DIGITAL TWIN READINESS ASSESSMENT
The Application of Digital Twins: What is the Current State of Industry?

prostep ivip Symposium 2020

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DIGITAL TWIN READINESS ASSESSMENT

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Questions and discussion
**Markus Samarajiwa** is a Lead Business Consulting at the IT and Service provider msg (Munich). In cooperation with David he is responsible for the Digital Twin in the Automotive division. He developed the idea for the study and provided important impulses for the concept and design.

**Theresa Riedelsheimer** is the deputy head of the department information and process control in the division of Virtual Product Creation. She is doing applied research on challenges in Product Lifecycle Management, Digital Twins and on the specific topic of sustainability in this context. Within the study on Digital Twins, she is responsible for the scientific planning and execution of the Digital Twin Readiness Assessment as well as the authoring of the study.

**David Salamon** is a Senior Business Consulting at the IT and Service provider msg (Munich). He is a thought leader for Digital Twins within the automotive division. He triggered the idea of the maturity assessment and contributed to design and conception of the study as well as client interview conduction.
We are an internationally operating group of companies

Founded in: 1980
Headquarters: Ismaning/Munich
Revenue: €1,031 million (2019)
More than 8,000 employees
Located in 27 countries
Industries: Automotive, Banking, Food, Insurance, Life Science & Healthcare, Manufacturing, Public Sector, Telecommunications, Travel & Logistics, Utilities
Strong group of companies with more than 20 strong brands
Number 6 among the top-selling IT consulting and system integration companies in Germany
Application-oriented research within five main research areas

1. Product development methods and processes
2. Product design and functional validation
3. Intuitive interaction with virtual prototypes
4. Information management for product creation
5. Digital manufacturing operations and factory processes
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The motivation for the study was triggered by the demand to assess the overall Digital Twin readiness of companies.

5 core questions form the basis of the "Digital Twin Readiness Assessment":

"How does the Digital Twin influence business models?"

"What value should be gained by the Digital Twin?"

"What do current concepts for the Digital Twin look like?"

"What kind of actions are necessary for the Digital Twin?"

"Which skills are required for the Digital Twin?"

Digital Twin Readiness Assessment: Assessment of the Digital Twin maturity in manufacturing industry

Overall maturity: 51%
In Kooperation mit
Digital Twin
Readiness Assessment
The Digital Twin Readiness Assessment is executed in three main steps and provides insights on your current state on the journey towards Digital Twins.

1. **Expert Interview:**
   - Tracking current status
   - Duration: approx. 2 h

2. **Evaluation:**
   - Determine degree of Readiness and comparison to the industry

3. **Feedback Session:**
   - Presentation of results, recommendations for action
   - Duration: approx. 2 h

Digital Twin Readiness Assessment
What is the current state of your Digital Twin in comparison to the industry?

Assessment of your degree of readiness in the three dimensions:
- Understanding and application
- Strategy and concept
- Implementation

Overall maturity:
- M1: Low
- M2: Middle
- M3: High

Overall maturity: 51%
Digital Twin Readiness Assessment

The anonymized and consolidated knowledge derived from the individual Digital Twin Readiness Assessments is captured and published in the study.
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The study shows as an overall result: Digital Twins are on average still under development, but most companies are on the way towards implementation.

Overall, Digital Twins are still in the conception phase, but there are many different approaches that reflect the diversity of the concept as a whole.

There is a good understanding of Digital Twins in general as well as first experiences from the application of Digital Twins.

The developed concepts have a medium maturity, whereby the strategies and target visions are more elaborated than the specific concepts.

The implementation of Digital Twins has the lowest level of maturity – especially with regard to data and information models as well as IT systems.
Digital Twin Readiness Assessment

There is a good understanding of Digital Twins in general and first experiences from the application of Digital Twins exist.

- **What is the understanding of Digital Twins in industry?**
- **How far is the application of Digital Twins within the companies in general?**

20% of the companies do not have a uniform definition of Digital Twins.

46% emphasize that the Digital Shadow is an integral part of a Digital Twin.

85% developed concepts for Digital Twins, but only 54% also developed a strategy.

8% already apply Digital Twins. 35% at least started their implementation.
The assessed concepts exhibit a medium maturity. Strategies and target visions are more elaborated than the specific concepts.

- How does the Digital Twin influence business models?
- What added value will be created by Digital Twins?
- How do products or systems have to change to be twinned?

35% intend to change their business model with the Digital Twin.

27% of respondents intend to offer new products using the Digital Twin.

15% specifically expect no change in their business model.

31% hope the Digital Twin will enable them to accelerate internal processes in the company.
Digital Twin Readiness Assessment

Digital Twins will influence most business models. They bring new possibilities for a complete change or a change of focus.

**Key aspects:**

Many companies assume that Digital Twins will transform their business models significantly or at least allow for an extension.

- **Most OEMs** expect a *complete change* or an *extension* to their business model, but 11% also expect no change at all.
- **Suppliers** expect a complete conversion or change of focus.
- **Machine manufacturers** assume that the focus will change.

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### Change in business models

<table>
<thead>
<tr>
<th>Change Type</th>
<th>OEM (mobility: road, rail, air)</th>
<th>Supplier (mobility: road, rail, air)</th>
<th>Machine construction, mechanical and instrument engineering</th>
</tr>
</thead>
<tbody>
<tr>
<td>Complete change</td>
<td>17%</td>
<td>27%</td>
<td>33%</td>
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<tr>
<td>Change of focus</td>
<td>22%</td>
<td>27%</td>
<td>33%</td>
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<tr>
<td>Minor change of focus</td>
<td>17%</td>
<td>18%</td>
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<tr>
<td>Extension</td>
<td>9%</td>
<td>17%</td>
<td>33%</td>
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<tr>
<td>Minor extension</td>
<td>17%</td>
<td>18%</td>
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<tr>
<td>No change</td>
<td>11%</td>
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</tbody>
</table>
The primary benefit of Digital Twins is seen in the acceleration of internal processes, increase in efficiency as well as cost reduction.

**Expected benefits**

- Acceleration of internal processes
- Increase in efficiency
- Reduction of costs
- New insights on products (behavior, use)
- Improve of customer relationship
- Improvement of products
- Realtime production control
- Improvement of adherence to delivery dates
- Increase in transparency in companies
- Optimization of processes

**Key aspects:**

Expected benefits from the Digital Twin mainly focus on internal aspects:

- Accelerated processes (31%)
- Increased efficiency (27%)
- Cost reduction (27%)

In detail: Specifically **OEMs** and **machine construction** companies focus on the acceleration of processes, **suppliers** on the increase in efficiency and the reduction of costs.
Digital Twin Readiness Assessment

The assessed concepts show a great diversity with regard to system in focus, related tasks and product life cycle phases.

- Which tasks will be executed by Digital Twins?
- How are Digital Twins applied and which capabilities are necessary?
- Which technologies are necessary for Digital Twins and their interconnection?

73% of the interviewed companies focus on product systems.

42% apply Digital Twins within the product development phase.

64% see data provision as a major task for Digital Twins.

36% did not yet define the interconnection between physical system and Digital Twin.

Digital Readiness Assessment | prostep ivip Symposium 2020 | msg and Fraunhofer IPK - 01.10.2020
The assessed concepts focus on the digital representation of the whole product or the related sub-systems.

**Key aspects:**

The assessed concepts mainly focus on product systems, rather than on the production context. The stated relevant information for the **product context** are:

- Status and condition
- Performance
- Behaviour
- Components in use
- Functions and their usage
- As well as geometry.

**Main groups of assessed Digital Twin concepts**

- **Product context** (73%)
- **Production and assembly context** (27%)
The assessed concepts focus on the digital representation of the whole product or the related sub-systems.

**Key aspects:**

Within Digital Twins in the **production and assembly context** the following information is depicted:

- Tolerances,
- Control behaviour,
- Functions,
- Kinematics,
- Geometry,
- Conditions,
- Material flow,
- As built status and KPIs.
Especially OEMs of the mobility industry aim at depicting entire product systems within their Digital Twin concepts.

**Key aspects:**

The comparison between the industry groups shows further differences:

- Products as a whole are the main focus of **OEMs**
- **Suppliers** see also Digital Twins of parts of the product system or processes as relevant
- **Machine construction** companies exhibit a wide spectrum of answers.
The main tasks of Digital Twins are data provision and to ensure functional safety.

Key aspects:
The concept of Digital Twins allows for a wide range of functions which is also reflected in the answer spectrum.

- In the **product context** a Digital Twin is supposed to provide data and to ensure functional safety
- In the **production context**, production planning tasks are additionally relevant.

Room for improvement: More complex tasks such as prediction and automated planning could be considered.
The implementation of Digital Twins exhibits the lowest level of maturity – especially with regard to data and information models as well as IT-systems.

- Which implementation measures are necessary on organisational, process, model and IT-system level?
- Which skills are necessary for the Digital Twins?

<table>
<thead>
<tr>
<th>Maturity „Implementation“</th>
<th>Processes and organisation</th>
<th>Data and information models</th>
<th>IT-systems</th>
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</thead>
<tbody>
<tr>
<td>Low maturity</td>
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<td></td>
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<tr>
<td>High maturity</td>
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</table>

- 85% expect a change in the organisational structure of their company for the implementation of Digital Twins.
- 55% state that the responsibilities for a change of the processes for Digital Twins are unclear.
- 24% use internal IT-solutions for the implementation of Digital Twins.
- 72% of the interviewed companies need new and more IT-skills to implement and operate Digital Twins.
The way of change of the business processes is for nearly half of the companies uncertain, but most expect organisational change.

Key aspects:
Processes will partly change for supplier companies in the mobility sector and machine construction companies, whereas OEMs expect a complete change in processes. The necessary organisational changes are not seen as urgent or are already executed.

Change in processes

- Complete change
  - OEM: 27%
  - Supplier: 17%
  - Machine construction: 33%
- Partly change
  - OEM: 22%
  - Supplier: 67%
  - Machine construction: 67%
- Minor change
  - OEM: 11%
  - Supplier: 73%
  - Machine construction: 67%
- No change
  - OEM: 11%
  - Supplier: 11%
  - Machine construction: 11%

Change in organisational structure

- Complete change
  - OEM: 9%
  - Supplier: 20%
  - Machine construction: 14%
- Major change
  - OEM: 20%
  - Supplier: 27%
  - Machine construction: 20%
- Partly change
  - OEM: 60%
  - Supplier: 64%
  - Machine construction: 64%
- Minor change
  - OEM: 14%
  - Supplier: 57%
  - Machine construction: 57%
- No change
  - OEM: 14%
  - Supplier: 14%
  - Machine construction: 14%

Legend
- OEM (mobility: road, rail, air)
- Supplier (mobility: road, rail, air)
- Machine construction, mechanical and instrument engineering
For the implementation of Digital Twins companies need to acquire IT- and technical skills. Most companies are not equipped with the necessary skill set.

**Key aspects:**

The necessary skill set for Digital Twins shows the relevance of Systems Engineering, Data Science and IT as well as technical sets. Most companies will need to attract new personnel or invest in qualification.

- **OEMs** are in need of IT-skills and emphasize Data Analytics and AI.
- **Most Suppliers** will need new skills next to current capabilities.
- **Machine construction** companies mainly focus on IT- and technical skills as well as holistic thinking.

**Necessary skills**

<table>
<thead>
<tr>
<th>Necessary Skills</th>
<th>IT-Skills</th>
<th>Technical Skills</th>
<th>New Skills</th>
<th>Holistic Thinking</th>
<th>Education / Qualification</th>
<th>Analytics / Artificial Intelligence</th>
<th>Transformation</th>
<th>Social skills</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>64%</td>
<td>50%</td>
<td>17%</td>
<td>25%</td>
<td>38%</td>
<td>18%</td>
<td>13%</td>
<td>9%</td>
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<tr>
<td></td>
<td>83%</td>
<td>64%</td>
<td>50%</td>
<td>45%</td>
<td>50%</td>
<td>33%</td>
<td>18%</td>
<td>17%</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>73%</td>
<td>55%</td>
<td>63%</td>
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</tr>
</tbody>
</table>

**Legend**

- **OEM (mobility: road, rail, air)**
- **Supplier (mobility: road, rail, air)**
- **Machine construction, mechanical and instrument engineering**
Digital Twin Readiness Assessment

All in all, the maturity analysis shows a great diversity of Digital Twin concepts and future challenges with regard to implementation.

There is a good understanding of Digital Twins in general as well as first experiences from the application of Digital Twins.

The developed concepts have a medium maturity, whereby the strategies and target visions are more elaborated than the specific concepts.

The implementation of Digital Twins has the lowest level of maturity – especially with regard to data and information models as well as IT-systems.

Overall, Digital Twins are still in the conception phase, but there are many different approaches that reflect the diversity of the concept as a whole.

Overall maturity: 51%
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The future vision for Digital Twins reflects in the hope for new digital services and new business by 2040 with a high potential for sustainability evaluation.

- What is the future vision of Digital Twins?
- How relevant is the Digital Twin for ecological and social sustainability?

35% expect their Digital Twin to depict the “full system” including their environment until 2040.

38% hope for new business models by means of the Digital Twins until 2040.

27% expect their Digital Twin to be in use much earlier than 2040.

63% see a very high potential that Digital Twins can also execute sustainability assessment in the future.
However, most companies emphasize on goals such as internal efficiency and productivity enhancements as their vision for the future the of Digital Twins.

Key aspects:
The future vision for Digital Twins until 2040 is very diverse for many companies:

- Their tasks will become more complex with automation, control and interconnection
- **New digital services** will be enabled by Digital Twins
- Focuses on internal added values, such as productivity and efficiency and feedback to design
5 core questions form the basis of the "Digital Twin Readiness Assessment":

"How does the Digital Twin influence business models?“
There are great expectations regarding data driven services or business models. However, the strategy for the future focuses rather on improving existing products, processes or services.

"What value should be gained by the Digital Twin?“
The value is seen mostly in the internal optimization of the products, systems or processes around quality optimization, cost reduction and increase in efficiency.

"What do current concepts for the Digital Twin look like?“
The assessed concepts are divers and vary according to the company vision. Depending on the expected benefits, the Digital Twin focuses on a product, its sub-systems or production.

"What kind of actions are necessary for the Digital Twin?“
Introducing Digital Twins is transforming an enterprise and requires a holistic or overall approach in order to utilize the benefits.

"Which skills are required for the Digital Twin?“
New responsibilities will be needed with a strong focus on a cross-domain thinking as well as IT and data analytics skills. Solid engineering skills will not be enough in the future to develop and operate Digital Twins.
Digital Twin Readiness Assessment

Our five key learnings and recommendation to you: Make the Digital Twin a part of your digitization strategy and align your processes and organization.

Recommendations

Break down data silos and ensure the availability of relevant data along the product life cycle to support your use case and value.

Utilize the full potential of the Digital Twin and take all elements of the Digital Twin definition into consideration.

Focus on your specific use case and the expected value.

Accompany the change through targeted change management.

Establish the necessary support structures, organization and processes for the implementation of your Digital Twin vision.
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Any questions?

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