Information Everywhere: And New Ways to Use It

Selected Views & Observations

*"**Information about money has become almost as important as money itself**."*

Walter Wriston, CEO Citibank/Citicorp, 1967-1984

*"**The Internet of Things** in the livestock industry is not about sensors or new technology. **It's about building a market around the results from these new data-collection disciplines**, while **improving the user experience and empowering engagement** between the players of the value-chain."*

Danilo Leão, CEO/Co-Founder BovControl, 2019

In this installment of our Smarter Living series, we share several observations of how information is being gathered in innovative ways in **retail**, **transportation supply chains**, **agriculture**, **construction**, **vehicle automation** and **government services**. We also provide a sampler of innovative information providers.

Walter Wriston achieved significant business success as an industry leader in the use of information technology. Today, as Danilo Leão's comments highlight, innovators are pursuing opportunities that address a new, broadly understood reality. The collection and analysis of information is exploding. Successful entrepreneurs are leveraging new information sources to drive competitive advantage for their business and adding significant value to their customers and partners.

We've written previously about Smarter Data—an emerging phenomenon of companies identifying just the right tidbits of information to propel their businesses. In this installment, we share observations on data sources—call it Smarter Data Sources—which underly this activity. What is it that allows the global supply chain to track the 89% of world trade that happens at sea? What allows the transportation industry to perform 8.8 billion miles of road testing on autonomous vehicles to ensure their safety? What allows retailers to gather weather information to improve customer experience? What enables the construction, agriculture and government sectors to transform their services?

To provide context for our discussion, consider the following chart which outlines these information sources.

Information from business processes	Generally, more structured data. Sources include 1) credit card data, banking records, supermarket scanner data, supply chain data, etc. and 2) government and public agencies.
Information from sensors	Including 1) sensors embedded in various devices (computers, wireless networking technologies. IoT), 2) satellite imaging (construction, shipping, commodity production, etc.), 3) geolocation data to track foot traffic in retail stores, ships in ports, etc. and 4) weather and environmental pollution sensors.
Information from individuals	Often formatted as unstructured text. Sources include 1) social media (websites like Twitter, Facebook and LinkedIn), 2) specialized sites such as business-reviewing websites like Yelp; e-commerce leaders like Amazon, Alibaba, etc., 3) web searches and personalized data such as Google Search trends and data from personal inboxes and 4) crowdsourced data such as Waze's live traffic alerts.

New information sources and new ways to use them continue to emerge. Innovators are adding significant value to their businesses. A poor understanding of these dynamics can present competitive threats. Yet, an advanced understanding can present opportunities to shine and differentiate. We look forward to having more in-depth discussions on this important topic with you soon.

In Retail: It's About Understanding the Customer Journey

For retailers, effectively supporting the "customer journey" is a business imperative. It is a process that requires better ways to understand: 1) how to reach new customers, 2) what drives purchasing decisions, 3) how customers look for products, 4) better ways to predict spending and 5) how to develop personalized product recommendations. Retailers are gaining insights from online data, weather data, sensors, product tags, artificial intelligence/machine learning services, and more.

With about 2.6 billion active social media users worldwide in 2018, on-line content is a significant part of understanding the customer journey. In "brick-and-mortar" retail, information for loyalty programs, credit card transactions, point-of-sale transactions and other sources are providing significant retail insights.

In on-line retail, **Amazon** generated 29% of sales through their recommendations engine which analyzes information from more than 150 million accounts. **Walgreens** and **Pantene** have worked with the **Weather Channel** to use weather data to customize product recommendations, such as promoting anti-frizz products during periods in increased humidity. **Costco** uses data collection to keep customers healthy: when a fruit packing company warned about potential contamination in peaches and plums, Costco directly notified customers who purchased the items instead of sending a broad email blast.

Illustrating the strategic value of collecting, analyzing and using information, **McDonald's Corp.** recently acquired **Dynamic Yield Ltd.** to improve the customer experience of drive-thru menu displays by showing certain food suggestions based on time of day, weather, current restaurant traffic and trending menu items based on a customer's current selections.

McDonald's CEO Steve Easterbrook said:

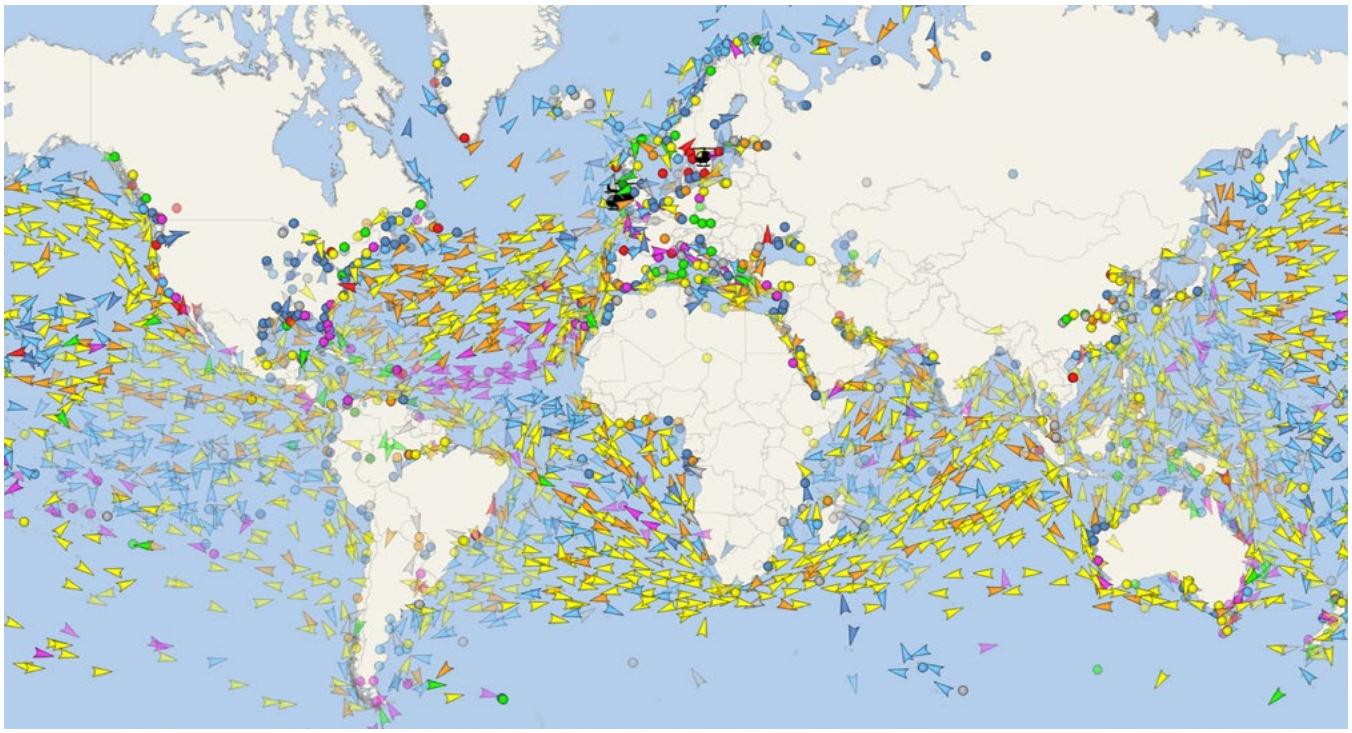
"With this acquisition, we're expanding both our ability to increase the role technology and data will play in our future and the speed with which we'll be able to implement our vision of creating more personalized experiences for our customers."

In Supply Chains: Optimizing a Just-in-Time Global Network

Managing and improving the efficiency and integrity of highly independent global supply chains are mission-critical business objectives. Whether by land, sea or air, addressing these needs requires many technologies and information from many sources—satellites in space, sensors on vehicles and more. Areas benefiting from supply chain innovation include fleet management, warehouse management, risk management, freight brokerage and trade finance.

One innovative example is tracking ship movements at sea where, according to UNCTAD, about 89% of physical goods are transported. At sea, the automatic identification system (AIS) is one approach to tracking sea trade. AIS uses transponders on ships to help avoid collisions. There is increasing interest in using satellite-based AIS services to help predict a ship's location, estimate its arrival time and assist in the navigation of autonomous ships.

Chart 1: Tracking Sea-bound Ships via AIS (May 27, 2019)



Source: www.vesselfinder.com

A land-based example of improving supply chains is UPS' Orion system, which is expected to be used by over 55,000 drivers. Potential results from Orion include: 1) reduce about 100 million delivery miles and 2) reduce carbon emissions by 100,000 metric tons.

UPS Chief Information and Engineering Officer Juan Perez said:

"The conversation in the past used to be about buying technology, creating a data repository and discovering information, Now the conversation is changing and it's exciting. Every time we talk about a new project, the start of the conversation includes data."

In Agriculture: Growing Products and Enterprises with Precision

Within agricultural markets, networks of sensors, drones, and satellites collect information that is essential to making informed business decisions. These technologies help deliver innovative solutions in areas such as precision farming, crop analytics, livestock monitoring, soil management, agricultural robotics and crop imagery. Significant business value is derived through: 1) ensuring equipment availability; 2) conserving seed, water, fertilizer, pesticide and other resources; 3) monitoring crops and products for their nutritional value and more.

Innovators in agriculture are focused on deriving information from: 1) government agencies (e.g., farm program participant records, soil surveys, and weather/ environmental data) and 2) farmers, ranchers and other producers (e.g., yield, soil analysis, irrigation levels, livestock movement, and grazing rates).

Opportunities are being pursued by: 1) agricultural equipment manufacturers (e.g., tractors, combines, and implements); 2) chemical companies and applicators (both in research and development and to improve application use); and 3) technology providers from other industries (for example, dairy farmers using radio frequency identification (RFID) to track herds).

While technology has helped automate many agricultural functions with more powerful and precise machines, using business intelligence to access various farming strategies (better crop pricing, improved sustainability, etc.) are at an early stage of development. Consider the following comment from **Caleb Harper**, a **Principal Research Scientist in MIT's Media Lab** and **Director of the OpenAg Group**:

> *"There is a big problem right now in the agricultural space in terms of lack of publicly available data, lack of standards in data collection, and lack of data sharing … So, while machine learning and artificial intelligence and advanced algorithm design have moved so fast, the collection of well-tagged, meaningful agricultural data is way behind. Our tools being open-source, hopefully they will get spread faster and create the ability to do networked science together."*
>
> ***The Future of Agriculture is Computerized***
> **MIT News April 3, 2019**

Recognizing the value of data to make better irrigation decisions, **Climate Corp.**, a subsidiary of **Bayer AG**, and **Lindsay Corp.**, a maker of irrigation systems, recently announced an agreement to connect their platforms. **Lindsay's President and CEO Tim Hassinger** said they want to: *"help more farmers harness the power of their data to more efficiently manage water use for improved productivity."*

Other agricultural innovators include **BovControl**—developing cattle/livestock management and production analysis tools, **Bowery Farming**—helping cultivate indoor crops, **Cainthus**—identifying the health of animals using computer vision, **CiBO Technologies**—providing data analytics to simulate agricultural conditions and **Indigo Ag**—using natural microbiology and digital technologies to help farmers sustainably feed the planet.

In Construction: Driving Radical Transformation

In the construction industry, information has been gathered about structures and projects for centuries. Traditional construction information systems have focused

on recording information about project schedules, CAD designs, costs, invoices, and employee details.

Today, data is being gathered from many sources: on-site workers, cranes, earth movers, material supply chains, and even buildings themselves. The challenge is that data alone is not helpful. What is done with the data and how it is used to develop innovative business process is more important. There are many opportunities to leverage technology to improve environmental sensitivity, manage cost-plus budgeting dynamics and address labor availability and costs.

To better understand the state-of-play in construction, consider the following comments from ***Katerra chairman and co-founder Michael Marks*** (previously he was a partner at ***Kohlberg Kravis Roberts & Co.*** and CEO/chairman of ***Flextronics International Ltd***). He said:

> *"Mired by under digitization and fragmentation, construction must find a new way to build … While other industries have radically modernized their processes, construction remains one of the most stagnant major industries in the world, still using many of the same methods first deployed in the 19th century. As a result, productivity is falling, the construction workforce is shrinking, and demand for housing continually outpaces supply … There are many reasons behind the stagnation. Foremost among them is the lack of technology investment by construction firms."*
>
> **Construction: The next great tech transformation**
> **McKinsey & Company—Voices (June 2017)**

Other players in the modular construction market include **RAD Urban**, **Guerdon Enterprises**, **US Modular Group**.

In the construction industry, the data-driven opportunities are significant, extending across all aspects of the design-build-operate lifecycle.

Design: Data on building design and modeling, environmental considerations and stakeholder/investor objectives can be used to determine how and where to pursue construction activities.

Build: Data from weather, traffic, and community and business activity can help determine optimal phasing of construction activities. On-location sensors can monitor equipment activity levels, asset energy/fuel needs and access ecological impact. Material levels can also be monitored.

Operate: Data from sensors in buildings, malls, office blocks, bridges, roads and other structures can monitor a variety of environmental and performance factors. Energy conservation can be tracked to ensure conformance to design objective. Traffic data can help detect and manage unusual events. Data can be fed back into building information modeling (BIM) systems to schedule maintenance activities.

In Vehicles—It's about Safety and Leveraging Automation

Data within vehicles is everywhere—created and used by a mix of sensors, on-board computers, entertainment centers and more. Historically, most of this information was produced and stored locally within the vehicle. The next wave of innovation will link and share data with Internet, edge networks and other external services.

Innovative solutions help determine if an oil change is needed, if radiator fluid is low, if engine performance is acceptable. Going forward, notifications can be sent to the driver, the vehicle manufacturer and other service providers.

In-vehicle services will increasingly incorporate personal concierge services as well. Vehicle maintenance will become more pre-emptive and less reactive, system problems should decline, performance should improve, and operating costs should be lower. As information about road construction, accidents, and congested intersections become more prevalent, the navigation of data-connected vehicles should be more efficient. Also, crowdsourced data about live events will increasingly be a part of traffic management solutions.

Insurance companies should benefit from vehicle innovation as well. Information about driver behavior, performance and safety can result in more precise underwriting.

For advertisers, data collected about the music people listen to and the drive-through restaurants they visit may influence marketing budget allocations.

A dramatic shift in vehicle technology is the move to "autonomous". These vehicles require the introduction and testing of many new technologies and new data analytic

approaches. As more autonomous vehicles enter the road, these technologies will lead to a more data-centric automotive industry.

In a research paper on safety testing of autonomous vehicles, the ***RAND Corp.*** said:

> *"Autonomous vehicles would have to be driven hundreds of millions of miles and sometimes hundreds of billions of miles to demonstrate their reliability in terms of fatalities and injuries."*
>
> **Driving to Safety: How Many Miles of Driving Would It Take to Demonstrate Autonomous Vehicle Reliability? (2016)**

To assure a proper level of vehicle safety, some industry participants believe 8.8 billion miles is the required amount of road testing for autonomous vehicles—this is equivalent to driving a fleet of 100 vehicles for 400 years. Researchers suggest alternative testing methods must be used to adequately test the safety of an autonomous vehicles. These data-driven alternatives include virtual testing and simulators, mathematical modeling and pilot studies.

In Government: For Public Services

The opportunity to improve government services via digital transformation is significant. Innovative approaches can lead to radical changes in how public services are designed, managed and used. Information can be more accessible, provided in real-time, and add value via cross-organizational sharing.

IoT technologies will accelerate the adoption of real-time management systems. Data capture using cameras and sensors will become more ubiquitous in public facilities and secure infrastructures.

Government 4.0, a term popularized in Europe, embraces the integration of automation, data exchange, and manufacturing technologies, and describes an environment of connecting government agencies engaging with public facilities, assets, and services through Internet of Things (IoT)-based networks for access by all citizens. Assessing the potential of data in Government 4.0, **McKinsey & Co.** said:

"In most countries, public sector expenditure represents 35 to 60 percent of the GDP. This means that the state's digital transformation is the largest transformation."

Public Services: Government 4.0—the public sector in the digital age
March 2018

Additionally, better protection of personal information is increasing. Public authorities need to comply with applicable laws while avoiding the introduction of unnecessary internal processes. Information transparency will also increase the need for services that provide opt-in or opt-out mechanisms.

Assuring security and safety of citizens is an important public service function. With this in mind, we share three data-driven examples to prevent, prepare for and put out fires.

- **Fire Department of the City of New York** (FDNY) is responsible for maintaining inspections for over 330,000 buildings, including commercial properties and apartment complexes. FDNY implemented a Risk-Based Inspection System (RBIS) built on a data-analytics algorithm called FireCast. It uses 7,500 risk factors to prepare daily reports of high fire-risk buildings.
- **Los Angeles Fire Department** uses WIFIRE, a tool to predict where wildfires may occur. The platform merges satellite imagery, footage from cameras and data from sensors to create a profile of a fire's conditions. A picture of the fire, conditions surrounding, historical data and other factors are used to predict what may happen next.
- **City of Amsterdam Fire Department** uses data to support their "smart fire engines." Sensors monitor equipment performance, pick up signs that repairs are required and help in predictive maintenance to keep equipment in good condition.

Table 1: Innovative Data Sources—a Sampler

Organization	Description
AgEagle	Provides a turnkey aerial data collection and analytics solutions to help farmers and agronomists acquire high quality, actionable intelligence that results in higher equipment efficiency, reduced crop damage, improved yield, less time on foot in the field and increased profits.

App Annie	Provides app download, revenue, demographic and usage estimates for every major mobile app. Market data metrics include historical rankings, ratings, reviews and keywords for any app across categories and countries.
Buildfax	Provides over 23 billion data points on residential and commercial structures and proprietary, providing predictive analytics about how building permit data predicts loss and how property history, improvements, structural risks, and changes over time.
CoreLogic	Supplier of U.S. real estate, mortgage, consumer and specialized business data, we supply high-value information, analytics and outsourcing services that thousands of companies use to make timely and insightful decisions. databases encompass more than 4.5 billion records,
DataSift	Platform does analysis on sources such as Bitly, Blogs, Boards, Daily Motion, Disqus, FB, Instagram, IMDB, Intense Debate, LexisNexis, NewsCred, Reddit, Topix, Tumblr, Videos, Wikipedia, Wordpress, Yammer and YouTube.
Descartes Labs	Provides a full imagery archive from hundreds of satellites. The Descartes Platform is built to ingest virtually any kind of data, including satellite, weather data, commodity price histories, web crawls, and sentiment analysis from social media networks.
Digital Globe	Its satellites collect information from over three million square kilometers a day. Its eighteen-year image library provides significant partial resolution and global coverage.
Echosec	SaaS, global real-time information discovery platform using AI and machine learning technology. Helps clients visualize, detect, understand, action and often predict activities and know about high-impact events and breaking information.
Esri	Via its ArcGIS platform, delivers location intelligence through: Spatial analysis, mapping and visualization, 3D GIS, real-time GIS, imagery & remote sensing and data collection and management
Orbital Insights	Has a geo-analytic platform for analyzing all types of geospatial data at massive and analyzes millions of satellite images at a time to help industry leaders identify socia-economic trends.
PlaceIQ	Mobile devices emit location signals through the form of latitude/longitude coordinates. The firm sources significant massive amounts of anonymous device signals to understand where audiences are moving in the physical world.

Planet Labs	Provides geospatial data for use in agriculture, government, and commercial mapping, and is seeing customer growth in new markets insurance, commodities, and finance. Has about 150 satellites in orbit.
RetailNext	A retail vertical IoT platform to bring e-commerce style shopper analytics to brick-and-mortar retailers. More than 400 retailers in over 75 countries use the firm's analytics software and retail expertise to increase sales, reduce theft and eliminate unnecessary costs.
RS Metrics	Provider of applications and data from large scale analysis of satellite and aerial imagery, and other geospatial information sources.
Sense360	Develops mobile applications that enable developers to create relevant, personalized, and situationally aware notifications using location, place, activity, context, and other phone sensory data. The company's products enable applications to unlock this situational awareness.
Skywatch	Its satellite data is used in the mining industry to inspect areas of interest; by oil companies to monitor pipelines; and by farmers to monitor their crops. Market intelligence companies use the data to count cars in parking lots and the number of construction cranes in use across the country.
Windward	Aggregates and analyzes maritime data, globally 24/7. With over 90% of the world's trade transported over the oceans, data on ship activity is critical to decision makers across industries.

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