DEFINITION OF ASSESSMENT STEPS AND GUIDELINES

Deliverable D3.1

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AUTHORS
Dr. Laura van den Aarssen

LEAD PARTNER
TNO

QUALITY CONTROLLERS
Dr. Tor Dokken
EXECUTIVE SUMMARY

This deliverable describes the assessment of SME companies to assess their Digital Twin readiness.

The audience for this document is Digital Innovation Hubs, Change2Twin participants and SME companies in the smart manufacturing and production industry domain who stand to benefit from enabling digitalization, specifically through the application of a Digital Twin solution.

The justification for this document is – as it is for the project Change2Twin as a whole – the slow uptake of Digital Twin solutions by SMEs.

To build a common ground for the assessment, Chapter 3 provides an outline of the assessment process in general. The next chapters (4 to 7) detail the steps of the Assessment.
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### 1 DOCUMENT SCOPE

The Change2Twin project aims to support companies, specifically Small and Medium Enterprises (SMEs) in finding a solution that is tailored to their specific business needs and ambitions.

An important part of the Change2Twin project are the open calls, in which two different instruments will be used: Assessment Voucher and Deployment Voucher (both through an FSTP mechanism). This document is about the assessment, which will provide manufacturing SMEs with access to an end-to-end service, which can be delivered by a Digital Innovation Hub (DIH) of choice – either one of the core partners of Change2Twin or a certified DIH that joined the Change2Twin network.

After being granted an Assessment Voucher, the participating SMEs will receive a detailed analysis (assessment) of their situation and 3 different “recipes” from a certified DIH who they chose to work with, containing the list of different technologies fitting the use case and details of an integrator able to implement them. Both the assessment report and the recipe are of value to the manufacturing company on their own – providing both the external, expert insights as well as a custom-tailored, ready to implement solution.

This deliverable (D3.1) describes the assessment of SME companies to assess their Digital Twin readiness.

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The justification for this document is – as it is for the project Change2Twin as a whole – the slow uptake of Digital Twin solutions by SMEs.

To build a common ground for the assessment, Chapter 3 provides an outline of the assessment process in general. The next chapters (4 to 7) detail the steps of the Assessment.
2 DESCRIPTION OF ASSESSMENT PROCESS

To be able to assess the state and plans of any company, it is preferred to visit this company and really get a feel for its way of working, its culture and level of technology uptake. However, in the middle of a Covid-19 pandemic, with lock-down and travel restrictions, the Change2Twin project realised that visiting would not be an option in many cases.

Soon in the project, the WP3 team decided that the Change2Twin project needed to do more to overcome these limitations caused by the Covid-19 pandemic. Since it is unlikely that physical visits are possible in most of 2021, the WP3 team felt obliged to create a set of tools that guide the DIHs and SMEs through the assessment, rather than just provide guidelines. The guidelines and KPI’s are incorporated into a set of assessment tools.

The assessment is based on the Digital Twinning primer that encompasses a seven-step model for successfully implementing Digital Twins. (ESI, 2020)

YOUR STRATEGY IN SEVEN STEPS

The first step is to clearly state WHY an SME is considering digitalisation and Digital Twinning. There are many different digitalization solutions available. Digital Twinning is only one of them. Step one is supported by a tool which uses several inputs from the SME and results in a ranking of digitalisation options, and the relevance of Digital Twinning.

In case Digital Twinning relevance is medium/high, the SME can continue with Step two: the digital twinning readiness assessment. This is a second tool that provides the SME with insights into its readiness and desired levels, and thus leads to clear steps that need to be taken to reach the desired state.

With the outcome of both tools, the DIH can then advice the SME on technology choices and create the recipes.
3 STEP 0: PREPARATION

The Certified DIHs have been instructed on how to use the Assessment tools, but an SME will probably only perform the assessment once. Since a serious assessment requires proper data, it is beneficial that the SME is well prepared, and has the requested information at hand. This will also greatly improve the efficiency of the assessment.

To allow the SME to prepare for the assessment, a document was created that outlines what is needed, what the process will be and who should attend. This document is to be send to the SMEs well in advance of the assessment and is added as an annex here (see 10 Annex: Preparation document).

4 STEP 1: DIGITALISATION ASSESSMENT (COMPASS)

There are many different digitalization solutions available where Digital Twinning comprises only one of them. SME’s are often focussed on running the daily business and lack the time to immerse themselves in all available options. For SME’s to invest in digitalization, however, they need to understand how these solutions will benefit their business.

For this reason, the Change2Twin assessment starts with evaluating the digitalisation status of the SME in relation to its strategy. For this the certified DIHs first need to understand the SME’s current situation and their future business ambitions. The key input to evaluate this information are the KPI’s that the SME wants to improve on in the future. The assessment then links the business needs to the most relevant digital transformations and indicates the relevance of digital twinning as a specific solution to achieve the business ambitions.

As shown in Figure 1, if the resulting relevance of Digital Twinning is low, the SME is advised to continue with other digitalisation aspects of the business first. The DIH should help the SME in this case to find other, more relevant digitalisation possibilities. On the other hand, if relevance seems medium or high, the SME is advised to continue with the second assessment step to check the readiness of the business for Digital Twinning. More on this step can be read in Chapter 6.

FIGURE 1 ASSESSMENT FLOW FROM BUSINESS NEEDS TO READINESS AND THE MARKETPLACE

The digitalization assessment is meant to be carried out by the DIH in an interview with at least one contact person of the SME, preferably management level or at least someone who is fully aware of the business
status and strategy. Preferably this assessment is carried out at the SME’s premises, however it was designed with the pandemic in mind such that a virtual meeting will suffice as well. In order to structure and guide this assessment interview an easy-to-use tool was created in Excel, called the Change2Twin Compass Tool. Certified DIH’s have been instructed in how to use the tool for the digitalization assessment.

The Compass tool is comprised of 6 parts:

- Introduction to the tool
- Current status
- Future ambitions
- Digital transformations
- Digital twinning
- Dashboard

Below we will further explain each of these elements of the Compass tool in more detail by means of a (fictive) case study.

4.1 INTRODUCTION TO THE TOOL

The Compass tool starts with a short introduction of the Change2Twin project and explains the goal of the assessment and the tool itself.

Furthermore a data protection statement is shown here, such that the SME is informed about how the data will be used and is assured that his data is kept confidential. The SME has to agree with this statement in order for the assessment to continue with the Compass tool.
The Change2Twin project aims to support companies in finding a solution that is tailored to their specific business needs and ambitions. The assessment is intended to explore these ambitions and evaluate whether and how Digital Twinning can help the company to achieve them.

The Compass tool will guide the first part of the assessment, focusing on the business ambitions, KPIs, and digitalization opportunities. As a result, the SME will know the relevance of a Digital Twin solution and the specific purpose it is suited to his business ambitions.

After completion, one can continue with the second part of the assessment, the 7-steps assessment tool, which determines Digital Twinning readiness of the company (not included here).

Your knowledge partner:
- Company name: ERH Europe
- Advisor name: Jane Doe
- Telephone: 014-22445769
- E-mail: Jane.Doe@Change2Twin.org

SME Information:
- Company name: Mustermann Manufacturing
- Client name: Max Mustermann
- E-mail: m.mustermann@manufacturing.com
- Function: Management/Executive
- Date: 13.1.2020

Data protection

Statement of purpose of use and confidentiality

Purpose of use
The assessment data from the Compass Tool will only be used by your Knowledge Partner (see above) for the purpose of the research, being information collection to advise companies on the opportunities of digitization and to identify trends from the anonymous data.

Confidentiality
The Knowledge Partner and its representatives will keep confidential all information of which he/she knows or can reasonably suspect the confidential nature and which is generated in the context of the assessment and will not disclose it internally or externally and/or provide it to third parties in any way.

Publication
Data from the Compass Tool may only be used in anonymous form, not traceable to individual(s) or companies, for publication by your Knowledge Partner, its representatives and the company.

Retention of research data
The participants and the Knowledge Partner are responsible for supervision and correct storage and use of the research data. In other words, all data is stored in a secure environment. The participants in the Compass Tool declare that they agree to the legal retention period of at least 15 years after official publication or 15 years after the project has ended.

Permission
On the basis of the above preconditions, the participant in the Digiscan grants permission to the Knowledge Partner to use research data obtained from the Compass Tool.

I agree with the statement of purpose of use and confidentiality
4.2 CURRENT STATUS

First the DIH must get a good overview of the current status of the SME. For this purpose, a variety of questions have been created in the tool with answering options. The top three questions are mandatory:

- Reason and motivation for starting with digitalization.
- Current KPI’s for the management of the business and the individual level of digitalization for each of them.
- Overall level of digitalization, based on the Industry 4.0 Maturity levels (Schuh, 2017).

For each of these questions a comprehensive explanation of the definitions involved is available in the tool. This ensures the quality of the answers given by the SME.
## Current KPIs and digitisation

Which of the KPIs below are important to business operations (left) and to what extent have they been digitised (right)?

*Please note the definitions of the KPIs (to see them, click on the plus sign above column W). Unless stated otherwise, KPI's hold for the SME being assessed, not for the customers of the SME.*

<table>
<thead>
<tr>
<th>Financial</th>
<th>3 most important:</th>
<th>Current value:</th>
<th>Digitisation level:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revenue</td>
<td></td>
<td></td>
<td>digital (ad hoc)</td>
</tr>
<tr>
<td>Profitability (e.g. Cross profit margin)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operating profit</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Return of Investment</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total costs of ownership (TCO) (own assets)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inventory value</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Market</th>
<th>3 most important:</th>
<th>Current value:</th>
<th>Digitisation level:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product / service portfolio diversity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Market share</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total costs of ownership (TCO) (at customer)</td>
<td></td>
<td></td>
<td>manual</td>
</tr>
<tr>
<td>Customer satisfaction</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sales forecast</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Operational</th>
<th>3 most important:</th>
<th>Current value:</th>
<th>Digitisation level:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Delivery times</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Delivery reliability</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rate of returns / rejects</td>
<td>3</td>
<td></td>
<td>digital (ad hoc)</td>
</tr>
<tr>
<td>Throughput</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Employee satisfaction</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Waste</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO2 emissions</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Changeover time</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>First Time Yield (FTY)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overall equipment effectiveness (OEE)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Downtime due to Maintenance (MTBF/MTTR/MDT)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Supply reliability</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Response time</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Besides these three mandatory questions, several additional (optional) questions are available in the tool as well. These are divided into three topics:

- Current Offer
- Current business operations
- Current Commerce

In this way, the DIH consultant can decide which topics need more detailing and can decide which questions are important to discuss. Answering options are available for these questions as well.
### Current offer

For questions about the current offer, click on the plus sign on the left (row 216).

#### Sector and market

<table>
<thead>
<tr>
<th>In which sector are you active?</th>
<th>In which market is your company mainly active?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction</td>
<td>Business to Business (B2B)</td>
</tr>
<tr>
<td>Media and entertainment</td>
<td>Business to Consumer (B2C)</td>
</tr>
<tr>
<td>Education and research</td>
<td>Other e.g.:</td>
</tr>
<tr>
<td>Government</td>
<td></td>
</tr>
<tr>
<td>Transport, storage and logistics</td>
<td></td>
</tr>
<tr>
<td>Retail and wholesale</td>
<td></td>
</tr>
<tr>
<td>Hospitality, leisure and tourism</td>
<td></td>
</tr>
<tr>
<td>Industry</td>
<td></td>
</tr>
<tr>
<td>Real estate</td>
<td></td>
</tr>
<tr>
<td>Water management</td>
<td></td>
</tr>
<tr>
<td>Information and communication technologies</td>
<td></td>
</tr>
<tr>
<td>Agriculture, forestry, horticulture and fisheries</td>
<td></td>
</tr>
</tbody>
</table>

#### Customer offer

What do you sell to your customers? Briefly explain this.

- Own products
- Own services
- Third-party products and/or services (brands)
- Other e.g.: ...

#### Personalisation of the offer

To what extent do you personalise your offer to your customers? How do you personalise the offer to your customer?

- Standard offer without adaptations
- Standard offer with minor adaptations to the customer needs
- Tailor-made to customer demand (based on a list of devices)
- Completely tailor-made according to the customer’s wishes
- Other e.g.: ...

#### Delivery time and quality

Can you guarantee your customer an exact delivery time? Can your organisation deliver the work on time?

- Yes
- No, because...

Does your customer usually get a faulty delivery?

- Yes
- No, because...

#### Complaints

Do you record complaints? If so, what is the most common complaint?

- Yes
- No, because...

---

### Current business operations

For questions about the current business operations, click on the plus sign on the left (row 216).

---

### Current commerce

For questions about the current commerce, click on the plus sign on the left (row 214).
4.3 FUTURE AMBITIONS

After having discussed the current situation of the SME in depth, a good understanding of the SME’s future ambitions is necessary to give good advice. In this part again several mandatory questions are available:

- Vision for the company’s future and the timeline
- KPI’s important for the future management of the business and the individual level of aspired digitalization for each of them (not shown in figure)
- Overall level of digitalization that is aspired in the future, based on the Industry 4.0 Maturity levels (Schuh, 2017)

The DIH can decide if more discussion is needed on the future ambitions. For this a number of optional questions with answering options are included in the tool. These are divided into three topics:

- Future Offer
- Future business operations
- Future Commerce

Future ambitions

Becoming market leader in our industry and double the sales. Making sure customers are satisfied.
4.4 DIGITAL TRANSFORMATIONS

In this part the SME gets a first glance into digitalization options and which are most suitable for their business. We make use here of the eight digital transformations: (Smart Industry programme, 2015)

- Advanced manufacturing
- Flexible Manufacturing
- Smart Products
- Servitisation/ Smart Services
- Digital Factory
- Connected Factories
- Sustainable Factory
- Smart Working

Each transformation includes a short explanation of typical effects that this transformation has on a business and some examples of applications that help to push this transformation.

Based on the future ambitions (KPI’s) of the SME, the tool calculates a score for each of the Digital Transformations. This scoring is then discussed with the SME and is to be used as a guideline. The DIH
and SME then decide on the top three most important transformations which they can fill out below. For each transformation, the SME must estimate his own knowledge and experience level.

<table>
<thead>
<tr>
<th>Digital Transformations</th>
<th>Typical effects</th>
<th>Relevance score</th>
<th>Examples of applications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Advanced Manufacturing</td>
<td>Higher production efficiency, time and cost savings through faultless production, innovative and attractive image for employees and customers.</td>
<td>7</td>
<td>Combining sensors with software so that automatic decisions can be made using them.</td>
</tr>
<tr>
<td>Flexible manufacturing</td>
<td>Smotherer changeover times between batches, automation in series for the process of less production, less stock / inventory needed.</td>
<td>3</td>
<td>Fast planning for robots without programming effort, autonomous environment on the basis of sensors and intelligence. 3D printing, multi-material and software optimized design.</td>
</tr>
<tr>
<td>Smart products</td>
<td>Streamlining products, use by the customer, product optimization for the customer, enabling services such as predictive maintenance.</td>
<td>7</td>
<td>Products which can react and communicate on own environment and can communicate with their environment (eg. through the Internet of Things IoT).</td>
</tr>
<tr>
<td>Smart services</td>
<td>Expansions of portfolio, new business models, entry into new markets, better-known customer relationships.</td>
<td>9</td>
<td>Providing services outside of the boundaries or collaborating with foreign actors.</td>
</tr>
<tr>
<td>Digital factory</td>
<td>Higher and optimal utilization of the production process, shorter lead times, less production downtime</td>
<td>6</td>
<td>Unlocking of factory data for the optimization of manufacturing processes, maintenance, etc. Use of computer models, combined with data for optimization.</td>
</tr>
<tr>
<td>Digital value chains</td>
<td>Less just-in-time administration, decisions, increased accessibility</td>
<td>4</td>
<td>Sharing of data between different companies and organizations for cooperation with (shared) partners.</td>
</tr>
<tr>
<td>Sustainable factory</td>
<td>Less CO2 emissions, less use of resources, green image for the outside world</td>
<td>2</td>
<td>Supporting or training employees, e.g. with safety instructions, help of specialists in the case of heavy physical strain.</td>
</tr>
<tr>
<td>Smart working</td>
<td>Avoid staff and retain them for longer, facilitate or staff averages through the deployment of lower skilled employees</td>
<td>4</td>
<td>Working and producing more sustainability using circular products and business models.</td>
</tr>
</tbody>
</table>

### Top 3 Digital transformations for the business

<table>
<thead>
<tr>
<th>Transformation</th>
<th>Relevance / intended effect</th>
<th>Innovation application</th>
<th>Own knowledge level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smart Products</td>
<td>Increase customer satisfaction</td>
<td>Digital Twin</td>
<td>Low</td>
</tr>
<tr>
<td>Smart Services</td>
<td>Increase sales and customer satisfaction</td>
<td>Robotics</td>
<td>Medium</td>
</tr>
<tr>
<td>Advanced Manufacturing</td>
<td>Increase quality of production</td>
<td></td>
<td>High</td>
</tr>
</tbody>
</table>

#### 4.5 DIGITAL TWINNING

Finally, the SME gets more information on digital twinning and the relevance for his business. First an estimation of the relevance is given (low, medium, high). This is based on the aspired digitalization level, which must be ideally equal or higher than 4. Also, the number of future KPI’s to which digital twinning can contribute is shown. Finally, an estimate of the effort needed to implement a digital twin is shown (low, medium, high).
After this, a list of typical examples of digital twins is shown, so-called digital twinning purposes. A definition and many application examples are shown such that the DIH can discuss these with the SME in detail. For each of the purposes the KPI’s that typically can be improved are shown as well. Based on the future KPI’s of the SME a scoring for each of the purposes is calculated by the tool. The DIH and SME can then decide on the most suitable digital twinning purpose for the business, with this scoring as a guideline.

4.6 DASHBOARD

Finally, the dashboard gives a summary of the digitalization assessment by showing the most important outcomes. It comprises four elements:

- Current status
- Future ambitions
- Digital transformations
- Digital twinning relevance

The SME then has all the important conclusions and advice available on one page.
As a next step, if the digital twinning relevance is medium or high, the SME can continue with the readiness assessment.
5 STEP 2: DIGITAL TWINNING READINESS ASSESSMENT

The Readiness assessment is meant to get more detailed information on the readiness of the SME for a specific digital twinning purpose on different aspects. For this part of the assessment another session with the DIH and the SME is necessary. Here it can be useful to have a more technical experienced member of the SME present. For this part of the assessment another Excel tool is available to guide the discussion between the DIH and the SME.

The readiness tool is comprised of the following parts:

- Introduction
- Current Status
- Intended
- Dashboard

These elements are discussed in detail below.

5.1 INTRODUCTION

The introduction shortly explains the goal of the Change2Twin project and the goal of the readiness assessment. It also has some space to document contact details. As in the compass tool a data protection statement is included to which the SME must agree to follow through with the assessment.
7-Steps for Digital Twins: Readiness Assessment

The Change2Twin project aims to support companies in finding a solution that is tailored to their specific business needs and ambitions. This assessment is intended to then explore the readiness of a company to implement solutions based on Digital Twinning.

This 7-Steps for Digital Twins: Readiness Assessment will often follow the Compass tool as first part of the overall assessment. The Compass tool focuses on the business ambitions, KPIs and digitalization opportunities. As a result of that step, the SME will know the relevance of a Digital Twin solution and the specific purposes best fitted to his business ambitions.

Your knowledge partner
Company name:  
Advisor name:  
Telephone:  
E-mail:  

Filled out for:
Company name:  
Client name:  
E-mail:  
Function:  
Date:  

Data protection
Permission
On the basis of the above preconditions, the participant in the assessment grants permission to the Knowledge Partner to use research data obtained from the assessment.

☐ I agree with the statement of purpose of use and confidentiality
5.2 CURRENT STATUS

In the "current status" part, a short explanation of the 7-steps method (ESI, 2020) is included as well as the digitalisation levels. For each of the 7 steps one or more questions have been designed to assess the current level of this step. For each question, the possible current digitalisation levels (6) have been indicated with an explanation of the level such that the SME is able to estimate his level more easily.

Current Status

Digital Twinning in 7-Steps

We assess the readiness for realizing Digital Twins following the 7 Steps approach.

The Smart Industry Digitalization levels provide the concepts for our readiness levels.

Start with Why

We assume clarity on the purpose of the innovation - the WHY - and the KPIs it addresses. If this is not the case change that with the Change2Twin Compass tool.

Asset Selection

Are you ready to select your asset?

Confidence in decision making

- Confident and detailed understanding

Infrastructure

Are you ready to tap into your assets?

Technology and process database

In your information infrastructure ready?

- Detailed overview of data

- Extensive database overview

- Extensive overview of data
5.3 INTENDED

In the digitalisation assessment the most interesting digital twinning purpose was identified. This is the first step in the 7-step method, namely identifying the reason for implementing a digital twin (the “WHY”).

Here with the help of the DIH the SME can indicate this purpose by choosing from the list (all purposes are included). Some of the purposes require more specification, e.g., in the example shown the purpose “optimization and best quality” needs specification from the SME if this digital twin needs to be predictive or not. The specifications can be indicated in the tool.

### Future Digital Twin

#### Intended Digital Twin Purpose

<table>
<thead>
<tr>
<th>Position</th>
<th>Purpose</th>
<th>Specification</th>
<th>Simulation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Model-based system engineering, incl. analysis and design, ensuring the systems are not and operating to near-zero integration, test, verification and validation.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Optimize digital systems and capabilities for customers and understand how internal needs and how they utilize it.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Checking the entire implementation of a system against its design as captured in the digital twin commissioning guide or manual.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Capturing design characteristics with the digital twin framework, updating digital twin designs, and future designs, on operational data.</td>
<td>Usage Profiling</td>
<td>Trend Analysis</td>
</tr>
<tr>
<td>6</td>
<td>Monitoring parameters of the system, and comparing the digital twin framework, with operational data.</td>
<td>Change Detection</td>
<td>Spatial Detection</td>
</tr>
<tr>
<td>7</td>
<td>Process control of the digital twin to optimize system operation for best performance and efficiency.</td>
<td>yes</td>
<td></td>
</tr>
</tbody>
</table>
5.4 DASHBOARD

Finally, in the dashboard the result for the assessment is shown. The chosen purpose along with any specifications is shown top left (first step of the 7 steps method). In the graph each of the remaining steps form the 7-steps method is shown. Current levels (red) are compared with necessary levels (dashed black line) for the specific purpose. Readiness gaps are indicated in light yellow. This indicates where the SME needs to invest time and resources to be able to fully implement and benefit from the chosen digital twinning purpose.
6 STEP 3: DIGITAL TWINNING RECIPES FOR SME’S

With the outcome of both tools, the DIH can then advice the SME on technology choices and create the recipes.

This is also where the assessment tools and the Change2Twin marketplace link. Ideally the flow that an SME experiences looks like this:

The SME has a general idea, and with the help of the assessment tool the SME gets a structured overview of its "current status" and the desired outcome. Based on this result the DIH can advise on the recipes that will bring the SME to the desired outcome. The ingredients in this recipe are the enabling technologies and services needed to reach the desired state. The SME can then move on to the Change2Twin marketplace where these enabling technologies and services are available.

7 CONCLUSION AND NEXT STEPS

The assessment tools have been tested at all four pilot partners (Graphenstone, Robopac, SPS and Additive Industries) in the Change2Twin project. Based on the feedback of the partners the tools were adjusted and tested again. Once the tools were stable the tools were released to the certified DIHs.

The tools will greatly benefit the execution of the Assessment phase of the open call, since now all DIHs will have a structured and standardised format to execute the Assessment.

An important next step is to ensure that the terminology and tags used in the marketplace and the Assessment tools is identical and perfectly clear to the intended audience, so that the recipes translate into a shopping list that SMEs can go to the marketplace with. This activity is part of Task 1.4 and Workpackage 2.

8 REFERENCES


DEFINITION OF ASSESSMENT STEPS AND GUIDELINES
Consisting of

SINTEF  SINTEF AS
TTTech-IND  TTTech INDUSTRIAL AUTOMATION AG
Jotne  JOTNE EPM TECHNOLOGY AS
FBA  FUNDINGBOX ACCELERATOR SP ZOO
TNO  NEDERLANDSE ORGANISATIE VOOR TOEGEPAST NATUURWETENSCHAPPELIJK ONDERZOEK TNO
BOC  BOC ASSET MANAGEMENT GMBH
UNIBO  ALMA MATER STUDIORUM - UNIVERSITA DI BOLOGNA
CLOUDBROKER  CLOUDBROKER GMBH
IR  ASSOCIATION IMAGES & RESEAUX
PSNC  INSTYTUT CHEMII BIOORGANICZNEJ POLSKIEJ AKADEMII NAUK
SPS  SPACE STRUCTURES GMBH
CORDIS  CORDIS AUTOMATION B.V
Unit040  UNIT040 ONTWERP BV
Author-e  AUTHOR-E BV
Additive  ADDITIVE INDUSTRIES BV
CT INGENIEROS  CT INGENIEROS AERONAUTICOS DE AUTOMOCION E INDUSTRIALES SL
AETNA GROUP  AETNA GROUP SPA
Graphenstone  INDUSTRIA ESPANOLA PARA EL DESARROLLO E INVESTIGACION 2100

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Document History

<table>
<thead>
<tr>
<th>Version</th>
<th>Issue Date</th>
<th>Stage</th>
<th>Content and Changes</th>
</tr>
</thead>
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<tr>
<td>1.0</td>
<td>11.01.2021</td>
<td>Final</td>
<td></td>
</tr>
</tbody>
</table>

1 Integers correspond to submitted versions
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1 CHANGE2TWIN ASSESSMENT

This document is intended to be used by the SME during the preparation phase of the assessment. It provides information and guidance regarding the environment, duration and participants of the assessment. Moreover, it aims to help the SME collect the necessary documents and information before the assessment session.

The Change2Twin project aims to support SME’s in finding a solution that is tailored to their specific business needs and ambitions. The assessment is intended to explore these ambitions and evaluate whether and how Digital Twinning can help the SME to achieve them. The assessment starts with understanding the SME’s current situation and what their future business ambitions are. The key input used for this purpose are the KPI’s that the SME wants to improve on in the future.

Organizations can highly benefit from this assessment by gaining significant competitive advantage in today’s rapidly growing technology landscape. The assessment can help them translate their business goals and vision into technical capabilities and a roadmap for success. Moreover, through the Change2Twin project, companies can leverage their innovation ecosystem by ensuring access to the largest European marketplace for implementing these solutions.

1.1 WHAT IS THE ENVIRONMENT OF THE ASSESSMENT?

It is preferable that the assessment meeting(s) will be held at the premises of the SME if the situation allows for it. A tour of the SME facilities would help the consultant performing the assessment to get a better understanding of the organization’s situation and context.

In case this is not possible due to circumstances, the assessment meeting(s) will be held virtually via any video conferencing software (e.g. Microsoft Teams, Webex, Skype, Zoom, etc.) that is available to both the SME and the consulting partner. A virtual tour of the facilities might be needed during for refinement of the assessment. Please make necessary arrangements on beforehand and notify the participants in case of any problems.

1.2 WHAT ARE THE PHASES AND DURATION OF THE ASSESSMENT?

The Change2Twin assessment is comprised of three phases. The first phase includes the preparation of the SME, which should make sure that has collected all the necessary information. Following the preparation, the second phase is the digitalization assessment. Based on the output of the second phase, the assessment team will perform the third and last session, namely the digital twinning readiness assessment. The time between the different phases of the assessment shall be decided in agreement with the SME.

- **Preparation**
  - The SME and the Knowledge partner prepare for the assessment session.
  - Time for preparation might vary per SME.

- **Digitalisation Assessment**
  - The digitalisation assessment links the business needs to the most relevant digital transformations and indicates the relevance of digital twinning as a technical solution.
  - The Knowledge Partner will use a tool named “Change2Twin Compass Tool” to perform the Digitalization assessment.
  - It can be performed in one or two sessions, depending on what the participants prefer. The duration of this assessment in total may be up to 4 hours.
    - S1: Explore the current status and future ambitions of the SME (up to 2.5h)
S2: Identify relevant digital transformations and the digital twinning relevance for the SME (up to 1.5h)

- **Digital Twinning Readiness Assessment**
  - The readiness assessment is suggested as a next step, if the assessment team concludes in the previous phase that Digital Twinning is a relevant solution for the SME (medium to high relevance).
  - The Knowledge Partner will use a tool named “Change2Twin Digital Twinning Readiness Tool” to perform the Readiness assessment.
  - It can be performed in one session, with a duration between up to 2.5 hours.

### 1.3 WHO WILL TAKE PART IN THE ASSESSMENT?

It is preferred that 1 to 3 persons from the SME take part in this assessment. We suggest that someone from management level (e.g. the CEO), who has clear overview of the SME’s business activities and strategic ambitions, is the main participant and contact person for the Knowledge partner. This is especially the case for the digitalization assessment phase.

It is beneficial for the assessment if employees with technical and/or innovation management expertise are involved in either the preparation or the assessment sessions themselves. Especially in the third phase, the Digital Twinning Readiness Assessment, technical expertise is necessary to perform the assessment.

In case it is not possible to involve the suggested persons, please ensure that the main participant has the necessary knowledge and access to relevant information such that he/she is able to reflect the needs of the organization during the assessment sessions.

### 1.4 HOW TO PREPARE FOR THE ASSESSMENT?

The following paragraphs give an indication of information that is useful to provide before or during the assessment. This information can either be in the form of a person answering questions from experience or in the form of relevant documents and reports. The more information that is available, the more detailed and tailored the results of the assessment will be to the SME. It is acceptable and understandable that not all of this information will be available. If necessary, it can also be added after the assessment session.

#### 1.4.1 General information

The SME will be asked to provide some general information **before** the assessment to the Knowledge partner such that they can prepare.

- Names and functions of participants
- Contact information
- Location
- Size of organization
- Years of activity
- Number of employees
- Manufacturing sector
- Information on products and services
- Information on client segments
1.4.2 Digitalization

During the assessment various aspects of digitalization will be discussed. The SME will be asked to provide information about previous digitalization projects as well as the current status of digital systems in the SME. Please make sure that someone can answer questions during the first session of the Digitalization assessment about the following topics:

- Previous experiences with digitalization projects
- Current digitalization status of all departments (production, sales, HR, etc.)

1.4.3 Future ambitions

It is important that the SME is able to clearly define and communicate with the Knowledge partner its short- and long-term goals and vision. The consultant(s) will discuss the areas where improvement might be needed in order to achieve these goals. It is suggested to have the following information at hand (or in mind) during the first session of the Digitalization assessment:

- Strategic roadmap (if available)
- Important KPIs with status quo and targeted values

1.4.4 Financial and operational information

It is suggested that the SME is prepared to provide detailed information about financial and operational aspects of the business. It is advised to – if available - have quantitative information on the following KPI’s at hand during the first assessment session:

<table>
<thead>
<tr>
<th>Key Performance Indicator</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revenue</td>
<td>How much money the SME makes in sales during a period (turnover).</td>
</tr>
<tr>
<td>Profitability (e.g. Gross profit margin)</td>
<td>SME's profit in relation to the size of the business. Gross profit margin = revenue (sales) - cost of goods sold (COGS). (Gross income)</td>
</tr>
<tr>
<td>Operating profit</td>
<td>Operating profit, also referred to as operating income, is a SME's profit after all expenses are taken out except for the cost of debt, taxes, and certain one-off items. (Operating profit = Gross Profit - Operating Expenses - Depreciation - Amortization)</td>
</tr>
<tr>
<td>Return of Investment</td>
<td>Approximate measure of an investment's profitability used to evaluate the efficiency of an investment or compare investments.</td>
</tr>
<tr>
<td>Total costs of ownership (TCO) (own assets)</td>
<td>Purchase price of a SME asset (or all assets combined) plus the costs of operation.</td>
</tr>
<tr>
<td>Inventory value</td>
<td>(Average) total value of inventory</td>
</tr>
</tbody>
</table>

Sources for definitions of KPI’s: Investopedia.com; goleansixsigma.com
<table>
<thead>
<tr>
<th>KPI</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product / service portfolio diversity</td>
<td>Number of products and services variations that are offered to clients.</td>
</tr>
<tr>
<td>Market share</td>
<td>Percent of total sales in an industry generated by this particular SME.</td>
</tr>
<tr>
<td>Total costs of ownership (TCO) (at</td>
<td>Purchase price of the produced goods plus the costs of operation for the</td>
</tr>
<tr>
<td>customer)</td>
<td>customer.</td>
</tr>
<tr>
<td>Customer satisfaction</td>
<td>Average level of satisfaction by customers on a predefined scale.</td>
</tr>
<tr>
<td>Sales forecast</td>
<td>Estimation of future sales for a particular period.</td>
</tr>
<tr>
<td>Delivery times</td>
<td>The time from the moment when the goods are produced until they are</td>
</tr>
<tr>
<td>Delivery reliability</td>
<td>delivered to the customer.</td>
</tr>
<tr>
<td>Rate of returns / rejects</td>
<td>Percentage of products that do not pass the quality check and/or are</td>
</tr>
<tr>
<td>Throughput</td>
<td>returned by customers.</td>
</tr>
<tr>
<td>Employee satisfaction</td>
<td>Average level of satisfaction by employees on a predefined scale.</td>
</tr>
<tr>
<td>Waste</td>
<td>Absolute value of waste generated in a period of time. (tonnes, €, m³, ...)</td>
</tr>
<tr>
<td>CO2 emissions</td>
<td>Amount of emissions generated by the SME during a period of time.</td>
</tr>
<tr>
<td>Changeover time</td>
<td>Time from the moment the last good part of the previous process is produced</td>
</tr>
<tr>
<td>First Time Yield (FTY)</td>
<td>The number of good units produced divided by the number of total units</td>
</tr>
<tr>
<td>Overall equipment effectiveness (OEE)</td>
<td>Measure of how well a manufacturing operation is utilized (facilities, time</td>
</tr>
<tr>
<td>Downtime due to Maintenance (MTBF/MTTR/MDT)</td>
<td>Time that the core business processes cannot run due to maintenance.</td>
</tr>
<tr>
<td>Supply reliability</td>
<td>Average ability of suppliers to consistently supply an acceptable resource</td>
</tr>
<tr>
<td>Response time</td>
<td>Response to a failure in the company’s own production process.</td>
</tr>
</tbody>
</table>

Please make sure to adhere to the definitions as given above. Any other KPI’s that are important for the SME’s business management that are not mentioned above should be communicated to the Knowledge partner. Together with them the SME can discuss how to relate this KPI to the definitions above and how to take it into account in the assessment.
1.5 DATA PROTECTION

All the data provided by the SME will be treated confidentially. Participants will be asked to read and approve the “Statement of purpose of use and confidentiality”, before one proceeds with the assessment. As a reference, details of the statement can be seen below, such that the SME can read it before the assessment.

1.5.1 Purpose of use

The assessment data from the Tools will only be used by your Knowledge Partner for the purpose of the research, being information collection to advise companies on the opportunities of digitization and to identify trends from the anonymous data.

1.5.2 Confidentiality

The Knowledge Partner and its representatives will keep confidential all information of which he / she knows or can reasonably suspect the confidential nature and which is generated in the context of the assessment and will not disclose it internally or externally and / or provide it to third parties in any way.

1.5.3 Publication

Data from the Tools may only be used in anonymous form, not traceable to individual (s) or companies, for publication by your Knowledge Partner, its representatives and the SME.

1.5.4 Retention of research data

The participants and the Knowledge Partner are responsible for supervision and correct storage and use of the research data. In other words, all data is stored in a secure environment. The participants in the Tools declare that they agree to the legal retention period of at least 15 years after official publication or 15 years after the project has ended.

1.5.5 Permission

On the basis of the above preconditions, the participant in the Assessment grants permission to the Knowledge Partner to use research data obtained from the Tools.