

What is Geographic Information System (GIS) Technology? Applications For Risk Planning and Management

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Recent extreme weather events, such as record-high temperatures, wildfires and flooding, pose new challenges to firms operating in parts of the world that previously may not have had to account for weather-related threats, underscoring the need for effective modeling and mapping. Beyond weather concerns, companies across the globe are finding it ever more important to understand their geographic surroundings to better assess other physical safety risks, evaluate supply chain resiliency, and, more broadly, maintain situational awareness of all their operations. As the threats facing businesses become increasingly complex, it is important for firms to develop a thorough understanding of how tools such as geographic information system (GIS) technology can help identify, forecast and mitigate the risks that they may face in the future. To better understand GIS and its potential applications to risk planning and management, **RANE** spoke with **Jim Wooten, President and CEO of Geomark Consulting, LLC.**

What is GIS and what makes it so effective?

According to **Wooten**, a geographic information system (GIS) is "an information system with a spatial component that is used to measure or analyze some geographic feature that is of interest to someone." Because GIS often includes large volumes of complex data on such topics as varied as water levels during a flood, market share for business, infrastructure for urban planning, and national defense, GIS practitioners often employ advanced statistical methods such as multiple regression, geographically weighted regression and other statistical tests to develop coherent, visually engaging graphics that can capture elaborate trends and help planners visualize distant regions of the world. **Wooten** observes that "one of the real powers of the technology is the ability to create layers of features that are of interest to the project, items such as street networks, land parcel data and land features." According to **Wooten**, the ability of GIS to layer related data sets to one another enables an analyst to uncover previously unknown relationships between geography, the location of a physical asset such as a building and the location of other supporting infrastructure.

To provide a practical example of how GIS can be applied, **Wooten** describes a hypothetical scenario where a hospital network wants to develop a graphical depiction of the surrounding community. Using GIS, **Wooten** says that the hospital network can map out the location of its hospitals, add the location of physical assets, introduce the location of individual doctors' offices and then incorporate street data to develop an accurate representation of the hospital network's scope relative to the surrounding area. Thus, he concludes that the "real power" of GIS is its ability to layer data to enable planners, risk managers and other practitioners to visualize relationships between competing variables and thereby make informed business decisions.

What is the process of developing an effective GIS framework?

According to **Wooten**, an effective GIS framework for security professionals within a business should take into account four things: the risk category and the specific issue(s) that the business seeks to understand; the assets and operational footprint of the business; the availability of actionable data; and should work towards building a streamlined digital platform to visualize the variables under consideration. First, **Wooten** observes that at the beginning of the GIS development process, "the first real challenge is to determine the risk category that the business wants to model." This can include weather events such as hurricanes and flooding, earthquakes, conflict between armed groups or a biological event such as a global pandemic. The second consideration that **Wooten** identifies is the particulars of a business' capabilities and size, beginning with the assets that a business has. If the firm in question is a multinational with significant financial reserves and personnel, corporate risk planners will be able to develop a more effective GIS framework than a smaller firm that does not have the same capabilities. Furthermore, according to **Wooten**, location is another key consideration businesses should consider when developing their GIS framework. For example, if a firm is evaluating opportunities to establish a new headquarters or regional hub in a region prone to violence, GIS can help corporate security professionals anticipate and monitor potential flare-ups and relocate assets and personnel in the event of a direct threat to company interests. GIS can also be used to model various threats to a company's suppliers and other third-party partners to evaluate secondary risks to business operations.

Third, with respect to data collection, beyond the available data sets that countries make available to the public for download, **Wooten** acknowledges the importance of social media and open-source intelligence. He contends that posts to social media sites such as TikTok and X (formerly Twitter), along with the geotagging information from pictures taken with smartphones and satellite imagery, provide valuable near-real-time information that can enable a GIS platform to make actionable forecasts on everything from future movements by soldiers, the path that a storm system may follow, or future population growth. Finally, once a business has gathered a sufficient amount of data, **Wooten** notes that based on whether a firm wants a static image of a situation or wants to monitor a trend over an extended period of time, the next phase in developing an effective GIS framework for a business is to develop a "spatial dashboard" for data visualization. While these may look very different depending on the firm in question and its particular objectives, he defines this as an interactive model that enables a firm to layer data and draw out actionable insights.

How can a firm leverage a GIS framework to identify corporate risks?

There are a variety of practical ways in which companies can use GIS. For instance, within the context of geopolitical risk, **Wooten** comments that a firm can visualize the ramifications of political instability and conflicts over natural resources, not only in its primary country of operations but also those nearby, by deploying a GIS-supported geopolitical dashboard. This can enable corporate security professionals to "develop a map, include those other countries, visualize those disruptions and model their potential impact on the supply chain." In this example, effective mapping and monitoring can assist a firm in making decisions about where to allocate financial resources, identifying risks to regional offices and

mitigating physical safety threats to company personnel.

Additionally, GIS can help firms identify and mitigate the risks associated with extreme weather events, such as record-high temperatures and flooding. **Wooten** points to the modeling of the damage caused by Superstorm Sandy in the State of New Jersey in October 2012 to argue that by layering data such as tax data for land parcels, the potential height of storm surge waters and property values within a GIS-supported predictive model, firms can accurately estimate any potential property losses in financial terms. Equipped with such knowledge, firms can identify where their physical assets face the greatest potential risk from natural disasters and then make decisions accordingly. The ability to monitor multiple events simultaneously (often referred to as compound events) such as earthquakes, hurricanes, and wildfires in near-real-time is also another strength of GIS.

Finally, as **Wooten** notes, effective communication is crucial to the successful deployment of any GIS approach to risk management. When using GIS to evaluate potential risks, it is important that corporate risk planners employ on-the-ground monitoring, consult multiple sources for data inputs and effectively communicate any important findings with the board of directors. To this end, he stresses that "the board needs to be involved. The board has to be educated and understand the level of risk". Without effective communication between corporate risk professionals and the board, **Wooten** stresses that efforts to use GIS to map out potential threats to company finances, infrastructure and personnel may be less effective as the key decision-makers will not have the necessary information.

What are some of the challenges associated with using GIS to manage risk?

Time-zone considerations, government restrictions and diverging standards for what constitutes quality data all pose challenges to a GIS-led risk management approach. First, in the event that a firm is interested in tracking developments in distant locations, it may not be possible to obtain real-time information to feed into its GIS models. For example, **Wooten** states that if a firm wants to track earthquake data in the Far East or ship movements in the South China Sea because the firm has supply chain interests in the region, GIS models can be limited by lags in data collection. Indeed, even though **Wooten** acknowledges that near real-time data for events taking place in different time zones can be effective for numerous risk management scenarios, time lags are not ideal when mapping out dynamic, fast-moving situations that require on-the-ground coverage, such as a street protest.

Second, **Wooten** says that government restrictions, both more broadly on data sharing and more specifically regarding certain types of more personal, sensitive street-level data, could complicate efforts by firms to map localized scenarios and events, such as flooding. For example, if a firm wants to build a regional hub in a country known for intense data scrutiny, China being a relevant example, restricted access to data for foreigners may force the firm to reconsider its plans because the firm will not be able to anticipate how weather or topographic events may affect future construction.

Finally, **Wooten** emphasizes that data quality can vary significantly and thus says that "you have to think about where you source your data." To the extent possible, he encourages firms to obtain their data from reliable sources but acknowledges that this is not always possible, especially in certain countries with more opaque government processes and few independent data providers. Recognizing the

challenges that firms face when confronted with unreliable data, **Wooten** notes that firms can verify the accuracy of the data being fed into their models by cross-referencing the data with open-source web searches. While this is an imperfect solution, it can often go at least some way to minimizing data quality concerns and/or at least highlighting which specific pieces of data may be most problematic.

About the Expert: Jim Wooten is the President and CEO of Geomark Consulting, LLC, based in New Jersey. Using Geographic Information System (GIS) tools and technologies, the firm develops actionable intelligence to enable key decision-makers to model and assess risk as well as for strategic planning purposes. Geomark Consulting also performs geospatial analysis to visualize and assess emerging local, national and international man-made and natural disruptions to operations. Jim has been assisting multiple industries to make strategic decisions for over 10 years and is a member of the United States Geospatial Intelligence Foundation as well as ASIS International.