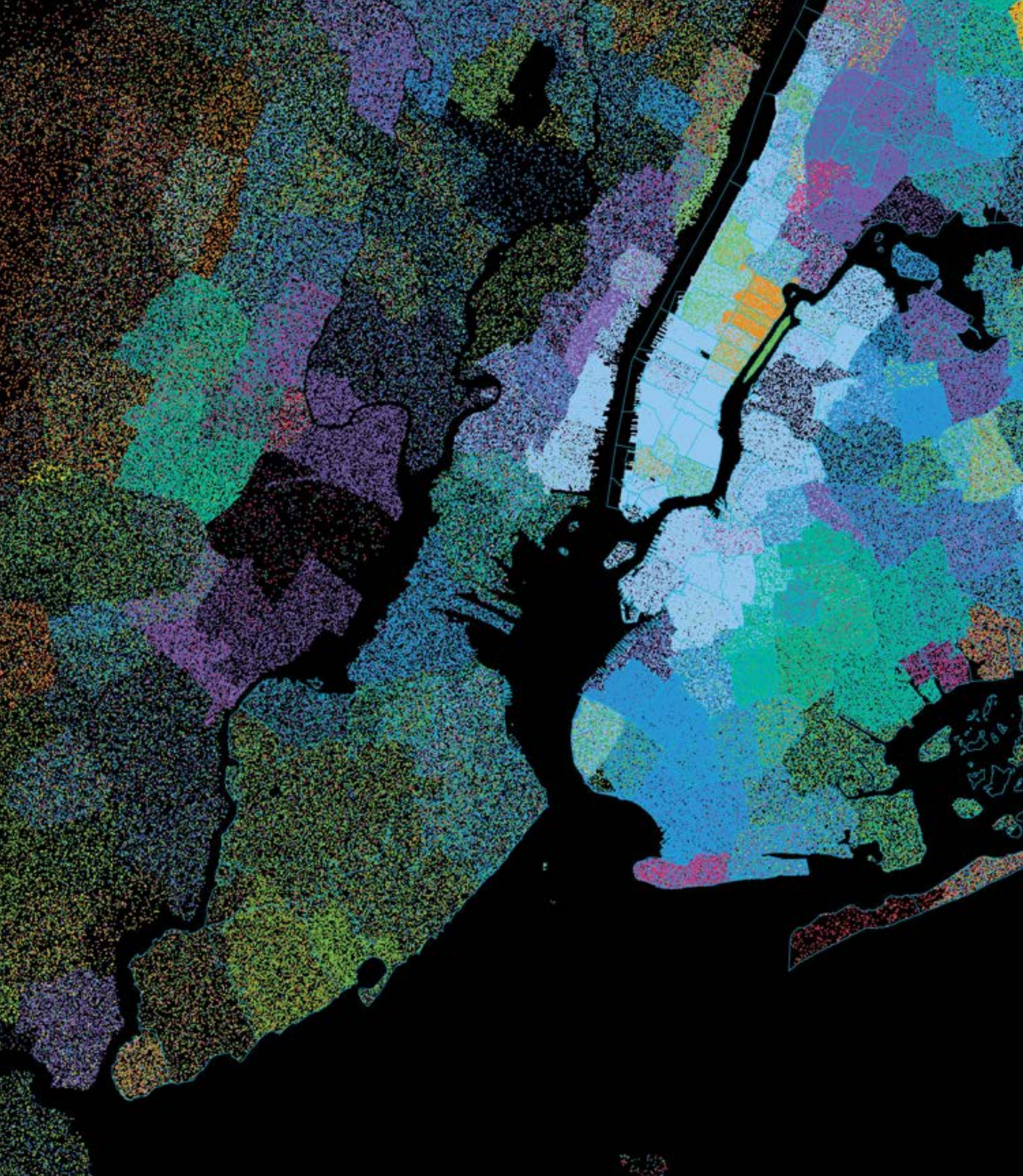the science of

where

MAKING SENSE OF DIGITAL TRANSFORMATION

How location technology
drives business growth

"One of the pervasive risks that we face in the Information Age... is that even if the amount of knowledge in the world is increasing, the gap between what we know and what we think we know may be widening."

– Nate Silver,
statistician and author of
best-selling *The Signal and the Noise*

HOW Location technology is helping transform businesses and industries

Big data, the Internet of Things (IoT), advanced analytics – they are terms that define our time, yes, but the reason we should be concerned about them is because we can apply them to solve real problems. Fundamentally, they're about using technology to build a new ecosystem of capabilities for businesses and organisations.

What's most important about the term digital transformation is that it signals a new era. More and more physical, "analog" objects, for example, are now complemented by a "digital twin" – a virtual mirror image comprised of data about the object's behavior, performance, environment, and location, both in real-time and across its lifecycle.

These "living data sets" hold the potential to improve everything about your business, from product design and maintenance, to the productivity and well-being of customers and end-users.

To thrive in a world of big data and exploit the potential of digital trends like these, organisations are rushing to increase their "digital quotients." Every company, agency or individual seeking sustained viability and long-term advantage must define a meaningful digital strategy.

But data can only be transformative if you have a clear understanding of which data are relevant to specific problems, goals or opportunities. Without an intelligent and practical strategy, organisations can succumb to "data toxicity," suffocating under the sheer volume and velocity of information they collect.

In this report we look at digital transformation from a practical perspective, and discuss how companies can ground themselves for effective transformation in our rapidly-evolving digital world.

Understanding the full potential of data

Digital transformation is about evolution of business through data science. Estimates are that by the year 2020, up to 50 billion devices will be connected to the internet. Imagine this massive river of data, as information is collected and stored every second, twenty-four hours a day, 365 days a year. The scale is nearly incomprehensible.

But research shows that less than 1% of available data is actually being used, and most of that for the detection and control of unusual events – a home security system going off, or a pump on an oil rig sounding an alarm. The unrealised potential for predictive maintenance and asset – and operational optimisation is only beginning to be grasped. The same study suggests that the "Internet of Things," driven by accelerating sensor proliferation in more and more kinds of manufactured objects, may have an economic potential of more than $11 trillion per year by 2025.[1]

So the need to make sense of tidal waves of data will only continue to grow. Businesses that can distill real, actionable intelligence from big data, and use it to make better decisions in real-time, will realise more of their potential than those who can't. If you intend to thrive, the time to get a handle on your data is now. ▶

McKinsey Global Institute, June 2015.
1 The Internet of Things: Mapping the value beyond the hype.
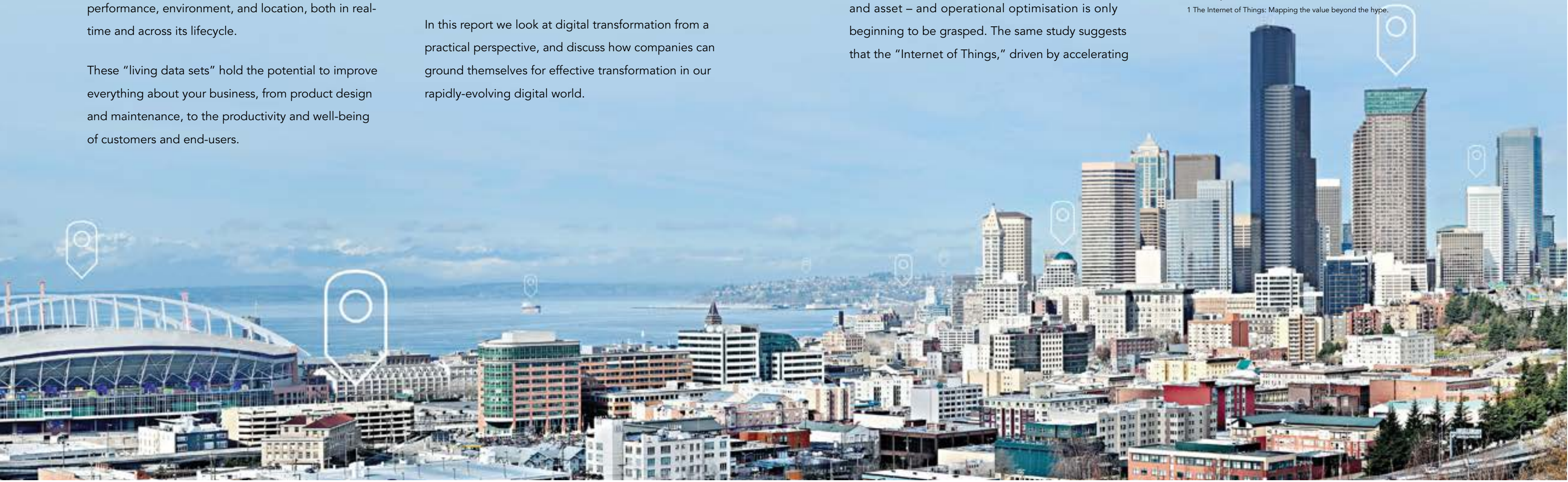
Top to bottom transformation

General Motors

When Mary Barra took over as CEO of US automaker General Motors (GM), she prioritised the need for a top to bottom transformation to position GM for the next 100 years.

It is very obvious that there is a lot of change taking place at GM.

Last year, GM grew its retail sales faster than any other full-line automaker. As of this writing (April 2017) industry analyst JD Powers says the company continues to lead in retail sales growth. Newly designed GM vehicles will soon be added to an already enviable product portfolio. GM is poised to continue its retail sales gains in the coming years.

But the story of change at GM goes beyond just its new products.

The GM Innovation Centers, under Chief Information Officer Randy Mott, is a driving part of the internal IT transformation strategy taking place at GM. Change is directed at providing greater information efficiency resulting in faster decisions and a shorter time to market. Providing better insight and understanding of the customer needs and wants, both internal and external, in a simpler and quicker manner is the single focus driving GM IT's application transformation.

A key component in the new GM application platform is geographic analytics. GM IT's integrated geographic information system (GIS) component will play an important role as GM's transformation story unfolds.

GM dealer network planning leaders currently rely on GIS-powered intelligent maps of their data to understand network and site performance and to develop short and long term strategic network plans.

GM IT's vision is to provide these same GIS geo-analytic capabilities to the other GM business disciplines.

"The problem with big data is using it," explained Bruce Wong, manager of GM's Advanced Network Analytics GIS system. "In its raw form, it is overwhelming. Data is not the answer; it's the information that is in the data that is important."

"Through GIS, we can bring data down to a level where we can look at it via maps and apply geo-analytics to understand the spatial relationships causing the real problems. Having the capability of geo-analytics will help all of GM, including our dealers."

GM is investigating how to leverage its GIS developed Site Analytics with individual GM dealers to improve their dealers target marketing and advertising efforts. GM's Site Analytics reveal the buying characteristics of the community that a particular dealer serves. As a result, dealer marketing dollars can be better targeted to yield a greater return.

GM Site Analytics uses GIS to combine census tract data with demographic-based consumer profiles. Interactive maps then illuminate the car buying habits of people in a dealer's region. Dealers use the information to build strategies that cater to the needs and wants of their communities right down to the census tract level.

Similarly, geo-analytics identify where dealers' potential customers live and how far they are willing to drive to buy a car or to have a car serviced. At the dealership level, **GIS enables predictive intelligence on how well a dealer should perform and allows visual comparisons to actual performance**. An additional layer of marketing analysis shows where new dealerships will thrive selling specific types of cars such as a Cadillac. It also makes clear where dealer territories begin to overlap so the company can reassess site locations.

Looking ahead, GM's IT transformation is positioning the company as a frontrunner in designing cars that will be ready for Internet of Things (IoT). Analysts forecasted that by 2020, 35 million cars would have onboard sensors connecting to networks for communication, navigation, traffic control, smart cities, and even other cars on the road, all contributing to the big data the company harvests for valuable insights. And all of which is further enhanced with geographic-based information, or location intelligence.

THE POWER OF INTELLIGENT
CONNECTION

JLL

Q: Why did JLL, a global company founded in the 18th century, embrace location intelligence as core to digital innovation?

A: To meet the demands of 21st century customers.

The Chicago-based professional services and investment management company employs more than 50,000 people in 80 countries, and is the second largest publicly traded commercial real estate firm in the world.

JLL turned to an enterprise-wide global geographic information system (GIS) to meet the increasing demands of clients all over the world who want more precision, confidence, and data-driven science in their investment decisions.

JLL's GIS-based solution delivers real-time, accurate location intelligence in support of investment and real estate decisions.

The firm's GIS allows the conversion of millions of data points – on everything from psychographic information to traffic patterns to economic development to zoning laws to code compliance to political instability – into digital maps. The GIS-enabled visuals conjure a much different kind of conversation with a customer than in the past.

"The biggest business challenge in commercial real estate has to do with visualising anything," explained

Michael Startin, vice president and director of GIS for JLL Americas. "Before GIS, we really had just your normal static maps. Moving to maps powered by a GIS, it's night and day. It has completely revolutionised the way our clients look at information from our brokers."

The GIS and data science-based approach has equipped JLL with a platform that can drive mission critical decisions from one centralised repository of real-time information and stored knowledge.

What all can they accomplish with the GIS technology? It's deployed in support of multiple business functions, including market planning, site selection, and site- and asset optimisation.

With GIS, the firm has been able to maximise use of its digital assets and share authoritative, data-driven results with clients who rely on its guidance.

In turn, JLL's customers can build successful long-term strategies based on the level of understanding they can derive from the disparate types of information fed into the GIS.

One application that has become a primary client advisement tool for JLL are reports called "storymaps," which are GIS-enabled visual reports that make quick sense of all the math involved in an investment decision.

Internally, with GIS, collaboration across the organisation has turned a corner into a new dimension. Store managers, retail line distributors, merchandise organisers, consultants, and logistics distributors can all work from the same page. They feel empowered by a user-friendly technology experience that pulls in some of the best data available and presents it in a way that streamlines decision-making.

"The fireworks are going off on the different ways they can use these tools," Startin said.

That's important, because what JLL has also learned is how much more today's clients and customers expect from the firm (JLL came into existence before George Washington became the first US president so the company has seen more than its share of customer-driven shifts). Very simply, their customers expect extremely high quality service and the best possible data science in today's digital retail universe.

"Databases by themselves are very hard to understand, but when you visualise that information you can certainly make quicker decisions. We help our clients understand what they're dealing with by mapping it out," said Dr. Wayne Gearey, a senior vice president with JLL. "We've gone from a siloed company to a truly connected company on a global scale."

> **"It has completely revolutionised the way our clients look at information from our brokers."**
> – Michael Startin,
>   vice president and director of GIS for JLL Americas
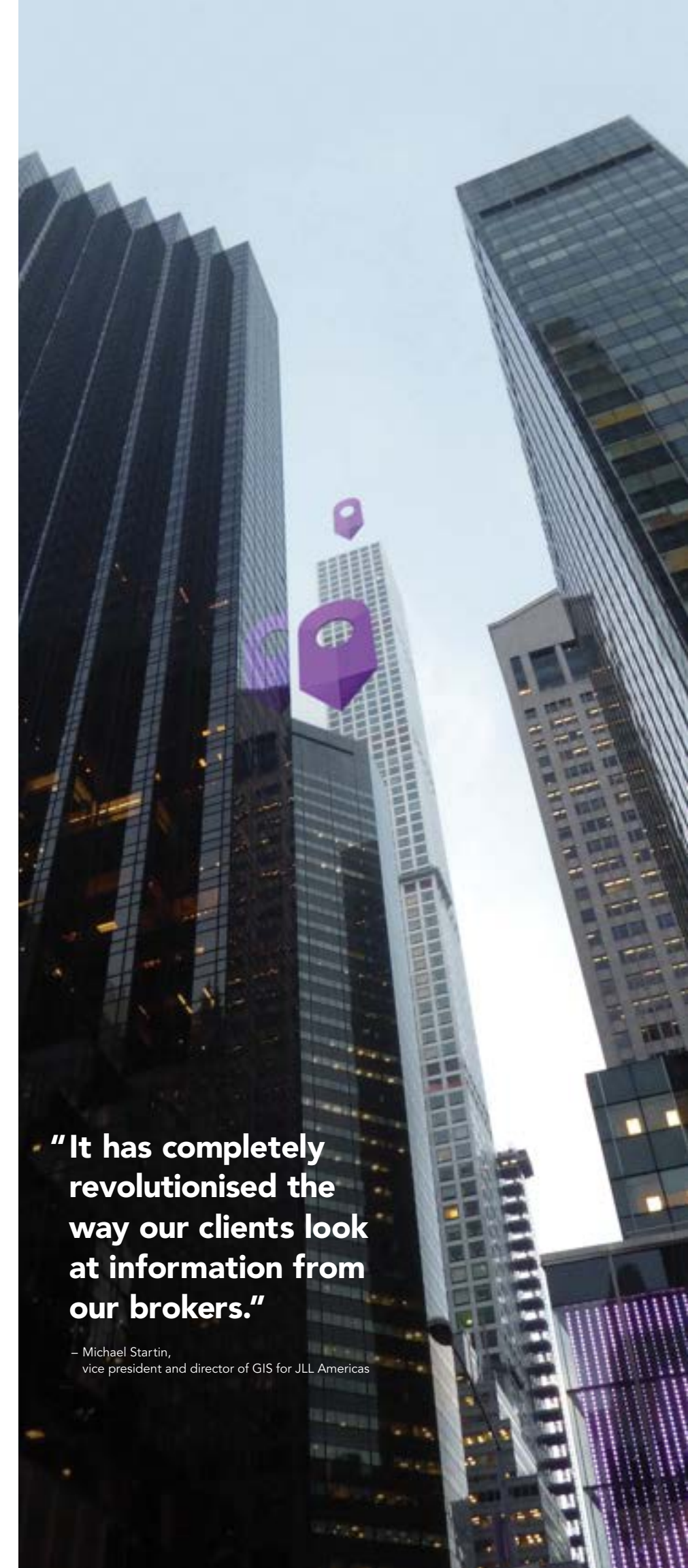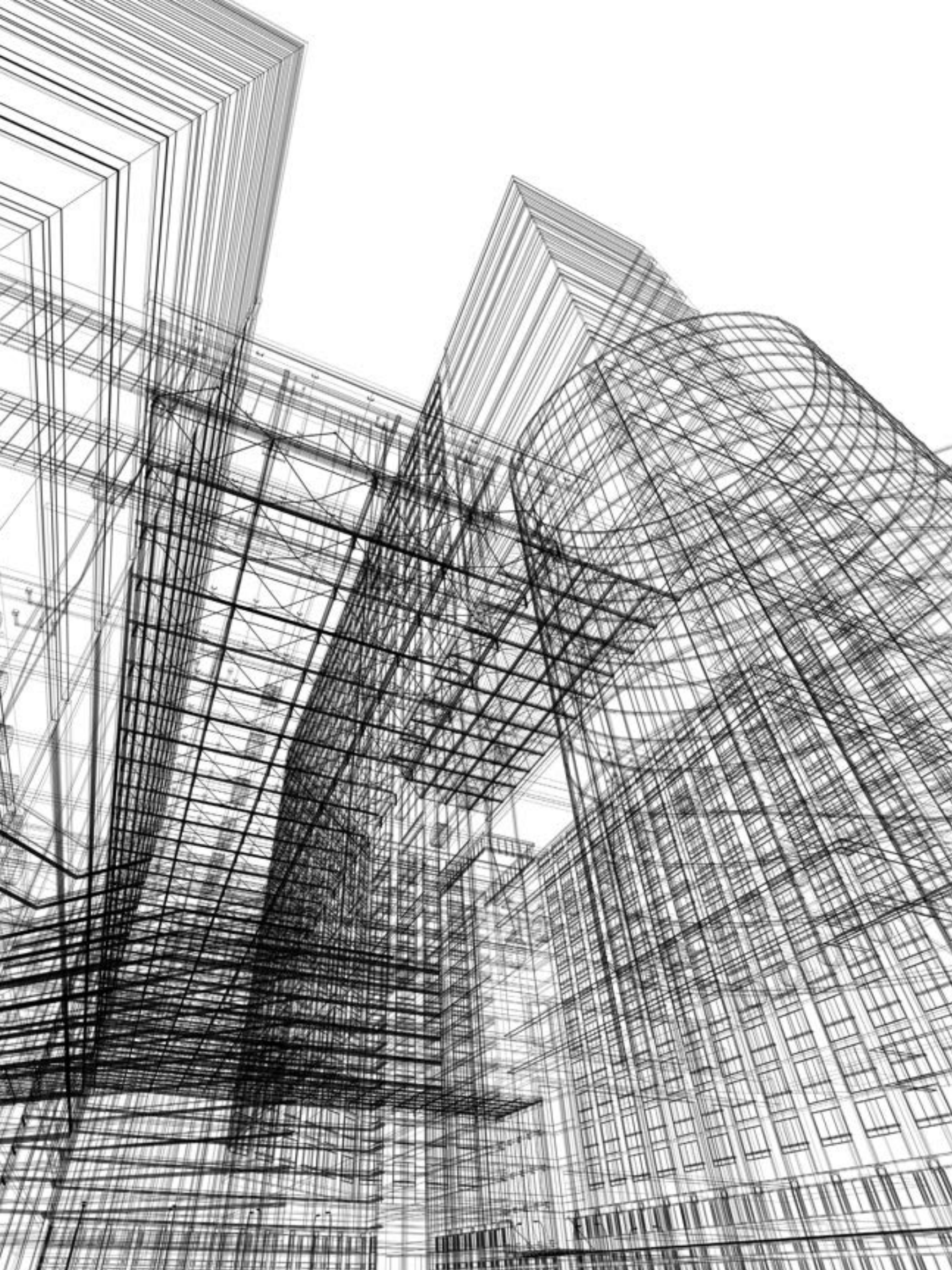
Driving to digital transformation

Research suggests that to remain competitive, businesses must drive efficiencies of five to 10 per cent in the next three years. At the operational level, the most logical way forward is to replace manual internal processes with digital workflows.

When you take a comprehensive approach to systems integration, efficiencies naturally occur. If your enterprise resource management system, customer resource management system, and workflow automation systems are all connected, the entire organisation works more efficiently. When data updates happen in real-time across entire "systems of systems," miscommunication is reduced, with correlating increases in productivity.

In general, when organisations are powered by accurate, up-to-the-second data, risk is reduced, collaboration increases, better decisions are made more quickly, and customer outcomes are improved across the board.

And this is true across all industries. Retail, commercial, manufacturing, utilities – and other organisations managing complex supply chains. No matter who your customers are, a digital transformation strategy that results in accurate information being delivered to decision makers in real-time is essential to sustained competitive advantage.

The challenge is obvious. But what's the roadmap? Organisations want and need to become more digitally focused, but the way into a digital strategy can be murky. Where to start, and how to create a strategy that works across marketing, operations, sales – and benefits the bottom line – is a daunting topic.

In an era where we are connecting billions of data–producing products, assets, buildings, and devices to the internet, a logical entry-point for many seeking a meaningful digital strategy is "location data." ▶

FROM FOREST TO FACTORY

TRACING NATURA'S SUSTAINABLE SUPPLY CHAIN STARTS IN THE AMAZON

Natura

In remote areas of the Amazon Rainforest grows castanha, andiroba, and cacau. These and other plants, fruits, and nuts are known to locals for their wellness-enhancing properties. They're also essential ingredients to Ekos, a personal care product line produced and distributed by Natura.

Natura – the No. 1 Brazilian manufacturer of beauty and household products – employs more than 7,000 people. In 2014, the company netted $2.7 billion in revenue through its sales channel of 1.4 million direct sales representatives. The manufacturer considers itself a digital-first company, investing in technology to enhance partner and end-consumers' experiences.

With a footprint in 21 countries and products in tens of millions of homes, Natura has been guided by sustainable development practices since it was founded in 1969. In 2000, the company made a commitment to reduce its environmental impact and support biodiversity by using more natural ingredients inspired by and from Brazil. The promise led to the launch of the Ekos line in 2013.

While the distribution and promotion of Ekos has been successful, the new venture has met with its share of challenges. Unlike other products, the Ekos supply chain starts in the Amazon Rainforest, not a factory – bringing new technology and sustainability challenges to the forefront. Natura needed to ensure a quality product would be delivered while benefits would be equitably shared along the supply chain.

Making the company's vision a reality would require more than a mission; it required data, mapping, and spatial analytics tools. To accomplish its goal, **Natura embarked on a new digital transformation initiative by building an enterprise-wide supply chain traceability system using geographic information system (GIS) software.**

In pursuit of real-time knowledge

It's important to know that getting Ekos products into the hands of consumers starts in the hands of more than 3,000 local Brazilian families. Natura relies on the families' ancestral knowledge of Brazil's native ingredients. In return for their local expertise and work to cultivate the crops, Natura pays the families a fair price in accord with fair trade practices, and helps local organisations sustain the communities, economically and socially.

With resources spread throughout the Amazon, the company needed better supply chain management and traceability from the start of the chain. ▶

Natura turned to an enterprise GIS platform to collect, visualise, and distribute supply chain data throughout the company. With the software, staff can go anywhere in the field and use mobile devices to collect production and harvest data as well as information regarding families, productivity, and socioeconomic impact. While the data is collected offline, it automatically syncs when the device is connected to the internet, and is made instantly available throughout the company.

"Making geo-referencing work in the middle of the Amazon isn't a trivial task. How do you do it in a place where there is no infrastructure or internet connection available?" said Mauro Costa, supply chain manager at Natura. "GIS gave Natura a solution to make it happen."

The platform takes data from the field and adds a new layer of intelligence – location-based. Staff can answer questions such as: Where are crops being harvested? Where did a shipment of ingredients originate? What is the fastest route from the farms to the next stop in the supply chain? Are there any factors impacting assets in motion, such as weather or issues with infrastructure?

GIS also combines location data with business data from SAP, Natura's core business system. Equipped with location intelligence and business intelligence, staff analyse the information in intuitive maps and apps, helping them make better supply chain management decisions.

"Once this integration took place, it speeded up the information flow, making our workflows faster," Costa said.

Going further with GIS

With information flowing from the Amazon Rainforest into Natura's core business system, the company ensures its quality standards and values are upheld. The manufacturer strikes a balance between creating quality products while empowering local families and ensuring the company meets obligations to farming cooperatives, consumers, and shareholders. All staff have detailed information and a greater ability to view the entire production chain to help maintain commitments to sociobiodiversity and environmental stewardship.

With GIS, "we share the same data but with different views and tools specific to our workflows," said Natura's Ronaldo Freitas. "This streamlines our workflow so we can concentrate on creating quality products and empowering local families."

Realising the potential of GIS and location intelligence, Natura is exploring innovative applications of the software to digitally transform other departments and workflows, including sales, marketing, and logistics.

"Geographic intelligence still has a lot to contribute here," said James Camargo, IT manager at Natura. "We've just begun."

Putting data on the ground

Everything happens somewhere. It's an obvious, but often underappreciated, truth in business that takes on even greater significance when charting your path through big data on the way to fully-realised digital transformation.

Typically, businesses approach data analysis in a statistical manner, using standard deviations and other methods to create numerical models. This type of analysis means that active, thoughtful exploration of data is confined to spreadsheets, requiring the extrapolation of key figures and statistics to make critical decisions.

Even more limiting, such exploration is confined to the cadre of professional analysts, number-crunching experts whose milieu is the spreadsheet. Myriad other users, whose potential insights and contributions can only be imagined, are left out.

Limiting data-based insights to such a narrow range of users can only equate to leaving money on the table.

A far more inclusive and powerful approach is to place data within a visual context, using location to add visual dimension; to ground the data in reality. Doing so will reveal patterns, connections, and opportunities that are difficult – or impossible – to decipher in spreadsheets and numbers.

For one retailer, one of the largest restaurant chains in the US with annual system-wide sales of more than $5 billion, its meteoric rise has almost as much to do with location-related technology as it does taste.

During the past four years, the company has integrated spatial analytics and location intelligence into daily operations, infusing business value and insight across thousands of owner-operated establishments in almost all 50 states. The decision to map data with state-of-the-art geographic information system (GIS) software stemmed directly from the company's mission of wanting to be a part of customers' lives and the communities the company serves. If you can determine what your customers care about, the company's thinking goes, you can better serve them.

To better understand its customers, the company uses GIS software to map large amounts of data about current and potential customers in local markets. Visual patterns emerge from the data, allowing the organisation to make smarter decisions about new site locations and operations throughout the lifecycle of a single store (or many stores in a specific region).

By enhancing internal data with demographic and psychographic data sets from multiple sources, the company gains a nuanced view of local markets and can analyse how it might cater to different customer bases. What's one thing they look for? Who the most promising customer segments are and where they're located.

The easy-to-use maps and spatial analytics provide the company with the confidence to make serious, often very expensive decisions. **With mobile and desktop access, more than 200 users across the organisation are making accurate, real-time business decisions and collaborating from the field to the office and back.**

According to one of the company's executives: "Success as a data-driven organisation depends on linking various arms of the business together. People are realising success means going beyond the confines of a singular department."

Presenting data visually so that stakeholders can understand not only what happened, but where and in what context, makes big data instantly more comprehensible and valuable. By creating physical and visual context, businesses can better assess and more intelligently deploy the massive amounts of information at their disposal. ▶

THE PORT OF ROTTERDAM

INTELLIGENT GROWTH:
The digitalisation of Europe's largest port

The Port of Rotterdam

How does the largest port in Europe grow its business capacity when it can't expand its physical footprint? Is it possible to double throughput without the ability to gain more space?

Those were the questions the Port of Rotterdam confronted in 2013. Hemmed in by cities and water on all sides, the port was forced to take stock of its operations, its goals, its strengths and weaknesses.

The Port of Rotterdam, established in the 14th century, is a marvel of engineering and transportation. It covers almost 30 acres of land and extends 26 miles inland from the water. It's the eighth largest port in the world and the largest port in Europe – a gateway to 500 million European consumers.

Today, the port operates around the clock 365 days a year. In a typical year, 35,000 ships (nearly 100 a day) visit, carrying 400 million tons of cargo; 80,000 barges enter it; 7.5 million trucks traverse its roadways (that's 25,000 trucks every day); and 80,000 employees come and go for work.

In 2013, the port set a goal to grow from 400 million tons of cargo per year to 750 million by 2030. Allard Castelein, the port's chief executive, put it succinctly: "The port should become faster, smarter, and more sustainable."

But from a business process standpoint, the Port of Rotterdam was a tangle of disjointed legacy systems that put different employees and assets in silos. Port leadership began to examine what needed to change. "We had to let go of everything. We went back to the start and asked ourselves basic questions. What are we? What is a port?" said Erwin Rademaker, port manager.

Ultimately, the solution was clear: "The only thing that is left for us to do is to improve, or to optimise, what we have," explained Rademaker. But the billion-dollar question remained – how?

At the time, port developers, business managers, project managers, asset managers, environmental advisors, port harbor operators, financial analysts, and many others, made the daily decisions that kept the port running. Each group used its own system for data collection and reports; even more confusing, groups used different definitions for the same terms across the port.

The port, its leadership realised, needed one authoritative source of information for all users and assets – a single point of entry that would allow anyone, anywhere, to quickly access the data they needed to make smart decisions and perform their jobs more efficiently. ▶

"We needed [another] modality in our port. And that is information. Because nothing in the port moves without information. Everything in the port, from the largest berth to the smallest lock and key, is connected by information," said Rademaker.

After researching best-in-class information systems, the Port of Rotterdam set its sights on creating a new solution based on geographic information systems (GIS) technology. **At its core, the solution is a beautifully simple map of the port. Underneath the skin of the map lie terabytes of big data – all accessible within three mouse clicks – and with connections to SAP, Microsoft Office, and a document management system**.

The port recognised that there are three distinct spatial components in the port and its users, and that each drive revenue generation in a different manner; the land component is used by terminals and infrastructure; the water component is used for transportation; and the interface between land and water is used for the mooring of ships. With those simple divisions, it was straightforward to assign existing layers of data to the 10 core objects that comprise the new port data system.

During implementation of the new GIS remedy, port leaders managed to phase out 49 other systems with relatively little disruption. Employees participated in the data migration, making the process one of active learning and training. And teenage children of employees tested the new interface, making sure it was truly user-friendly.

Today, more than 1,000 digital maps are created each day to guide operations and decision-making. In fact, all Port of Rotterdam data is presented visually. Any employee can pull up a map on a computer or mobile device, navigate to an area of the port, and click for more information. For instance, clicking on a wharf shows maintenance information, current contracts, ship movement data, and more.

Employees can also generate maps based on their specific needs. Rather than working with spreadsheets and lists, a business manager can pull up a lease expiration map and quickly see what areas are occupied, under reservation, or free, and view the details of existing contracts.

Since implementing the new system, the port has seen an increase in throughput to 461 million tons, a 15 per cent increase since 2013, and a significant step toward its 2030 goal.

Aside from financial goals, the port sees its new GIS-based approach as a way to become a world-class port. "Instead of being the biggest port in the world, which we were for decades," says Rademaker, the port manager, "we want to be the best port in the world. That means the most responsive to our customer needs."
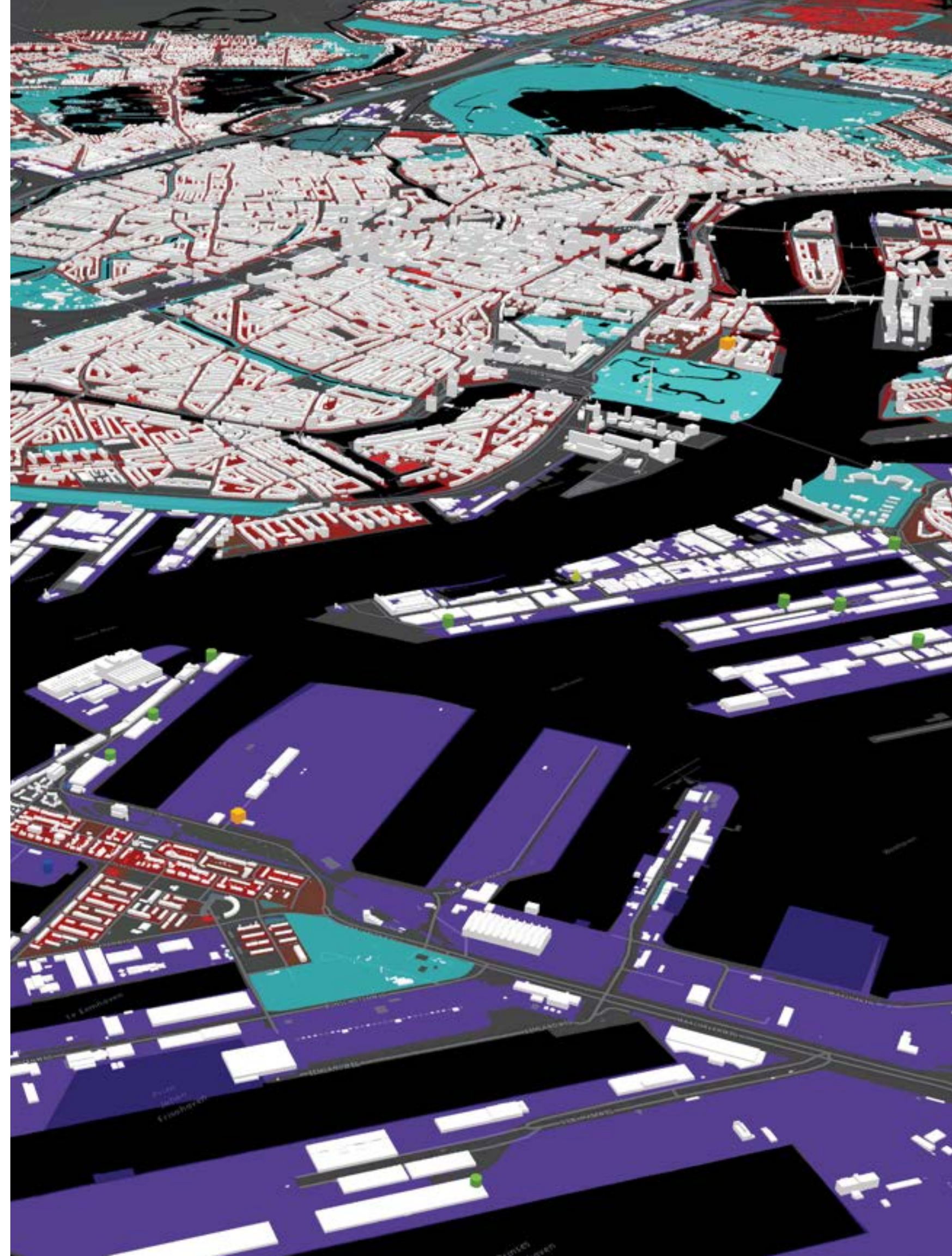
Spatial analytics in the real world

Spatial analytics add indispensable context to everything from buying habits, to transportation patterns to industrial maintenance needs. Let's look at another way location data can give an organisation entry to digital transformation.

A retailer runs a mobile ad campaign, capturing click-through rates. At the same time, he or she captures point-of-sale and online sales generated during the campaign. In a traditional analytic model, these two groups of data – ad clicks and sales – are siloed. They could be connected through more numbers (latitude and longitude coordinates), but the context for each sale is lost.

Now imagine the data is shown on a map. You can quickly see which ad clicks are connected to which physical stores, and where viewers who didn't click were located at the time. Visually plotting purchasing behaviour can reveal very valuable information. Did lost clicks correlate to distance from a store? Did people who clicked and bought go to the nearest store? Were online sales made at home, or while commuting?

Combining multiple data sets with physical location creates a rich model for data analysis and an intuitive platform for stakeholders to view and understand large amounts of data. Spatial analytics spreads the understanding of data across an enterprise, rendering it far less intimidating. ▶

"Visual language has the potential for increasing human 'bandwidth,' the capacity to take in, comprehend, and more efficiently synthesise large amounts of new information. It has this capacity on the individual, group, and organisational levels."
– Stanford University professor Robert Horn

Where to start?

A digital transformation comprises a web of connected processes and decisions. Everything is connected – but each of those connections must be made visible to discern its value. Maps provide meaningful context; a window through which different constituents can view the right data for their individual roles – and for broader, common understanding across the company.

In fact, maps can serve as the most effective framework for organisational integration. **On the back end, geographic system information (GIS) technology links customer relationship management (CRM), business intelligence (BI), records management, asset management, and many other systems. On the front end, where workers and customers consume information from mobile devices, computers, and the IoT, maps provide an intuitive operating picture.**

Your CEO, CIO and other key personnel can work from customised dashboards according to their needs. Your field crews and customer service reps can document and upload mobile data in real-time. Analysts can perform the algorithms, models, and calculations that drive data forward. **And the big picture of your business becomes holistically comprehensible, rather than an amalgam of disparate data sets from siloed departments, held together by little more than experience, intuition and often-incompatible software platforms.**

People process information faster when it's presented visually. Maps and location create a powerful entry into the world of big data and digital transformation – delivering the context that can reveal hidden insights, creating efficiencies, and increasing productivity – and profits.

As we are just at the beginning of the fourth industrial revolution, we can only speculate as to what the coming years will bring, but the Internet of Things and digitalisation indicate a clear overall direction. The IoT is a network of devices, sensors and systems that work together autonomously, collecting and sharing data. It's a system that will depend heavily on location information and technology.

THE CITY UNDER THE CITY

San Francisco's 100-year-old water and sewer system

San Francisco Public Utilities Commission

On a recent day in San Francisco, a noxious odour invaded "The City." As the smell spread, the phones at the San Francisco Public Utilities Commission (SFPUC) started to ring with hundreds of resident complaints. The SFPUC, guardian of a 1,000-mile-long sewer system, needed to respond.

Just a few years ago, the plan would have been to dispatch a crew to each complaint location, write a paper report, and try to pinpoint the source of the odour. In a situation involving hundreds of work orders coming in, the day would have fallen into chaos and the office depleted of staff.

In this instance, Lewis Harrison, manager, SFPUC's Wastewater Collection System Division, did what he does first these days: he looked at a digital map.

Over the last five years, the SFPUC has transformed the way it collects and analyses data, moving from a cumbersome paper-based system to a digital approach that presents data visually.

Rather than immediately responding to individual calls – whether for odour, flooding, a breakage, or other corrective maintenance – today the location of a complaint is swiftly posted to a real-time digital city map, revealing clusters or patterns of incidences.

In the case of the foul aroma, the map was painted in resident complaints, showing a widespread, diffuse pattern with no clear indicators of a specific origin. Then, a call to the Coast Guard confirmed a suspicion that it was most likely coming from the San Francisco Bay and in all probability from a specific tanker offshore. The SFPUC couldn't physically resolve the situation, but it could share up-to-date information with concerned citizens. Also, because the visualisation suggested the cause was not a specific location in the city and pointed to the bay as a possible source, scores of hours of staff time were also spared.

"If an odour is emanating from a certain focal point, then we should investigate," says Harrison. "But in this case, it was so widespread that […] there's no way this came from San Francisco. That's the difference, being able to see information visually."

SFPUC Wastewater Enterprise collects and treats both sewage and storm water while maintaining the city's 17 pump stations and three water treatment plants. Harrison describes the network of pipes as "the city under the city." It's a vast – and aging – infrastructure crucial to SFPUC's daily operations in a city that is home to 850,000 residents and some of the highest-priced real estate in the US. ▶
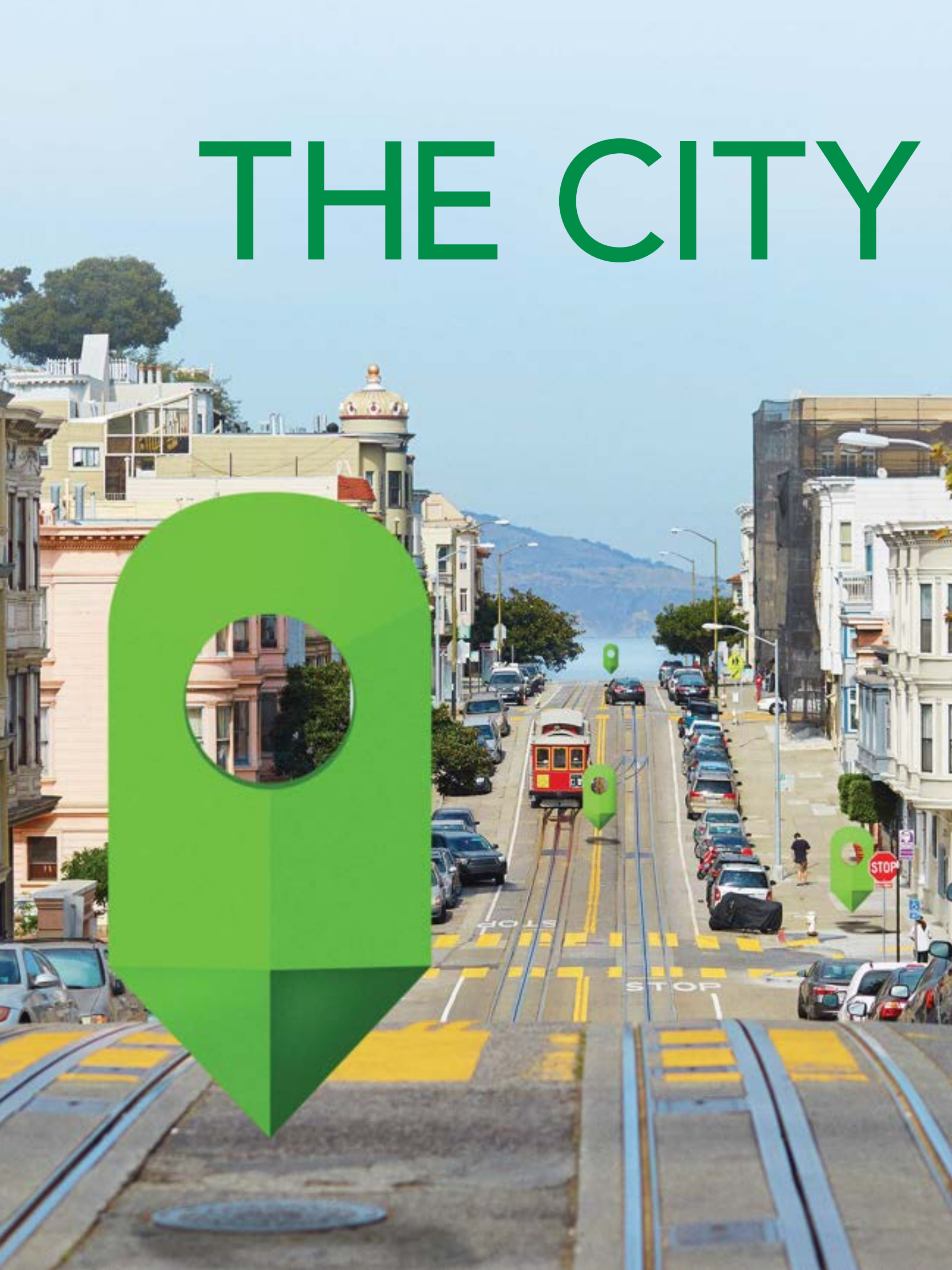
SFPUC is responsible for all preventative work on the city's water and sewage system, with a plan now in place to replace and upgrade the century-old system. The SFPUC also performs all corrective maintenance – both proactively and by responding to more than 16,000 calls a year from city residents.

Traditionally, the process for initiating and documenting fieldwork was onerous and time-consuming. Sewer Operations received service calls, noted the location, converted requests into work orders, and assigned them to field personnel on 3 x 5 paper cards. Asset IDs were then identified and manually attached to work orders.

When a team was in the field, they carried notebooks, paper survey forms, and digital cameras for documenting issues and work performed. Back in the office, digital images had to be uploaded to the SFPUC network, paired to relevant notes, printed, and then scanned back in as a full report. The process took up to 30 minutes per inspection.

In the winter of 2016, SFPUC learned of a new app based on geographic information systems (GIS) technology. SFPUC was already benefiting from GIS-based maps, so they were comfortable adding another dimension to their GIS.

The app was uploaded to agency-provided iPhones and sent into the field. Inspectors now use the GIS-powered app to fill out a full report and take geo-tagged photos on site. Reports are uploaded to SharePoint and Maximo from the field, eliminating lag time between an inspection and a report being generated.

"What used to take up to half an hour is now accomplished in about 5 minutes," Harrison says. "Another benefit has been that managers now have access to real-time data that enables them to monitor evolving issues during events."

Digitising its fieldwork has introduced a transformative shift in SFPUC's problem-solving and collaboration. Because all stakeholders have real-time access to the same information across sites, decisions are data-driven and made faster than ever.

"It used to be a lot of phone calls, meetings in person, and paper handouts…reports that were circulated around a table," Lewis says. "[Now] it's instantaneous information and geo-referenced so people know we're talking about the same thing. Digital, visual data makes it cleaner in terms of everybody seeing the same thing, and it makes the decision-making quicker as well."

The shift to digital workflows also brought to life an unexpected culture change at the agency. "We had guys who never thought they would touch a computer," says Harrison. "And now we can't roll the app out fast enough because it's so convenient. It really tells us we're on the right track."

IRELAND DRIVES
TRANSFORMATION
AND INNOVATION
WITH NEW DIGITAL MAPPING EFFORT

Ordnance Survey Ireland

Ordnance Survey Ireland (OSi), the country's national mapping authority, has long been a technology innovator. But when its customers kept asking for more intelligent data, leadership recognised that they were in danger of falling behind.

"We have been a digital organisation for 30 years, but our national spatial platform was coming to the end of its life," says Colin Bray, chief executive of OSi. "We needed to create a national spatial database to allow us to create new products and services."

During the hardest of economic circumstances – the global recession of 2007 and 2008 – the organisation began to invest in next generation technology because its leaders knew that would help citizens, businesses, and government make better decisions on matters related to place and property. In turn, those decisions could aid the overall economy.

"Our customers wanted data with rich attribution and intelligence in order to do analysis," says Tony Murphy, OSi's business and marketing manager. "This wasn't possible with the flat file data structure that we had."

The modernisation had a phased approach, starting with data, followed by technology and then the end user. The transformation road map included both focusing on products (maps and data) and streamlining production systems.

In 2007, OSi began to prepare for the future needs of its customers. But by 2008, the dramatic hit to the economy left OSi's field staff with a lot less work. Instead of 90,000 or 100,000 new buildings to be surveyed every year, there were only 6,000 or 7,000. Looking to the future, the leadership redirected the extra staff capacity to the task of converting data from a flat file to a data store with added intelligence. This accelerated the transition with minimal added labour costs and laid the foundation for further modernisation and transformation.

Overall, OSi invested $7 million in its digital transformation – an amount that was hard to come by after the economic collapse.

"We had a battle on our hands at each stage to push through and get approval for funding," Murphy said. A report that quantified how much annual savings would be realised because of improved decision-making – in excess of $90 million annually – helped make the case for the digitalisation initiative. The unforeseen collapse of the housing market – and people's wish to know in advance if it could happen again – proved motivating, given that all real estate transactions revolve around location intelligence. ▶

Several components of the geographic information system (GIS)-powered modernisation effort have been achieved over a 10-year period:

A centralised data store combines three separate databases into a streamlined hub.

A new online mapping platform provides data to all citizens and businesses, allowing them to download data for analysis purposes or to easily create maps online.

A new rules-based map production site automates the update of maps by using web services rather than manual processes.

This ambitious transformation has had a considerable impact on OSi's efficiency, and there have been eye-opening lessons along the way.

"Not all of the parts of the road map came together as planned," said Lorraine McNerney, OSi's general manager for geospatial systems. "For instance, we thought we knew our data until we started on the data reengineering process."

Staff learned that

Spending the time up front to ensure that data is in the best shape possible is essential to realise the efficiencies of automation.

The more the data is used, the better the data gets and the quicker their products can be produced. Providing an easy means for feedback on problems customers encounter with data helps ensure that problems are fixed for the benefit of all.

Adopting the tenets of agile software development— where requirements and solutions evolve through the collaborative effort of self-organising, cross-functional teams – helps companies gain buy-in on dramatic changes because they empower everyone. Rather than a top-down process, everyone has authority and responsibility, which fosters collaboration and pride in the results.

"If I look at the changes over 10 years, we've effectively retooled every business process, workflow, operational procedure, toolset, and more," said McNerney. "What people are doing day-to-day is fundamentally different. Nobody's role is the same."

Making data open and free to citizens and the public sector has been fundamental to changing the dialog about the value of the data. Instead of arguing about cost, the focus becomes the value of better decisions.

"Our interactions with central government were hit-and-miss before," says McNerney. "We're at the table now, and we're reminding the various departments to think about location; think about spatial analysis; and regardless of whether they're business or political questions, don't forget about location intelligence."

Competitive advantage in retail

The Shopping Center Group

In the world of retail real estate, choosing the wrong corner or city block can mean millions in lost revenue. "If you're off by an inch, you're off by a mile," says David Birnbrey, chief executive of The Shopping Center Group (TSCG), the largest retail-only real estate service provider in the U.S.

The Shopping Center Group helps customers steer clear of such strategic missteps by presenting visual, data-driven stories about markets, trade areas, and potential sites.

Sharing information visually and digitally helps customers understand large amounts of data that, in almost any other format, would be incomprehensible. By engaging with data presented visually on a map, retailers can analyse local markets and customer information with precision and be better equipped to choose successful retail locations.

The Shopping Center Group has 21 offices from coast to coast. Since 1984, the company has taken a client-first approach to their services of tenant representation, project leasing, property management and construction supervision.

The company has an historical commitment to research and geographic information systems (GIS), but a few years ago, TSCG sharpened its vision and its commitment in an effort to collect the most comprehensive data on local markets to help its customers choose the best locations for their businesses.

How did TSCG drive this digital transformation of real estate decisions? Four years ago, the company's legacy mapping software system had become obsolete. A company-wide committee made up of participants from every discipline, decided it needed a more powerful GIS system to use across the entire enterprise.

The enterprise GIS system paved the way for TSCG to combine and visualise a rich array of data, including demographic and psychographic data sets, ultimately creating the largest proprietary database of its kind in the industry.

The company taps its database to create digital twins of local markets, populated with relevant correlative data to facilitate precise, successful real estate decisions.

"We consider GIS and research to be the heartbeat of the organisation. It allows [all our service lines] to tell a story," explains Gregg Katz, the director of innovation and technology at TSCG.

With 28 mappers on staff – a 1:4 ratio of mappers to brokers, unheard of in the commercial real estate industry – TSCG has changed the way retailers approach market analytics, customer analytics, competitive analysis, and site selection.

By example, a grocery retailer can view data specific to its industry segment on a map with nearby competitors, complementary and conflicting retailers and any demographic detail desired, all in an effort to identify potential opportunities. Traffic and commuter patterns add to the study, providing their own subset of business affecting implications. At an even more granular level, GIS allows retail strategists to highlight specific customer profiles and analyse how those consumers physically move throughout the day which affects a specific trade area. Similarly, if a client is a bank, or a restaurant, the layers of the map change to show data relevant to those industries.

"For the first time," Katz says, "instead of [only] understanding where consumers live, we're able to see how they move, what that movement does for a trade area and the effect that then has to the site selection process."

By using cloud-based GIS software, TSCG brokers can share maps and reports with clients in the field and access data anytime, anywhere, on any device. They can also update data on the fly immediately adding recently opened or recently closed stores, keeping the database timely and accurate.

"You need the right data," Katz says. "Big data is everywhere, but you need accurate, useful data."

Since it placed data-driven maps at the centre of its business in 2012, The Shopping Center Group has seen a 30 per cent increase in revenue and has become the premier source for retail real estate decisions.
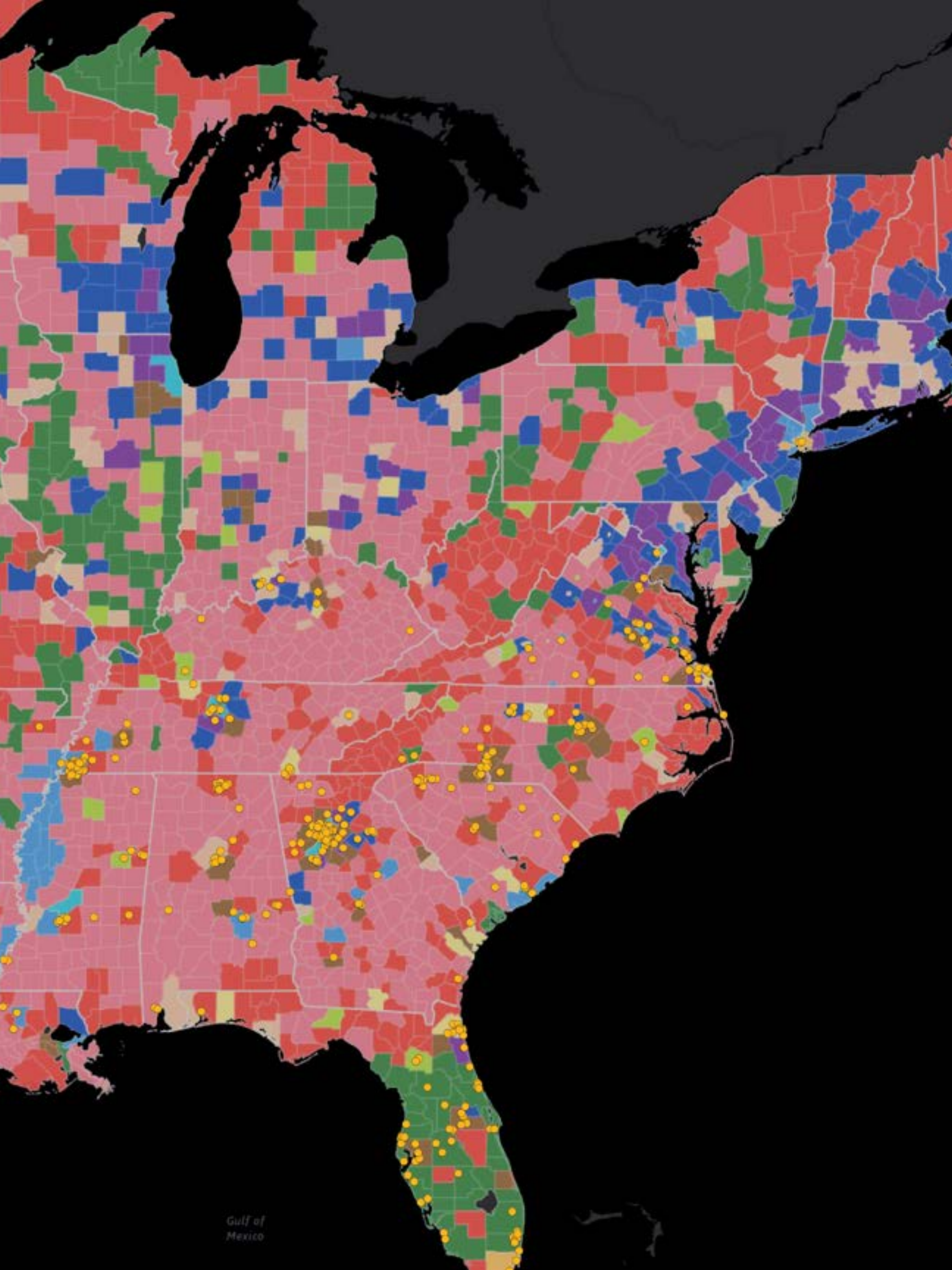
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