Monitor **Deloitte.**

Intelligent Strategies for Intelligence and National Security

Understanding the Geospatial Customer Ecosystem

April 2016

Contents

2	Executive summary
3	The challenge to national security
4	Examining ecosystems
5	The geospatial customer ecosystem
6	Ecosystem network visualization
7	Understanding the life cycle and value archetypes
11	Strategic planning through ecosystem mapping
12	Using the ecosystem to understand collaboration opportunities
13	A changing ecosystem necessitates changing strategy
14	What the future could hold for the geospatial ecosystem
16	Summary
17	Methodology
18	For more information

Executive summary

Surviving and thriving in a dynamic environment requires that decision-makers see external interactions as more than a series of bilateral supply chain relationships. Instead, decision-makers must understand value creation across a much broader ecosystem of entities. By examining the new and evolving ways value is created within a market ecosystem, decision-makers can achieve a more accurate perception of their own entity's current value. Pairing this self-perception with an understanding of the diversity of actors and activities in the ecosystem empowers the decision-maker to respond to emerging opportunities and risks. How can an entity regain influence lost to new disruptive suppliers? How can organizations meet new and evolving customer demands when faced with resource limitations? Whether forging strategic partnerships, investing in key technologies, or increasing impact to customers, ecosystem mapping leverages market understanding to help create tangible benefits for organizations. The geospatial ecosystem is a prime example of a highly dynamic market whose members may be able to benefit from ecosystem mapping—particularly as older high-investment incumbents lose influence, market share, and customer impact to new innovative disruptors.

The challenge to national security

The United States (US) defense, intelligence, and homeland security communities face an increasingly complex operating environment. National security threats have transformed and diversified since the 2000s, requiring missions to be fulfilled globally against a frequently shifting set of threats from state and non-state actors. Resources have not expanded along with these larger mission sets. Instead, federal budgets face intensified scrutiny. This results in frequent caps or reductions in funding and personnel—further straining an already stretched workforce. Simultaneously, there has been a fundamental change in the number and type of entities with which national security agencies interact. The US national security space, which was once the sole realm of government agencies, now contains commercial businesses, non-profit organizations, media outlets, foreign government agencies, and private constituents. These entities in turn generate new technologies, new regulations, and new stakeholder demands, which can threaten to leave US government agencies further behind in meeting mission requirements.

This challenge forces national security agencies to prioritize limited resources and seek innovative ways to achieve mission success. An advanced understanding of stakeholders' needs and situational awareness of the cross-sector ecosystems in which the agency operates can help agency personnel succeed in this new environment.

Examining ecosystems

"Ecosystems are dynamic and co-evolving communities of diverse actors who create new value through increasingly productive and sophisticated models of both collaboration and competition."[1]

To create effective long-term strategies, national security agencies should understand both what an ecosystem is and how mission value is created within it. Ecosystem mapping enables organizations to discover partners for collaboration, recognize cross-sector value propositions, understand dependencies, as well as identify both underserved and overserved customer groups.

Traditionally, marketplaces—both governmental and commercial—were categorized as rigid, hierarchical structures resistant to change. In recent years, however, the explosive growth of technology and innovative disruptors across industries brought constant change to nearly every marketplace. The commercial realm originally adopted the word "ecosystem" from biologists, as a metaphor for new symbiotic relationships between business entities. Some organizations have left 'ecosystem' merely as an easy term-of-reference. Others, however, have used it to inform an understanding of the global operating environment and, more importantly, to make better organization-wide decisions.

The study, Business Ecosystems Come of Age (Figure 1, to the right), analyzed the emergence of ecosystems and their importance in the modern commercial sphere[1]. A defining characteristic of an ecosystem is the vast diversity in types and sizes of the actors and entities involved. Entities cannot be codified simply as suppliers, consumers, or competitors relative to one's own position. These roles may shift and interweave based on specific processes and challenges. This interconnectedness establishes the potential for broad-spectrum cooperative solutions that exceed the capacity of any individual entity or group of similar entities (e.g., government agencies). The success of an ecosystem entity is determined by its ability to adapt and innovate within the collective operations of the ecosystem. While competition certainly continues to exist, it is not the sole or even primary driver of value development. Shared interests, principles, and goals drive entities to cooperate in many areas even as they may compete in others. In this environment, traditional, proven strategies meant to defend market share or establish market dominance are likely to harm the entity's standing, as such efforts can alienate the entity from the ecosystem's broader collaborative trends.

This paper explores the geospatial ecosystem as a model for how ecosystem mapping can help national security entities link their missions and value positions in the midst of rapid diversification and revolutionary market shifts. The geospatial ecosystem exemplifies these challenges, as it has grown at a phenomenal rate over the past 25 years, contains tremendous diversity of entities, and regularly develops cooperative solutions drawing on cross-sector strengths to help solve societal problems.

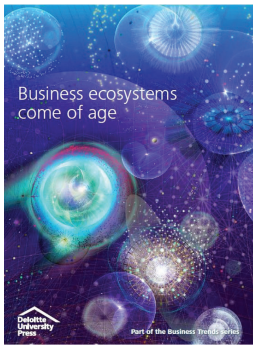


Figure 1: Business Ecosystems Come of Age, 2015"

1 Bruce Chew, Don Derosby, Eamonn Kelly, and Bill Miracky, "Regulating Ecosystems," in *Business Ecosystems Come of Age, Business Trends, 2015*, Deloitte University Press, 2015.

The geospatial customer ecosystem

The geospatial ecosystem has grown exponentially over the last 25 years. Regulatory changes have allowed for more industry players to enter a sector previously dominated by military, intelligence, and civilian government agencies. This has been paired with the global proliferation of new collection platforms: from geospatial data-capable smartphones, to individually operated unmanned aerial vehicles (UAVs), to constellations of small satellites launched by start-ups. From a customer base numbering in only the tens of thousands in 1990—most of whom served in government agencies—the users of geospatial data now number in the billions on the commercial side alone[2]. This growth in users has been both a result of and a catalyzer for the rapid growth in the number of entities providing geospatial services—across the private, non-profit, and public sectors.

2 Deloitte original research and analysis. See Methodology on page 17.

Ecosystem network visualization

Decision-makers can use an ecosystem network visualization to identify opportunities for collaboration.

Effective ecosystem mapping analysis begins with identifying the network of entities within the ecosystem. Figure 2 below presents a representative sample of these entities in 1990 and in 2015[3]. By comparing these two ecosystems, the transformation of the geospatial customer ecosystem in the intervening years becomes clear. Each circle represents a specific entity (e.g., Esri) or group of similar entities (e.g., oil and natural gas companies). Lines between nodes display publicly recognized partnerships or supplier-consumer relationships, while the size of the node indicates its number of relationships.

An ecosystem network visualization serves to identify influential players, and the interconnected sub-communities with which they collaborate. In Figure 2, the most connected entities are the National Geospatial-Intelligence Agency (NGA), DigitalGlobe, Google, and Esri. These large, highly connected entities may link otherwise disparate entities and also serve as important centers of industry information. Large firms may achieve this by providing services to a diverse set of customers. Similarly, on the government side, agencies like NGA can serve as a nexus of geospatial information for the broader government community and provide foundational data for many commercial providers' services.

Network visualizations also reveal entities that are only loosely connected to the customer ecosystem. These entities may perform specialized functions or only use geospatial information in specific contexts, for example, non-governmental organizations (NGO) that use geospatial information in emergency response or niche industry-oriented geospatial firms. These "weak links" connect other communities that otherwise would not participate in to the broader community. These facilitate the transfer of information between disparate groups.

Some ecosystem entities may be widely known, but others may be outside a decision-maker's field of view. A network visualization can, for example, reveal important ecosystem actors who are not part of an industry conference circuit. Geospatial NGOs may rarely attend government-led national security conferences. However, NGOs are critical to the geospatial ecosystem's success. Decision-makers can use an ecosystem network visualization to identify opportunities for collaboration. New strategic connections can unlock efficiency gains and help ensure continued entity success.

3 Based on Deloitte's analysis of the public websites of 310 representative entities within the geospatial ecosystem, see Methodology on page 17.

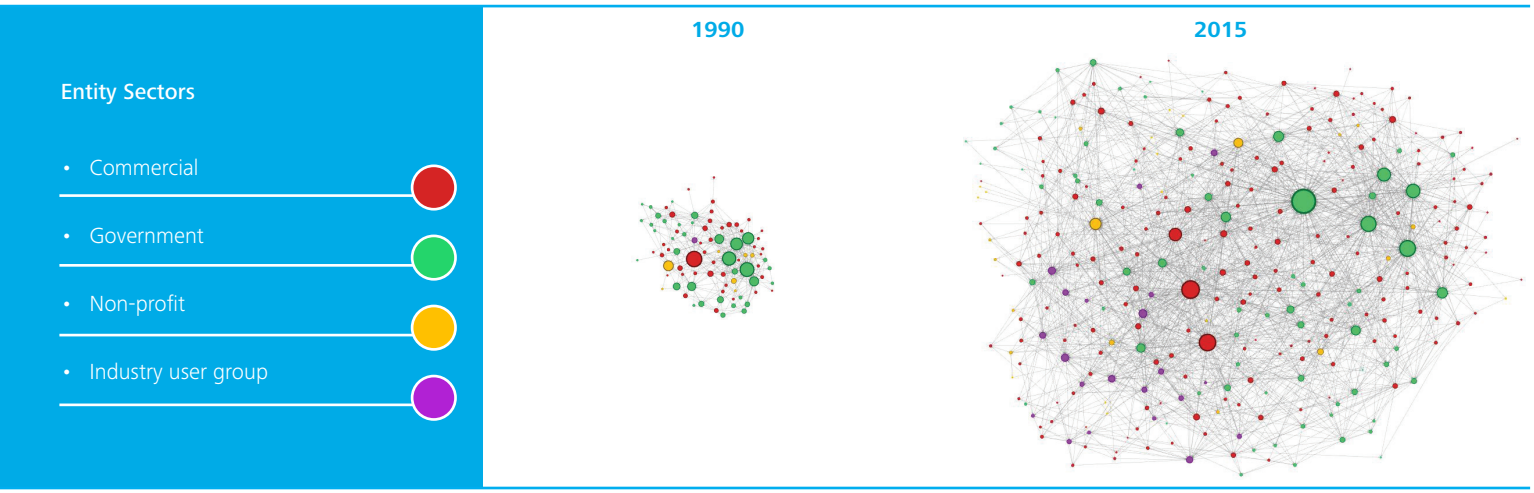


Figure 2: *The Geospatial Ecosystem 1990 and 2015 by Sector*

Understanding the life cycle and value archetypes

A network visualization is only one piece in the ecosystem puzzle. Decision-makers can step beyond the standard sector-based view and instead examine the various value propositions present in the ecosystem. A government agency, a multibillion dollar commercial entity, and a small university may appear to exist in completely separate spheres, but in fact may offer the same value propositions to the ecosystem. In the geospatial ecosystem, value is created by providing services across different stages in the geospatial life cycle. Figure 3, below, conceptualizes the stages of the geospatial life cycle and representative functions in each—from foundational planning needed to collect geospatial information through final end use of geospatial products and recontribution by users to the ecosystem.

Regardless of the type of entity that is providing geospatial services, the six stages closely match the phases of the US intelligence cycle.

The geospatial life cycle is not a single linear process. Rather, users may access services at each stage based on their unique needs. Frequent feedback loops and the increasingly blurred distinction between producers and consumers of geospatial content force upstream actions to change based on alterations in downstream requirements. This fosters a complex interplay and coordination that distinguishes an ecosystem from a standard supply chain.

Each entity creates value in different stages of the life cycle. Some entities specialize in a particular activity, such as collecting geospatial data through airborne LiDAR or providing software for data visualization, while other entities are active across nearly the entire cycle. For example, TerraServer's primary function is selling preprocessed imagery to commercial customers and so creates value primarily during the Integration and Dissemination stage. Meanwhile, entities like NASA or the US Geological Survey (USGS) are active across many stages of the geospatial life cycle.[4]

4 Based on Deloitte's analysis of public website data from TerraServer and NOAA.

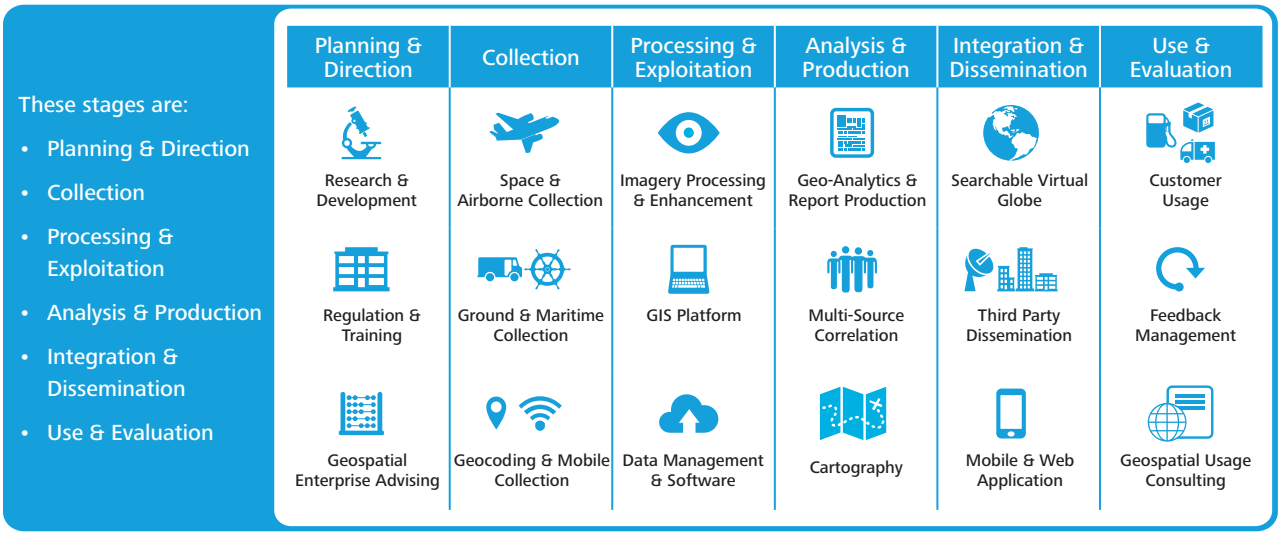


Figure 3: *The Six Stages of the Geospatial Life cycle*

Entities across the ecosystem can be grouped based on similar value propositions. There are eight different groupings, or value archetypes, that exist within the geospatial ecosystem. Figure 4 shows how each archetype creates value in different stages of the geospatial ecosystem.[5]. These archetypes frequently contain entities of varying size and influence spread across the public, private, and non-profit sectors. Within each archetype, there are several sub-archetypes based on product offerings or use patterns.

The geospatial ecosystem's eight identified value archetypes are as follows:

- **Enterprise Developers:** Entities that provide the focus on conducting research, creating standards, and establishing broad-based solutions for the geospatial sector. Applying these solutions enables entities to intersect with other phases of the life cycle
- **Full-Spectrum Aerospace Firms:** Large non-government entities that develop, operate, and exploit traditional space and airborne collection platforms
- **Government Geospatial Actors:** Government entities which operate and exploit traditional and non-traditional collection platforms and create geospatial products as a key focus of agency activity
- **Non-Traditional Collectors:** Non-government entities that develop, operate, and exploit non-traditional collections platforms and distribute the data collected by these platforms
- **Technology Providers:** Entities that create hardware and software solutions, which enable users to process or analyze geospatial information
- **Product Creators:** Entities that use externally provided data to create tailored finished products for clients
- **Information Distributors:** Entities that serve as conduits for users to access externally-created data and products
- **End Users & Re-Contributors:** Entities that consume geospatial products and, in some cases, convert existing datasets or ongoing actions into georeferenced products

5 Based on Deloitte's analysis of the public websites of 310 representative entities, see Methodology on page 17.

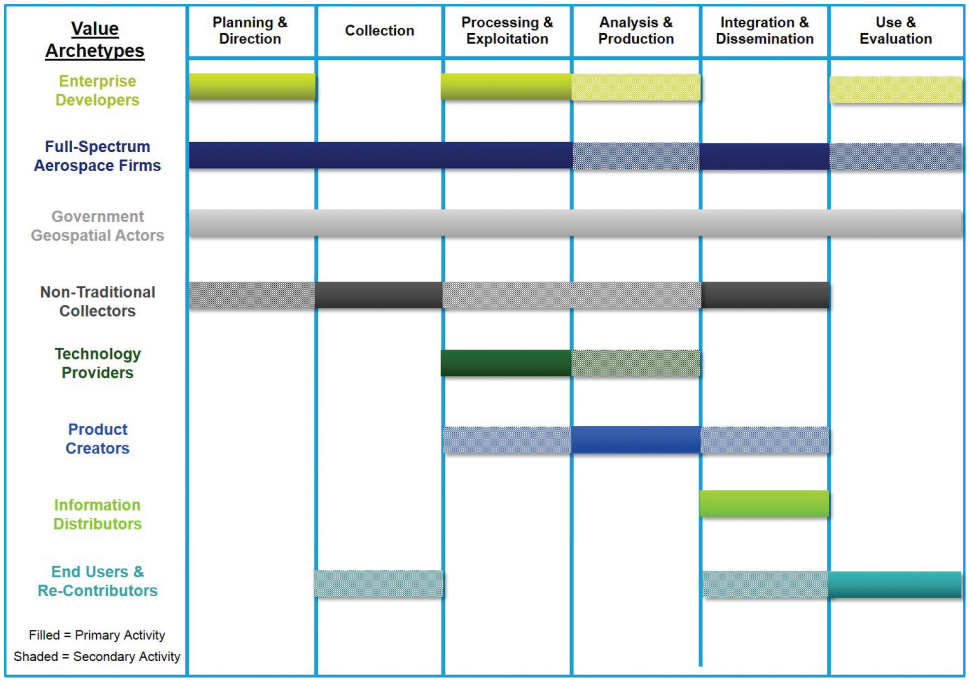


Figure 4: *Where Each Archetype Creates Value in the Geospatial Life Cycle*

Value archetypes reveal the true similarities and differences among entities by focusing on their value to the ecosystem.

Sorting entities into different value archetypes demonstrates the diversity in each stage of the life cycle. Figure 5 shows these smaller sub-archetypes branching off from each main value archetype. For example, Full Spectrum Aerospace Firms create value differently depending on whether they primarily serve commercial or military clients. Non-Traditional Collectors vary based on the type of collection platform, including UAVs, mobile devices, and underground sensors. Product Creators can add value either by providing tailored mapping services or by correlating multiple sources of data.

The divisions between government, commercial, and non-profit entities can lead decision-makers to assume that each sector is similar. However, there is more similarity across sectors than within them. Value archetypes reveal the true similarities and differences among entities by focusing on their value to the ecosystem. Decision-makers who understand their ecosystem's archetypes can see through superficial sector-based divisions to identify high-impact opportunities and risks.

Figure 5: *The Value Archetypes and Sub-Archetypes of the Geospatial Ecosystem*

The geospatial ecosystem exemplifies these challenges, as it has grown at a phenomenal rate over the past 25 years, contains tremendous diversity of entities, and regularly develops cooperative solutions drawing on cross-sector strengths to help solve societal problems.

How has value creation in the geospatial ecosystem changed over time?

1990

- Geospatial ecosystem closely mirrors aerospace defense industry
- Aerospace firms, enterprise developers, and tech providers oriented to support military and intelligence infrastructure
- Government geospatial providers dominate collection space

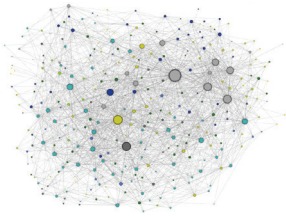
1995

- Rise of commercial aerospace firms not tied to defense industry
- Rapid growth of geospatial enterprise developers
- Beginning of non-traditional airborne and ground collection methods
- Expansion in government and commercial user groups

2005

- Explosion in geospatial data visualization firms
- Introduction of mobile collection and data geocoding
- Establishment of NIMA/NGA creates central hub for governmental geospatial development
- Initial usage by laymen individuals and non-profit groups

2015



- Consolidation among technology providers and aerospace firms
- Second expansion of geospatial enterprise developers
- Rapid growth in non-traditional collection methods
- Emergence of new service-based information distributers and information stream correlators
- Democratization of geospatial usage throughout all sectors

Based on Deloitte's analysis of the public websites of 310 representative entities, see Methodology on page 17

Strategic planning through ecosystem mapping

Ecosystem mapping enables agencies and firms to see where they are now, and help determine a path towards a desired future end state.

No ecosystem entity is connected to all other entities. However, each entity's unique set of connections reveals its value to the ecosystem. It is important to analyze the value archetypes within the entity's unique network. For example, Government Geospatial Actors, while well-connected to Enterprise Developers and Technology Providers, are minimally connected to End Users & Re-Contributors. This position enables Government Geospatial Actors to exert broad influence over the foundations of the geospatial ecosystem, but can also create risks for losing public recognition and support for agency action. Take, for example, Google's distribution of USGS- or NASA-collected imagery, via the Google Earth program. Public recognition and use of Google's geospatial services is near-universal. Generally, there is less recognition of Government Geospatial Actors. This could be an acceptable ecosystem equilibrium. But what if an entity hopes to change this equilibrium? This often requires a change in strategy. Does an entity wish to work directly with users, or closer to foundational development? Invest in its own collection capabilities, or instead rely on collection done by others? Ecosystem mapping enables agencies and firms to see where they are now, and help determine a path towards a desired future end state.

An entity's archetype is not permanent, and can alter as the entity's strategy and value proposition evolves. When Google entered the geospatial ecosystem, its demonstrated value closely resembled that of a Technology Provider or Information Distributor, by offering services like Google Maps and Google Earth in which other entities' data could be viewed. While this connected Google directly to users, it effectively made the company reliant on upstream collectors—both Full Spectrum Aerospace Firms and Government Geospatial Actors[6]. However, through acquiring various Non-Traditional Collectors Google expanded its services to the Collection stage with ground, mobile, and airborne data collection. This expanded the firm's role across the geospatial life cycle, gaining further influence and increasing its global impact. Google's current value proposition may now be seen as closer to that of a massive Non-Traditional Collector. Nor is this a fixed state, as Google's recent acquisition of the Skybox Imaging's satellite constellation[7] may indicate either a future shift towards joining the ranks of Full-Spectrum Aerospace Firms or even the creation of an entirely new value archetype.

6 James Lewis, "Google Earth—How They Do It!:A look at how Google Earth puts together images from all over the world," *Popular Photography*, December 16, 2008.

7 Brian Womack, "Google Buying Satellite Company Skybox for $500 Million in Cash," *Bloomberg*, June 11, 2014.

Using the ecosystem to understand collaboration opportunities

Ecosystems do not exist merely in the strategic ether, but rather are expressed in the tactical, on-the-ground collaboration amongst ecosystem entities. The April 2015 Nepal earthquake provides an effective case study for understanding how different geospatial entities collaborate across sectors and functions. Figure 6 shows how the ecosystem was activated in response to the earthquake. In the immediate aftermath of the disaster, aid providers—representing local government, foreign military supporters, and international aid organizations asked a series of urgent, geospatially relevant questions:

- What are the best places for refugee camps to be placed?
- What roads are passable by aid vehicles?
- Where can supply helicopters land?

To address these questions, aid providers first turned to existing geospatial data resources, including existing imagery on Google Earth, user-created maps on OpenStreetMap, and government-produced maps[8].

In some cases existing products were insufficient—both due to the lack of pre-earthquake high-fidelity data and changes caused by the disaster. Aid providers contacted geospatial providers (including NGA and DigitalGlobe) to conduct new data collection.

This initial statement of need cued the geospatial life cycle—the centerpiece of the geospatial ecosystem. Government and private-sector satellite operators began conducting additional imagery collection over the affected areas of Nepal. Non-profits on site collaborated with remotely based commercial entities to geocode and compile textual reports and social media postings displaying damaged areas. This information—raw imagery and unstructured data—underwent processing and analysis to be converted into products relevant to the initial requesters. Diverse government, commercial, and non-profit entities all participated in this stage of the life cycle. The products created during this stage were then uploaded to a data

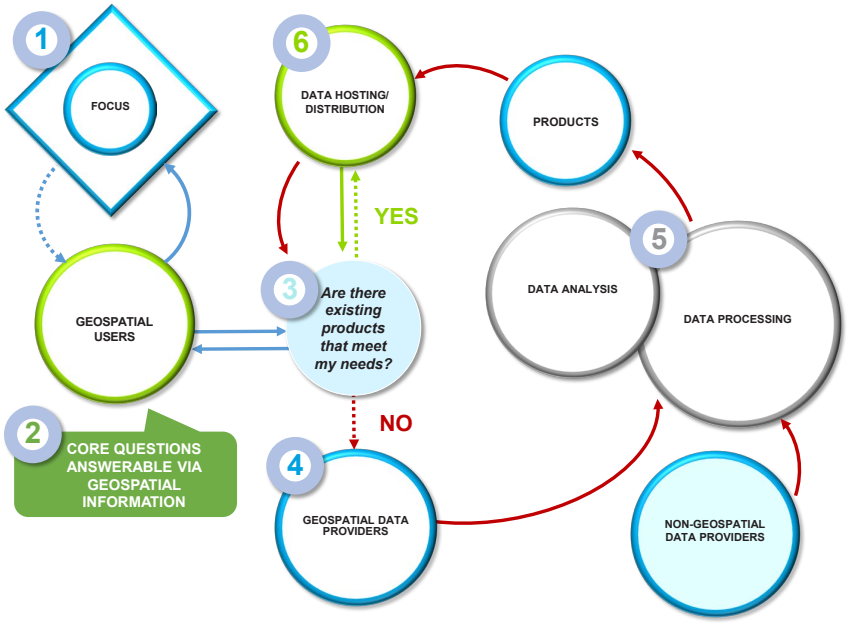


Figure 6: *How the Ecosystem Responds to Societal Challenges*

hosting point to ensure ease of access for aid providers. Google's Crisis Response platform served as a primary coordination and hosting site for a variety of geospatial products created by various entities[9]. Aid providers could then easily access products on laptops or mobile devices to deliver food, water, shelter, and healthcare to victims in Nepal. A similar process is repeated when the geospatial ecosystem responds to more prosaic problems, such as enabling utility flow and delivering packages or meeting security challenges like conducting military strikes.

8 Harvard University Center for Geographic Analysis, "Nepal Earthquake—Geographic Community Response," Project Resume, gis.harvard.edu/services/project-consultation/project-resume/nepal-earthquake-geographic-community-response, accessed September 2, 2015.

9 Pete Giencke, "From Haiti to Nepal, Google team helps users find critical geographic data during crises," *Directions Magazine*, July 1, 2015.

A changing ecosystem necessitates changing strategy

An ecosystem is not static. As new firms enter and old firms alter their strategies, the way value is created and accessed in the ecosystem changes. The case study above shows a slice in time, but the ways various entities collaborate and interact are changing. This can be most easily viewed from the perspective of a user, attempting to maneuver through the geospatial ecosystem to solve a specific problem.

From a user's perspective, the ecosystem may be viewed as containing three concentric layers: data access, collection, and infrastructure; displayed in Figure 7 below. The outermost layer is access to existing geospatial data, both through imagery hosting platforms like Google Earth and via Application Program Interfaces (APIs) like OpenStreetMap. From the perspective of the user, this layer involves the least time and resources to penetrate, and thus is available to the largest percentage of geospatial customers--including most internet and mobile device users. Data access is enabled via a deeper layer in which geospatial information is collected by sensors. Collection requests from users allow actions at this layer to be tailored to meet specific needs. However, accessing the collection layer demands a higher degree of time, monetary resources, and regulatory compliance from users. This generally limits the possibility of access to defined commercial, government, and non-profit entities. Collection is enabled via a core layer of geospatial infrastructure, consisting of the development of sensors, collection platforms, and computer technology. Some users are able to access this layer—and thus create geospatial infrastructure tailored to the user's specific requirements (e.g., launching a new satellite)—but time horizons are longer and resource obstacles higher when compared to the collection layer. The ability to purchase new infrastructure has thus been limited to only government agencies and the largest commercial firms.

Recent years have seen increased dynamism between the traditional divisions among the three access layers—enabling the sort of international cross-sector collaboration seen during the Nepal earthquake. The ubiquity of open source or limited-fee data servers has rapidly eased access to geospatial products. Deregulation of the commercial satellite and airborne imaging markets has led to a drop in the cost of geospatial products and an overall expansion in the number of geospatial providers. This makes it easier for users to access tailored collection. Technological improvements have opened the potential for smaller firms to purchase unique geospatial infrastructure solutions. This increases the number of users who can access tailored geospatial infrastructure. The divisions between users and producers are blurring. Users will be able to operate at multiple layers, through self-derived collection (e.g., mobile location sharing) and infrastructure building (e.g., mini-UAV construction). As these lines blur, it will become even more important for entities to leverage their connectivity across different levels of the geospatial life cycle rather than remaining fixed in older assumptions of value-creation.

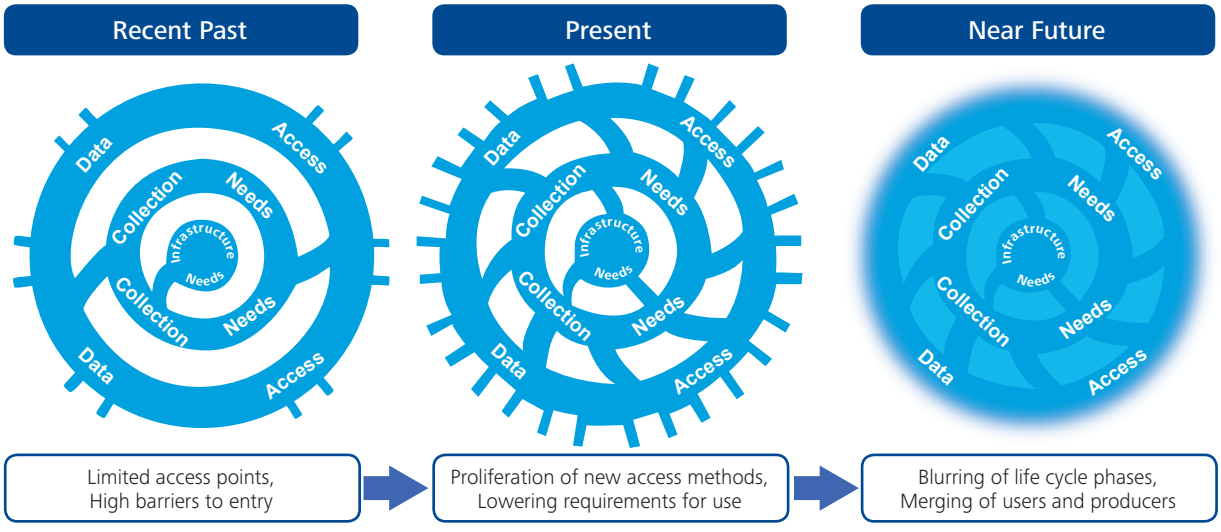


Figure 7: *Ecosystem Access Paths Change Over Time*

What the future could hold for the geospatial ecosystem

The geospatial ecosystem is rapidly becoming a disrupted market. This term, originally coined by Clayton Christensen in *The Innovator's Dilemma*, indicates the rapid transformation that occurs when traditional, well-positioned incumbents come into contact with new innovative market entrants[10]. In the case of the geospatial market, the traditional incumbents are Government Geospatial Actors and many of the military-industrial Full-Spectrum Aerospace Firms. New innovative and disruptive entities have arisen across the geospatial life cycle, particularly within the Non-Traditional Collectors and commercially-focused Full-Spectrum Aerospace value archetypes. The latter groups have made use of disruptive technologies to gain rapid market share among geospatial consumers. As Christensen describes, markets often have stratified customer sets based on their requirements for product performance[11]. Incumbents pursue improvement along a particular set of performance dimensions, often orienting solutions towards meeting the needs of the most demanding customers (see Figure 8). Disruptive technologies, instead target the underserved or unserved low-end market with innovations offering lower cost often coupled with non-standard performance characteristics (e.g., accessibility). Incumbents, choosing to remain committed to the most demanding customers, relinquish market share among low-requirement customers to the disruptors. Yet over time, the disruptive technology improves in quality, rapidly overtaking incumbents across successively higher tiers of quality. This continues until even the most demanding customers begin to switch to disruptive suppliers—undercutting and potentially crippling the traditional incumbents.

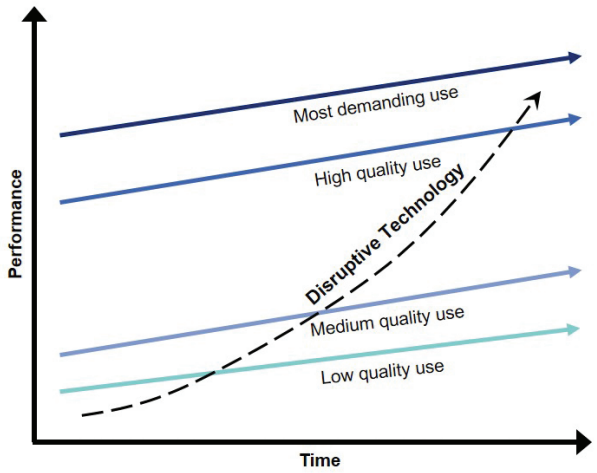


Figure 8: *Clayton Christensen's Disruptive Technology Curve*

In the geospatial ecosystem, this is mirrored in the drive by Government Geospatial Actors to orient technology towards serving high-requirement intelligence, military, and policy customers. From the early 1990s, the low-quality demand emerged from commercial customers who required relatively low-quality remote sensing for basic surveying. Disruptive commercial firms (such as DigitalGlobe in the 1990s and Google in the 2000s) emerged to serve these low-quality users. Yet over time, through technological development and deregulation, commercially provided remote sensing technology became higher and higher quality, while GIS solutions expanded to additional industries' needs[12]. Government Geospatial Actors—relying on high quality collection and top-quality analysis—generally retained older strategies, allowing most potential commercial customers to shift to disruptive providers. Now, even the most demanding users amongst intelligence,

10 Clayton Christensen, *The Innovator's Dilemma*, Boston: Harvard Business School Publishing, 1997.

11 Ibid.

12 Dr. David J. Cowen, Dr. Sean Ahearn, Mr. Michael Byrne, "The Changing Geospatial Landscape," National Geospatial Advisory Committee, January 2009.

As with every era in the evolution of the geospatial ecosystem, the roles of incumbents and disruptors will not be static.

military, and policy are likely switching to use commercial geospatial services that are of a high enough quality to help solve national security problems, even if the quality remains below that of the traditional incumbents.

The question, then, is whether Government Geospatial Actors will suffer the fate of incumbents in other disrupted markets. In the steel industry, vertically integrated steel mills have dropped from near 100% market share to around 50% with the emergence of disruptive "minimills"[13]. Could Government Geospatial Actors face similar, permanent marginalization in the overall ecosystem? In the media market, physical media incumbents relinquished innovation momentum to disruptive digital media providers, but were later able to regain relevance by adopting these new technologies themselves[14]. Could the geospatial ecosystem incumbents similarly adopt disruptors' leading practices to regain influence among end users? Blockbuster's extensive physical infrastructure and long supply chains hindered its ability to compete with the smaller, more nimble online movie-streaming companies[15]. Will firms that own similar high-investment geospatial collection platforms similarly fade as low-investment small satellites and UAVs become the predominant form of information gathering? In one particularly dire example of a disrupted market, encyclopedic services were dominated by the academically acclaimed Encyclopedia Britannica until it came into competition with the disruptive, crowd-sourced Wikipedia. Wikipedia contributed initially non-validated, seemingly low-quality encyclopedic data, but has become near-ubiquitous in the encyclopedic market. Encyclopedia Britannica, meanwhile, was forced to stop physical encyclopedia-printing altogether due to low sales[16]. In this worst of scenarios, could geospatial incumbents eventually lose so much market share among customers that they can no longer justify their large budgets to serve only a small number of concierge-level government users?

Hope, however, is not lost for the incumbents, as new technologies can open temporarily blue-ocean territory within the geospatial ecosystem. The proliferation of LiDAR, mini-UAVs, and small satellites offer new methods of data collection. Meanwhile, the emergence of the Internet of Things, increased crowd sourcing, and the extension of geospatial services to the developing world will exponentially increase the amount of potential data available for collection and analysis[17]. These trends are likely to catalyze a further explosion in the number of customers and geospatial services providers. As with every era in the evolution of the geospatial ecosystem, the roles of incumbents and disruptors will not be static. DigitalGlobe, having emerged as such a strong disruptor in the 1990s, has seemingly ceded innovative ground to new small satellite companies—and thus has moved closer to the camp of incumbents. Yet the reverse is also possible—if incumbents can leverage unique value propositions and technologies to reemerge as value-creating disruptors in this ever-evolving ecosystem.

13 John Stubbles, "The Minimill Story," AIST J. Keith Brimacombe Memorial Lecture, AISTech 2006, Cleveland Ohio, 2006, brimacombecourse.org/pdf/2006_Stubbles.pdf.

14 Robert G. Picard, "Mapping Digital Media: Digitization and Media Business Models," Open Society Foundations, Reference Series No. 5, July 2011.

15 Larry Downes & Paul Nunes, "Blockbuster Becomes a Casualty of Big Bang Disruption," *Harvard Business Review*, November 7, 2013.

16 Pete Albro, Bill Aull, Ryan Fitzgerald, John Goldsmith, Tom Harris, & Jon Mohraz, "A Graceful Retreat: Encyclopedia Britannica," The Tuck School of Business at Dartmouth, 2008.; Dan Gillmor, "Encyclopedia Britannica in the age of Wikipedia," *The Guardian*, March 14, 2012.

17 United Nations Initiative on Global Geospatial Information Management, "Future trends in geospatial information management: the 5-to 10-year vision," January 2013; "Open Geospatial Consortium, "Geospatial Technology Trends 2013: Overview of the 'Ripe Issues'", April 8, 2013; Dr. Hrishikesh Samant; "UAVs: The new trend in acquiring geospatial data through remote sensing," *Geospatial World*, geospatialworld.net/Paper/Technology/ArticleView.aspx?aid=31279, accessed August 20, 2015. John Whitehead & William Marbell, "The Economic Benefits of Geospatial Technology in the Developing World," Annual World Bank Conference on Land and Poverty, April 23-26, 2012.

Summary

The geospatial ecosystem embodies revolutionary change. In 1990, the ecosystem contained dozens of of entities with tens of thousands of mostly government users. Today, the ecosystem contains many hundreds of entities with billions of users across all sectors. This is not limited to the geospatial market, but rather mirrors ongoing cross-sector revolutions across the globe. Traditional supply chain maps and linear customer diagrams no longer reflect reality; these outdated models both stifle opportunity recognition and hinder delivery of currently provided services. Customer ecosystem mapping empowers an entity—regardless of sector—to identify how customers access its services, determine to what end-goal those services contribute, and identify valuable cross-sector or cross-function relationship-building opportunities. This clear understanding of the changing customer ecosystem is key to building long-term strategies to promote both customer experience and mission success.

Methodology

Determining Number of Geospatial Users:

To determine estimates for growth in the number of geospatial users, the Deloitte team examined the history of remote sensing and GIS from its inception in intelligence, military, and academic realms in the mid-20th century through deregulation and promulgation to initial commercial entities in the 1990s, and ubiquitous expansion to Internet and smartphone users during the 2000s and 2010s[18]. The Deloitte team then combined this temporal market change research with an exploration of use studies based on various articles in *Geospatial World* and *Directions Magazine* along with case studies publicly available on the websites of Esri and DigitalGlobe to determine the different groups that now use geospatial services and during which time periods they likely began using geospatial services (e.g., commercial firms mostly entered the geospatial market after the 1992 Land Remote Sensing Policy Act). The likely number of users in each user group was determined by comparing these case studies against the total number of potential users in each group as presented in US government, US Bureau of Labor Statistics, US Census, and market data[19]. These numbers were then extrapolated to determine numbers for similar user groups outside of the United States. Through analysis of the likely year in which new users groups entered the geospatial ecosystem, the likely intensity of usage of geospatial services, and the total possible number of users in each category the Deloitte team determined the likely relatively growth rates in total users and multigroup user categories (e.g., military, civilian government, commercial, and individual). Based on this analysis, the Deloitte team assessed prederegulation geospatial services were limited predominantly to a relatively small portion of the national security and civilian agencies, postderegulation geospatial usage has expanded both amongst these traditional users and among the ~3 billion smartphone users globally assuming that nearly all smartphone users have access to automatically uploaded GPS mapping applications.

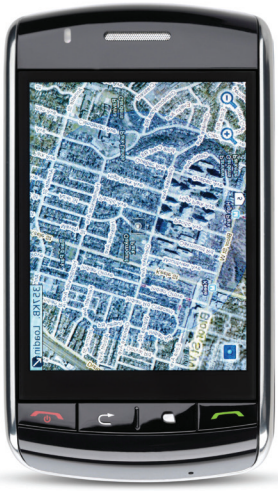
Determining Value Creation and Growth of Ecosystem Entities:

To determine the growth and change in the number and type of geospatial ecosystem entities, the Deloitte team created a database including 310 geospatial entities. While this database is not a complete representation of all entities present in the geospatial ecosystem, the entities are representative of the diversity in value-creation present in the ecosystem. The Deloitte team used each entity's public website information to determine the services provided by it and the year in which the entity was founded or began providing geospatial services. For entities that primarily use geospatial services, the year of entry into the ecosystem was determined based on qualitative data provided by user case studies (see note above). Based on similarities in types of geospatial activities in which each entity participated in, geospatial ecosystem value archetypes were created and assigned to each entity. By comparing these value archetypes to the entry year of each entity, the Deloitte team was able to assess broad shifts in value creation overtime.

18 See for an effective summation of geospatial historical trends: Dr. David J. Cowen, Dr. Sean Ahearn, Mr. Mi¬chael Byrne, "The Changing Geospatial Landscape," National Geospatial Advisory Committee, January 2009.

19 Office of the Deputy Assistant Secretary of Defense (Military Community and Family Policy), "2013 Demographics Profile of the Military Community," Department of Defense, 2013; Bureau of Labor Statistics, "Occupation Outlook Handbook," bls.gov/ooh/home.htm, accessed October 15, 2015. US Census, "Industry and Occupations", census.gov/people/io/, accessed October 15, 2015. GSMA, "The Mobile Economy, 2015," London, 2015.

For more information



Please contact:

Bruce Chew
Director, Chief Strategy Officer
Deloitte Consulting LLP
+1 617 437 3526
brchew@deloitte.com

Matt Gentile
Principal, Geospatial Analytics Practice Leader
Deloitte Advisory LLP
+1 617 480 5559
magentile@deloitte.com

Craig White
Principal, National Security Sector
Deloitte Consulting LLP
+1 937 272 4416
craiwhite@deloitte.com

Rajiv Gupta
Senior Manager
Deloitte Consulting LLP
+1 240 463 2516
rajivgupta@deloitte.com

Primary contributors:

Liz Nelson
Analyst
Deloitte Consulting LLP

Nicholas Bellomy
Consultant
Deloitte Consulting LLP

Jessica Kuntz
Consultant
Deloitte Consulting LLP

Drew Howell
Senior Consultant
Deloitte Consulting LLP

Andy Nichols
Senior Consultant
Deloitte Consulting LLP

John Hermansen
Manager
Deloitte Consulting LLP

This document contains general information only and Deloitte is not, by means of this document, rendering accounting, business, financial, investment, legal, tax, or other professional advice or services. This document is not a substitute for such professional advice or services, nor should it be used as a basis for any decision or action that may affect your business. Before making any decision or taking any action that may affect your business, you should consult a qualified professional advisor. Deloitte shall not be responsible for any loss sustained by any person who relies on this document.

As used in this document, "Deloitte" means Deloitte Consulting LLP, a subsidiary of Deloitte LLP. Please see www.deloitte.com/us/about for a detailed description of the legal structure of Deloitte LLP and its subsidiaries. Certain services may not be available to attest clients under the rules and regulations of public accounting.

Copyright © 2016 Deloitte Development LLC. All rights reserved.
Member of Deloitte Touche Tohmatsu Limited.