When IoT meets AI

Building AI capabilities is helping companies extract value from their IoT data

The Internet of Things (IoT) enables businesses to remotely perceive the state of products and equipment and, by extension, their environment. But as with any source of information, the value businesses can extract from this new field of perception depends on how they use it.

The first step for many firms is simply monitoring equipment to identify performance issues instantly, but this is just the beginning. "The data that IoT gives you can only provide so much value on its own," explains Regu Ayyaswamy, global head of IoT and engineering services at Tata Consultancy Services (TCS).

The next step is to use this data to predict operational issues and take precautionary action. In this, he says, artificial intelligence (AI) plays a crucial role. More specifically, recent advances in machine learning allow systems to learn what normal operations or customer behaviour looks like, automatically identify anomalies and, eventually, predict outages or other issues. "Prediction is where the true value of IoT data comes from, and AI is what delivers that," Mr Ayyaswamy explains.

This symbiosis of AI and IoT is evident in the IoT Business Index 2020 executive survey. Just over a quarter of respondents (26%) describe IoT data as "pivotal" to their organisation's current or planned use of AI, and a further 56% describe them as one of many important sources.

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Respondents from the manufacturing and facilities management industries are the most likely to describe IoT data as "pivotal" to their AI initiatives (both 35%), as do more than half of respondents whose companies have reached "extensive" IoT implementation (53%—see figure 1). Similarly, almost two-thirds (64%) of all respondents agree that the value of their IoT data has increased as their AI capabilities have advanced (25% strongly, 39% somewhat)

To capitalise on the IoT, this suggests, companies must develop AI capabilities too. The experience of firms who have successfully done so suggests that it requires new practices, new roles and, perhaps, structural transformation.
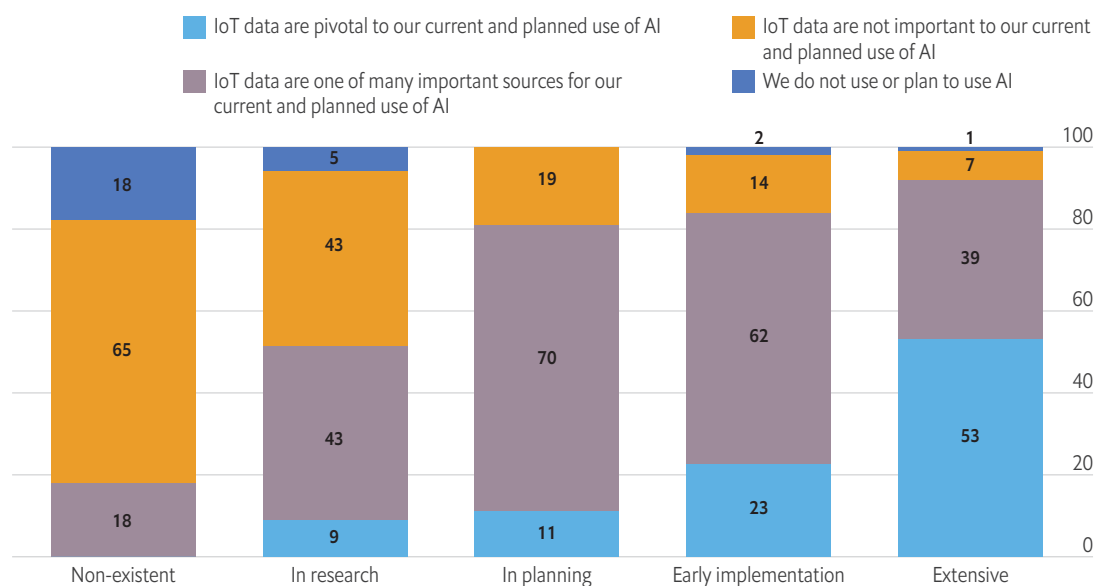
AI near and far

AI is central to the value proposition of AquaSeca, a water infrastructure management start-up based in San Francisco. It applies acoustic sensors to its customers' plumbing and "listens" for evidence of leaks or other disruptions—a process underpinned by machine learning.

The company is building a suite of machine learning algorithms that can decipher the data its sensors produce and identify anomalous activity. When the company adds a new customer, they undergo a training phase in which AquaSeca's system learns the particular acoustic conditions of their plumbing. However, as the company accumulates more

Figure 1. AI and IoT adoption
Importance of IoT data to AI initiatives by most advanced stage of IoT adoption
(% of respondents)

Source: The Economist Intelligence Unit.

training data, CEO Nancy Hartsoch expects this process to become redundant. "Once we have thousands of installations in our database, then we probably won't need to train the system to understand a new office building, for example."

As that database grows, AquaSeca also intends to move from descriptive analytics to prediction: "We've found patterns in the data that allow you to identify events before they have a knock-on effect."
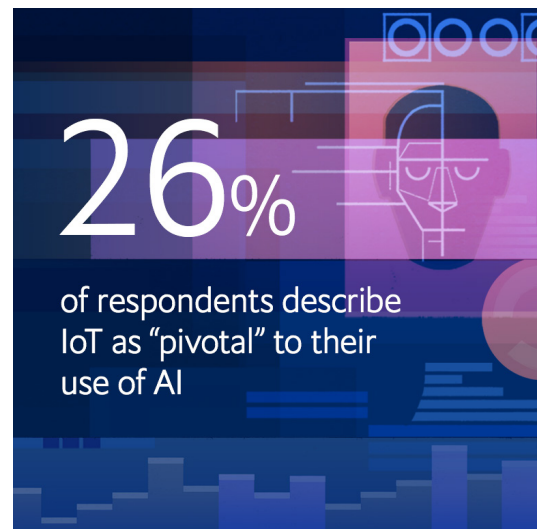
Currently, much of the intelligence in AquaSeca's system is administered in the cloud: sensors return salient data to the company's servers to be processed centrally. However, the company aims to move as much intelligence as possible into the sensors themselves. This reduces the amount of data that needs to be transmitted wirelessly and, therefore, the power requirements of the sensors.

"We're currently using endpoint AI to wake the sensors and compress the relevant data for transmission," Ms Hartsoch explains. "As we move forward, we'll push more of what's happening in the cloud into the sensors so we don't have to move as much data."

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Roles and responsibilities

To operate this apparatus of pipes, sensors and machine learning algorithms, AquaSeca employs not only data scientists, whose job is to analyse the data, but also data engineers, who are responsible for the data pipeline from the sensors to the cloud through to the customer-facing dashboards. Crucially, both teams work in collaboration with the company's "aquatic" engineers to understand the significance of critical events and their acoustic fingerprints.

This combination of domain expertise with data science know-how is key to integrating AI and IoT. One reason is that, unlike in machine learning applications such as language processing or facial recognition, training data for business and industrial applications are hard to come by. There are few, if any, well-labelled, open-source datasets describing outages to electrical equipment, for example.

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That means companies must integrate their human expertise into the AI development process. "To build a prediction model for industrial equipment, you need to understand the physics of the equipment," explains TCS's Mr Ayyaswamy. "To construct our prediction models, we normally put a data-science engineer who knows the algorithms and machine learning together in a room with a domain expert who knows the physics. That is how you create true value."

Meanwhile, integrating AI capabilities into connected products may require even greater structural changes. TCL is a Chinese electronics firm that has traditionally manufactured products such as phones, TVs and domestic appliances for other brand names. Recently, though, it launched its first TCL-branded smartphone, which it intends to be the lynchpin of a suite of smart-home devices.

The company views AI as a crucial differentiator in the highly competitive consumer electronics market. "TCL has a strategy called 'AI x IoT'," explains global head of marketing Stefan Streit. "We believe every product should have some level of smartness in it, so we are building AI into everything." This ranges from improving the performance of smartphone cameras to boosting the resolution of displays.

In order to pursue this strategy, the company has undergone a substantial reorganisation, Mr Streit explains. "In the past, TCL was organised into product-focused business units, and we used to have product-focused chief technology officers (CTOs) who were focused on engineering and manufacturing."

"Now we've created one legal entity for all products, and we have one CTO whose job it is to create an ecosystem of technology. We have nine research and development

facilities around the world that specialise in, for example, voice or display. This means we can take learnings from one product division and bring them into other categories."

This new structure allows AI insights and capabilities to be shared across product lines quickly and easily. Lessons learned in the fast-moving mobile category, for example, can be shared with the relatively sedate washing machine business to capture competitive advantage.

Business leaders who aim to draw on the combination of AI and IoT must be mindful, not only of the technical skills and capabilities required but also how those capabilities are managed and organised, as this will determine the value they create.

About this article

This article accompanies The IoT Business Index 2020: a step change in adoption, the latest edition of The Economist Intelligence Unit's ongoing study of the IoT and its use by businesses. The study, sponsored by Arm, is based on a global, cross-industry survey of 825 business executives conducted in October 2019.

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