Digital Engineering:
Accelerating R&D

element

Who are Element Digital Engineering?

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- The consultancy division of Element Materials Technology, a global test, inspection and certification business with 200 locations worldwide and 6000+ associates.
- Deep specialists in the use of numerical analysis to support design, operational and safety challenges in high-hazard and capital-intensive industries.
- Active participants in nationally-funded R&D programmes, collaborating with major software companies on developing new methods and techniques.
- Developers of specialist software solutions for analysis and assessment problems that cannot be addressed with commercial codes.

Element in Digital Engineering

Slido Q. Which of these are more likely to be relevant for your company?

- Structural Analysis
- Fluid/Thermo Dynamics
- Scripting & Mathematical Modelling
- Data Science and Machine Learning
- Digital Twins (In-Silico)
- Software Development and Workflow Automation

Element and Digital Engineering:
Full Life Cycle Service

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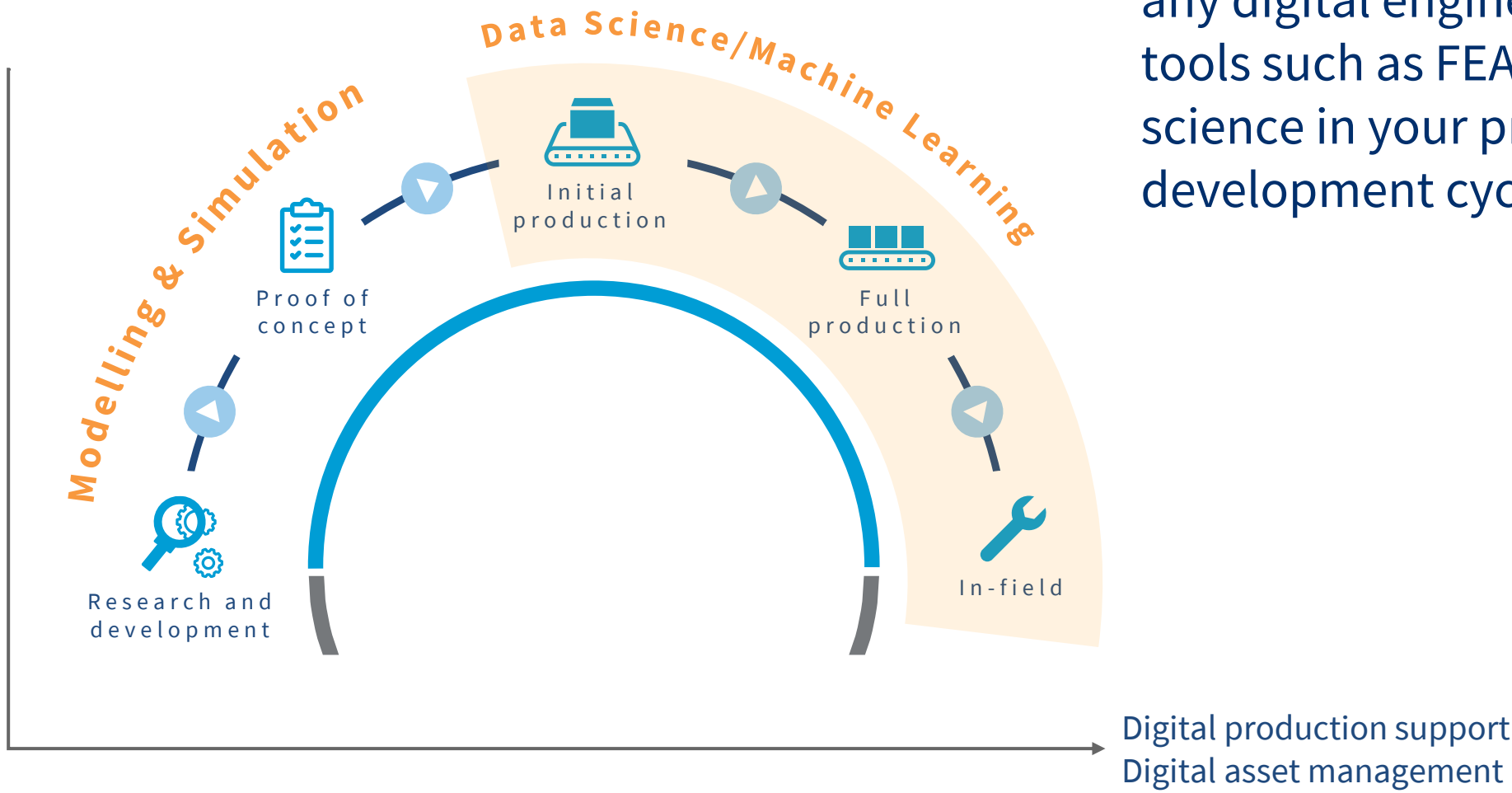
Slido Q. Have you used any digital engineering tools such as FEA or data science in your product development cycle?

One stop shop for product development

Faster and smarter R&D iterations



What is the role of Digital Engineering in MedTech?

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Computational (in-silico) modelling and simulation are powerful tools that can complement traditional methods for gathering evidence about products regulated by the Food and Drug Administration (FDA) or other regulatory agencies

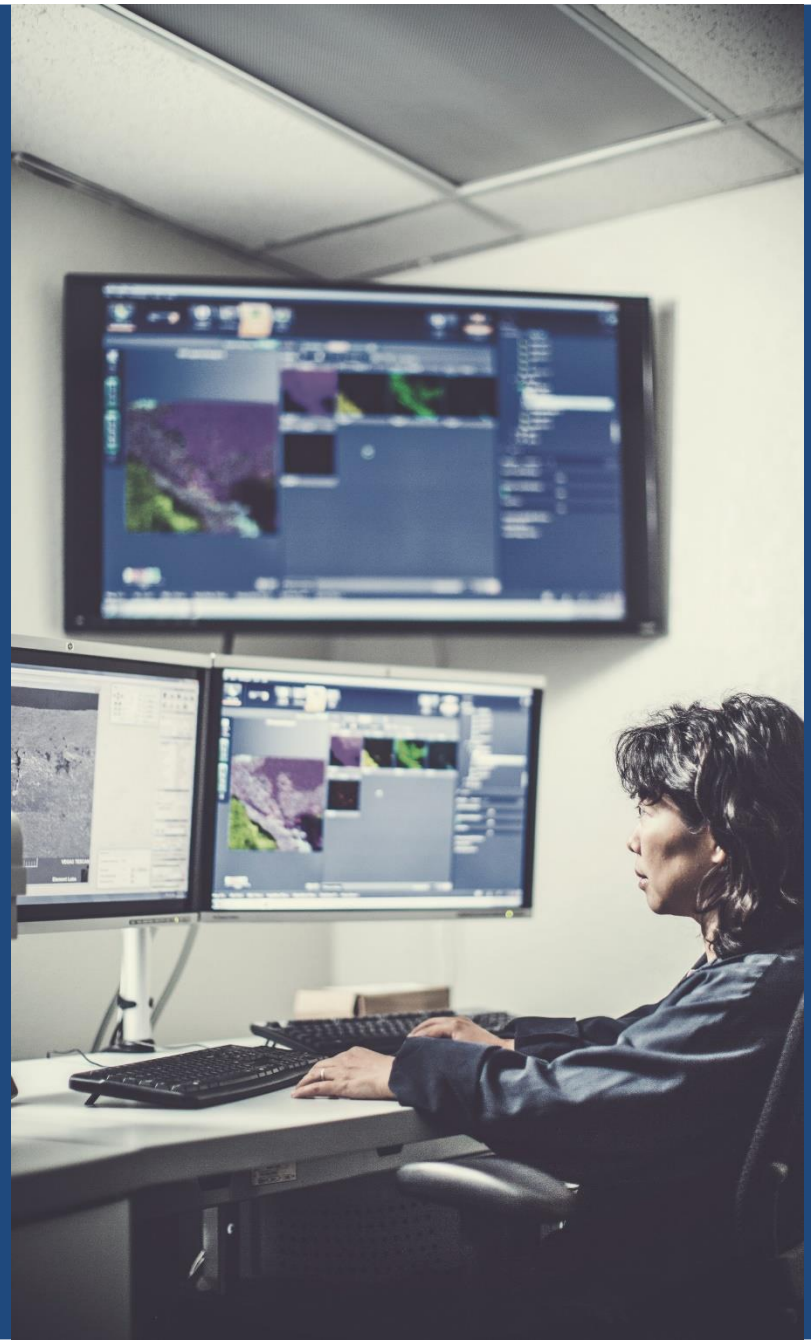
It is predicted that by 2025, 25% of new pharmaceuticals and 50% of all new medical devices will utilise in-silico technology in their R&D lifecycle [1]

Regulatory bodies are participating in the establishment of Good Simulation Practice guidelines to ensure best practice and quality control principles are followed and strengthen current modelling and simulation practices

[1] Frangi, Alejandro F, Denison, Timothy, & Lincoln, John. (2023). The Economic Impact of In-silico Technology on the UK and its Lifesciences Sector (Version v1). Zenodo. https://doi.org/10.5281/zenodo.7558649

Case Studies in MedTech

Slido Q. What is your main concern with the use of digital engineering tools?



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CR Femur Prosthesis
Fatigue Analysis

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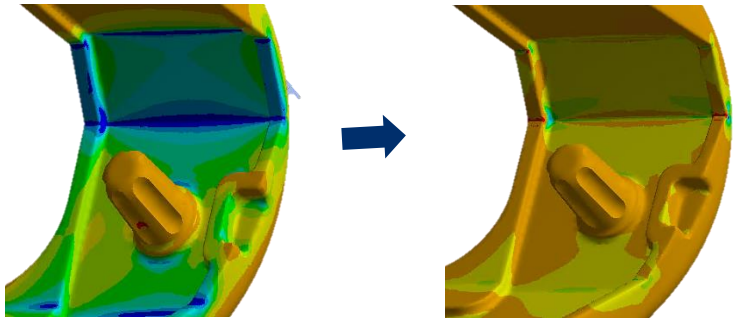
Hairline cracks were detected in a cruciate-retaining femur prosthesis during physical **fatigue testing**. The client wished to understand why the hairline fracture was occurring in a region which is only expected to see compressive loading.

Finite Element Analysis (FEA) was used to understand how the stress in the prosthesis changed during the cyclic load application.

Our assessment concluded that the hairline cracks were a fatigue failure caused by residual tensile stresses after the initial loading cycle. We were able to **recommend design changes** to the client to mitigate this effect.



pMDI Droplet Deposition
Computational Fluid Dynamics

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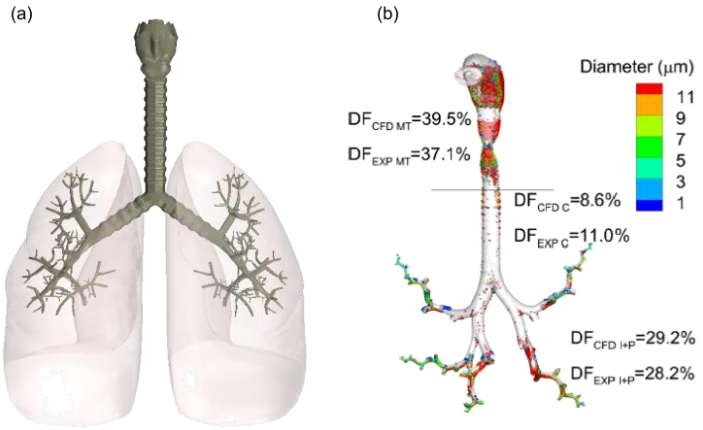
Pressurized metered dose inhalers (pMDI) deliver the active compound in the form of **liquid droplets** which are atomized and travel through the airways into the lungs. It is of interest to know where in the lungs the droplets are deposited.

Computational Fluid Dynamics (CFD) can be used to predict the deposition distribution from which the effectiveness of the treatment may be determined. CFD can be used to simulate the flow of atomized droplets through the lung passageways in the airflow.

The results can be compared against experimental data to validate the **in-silico model**. This allows for assessment of a number of different cases, for example, using different solution formulations.



Example results from a published paper

From Data to Knowledge
Data Science

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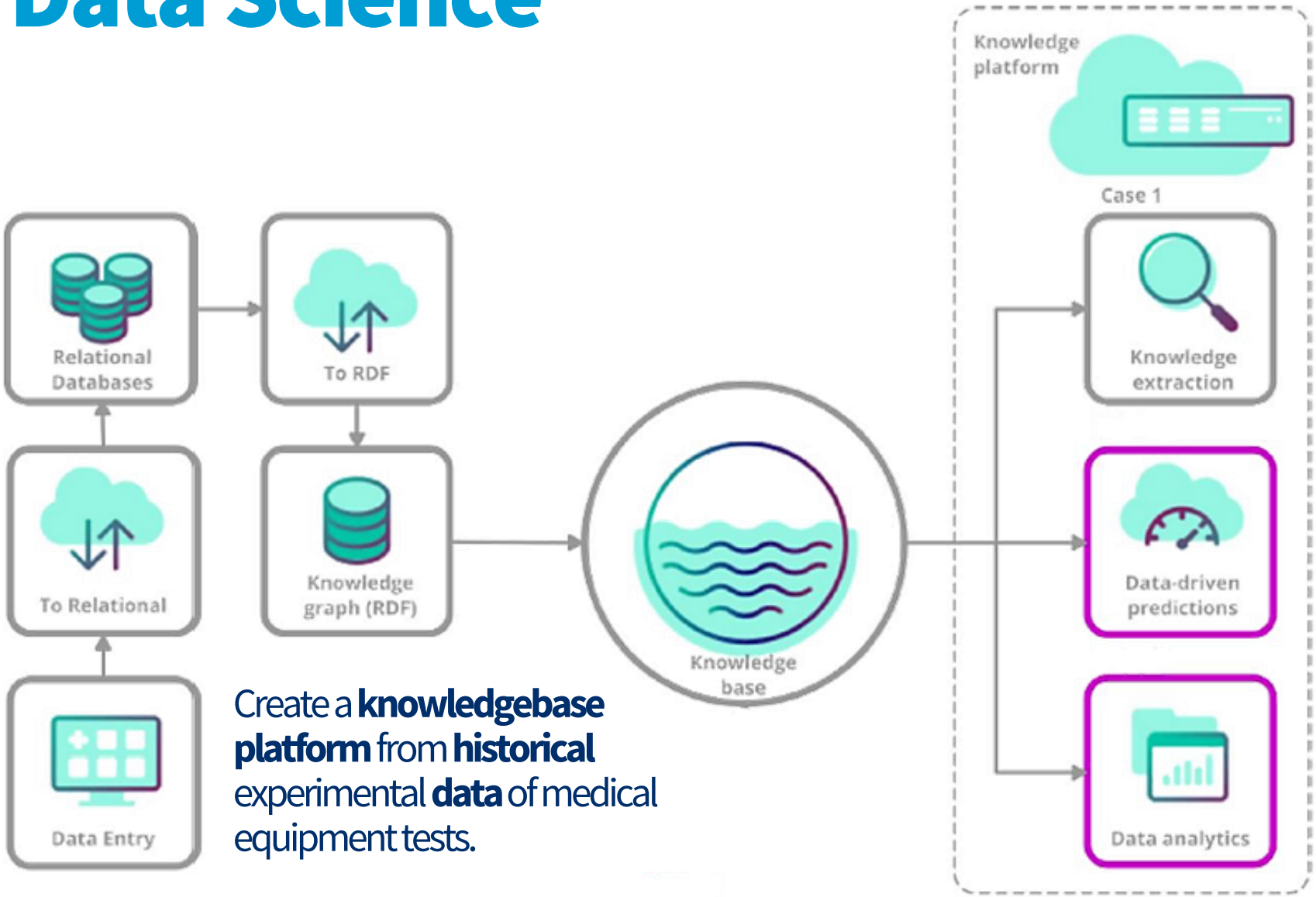

Create a **knowledgebase platform** from **historical** experimental **data** of medical equipment tests.

Make accessible to scientists via web and desktop **GUI apps** powered by a **queryable** knowledge graph database backend.

Enable **data-driven predictions, analytics and decision making** for non-programmers.

THANK YOU

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