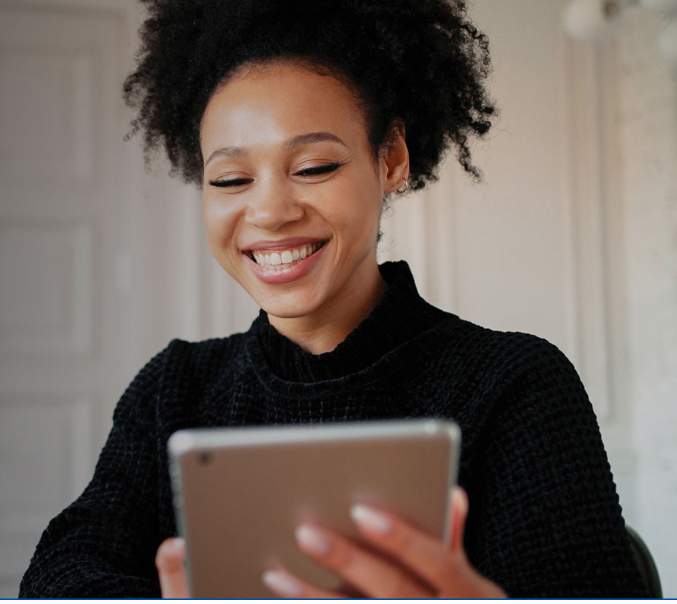

KPMG

Digital twin landscape and getting started blog

May 2022

Background

"Digital twin" is a term that is coming up increasingly in a variety of situations for life science industry professionals. Broadly speaking, a digital twin can be thought of as a realistic digital representation of a physical thing (e.g., living, or inanimate, molecule, device), design (i.e., prototype design), system (manufacturing line or facility), or process (e.g., medical devices complaints intake, clinical trials operational management).

Targets of digital twins for life science application can range from therapeutic compounds down to the molecular level, which can be used to explore promising pharmacological mechanisms of action in virtual, *in vitro, or in vivo experiments*, to modeling of complex, end-to-end supply chains for precision medicine, such as CAR-T, to ensure their robustness during design and operation. Other common applications include modeling the operational cost of existing or proposed facilities.

Typically, a digital twin also includes a digital model of the source's dynamics, which enables prediction of how it would respond in a variety of different situations/scenarios. This digital model can be achieved through a variety of prediction and simulation techniques such as discrete-event and agent-based modeling, or all the way to advanced, physics-based modeling.

Modeling is a key capability that enables **virtual experiments**, and **flexible scenario and options analysis.** This takes place before any finalized decisions or implementations are taken and **before** rolling out any expensive process changes, executing a complex plan with multiple dependencies, or making a significant investment in a new facility or automation system.

Digital twins are used to provide information and insights on **what happened, what is happening,** or **what will happen** to the source of the digital twin. This can be a specific physical quantity or factor such as temperature, flow, mechanical wear, energy consumption, or safety and other risk factors, through to high-level operational quality, and financial factors such as labor availability, uptime, throughput, quality, yield, costs, and profitability (in terms of labor, assets, and consumables).

Although the term digital twin is relatively new one, the concept combines several long-standing and well-accepted techniques in life science, such as process analytics, operations research, process mining, Monte Carlo simulation, prediction, and optimization. The rapid growth, scale, and sophistication of digital twins has been driven by the ubiquitous availability of cloud-computing providing the necessary computing power, advanced AI techniques for process step predictions, process orchestration, and large-scale data integration/IoT from key life science enterprise sources that is becoming more mainstream every day.

Key considerations in getting started with digital twins. Fortunately, one does not need to be an expert in all the above technical areas to get started in digital twins. Software applications available to develop and leverage digital twins have also moved ahead quickly. There are several easier-to-use tools for rapid, almost "drag-and-drop" development of digital twins, which means starting to leverage them is much easier for life science organizations and professionals than ever before, while still providing a path to enterprise impact and value.

Many life science professionals also mistakenly think that a vast and mature enterprise data and IoT infrastructure is required before getting started in digital twins, and to be useful, an end-to-end digital twin of the entire system or enterprise is needed to achieve value. Fortunately, this is no longer the case, since many realistic digital twins can be developed through a modest gathering of assumptions readily available in team members, combined with existing process data/metrics that are already being captured as a part of life science quality and regulatory requirements or existing Lean Process/6 Sigma and SPC efforts. As additional data become available over time, which is inevitable with the increase use of digitally orchestrated workflows for R&D, quality, and regulatory and business processes, this data can be used to further refine the digital twins in terms of capability and fidelity.

© 2022 KPMG LLP, a Delaware limited liability partnership and a member firm of the KPMG global organization of independent member firms affiliated with KPMG International Limited, a private English company limited by guarantee. All rights reserved. NDP333376-1A

A key consideration to understand your requirements in terms of the precision of the digital twin is that while high precision is possible, it is not always warranted versus the effort invested to achieve it. Digital twins using even high-level assumptions and basic historical data often provide surprising and valuable insights around potential bottlenecks or other unintended interactions, as well as the overall behavior of the system and root cause of problems.

By leveraging KPMG digital twin platform, accelerators, knowledge and experience, our firm supports leading life science companies on selecting the right approach, and then in rapidly implementing, scaling, and leveraging digital twins in a prioritized and value-driven manner.

The digital twin enables many powerful capabilities for life science companies

- Continuous business and clinical process improvement—supplementing a value-stream methodology with virtual experiments
- Extending process twins to model and optimize end-to-end processes in R&D, clinical, regulatory, quality, and commercial functions

- Improved capital efficiency—getting more out of existing capital equipment/facilities
- Infrastructure investment decisioning/ROI analysis for capital investment
- Determining the "sweet spot" for major automation investments/ RPA

- Complex clinical trial planning, modeling and execution
- Supply chain modeling and optimization including complex manufacturing
- Dynamic replanning in the loop due to external and upstream/downstream factors
- Intelligent workforce planning, balancing, and scheduling
- Wargaming and dynamic plan response/ continuity management through adaptive scenario modeling

- Hybrid AI/simulation predictive and prescriptive analytics
- Generation of realistic simulation data to supplement real data for AI algorithm training (overcome data scarcity issues for training AI) for deep reinforcement learning
- Simulated deployment and prevalidation of AI algorithms in the loop prior to going live operationally

Contact us

Marcos Salganicoff
Director, Data Scientist
T: 484-362-8109
E: msalganicoff@kpmg.com

Semion Bezrukov
Managing Director
T: 703-286-8000
E: sbezrukov@kpmg.com

Kelli Brooks
Principal, National Life Sciences,
Consulting Leader
T: 213-533-3389
E: kjbrooks@kpmg.com

Justin Hoss
Principal, National Life Sciences,
Technology Leader
T: 312-665-3265
E: jhoss@kpmg.com

Some or all of the services described herein may not be permissible for KPMG audit clients and their affiliates or related entities.

kpmg.com/socialmedia

The information contained herein is of a general nature and is not intended to address the circumstances of any particular individual or entity. Although we endeavor to provide accurate and timely information, there can be no guarantee that such information is accurate as of the date it is received or that it will continue to be accurate in the future. No one should act upon such information without appropriate professional advice after a thorough examination of the particular situation.

© 2022 KPMG LLP, a Delaware limited liability partnership and a member firm of the KPMG global organization of independent member firms affiliated with KPMG International Limited, a private English company limited by guarantee. All rights reserved. The KPMG name and logo are trademarks used under license by the independent member firms of the KPMG global organization. NDP333376-1A