



Digital twins: driving business model innovation

For B2B firms struggling to reap the rewards of digitalisation, could digital twins be the way forward? Dr Erika Pärn explores the relationship between this emerging technology and business model innovation.

For many engineering and manufacturing firms, digital transformation remains elusive as they struggle to emulate the success of platform-based consumer businesses such as Uber, AirBnB and Facebook. While new technologies are undoubtedly delivering important efficiency gains, full-on digital revolution has proved more difficult to achieve in the B2B world.

Could digital twins be the way forward? As well as connecting the physical with the digital, like B2C platforms they also connect individuals and organisations. As such, they may be the enablers of disruption and business model innovation that the B2B world has been waiting for.

To explore this hypothesis we are working with colleagues at TU Dortmund and the Fraunhofer Institute for Software and Systems Engineering in Dortmund, Germany. Our goal is to develop a framework that will help firms understand both the opportunities digital twins can offer and how well placed they are to capitalise on those opportunities through a digital twin business model taxonomy.

As is the case with other digital technologies, the benefits of digital twins have to date largely been derived from increased efficiencies: improving performance, speeding up processes, predicting and pre-empting maintenance issues, quality control and cutting costs.

The cost savings alone are likely to be impressive. According to Gartner, by 2022 digital twins will be saving consumers and businesses \$1 trillion a year in asset maintenance. Which makes it not surprising that Gartner is also predicting their widespread adoption, with half of major enterprises expected to be using digital twins by 2023.

Our contention is that if businesses are to derive maximum value from digital twins, they need to think more creatively about how they can support new value

propositions. We are starting to see this happening. In 2020, for example, Rolls-Royce partnered with a start-up to create digital twins of its power systems to provide real-time insights that cross customer, supplier and partner boundaries. This is not just about increasing efficiencies – it's platform-based business model thinking.

Digital twins and business model innovation in aviation, automotive and construction

In commercial aviation, digital twins have to date mainly been used to support maintenance and fleet management. However, twins of both aircraft and airport could provide new services such as the connected tracking of luggage or personalised cabin control.

In automotive, Tesla is using the technology to deliver a new kind of service. Every one of its vehicles is in constant touch with the Tesla 'mothership', continuously transmitting performance data and receiving, in return, software patches and upgrades.

We are likely to see this kind of approach expand so that, for example, drivers' interests and locations are matched with relevant service providers. As you arrive in a new city, for example, you might be told, depending on your profile, what's on at the cinema, where you can go for a swim or find the best sushi.

As autonomous vehicles become more of a reality, we can see a completely new business model in which a car becomes a channel through which to sell other services. In each of these scenarios, it is a digital twin that connects the customer with the service provider.

Digital twins are also starting to have an impact in the construction sector. Software providers such as Autodesk have platforms based on digital twins which are allowing new business models

to emerge particularly around 3D design and construction services. As a result, we are starting to see a proliferation of start-ups offering new web-based tools and services.

However, where the aviation and automotive sectors are making good progress with digital twins, the construction industry faces more obstacles. It takes a relatively long time to build a building, the supply chains are long and include lots of small and micro-businesses that are not in a position to adopt new technologies. Buildings also need to last a long time - decades, if not centuries - making lifecycle maintenance both critical and challenging.

External forces are, however, beginning to drive change, whether it's governments mandating the sector to digitalise, building new hospitals at pace in Wuhan, responding to disasters such as Grenfell Tower or supporting commitments to carbon reduction.

In all three sectors, then, we are starting to see some examples of how digital twins are – or may - drive business model innovation, moving beyond delivering operational efficiencies to providing completely new products or services.

Understanding the direction of change

To help us think about how digital twins can enable business model innovation, we have identified three pathways to change.

1. From dependency to autonomy

The inexorable drive towards autonomy is emerging in many engineering in fields from automotive, aviation to manufacturing. One important feature of digital twins is their ability to understand, learn and react autonomously.

Autonomous decision making is seen as the pinnacle of value emanating from digital twins.

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2. From ignorance to insight

By providing continuous insights into the performance of their physical counterparts, digital twins make real-time improvements to services possible. When ambitions are realised to create ‘national digital twins’ of whole countries, covering power, water, transport, communications, weather and demographic data, we will be able to answer a whole set of previously unanswerable questions. Can you, for example, avoid building a hospital car park by managing appointments and public transport flows? Can you reduce energy consumption by 10 per cent per person over a six-month period? What would be the impact of closing a main road to deal with flooding?

3. From inaccuracy to fidelity

How accurately the digital twin reflects its real-world counterpart is critical. For a digital twin factory, the level of fidelity needs to be high, not least because data – and the actions that data might trigger – is being passed between machines with no human intervention. In the construction sector, the level of fidelity tends to be much lower because more human intervention is still needed at both the design and construction stage.

Alongside these three key characteristics of digital twins, we observe three key forces that are also driving change within business models: the switch from products to services, the shift in focus from efficiency to agility and the move from digital separation to fusion.

1. From products to services

By enabling new business models that can create new value from operations, digital twins will have a critical role to play in the shift from products to services. What might this look like? In automotive, digital twins will be able to feed back to manufacturers which features are being most used by drivers. In construction, a digital twin allows workers to personalise their office environment by using an app.

2. From efficiency to agility

If manufacturing and engineering firms are going to meet the diverse needs of their end-users and downstream supply chain partners, they need to stop focusing on efficiency and start thinking more about agility and customisation. Digital twins can enable this change.

3. From separation to fusion

By using digital twins to fuse the virtual world with the real, new business models become possible. In aviation, automotive and construction, as we have seen, the technology has the potential to underpin a revolution in the customer experience through, for example, new in-flight entertainment and the personalisation of the driving or office experience.

Towards a maturity assessment model

Although our research is still at an early stage, these characterisations of how digital twins can enable business model transformation are helping us develop a framework to understand firms’ digital twin capabilities and where their business model innovation opportunities lie.

They are informing our preliminary analysis of the five key elements of a digital twin-enabled business model, against which we can measure a firm’s activities.

1. The **value architecture** – or how the business model works. Is it, for example, based on machine-to-machine interaction or machine-to-human? Where is the data coming from?

2. **Value finance** – or how the digital twin makes money. Does it, for example, generate revenues through sales or leasing? Is the pricing fixed or based on outcomes?

3. **Value network** – or how it connects. Is it a standalone platform or part of an ecosystem?

4. **Value proposition** – or what it provides its customers. This is both the services it offers such as customer insight, training, visualisation and what they deliver such as decision support, personalisation or process optimisation.

5. **Value generation** – or how it creates value for its customers. Examples include data analytics, simulations, gamification, improved customer experience or extending the lifespan of an asset.

By breaking down the business model into its constituent parts we get a better understanding of how value is created with a digital twin. This will give us a structured way of evaluating a firm’s opportunities for business model innovation and identifying those that best fit with its unique capabilities.

In today’s world of digital (and pandemic) disruption, business model innovation is increasingly seen as ‘business as usual’ and not a one-off exercise, at least for consumer businesses.

Manufacturing and engineering companies are yet to fully realise the potential of digital twins to transform the way they do business in the after-sale market. A number of obstacles stand in their way: digital twins take an immense amount of computational power to operate, need people with the right skills to develop them and, perhaps most significantly, a huge amount of money to implement them. For those firms that can find a way forward, we think digital twins present an opportunity to irrevocably change the landscape and steal a march on their competitors.



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