

THE ERA OF INDUSTRIAL DIGITAL TRANSFORMATION

USING EDGE-FOG COMPUTING AND BIG DATA ANALYTICS TO HARMONIZE IIOT DATA



Amar Senan

amar.senan@woodsidecap.com

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Executive Summary

Digital transformation and disruption have rapidly become part of everyday life. Companies such as Uber, Airbnb, Skype, WeChat, WhatsApp, Amazon, Alibaba, Facebook and Netflix have used digital technologies to develop innovative business models that have created great wealth for their shareholders and inflicted pain on industry incumbents.

There is another digital transformation underway mostly out of view, but which promises to more radically change industries and even national economies. It has led to heated debates on industrial policy, threats of trade wars, and increased geo-political tensions, particularly between the USA and China.

This industrial digital transformation, which will upend how industries and enterprises produce and deliver “goods”, goes by many names including the *Fourth Industrial Revolution*, *Industrial Internet (GE)*, *Industry 4.0 (Germany)*, *Industrial Value Chain Initiative (Japan)* and *Made in China 2025*. Essentially all these concepts leverage software, cloud computing, artificial intelligence, big data, the internet of things and other emerging technologies to create cyber-physical systems to promote innovation, improve efficiencies and optimize costs.

In the United States, the Trump administration, in addition to enacting trade tariffs, has strengthened rules that govern the acquisition and investment in American companies by foreign entities. Under the revised Committee on Foreign Investment in the United States (CFIUS) rules, this body will now be required to review a wider array of deals beyond its historical remit, and address evolving national security risks around foreign entity investments in critical infrastructure and access to a broad range of critical technologies (e.g. quantum computing, artificial intelligence, encryption) and sensitive information (e.g. personal and health data of U.S citizens).

In our prior industry report, *“The Internet of Things: Smart Products Demand a Smart Strategy. Using M&A for a Competitive Edge”*, we analyzed the vast landscape being touched by IoT and the activities by many industry players. Since then, IoT technology has matured with the focus

shifting away from things and connectivity to data and analytics.

In this report we look mainly at the Industrial Internet of Things, which is the use of IoT technologies to enhance industrial, manufacturing and production processes. We examine IIoT from a data perspective and the various innovations required to translate this data into useful forms suitable to drive industrial digital transformation. Much of the innovation centers around software-based approaches.

We note that the sheer volume of Big Data generated by IIoT systems and the need for real-time actions have exposed the limitations of central cloud computing models. Alternate models based on Edge-Fog computing have emerged to address these limitations, but these have introduced additional complications.

The billion-dollar markets for Industry 4.0 technologies and IIoT solutions have seen large infusions of venture capital into startups. While the early IoT investments were into companies focused on consumer, wearable and smart home solutions, the investment trend has strongly shifted to investments in startups that offer *industrial-grade IoT solutions* that serve producers of goods and services in both industrial and commercial markets. We investigated many such companies and have profiled more than one hundred startups with innovative solutions in the appendix to this report.

Industrial digital transformation is complicated. Just ask GE, the once mighty industrial conglomerate that was synonymous with American innovation.

GE has been trying to transform itself into a “digital industrial company” with the goal of becoming a top 10 software provider by 2020. The company also spent billions on developing Predix, its industrial cloud and applications platform. Jeff Immelt, the CEO, promoted the company as a 124-year-old startup poised to transform itself and the industry. The Bloomberg Businessweek of March 17, 2016 headline posited that *“A decade after taking over, Jeff Immelt’s long bet on the Internet of Really Big Things seems to be paying off”*.

However, things have not worked out as planned. GE is on its third CEO in three years. The company's stock market capitalization has fallen to \$107 billion today from a peak of \$600 billion in August 2000. (In startup parlance, this would be a "re-cap" or a down round). And, the Wall Street Journal reported in July 2018 that GE is looking to sell parts of its digital business including Predix. Bloomberg Businessweek's headline of February 1, 2018 now scathingly reads as *"How GE went from American Icon to Astonishing Mess"*.

Perhaps Tom Siebel, CEO of C3 IoT, was prescient when he said, "GE is trying to do this the way a big company does, by throwing thousands of people and billions of dollars at it. But they are not software people." (Siebel Systems, his prior software company was sold to Oracle Systems for \$5.85 billion in July 2006).

GE's problems should serve as a warning for other industrial equipment manufacturers who want to undertake software-heavy digital transformation and explore new business models. They may not have the nimbleness of startups, nor the IT savvy of the industry's leading cloud, networking and software vendors, to pull-off this transformation while also supporting large existing businesses.

Many IT vendors have identified the industrial space as key new markets where they can leverage their cloud, networking and software skills to facilitate the IT-OT integration underway. But, we do not think it will be a smooth passage for newer entrants from the IT worlds either. What the GE's and other industrial OEMs may lack in nimbleness and software expertise, they make up with long-standing relationships with industrial customers, coupled with a history of supplying equipment that operate with five-nines reliability.

We expect to see a wave of mergers, acquisitions and divestitures in the coming years as industry players try to solve the *Edge-Fog-Big Data-Analytics* conundrum and jockey for market share. Venture capital investments into the space remain healthy and our discussions with entrepreneurs, investors and industry experts seem to indicate that the sector will continue to attract attention and investment.

To discuss your investment banking needs and to obtain the 129-page report, please contact the author at:

Amar Senan,
Managing Director
amar.senan@woodsidecap.com
+1 650 656 3374

Amar Senan leads the IoT-IIoT-Industry 4.0 (Software and Cybersecurity) investment banking practice at WCP.

He is a software engineer turned investment banker with experience on Wall Street and a successful track record of advising CEOs and boards of technology companies in sectors such as cloud computing, infrastructure software and cybersecurity on strategy, capital raising, IPOs, and mergers & acquisitions.

Amar also has operating experience at executive level in business-corporate development, marketing and finance at public and venture-funded Silicon Valley companies.

He has engineering degrees: BEng (*Electrical*) and MEng (*Systems*) from RMIT; a BSc in Economics (*Trade, Industrial Policy & Banking*) from the University of London; and a Masters (*International Business*) from the University of Glasgow, Scotland.

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