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Digital twins for business operations

The application of the digital twin to finance, HR, and supply chain, and its implications for business operations.

A point of view by **Lee Beardmore**,

Vice President and Chief Innovation Officer,
Capgemini's Business Services

Introduction

Necessity is often said to be the mother of invention, and the story of Apollo 13 in 1970 is a prime case in point. Watch Ron Howard's film of the accident, and you'll see.

After lift-off, an oxygen tank explodes in the side of the spacecraft, depleting not just its oxygen supply, but its power. The ground crew issue guidelines to the astronauts, but those instructions prove to be irrelevant, because they bear no relation to the real-world circumstances.

At the Mission Control Center in Houston, a fellow astronaut realizes the problem, and organizes a team to replicate as exactly as possible the conditions being experienced out in space. They equip their own version of the spacecraft modules only with the tools and materials available to the Apollo 13 crew. Between them, they develop a new understanding of the issues, and find ways round problems that aren't in the manual.

The ground-based Apollo 13 replica was effectively a physical twin of the active spacecraft, enabling experimentation in a safe, offline environment – and now, almost 50 years later, we're increasingly seeing the development of non-physical, digital twins for the same purpose.

Digital twins are quickly becoming established in IoT heavy domains. In manufacturing, for example, they enable planners to gauge the effect of changes in production runs before taking them live on the factory floor. Digital twins can be used to avoid bottlenecks through problem prediction, increasing efficiency, and reducing downtime.

What is perhaps less obvious are the potential benefits digital twins can bring to the information processing domains of finance and accounting (F&A), human resources (HR), and supply chain management (SCM). In this realm, the data-heavy process itself is the asset – in effect, it's a production line for processing data.

And, of course, as we enter the AI-infused era, digital twins provide a playground for human and artificial intelligence (AI) minds to meet, pulling in the data needed to train AI models. When fully harmonised with the physical world, the impact will be ground breaking.

We have already explored this topic in Capgemini's ***TechnoVision*** as a fundamental building block called "***Twin Worlds***." In this paper, I will build on some of these ideas and add a perspective on what can be addressed, and what we can expect to achieve.

> *"Digital twin refers to a digital replica of potential and actual physical assets, processes, people, places, systems, and devices that can be used for a variety of purposes."*
>
> **Lee Beardmore**
> *Vice President and Chief Innovation Officer, Capgemini's Business Services*

The virtuous circle

Part of the usefulness of a digital twin lies in its capacity to be modeled on reality but developed in isolation from the real world until it approaches the best possible performance in its current and anticipated circumstances. It starts as a replica of the real thing, with all the compromises that may entail, and evolves towards the ideal.

It's therefore a good idea to have a sense at the outset of what that ideal may be. Over the years, Capgemini has built a comprehensive corpus covering finance, HR, and supply chain operations. This involves developing a deep understanding of a business's key drivers, the minutiae of individual business processes, and the tools and resources, human and otherwise, employed to pursue them. It is this unique collection of assets that underpins our ***Digital Global Enterprise Model*** (D-GEM) – Capgemini's architecture to capture the metadata and parameters necessary to build a comprehensive model – and gives us a head start understanding the ideal.

By considering all these factors, the metadata of the organization and its activities, people, and systems can be gathered and shaped to help define a model.

With the ideal in place, organizations can start to map out the current real-world practices against which they will be measuring and testing.

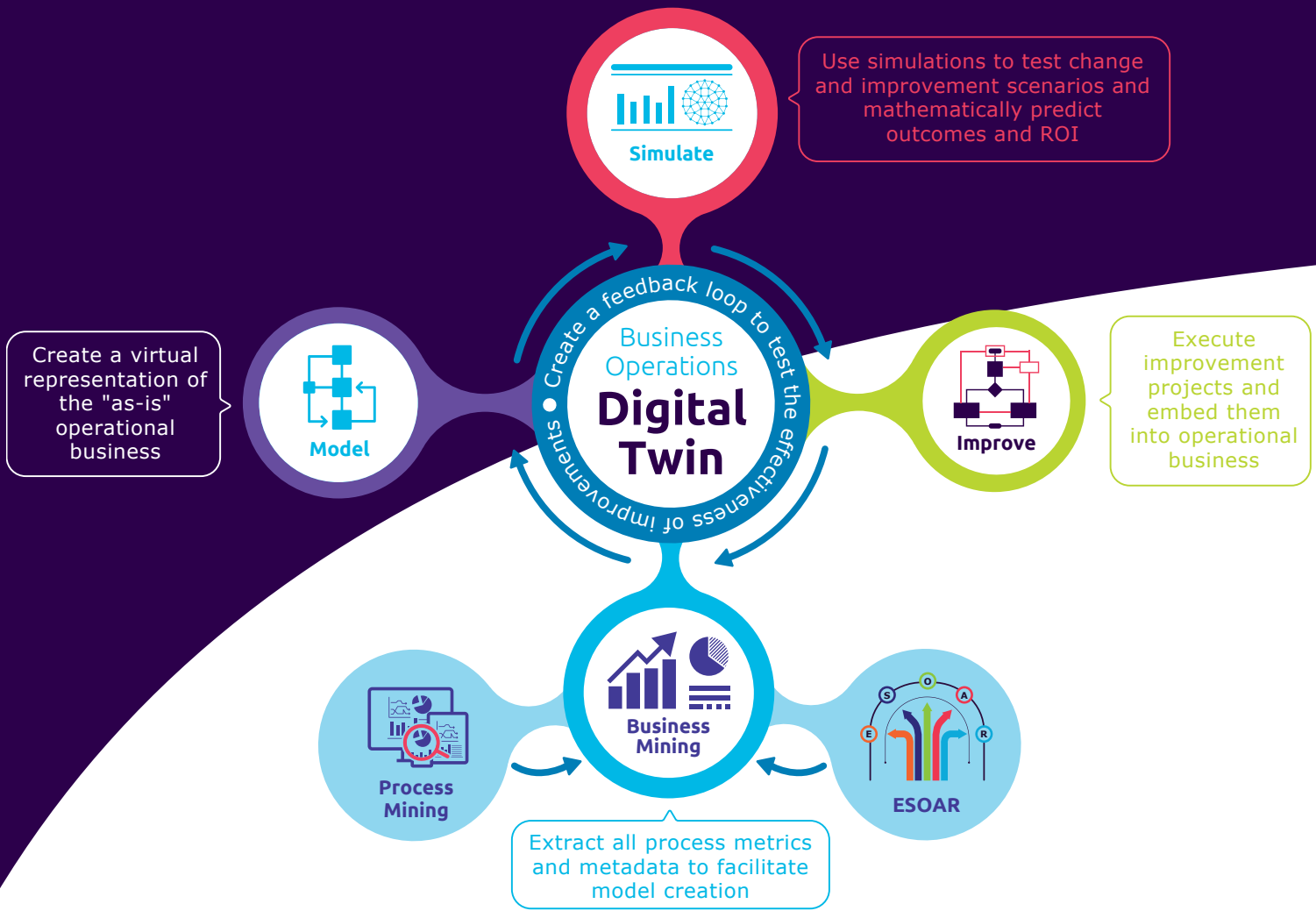

Figure 1. The virtuous circle of the digital twin

Look at the diagram in Figure 1. The process begins on the left with business mining. Business mining incorporates technology (process mining and system monitoring) and digitally assisted consulting that helps organizations execute Capgemini's ESOAR methodology (Eliminate, Standardize, Optimize, Automate, Robotize – see Figure 2).

The technology provides the "as-is" evidence – what's actually taking place in the systems as they operate today. But that's only part of the story. The technology helps to visualize what's going on, but doesn't explain why things are the way they are. The organization has to tap into people's personal experiences to create a sense of why processes are structured the way they are.

This provides a clear and full perspective on how things are operating, which is used to generate the model of the digital twin.

Armed with all the details, characteristics, financials, and metadata of "as-is" processes, organizations can create a model of what's happening today – that is, the digital twin. They can then use this model as a test-bed for simulating any number of scenarios, exploring hypotheses and opportunities for change.

These insights will enable organizations to work out what's best for the current situation – including budgets, the appetite for change, the speed of response required, and more – and then execute the improvements, before starting the cycle over again. In essence, it drives a virtuous circle.

The technical backbone of the digital twin receives data feeds and orchestrates the business mining, modeling, and simulations. It embeds and supports the industrialized application of ESOAR. In combination, this reveals the DNA of the organization and enables it to work pathways for accelerated evolution.

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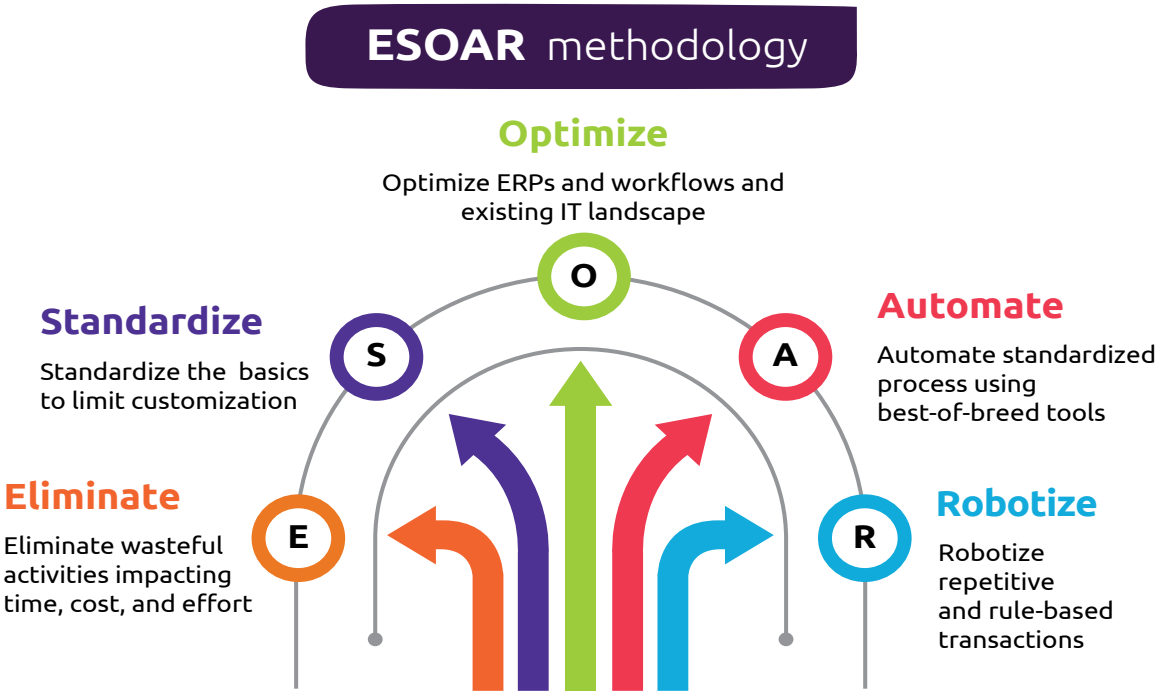
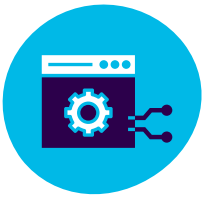


Figure 2. Capgemini's ESOAR methodology



Testing the limits

Digital twins can be put to work in a number of ways. The most obvious is the way I've just described – a cyclical sequence of steady, incremental improvement that drives our virtuous circle. But there are other options, and one of them is extreme.

One of the great advantages of the digital twin is that, although based on reality, the simulations can test changes to the "as is" situation without actually changing it, giving a virtual view of reality that doesn't impact operations. Changes or additions made to the model are localized. Scenarios can be tested to your heart's content.

This is why a digital twin gives organizations the option of taking things to the max. Businesses can simulate radical changes to operations to see what happens, in a way no one would dare attempt in real life. For example, suppose you want to test large-scale relocation of work between countries and then introduce radical process changes to make best use of productivity-enhancing AI and automation solutions. How could you make that work?

Or suppose a government imposes temporary but harsh import tariffs on a country that brings together sub-assemblies for completion and shipment as finished products? What does this do to your costs and time-to-delivery, what are your other production options, and what regulatory issues will need to be addressed if you manufacture elsewhere?

In these and other such cases, the digital twin can help you make the most of a best-case scenario and mitigate against worst-case outcomes.

Will it or won't it?

While the cyclical approach aims to achieve steady improvement in a stable environment and the extreme approach addresses cases of unlikely triumphs and disasters, a third application provides a means of developing an appropriate reaction to possible or even probable scenarios before they happen.

These might include a shift in balance of one's business objectives, such as new emphasis on a specific growth sector; a change in corporate strategy, such as an increased commitment to reduction in use of fossil fuels; or an external change such as the operating climate if a new market entrant's growth path continues for the next three years. In all these cases, the digital twin can be used on a "what-if" basis to find the most promising course of action, not just in production terms, but in the way F&A, HR, and the supply chain address the situation. The response that emerges will form part of the organization's digital transformation that bridges the front and back offices, creating a unified business operation.

There is another factor here. We are going through an AI-infused revolution, and the digital twin is part of it. Machine learning (ML) – a subset of AI – is applied to the mining data received from the company's systems. While the mining delivers information on where the bottlenecks are, ML makes predictions for key metrics and service level agreements (SLA) that will improve over time. In this way, organizations can gain foresight over business operations, enabling considered and prepared responses.

When the digital twin is leveraged to simulate changes, organizations will be able to model the impact of AI on the business. Often radical process change is required to get the best out of the new wave of intelligent automation and AI solutions. (Indeed, we've written another white paper on that very topic. Read Taoufik Amri's paper on "***Towards operational excellence through orchestrating machines and humans with AI***") Simulating the impact gives more weight to such approaches.

Navigate the future

The implications for organizations extend beyond simple process improvement. The visibility afforded by the digital twin enables the organization to look at aspects of itself in a number of completely new ways that come with some exciting prospects:

- A continuous data stream that enables the organization to maintain its digital twin in perfect synchronicity with its business operations
- More advanced monitoring that enables the organization to improve compliance and isolate key data to support root cause analysis
- A world of prediction that helps the organization reinvent its digital operations
- An active feedback loop between strategy and execution that brings new evidence to performance management
- A means to test and evaluate change scenarios that enliven a continual cycle of improvement
- Combining digital twins to provide divisional and enterprise-level modeling for enhanced visibility of business operations across the organization
- Predictions of business-impacting events – both positive and negative – that can lead to less reactive management of SLAs
- Creation of an AI playground by collecting training data used to seed any number of AI algorithms.

Several significant changes may emerge from the concept of the digital twin. It is already transforming the efficiency of current business processes – but, in time, it can also become a full-scale, next-generation command center for the enterprise.

It can, indeed, change the way business is done, enabling current models to adapt to changing circumstances, benefiting organizations, their suppliers, and their customers alike.

Apollo 13 had a happy ending – the space crew all returned safely to Earth. I fully anticipate the story of digital twins will also be a happy one – but here, there won't be a splashdown. The journey is just beginning.

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Lee Beardmore
Vice President and Chief Innovation Officer, Capgemini's Business Services

About the author

Lee Beardmore has spent over two decades advising clients on best strategies for technology adoption. More recently, he has been leading the push in AI and intelligent automation for Capgemini's Business Services. Lee is a computer scientist by education, a technologist at heart, and has a wealth of cross-industry experience.

Connect with us:

@CapgeminiBusSvc

www.linkedin.com/company/bpo-thought-process

businessservices.global@capgemini.com

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