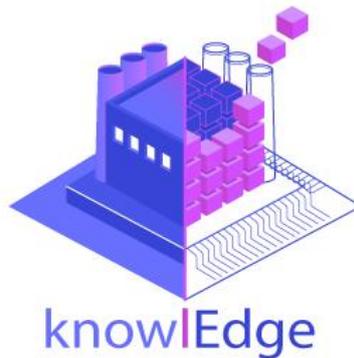


HORIZON 2020

Towards AI powered manufacturing services, processes, and products in an edge-to-cloud-knowlEdge continuum for humans [in-the-loop]



WP8: Applications of the AI Services on the shop-floor

EU ID: D8.2 Final Evaluation KPIs v1.0

Deliverable Lead and Editor: Leila Saari, VTT

Contributing Partners: Parmalat, Kautex, Bonfiglioli, Fraunhofer FIT

Date: 15 June 2022

Dissemination: Public

Status: Final for EU Approval

Abstract

The purpose of this knowlEdge deliverable, D8.2 “Final evaluation KPIs”, is to describe the final evaluation methodology and KPIs for the assessment of three pilots.

Grant Agreement:
957331



Document Status

Deliverable Lead	Leila Saari, VTT
Internal Reviewer 1	FIT Sisay Adugna Chala
Type	Deliverable
Work Package	WP8: Applications of the AI services on the shop-floor
ID	D8.2 Final Evaluation KPIs
Due Date (Original)	M18 = June 2022
Delivery Date	15 June 2022
Status	V.1.0: Final for EU Approval

History

See Annex B.

Status

This deliverable is subject to final acceptance by the European Commission.

Further Information

www.knowlEdge-project.eu and <mailto:info@knowlEdge-project.eu>

Disclaimer

The views represented in this document only reflect the views of the authors and not the views of the European Union. The European Union is not liable for any use that may be made of the information contained in this document.

Furthermore, the information is provided “as is” and no guarantee or warranty is given that the information is fit for any particular purpose. The user of the information uses it at its sole risk and liability.

Project Partners:

For full details of partners go to www.knowlEdge-project.eu/partners



Executive Summary

This deliverable D8.2 with title “Final Evaluation KPIs” presents the **evaluation framework of pilots** to be used in the final evaluation by M35. Knowledge project has four pilots. The pilot company and main goal are as follows:

- i. Parmalat (in Collecchio): Given a set of incoming order information, generate an optimized production scheduling.
- ii. Parmalat (in Rome): Given a set of interconnected information of production and distribution chain, estimate/predict the needed operational changes for enhanced process efficiency.
- iii. Kautex-Textronix: Given a set of adjustable manufacturing information (e.g. a set of modifiable key parameters), estimate/predict the final product quality.
- iv. Bonfiglioli: Given a picture of an assembled product in each assembly phase, generate solution for decision support whether or not the product is assembled correctly.

The framework is two-part: The AI maturity of companies is assessed in the begin of development (spring 2022) and again before the project will end (autumn2024). Initial AI maturity was assessed with the AI maturity tool of VTT and it will be repeated in the end.

Also KPIs are two-part as there are both common KPIs reflecting the development of pilots’ development and implementation in terms of:

- Number of pilot’s datasets involved in an AI solution developed for a pilot
- Number of AI algorithms demonstrated and tested with pilot’s dataset(s)
- Number of AI algorithms validated in a pilot
- Number of digital twin models developed for a pilot
- Number of data sources added (during the project) because of an AI solution or digital twin model created for a pilot

In addition to these common (technical) pilot KPIs also business KPIs – unique for each pilot - are set and the development target is identified. Unfortunately – for business reasons – the actual initial (nor final) values will be presented in the deliverable but the delta % improvement. The final assessment results will be presented in D8.6 Evaluation results and KPI assessment in M35 based on the framework presented in this deliverable.

Table of Contents

0	Introduction	1
0.1	knowlEdge Project Overview	1
0.2	Deliverable Purpose and Scope	1
0.3	Target Audience	1
0.4	Deliverable Context	2
0.5	Document Status	2
0.6	Document Dependencies	2
0.7	Glossary and Abbreviations.....	2
0.8	External Annexes and Supporting Documents	2
0.9	Reading Notes.....	2
0.10	Document Updates.....	2
1	Introduction	3
2	AI maturity assessment.....	4
2.1	AI maturity tool.....	4
2.2	Initial AI maturity results	6
3	Pilot KPIs	10
3.1	Pilot 1 production scheduling.....	11
3.2	Pilot 2 estimate and predict changes.....	12
3.3	Pilot 3 – estimate product quality.....	12
3.4	Pilot 4 – quality assurance of assembly.....	13
4	Conclusions	15
	Annex A: History	16

0 Introduction

0.1 knowlEdge Project Overview

The knowlEdge project is funded by the H2020 Framework Programme of the European Commission under Grant Agreement 957331 and conducted from January 2021 until December 2023. The knowlEdge consortium consists of 12 partners from 7 EU countries, and its solution will be tested and evaluated in 3 manufacturing sectors with a total budget of circa 6M€. Further information can be found at www.knowlEdge-project.eu

AI is one of the biggest mega-trends towards the 4th industrial revolution. While these technologies promise business sustainability and product/process quality, it seems that the ever-changing market demands and the lack of skilled humans, in combination with the complexity of technologies, raise an urgent need for new suggestions. Suggestions that will be agile, reusable, distributed, scalable, accountable, secure, standardized and collaborative.

To break the entry barriers for these technologies and unleash their potential, the knowlEdge project will develop a new generation of AI methods, systems and data management infrastructure. This framework will provide means for the secure management of distributed data and the computational infrastructure to execute the needed analytic algorithms and redistribute the knowledge towards a knowledge exchange society. To do so, knowlEdge proposes 6 major innovations in the areas of data management, data analytics and knowledge management: (i) A set of AI services that allow the usage of edge deployments as computational and live data infrastructure, an edge continuous learning execution pipeline; (ii) A digital twin of the shop-floor to test the AI models; (iii) A data management framework deployed from the edge to the cloud ensuring data quality, privacy and confidentiality, building a data safe fog continuum; (iv) Human-AI Collaboration and Domain Knowledge Fusion tools for domain experts to inject their experience into the system to trigger an automatic discovery of knowledge that allows the system to adapt automatically to system changes; (v) A set of standardization mechanisms for the exchange of trained AI-models from one context to another; (vi) A knowledge marketplace platform to distribute and interchange AI trained models.

0.2 Deliverable Purpose and Scope

The purpose of this knowlEdge deliverable, D8.2 “Final evaluation KPIs”, is to describe the final evaluation methodology including both the AI maturity assessment and selected KPIs for each pilot.

0.3 Target Audience

The D8.2 “Final evaluation KPIs”, aims primarily to set up the evaluation framework for the pilots.

0.4 Deliverable Context

This report is based on the project procedures as defined within the knowlEdge Description of Action and Consortium Agreement and where necessary extends them in the operational aspects. However, it is subservient to those documents.

It is one of the cornerstones for achieving the project results, identified as follows:

- **Deliverable:** This deliverable will present the evaluation methodology and KPIs (M18). The assessment will take place M35 and presented in in D8.6:

0.5 Document Status

This document is listed in the Description of Action as “Public”.

0.6 Document Dependencies

This document has no preceding documents although the pilots are described in more detail in knowledge deliverables such as D2.1 (Pins, 2021) and D8.1 (Lämsä, 2022). The evaluation framework of pilots is presented in this deliverable and the final assessment will be presented in D8.6 Evaluation results and KPI assessment in M35. Thus, the output (framework for final evaluation) of D8.2 will be used as input for D8.6.

0.7 Glossary and Abbreviations

A definition of common terms related to knowlEdge, as well as a list of abbreviations, is available at www.knowlEdge-project.eu/glossary

0.8 External Annexes and Supporting Documents

External Documents:

- Annexes:
 - [AI maturity introduction in WP8 meeting](#) on 18th January 2022
 - [AI maturity results in WP8 meeting](#) on 13th April 2022
 - [KPI discussion](#) in GA- meeting on 19th May 2022
- No Supporting Documents:

0.9 Reading Notes

None

0.10 Document Updates

None

1 Introduction

The evaluation framework of pilots is presented in this deliverable and the final assessment will be presented in D8.6 Evaluation results and KPI assessment in M35. The evaluation framework of knowledge pilots is two-part. The first part consists of the Artificial Intelligence (AI) maturity assessment conducted with VTT's AI maturity tool.

Artificial intelligence (AI) is both revolutionising the ways in which societies functions and opening up new business opportunities. AI is expected to increase automation and boost productivity. It, therefore, is essential for all organisations to understand their readiness to take advantage of AI. VTT has created and published the AI maturity tool in Finnish and in English in 2019 (Saari et al., 2019). During 2021 the tool was translated also in French, German, Italian, Polish and Spanish for the EIT cross KIC AI activity (Saari et al., 2022).

The second part introduces the Key Performance Indicators (KPI) of pilots. KPIs cover both common project development goals and companies' business goals. The pilot KPIs are heterogeneous, unique for each pilot supporting their original unique business goals. In the next section the results of initial AI maturity assessment are presented. In the third section the unique pilot KPIs are presented with their development goals. The evaluation framework will be used in the final assessment of pilots in M35 and reported in D8.6.

2 AI maturity assessment

The AI maturity assessment was conducted with VTT's AI maturity tool¹ published in 2019 as a free self-assessment tool for companies to assess their current AI maturity and to find next steps to proceed with the exploitation of AI.

2.1 AI maturity tool

The AI maturity tool has six dimensions (**Figure 1**). Each dimension has two questions with prewritten responses reflecting the maturity levels. The maturity levels are (Pirttikangas et al., 2018)

1. Awareness of AI
2. Initial AI
3. Integrated AI
4. AI as part of identity.

On the zero level even the AI awareness is not existing. As an example, **Figure 2** presents the optional responses for the question “Does your organisation have roles or tasks related to AI?”.

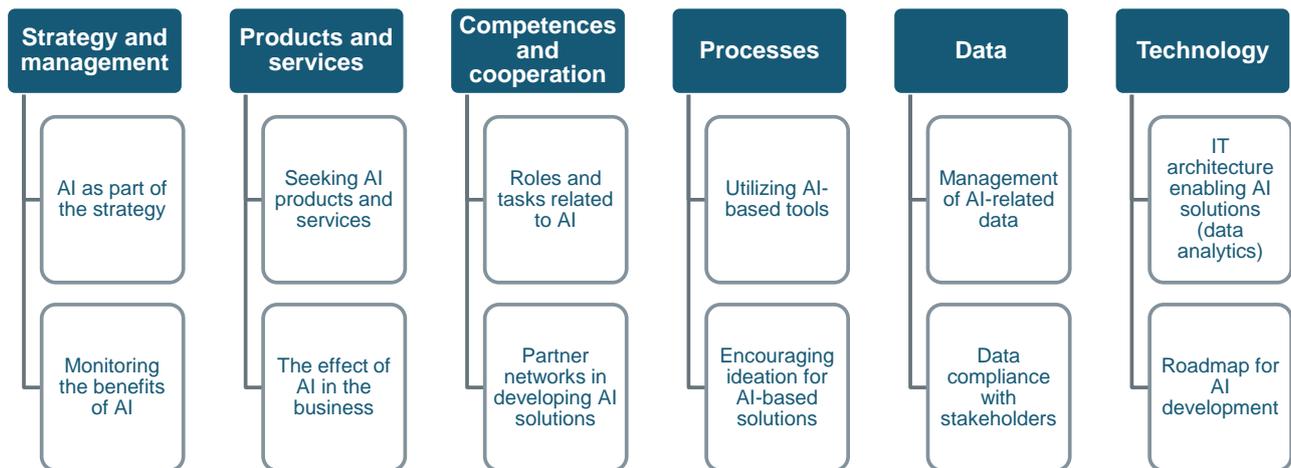


Figure 1 The dimensions and question areas of AI maturity tool.

¹ <https://ai.digimaturity.vtt.fi/>

Does your organisation have roles or tasks related to AI? (The role can be e.g. data engineer, data analyst, data scientist, service designer, UX engineer, etc.)

- No roles or tasks related to AI have been specified or identified.
- Occasional tasks related to AI are managed in an improvised form and are performed alongside other tasks, depending on the expertise of the person doing them.
- The roles and tasks related to AI are clear for certain teams or departments.
- The roles and tasks related to AI have been defined in the organisation.
- The roles and tasks related to AI have been defined internally and with stakeholders related to the broader ecosystem.

Figure 2 The prewritten response options reflect the maturity levels. Here, as an example is the first question about competences and cooperation.

The AI maturity assessment starts with registration at <https://ai.digimaturity.vtt.fi/>. The responder(candidate) needs to return via the link sent in the confirmation message. Further the respondent needs to enter some background information before starting the self-assessment. After selecting the best ones from twelve set of prewritten response options the responded can finally find the result diagram (**Figure 3**).

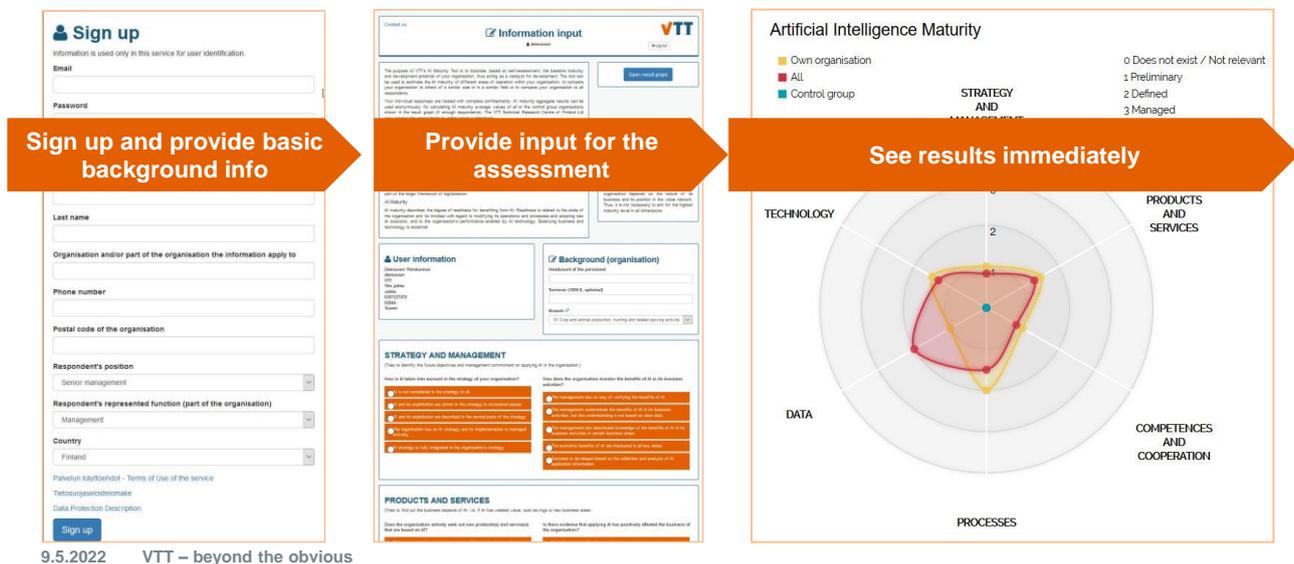


Figure 3 Each respondent needs to register with proper email address, fill in background information and select twelve best fitting response options before the result diagram is displayed.

2.2 Initial AI maturity results

The AI maturity tool was introduced to pilots in WP8 meeting on 18th January 2022 (Annex 1) and the overall results were presented on 13th April 2022 (Annex 2). In addition, each organisation got their company-specific results and possibility to have a remote result discussion (about 1h).

The AI maturity tool received a total of eleven responses (Table 1). We are of course slightly disappointed because of the low number of responses. Still, the initial measure was taken. The assessment will be repeated in the end of KnowlEdge project, hopefully with more responses. We can say that the Parmalat pilot was interested to review their AI maturity. There were two large companies (Kautex Textron and Parmalat) and one research organisation, Links from Italy. Figure 4 displays the roles of respondents and Figure 5 the function or organisation of respondents.

Table 1 Companies and countries of responses

Company	Country	Number of responses
Kautex Textron	DE	2
Parmalat	IT	7
Links	IT	2

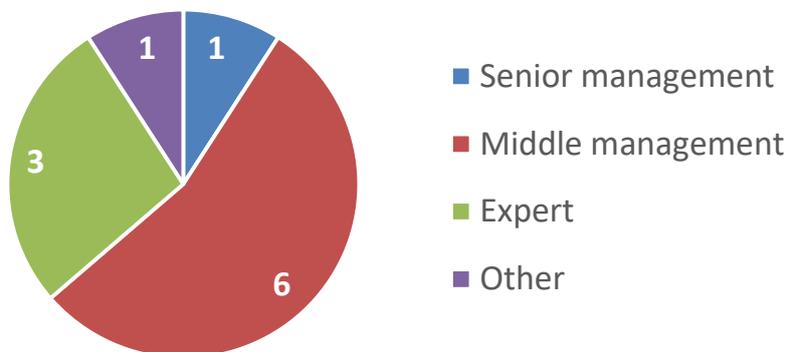


Figure 4 The roles of respondents

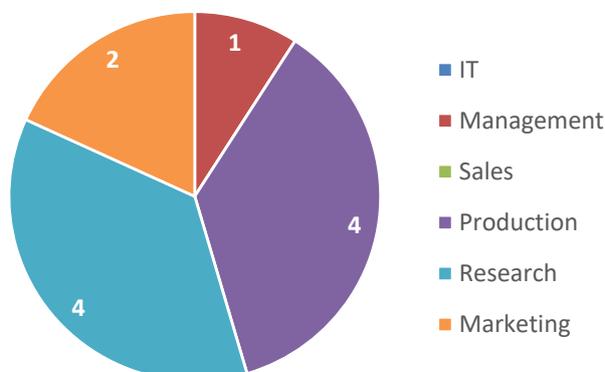


Figure 5 The function or organisation of respondents.

Figure 6 displays the average responses of KnowlEdge partners (N=11) with red line and the average of all responses (N=63) with blue line. The average result of KnowlEdge partners is below all responses in three dimensions, such as strategy and management, process and technology. In the competences and cooperation dimension KnowlEdge partners are above the all responses – may be because of this project. In two dimensions (product and services and data) the average responses are very close to each other.

Figure 6 also tells that the exploitation of AI has not spread in industry as desired, but is still below level 2, which is initial AI. In Technology and Process dimensions the average of responses is closer to level 1 (Awareness of AI) than level 2.

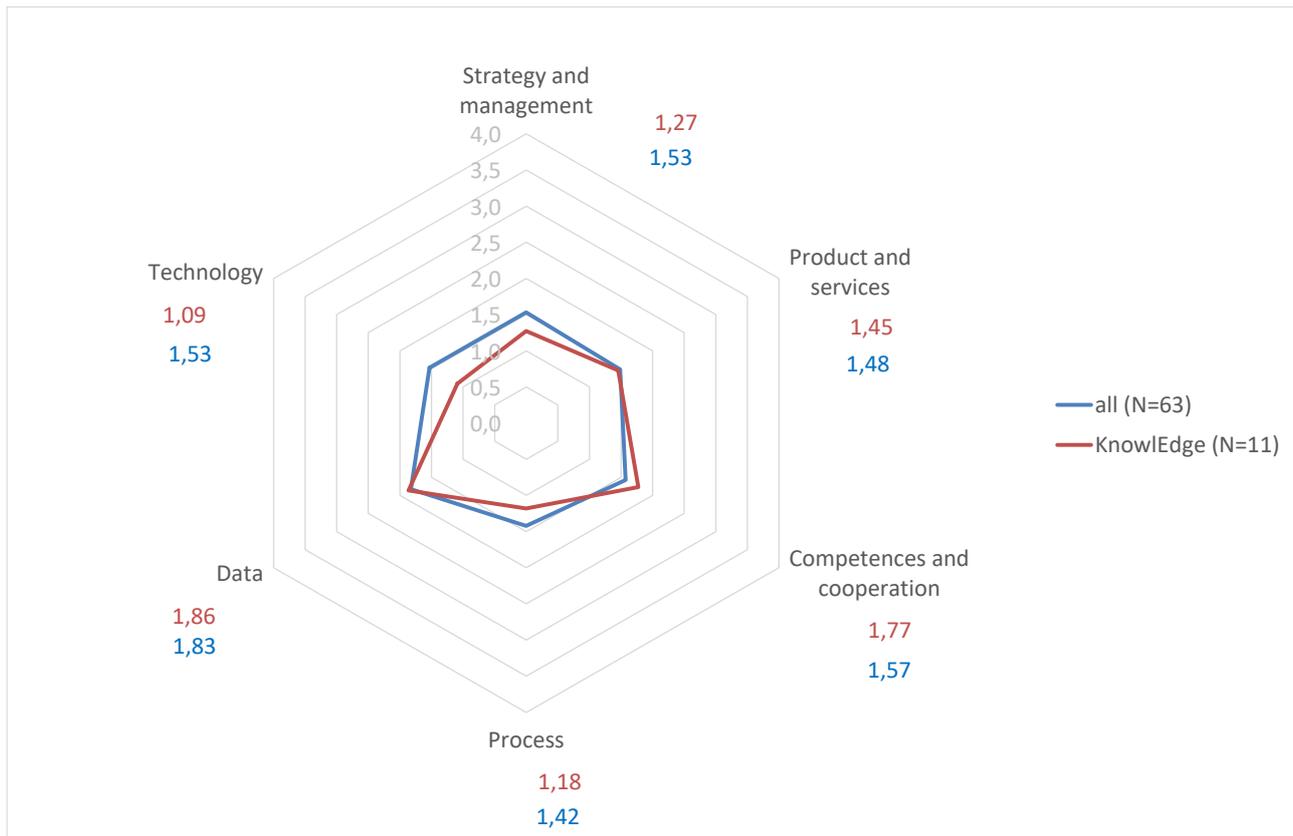


Figure 6 Result diagram

Figure 7 displays the question-specific average results of KnowlEdge (turquoise) partners and all (grey) respondents. The top two bars in Figure 7 fall into the **technology** dimension. The responses highlight that the awareness of AI (level 1) has been reached within the technology dimension this means that

- Experiments have been conducted using different techniques (such as machine learning for classification, or chatbots), tools cannot be integrated, and they are batch processed.
- The need for a roadmap has been identified.

The responses correlate well with the fact that the companies are now kicking off the implementation of AI solutions. Unfortunately, the average of knowledge responses remains behind the average of all responses.

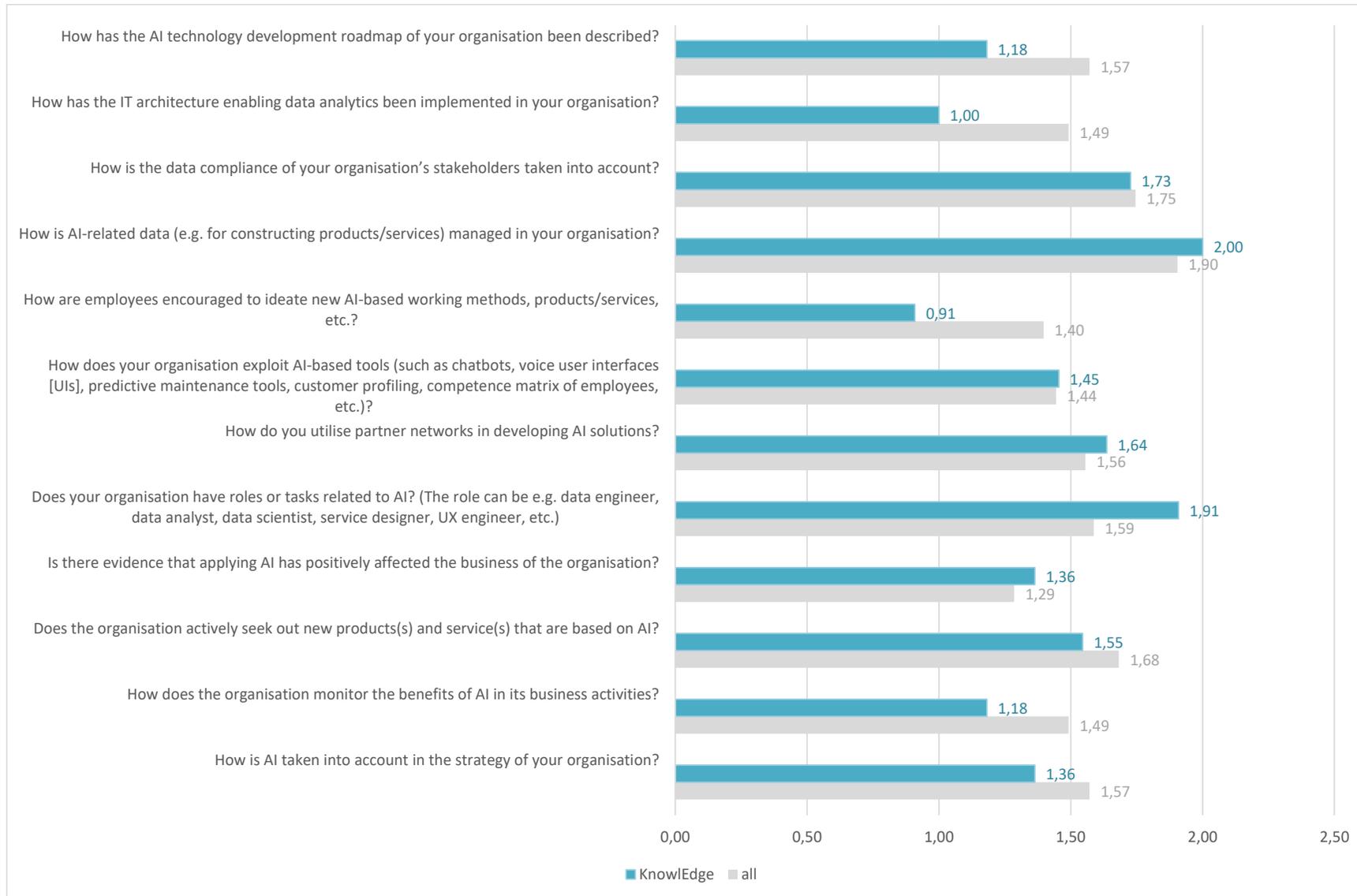


Figure 7 Question-specific average responses

The third and fourth bar belong to the **data** dimension. The average of data dimension is close to two (being 1,86) and exceeding the average of all responses (grey). AI related data is on level two, which indicates that the data management works, for example by function; data interconnections are possible between some applications. The data compliance is below level 2 as currently the AI solutions mainly do not interact with the external companies and stakeholders. Level 2 would be: compliance has been defined, for example by function (such as bilateral deals and individual working methods) when necessary.

The **processes** dimension remains below all responses as knowledge average was 1,18 and the average of all respondents 1,42. In the question related to the innovation process and AI based innovation encouragement knowledge remains below level 1 (0,91) indicating that no suggestion box or something equivalent for ideas exists. In the question related to AI-based tools the score is higher (1,45), i.e., between levels 1 and 2. The exceeded level 1 means that the utilisation of AI based tools is random and/or varies among individuals. Still, some isolated experiments have been performed. On level 2 the exploitation is on team level as some groups use these tools actively (e.g., the financial management or sales and marketing departments).

The average knowledge response of **competences and cooperation** dimension is higher than the average of all respondents. This is easy to believe as the partners participate in the project and will co-create AI-solutions. Both the utilisation of partner network and AI related question exceed the average of all responses and approach level 2. Level 2 in network question would indicate that the new AI solutions are developed systematically with partners and in role related question: The roles and tasks related to AI are clear in certain teams or departments.

In the **product and services** dimension the averages of knowledge and all respondents are at the same level, as the numeric difference is only 3 hundredths. The results remain between levels 1 and 2. Further, the average of knowledge responses reach higher when considering evidence that AI has positively affected the business. Still, the (average knowledge) value is 1,36 being clearly above level 1, which indicates small improvements as it has been possible to cut costs of the old business model and processes. When considering if the organisation actively seeks out new products or services - that are based on AI - the average of knowledges remains below the average of all. Both are slightly closer to level 2 meaning that the organisation systematically searches for new AI-based products and/or services.

The **strategy** dimension is on the bottom of Figure 7. There the knowledge responses (1,27) remain clearly below average of all responses (1,53). The gap is higher in the question related to the monitoring of business benefits of AI. The score is 1,18 slightly above level 1 indicating that the management understands the benefits of AI in its business activities, but this understanding is not based on clear data. The visibility of AI in strategy is 1,36 indicating that AI and its exploitation are shown in the strategy in occasional places.

The AI maturity assessment will be repeated before the end of the project and reported in deliverable D8.6 Evaluation results and KPI assessment in M35". It is expected that the number of respondents will increase as well as the AI maturity of respondents.

3 Pilot KPIs

The Key Performance Indicators (KPI) for pilot assessment were discussed together with the pilots and their AI solution providers. The mutually agreed measurable common pilot KPIs are listed here.

- Number of pilot’s datasets involved in an AI solution developed for a pilot
- Number of AI algorithms demonstrated and tested with pilot’s dataset(s)
- Number of AI algorithms validated in a pilot
- Number of digital twin models developed for a pilot
- Number of data sources added (during the project) because of an AI solution or digital twin model created for a pilot

The initial values of these were zero when the project started. By the final assessment (M35) we expect to have positive figures and plan to present the contribution of pilots to each KPI in D8.6.

These KPIs common to all pilots also drive the project goals. In the General Agreement (GA) knowlEdge proposes six major innovations in the areas of data management, data analytics and knowledge management such as: i) deployments as computational and live data infrastructure, an edge continuous learning execution pipeline; (ii) A digital twin of the shop-floor to test the AI models; (iii) A data management framework deployed from the edge to the cloud ensuring data quality, privacy and confidentiality, building a data safe fog continuum; (iv) Human-AI Collaboration and Domain Knowledge Fusion tools for domain experts to inject their experience into the system to trigger an automatic discovery of knowledge that allows the system to adapt automatically to system changes; (v) A set of standardization mechanisms for the exchange of trained AI-models from one context to another; (vi) A knowlEdge marketplace platform to distribute and interchange AI trained models (European Commission, 2020).

In addition to the common KPIs towards project goals, pilots were eager to set unique KPIs. Table 2 describes the high-level goals of knowlEdge pilots. The pilots are described in more detail in deliverables D2.1(Pins, 2021) and D8.1 (Lämsä, 2022).

Table 2 The high-level goals of knowlEdge pilots

#	Owner company	Goal
1	Parmalat (in Collecchio)	Given a set of incoming order information, generate an optimized production scheduling
2	Parmalat (in Rome)	Given a set of interconnected information of production and distribution chain, estimate/predict the needed operational changes for enhanced process efficiency
3	Kautex- Textronix	Given a set of adjustable manufacturing information (e.g. a set of modifiable key parameters), estimate/predict the final product quality
4	Bonfiglioli	Given a picture of an assembled product in each assembly phase, generate solution for decision support whether or not the product is assembled correctly

The columns for KPI tables are: KPI name, goal, target and measure (Table 3). Instead of the initial and target values the enhancement goal (delta%) is presented. The pilot specific KPIs are defined in next chapters.

Table 3 Columns for pilot KPI tables

KPI	Goal	Target	Measure
Descriptive short name of the KPI	Description of the improvement sought	enhancement goal, delta %	Declaration of measurement: what is measured, how the measurement is provided (automatically from ERP or manually), what is the measurement period (week, month) and is the measure cumulative or average

3.1 Pilot 1 production scheduling

Table 4 presents the unique KPIs set for production scheduling pilot at Parmalat in Collecchio. The production scheduling solution aims to decrease of human activities in production planning as currently one person is devoted to production planning for 80% of the whole daily working time. OEE² measures the overall efficiency of a given machine taking account of planned and unplanned downtimes. It gives insights into the efficiency of the production plant. These KPIs are dedicated for the yogurt product unit only.

Table 4 Parmalat Collecchio KPIs

KPI	Goal	Target	Measure
Scheduling hours	Decrease time devoted for production planning or scheduling.	-50%	Average of weekly hours (registered manually) devoted for production scheduling, Four months (weeks 22-28 in 2021) as baseline.
Yogurt OEE	Improve the theoretical OEE of yogurt production	+2-5%	Historical production data (from 2021-2024) will be rescheduled with the knowlEdge simulator and the simulated OEE is compared to the 2021 actual OEE.
Response time	Time to create a new production plan responding to real-time changes/variations based upon real-time data will decrease more than 50%	-50%	Timestamps from the deviation event (change or variation) and the delivery time of a revised plan are collected. Average manual response time (during Q2 2022) vs. average automatic proposal time (in Q3 2024)

² OEE Overall Equipment Efficiency

KPI	Goal	Target	Measure
Productivity	Decrease the number of man hours needed to produce one ton of product	from -2 to -5%	Use data of production and man hours on production line from our ERP (SAP). Baseline 2021
Downtime	Decrease the time of downtime and setups	-10%	Duration of changeovers and setups per ton produced in a week (baseline Q2 2022)
Scrap	Decrease the amount of scrap	-10%	Scrap per tons produced during a week (baseline Q2 2022)

3.2 Pilot 2 estimate and predict changes

Table 5 presents the KPIs of Parmalat Rome. The selected KPIs include both forecasting accuracy and Operative Efficiency of Equipment (OEE).

Table 5 Parmalat Rome KPIs

KPI	Goal	Target	Measure
Forecasting accuracy	Decrease the percentage of error in forecasting	-10%	Compare the forecast with real production data. Baseline H1 2022
OEE	Improve the OEE	+2-5%	Compare OEE from Parmalat's MES. Baseline H1 2022

3.3 Pilot 3 – estimate product quality

Table 6 presents the KPIs of Kautex pilot.

Table 6 KPIs of Kautex pilot

KPI	Goal	Target	Measure
Sampling days	Decrease the sampling time in days / hours to achieve Production Part Approval Process (PPAP)	-50%	Average daily sampling time (in hours) during a week in spring 2022 and autumn 2024 recorded manually excluding BMM troubleshooting, pure setup time.
Simulation accuracy "shot weight"	Increase simulation accuracy of shot weight	+70%	Average of shot weight variation of 10 articles in spring 2022 and 2014: measuring the shot weight manually, running the simulation and registering the difference of manual measurement and simulated result. Average of differences.

KPI	Goal	Target	Measure
Simulation accuracy “dimension”	Increase simulation accuracy of dimension i.e. decrease geometrical deviation	+70%	Average of dimension variation of 10 articles in spring 2022 and 2014: measuring the dimensions manually, running the simulation and registering the difference of manual measurement and simulated result. Average of differences.
Simulation accuracy “wall thickness”	Increase simulation accuracy of wall thickness	+15%	Average of wall thickness variation of 10 articles in spring 2022 and 2014: measuring the wall thickness manually, running the simulation and registering the difference of manual measurement and simulated result. Average of differences.
Process Improvements	Increase the number of preventive process adjustments	+10%	Amount of preventive process adjustments based on DSS proposals during a week in spring 2022 and autumn 2024 recorded manually

3.4 Pilot 4 – quality assurance of assembly

Table 7 presents the KPIs of Bonfigioli’s pilot focusing on the quality assurance of assembly. The first KPI considers the rework time. At now when an error occurs the process indicates to move the piece out of the line and proceed with rework. Idea is to be able to identify specific errors and rework right away. Also there are activities at high risk. With AI is possible to have detailed analysis and corrective action, lowering the risk. Company is willing to increase systematic data gathering of manual operations.

Table 7 KPIs of Bonfigioli

KPI	Goal	Target	Measure
Rework Time	Reduction of rework time	-5%	Rework time (amount of hours) will be manually recorded during a month in spring 2022 and autumn 2024.
Risk reduction	Increase corrective actions proposed by AI solution	+10%	Record the corrective actions (proposed by the AI solution) on critical steps during a month in spring 2022 and autumn 2024.
Data storage	Amount of exploitable data from manual operations will increase	+5%	Data volume (Gb) of manual operations will be registered in spring 2022 and autumn 2024.

KPI	Goal	Target	Measure
Real time control	Real-time control with step-by step checks (based on Ai solution) detects errors of manual operation before the final test.	+5%	Number of errors detected before final test during a month in spring 2022 and autumn 2024 are registered manually (spring 2022) and by AI (autumn 2024).
Quality control	The quality control of unique gear boxes is powered with configurable digital twin and camera-based measurement system.	+10%	Number of produced gear boxes validated with the configurable digital twin and camera-based measurement system during a month in spring 2022 and autumn 2024.

4 Conclusions

In this deliverable the evaluation framework has been described. The first part describes the AI maturity assessment conducted in March 2022. The overall results of knowlEdge partners are quite similar to the average of all respondents. Still, the knowlEdge partners are already higher than average on the dimensions such as: data, competences and cooperation.

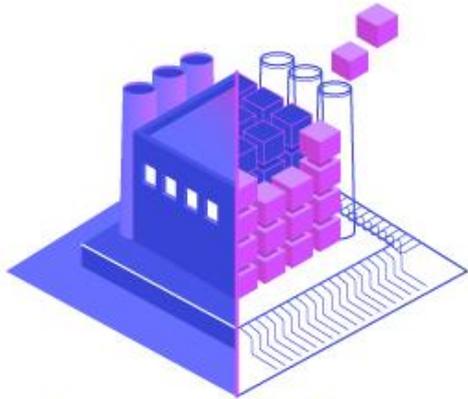
The second part of the framework consists of the pilot KPIs. There are common KPIs that help to assess the overall goals of the project. The business KPIs are unique for each pilot. They are set towards the overall goals of each pilot and to prove the progress in pilot development and deployment. In addition to these viewpoints the KPIs need to be measurable. For the business reasons of pilots the real initial values nor target values are presented here. Instead of these values the share (%) of progress is presented.

Annex A: History

Version	Contributor(s)	Date	Modifications
0.1	Leila Saari	8 th Sept 2021	ToC
0.2	Leila Saari	11 th May 2022	AI maturity results and preliminary KPI tables.
0.3	Leila Saari	31 st May 2022	After Helsinki meeting, second revision of pilot KPI tables.
0.4	Leila Saari	5 th June 2022	Executive summary
0.6	Sisay Chala	9 th June 2022	Review
0.7	Leila Saari	10 th June 2022	Final pilot enhancement goals and review comments fixed.
1.0	Leila Saari	10 th June 2022	Final for EU Approval

Annex B: References

- European Commission. (2020). *Grant Agreement-957331-knowlEdge*.
- Lämsä, V. (2022). *knowlEdge - D8.1 Pilot evaluation methodology and implementation plan*.
- Pins, D. (2021). *knowlEdge - D2.1 System Engineering, Specification and External Collaboration*. www.knowlEdge-project.eu/deliverables/
- Pirttikangas, S., Järvinen, T., Tarkoma, S., & Klemettinen, M. (2018). *Suomi tekoälyn kärkimaaksi: itsearviointin kautta kasvupolulle*. (in Finnish)
<https://www.ohjelmistoebusiness.fi/digibarometri-2018/>
- Saari, L., Kuusisto, O., & Pirttikangas, S. (2019). *AI Maturity Web Tool Helps Organisations Proceed with AI*. <https://doi.org/10.32040/Whitepaper.2019.AIMaturity>
- Saari, L., Ylikerälä, M., & Siltanen, P. (2022). *Background of the AI maturity tool for the EIT Cross KIC AI activity*. <https://cris.vtt.fi/en/publications/background-of-the-ai-maturity-tool-for-the-eit-cross-kic-ai-activ>



know|Edge

www.knowEdge-project.eu