Industry 4.0 – Embracing Technology for Asset Performance Certainty

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Introduction

The fourth industrial revolution is underway and like every new iteration born out of the technology sector it has been given the future forward moniker of Industry 4.0. The impact from this industrial revolution could be greater than the combined impact of the previous three revolutions, which is a strong claim when you consider the productive might generated from the previous three:



Figure 1

Image sourced from Industry 4.0 by Br.iq

The component parts that are coming together at this moment in time are the keys to understanding why this new evolution of industry could be larger than all previous evolutions. One can imagine a world where these component parts are fully installed and optimally operating. What are the innovations that are creating such optimism around the potential of Industry 4.0?

Big Data	Internet of Things	Blockchain	Machine Learning & Artificial Intelligence (ML/AI)
Massive compilations of previously disconnected or siloed data coming together to fuel insight and innovation. Collection and storage technology have made big data possible.	Every device connected to the internet thereby providing data and information about our physical world that was previously unattainable. The nerves that make the physical world aware.	Technological innovation that allows for storage, structuring and security of all collected data. Certainty around data quality and ease of access to data to drive insights and innovation.	The effective brain of Industry 4.0 that combines its ability to learn and its ability to process massive amounts of data into better decisions leading to greater productivity and lower risk.

The Foundation – Moore's Law Going Vertical

Moore's law indicates the number of transistors that can fit onto a microprocessor will double every two years. This law has continued to hold true for the past 50 years and without this exponential progression in computing power, many of the technologies fueling Industry 4.0 would not exist. As is the case with any exponential progression, Moore's law is going vertical, which has resulted in a previously unimaginable scaling of technological innovation – thus representing the foundation which is fueling the optimistic impact of Industry 4.0

Table 1

One can begin to imagine how these component parts of Industry 4.0 will come together to create an environment where risk is significantly reduced, and productivity is significantly improved. To imagine the future world, take a step back and look at how humans manage their productivity and risk.

Humans manage risk and ensure productivity is optimized by utilizing their senses. Threats to well-being are seen, heard, tasted, smelled and felt. Likewise, the ability to improve productive potential is driven from the combination of these senses coming together to optimize the output of efforts.

Building on the human senses analogy, how do humans manage the risks faced by the physical world (or built world assets)? In the past, they would use these same senses when determining the condition of physical and natural assets around them. Effectively, human beings managed the assets of the world through their senses.

The physical (and natural) assets of the world have relied upon inspections by human beings to ensure the optimization of their productivity and risk reduction potential. Such an inspection framework is not ideal as there are not enough human beings to properly assess the condition of physical world assets and humans can make mistakes when assessing an asset's condition.

Given the component parts of Industry 4.0, outlined above, imagine how assets will be managed in their future state.

How Will Asset Be Managed in the future?



Asset awareness through IoT

Figure 2

IoT devices will provide sensory data from the asset in real-time thereby bringing the asset to an aware state. This would be like having hundreds of highly reliable humans monitoring all dimensions of the asset 24 hours a day; 7 days a week. Until now such monitoring was previously unattainable due to logistics and costs. But the potential of Industry 4.0 technology doesn't stop there. All these IoT devices provide a powerful repository of data that can be combined with other data sources to create a truly efficient state for the asset: a state where the asset is aware not only in real-time but aware of its potential future state.

Components of Asset Awareness



Figure 3

The key component parts of Industry 4.0 come together to provide full transparency into the asset's current state and real-time awareness to minimize event impact. Industry 4.0 promises to even provide predictive awareness through the harnessing of machine learning/artificial intelligence algorithms that sift through mounds of data looking for learned data signatures that predict future risk events.

By combining these key components of Industry 4.0, governments, corporations and citizens should realize a significant reduction in the total cost of owning assets. Aware assets will have a greater likelihood of being completed on-time and on-budget, delivered defect free, and, perhaps most importantly, remaining operational throughout their extended life – in other words, minimal unplanned downtime. Combining the potential of asset certainty in the future state with an estimate of the total cost of asset ownership within the economy truly demonstrates why some believe that Industry 4.0 will have a greater impact on the global economy than the previous three industrial revolutions.

The total cost of ownership for an asset must factor in the cost of design, construction, operations, human capital, and societal costs. The operational costs, human capital costs and societal costs are those incurred over the entire life of the asset and thus should be considered in present value. For typical assets, the design is approximately 10% of the construction costs, and the construction costs are approximately 15% of the operational costs. Further, the human capital costs are approximately double the operational costs. Currently, according to Arcadis, the total inventory of built world assets globally is over \$220 trillion. Based on this measure, the total cost of ownership for design, construction, operations and human capital is as follows:

Design & Construction	\$220 Trillion ¹ (4.67% of total cost of ownership) ²
• Operations	\$1.5 Quadrillion (6.67 times design & construction)
Human Capital	\$3 Quadrillion (2 times operations)
• TOTAL	\$4.72 Quadrillion

The total cost of ownership of the current inventory of physical assets is a staggering \$4.72 quadrillion! The above calculation does not consider the societal costs of the asset. These costs can be equally staggering, which include things like lost productivity from being stuck on a subway, health impacts of a chemical leak on local population, impact of the asset on the environment. Given that the cost to the economy numbers in the quadrillions and given the potential impact on these costs from Industry 4.0 technologies, one can begin to understand why some believe this industrial revolution could be far more significant than the previous three. A technological revolution in the way we design, construct and operate assets couldn't have come at a better moment in our history given the many issues facing the global economy. Productivity and risk will be significantly impacted by the convergence of these technologies. The speed and transparency of data available to asset owners will increase the certainty around total cost of ownership and performance potential. Both combined have the potential to leave a lasting positive impact on the global economy.

¹ This cost may include the cost of underlying real estate in addition to the actual cost of design and construction

² The design and construction costs make up less than 5% of the total cost of ownership of the asset - consideration should be given to investing more in this phase to create far greater savings in post construction costs - it is easier to integrate technology in the early stage of the asset's life.

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