

Esri® Location Analytics for Business Intelligence

An Esri® White Paper
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Contents	Page
Executive Overview	1
Proven Value of Business Intelligence	1
GIS and BI: The Timing Is Right	2
Challenges.....	3
Solution: Esri Location Analytics.....	4
Architectural Overview.....	4
Location Analytics Solution Examples.....	5
Location Analytics Benefits.....	8
Summary.....	9

Esri Location Analytics for Business Intelligence

This paper discusses the market dynamics that are driving integration of two highly complementary enterprise software solutions: business intelligence (BI) and geographic information system (GIS) technology. It also outlines the benefits of such integration and how to easily enable it with Esri® Location Analytics.

Executive Overview

BI is a priority for organizations interested in gaining a competitive advantage. BI leverages corporate data and strategically equips knowledge workers with insights that drive sound business decisions.

As BI has matured, the reach of GIS has expanded significantly as well. In addition to specialty IT groups, GIS provides agility to a multitude of departments in many industries. It allows users to visualize and intelligently analyze historically underutilized data in ways not typically seen in traditional BI implementations.

Given the complementary natures of BI and GIS, the adoption of geographic analysis to enhance business intelligence is growing rapidly. Through the fusion of these two enterprise technologies, organizations can visualize and analyze key business data through "smart" maps to discover patterns and trends that would have been easily overlooked with traditional BI tables and charts.

Proven Value of Business Intelligence

With the dynamic economic landscape, businesses are increasingly looking for ways to do more with less and maximize their existing assets to extract the most value. To achieve this, BI has been a significant component in many organizations' technology portfolios. Well-implemented BI allows organizations to focus on what's important and make business decisions to drive performance.

Because BI has been mainstream since the 1990s, organizations have had BI implementations in production for years. Most organizations begin with simple reporting, which remains a huge component of what many people think of as BI. Every large organization has reports it runs daily, weekly, and monthly to deliver information to key stakeholders in the company. Most organizations also have some level of self-service reporting so users can access information from data warehouses and use intuitive visual tools to formulate queries and get answers without direct IT support. From there, BI runs the gamut of corporate dashboards, scorecards, and graphic visualizations.

More recently, the BI market has been redefined as a subset of the business analytics (BA) market. Business analytics includes BI but also more advanced analytical tools such as predictive analytics and even prescriptive analytics, which employ the output from predictive algorithms to make actual suggestions related to business decisions.

The evolution from simple reporting and online analytical processing (OLAP) through scorecards and dashboards to predictive and prescriptive analytics shows a constant

GIS and BI: The Timing Is Right

expansion of value-added capabilities in the area of BI and analytics. Organizations have become increasingly sophisticated in the application of new and complementary technologies in this domain to drive ever-better business decisions.

In spite of the steady technological progression in the BI market, few organizations have made strides in integrating GIS technologies with business intelligence, even though there are obvious synergies between these two disciplines. However, given technological advances and the advent of enterprise-scale, high-performance, web-based solutions in both domains, the fit for BI and GIS presents a timely opportunity.

What Is GIS?

GIS integrates software and data to capture, manage, analyze, and display all forms of geographically referenced information. GIS allows users to view, understand, question, interpret, and visualize data in ways that reveal relationships, patterns, and trends in the form of maps, globes, reports, and charts.

GIS has come a long way as a discipline since its humble beginnings in the 1960s. Now there are deployments in almost every field. Government and industries, including finance, retail, health and human services, natural resources, public safety, transportation, and utilities, have leveraged GIS to do the following:

- Store, manage, and maintain accurate spatial asset information
- Transform data into actionable intelligence
- Get information into and out of central offices
- Disseminate knowledge where and when it's needed

GIS performs a core business function in many organizations, but it is often siloed in GIS departments and viewed as a complex enterprise technology requiring a significant investment. Therefore, most BI users are not accustomed to using maps as analytical tools. They typically analyze business data for patterns and trends using tables, charts, and graphs. They also benefit from OLAP data, which involves users analyzing the major dimensions of a business by drilling up and down through business data to uncover trends and anomalies.

Although traditional BI tools are powerful and have delivered proven results, they do not incorporate a crucial component of most business information: location. The majority of business data contains some sort of location information: office locales, customer addresses, sales territories, marketing areas, facilities, and so on. When this data is viewed spatially on a map, patterns and trends that were once overlooked are clearly revealed.

When combining GIS with business intelligence data, organizations can answer questions like these:

- Who are my best customers and where are they located?
- Are there location-based patterns related to customers' purchase decisions?
- Where can I find potential customers similar to existing customers?

- Where have our marketing efforts been the most or least successful and why?
- Do we have customers at risk from physical phenomena, such as severe weather events, and what impact might that have on our business?

Answers to these and other critical questions are delivered through the successful integration of BI and GIS that provides the following:

- Powerful visual analysis capabilities for key BI data such as customers, retail outlets, assets and infrastructure, partner locations, supply chains, operational events, and utility grids
- Easy correlation of BI data with demographics, occupational classifications, lifestyle and socioeconomic factors, and consumer information to analyze and optimize product and service sales across multiple geographies
- Immediate insight to enable rapid and informed decision making, including clear visualization of what matters and where it matters, complemented with supporting business analytics, allowing knowledge workers to prioritize efforts and immediately become more productive

Challenges

For most large organizations, BI represents a significant portion of their technology portfolios. Enterprise GIS software likewise represents a significant IT investment. Both investments are commonly supported by distinct departments or teams. Unfortunately, in many organizations that utilize both BI and GIS capabilities, there is often little communication between these groups.

Even in cases where communication is open, integration of these two systems has been a challenge, requiring custom coding processes and programmers to integrate maps using advanced application programming interfaces (APIs). Every time a new type of report was required, it meant more coding. Every time new functionality was required—like output to PDF or map-driven filtering—it meant yet more coding. Of course, ongoing operational expenses are then incurred, as with any custom development, to maintain and sustain the resultant products.

But this laborious approach flies directly in the face of what BI is all about, since one of the original drivers of BI was eradicating this type of custom development process. BI evolved rapidly as a technology in response to widespread business-driven demands for information. Before BI, every request for a specific report came to a database expert who could custom code the SQL query required to answer the questions being posed. As demand for information grew, so did the reporting backlog, which meant users could not get the information they needed in time to make their decisions.

BI was born to enable broad deployment of reporting and analytics across the enterprise without custom coding to answer every new question.

While there are certainly cases where the implementation of advanced GIS capabilities warrants custom development of spatially enabled BI dashboards, this should not be the case for the straightforward implementation of maps into BI systems. BI directors and IT

managers are highly reluctant to implement complex, time-intensive solutions that integrate GIS and BI.

Solution: Esri Location Analytics

The solution to overcoming BI and GIS integration challenges is Esri Location Analytics. Location analytics augments mission-critical, enterprise business systems with content, mapping, and geographic capabilities through complementary and nondisruptive technology. Unlike the custom-coding approach mentioned earlier, a location analytics solution seamlessly integrates maps into the target BI application using technology that's native to the underlying business system. This is a fundamental tenet of a location analytics solution: the GIS capabilities that it brings to bear on any business problem must feel like a natural extension of the in-place system that it enhances.

There are three core capabilities that are present in any location analytics solution:

- **Mapping and visualization**—Provide access to simple yet intelligent mapping, enabling users to explore their business information on an interactive map.
- **Spatial analytics**—Empower users to analyze their business information spatially through a map. For example, a simple yet powerful type of spatial analytics is bidirectional connection, establishing a visual relationship between tabular/graphic BI data and the map. As an analyst selects spatial information on the map, the associated information is automatically refreshed in the tables, charts, and graphs.
- **Information/Data enrichment**—Supplement BI data with critical geographic information. One form of data enrichment is geocoding, creating geographic coordinates—often expressed as latitude and longitude coordinates (x,y)—from data such as a home address or ZIP code. Enrichment also means analysts can add key demographic and consumer expenditure information to a map that drives analytics for existing lists of customers or service territories. This communication between tabular and spatial data provides even more context for exploring business information, uncovering patterns and trends, and enabling advanced business decisions.

Architectural Overview

Integrating anything into an environment as complex as a large enterprise BI deployment can be a daunting task. BI applications range in size and scale from small (25 to 50 users) to much larger enterprise deployments that service tens of thousands of users, running thousands of reports a day, exploring and analyzing data in hundreds or thousands of dashboards. These large BI implementations bring together heterogeneous data from multiple operational systems into a consistent view in the corporate data warehouse.

Clearly, for a location analytics solution to succeed in such complex environments, it must be architected to fit those environments. A successful location analytics solution must do several things:

- **Leverage all the architectural strengths inherent in the solutions that it extends.** For example, if the target system is web based, the maps and GIS capabilities of the location analytics solution must be web based. If that solution spans multiple hardware platforms, the location analytics solution must support such an environment.

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If there is a scalable, multiserver BI solution in place to ensure scalability and reliability, the components that comprise the location analytics solution must plug directly into that architecture without disruption. Similarly, if the target BI solution has in-place security, there can be no disruption to that: the location analytics solution must leverage the in-place security for all defined users and roles.

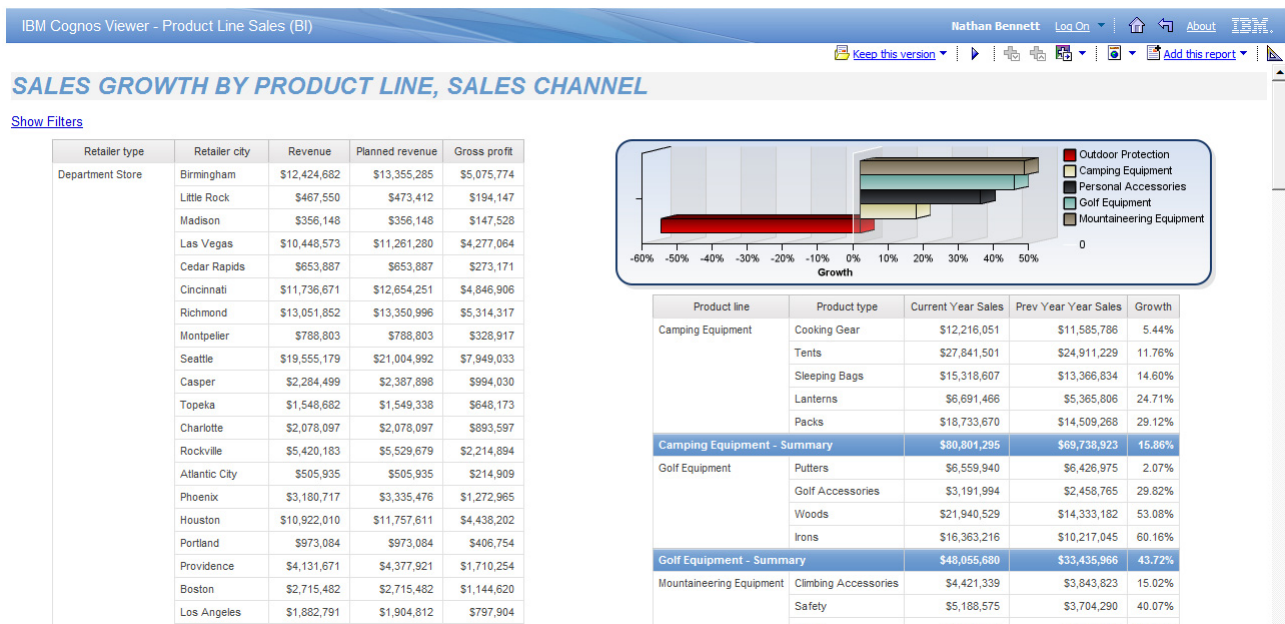
- **Support in-place workflows and skills.** Developing and maintaining BI solutions requires specialized skills that take time and effort to build. A solution that extends such a system with GIS capabilities must leverage those in-place skills and not require users of the BI system to learn complex new skills related to the domain of GIS.
- **Provide flexibility in terms of how maps are implemented into existing solutions.** A BI group that is just starting to implement a location analytics solution may not have the in-house resources and capabilities to implement a GIS solution with GIS servers. In such cases, it's incumbent on the location analytics solution to offer flexibility in terms of map integration, including any combination of on-premises or cloud-based map servers.

Esri's flexible location analytics deployments enable organizations to adopt the approach that makes sense for their businesses.

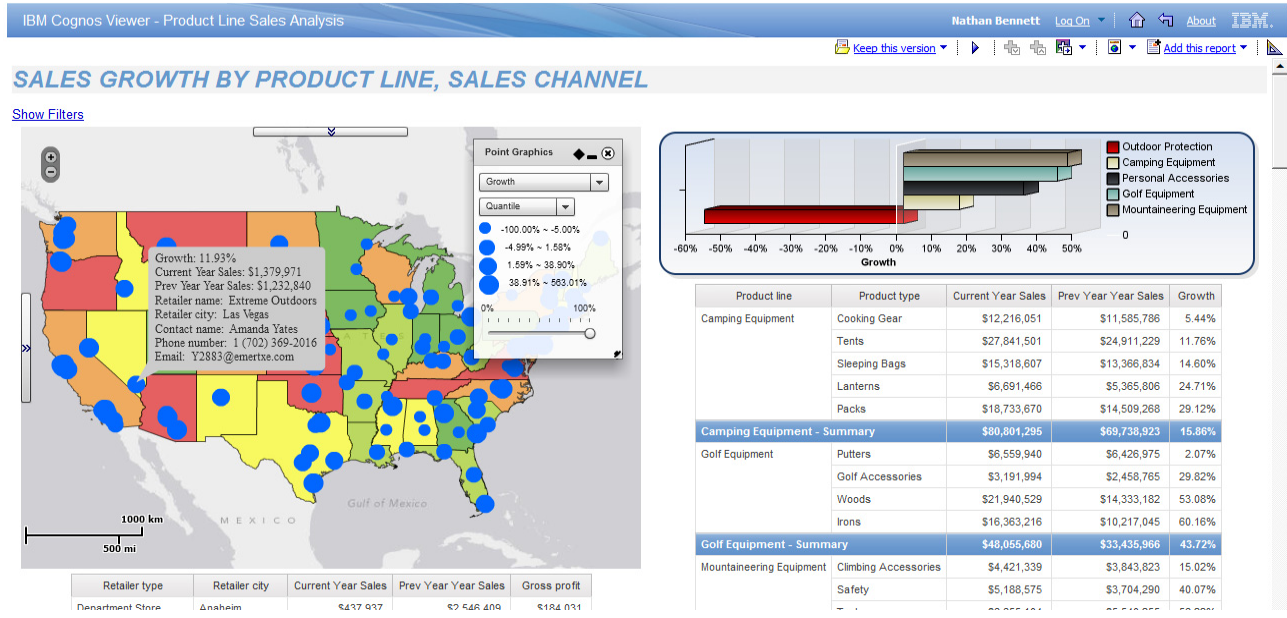
Location Analytics Solution Examples

Here are a couple of examples of how Esri's Location Analytics solution can add value to an in-place BI solution.

Below, a typical BI dashboard shows sales by channel for a wholesaler of camping and outfitting products:

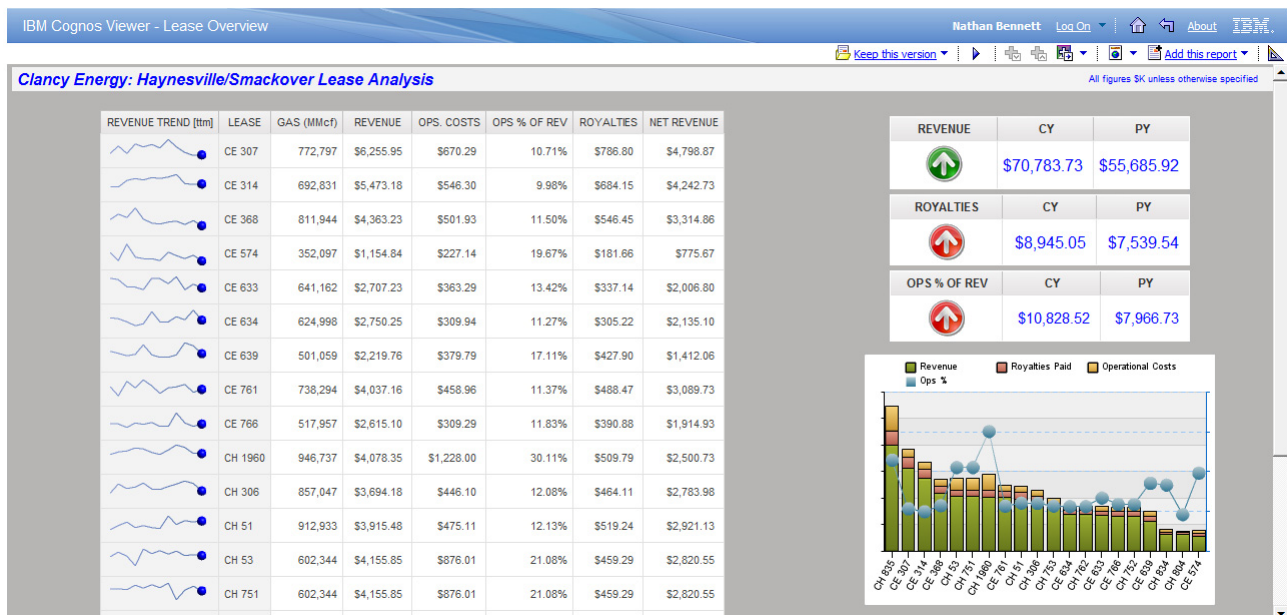


Here is that dashboard enhanced with a map that provides a very clear and easily interpreted visualization of the organization's sales and revenue performance at the state and national levels, as well as for specific sales outlets:



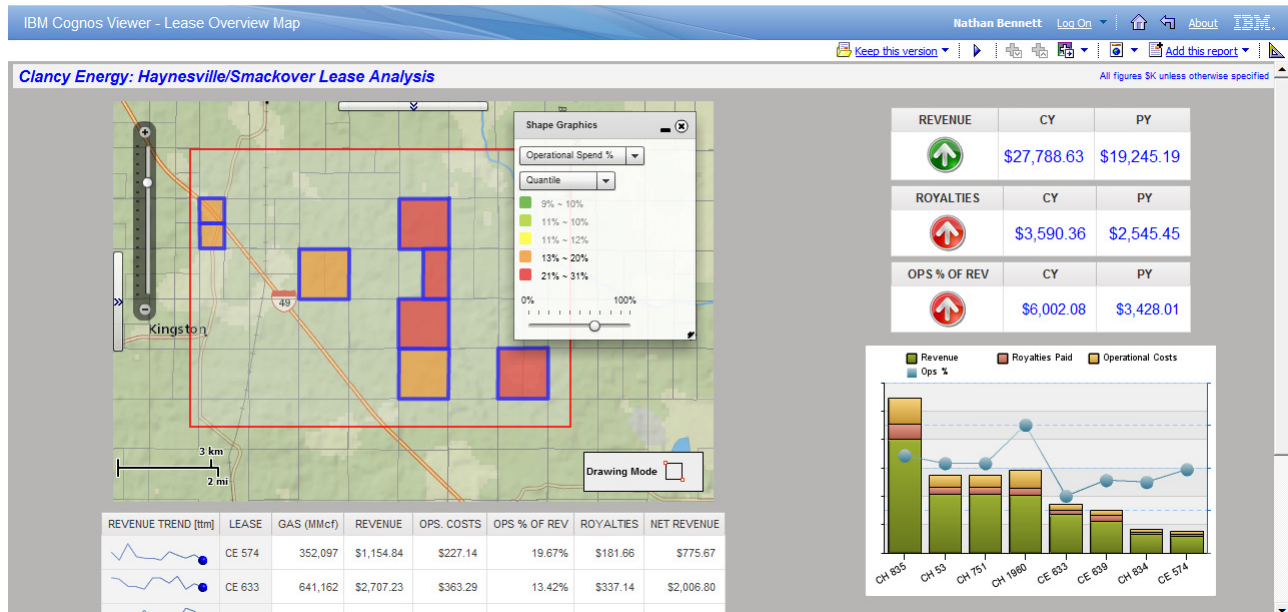
The map's impact is instant and obvious. With a glance, knowledge workers and analysts can see which regions and locations are performing well and which are not.

In another case, a dashboard shows lease and well performance for an oil company. The dashboard displays historical trends for lease revenue together with key metrics for revenue, royalties paid, and operational costs:



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Here is that same dashboard enhanced with a map showing actual lease performance, symbolized for all the key measures of concern. Analysts can use the map to drive the analysis based on the patterns they see:



Industries that use location analytics include the following:

- **Insurance**—Analyze total insured value (TIV) by region and policyholder; revenue; gross and net losses; claims; fraud detection; or risk based on weather, potential terrorism, or other extreme events.
- **Financial**—Analyze key financial measures such as total deposits, household savings, household automotive loans, and liquidity, as well as period-over-period changes in these key measures by region and branch.
- **Utilities**—View and analyze key measures such as outages and associated costs and anomalies in delivery and employ customer location-based analysis on products and services to optimize revenues and costs.
- **Transportation**—View and analyze route performance based on scheduled versus actual times, average revenue per seat, percentage of late deliveries or flights, and proximity to en-route service depots.
- **Retail**—Analyze sales territory revenue and profitability by region and location, as well as key physical contextual influencers such as competitor location and demographics. Analyze marketing campaign effectiveness.
- **Public sector**—View and analyze delivery and costs of services by service area, as well as public-sector projects and fund allocation by region and project location.

Location Analytics Benefits

- **Education**—Analyze alumni fund-raising and management and recruiting based on demographics.

The benefits a BI group will achieve from location analytics depend largely on a person's role within the organization. However, from a business perspective, some primary advantages that location analytics offer to the BI group are listed here:

- **Complementary technology**—Because the location analytics solution extends in-place assets and solutions in ways designed to fit those systems, there is a short learning curve and quick results.
- **Nondisruptive workflows**—The familiar workflows of the target BI system remain completely intact for both the design personnel authoring BI content and the business personnel consuming the information in published reports and dashboards.
- **High-value analytics**—With the ability to visualize and interact with data in new ways, users can recognize patterns and connections that may not be revealed with only charts and graphs. For example, two locations may be operating at less than 50 percent capacity. If these locations were exposed only through a list, it may not be apparent that they are in close geographic proximity and potentially cannibalizing each other.

Users, developers, and stakeholders in a BI solution span a wide spectrum. The actual benefits derived from a location analytics solution according to the role of the user are included below:

- **CIO**—Quick-win delivery of business advantage, with a low-cost, low-risk combination of two highly complementary technologies
- **Director of BI**—A richly enhanced location analytics solution in a fraction of the time required to custom develop, with minimal disruption of existing BI assets and resources
- **BI report developer**—Seamless access to enterprise GIS capabilities directly within BI authoring environments for immediate productivity without custom development
- **Line-of-business manager (sales, marketing, operations, procurement)**—Enhancement of the ability to analyze and understand performance using the intuitive and familiar visual context of maps; instant availability of performance and maps to drive BI analysis
- **Report consumer**—A seamless map experience in BI, with instant-impact visuals, to show exactly where performance is meeting expectations and provide the ability to perform complex spatial queries visually in conjunction with key business intelligence data

Summary

The maturing business intelligence market is ready for value-added extensions and enhancements. Many organizations are beginning to use location analytics to enable spatial analysis of data and drive business performance. These organizations typically have very large investments in business intelligence.

Uniting enterprise BI and enterprise GIS used to involve large development costs and long development cycles. Now, Esri Location Analytics provides a low-cost, low-risk alternative for organizations looking to realize increased business value and agility by integrating these two powerful technologies.



Esri inspires and enables people to positively impact their future through a deeper, geographic understanding of the changing world around them.

Governments, industry leaders, academics, and nongovernmental organizations trust us to connect them with the analytic knowledge they need to make the critical decisions that shape the planet. For more than 40 years, Esri has cultivated collaborative relationships with partners who share our commitment to solving earth's most pressing challenges with geographic expertise and rational resolve. Today, we believe that geography is at the heart of a more resilient and sustainable future. Creating responsible products and solutions drives our passion for improving quality of life everywhere.



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