-ins like those made available via Foursquare, a leading provider of geo-enabled social media, or similar functions in social networks like Instagram, Facebook, or Twitter/X. Alternatively, geolocation data can also be harvested through without the users explicitly volunteering such data. This can be done by accessing data from GPS-enabled smartphones, gathering the IP addresses unique to each computer, or through other means such as determining a cell phone’s location from the cellular towers it connected with via ‘pings’. Prominent applications of these methods include policing, marketing analytics, and epidemic surveillance, which was carried out intensively during the COVID-19 pandemic by many governments. Such geolocated data, combined with other forms of information can allow advertisers, search engine companies Google, retailers like Amazon and Target, and increasingly social networks like Facebook and Twitter to tailor content for individual users. While these practices create new markets, they also introduce new privacy concerns resulting from new forms of (corporate and state) surveillance, or cybersecurity risks like identity theft.

Given the embeddedness of geospatial information markets with the everyday activities of vast numbers of people, as well as the decisions of corporations and states, it is necessary to consider how those markets are structured, governed, and regulated. Hence, the institutional, policy, and property frameworks that dictate the collection, distribution, and

incorporation of geographic information into commercial products are essential components of these markets (Alvarez León, 2018). These frameworks are often shaped by nation state governments, who tend to collect, produce, and use some of the most valuable geographic information. This continues to include the military and intelligence communities, who have developed some of the most sophisticated data collection capabilities, as well as an ongoing need for highly accurate and up to date geographic information. However, the complexity and global scope of the digital economy transcends any single government or actor and requires increased levels of interagency, cross-scalar, and transnational collaboration. Notable examples of this collaboration are the Infrastructure for Spatial Information in the European Community (INSPIRE) framework and the Digital Single Market (DSM) in the European Union, the Federal Geographic Data Committee (FGDC) in the United States, and United Nations Integrated Geospatial Information Framework (UN-IGIF).

While the market for Geographic Information Systems stands at a sizeable $14.5 billion in 2023, it represents only a fraction of a much larger, and more diffuse market for geographic information. This is because, while governments, private companies, educational institutions, and other organizations constitute the primary customers of systems specifically designed to analyze and process geographic information, this type of information has not only grown in volume, but in diversity, sources, and applications: from social media to new satellite constellations, to Artificial Intelligence-generated geographic information. Hence, even as the market for GIS is likely to continue growing, geographic information is simultaneously becoming more important and more difficult to disentangle from other types of information (since so much of it is explicitly or implicitly geographic), and the markets within which they circulate. This means that to understand the present and future of the geographic information market it is also necessary to understand the dynamics of the digital economy of which it is an increasingly significant segment.

References

Adams, J. S. (2014). The quantitative revolution in urban geography. In Berry, B.J.L., & Wheeler, J. (Eds.). (2005). Urban Geography in America, 1950-2000: Paradigms and Personalities (1st ed.). Routledge. pp.115–126.

Alvarez León, L. F. (2018). Information Policy and the Spatial Constitution of Digital Geographic Information Markets. Economic Geography, 94(3), 217–237.

Chrisman, N. R. (2006). Charting the Unknown: How Computer Mapping at Harvard became GIS. Redlands, California: ESRI Press.

Credence Research. (2024). Geographic Information Systems Market Size and Forecast 2032 (6526).

Edwards, P. N. (1997). The closed world: Computers and the politics of discourse in Cold War America (1. paperback ed). MIT Press.

Elwood, S., Goodchild, M. F., & Sui, D. Z. (2012). Researching Volunteered Geographic Information: Spatial Data, Geographic Research, and New Social Practice. Annals of the Association of American Geographers, 102(3), 571-590.

Leszczynski, A. (2012). Situating the geoweb in political economy. Progress in Human

Geography, 36(1), 72–89.

Peterson, M. P. (2021). MapQuest and the beginnings of web cartography. International Journal of Cartography, 7(2), 275–281.

Sui, D., Elwood, S., and Goodchild, M. eds. (2013). Crowdsourcing Geographic Knowledge: olunteered Geographic Information (VGI) in Theory and Practice. Springer Netherlands.

Thrower, N. J. W. (2008). Maps and Civilization, 3rd edition. University of Chicago Press.

Tomlinson, R. F. (1969). A Geographic Information System for Regional Planning. Journal of Geography (Chigaku Zasshi), 78(1), 45–48.

Tomlinson, R. F. (1974). Geographical Information Systems, Spatial Data Analysis and Decision Making in Government [Doctoral, University of London]. In Doctoral thesis, University of London.

Wilson, M. (2017). New Lines. University of Minnesota Press.