esri THE SCIENCE OF WHERE®

Location Analytics

The Key to More Powerful Analysis

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"Using Esri technology, we created store-specific customer trade areas and highlighted opportunities for better placement of our retail stores."

U.S. Cellular

What's Missing from Your Analysis?

Why isn't this plan working? Why aren't we making as much money as we did last year? What is on our road map that shows where we are now, where we go from here, and how we get there? Experts glibly pronounce that the answers can be found in the data. That's more easily said than done.

Managers want tools to make their data understandable. A sales manager wants to see weekly sales and what has caused a downturn. A campaign specialist wants to test different media options and choose the best one. A project manager wants to track the status of completion activities, stay on budget, and identify holdups.

Location analytics helps businesses understand these problems and find answers. It reveals patterns, trends, and relationships that could be overlooked if data is not viewed in a spatial dimension. While maps play a role in location analysis, location analytics goes beyond mapping. It adds qualitative, quantitative, and temporal context to spatial information. It uses spatial and nonspatial data types to provide answers to very specific questions.

ArcGIS Insights enables all departments within an organization to access powerful location analytics. It enhances current workflows with easy-to-use, spatially focused functions and a wealth of geospatial data. Built for the web, ArcGIS Insights allows companies to effortlessly embed geographic information system (GIS) technology into everyday decision-making. Web applications help staff who are not GIS experts perform spatial analysis. They make it possible for decision-makers to understand complex analysis, do their own queries, and explore ways to take action.

Location Analytics, Defined

Location analytics is the process of exposing the unseen through the analytical lens of where. It goes deeper than simple map visualizations to make sense of patterns, trends, and relationships found in spatial information. Although spatial in nature, it uses both location and business data together to answer questions, predict outcomes, and uncover insights often overlooked in tables and charts.

The Value of Location Analytics

Overwhelmed by data churned out by today's technologies, businesses often cannot see vital information that could result in success or failure. Location analytics consumes and models data to answer questions about what is happening and what will happen next. Most importantly, it offers insight for making the right decisions.

Businesses that explore data using location analytics have a huge edge over the rest. They can find potential markets before the competition does. They can avoid lackluster investments and solve problems before they impact the bottom line.

Add Context to Your Data

The location analytics workflow begins with data. Businesses usually collect raw data in a tabular format such as an Excel spreadsheet. But it is quite difficult to look at a table's 20 fields and 250,000 rows and understand what is going on. This is where location analytics comes into play.

Most business data is about a place. If that data has been linked to place, location analytics can build meaning around that position. It enhances place data with context, such as streets, distances, sun exposure, energy use, foot traffic—whatever features are valuable to you. Maps, charts, and graphs make the data understandable and allow you to compare features with those of other places. This capability is the foundation for location analysis. By adding different feature layers such as sales figures, competitor locations, or customer types, you see the business landscape in the context of your objectives. That overwhelming data now becomes highly valuable.

Get more value from the existing data in your business systems. Turn SharePoint lists and data into maps and drag Excel tabular data directly onto your business map to see sales by store. Enhance other digital systems, such as SAP HANA, to analyze big data.

Esri collaborates with IBM, Microsoft, FICO, and SAS to couple location analytics with their business analytics systems. This means that employees company-wide can use location analytics to understand business data.

Share Insights Across the Organization

Analysts, skilled in performing heavy analysis and using sophisticated location analytics tools, are valuable resources. Location analytics provides them with additional tools to build models and perform statistical analysis. Proximity tools identify the types of people or facilities within a certain number of miles. Correlation tools calculate the strength of cause-and-effect relationships and find like-minded customers and optimal locations. Regression tools test what-if scenarios by predicting their likelihood of success.

Analysts can combine analytic tools, such as R, to enhance statistical location analysis. The location analytics toolbox provides many more data modeling capabilities and visuals to help analysts make sense of data. They can save their workflows and reuse them for other projects.

Managers use online viewers to interact with analysts' reports and expand the scope of the analysis. They can mash up data layers from various sources, such as ArcGIS Living Atlas of the World, to see new relationships and trends. Moreover, managers can edit and save their maps, publish them as new web maps, and invite others to view them.

Employees can now dive deeper into analysis by using apps for self-service mapping. They don't need to understand technology to use it. They simply connect to the location analytics platform and access data and tools to map information.

The web-based system puts location analytics into the hands of employees across the enterprise so that they can use it in their regular workflows. A marketing campaign strategist sees where to target a coupon campaign. The properties manager locates the best place to open a new office. The distribution department uncovers why delivery costs are higher than expected.

By connecting to location information, employees throughout the company are empowered to make data-driven decisions that improve the bottom line.

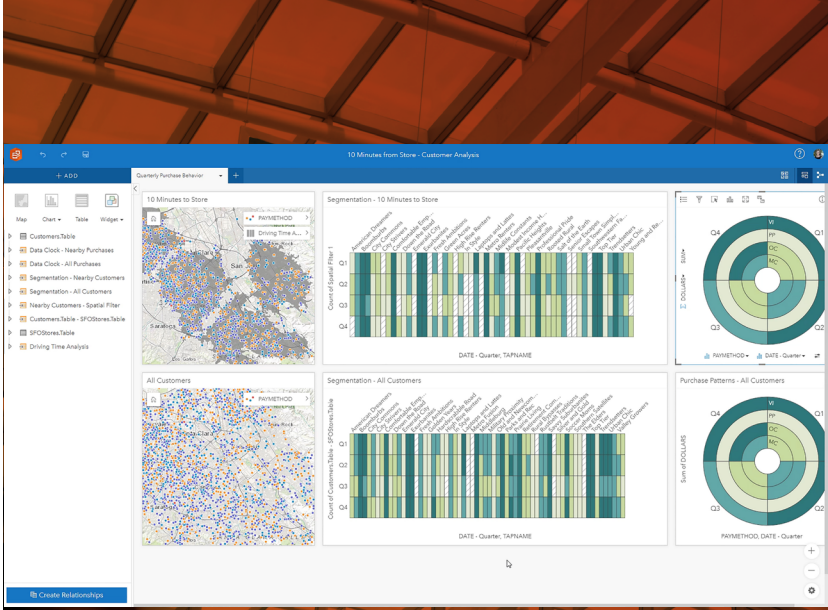
Establish and Evaluate Your KPIs

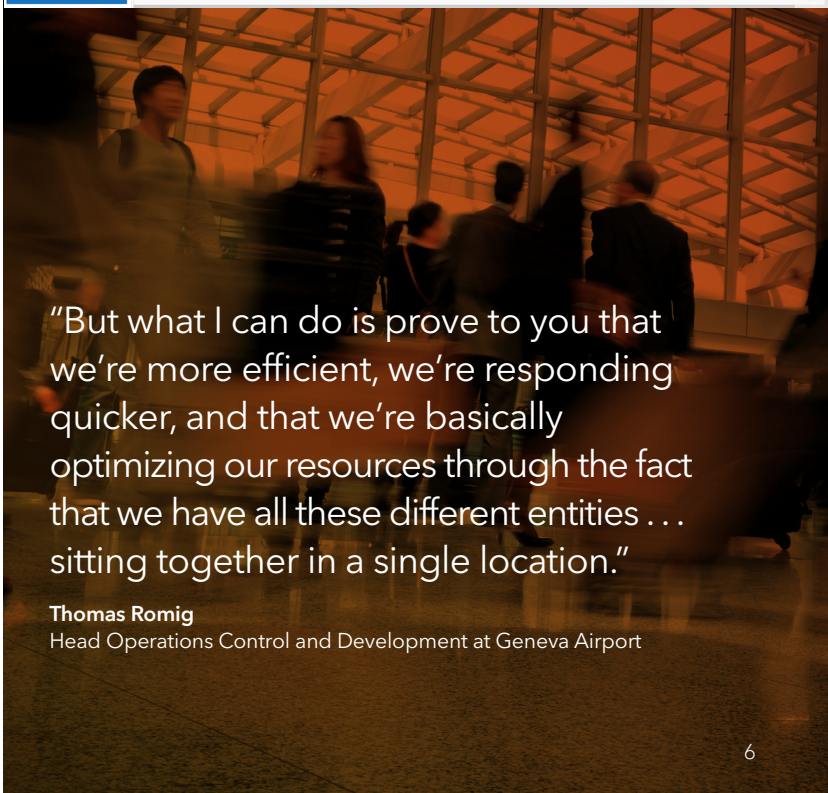
Businesses use key performance indicators (KPIs) to monitor profits, costs, and operational efficiency. A KPI is a performance measurement that shows how an organization is doing. For instance, the sales director uses KPIs to track where regional sales goals are being met.

Location analytics helps you establish the baseline for a KPI and set objectives for improving performance. Compare the status with a company's target goal and track progress over time. In today's business environment of constant change, enterprises must be able to establish and evaluate a portfolio of changing KPIs so that they can thrive.

Follow progress with familiar tools such as scatter, line, and timeline charts—whatever speaks to you. The location element is, of course, maps. A dashboard shows you the information you need, in as many formats as you want. Data that changes in one representation (e.g., frequency map) will be reflected across the board (e.g., bar and line charts).

Location analytics tends to put people on the same page, so they can work together to solve problems. By using intuitive charts that represent location and business data, managers clarify the situation and reduce misunderstandings. Teams collaborate by sharing interactive maps and charts that they can tinker with to get more details.





Enhance the Analytical Process

Uniting your analysis around spatial information allows you to trace problems back to their origins, examine all factors involved, and create predictive models that inform future decisions. Location analytics can be weaved throughout the following types of analysis to improve results at every stage:

Descriptive Analysis

provides a full picture of where and when something happened.

Diagnostic Analysis

explores cause-and-effect relationships to pinpoint why it happened.

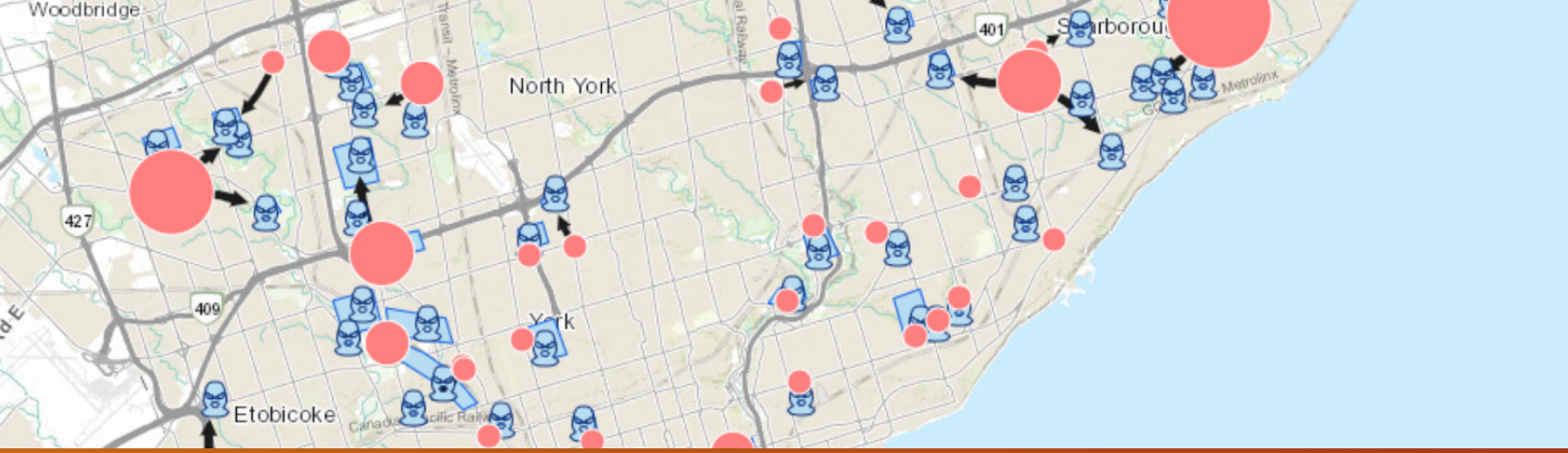
Predictive Analysis

builds predictions about what will happen in a particular location, and finds other locations likely to experience similar outcomes.

Prescriptive Analysis

guides you to a course of action and shows you what could happen if you followed it.

Organizations across industries are infusing every aspect of their analysis with spatial insights.



Social Services Centre Locations to (Potential) Gang Areas

See the Problem

Descriptive Analysis
Location analytics uses intelligent maps to describe what has happened and what is happening now while showing you patterns and trends. You can use interactive map tools to explore ideas about very specific topics. Every data layer you add to the map gives you a different perspective of the business environment.

A location analytics map grows understanding. For instance, a map shows the locations of all a company's stores. Add a data layer about nearby residents' income levels, and the map gets more interesting. Add more data layers to show where people who redeemed your coupons live and where stores had a sales spike. This is turning into useful information.

The possibilities for visualizing trends and relationships are endless. One retailer used video and facial recognition software to show on a map how many people stopped to look at a window display, how many of those went into the store, and how long they stayed.

If you can find data that has location, you can see it on a map. See daily/weekly revenues of your stores in the context of their locations. Map the rates of seasonal returns, customer retention, hourly foot traffic, and whatever else you need to know that could affect sales.

Location analytics compares past data with a company's target goal and tracks that progress over time. In this way, managers keep their finger on the pulse of a single project or a worldwide enterprise.

- Summarize sales
- Track social media
- Chart seasonal trends
- Map supply chains
- Monitor sensors
- Locate assets
- Track inventory
- Report revenues

Business Case

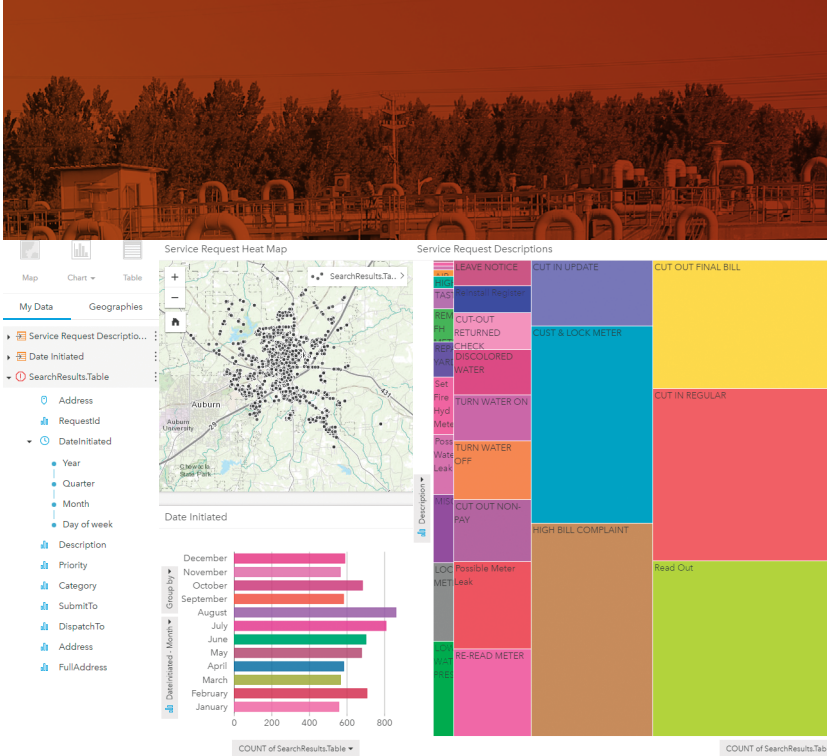
Opelika Utilities serves 20,000 customers in Alabama. The company suspected that broken water meters had been underreporting its customers' water use. To confirm its suspicions, the company performed descriptive analysis using location analytics and found revenue leaks in its water billing system.

Opelika Utilities' database provided a rich resource for analysis. Analysts ran hundreds of thousands of records about service connections, meter usage, work order history, and more, through a location analytics model. Maps made it simple to visualize the results, which were eye-opening.

Out of 14,000 meters, more than 3,000 were dead. This translated into about a $25,000 revenue loss per month—a much higher loss than Opelika Utilities initially expected. Location analytics detected customer billing anomalies that were well below normal and mapped them. Filtering the data on these meters by manufacturer, analytics revealed who had supplied the faulty products. Filtering the data again, analytics showed which of these meters were under warranty.

The Bottom Line

Seeing where operations underperform helps decision-makers see hidden revenue loss.



Using ArcGIS Insights, Opelika Utilities identified dead water meters. Replacements correctly recorded water usage and increased annual revenues by $300,000.

Understand Why the Problem Happened

Diagnostic Analysis

Once you uncover problems, you then want to know what caused them. It's like telling your doctor that your chest hurts–your doctor runs a battery of tests to diagnose the problem before treating you. In a business context, you see sales dropping in a region and you use diagnostic analysis to determine what happened.

Diagnostic analysis seeks causes. Location analytics tools are very good for exploring cause-and-effect relationships and revealing what factors drive positive and negative performance. Correlation, filtering, time series, and other types of tools reveal which factors are creating problems.

Data is key to running diagnostics. If there is a lot of data, location analytics runs automated algorithms that comb data and recognize patterns, detect trends, and highlight anomalies. Some geospatial data systems do this at a high level, but do not provide the insights needed to truly understand ground-level situations. Location analytics takes your analysis to the granular level. It drills into data to get the specificity you need.

Be forewarned, if the company's data is siloed, then diagnostic analysis is very difficult. A solution is to manage key data using a location analytics cloud service or enterprise system that others can access.

Business Case

Diagnostic analysis shows how and why something happened. Location analytics drills into data to add clarity to the diagnosis and imply a resolution.

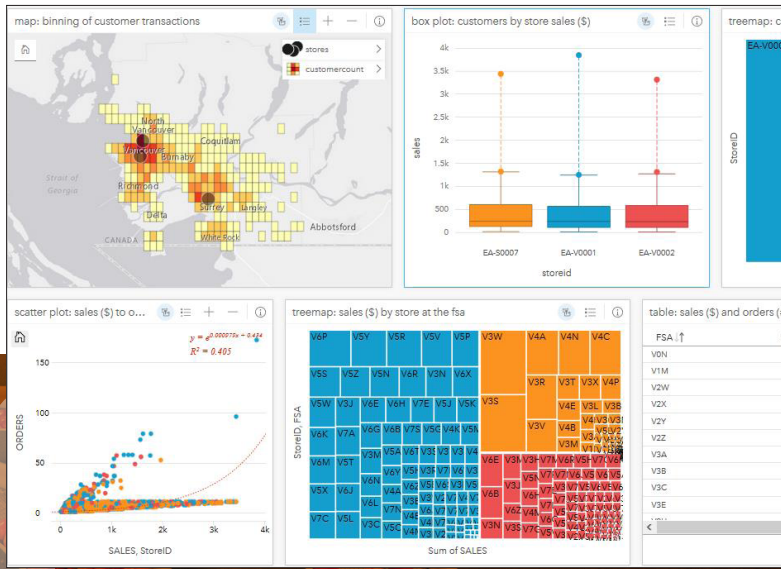
Through descriptive analysis, a company's fleet department noticed that gas consumption was higher than usual. Through diagnostic analysis, the manager discovered data anomalies that pointed to unauthorized fuel purchases on gas credit cards. The analysis also showed the point-of-purchase filling stations located well outside the company's service areas. Fleet managers traced credit card fraud to three field technicians.

A grocer's descriptive analysis revealed a rise in produce-related complaints at the point of delivery and told the supplier. The supplier diagnosed the supply chain by tracing it back from grocer delivery to truck routes and schedules to overnight warehouse storage to boxing operations. The weakest link was the warehouse. Further investigation found that the warehouse had a faulty refrigeration unit.

A descriptive analysis showed that plumbing supply sales had fallen in Fresno. The diagnostic analysis compared the current and previous years' data, calculated the most likely causes, and ranked outcomes by probability. The highest cause was a decrease in housing starts; the second highest was increased supplier competition; and the third highest was consumer awareness. Management decided to focus resources on developing a competitive strategy.

The Bottom Line

- Locate fraud and reduce loss by spotting and responding to anomalies.
- Resolve problems by tracing them back to their origins.
- Use resources wisely by prioritizing actions.
- Avoid future problems by understanding pitfalls and rethinking strategies.



Track assets and work orders in real time.

Anticipate What Could Happen

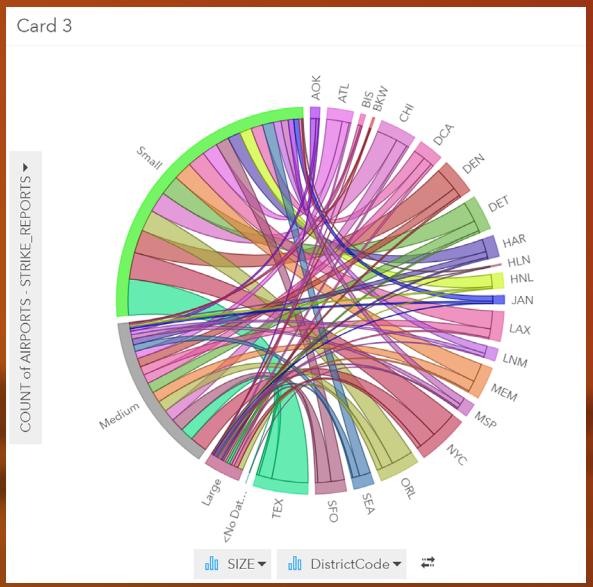
Predictive Analysis

No one knows what will happen in the future. Prediction is simply guesswork that comes in many forms, from reading tea leaves to looking to the stars. Whether decision-makers realize it or not, they all engage in some form of forecasting. Some use the HiPPO–Highest Paid Person's Opinion–method, but this instinct-driven process is fraught with partiality and misunderstanding. Others rely on informed guesswork based on experience and credentials, but the prediction is subject to human bias. Is the expert an optimist or a pessimist, a risk-taker or a skeptic, a novice or an old-timer? Personality variables taint the outcome.

Predictive analysis decreases bias because the work is mostly done by computers. Using machine learning and statistical modeling technology, predictive analysis mines data and builds predictions. By combining predictive analysis with location analytics, the user sees predictions come to life on a map.

Location analytics uses statistics to calculate spatial regression. It determines if the factors that contributed to an event in one location can cause the same thing to happen in other locations. This important function helps businesses find like-minded customers and potential sales locations.

Spatial regression also calculates risk levels and ranks vulnerabilities. Insurance companies use location analytics to determine the risk associated with disaster claims from floods and wildfires. Manufacturers' supply chains are vulnerable to floods, strikes, terrorism, fires, and civil unrest that could disrupt the procurement of parts. Knowing the likelihood of interruptions in an area helps managers know how and where to focus response plans for fast recovery.



Count of Airports

Business Case

East Hants, Nova Scotia, Canada, sought to develop a five-year economic growth strategy. The city's Economic & Business Development team set a goal to grow commercial assessment by $36 million by 2030 and support at least 150 local businesses. The team's analyst used location analytics to see the business types that would most likely benefit from investing in the community. The analysis included regression, variable prediction, density calculation, and data aggregation. Although he was not a GIS expert, the analyst successfully used GIS tools to perform these operations.

Using location analytics, the analyst created a report that explained local industry clustering and business-to-business supply chain spending. To focus on trends and outliers, he created chart and graph pages that represented industry mix and location. Team members used the information to develop selling propositions that included the estimated growth of the city. Finally, they approached potential entrepreneurs and shared relevant analyses to persuade them to invest in East Hants.

The Bottom Line

Predict whether a new market is worth your time and, if it is, identify local buyers before you open for business. Help clients understand the potential of their locations. Using science-based analysis, persuade investors to make decisions that benefit their business and yours.

Decide on a Course of Action

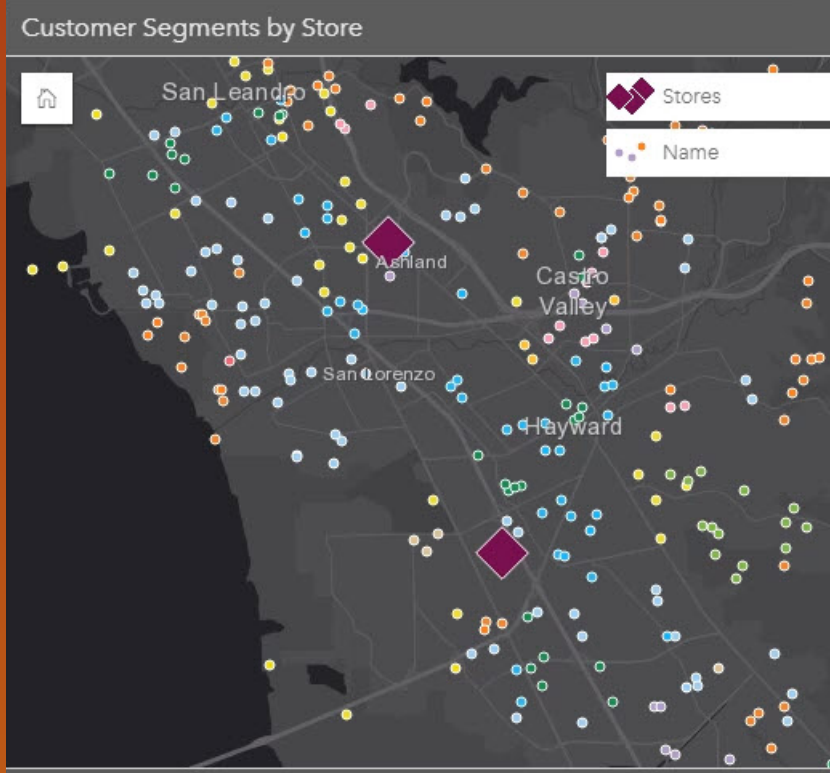
Prescriptive Analysis
Prescriptive analysis creates the road map for building strategies that meet your goals. As the culmination of descriptive, diagnostic, and predictive analyses, prescriptive analysis answers the question, So now what?

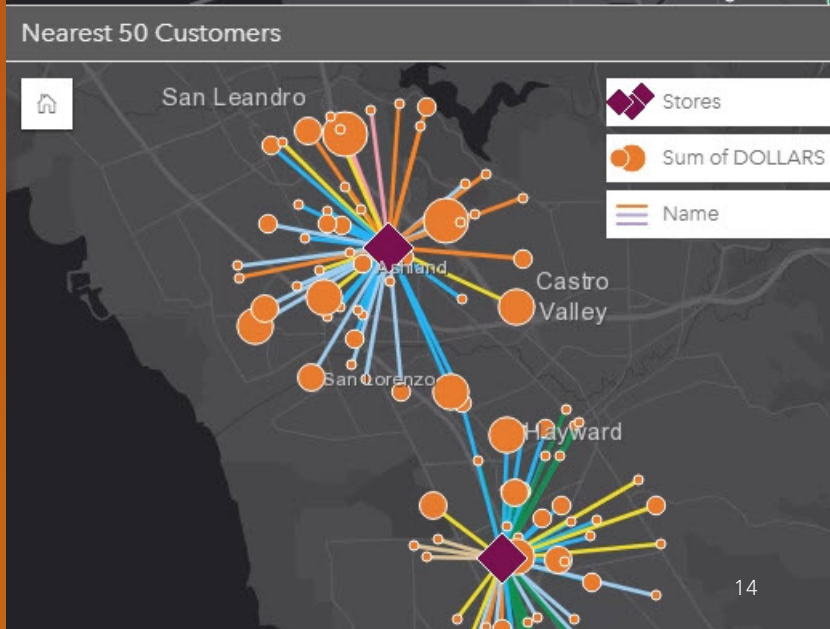
When building a prescriptive model, the analyst takes every factor into account–supply chain, labor costs, scheduling of workers, energy costs, potential machine failure, and so forth. Running statistical computations in minutes, location analytics calculates correlations, ranks risks, and projects the outcomes.

This analysis gives decision-makers details, so they can rule out any weak options. Analysts can tweak certain variables to achieve the best possible outcome–the optimal result of your decision.

Location analytics performs prescriptive analysis to create a comprehensive understanding of the business environment and rank the value of proposed actions so that you can make the best decision possible.

Find other locations like the one that's been so successful.





Business Case

A tech company wanted to find suitable office space in San Francisco. The CEO told the real estate agent that the new office must be near public transportation because parking is expensive and traffic creates delays. The tech company's admin had already created a spreadsheet of top picks to consider.

To find the ideal location, the realty agent opened a project in ArcGIS Insights, dragged the admin's spreadsheet into the project, and immediately saw each proposed office's location on a map. The most important criteria to consider were the available office space and the distance to transit stations. She identified stations within a few blocks' walking distance to vacant office spaces.

The tech company also hoped that an area's talent pool would include potential employees. Searching Esri business data for information technology specialists living within 10 miles of each potential office, she found areas that met this criterion.

The agent asked herself, "Are their eateries in the area where employees could go for lunch?" A reasonable trade area around a location is two miles, so she drew two-mile buffers around each potential site. Again, she searched Esri business data to find food services, coffee shops, and bars, then added the layers to her map to see nearby restaurants. She also added office feature data layers—such as square footage, prices, views, and other information provided by sellers—that she was certain the client would want to see.

Each criterion (variable) had an associated pie chart that rated its importance. The agent set the weight of each variable to match the tech company's goals. Because closeness to light rail stations was more important than restaurants, she gave it the greatest weight.

Finally, the agent ran the Apply tool in Insights to see how each site measured up to the tech company's needs. She posted the report to the cloud and invited the CEO to access it. The map showed him each area's rank. The report included tools for viewing the results and interacting with the data. He could filter data by cost, square footage, and other factors and see results on the map.

The Bottom Line

The real estate agent gives clients an optimum-site-analysis report that includes tools for viewing and interacting with the results. Investors can quickly understand the pluses and minuses of proposed locations. They can also consider the trade-offs between one site and another.

Share Your Results

Shared findings allow teams to understand potential risks and rewards of various proposals and come together to develop plans that meet the organization's goals. Esri's location analytics tools allow analysts to securely share the results of their research with one person, a team, or a department. People use app tools to play with the data without affecting the original report. In addition, the information used in parts of the analysis can be shared with other people, who can add it to their own analysis. Location analytics documents steps such as data filtering and aggregation, which analysts can use to create a model that can be reused, edited, and shared. Model components can also be used to automate common analytic tasks in web apps. For instance, a sales manager can use a report to run weekly sales growth analyses.

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