



Digital Business

# The Internet of Us: Why Human Experience Is Vital to Building Useful IoT Applications

Successful industrial IoT solutions incorporate insights into human behavior before building things, thereby reducing adoption risk, improving productivity, compressing development cycles and more quickly realizing looked-for ROI.

## Executive Summary

Has the Internet of Things (IoT) been over-hyped? We don't believe so. But expectations are high, with a trillion connected devices expected to be in use by 2020,<sup>1</sup> and worldwide IoT spending expected to hit a trillion dollars by 2022.<sup>2</sup>

It is true, however, that many businesses and individual buyers do not realize the promised benefits or expected

value of IoT, leading to adoption rates that are lower than expected and reduced return on investment (ROI). The problem is particularly acute when developing IoT solutions for industrial applications (known as the IIoT), for which solutions must be scalable and where near- and long-term ROI are imperative for promoting enterprise adoption.

The crux of the problem, as we see it, is that too many IoT solutions today are being designed without sufficient focus on human experiences. Indeed, IoT will under-deliver if companies do not focus on human-centered design that delivers tangible value to customers, employees, partners and other stakeholders. It is important to move from simply articulating the principle of basing design on human needs to actually practicing that ethic in developing IIoT solutions. To do this requires a formal mechanism for incorporating qualitative insights from people's actual use of products or solutions into design. This is a practical approach that incorporates learning from not just big data, but from so-called "thick data" distilled from observation of actual human behavior. The goal is to develop products, processes and solutions

that create a pervasive and seamless experience which benefits users and drives adoption across the enterprise.

We have worked on a range of projects to help consumer-facing and industrial companies conceive, design and develop human-centered technology and solutions at scale. This white paper examines the art and science of developing IIoT solutions based on insights from human behavior. Our approach helps organizations reduce adoption risk, decrease costly rework, improve productivity and compress development cycles. Successful industrial IoT solutions connect human insight to building things. We call it "putting humans in the loop."



## Insight to things: building solutions for people

IoT is no mirage. Organizations in consumer products,<sup>3</sup> manufacturing,<sup>4</sup> automotive,<sup>5</sup> life sciences<sup>6</sup> and other industries are already generating impressive results.<sup>7</sup> Many of these businesses are exploring how IoT solutions add value, or lower cost, or both. Examples: sensors on packaging machines; hardware engineering and software-in-the-loop; sensor-enabled manufacturing shop floors.

Every business has its own discrete, identifiable value chain. The objective of every process improvement — including the design and implementation of IoT solutions — is to optimize that value chain. In the insurance business, it's underwriting or the claims process. And even in the most highly mechanical and automated processes, at every link — from materials sourcing to manufacturing to sales and shipping and service delivery — there is a human in the loop.

In retail, the value chain consists of employees with hands-on inventory management. In manufacturing, it may be artificial intelligence (AI)-driven shop-floor operations and an automated supply chain. In medical products, it's R&D and product testing — including the compliance track. In delivering healthcare, it may be physicians working with an IoT-enabled CAT scanner or even scalpel.

With virtually all IoT solutions, it's imperative that users adopt and use them easily and comfortably. Humans have a central role in bringing the IoT to life, and this will continue. Successful solution design begins not with technology, but with an understanding of what we humans — as consumers, factory workers, repair agents and much more — want and need. Putting humans in the loop avoids creating technical solutions that people use under a mandate instead of by choice. Moving from human insight to things helps create *the internet of us*.

## The importance of human-centered design

Human experience must be at the core of design — whether for consumer-facing products such as automobiles and kitchen appliances, complex products-as-a-solution such as sensorized medical devices or machinery, or cross-platform industrial IoT applications to serve manufacturing businesses.

It's easy enough to state the challenge. It's easy to assert the importance of ensuring that the human experience of technology is simple to use, enjoyable and rewarding. What is harder, we think — and what we impress upon our clients to prioritize —

is how to develop products in a way that meets this challenge.

It's not enough to simply adopt a charter of design principles, or to express a mission and vision for how humans can be put into the design loop. These steps are important. But the true change that needs to be effected in product and solution development is adopting a tangible, analytical approach to product or solution conception, design and development that is anchored in rigorous research into actual human needs.

## The IoT strategy and advisory roadmap



Figure 1

Figure 1 depicts our roadmap for IoT strategy and advisory services. From the start of the journey and throughout, we help clients embed the principles of human-centered design and research. This methodology connects data science and the human sciences together to inform strategies for launching new product ideas to market that deliver demonstrable value. We begin with uncovering key insights that inform market opportunities. Using the principles of human-centered design, we seek to identify unmet needs and opportunities for your business, and make recommendations to leadership. After an IoT strategy is established, we assess your organization's capacity to succeed and design the technology solution architecture the business needs.

Keeping humans in the loop ensures the relevance and desirability of our business and technological advances. This can happen only by marrying data analysis with the measurable, qualitative insights

derived from social and behavioral research into not only what users say they want but also how they actually use products.

All stakeholders count: Consumers. Factory workers. Repair agents in the field. Customer service representatives. Product inspectors. Machine operators. Insights and learning from all these types of people will help build more useful, accurate and deployable IoT solutions – ones that consumers put at the top of their shopping lists, and ones that can drive business outcomes at scale.

Said differently, people don't want to do work to make products work. Design fails when not informed by how people use products – not just what they say they want or need, but how they actually behave. At a time when digital thinking and technology requires considerable investment, miscalculations are costly. Businesses cannot afford that risk.

# Quick Take

## Sensors Make Sense When Cars Are Built for People

The average automobile today has more than 100 sensors. Half of them monitor engine function and performance; others manage systems from antilock braking to active traction and suspension control to internal air to tire pressure. From the standpoint of safety, reliability and comfort, cars have never been better – and the future only promises more advances.

So why do the majority of features engineered into new automobiles today – for comfort, ease-of-use, navigation and even safety – languish unused after the first few weeks of the car's purchase? People try them, and then turn them off or ignore them. What's missing?

People are missing. Automobiles are designed with features that designers think are attractive and important, but engineers and technologists often develop features and entire products without examining how drivers and passengers actually behave. It's not just cars. Many products brought to market today – from industrial sensors to smart watches to refrigerators and even heavy equipment – incorporate features that owners or operators never use, because they're difficult to adopt, too cumbersome or simply not relevant to users. This has to change.

## The power of human sciences in the age of the algorithm

In today's world of connectivity, with algorithms parsing data from the enterprise network's edge to the cloud, it's easy to lose sight of the crucial method for understanding what customers need and will adopt: watching them and asking them. Learning how they live. Such work must occur before the technology is designed.

Moving from insight to things starts with research on needs/behaviors, followed by use-case development, prototypes and testing in real life. The most successful products are those that slip invisibly into user's lives, meeting needs that may not even be consciously acknowledged.

An example? Consider the challenges of providing care to the elderly.<sup>8</sup> What happens when an aging adult falls in the home, and no one is there to help? What if people who want to live in their own homes wear a sensor that lets caregivers know if they

take an abrupt fall? Or when biometrics signal an increased heart rate, the appearance of biomarkers like adrenaline, spikes in blood sugar or high levels of enzymes that appear only when a patient is stressed?

Sensors that connect to IoT-enabled smart-home devices can send biometric data immediately to an approved caregiver, thus allowing them to deliver suggestions for care directly to emergency medical technicians. Such IoT solutions are now reducing the risk for aging adults with a range of conditions, while improving their quality of life.

This means reframing what the IoT needs to be doing: applying human insights to learn ways to build meaningful products. This approach places product design and development on the road to building *the internet of us*.

## The value equation: sensors + data + AI + people = IIoT Value

Sensors? Yes. Cloud? Of course. Algorithmic processing. Absolutely. Digital connectivity provides more opportunities for intelligent design and engineering than ever. But watching people interact with technology, learning from what they adopt and what they ignore, learning from their behavior — including their mistakes or one's own — is essential to realizing value.

In our work with clients, we complement data analytics with research into human behavior and preferences, learning wants and needs before

engineering our solutions. Such solutions can include:

- **Manufacturing plants:** Connected across a global footprint, today's industrial facilities allow for design and production changes on the fly at multiple facilities as they adjust to rapidly changing customer needs. Information on decision-making extends from the C-suite to the factory floor and to the extended supply chain, combining for a value-add to customers that meets a real need.

# Quick Take

## A Flood of Data Helps Manage Risk

Does anyone think about insurance until they need it? For most insurers, the only way they connect with customers is when they send a bill or receive a claim. People's entire experience of insurers is negative.

IoT solutions offer the opportunity to move from a model of paying on claims to anticipating and preventing them. Consider flood insurance. With a sensor-equipped water detector located next to a basement sump-pump, an insurer can alert home and business owners to conditions that may signal a flood, and help prevent larger claims later. We have designed and built such a solution for a major national insurer.

The key is widespread adoption – which depends on offering a compelling price-point for the detectors and ensuring they are easy to use. (If it takes 10 or more minutes to hook it up, half of the users who pay for the sensor will not connect it.) Incentivizing adoption by featuring lower rates has the additional benefit of giving homeowners a discount.

The IoT offers ways to flip the script for insurers, putting human needs at the forefront in solution design and making real human expectations a driver of innovation. Insurers can shift consumers' perceptions of them from being, at best, an annual cost to being a helpful information service provider that saves money and even improves their lives. Insurers move from being claims-payers to being focused on damage prevention and control. It's a win-win – and represents a huge shift in customer relations.



- I Industrial equipment:** Engineers use submersible pumps attached to subsea pipelines to send real-time reports via the cloud on the volume, density and chemical composition of what they're carrying. Algorithms parse that data, issue alerts and can prompt remedial action when a chemical mix becomes too volatile or environmentally harmful, thus meeting a business and a human need.
- I Energy and utilities:** Nuclear power plants have an exhaustive array of sensors to monitor operations, from the reactor core and control rods to pumps and generators to the lead and concrete skin that contains the reactor. These integrated IoT solutions process copious amounts of data. Computerized control software reacts to changes such as hot spots, pressure drops, and anomalies faster than human operators and mechanical equipment ever could, meeting a business need with enormous implications for people and communities.
- I Public safety:** Emergency management personnel and public safety workers use connected devices that not only allow two-way communication but send digital information during dangerous situations, including live video of events and measures of body temperature, heart rate and stress. During a disaster or when a worker is at risk, help can be routed immediately to the right place, protecting people.
- I Health and human services:** Elderly patients now wear sensorized medical devices so doctors can remotely monitor activity, medication use and vital signs. Physicians have more tools than ever to improve quality of care and quality of life for people with depression, diabetes or other chronic diseases.

These are solutions designed with human needs at the forefront, from conception to realization. Human-centered design marries technology to human insight, not by connecting sensors to the cloud, but by connecting engineering and scientific applications to human behaviors and needs. Connecting data science with behavioral science accelerates the velocity of innovation and increases economic impact.

## Making IoT work

The IoT doesn't quite feel human enough yet, for several reasons:

- I There aren't enough humans in the picture.** The IoT has to work for people. For product designers and developers, the question is not "What can we do?" but "What will work best for people?"
- I Overpromising risks underwhelming results.** Much of the conversation about IoT is driven more by imaginative rhetoric than practical reality. While grand conceptions inspire us, projects must be based on what will provide near- and long-term ROI.
- I Flavor of the day.** Many IT and departmental executives focus on discrete projects so they can point to a successful IoT initiative, rather than focusing on the ways and means of increasing operational efficiency through streamlined processes and cost reduction, delivering on customer and stakeholder needs, and generating new revenues.

# Quick Take

## Cool Savings, Consumer Safety

At home and at work, we're constantly distracted and busy, multitasking as our devices beep, buzz and tingle. The little things escape us. (It's our nature.) For example, when we open the fridge, we often leave doors ajar, and cool air leaks out.

Recently, we worked with one of the world's largest sellers of fresh and frozen foods on a project with tangible human impact. In every country where it operates, our client has distribution centers with massive refrigerator/freezers. Running 24 x 7 x 365, the company meets thousands of orders with hundreds of thousands of deliveries. And every day, many times a day, these refrigerators are left open or even propped open deliberately. Energy costs spike sharply. The risk of associated food spoilage is an estimated \$300,000 per year, and especially increases in warm climates. It's a business imperative to lower costs – and a human imperative to address the risks.

The heart of the challenge isn't technology adoption. It's using technology to change human behavior. Our solution ties together sensors, cloud-based monitoring, algorithms that trigger alerts and warnings, reminders in handheld applications and a direct link of performance data to individual employees to encourage compliance. This covers hundreds of freezers, thousands of deliveries, millions of pounds of food. With the rollout of the new platform to the first 100 stores, the team has reduced service response times from 36 hours to four hours, and can predict refrigeration failures to help decrease food loss by 10% within the first year. The vision is to scale the rollout in 2019 to 5,300 stores with the potential to reduce \$40 million in operating costs and further reduce human risks by ensuring safe storage of food.

The digitization of our economy and our business models requires sound insight into the behavior of humans to ensure solution design fits their needs.

- **The IoT means different things to different people.** Applications for industry have specific objectives; consumer-focused product development has other goals. IoT means different things to its potential users – and the needs and wants of buyers should dictate project scope and product design.
- **The IoT introduces risks.** Ironically, moving toward a connected enterprise engenders unforeseen risk, such as when a loss of information flow across an organization cripples operations. Enterprises must work to connect, but be able to work disconnected.
- **The importance of enchantment.**<sup>9</sup> Along with discovering what people say they need, and testing it to make sure it's right, designers need to watch what people's actions show they need, so people are delighted by what technology helps them do. A small but essential sense of wonder derives from anticipating human needs.

If a business sets out to build a thing, that product or solution had better work for people. And the best time to learn what people need and want is not only to ask what they do, but watch what they do – from conception to development to realization.

## The velocity of innovation

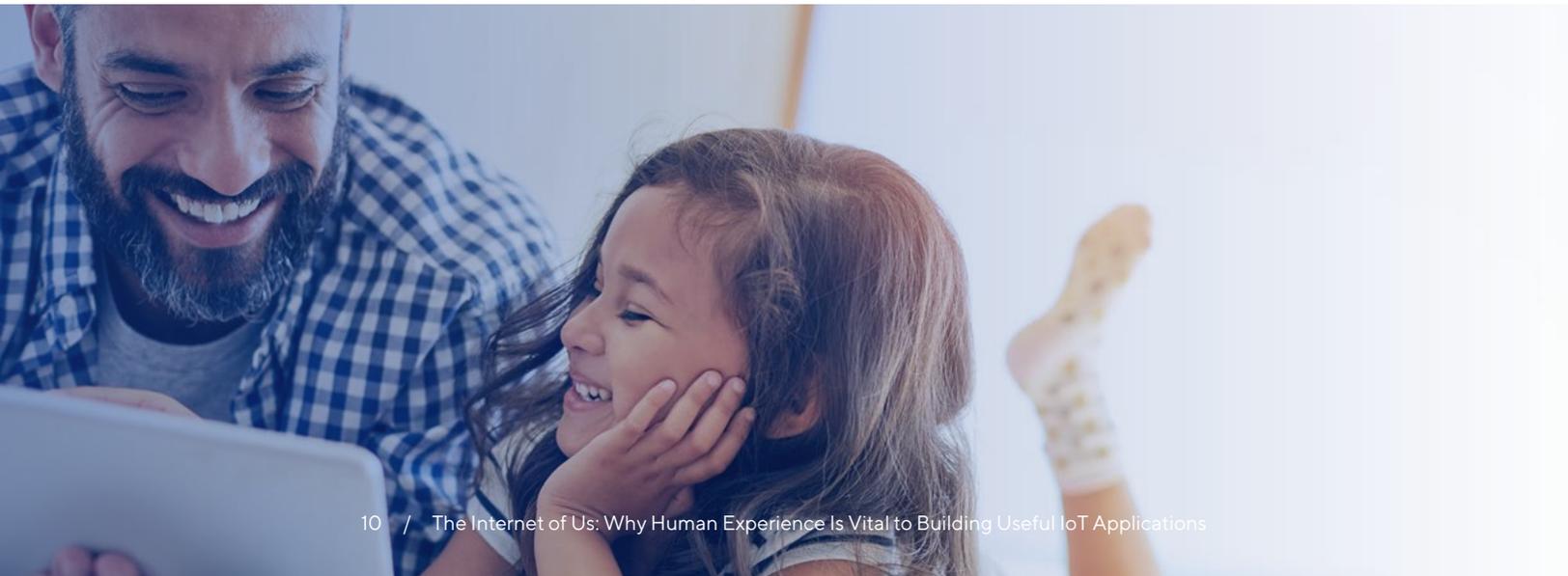
There is a tremendous value proposition when design principles are focused on improving the

human experience. It creates economic benefits: productivity improvements and the ability to command a market, charge premium prices and better retain customers. It also accelerates the velocity of innovation.

Our work touches on the realm of humans as consumers and that of humans as makers – from consumer products to factory shop floors, from complex “smart cities” to autonomous vehicles, from operational equipment in the field to commercial smart-equipped buildings.

The industrial IoT delivers solutions to the world of industrial engineering and manufacturing: shop-floor operations and robotics, inventory management, logistics and supply-chain effectiveness, and more. Its best solutions put real people at the center, applying principles from the human sciences to establish how people think and work, what they say they want, and what their actions show they want and need. Common to both realms is the effort to build actionable intelligence based on data and connectivity.

We're at an exciting, generative time. Eventually, we believe, the boundary between human intelligence and artificial intelligence will break down. We aren't there yet, but the pace is accelerating. And the IoT will be part of that evolution, but we will succeed only if we're focused on developing answers for real human needs.



## Endnotes

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Frank Antonysamy is the Global Leader for Cognizant’s Connected Products Practice, which comprises 3,000 IoT and product engineering professionals. Frank has over 20 years of experience in leading transformational programs for Fortune 500 customers using a global delivery model. He works with companies to help drive the integration of IT and OT systems and deliver powerful synergies between the physical world of machines, industrial operations and factories and the digital world of IoT-enabled platforms, applications and insights. Such synergies help global organizations drive efficiency, enhance safety, improve customer experience, and deliver new business models and revenue streams. Frank has a computer engineering degree from the University of Madras, India. He can be reached at [Frank.Antonysamy@cognizant.com](mailto:Frank.Antonysamy@cognizant.com) | [www.linkedin.com/in/frank-antonysamy-5161a91/](http://www.linkedin.com/in/frank-antonysamy-5161a91/).

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## About Cognizant Digital Business | Connected Products

Cognizant Digital Business helps our clients envision and build human-centric digital solutions – fusing strategy, intelligence, experience and software to drive industry-aligned transformative growth. As emerging technologies like IoT extend across the enterprise, factories, supply chains and beyond – as well as become more pervasive throughout our everyday lives at home, school and work – clients across industries are seeking Cognizant’s expertise to advance and implement their IoT strategies. IoT, combined with applied analytics and intelligence, is helping them deliver greater business performance, products and service offerings – all leading to superior customer experiences. To learn more, please visit [www.cognizant.com/iot](http://www.cognizant.com/iot) or join the conversation on [LinkedIn](#).

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## About Cognizant

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