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STRATEGY

Leveraging Digital Twins to Attain a Competitive Edge

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Leveraging the power of digital twins for business innovation and public policy insights.

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Deepcake, a company founded by Maria Chmir originally from Tbilisi, Georgia, now headquartered in Dover, Delaware, features a digital twin or deepfake video of Bruce Willis on their website. Utilizing artificial intelligence (AI) and machine learning technology, deepfakes typically portray public figures like celebrities or politicians. This innovation could potentially revolutionize the acting industry by allowing actors to perform roles they may no longer be able to. Deepcake produced a digital twin of Bruce Willis specifically for an advertising campaign for the Russian telecom brand Megafon.

A digital twin is a digital replication of any given entity, not limited to humans, which can exist both in the physical world and be connected to real-world data. NASA notably utilized this technology in the Apollo 13 mission to simulate and optimize spacecraft behavior. Digital twins can represent partial or entire systems, including physical objects and people. Initially used as virtual representations of machines and processes in engineering, digital twins have become increasingly popular and are generally beneficial for simulations and scenario creation. Sjödin, Parida, and Visnjic (2022), allowing to engage with dynamic content and complex situations. The concept of complexity is utilized as a methodological tool in this context. The originality of this development lies in the distribution and depth of both structured and unstructured real-time data. These data are not limited to the machines and sensors used to generate them; they also involve people (and their sensors) and organizations (and their sensors). Nowadays, digital twins encompass complex social organizations, economic representations, and predictions in ambiguous settings.

Given this, the question arises: how can digital twins be utilized? The subsequent paragraphs provide insights into the nature of digital twins, specifically their contours, forms, and degrees of depth, and discuss potential applications in two different contexts: the economic and public policy domains.

Digital Twins for Useful Insights

Digital twin technology is particularly valuable for businesses and governments that must navigate periods of uncertainty. By simulating and predicting the behavior of physical objects and entities, organizations can make informed decisions that mitigate financial and human safety risks. For instance, digital twins can be used to model supply chain disruptions, natural disasters, and other unexpected events that may impact operations. By doing so, organizations can identify potential risks and develop contingency plans before a crisis occurs.

Furthermore, digital twins allow for rapid testing and prototyping of new products and processes. This can lead to more efficient and cost-effective design processes, as well as improved product performance. For example, a car manufacturer could use digital twins to simulate the impact of different road conditions on a new vehicle design before manufacturing a physical prototype. (Knight 1921). Before delving into the topic, it is important to differentiate between risk and uncertainty. Risk refers to a series of events that come with a probability attached to them. In other words, a risk can be quantified by assigning a probability to the possible outcomes. On the other hand, uncertainty refers to a situation where the events are unknown or unpredictable. Uncertainty can be subjective and difficult to quantify as it involves unknown and unforeseeable factors (de Marcellis-Warin, Munoz, and Warin 2020a).

Uncertainty can have a significant impact on strategic decision-making, making it difficult for businesses to plan and move forward in a clear direction. In this context, scenario planning can be a valuable tool for organizations to engage in strategic decision-making while managing uncertainty.

Scenario planning involves the creation of multiple scenarios that could potentially occur in the future. By considering a range of possible outcomes, organizations can develop strategies that are flexible enough to adapt to different scenarios. This approach can help reduce confusion and potential chaos within the organization, as well as increase preparedness for different eventualities. Additionally, scenario planning can promote

collaboration and communication within the organization, as teams work together to develop and analyze different scenarios. This can help break down silos and encourage cross-functional cooperation, leading to more innovative and effective solutions.

The subsequent inquiry pertains to the potential benefits of implementing a digital twin-based strategy in scenario planning. Upon digitalization, a portion or the entirety of a system can offer several advantages. Specifically, scenario planning involves making informed projections regarding the future state of affairs and the shifts in the dynamics of the working environment in response to those projections. It is a process that entails identifying a particular set of uncertainties, or "realities," that may emerge in the future operations of a company. This includes preparing for various possible outcomes and their corresponding impacts, as well as assessing and managing both positive and negative outcomes and impacts. By leveraging scenario planning to visualize potential risks and opportunities, organizations can adopt a proactive approach instead of being reactive to unfolding events (Teece, Peteraf, and Leih 2016).

Scenarios can take on various forms, including quantitative, operational, normative, or strategic, and digital twins can be applied in multiple use cases. One such application involves utilizing digital twins to build scenarios that target the development of more resilient supply chains, while also aiding in data-driven manufacturing decisions and improving manufacturing efficiencies. Additionally, digital twins can be employed for simulations, enabling the replication of real-world conditions and facilitating the prediction of the outcomes of business processes or initiatives in the near future. Furthermore, digital twins can be employed for training purposes, enabling the study and refinement of processes, while providing a safe environment for training. Finally, digital twins can serve as a valuable tool for change management, allowing for the testing of various strategies and the identification of potential organizational blind spots. These digital twins can be customized to serve as sandboxes, enhancing onboarding and knowledge sharing, while also improving the understanding of complex multidimensional problems.

How Digital Twins Can Add Strategic Value

Digital twins are important in the strategist's toolbox for two main reasons:

1. The potential of digital twins as a tool for decision-making: Digital twins can provide organizations with a better understanding of their physical systems, enabling them to make evidence-based decisions. By simulating scenarios and predicting outcomes, digital twins can help organizations optimize their operations and prepare for the future.

2. The impact of digital twins on innovation and efficiency: Digital twins can facilitate innovation by enabling organizations to test new ideas and technologies in a virtual environment. They can also improve efficiency by reducing the need for physical testing and enabling real-time adjustments to systems.

The concept of a digital twin can be examined through two dimensions: the breadth of the digital twin and the characteristics of the physical object being replicated. The object being replicated will determine the scope of investigation undertaken by the organization. There are four types of objects that can be replicated in a digital twin: an individual, a company, an ecosystem, and a geographic region.

In the case of an **individual**, a digital twin can represent an avatar that simulates a real person in an online environment. The digital twin can simulate social and biological actions, such as testing new proteins on the avatar. In the medical field, digital twins are anticipated to play a role in Health 4.0. However, ethical concerns surrounding data protection and administration of the technology must be addressed. In the context of sports teams, a digital twin can be employed to simulate recovery times or performance outcomes of team members. This can assist in designing the team's strategy for upcoming competitions and in making informed decisions regarding future recruitments, ensuring that new members fit in with the team and its strategic plan.

For a **company**, a digital twin can model the entire firm or specific departments and projects. This can assist in assessing various situations, predicting potential threats, and simulating scenarios. Examples include using data from a vertical farm to create AI-based

predictive models or modeling value chains and company ecosystems in different industries. Vodafone has developed a 3D digital twin of its mobile mast network in the UK, enabling its engineers to visualize and strategize network enhancements and expansions. The digital twin provides engineers with the ability to make instant decisions on how to improve customer services without having to leave their workstations (Vodafone, 2022).

For an **ecosystem**, a digital twin can map the industry, allowing for the construction of scenarios, simulations, and bottleneck evaluations. By digitalizing the ecosystem, theoretical premises such as Porter's 5 Forces can be grounded in empirical reality.

Thus, the breadth and characteristics of a digital twin are critical factors in determining its utility for an organization, and various ethical considerations must be addressed to ensure its successful implementation. (Porter 1985). It is possible that a digital twin of an ecosystem could assist in the resolution of some significant problems that companies face inside their ecosystems, such as coordination or orchestration. Firms need to be analyzed in the context of their business ecosystems (Kapoor and Lee 2013) and the creation of digital twins of ecosystems has the potential to be a handy tool for businesses as well as future generations of academics.

The implications of digital twins extend beyond individual companies or sectors, and also affect public and innovation policy. Governments can leverage digital twins of ecosystems to test ideas, establish policies, and model their effects, including the level of stakeholder acceptance. Digital twins can be useful for partnership formation and maintenance, management of technological infrastructure, governance of ecosystems, and orchestration of value-creation and value-capture activities. They can also be employed to model the dynamics of invention and knowledge dissemination within an ecosystem.

A digital twin of a country or region can be equally beneficial. For instance, a digital twin of a city, such as San Francisco, can be created to map economic and social data, creative industries, gentrification, innovation hotspots, and other relevant topics. Similarly, a digital twin of a nation can be built around governmental databases, such as the companies registry, to create new geolocated and real-time indicators of wealth creation, unlike traditional GDP measures. Digital twins can then be employed to establish and alter policies in real-time, and potentially become one of the tools used by governments to

upgrade their policies to become governments 4.0 (de Marcellis-Warin and Warin 2020; de Marcellis-Warin, Munoz, and Warin 2020b). Furthermore, digital twins can also be applied to regions that span multiple countries, particularly in cases where they share critical transportation infrastructure or natural resources. By constructing a digital twin, organizations can gain a deeper understanding of economic links, supply networks, and the positive and negative externalities associated with specific local activities. This can assist in better planning for future improvements in a setting that is both complex and nuanced. Overall, the use of digital twins in regional planning can lead to better decision-making, increased efficiency, and improved outcomes for both businesses and communities.

Discussion and conclusion

In summary, a digital twin is a digital representation of an entity, and its application varies based on the object being replicated. Predictive modeling is a transversal dimension that applies to all digital twins, and they can be valuable both technically and in terms of their application domains. Digital twins can evolve in real-time and serve as new horizons for decision theory and modeling methodologies.

Digital twins are versatile tools that can be used to make evidence-based decisions, test existing procedures, build resilient organizations, and stimulate analytical creativity. They are not limited to virtual representations of machines or processes but can also be used to represent regions spanning multiple countries.

In conclusion, digital twins have vast potential and will continue to shape and transform various fields in the years to come.

Endnotes

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