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There's Another Way to Pay for Infrastructure Projects.

Rather than raising taxes, we can finance bridge and road improvements by packaging and selling data on their usage.

It's no secret that the roads, bridges, water and sewer systems that have shaped how our communities developed over the last century are, in too many cases, operating on borrowed time. Infrastructure is — after all — the collective of services that allows a society to function.

In its recently released infrastructure report card, the American Society for Civil Engineers (ASCE) counted more than 45,000 of the nation's bridges as structurally deficient. Despite the poor condition of these overpasses, they carry 178 million trips every day. While our drinking water system has improved in the past few years, there's still a water main break every two minutes somewhere along its 2.2 million miles of pipes. Those are just two examples of the many U.S. infrastructure services that need to be fixed and future-proofed—and urgently.

It's promising to hear that President Joe Biden is prioritizing infrastructure with a multi-trillion-dollar plan. To address the nation's infrastructure needs by 2029, ASCE estimates the infrastructure finance gap between needs and available funding at \$2.68 trillion across the multiple categories defined in the report card. These include surface transportation, water and stormwater, energy, schools, inland waterways and ports, airports, solid waste management, levees and dams, and broadband, to name a few. If we are going to truly tackle the scale and breadth of these challenges, we have to turn to new financing and funding models.

Typically, governments use a combination of public and private financing instruments to pay for major infrastructure projects. The main public financing comes from municipal bonds that are funded by taxpayers or project-specific revenue streams, revolving loans and grants. The rest comes from private financing through public-private partnerships such as toll roads and other user-fee-based arrangements. But neither approach will raise enough money to eliminate our roads' potholes, make all of our bridges safe and deliver clean drinking water that every member of the public can trust. The cost of borrowing enough is simply too high, or politically unpalatable, for cities and towns to collect in taxes. And the options on today's menu of public-private partnerships won't cover it in fees.

There is a better way. Based on my work with financing mechanisms that integrate performance or structural health metrics, there are ways to unlock new revenue streams for projects, tie the cost of borrowing to metrics (which lowers the risk), and decrease the cost of infrastructure operations using smart contracts. These new financing opportunities don't require raising taxes, making it easier for them to garner bipartisan support. We can do it with smart city infrastructure, but replacing existing systems won't be instantaneous. The race is on to define transformative practical applications in road design, solar energy, water distribution systems, solid waste and port management.

Financing With Data

Increasingly, our roads and bridges, drinking water and sewer pipelines, buildings, ports and hospitals are outfitted with sensors and other data collection systems. An urban internet of things is emerging, and its data have the potential to generate an incredible amount of added value. We can harness this technology to deliver insights that will make financing more efficient and to develop the next generation of public-private partnerships.

Sensors can pull data on water flow, traffic congestion, air pollution and more—all of which can be processed to illuminate how to deliver services more efficiently and cost-effectively. The data are attractive to insurance companies because they help to hedge risk, and to investors because the information can give rise to new revenue streams, or create value well beyond the infrastructure itself.

For example, sensors on roads and bridges can monitor deterioration as well as the impacts of trucking. These insights could be used to price a fee structure for logistics companies based on how they reduce lifetime use or maintenance requirements. Models like this are being explored in the Netherlands and Germany. Rather than charge tolls, public agencies in those nations are considering farming out bridge portfolios to asset management companies that are collecting anonymized data on traffic volume, truck weights and structural health. In turn, those companies can sell that data in derivative markets to materials suppliers, insurance companies, marketing firms and hedge fund investors.

In pilots that couple a new financing instrument with sustainability goals, utilities in Washington, D.C., and Atlanta, and Buffalo, New York, have issued “environmental impact bonds” for green stormwater infrastructure. Rather than financing construction of more “gray” pipes at a fixed interest rate, they’ve tied the cost of these bonds to outcomes. Sensors measure stormwater runoff, and the performance of the infrastructure can be quantified and translated into operational savings for the utility. In turn, the utility pays out some of the savings to investors. Because the financial returns are uncorrelated to the broader market, interest from investors in this type of performance bond is ballooning.

The ‘Stock’ of Infrastructure

Indeed, just like data from smartphone apps create value, the data from physical infrastructure will lead to a new marketplace in which public infrastructure is a lot more attractive to private capital than it is right now. Data contracts can be securitized like mortgages, repackaged and resold in various business-to-business data markets.

Not only does data have the potential to add new revenue streams, it also improves the liquidity of investments. Most investments in infrastructure take the form of debt or equity and cannot be easily converted to cash, limiting the type of money that invests in it. Data provides near real time insights into performance, structural health and use, much like share prices update as new information becomes available to inform buyers and sellers. Data represent the informational ‘stock’ of infrastructure, which allows for better pricing of its value and can improve liquidity of investments.

This is good news for cities, counties and states — the public asset owners — and at a difficult time. At the start of the pandemic some city and state budgets faced financial challenges that threatened to further defer the financing of infrastructure and exacerbate existing deficiencies and societal inequities. The federal stimulus relief has helped eased those strains, but many of the areas that were hardest hit by the pandemic have the greatest needs in upgrading infrastructure. Smart financing can serve as an equalizer for high- and low income communities alike.

So instead of merely issuing new debt and raising taxes, let us begin to look beyond the cement,

steel or fiber-optic cables that make up our physical infrastructure to the data it can generate. Let us view data as a new inheritance or windfall that can lift the nation's foundational systems toward a more resilient future.

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Peter Adriaens

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Peter Adriaens is the Director for the Center for Smart Infrastructure Finance and a Professor of engineering, finance and entrepreneurship at the University of Michigan, Ann Arbor.

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