Forbes INSIGHTS

SOCIAL INNOVATION

THE BUSINESS OF SAFETY, SECURITY AND HEALTH

IN ASSOCIATION WITH: Hitachi Data Systems

Forbes
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PART 1:
THE POTENTIAL

By 2020, there will be 28 billion connected devices—nearly four times as many devices as there are humans.[1] Machines are already communicating with other machines—as well as with people, robots and even cows. The data these devices generate is proliferating faster than enterprise data,[2] and IDC expects the applications, analytics, platforms, intelligent systems and new devices associated with this phenomenon will have a market impact of $7 trillion over the next five years.[3] Sensors are embedded in nearly everything produced now, and utilizing that data provides the potential to save resources, improve healthcare systems and revolutionize urban planning to enable smart cities.

But not all at once. Traffic congestion, for example, costs the United States $160 billion a year in lost productivity, wasted fuel and shipping delays.[4] The biggest share of waste comes from traffic snarls on city streets where drivers searching for a parking space add to congestion. What if technology could help you find a parking space now? In the future, your car might be able to drop you off, park itself and come back to get you when you call it—your own private valet service. Some parking structures are running pilot programs with robotic valets already, while automakers are incorporating automated parking capabilities into high-end vehicles.

Building a better way to find a parking space is one example of how solving what seems like a small problem can help solve a larger issue: traffic congestion. It is also an example of how creating the sensors, networks and services that help reduce traffic is a good business plan that also addresses a nuisance with real social costs. Building more infrastructure is not necessarily the answer. What good would it do to have more parking spaces if drivers must still drive around to find them? And if there are more cars, more roads and more traffic in the future, then adding more parking spaces will not be enough to solve what is essentially a distribution problem with many hidden social costs: lost productivity, wasted fuel, added pollution and sheer frustration.

If finding a parking space is a problem today, imagine what it could be like in 2050, when there will be 2.4 billion more people on the planet.[5] Many more will live in cities, which could see a stunning population growth of 63% over the next 35 years, mostly in Asia and Africa. It will take more than automated parking to manage that sort of growth. How will urban planners keep up with traffic management, public transit and housing needs, energy distribution, trash pickup and public safety? And since people are living longer, there is tremendous pressure on existing healthcare and financial systems.

BY 2020, THERE WILL BE 28 BILLION CONNECTED DEVICES—NEARLY FOUR TIMES AS MANY DEVICES AS THERE ARE HUMANS

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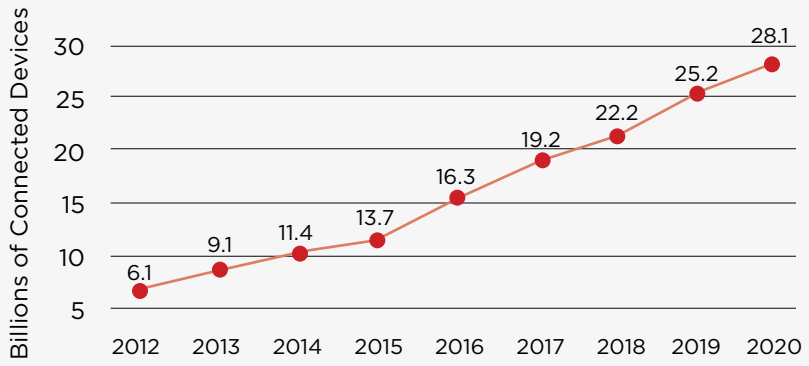
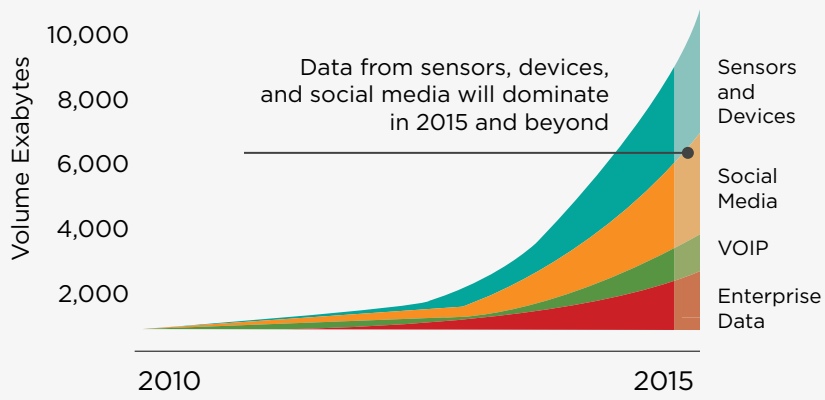
INTERNET OF THINGS



Source: IDC, 2014

GROWTH OF BIG DATA



Big data alone is not the answer

Source: Tech Dynamics

Clearly, there is a need for smarter management. That demand is driving innovation at companies such as Hitachi, which has 105 years of experience in operational technology, 55 years in information technology and more than 10+ years in the Internet of Things. Today, Hitachi solutions extend beyond the trains, turbines and telecom equipment that the company has manufactured since the second industrial revolution. Hitachi is embedding intelligence in equipment and networks—from transportation and communication to public safety and healthcare—to create smarter and safer cities, manage resources more effectively and support a healthier planet.

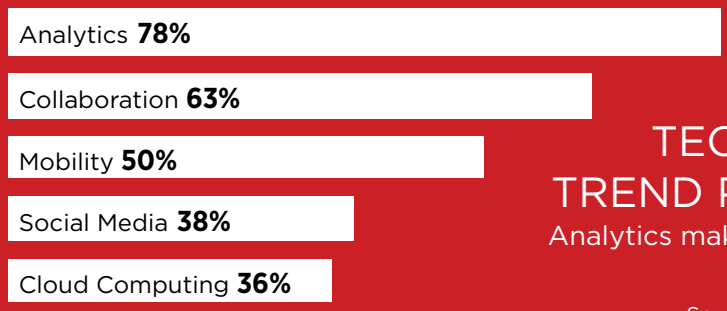
"We look for some of the big problems that enterprise and governments have to deal with and look at what we're good at," explains Hitachi Data Systems' Kevin Eggleston, senior vice president, social innovation and global industries. Social innovation—creating products and services that make the world safer, smarter and healthier—is usually associated with charitable foundations and non-profit organizations, but it is also good business. "I get a lot of questions about what we mean by social innovation," says Eggleston. "It is what we call our Internet of Things and big data strategy—with a focus on the Internet of Things *that matter* and make a real difference."

The last point is key, given the sheer volume of data that is now being generated by connected devices. How much of it matters? Even an organization that can answer that question is still faced with a challenge: how to isolate and analyze what does matter? And how to turn that analysis into the kind of intelligence and action that can make social infrastructure smarter?

Connecting devices and collecting data doesn't mean much without analytics to deliver the insight needed for companies to make quick, meaningful business decisions.

TECHNOLOGY TREND PRIORITIES

Analytics makes the difference



Source: Ventana Research

PART 2: THE BACKBONE

It's easy to understand some of the initial appeal of connecting all sorts of physical infrastructure to a network. All of the different physical systems that go to make up social infrastructure—railways, roads, power grids and more—can be monitored and controlled remotely and accurately. Problems can be diagnosed before they lead to breakdowns. For the makers and operators of physical infrastructure, the value is not necessarily in building a better train or a better turbine, it's about making these machines operate better and more reliably through predictive maintenance.

THREE PILLARS TO DELIVER ON THE PROMISE OF THE INTERNET OF THINGS *THAT MATTER:*

1. A deep understanding of where the data comes from—the sensors, connected devices, machines and the systems that generate data—and what information might be hidden in the data.
2. The ability to efficiently and safely manage and analyze the data.
3. Industry knowledge, to understand what information matters and the potential for applications.

This is where information technology meets operational technology, explains Sara Gardner, CTO for social innovation at Hitachi Data Systems. This is bridging two spaces that used to be completely separate. "This is about the blending of technologies and techniques, like analytics and data management, taking those things that we've been using for many years in back-office systems and applying them to the physical world," she says. "A lot of this physical infrastructure is shockingly old," she adds. "It's just not feasible to rip and replace everything. We need to think about how we can make it smarter."

Machine data is the common thread of the Internet of Things *that matter.* This year marks a turning point in the amount of machine data collected and analyzed. There is an unprecedented amount of detailed data being collected from sensors and devices, and it is more granular than anything seen before. Telecom networks, for example, are subject to spikes that are invisible if usage is measured as a moving average without enough granularity.

"Telecoms spend most of their money on network equipment, yet this is the one area where they have had the least amount of insight," says Gardner. "We worked with partners to come up with a technology that allows a telecom network operator to view all traffic end-to-end in real time." This not only opens the door to better service from the same equipment, but it also gives operators the chance to sell network-as-a-service through dynamic provisioning.

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WHERE CYBER MEETS PHYSICAL:

CREATING A PLATFORM FOR MEANINGFUL APPS

The idea that society will be better off if everything is connected is not immediately obvious until one speaks with experts who understand the promise of cyber-physical interoperability. One such expert is Janos Sztipanovits, a professor of electrical engineering and computer engineering and director of the Institute for Software Integrated Systems at Vanderbilt University School of Engineering.

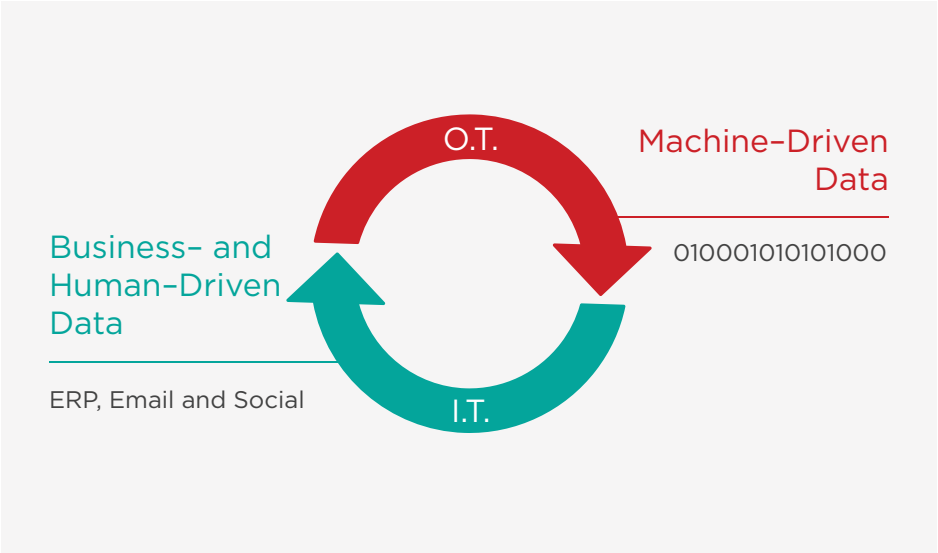
Sztipanovits says that the Internet of Things is a platform upon which we can build cyber-physical systems that are a true integration of physical and computational elements. "The Internet of Things creates foundations for systems that have millions of sensors, connected through the Internet and to each other," he explains. "These sensors and the associated computations and processes create massive databases that can provide opportunities for running data and analytics." But this is just the beginning. "Then you better understand whatever you monitor through those many sensors," he says, "whether it's a manufacturing process or a home or a transportation system, and you can create optimization and control loops around it."

Sztipanovits believes that predictions about the impact of tens of billions of connected devices in the next decade is grossly underestimated. "These are disruptive technology shifts," he says, "and are therefore hard to estimate. More importantly, these billions of devices will all be very diverse and very heterogenic. And they have to drive a wide spectrum of applications."

The market for apps, he says, will be bigger than for the platforms themselves because "these new applications will touch everything" as developers focus on what matters in transportation, security, agriculture and in our personal lives. There will emerge an ecosystem where small developers who understand the microenvironment are able to innovate to create these new apps, he predicts.

There will probably be more than a few stupid apps, he says, but there will also be those that we didn't know we needed and won't be able to live without. Sztipanovits believes one such app is transactive energy management. Think about a dryer that can discern the real-time cost of electricity with the utility and negotiate when to turn on—all without any involvement from the user. This kind of "energy negotiation mechanism," operating in the background could help balance overall energy usage, improve the efficiency of the power grid and saves consumers money.

Understanding the massive quantities of data now being generated by machines is only the beginning. Analytics is key: spotting emergent trends, separating true signals from noise and anticipating future events based on context. Machine learning in the form of predictive analytics is a big step beyond simply monitoring and controlling physical infrastructure. The next big step is prescriptive analytics to increase uptime, lower cost of operations and take planned action before an emerging trend becomes a problem.



TO REALIZE THE FULL POTENTIAL OF THE INTERNET OF THINGS *THAT MATTER* REQUIRES A BIG DATA REPOSITORY, LIVE INSIGHTS FROM REAL-WORLD APPS, BUSINESS INTELLIGENCE AND AN ADVANCED ANALYTICS FRAMEWORK TO TURN THAT INFORMATION INTO INTELLIGENCE.

Beyond machine data, there is data about weather, human behavior, physical phenomena, video images, social media and more. The ability to understand and analyze data from disparate sources and in context of time and place is an opportunity to extract knowledge on a different scale than ever before. This has wide potential for social innovation.

For now, however, many organizations don't yet know what they can or should do with the copious amount of data they already have. The trend now is to analyze unstructured, external data, while much of the proprietary data that organizations already own remains dark.

Another problem is the need to analyze data across different systems, many of which are not compatible. The City of Copenhagen, for example, is facing a data-silo problem in its quest to become carbon neutral by 2025. The city government is working with Hitachi Consulting to create the City Data Exchange, a big data platform that will bring together relevant municipal data—energy consumption, water usage, transportation, crime statistics and weather data—from every possible source, public and private.

Many large cities around the globe have adopted an open-data platform. Amsterdam, for example, collects and publishes city and regional government data in an app-friendly open database. One recent application tracks energy usage on a series of interactive city maps. New York City is using analytics to predict which buildings pose a fire hazard or identifying the 1% of pharmacies that are filing the majority of Medicaid claims for oxycodone prescriptions, drawing from the combined data from 40 different city agencies. The City of Copenhagen is trying something new: combining public, private and commercial sources to create an exchange.

The City Data Exchange will be a dynamic repository and a marketplace for data that can be tapped by private enterprise as well as government, citizens, academia and non-profits to spot trends, develop apps and work toward the city's sustainability and quality-of-life goals. The new data platform will eliminate the need to build the plumbing for each analysis, and it will break down the data silos that make it difficult to share information. Users will pay a subscription fee to use data from the platform for research, planning or to develop applications, and suppliers will be paid every time someone uses their data. But the true value of the exchange will be in what can be created with the data.

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The city began work on its vision for the data exchange two years ago, says Robert Farris, vice president of Hitachi Consulting, and the mayor's office considered many different options. "Ultimately, the goal was to create a business model that was sustainable for the city," he says. Hitachi also saw the exchange as an opportunity and has invested, along with the City of Copenhagen and the Capital Region of Denmark, to develop the exchange. "We see this as a repeatable model, one that helps cities do something practical that can provide a real return and includes a commercial aspect to attract private enterprise," explains Farris. "This is bigger than one city."

Creating a data exchange is about more than implementing a software solution, he says. "We have a team on the ground to work with companies to help them understand how to participate in this marketplace," he explains. Telecommunication providers, for example, have data that could be useful to retailers who are trying to gauge activity at a specific location and track how patterns change over time. App developers can use the data to help individuals and businesses monitor energy consumption and provide insights in energy usage throughout the city. Many of the initial subscribers are interested in seeing the initiative spread throughout the region and to other large cities in their market area, says Farris, and many will be watching closely when the Copenhagen exchange goes live in 2016.

The City Data Exchange is an example of how the focus in big data is expanding from infrastructure toward analytics and applications. The Organization for Economic Cooperation and Development describes the analytics, visualization and application layer as "the last mile of big data…where most of the value of data is generated and where true differentiating quality resides as the commoditization of data analytics continues." [7]

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PART 3:
THE BENEFITS

The potential may be huge, but for most organizations it makes sense to start small and focus on what really matters, says Eggleston. "It's important to ask: where can this make a difference?" A focused project with some analytics and a dashboard designed for a specific environment can become the foundation for additional insights. A use case that works in healthcare, for example, might also have applications in traffic management. All of them might be cross-pollinated in some of the smart city initiatives under way around the globe.

Here are some of the most innovative possibilities in key sectors:

SMART CITIES

Smart cities are a microcosm for initiatives that combine traditional infrastructure with technology to reduce traffic, congestion, pollution, energy consumption and crime—all of which could be adopted on a larger or smaller scale in other areas.

"But all this technology is meaningless without a greater purpose," says Adie Tomer, a fellow at the Brookings Institution Metropolitan Policy Program, focused on metropolitan infrastructure usage patterns and the intersections between infrastructure and technological development. He believes a truly smart city starts with a purpose and an economic vision defined by planners and citizens—not by technology. "How is the city trying to grow in terms of size and efficiency? How well can people access opportunity? How important is sustainability to the plan? All these issues will impact what technology a city or region should choose and how it's implemented," he says.

What changes in the era of big data is the amount of information policy makers can have at their fingertips. And what changes with advanced analytics is the deeper understanding of how people and systems interact in the built environment, says Tomer. Transportation planning, for example, has traditionally been based on guesswork and projections that extend out for decades. "Now, we have the capability to better understand where people are moving, at what time of day and how that varies by day of week in a way we never could before," he says. "Some of that information comes through the sensor technology we carry in our smartphones or the GPS in our cars." But that information in itself is not the question, nor is it the answer. "Now that we have the data, how do we make decisions based on it?" he asks.

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In Amsterdam, for example, energy efficiency is a goal, and many of the public-private initiatives reflect that goal. A power grid in one district was retrofitted with sensor technology at key nodes, enabling power from the existing grid to be increased in some areas. The improved network structure will make potential power outages more visible. The city has invited developers to find ways to use the intelligence of the smart grid to incorporate large-scale generation and discharge of solar power by consumers to the grid, balance small-scale demand and link vehicles to the grid.

Barcelona, Spain—the urban area most identified with smart city technology—is already recognizing annual energy savings of more than $100 million per year after installing smart street lighting and improving the water management system. There is free Wi-Fi citywide. Embedded sensors in parking spaces can communicate with drivers, reducing congestion, wasted fuel and emissions.

Songdo International Business Center outside Incheon, South Korea, is being built from the ground up as a smart, green city. All new construction, including streets and buildings, are wired into a wide-area network. The waste collection system was designed to eliminate the need to remove trash by trucks. Wide roads encourage biking and walking, and many services are available within a short walk or remotely from home.

PUBLIC SAFETY: CONNECTED INTELLIGENCE

Imagine being able to see live feeds from disparate sources—video surveillance, 911 systems, gunshot detection, license plate recognition and even social media—all appearing on a single pane of glass. Running analytics on all of these feeds can help law enforcement anticipate hot spots where there may be a spike in crime, and apply resources more effectively. For first responders, having relevant information displayed in real time on a digital map can eliminate blind spots and improve safety—and allow them to go into a situation with full awareness.

Vendor-neutral technology can also help local police cooperate more seamlessly with security personnel at private entities such as universities and malls. And with predictive crime analytics, algorithms can be used to create threat-level predictions to accurately forecast where crimes are likely to occur or when additional resources are likely to be needed.

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ENERGY AND WATER: CONNECTED AND SUSTAINABLE

Some of the oldest infrastructure networks in the world are water transportation systems, many of which are plagued by leaks and breakage. The U.S. Geological Survey estimates that 1.7 trillion gallons of water are leaked in America each year. In Europe, some cities have leakage rates as high as 70%, according to the European Water Partnership, a non-profit organization. This is especially concerning in drought-stricken areas across the globe.

Better sensors can help limit leakage and give utilities more precise information about usage and waste. Better data and analysis can also help 100-year-old power grids integrate 21st-century technology by identifying outages more quickly and even predicting where breaks are likely to occur.

Another area to consider is power. One of the biggest challenges to power utilities today is the integration of renewables onto the grid, as when households sell their excess solar energy back to their local utility. Integrated weather data and analysis usage patterns could help match supply with demand. Maintaining microgrids can also increase resilience and reduce reliance on centralized distribution, preventing cascading blackouts.

Perhaps the most visible application for social innovation: smart features in structures and on city streets that turn the lights off when no one is there or adjust sun shades to reduce the need for air conditioning.

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TRANSPORTATION

One of the most tangible examples of how smart sensors and advanced analytics will make a difference is in transportation. At the far end of the spectrum are fully autonomous vehicles: automakers and tech pioneers are testing them now, but the networks they will need to operate widely have yet to be built. But most newer-model vehicles are already loaded with sensors and connected to a GPS network via satellite.

Some manufacturers, such as BMW, Lexus, Toyota and Ford, offer models with parking assistance and other automated safety features. These embedded features and other specialty devices allow insurance companies to test pay-how-you-drive insurance pricing. Eventually, cloud-based connectivity with smart cities could give rise to many apps that save time, cut emissions and improve safety. Similar technologies could enable semi-autonomous trucking fleets.

For public transportation, the Internet of Things means improving safety and predictive maintenance with smarter trains, real-time, personalized updates for bus routes and dynamic, demand-based management for city bike sharing. Eventually, city dwellers may be able to call up on-demand public transport, including driverless car sharing.

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CONNECTED HEALTH

Most healthcare providers rely on a series of proprietary applications to capture and store clinical data, with multiple interfaces to obtain patient information and delays in transmission of information from separate applications. New technology can bridge these data silos without the need to rip and replace enterprise systems or imaging equipment.

Technology also can help close the gap between an increase in demand for healthcare and a shortage of specialists in some fields. Doctors are already taking advantage of robotics for advanced consultations, and treatment can begin on the way to the hospital, in the ambulance—if it is equipped with the right technology. None of this can happen without access to digital patient records as the first step.

Add to this the possibility of what advanced analytics could mean for structured and unstructured patient data—decreased risk for medical error, better diagnostics and meta-data for medical research and community medicine—and the potential for healthcare analytics will be a key social innovation.

TELECOM ANALYTICS

With real-time analytics, telecom providers can see what is happening on their networks at a sub-second level. This empowers operators with granular insights into how the network functions and where there may be outages. It also gives them predictive insights into when to expect a surge or schedule preventive maintenance, improving quality of services on existing infrastructure.

This ability is transforming the business model for network hardware providers. Instead of selling and maintaining equipment, they can offer pay-as-you-use models now that they have better ways to measure usage.

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CONCLUSION

There is a tangible competition among urban areas to create and maintain an environment where people want to live, work and play. The best initiatives combine advantages for business, government and individuals, just as they do in the wider world. More efficient transportation cuts energy usage and reduces carbon emissions. Better water management means more than limiting waste in the system. In many parts of the world, it means a safer environment, a healthier society and greater security. Even something as simple as using sensors and software to build a better parking system shows how using technology to solve an individual problem can start to mitigate bigger problems, such as productivity-sapping congestion and wasted fuel.

THE IDEA OF SOCIAL INNOVATION IS BUILT ON THE PREMISE THAT THE INTEGRATION OF MACHINE DATA, ADVANCED ANALYTICS AND INDUSTRY EXPERTISE WILL MEAN SMARTER PRODUCTS AND SERVICES TO ADDRESS ISSUES AT EVERY LEVEL OF SOCIETY, FROM URBANIZATION AND SMART CITIES TO PUBLIC SAFETY AND THE HEALTHCARE NEEDS OF AN AGING POPULATION.

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Adie Tomer, Fellow, the Brookings Institution Metropolitan Policy Program

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CITATIONS

[1] http://www.idc.com/getdoc.jsp?containerId=248451

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[6] ibid

[7] OECD (2015), "Mapping the global data ecosystem and its points of control," page 95, in Data-driven Innovation: big data for Growth and Well-Being, OECD Publishing, Paris.

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Hitachi Data Systems builds information management and Social Innovation solutions for business and social prosperity. Our IT solutions and services drive strategic management and analysis of the world's data. Only HDS integrates the best of Hitachi IT and operational technology to deliver the insight that businesses need to thrive. HDS.com

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