

***Double your
insight. Predict your future.***



**Demystifying digital twins for railways
IRS 2021**

**Peter Boom
Bilbao, September 2021**

INTRODUCTION ROYAL HASKONINGDHV

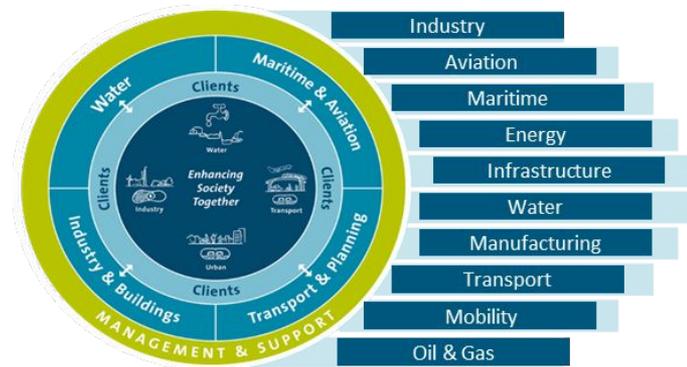
Our company profile

- Proud heritage since **1881**, **employee owned**
- Independent international hybrid **engineering, consultancy and (digital) technology** firm
- Expertise and experience of **6,000 colleagues** in over **140 countries**
- Bringing together world class domain expertise and **engineering heritage** in chosen industry sectors **with digital business** in consultancy & software capabilities
- 637€ million operation income in 2019



Our ambitions and focus

- **Market leader** in the Netherlands, United Kingdom, South Africa and Indonesia: globally leading services and export services
- 25% new business from innovation and **digital solutions**
- Drive inclusive **sustainable development** with our clients
- Focus on bringing data science and digital technology into the domains we are active in.
- Adopted Digital Twins as companywide growth theme



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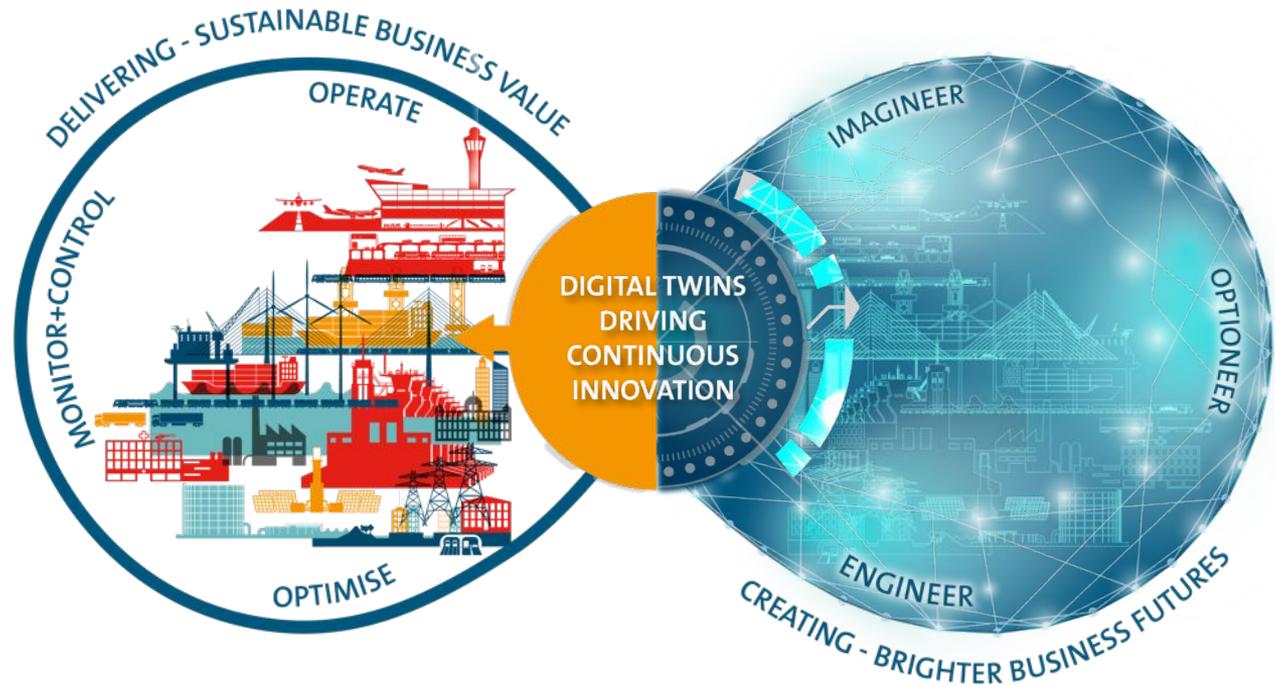
WHAT ARE DIGITAL TWINS?



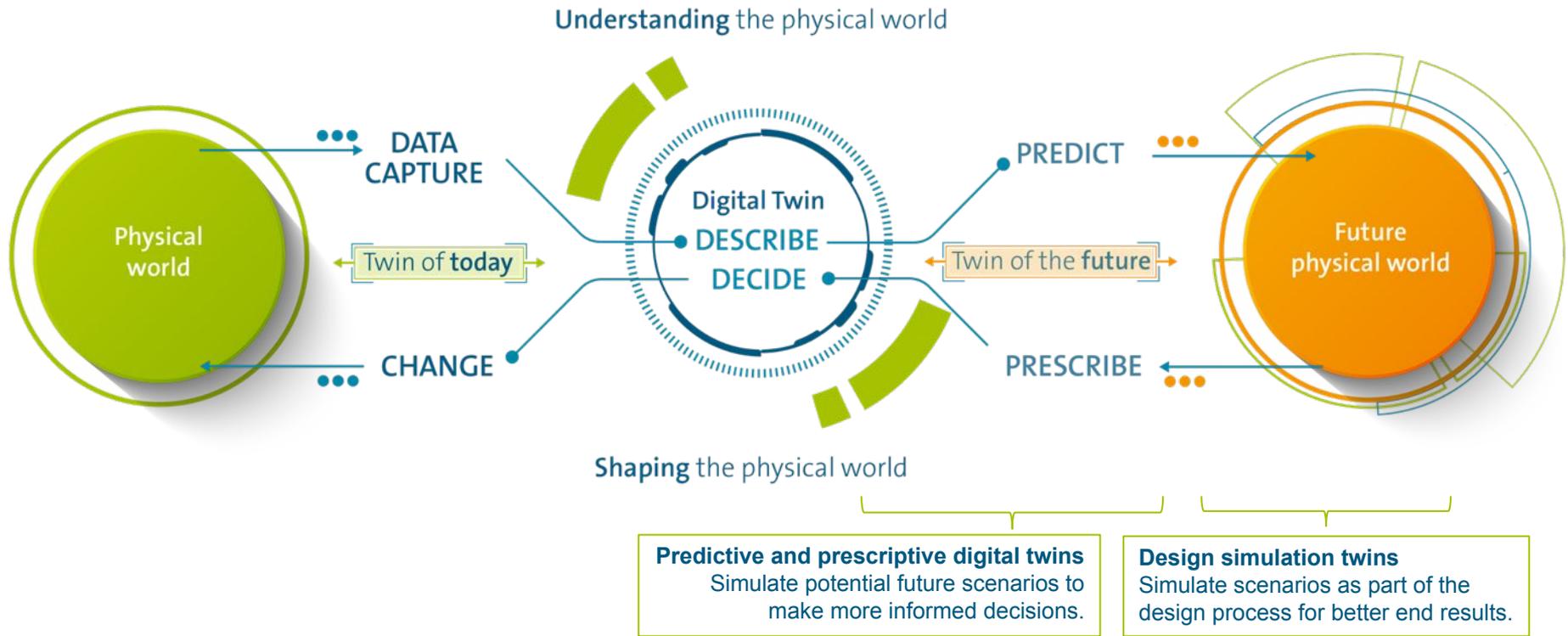
CONNECTING THE PHYSICAL AND DIGITAL WORLDS

Accurate decision-making is key to driving sustainable business value, increasing resilience and improving performance.

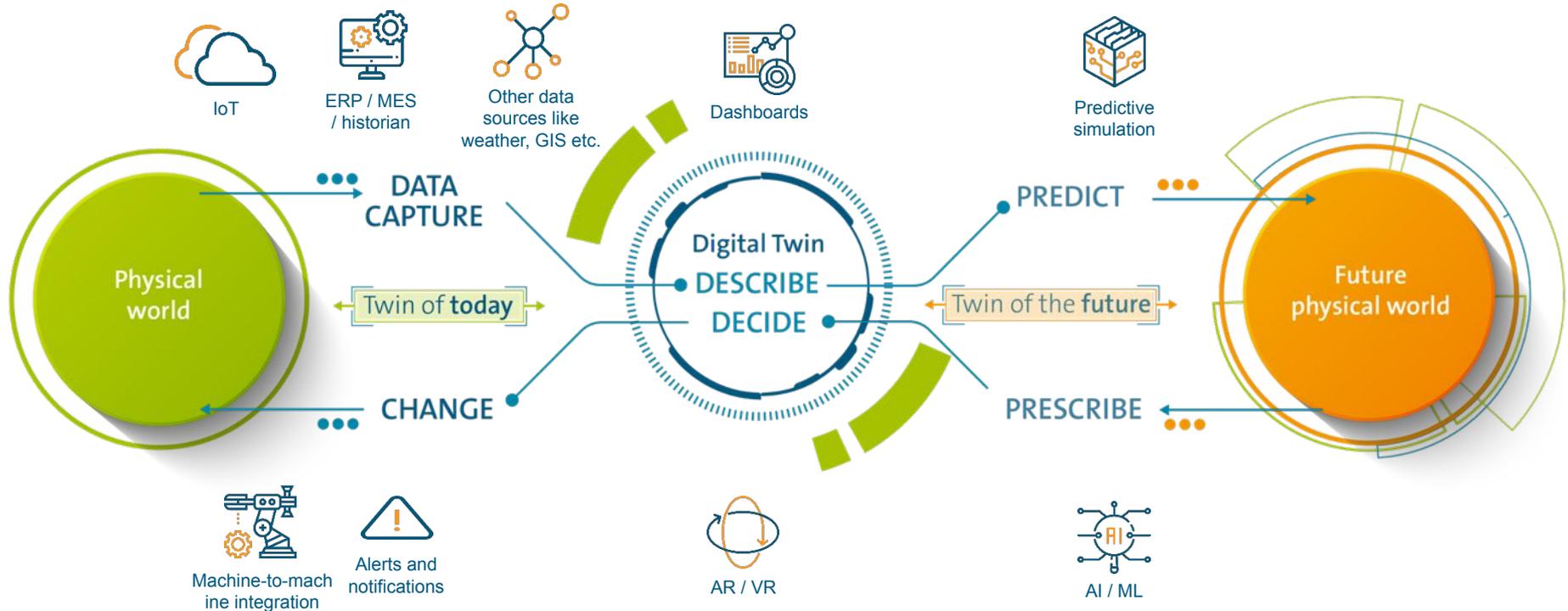
To make the right decisions, organisations need to create a continuous process of innovation and learning, and leverage new technologies like data science and predictive simulations. At the heart of this trend, we see the rise of digital twins.



WHAT ARE DIGITAL TWINS?



BRINGING TOGETHER VARIOUS CONCEPTS & TECHNOLOGIES



DIFFERENT LEVELS OF DIGITAL TWINS

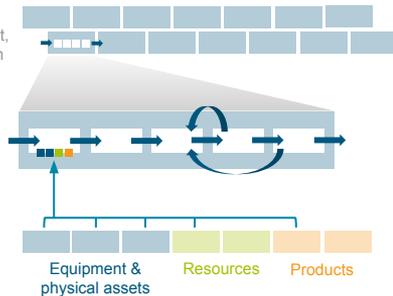
FROM ASSET TO SYSTEM LEVEL

Today, most digital twins in the market focus on an asset level. But, with the correct interoperability and industry standards, they can potentially be combined to create an eco-system of twins up to city, country or supply chain level.

LEVEL 3:
Enterprise Layer
 Ecosystem management, Integration, IoT, historian data, governance & security

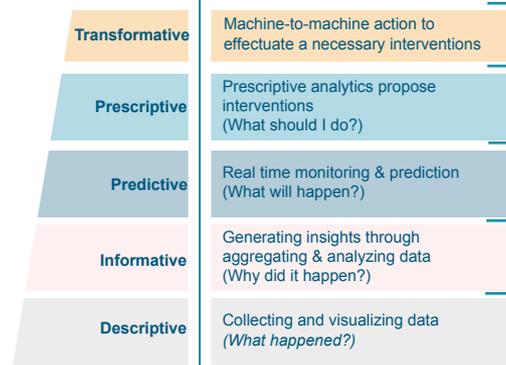
LEVEL 2:
Process Layer
 Predictive simulation, scenario design, testing & optimization

LEVEL 1:
Asset Layers
 Edge connectivity, monitoring & control



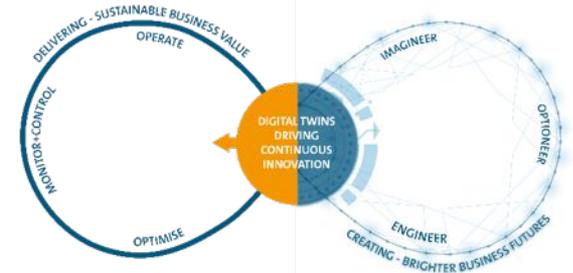
MATURITY LEVELS

Depending on the digital maturity of the organisation, and the availability of data and the business questions, there are various maturity or sophistication levels for twins (f.i. predictive or prescriptive twins). Also the level of human intervention differs per twin



LIFECYCLE

Digital twins add value across the life cycle of an asset, process, system or organisation. Already in the design process, design simulation twins add value. Connecting capex to opex phases enables value creation. But twins can also be created from existing assets or systems using IoT or scan to BIM



OPTIMISING PROCESSES IN EVERY ENVIRONMENT



ASSET MANAGEMENT

LEVERAGE DATA TO
EXTEND AND OPTIMISE
ASSET LIFETIMES



CROWD MANAGEMENT

GAIN INSIGHTS IN FLOWS OF
PEOPLE USING MONITORING
AND PREDICTIVE MODELS



TRAFFIC MANAGEMENT

FORECAST AND OPTIMISE
TRAFFIC FLOW ACROSS
DIFFERENT MODES OF
TRANSPORT



WATER MANAGEMENT

MEASURE, CONTROL AND
PREDICT WATER FLOWS
ACROSS NETWORKS



PROCESS OPTIMISATION

OPTIMISE KEY BUSINESS
PROCESSES AND LOGISTICS
WITH REAL-TIME MONITORING
AND PREDICTIVE TECHNOLOGIES



ENERGY OPTIMISATION

BALANCE SUPPLY AND
DEMAND FOR ENERGY
GENERATION, DISTRIBUTION
AND STORAGE - AND
OPTIMISE USAGE



CLIMATE RESILIENCE

UNDERSTAND THE IMPACT OF
CLIMATE CHANGE ON YOUR
ORGANISATION



Quotes from report “Flourishing systems”

- “Silos in policy, decision-making, development and operation produce suboptimal outcomes. A paradigm shift is required: we must recognise infrastructure as a **system of systems** and manage it accordingly”
- “For as long as we want society to function, we must keep infrastructure working. It will become increasingly difficult to sustain infrastructure and society unless the system itself becomes **sustainable, secure and resilient**”
- “We must recognise **digital assets**, such as data, information, algorithms and digital twins, as genuine ‘assets’, which have value and must be managed effectively”



DIGITAL TWINS IN ACTION



DIGITAL TWINS IN PRACTICE SCHIPHOL AIRPORT



We connected the flight information and climate systems at Schiphol airport to optimise the airflow in terminals based on forecasted usage. This system was augmented with Wi-Fi tracking and CO₂ level monitoring to help continuous improvement of comfort, reduction of emissions and lowering of passenger costs.



DIGITAL TWINS IN PRACTICE

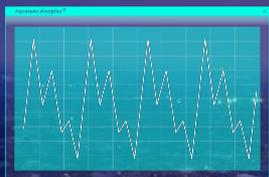
AQUASUITE VIRTUAL OPERATOR



Analyze



Optimize &
control



Predict



Learn &
detect

AQUASUITE®



By combining Aquasuite, our water-focused machine learning and AI platform, with MyNereda, our asset information platform, we're helping more than 80 organisations around the world streamline the way they work with wastewater.

These tools act as an autopilot, virtual operator and analyst, automating workflows and assessing the performance of your assets, networks and processes. You can use its capabilities to model disruption scenarios, virtually test upgrades, and integrate automation into your operations.

For more information, visit [our website](#).

DIGITAL TWINS IN PRACTICE HAYWARD TYLER



Predictive model developed in Lanner's WITNESS software



Hayward Tyler, a manufacturer of mission-critical pumps and motors, wanted to take advantage of huge recent growth by doubling the size and production capabilities of its UK facility. Using our WITNESS digital twin technology, the manufacturer built a dynamic, 3D virtual factory that can run a full year's worth of simulations in a matter of seconds. It's helping the company maximise efficiency, profitability, and resource allocation.

Running on Microsoft Azure and fully integrated with other core systems like ERP, Hayward Tyler's new digital twin environment has not only helped with the initial expansion, but is also providing the team with the insight it needs to develop a clear roadmap for transformation in the coming years. This innovative work won the company a UK Smart Manufacturer award.

For more information, visit [our website](#).



DIGITAL TWINS IN PRACTICE

WASHINGTON RIVER PROTECTION SOLUTIONS



WRPS is using our digital twin and AI capabilities to add a crucial layer of real-time, real-world intelligence to its nuclear clean-up operation.

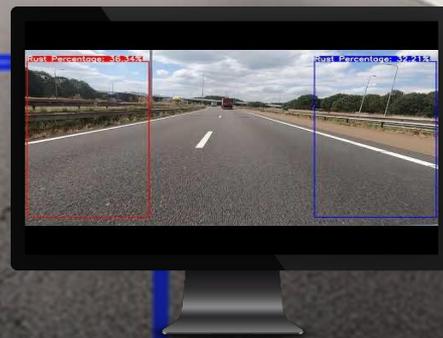
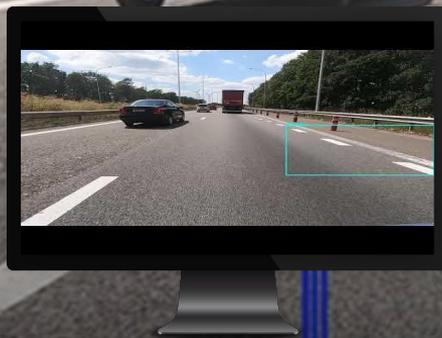
With our simulation solution, WRPS has twins of thousands of individual components from across its site, each connected to a cloud-based app which can run multiple complex what-if simulations in parallel, far faster than WRPS's previous models.

The team is now using machine learning and AI to introduce automated analysis for its simulation outcomes, with automatic bottleneck detection in place to offer fast, efficient solutions to streamlining its operation.

For more information, visit [our website](#).



DIGITAL TWINS IN PRACTICE INFRASTRUCTURE ASSET LIFE CYCLE MANAGEMENT

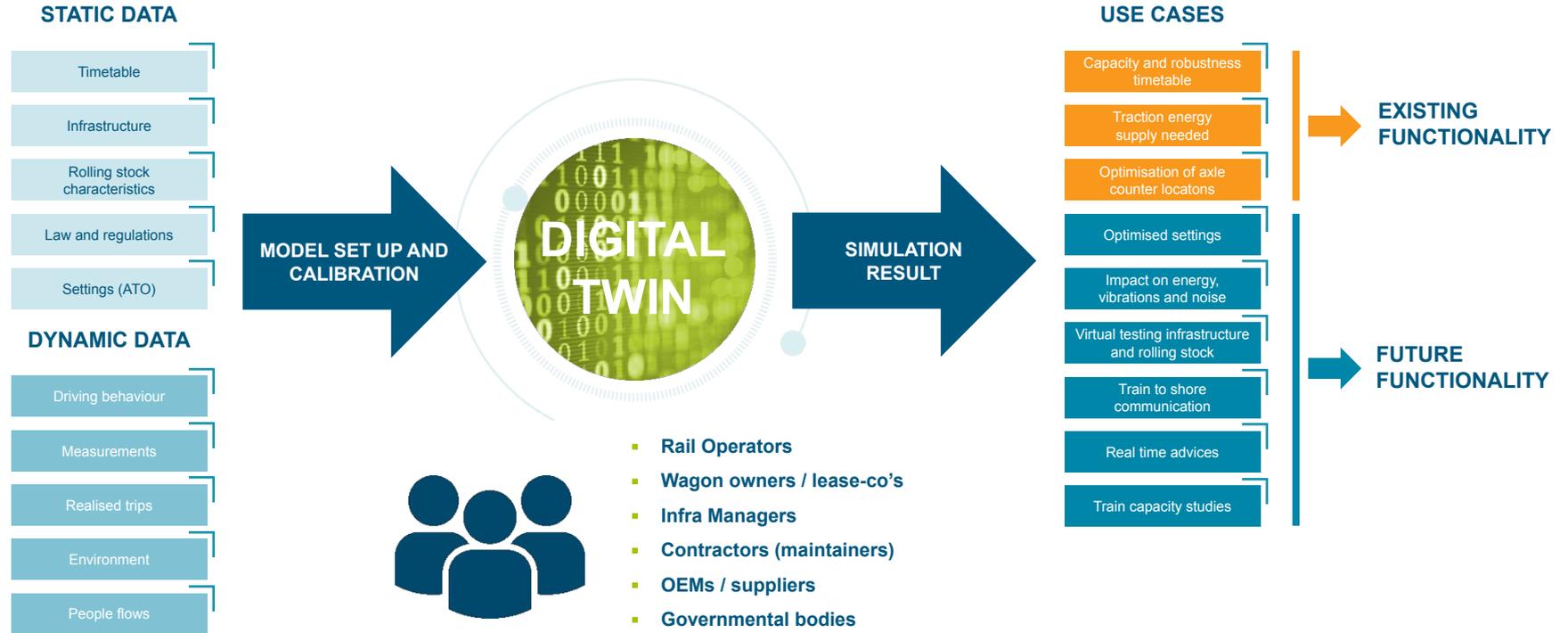


The Dutch provinces of Overijssel and Noord-Holland use our digital twin capabilities to streamline their operational and strategic asset management processes. Covering assets such as pavements, guard rails and lane markings, the provinces are putting our SIXD and Create solutions to work monitoring performance and making long-term plans for how assets are used and managed on their roads.

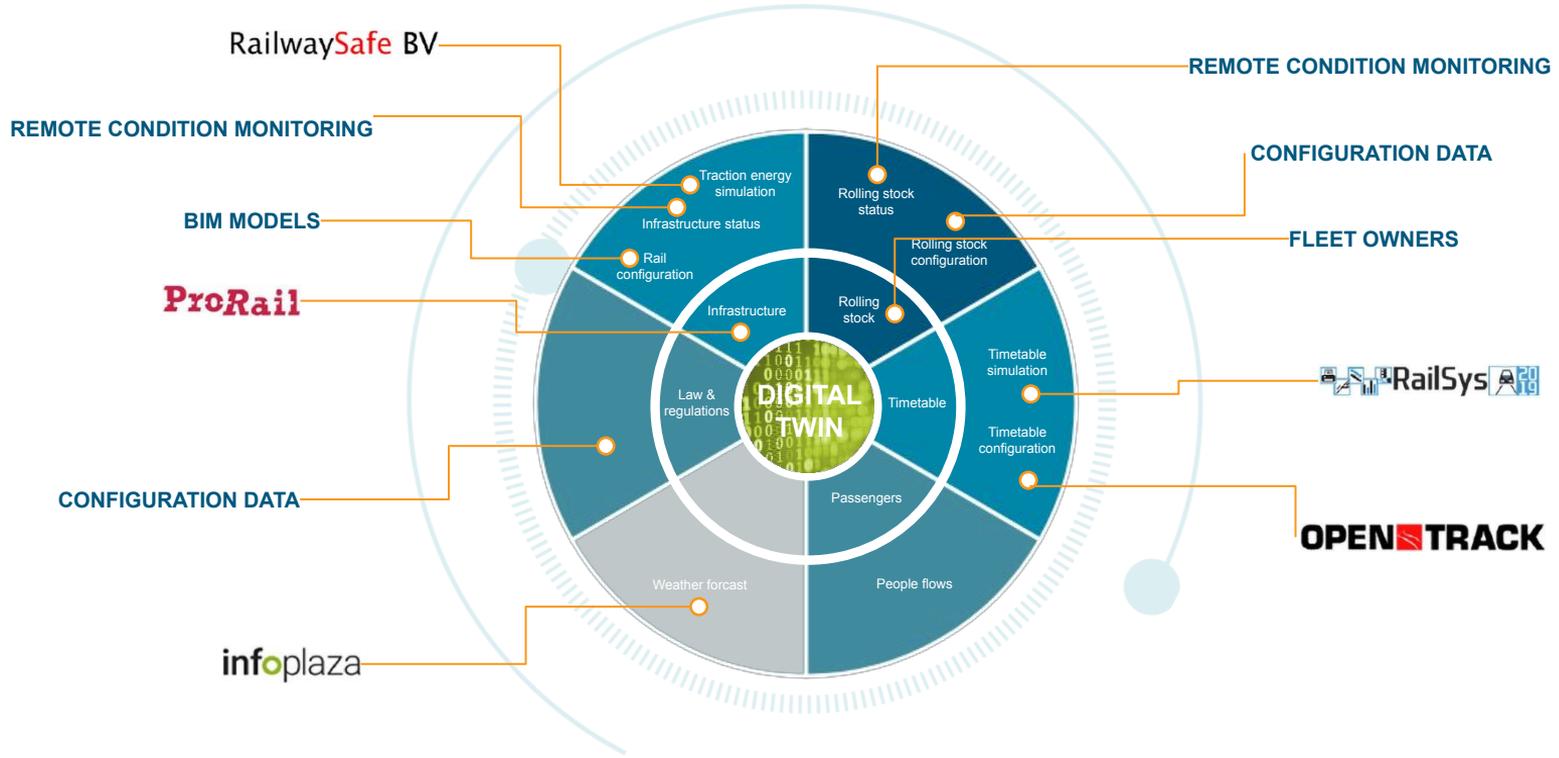
DIGITAL TWIN IN RAIL



DIGITAL TWIN USE CASES



APPLICATIONS & PARTNERS



Three ways to start



Approach digital twins as integrated part of your digital transformation

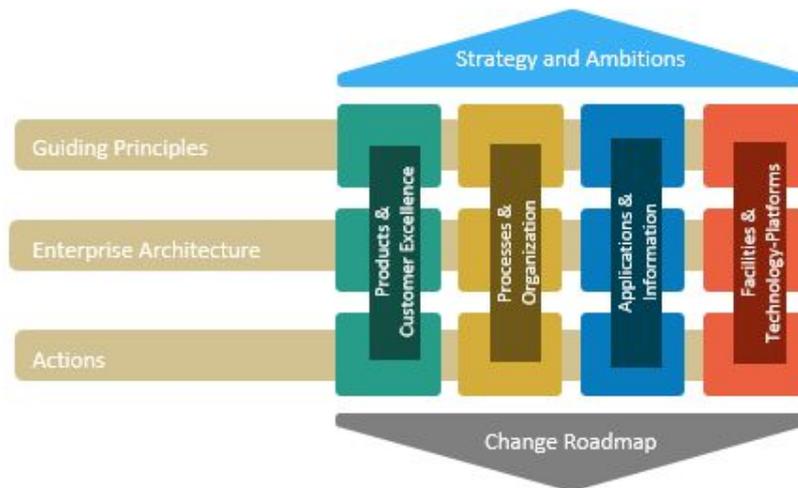


Optimize in operations: increase insight of your existing situation



Incorporate digital twins as part of every investment projects

**east
west
RAIL**



Apply Business Transformation framework to ensure an integrated approach

KEY TAKE AWAYS

Learn form
other
industries

Create a
roadmap

Follow a
modular
approach

Co-create
and think
eco systems

Connect to
other
initiatives

Apply open
standards



WHERE WE HELP OUR CLIENTS



WE ENABLE TRANSFORMATION BY DIGITAL TWINS

We'll help you define the right strategies and roadmaps to create value using digital twin. We combine our understanding of the physical world with digital transformation expertise to help you raise awareness, identify relevant use cases and enable value creation.



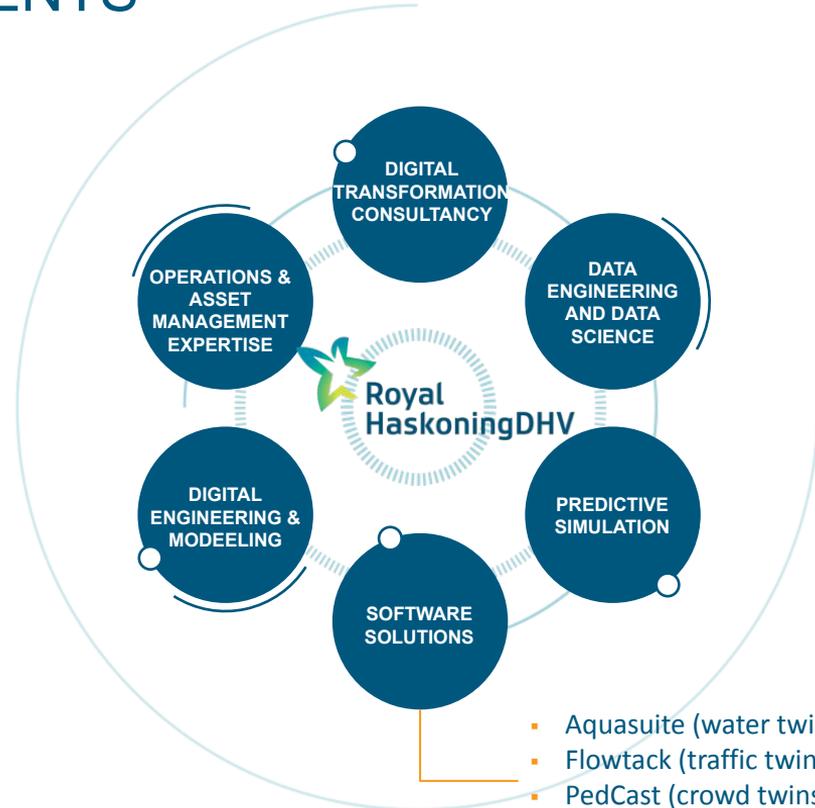
WE DELIVER DIGITAL TWIN SOLUTIONS

We help you to design and deploy the right software solutions to meet your digital twin requirements and create value out of data. Our strategic partnerships with many leading technology vendors allows us to deliver value regardless of your technology landscape.



WE DEVELOP DIGITAL TWIN SOFTWARE

We develop and support our own suite of software products that enable your digital twin capabilities including AI, predictive simulation, people flows and data management.



- Aquasuite (water twins)
- Flowtack (traffic twins)
- PedCast (crowd twins)
- Witness (simulation)



QUESTIONS?

For more information, visit our website:
www.royalhaskoningdhv.com/digitaltwin

[Enabling digital rail to deliver next generation mobility \(royalhaskoningdhv.com\)](http://royalhaskoningdhv.com)

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