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THE ECONOMICS OF IOT DATA SHARING

CONTACT TRACING ACCELERATES IoT OPPORTUNITIES AND RISKS

By Massimo Russo and Tian Feng

This is the second article in a multipart series.

COVID-19 AND THE WORLDWIDE response to the pandemic are accelerating all kinds of trends. Telemedicine, for example, has gone from an essential tool in rural areas to a mainstream health care option everywhere. Online video meetings and webinars have become a fixture—for business, education, families, and fun.

One of the most significant, complex, far-reaching—and accelerating—trends is the rise of data sharing, particularly data from the Internet of Things. In B2C businesses, marketers and tech companies have long shared data to better discern and address evolving customer needs and behaviors. In B2B, industrial and tech companies collaborate on data sharing to create new platform-based business models and services.

Now countries around the world are tying together disparate data sets—cellphone location data, credit card information, CCTV imagery, point-of-sale data, and health data—in an effort to track the novel coronavirus and trace those who have come into contact with infected individuals. As we look forward to the easing of social-distancing requirements—which will necessitate testing, tracing, isolation, and treatment—technology solutions are a critical tool on the path to normalcy. Data aggregation and sharing are the lubricants that make those tools work.

In our first article in this series, we looked at some of the legal, ethical, and economic prerequisites for data sharing. Here, we draw on our work on smart cities to examine the opportunities and risks that data aggregation and sharing present to business and society in general.

The Benefits of Data Sharing and Aggregation

Data aggregates in many places: in cars, smartphones, manufacturing plants, stores, and homes, among many other locations. One of the largest of these is cities; indeed, the sharing of vast quantities of aggregated data is what makes smart cities possible.

As data assembles, or is collected, around data entities (such as people, cars, homes, or cities), potential high-value use cases that would benefit from data sharing can come to light. (See the sidebar, "Defining Data-Sharing Nomenclature.") The urgency of the COVID-19 crisis is causing this kind of innovation to accelerate, particularly efforts to contain the spread of the virus.

Singapore, for example, has implemented an opt-in Bluetooth token solution: throughout the day, a user's smart device tracks every contact with other people, and he or she is notified if any of those individuals becomes ill. Google and Apple are working on a similar solution for Android and iOS devices. In a more comprehensive response, South Korea weaves together cellphone location data, credit card transaction data, CCTV images, and health care data to track COVID patients and enforce social distancing.

Crises tend to magnify many things, including rewards, perils, and the impact of decisions (those made and those passed over). COVID-19 highlights both the benefits and the risks of data sharing and aggregation. Here are three big benefits.

Data sharing can promote innovation. We have written before about how companies in multiple industries, including agriculture, auto manufacturing, and commercial trucking, have developed data-sharing platforms that offer new services and enable third-party app developers to use the shared data to develop additional services. Across the globe, governments are releasing COVID-19 data, not only to foster transparency but also to invite innovative solutions. Most of the 30 smart cities we reviewed globally have some form of open-data platform, and 65% have hosted hackathons to source solutions to public problems. (A future article will examine

DEFINING DATA-SHARING NOMENCLATURE

People, places, and technological devices all play a role in creating data and facilitating the sharing of data so that it can be put to new and innovative uses. Here's how we think about the roles of the various participants in this process.

Data Entity. The generator and end user of data. Examples include people, buildings, farms, and factories.

Platform. A collection of data sources that connects smart things and users to facilitate data sharing. Platforms can center on industries or data entities. So far, many have been focused on industries and have emerged through collaboration in industry consortia. Examples include Schneider Electric EcoStruxure, Strava, Spotify, Uber, eBay, and HERE.

Superplatform. Giant platforms that integrate several smaller platforms into one fully integrated service offering while capturing user data. Apple's iOS and Google's Android operating systems, Alibaba, Tencent, Facebook, and Amazon Alexa are leading B2C examples. B2B superplatforms include those operated by tech company "hyperscalers," such as Amazon Web Services and Microsoft Azure; industry-specific examples include Siemens' MindSphere and Honeywell Forge. The line between platforms and superplatforms is easily blurred, but the two can be distinguished by the degree of openness and the number of partners and industries involved.

Data Application Marketplace. One potential model of data and application sharing in which data and developers meet to develop interesting, and often commercially viable, use cases. Examples include the iPhone and Android app stores, smart-city open-data platforms and app development spaces, and industry-specific marketplaces. Marketplaces can intersect with one or more platforms.

how smart cities are using data to promote innovation.)

The pandemic has accelerated this kind of innovative collaboration. The national governments of Estonia, India, and the Netherlands are among many that have encouraged citizens to "hack the crisis." According to the *Wall Street Journal*, more than 1,000 people participated in a remote hackathon organized by the Estonian government, and a Johns Hopkins hackathon generated such ideas as a location-based mobile app to track traffic in grocery stores and a tool to tag misinformation on messaging platforms. Dozens of data visualization techniques have sprung up that help pinpoint where resources are needed and where potential future outbreaks might be.

Aggregated data can generate insight. On its own, contact data can help track the spread of COVID-19. By combining contact and health data, public health experts can gain new knowledge about disease progression while making contact tracing more effective. Temperature tests from Kinsa, a connected-thermometer company, provide fever and location data and are playing a key role in the use of fever tracking as a leading indicator of potential COVID-19 hotspots. Smartphones can provide contact and location data, but if an individual leaves his or her phone at home, car telematics data, CCTVs, and point-of-sales data can take its place. Of the more than 70 smart-city applications we reviewed, almost half involve data aggregation across different sources. (We will explore various models of data sharing and aggregation in a future publication.)

Outside of COVID-19, there is a complex ecosystem of data enterprises that clean, aggregate, and process data, either to pass it on directly or to turn it into insights. For example, IHS Markit collects both public and proprietary data from various sources and transforms it into data products and forecasts.

Data can ultimately find uses very different from the original application. When smartphone manufacturers were adopting Bluetooth technology and Wi-Fi-enabled location tracking, they probably did not have a pandemic in mind. Yet responding to COVID is exactly the use for these tools that many public-health authorities are recommending today. And our study of smart-city applications revealed a multitude of innovative applications enabled by aggregating IoT and other data.

One interesting example is AIR Louisville, a project that uses data from smart inhalers to gauge pollution levels in that Kentucky city. Another example, in the marine industry, is the Automatic Identification System, originally developed more than a decade ago to leverage GPS information to prevent ship collisions. Now it is used in fleet control, search and rescue, commodity tracking, asset protection, insurance underwriting, ocean current measurement, and maritime security, among other purposes. (A future article will examine how IoT data finds alternative uses.)

Risks and Challenges Also Loom Large

The COVID-19 crisis also highlights several risks and challenges associated with IoT data sharing.

It can be difficult to control how data is ultimately used. Contact tracing can help contain the spread of the coronavirus; in fact, it may be our best available tool until a vaccine is developed. But there are complicated and deep ecosystems, such as telematics data markets, that allow location data from navigation devices to pass through multiple entities and into the hands of companies that the original generator—and presumed owner—of the data (such as the smartphone user) never contemplated. These entities use the data for purposes that the data owner never intended, such as marketing, traffic analysis, insurance optimization, and infrastructure monitoring, among other applications. It's not that these uses are necessarily malign, but they are far from the purpose for which the data was originally collected—and far from the purpose that the data owner probably had in mind when he or

she consented to its collection.

Aggregation can make it difficult to fully anonymize data. As has been exhaustively demonstrated, location data is hard to anonymize. Just think about how many people make the exact same daily commute between your home and your workplace every day (in normal times). Exactly one. As "anonymous" data is knitted together with additional data sets, it becomes even more difficult to protect identity and privacy.

An unwillingness to share data will hinder the development of innovative solutions to important challenges. A substantial number of high-value use cases, within a single industry or spanning industries, benefit from network effects—the phenomenon whereby the aggregate value of a network increases with each additional member, or with the creation of mutual and complementary value by two members of a network. Network effects are the basis of an effective contact-tracing system, which won't work if no one agrees (or is required) to be traced. Similarly, as more and more farmers contribute data to a precision agriculture platform, the more valuable the platform becomes to both users and app developers. For network effects to take hold, users must believe that the value to be gained outweighs the risks or downside. Uncertainties over data control and misuse on the part of consumers and corporate managers alike can undermine the growth of network effects.

What's Next?

In the immediate context of COVID-19, enterprises and governments need to find an effective balance between technological capability and the associated privacy risks so that contact tracing can help hasten the return to social and economic normalcy.

Looking past the crisis, it seems clear that for businesses to invent new uses for data and new models for generating value from data sharing, they must address the concerns described above, starting with privacy and security. Part of the solution may lie in new technologies that address privacy permission, validation, and tracing. These might take the form of semantic metadata standards, distributed ledger technologies, data streaming security, or data syndication models.

In addition, we can expect to see new collaboration models that will aggregate data across existing platforms (whether these serve a single industry or multiple industries) in order to create new application marketplaces for data, use cases, and the resulting applications. Smart-city data aggregation platforms are a prime example. New governance and legal frameworks will need to complement these sharing models and technology solutions.

These and other developments were in the works before the pandemic took hold of the global economy. The business shutdown that followed is accelerating the search for solutions. Data and data sharing are at the forefront of the effort. It behooves all of us to make sure that we have the necessary understanding and rules in place as the role of IoT capabilities and data sharing expand during the COVID-19 crisis and thereafter.

About the Authors

Massimo Russo is a managing director and senior partner in the Boston office of Boston Consulting Group. You may contact him by email at russo.massimo@bcg.com.

Tian Feng is a consultant in BCG's Boston office. You may contact her by email at feng.tian@bcg.com.

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