Pitney Bowes

The "Where" Factor and Business Intelligence

Integrating geospatial analysis with BI for greater business effectiveness

WHITE PAPER:

LOCATION INTELLIGENCE

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ABSTRACT

EIGHTY PERCENT OF BUSINESS DATA CONTAINS LOCATION INFORMATION THAT IMPROVES PROCESSES, DECISION-MAKING AND OVERALL BUSINESS PERFORMANCE, AND CREATES COMPETITIVE ADVANTAGE.

BUT FEW BUSINESS INTELLIGENCE (BI) PLATFORMS, INCLUDING THOSE FROM COMPANIES LIKE IBM, MICROSOFT, ORACLE, AND SAP, OFFER ADVANCED GEOSPATIAL FUNCTIONALITY.

BUSINESS ANALYSTS WHO DEPEND ON THEIR ORGANIZATION'S MAIN BI SYSTEMS THEREFORE ROUTINELY LACK THE POWER TO USE LOCATION INTELLIGENCE (LI) TO APPLY NEW MARKET INSIGHTS THAT COULD OPTIMIZE STRATEGIC PLANNING.

BI PLATFORMS ARE VITAL. ORGANIZATIONS WORLDWIDE HAVE INVESTED HUNDREDS OF BILLIONS OF DOLLARS IN BI SOFTWARE AND DATA, AND AN EQUALLY MASSIVE AMOUNT IN THE PEOPLE WHO USE THOSE TOOLS EVERY DAY.

DESPITE THE FACT THAT NO SINGLE SYSTEM CAN SATISFY THE EVOLVING NEEDS OF "AGILE BI," THESE ENTERPRISES UNDERSTANDABLY REFUSE TO REPLACE EXISTING BI SOLUTIONS, EVEN FOR THE LATEST AND GREATEST UPGRADE.

INSTEAD, A MULTI-PLATFORM BI TECHNOLOGY ENVIRONMENT HAS EVOLVED. AS ANALYSTS LOOK TO NEW WAYS OF INCREASING REVENUES FROM EXISTING CUSTOMERS OR OF IDENTIFYING NEW MARKET SEGMENTS, MANY HAVE BRIDGED THIS "AGILITY GAP" BY SUPPLEMENTING THEIR MAIN BI SYSTEM WITH NICHE SOLUTIONS.

THIS HAS DRIVEN DEMAND FOR THE RAPID INTEGRATION OF OPEN GEOSPATIAL ANALYSIS TECHNOLOGY INTO EXISTING BI ENVIRONMENTS.

WHAT CHALLENGES MUST BE OVERCOME TO ACHIEVE THIS NECESSARY INTEGRATION?

80%

of business data has a location component

LOCATION INTELLIGENCE IS INTEGRAL TO BUSINESS INTELLIGENCE.

The critical importance of spatial relationships

BI systems often track customer, home and work addresses, store locations, and the location of assets, like ATMs, cell towers, leased equipment, insured assets and more.

While this static information is valuable, so too are the spatial *relationships* these people and things have to each other, and to infrastructure and topography—highways, rail lines, airports and harbors; bridges and tunnels; national, state and local boundaries; and oceans, rivers, mountain ranges, fault lines, wetlands and wildfire zones.

Organizations know the importance of geospatial data and analysis to business intelligence and analytics, and are actively seeking to drive insights from it.

Respondents to a 2013 analytics survey by The Data Warehouse Institute (TDWI) predicted that use of geospatial analysis will double by 2016.[1]

Decision makers need to exploit location intelligence to readily understand crucial concepts:

- *Where are my customers and prospects?*
- *How can I retain the former and attract the latter by optimizing my distribution networks and use location to refine product and market strategies?*
- *How can I streamline my supply chain, become a more efficient manufacturer or get my goods to market quicker?*
- *How can my workforce perform at a higher and more effective level?*

Yet location data has until recently gone unused or has been underutilized—as merely "descriptive … or a very coarse-grained and often static dimension"[2]—in business intelligence.

In general, organizations have lacked the ability to powerfully and dynamically present location-driven insights on a map for better, swifter and more agile decision-making.

The urgent quest for business intelligence and agility

Meanwhile, as BI has become an essential management discipline, BI technology environments have become more complex.

AN INABILITY TO INTEGRATE MAPPING AND GIS TOOLS WITH BI SOLUTIONS HAS DEPRIVED MOST ORGANIZATIONS OF THE ABILITY TO GAIN INSIGHTS FROM GEOSPATIAL ANALYSIS.

Large organizations manage a huge user population and asset base with hundreds (sometimes thousands) of physical locations, geographically dispersed across local, state and national boundaries, as well as applications and data that are both internal and customer-facing.

Their investments in software and services well exceeds $100 billion. Pringle & Company and *Information Age* estimated that the total spend on BI software and services alone was $86 billion in 2013,[3] and could reach $143 billion in 2016.[4]

An early 2014 forecast from the same sources pegged the compounded annual growth rate of BI software and services at an estimated 16.4 percent through 2017.[5]

Moreover, organizations' investment in people (business analysts and system users) and data is incalculable.

The need of those users for immediate insight into issues and opportunities has created the demand for "agile BI."

They are deploying tools and capabilities outside the core BI system that provide those insights.

Says Forrester Research: "For information workers who need information anytime and anywhere, agility concerns will trump standards … there is simply no one vendor that provides all of the key agile BI capabilities."[6]

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BI has become a multi-platform world

As a result, many organizations, especially large enterprises, deploy multiple business intelligence platforms.

This multiplatform environment renders unthinkable any geospatial analysis solution that creates a new and unnecessary layer of complexity or builds a new data or IT silo.

In addition, the maintenance of a separate geospatial database flies in the face of both traditional data governance and emerging Big Data best practices.

Traditional GIS—considered inherently "proprietary"—is thus a less-than-ideal integration partner.

Business intelligence and LI: the interoperability imperative

It is essential for a geospatial analysis solution to integrate and interoperate with an organization's BI platforms and its data warehouse. It must support its data management policies.

And, of course, it must bring to the table a powerful array of such location intelligence functions as:

- Geocoding
- Mapping
- Time and distance-based route planning
- Hot-spot analysis
- Other spatial-analytical features

This must be enabled at a data, system and human level.

The data requirement: completeness, accuracy and integrity

In the past, "spatial" data was outside the realm of spreadsheet-based BI information sets. It was one-dimensional and described stationary things, like address or location, with limited analytical value.

Geospatially-enabled intelligence combines a precise understanding of physical location with dynamic data (distance between locations, isochrone data and traffic analysis to calculate probable driving times, the impact of physical terrain characteristics, market demographics, and location-driven user behavioral patterns).

Then, it lets analysts model scenarios and visualize data on a map interface within their familiar BI environment.

Superior data management, whether it comes from the data warehouse or from feeder applications and external sources, is crucial. Incorporating data quality processes within BI applications and the underlying data warehouse yields higher quality analysis.

Geocoding takes address data and assigns appropriate latitudinal, longitudinal and altitudinal values or information like assessors' parcel numbers that can be used within applications or processes. It may also include dynamic information retrieved through mobile networks and location-aware devices.

Value-added **spatial data** (geographic, domain-specific dynamic, and demographic) can be integrated from a wide array of sources, e.g., TIGER (U.S.), INSPIRE (Europe), commercial vendors (including Google, OpenStreet Maps, and TomTom), depending on use cases.

The system requirement: an open standards approach

Technical requirements for the integration of LI into a BI environment, usually considered early in the discovery process, include the following criteria:

- How can integrated LI support multiple business processes or departmental units within the enterprise?
- Can integration inflict minimal pain on the IT team and can it optimize the IT department's resources?
- Can the resulting solution support existing systems and processes (monitoring, security, ongoing management)?
- Can future upgrades and system maintenance be easily managed?

The advent of service oriented architectures (SOAs) and web services has enabled BI systems and analytical tools to communicate freely among themselves and with data warehouses. SOA and web services also make possible the seamless integration of scalable and standards-based geospatial analysis functionality within an enterprise business intelligence system, even in a multiplatform BI environment.

As Madan Sheina of Ovum summarized:

"SOA flexibility, coupled with the composite open application integration mash-ups, is a dramatic departure from the traditional proprietary nature of geospatial applications. These advances are simplifying what used to be complex GIS development cycles, offering a modular plug-and-play approach that is cheaper to implement, and opening up ways for location data to interact with enterprise business applications."

"Interoperability" is about more than just software

The development of web services and new software design paradigms has occurred simultaneously with the open-source movement.

Founded in 1994 and now composed of almost 500 entities, the Open Geospatial Consortium has developed through consensus and published over 30 standards designed to support interoperability among geospatial software, services and content.

Location-enabling business data often follows this process:

- Integration and cleansing of corporate data to optimize quality and integrity
- Geocoding that data to accurately determine spatial coordinates of the appropriate addresses
- Integrating spatial data from internal databases and/or third-party sources for modeling and analysis
- Performing additional spatial operations to generate additional spatial insights
- Delivering those insights to applications and processes that require them

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Open standards ease integration and broaden usability

Among the standards that have been developed are common advanced programming interfaces such as Web Feature Service (WFS), Web Map Service (WMS) and Catalog Service for the Web (CSW), as well as the Web Map Tile Service (WMTS) standard, published in 2010 and based on an earlier specification from the Open Source Geospatial Foundation.

The WMTS specification has furthered the ability of geospatial analysis systems to create maps at much higher speeds, and consuming much less computing horsepower, by assembling pre-rendered georeferenced tiles, the 256-by-256-pixel square units that comprise a web map.

These standards and advancements enable geospatial functionality to be integrated with business intelligence applications and data, and made that functionality accessible to a broader base of people: business users.

The human requirement: usability, flexibility and performance

GIS tools were traditionally designed for GIS analysts and programmers. But users of LI capabilities in most enterprises and government organizations are overwhelmingly business analysts.

Analysts and domain experts responsible for agile decision-making and solving business problems cannot be asked to become GIS experts, or to worry about enabling technologies and the complexities inherent in integrating their geospatial analysis tools with their BI systems.

"People love using familiar tools and processes," said Brendan Halloran, who successfully managed the integration of geospatial analysis into the BI infrastructure at Australia's federal Department of Families, Housing, Community Services and Indigenous Affairs (FaHCSIA). For the last five years he has been contracting and consulting to both the private and public sector on areas related to geospatial systems and business intelligence.

"Their managers tend to want to push technology solutions in a new direction. Intention to change is rapid, but actual change tends to be much slower."

A seamless extension of existing processes for users

The mainstream users of BI systems interpret *integration* and *interoperability* in their own language.

To them, the words mean ease and flexibility in generating maps and geospatial analyses, and the ability to treat location intelligence and geospatial analysis as a seamless extension of their existing BI technologies and standard processes.

MANY ORGANIZATIONS USE MORE THAN ONE BUSINESS INTELLIGENCE SOLUTION; GEOSPATIAL ANALYSIS TOOLS MUST "PLAY WELL WITH OTHERS" IN TODAY'S MULTIPLATFORM BI ENVIRONMENT.

Many organizations use more than one BI solution. Some use competing enterprise-scale software systems across and within departments. Others use niche BI tools that users adopt to solve emerging problems.

Geospatial analysis tools thus must "play well with others" in today's multiplatform BI environment.

The ideal BI + LI integration:

- Interoperates with BI solutions
- Supports BI processes, data management best practices
- Integrates superior LI functionality

Organizations follow multiple integration paths

Methods of integrating geospatial analysis with BI systems generally follow one of five paths:

- Forklift upgrades
- Custom integrations
- Discrete integrations
- Pure mapping and Open Source solutions
- Open, standards-based commercial, off-the-shelf (COTS) solutions

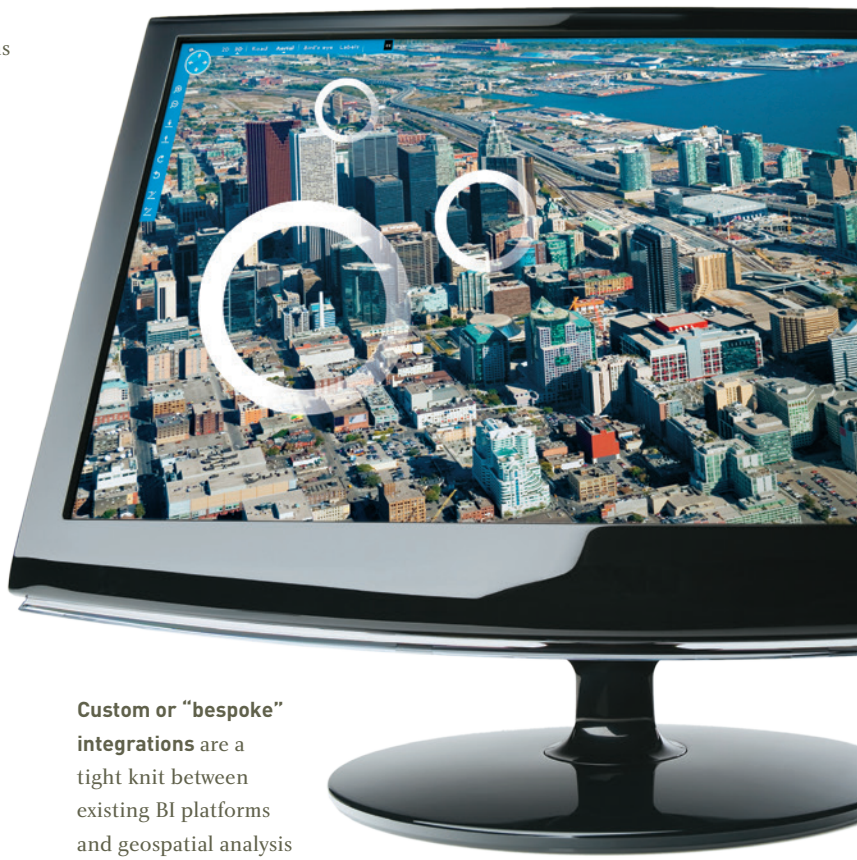
Depending on the interoperability of the solutions involved, organizations can also adopt a hybrid integration path.

Forklift upgrades (either as a radical replacement of an existing system or a "greenfield" system in a start-up setting) offer a tightly integrated environment, greater security and the promise of both high data processing and visualization performance and overall reliability.

Industries that are heavily GIS-dependent, like oil and gas exploration, or military "command and control" applications, demand such integration into their analytics platform.

However, there are pitfalls: expense, the impact on IT during implementation, and interoperability questions, especially concerned with ensuring that the system can support "niche" geo-analysis systems and data from third parties.

Newer, more modern BI platforms rarely replace all existing BIs within an organization. Those organizations, therefore, are still faced with having inconsistent spatial capabilities across their BI technologies.



Custom or "bespoke" integrations are a tight knit between existing BI platforms and geospatial analysis technologies. They provide a high level of interoperability with existing BI systems, data and processes, as well as superior performance, reliability and security. They also appeal to industries where high data volumes must be processed, maps must be rendered instantly, and data security is business critical.

They too have drawbacks: they're expensive, often time-consuming to implement (burdening the IT staff), slow to gain ROI and difficult to update and maintain. Interoperability across BI and geospatial analysis platforms may also be an issue.

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Tightly integrated solutions must support multi-platform BI

Discrete integration, in which business intelligence vendors incorporate mapping and visualization functions (and in which GIS vendors offer a solution especially designed for a BI platform) tightly integrate geospatial analysis capability with BI systems, data stores, workflow processes and reports. They typically are less time-consuming and less complex than custom integrations.

Such solutions, however, can understandably show a strong bias towards the vendors' core capabilities. A database system vendor, for example, may offer a spatial database to complement (and improve the security, control and data management capabilities of) an enterprise geographic information system.

GIS vendors offering BI-platform-specific solutions can spatially enable that BI platform, but at the expense of usability and flexibility for the business analysts for whom the solution should be intended.

Mapping solutions that have been nurtured via the Open Source movement offer a wide array of sophisticated mapping functionality, as well as interoperability.

Analysts who often use such consumer-oriented spatial technologies as Google Maps increasingly demand the ability to use Google Maps-like capabilities within their BI solution to add value to their data analyses.

However, not all of them include geocoding, geoprocessing (the ability to easily create workflows and services that enable emerging BI/geospatial analytics processes), or third-party data sets. Nor are all of them considered "commercial grade."

Purely cloud-based offerings can't support every use case. Issues such as data security and privacy can become particularly sticky. These solutions often move the organization's most sensitive proprietary data outside the firewall for mapping.

"Different geospatial data sets, like land-use categories, population demographics and traffic pattern analysis, provide tremendous value for business analysts who make strategic decisions," said Roderick Ross, manager of business and partner development for Integeo, a mapping technology company based in Sydney, Australia.

"Tying the right data together, from different sources, is essential to both business intelligence and location intelligence."

INTEGRATING STANDARDS-BASED, OPEN GEOSPATIAL SOLUTIONS INTO BI ENVIRONMENTS DRIVES INSIGHTS, AGILITY AND BETTER DECISION-MAKING

Open, COTS (commercial off-the-shelf) geospatial technologies, such as Pitney Bowes Spectrum Spatial, are designed to be standards-driven and compatible with both other standards-based analytics systems and leading BI platforms. These include Actuate/BIRT, IBM/Cognos, Microsoft/Excel and SQL Server, MicroStrategy, Oracle/Hyperion and OBIEE, QlikTech/QlikView and SAP/Business Objects.

Their open-standards focus enables an accelerated integration process and simplified updates and upgrades. This focus also supports agile BI environments comprised of multiple, open BI systems.

Solutions that are designed for business use, rather than for GIS experts, reduce training overhead.

These solutions offer broad utility across many industry segments and use-cases, including:

- Defense and intelligence
- Financial services
- Government agencies
- Health and human services
- Insurance
- Marketing
- Natural resources
- Power and utilities
- Public safety
- Real estate
- Retail
- Telecommunications

Standards-based solutions like Spectrum Spatial are easy to deploy, easy to access through a web browser, and easier for business analysts to use. They can often be implemented out-of-the-box. They're robust and easy to integrate, customize and update.

By seamlessly integrating advanced GIS capability—(i.e., address management, geocoding and reverse geocoding, spatial data analysis, and routing) into BI platforms, they offer multiple benefits. They:

- Extend the dimension of location to existing processes and workflows
- Enable rapid and intuitive visualization, modeling, and analysis of business data
- Integrate location intelligence across multiple applications and departments to help break down data silos
- Enable the management of these applications over a centralized platform

Most importantly, they put difference-making spatial information into the hands of decision-makers.

Spatially enabling business intelligence platforms through the integration of location intelligence tools has many advantages.

Companies will use differing strategies to achieve their strategic objectives, depending on their unique needs.

AN IDEAL SOLUTION PRESERVES TO ORGANIZATION INVESTMENTS, OFFERS RAPID TIME TO VALUE, IMPROVES BOTH PROCESSES DECISION-MAKING, ADDRESSES PERFORMANCE AND SECURITY REQUIREMENTS, AND SUPPORTS OPEN STANDARDS.

An ideal one preserves their investments in BI technology, business data and people; offers those organizations rapid time to value; improves both day-do-day processes and the quality and speed of decisions through geospatial data and analytical tools; addresses processing performance and data security requirements; and is "future proof" by its ability to support standards-based new tools, data sets and system upgrades.

[1] Halper, Fern, Seven Use Cases for Geospatial Analytics; The Data Warehouse Institute, (December 2013).

[2] Bitterer, Andreas, Location Intelligence is Expanding the Scope of BI; The Gartner Group (23 November 2012).

[3] Rossi, Ben, "Cloud Emerges as Enabler of BI Shift to Mass Market;" Information Age (30 January 2014).

[4] "Business Intelligence Market to Double in Four Years;" Information Age (9 January 2013).

[5] Rossi, op. cit.

[6] Evelson, Boris, Top 10 BI Predictions for 2013 and Beyond; Forrester Research (12 December 2012).

[7] Sheina, op. cit.

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