UN EXPERT COMMITTEE REGARDS CONNECTIVITY AS KEY TO GROWTH

Future Trends in Geospatial Information Management

The most significant changes in the geospatial industry in the next decade will come not through a single technology, but rather from linking multiple technologies together. Especially the development of big data analytics will boost smart use of the location component to integrate data from many sources. The United Nations Committee of Experts on Global Geospatial Information Management (UN-GGIM) sees precise location information forming a core part of tomorrow's all-connecting IT infrastructure. Read on for its insights into the trends over the next five to ten years.

(By Frédérique Coumans, contributing editor, GIM International)

In December 2015 the United Nations published a second report in which 30 international public-sector experts on geoinformation outline the trends for the next 5 to 10 years, alongside input from 10 private companies and various universities and international organisations. "The paradigm of geospatial information is changing; no longer is it used just for mapping and visualisation, but for integrating with other data sources, data analytics, modelling. We need to link data together with the one thing they have in common: geospatial data." That is absolutely not a new message: Jack Dangermond first started advocating it more than 20 years ago. But, in the world of tomorrow, lots of things will act as a sensor, be connected and produce data. That creates a huge need for big data analytics, which opens up growth possibilities for this sector based on the concept of 'geo inside'.

Artificial Intelligence Leads the Way

The sheer volume of data produced today is already too huge to be processed manually and that situation will increasingly intensify as the Internet of Things continues to make progress. Success in addressing this problem will rely on the development of big data techniques including artificial intelligence or machine learning technologies that will enable the data to be processed more efficiently: computer algorithms seek structure within large quantities of seemingly unstructured data.

The application of the Internet of Things was originally designed to support the smart city concept, using IT to manage complex urban surroundings. A key factor in how this concept develops will be how geospatial information is integrated into the architecture and standards; this drives the demand for geospatial identifiers in the data.

The importance of location also becomes apparent as every sensor item connected to the internet has a location, and this location is often a vital piece of information that sets the context for the information transmitted. Artificial intelligence needs to represent objects, properties, categories and relations between objects, and all these things can be represented in geospatial databases. Machines/robots equipped with artificial intelligence will be able to 'understand' geospatial information themselves and even 'survey' their surroundings to obtain the geospatial information they need to do their jobs, processing it in real time. Learning geospatial concepts will improve the interpretation of aerial and satellite imagery because it will be possible to identify geospatial features with more precision.

Time is of the Essence

Software for processing 3D information will incorporate time information to create 4D products and services. The use of 4D information is a growth area in a wide variety of industries including transport (driverless car technologies), building construction (integration into BIM) and environmental monitoring. The temporal element is also crucial to applications such as disaster management, emergency service response, simulations and analytics, and the tracking of moving objects.

Another area of growth is likely to be predictive analysis, with a focus on real-time socialâ€'dynamic information. Such tools may run persistently on continuous streams of data; users will want to receive the right information at the right time. In light of the large volumes of data available, and also because of the time element, the geospatial computation required will therefore be increasingly automated in terms of both the generation and the direct provision of accurate results to the end user. Efforts should be devoted to integrating involuntary sensors – smartphones, RFID sensors and so on – which, aside from their primary purpose, may produce information regarding not only the location but also the time at which that information was collected. This includes the use of social media for providing

realâ€‘time information.

Unmanned aerial vehicles (UAVs) can provide real-time remote-sensed information to decision-makers and are an invaluable tool when additional information is needed to improve vital decision-making capabilities. More and more regulations covering the use of UAVs will be developed over the next five to ten years, including tighter privacy and security laws. How governments decide to regulate the use of UAVs will have significant implications for their adoption and their value. However, technological advancement continues to outpace the changes in the legal and policy frameworks. As a result, new products and services that collect and use geospatial information will face increasing resistance due to outdated or inconsistent legislation and policies.

Progress Needed in Legal Framework

With the increased ability to integrate data from different sources comes a growing possibility of determining a person's location based on the information they provide to different systems. Cybersecurity threats are not just related to personal information, but also to governmental and business information. Powerful encryption technologies and other security protection measures, in terms of both software and hardware, will gain in importance.

Data acquired in one country is increasingly likely to be processed in a second country by an organisation domiciled in a third country. Meanwhile the data itself is stored in 'the cloud'. The lack of a multinational legal or policy framework to deal with these issues will need to be addressed. Furthermore, there is still a major possibility that significant disparities will emerge over the next five years between countries whose governments have developed legal and policy frameworks in line with technological changes to enable the growth of location-based or spatially enabled societies, and those countries where such frameworks have not been developed.

Legitimacy as Important as Legality

Governments remain in a unique position to provide a reliable, trusted and maintained geospatial information base. However, convincing governments of the value of geospatial information and the benefits it offers remains a challenge. The authority and accuracy of the data but also the defined quality, the longâ€‘term availability and the consistent maintenance, irrespective of commercial interests, must be underlined. The key challenge will be to secure sufficient funding.

Global brands and organisations have made digital mapping accessible to the masses. If this trend towards location data being provided by private-sector companies continues, there is a risk that the only unique attribute provided by public-sector organisations will be the certification of data as authoritative. Given different working methods and resourcing strategies, even this role could come under threat from the private sector. Cost and efficiency requirements will result in many government departments outsourcing many processes to the private sector. The increasing amount of data created offers huge potential for the private sector to add value to existing geospatial information databases through interpretation and analysis, and this is very likely to lead to more publicâ€‘private partnerships.

The issues of quality and accuracy may create a dividing line between crowdsourced and government/commercial data, but this gap will reduce in the next five to ten years as partnerships between all types of organisations increase. In countries where other sources of data are less readily available, public participation may be driven by necessity rather than choice.

Staff More Costly

The importance of geoinformation experts will not diminish as data outputs will still need to be interpreted for policymakers and decisionâ€‘makers, and these experts are becoming ever-more comfortable with interpreting unstructured data. The adoption of dataâ€‘driven rather than cartographically driven geospatial content will see a fundamental shift in the skills base and costs. National mapping and cadastre agencies are already finding that their data management staff are more costly to employ than the employees in their cartographic and data collection units. The techniques and processes developed through big data analysis and artificial intelligence will need data experts who understand the complexities of linking geospatial and nonâ€‘geospatial data together. This expertise will be spread across different sectors, such as computer science, mathematics and the games industry.

Interoperability Remains Crucial

For the full potential of multiple-sourced data to be realised, data needs to be interoperable and standardised. Deploying smart devices and appliances will increase the need for technological standards and information exchange protocols to achieve full interoperability of all systems. Furthermore, as location provides a vital link between the sensors – which will facilitate the Internet of Things – and the uniform resource identifiers which are assigned to all objects within that connected world, standardised metadata as part of geospatial data is a must.

Another challenging issue is the development of standards for indoor location detection/computation technologies. The lack of such standards may continue to hold back the development of seamless indoor/outdoor location applications with miniaturised RFID devices/tags. The aim is to achieve seamless access to appropriate location information regardless of protocols, networks, frequency bands and physical environments, as the user moves between outdoor and indoor locations. Digital maps of all large public buildings are a prerequisite for indoor navigation, so 3D coverage should be included in procurement budgets – although some people predict that in the Internet of Things the interactive end devices will automatically map the indoor environments.

It will also be important to link geospatial information with statistical data to produce spatial statistics. One approach that may develop further over the next five years is the development of a table joining service (TJS) standard. This standard offers a web-based interface that enables the automatic, service-oriented joining of tabular and geographic data via the internet while keeping the shared data at the data provider's source location. The diversity of the semantic terminology presents a challenge, however.

As well as the focus on linking geospatial and statistical information, there has been rising interest in the interoperability and integration of marine and terrestrial information, which is of the upmost importance to coastal and island states. The development of hydrographic data models, such as the IHO's Universal Hydrographic Data Model, will be a strong enabler of enhanced data sharing across a diverse range

of applications.

Through a global effort over the next five to ten years, the UN-GGIM considers it feasible to develop a seamless, durable, unified geodetic infrastructure on land, in the air and at sea, based on uniform global referencing.