

## ARTIFICIAL INTELLIGENCE AND BIG DATA CSA FOR PROCESS INDUSTRY USERS, BUSINESS DEVELOPMENT AND EXPLOITATION



#### Enjoy reading the third issue of the AI-CUBE newsletter!

Interesting details on barriers for implementation, solution strategies, implementation process, methods and tools for development... and further exploitation of Artificial Intelligence and Big Data.

Discover how you can still help the AI-CUBE consortium reaching its goals sharing your knowledge, and don't forget to follow the project on LinkedIn and Twitter to be always updated on the latest news!

#### Mapping of AI & BD technologies and Maturity Level Assessment

In the last six months, the Fraunhofer Institute for Material Flow and Logistics (IML) has continued to lead work package 3 and the underlying tasks. While the survey on currently applied AI and BD technologies and their maturities continued to be filled out by process industry experts and technology experts, the main focus was on

methods and processes for the implementation and the development of AI and Big Data solutions in the process industry. For this purpose, the most relevant barriers and challenges of an AI introduction were collected and analysed, which could be validated and prioritised through a first interim analyses of the survey results for application in the process industry. Based on this prioritisation, solution strategies for these implementation barriers were then developed and described.

However, the multitude of solutions from the areas of strategy, technology and data as well as human-centred cannot be considered individually. For this reason, the individual barriers and solutions were integrated into a comprehensive process model for the development and implementation of AI and BD solutions in the process industry. This work was supported by the drafting, submission and publication of a paper at DET 2021 on maturity-based workflows for the implementation of ML-applications in the exemplary application field of demand forecasting. Concrete methods and tools for the individual phases and tasks of the process model were then collected from other industries and application areas and presented in a structured way. By combining the process model and with the help of the exemplary practical methods and tools, barriers can be taken into account process-wise and solved in the best possible way.

As an initial preparation for the technology mapping and the cross-comparisons within the process industry to be derived from the survey results, transfer opportunities from other sectors to the process industry were identified. Structured by application area and sub-process, best practices with similar environmental requirements are compared and highlighted. Since each AI or BD model or algorithm must be updated or modified in a transfer process, the identified potentials require further analysis for a detailed evaluation of the transfer possibilities and effort.

Considering the focus of AI-CUBE and compared to the studies analysed above, the consortium designed a customized Maturity Level Assessment (MLA) framework for the process industry with a comprehensive approach of mapping AI and BD technologies within the processes, analysing the interplay between each technology and each process. The proposed MLA framework can be used to:

- assess the as-is situation of the organization/process;
- approach maturity improvement in order to positively affect business value;
- enable benchmarking across companies; in particular, a model of this nature would be able to compare similar practices across organizations.

The MLA framework is the multi-level approach, where the maturity is classified in two levels: company and technology. The effect of the company approach is assessed through dimensions like strategy, organization, and people involvement. The role of AI/BD is evaluated in terms of technological capability to give support to processes. This approach helps bridging the gap in the theory of maturity models and leveraging AI/BD solutions.



Strategy  $\rightarrow$  The strategic alignment of a company towards the AI/BD application. A clear AI/BD strategy should be integrated with the corporate level, and committed by the top management. AI/BD are considered as a competitive advantage for successful companies, and are aligned with the ethical, legal, and social issues.

**Organisation**  $\rightarrow$  The role of AI/BD experts and AI/BD governance capabilities within the company and its organisational structure. These aspects can affect the financial status and companies' capabilities to handle their AI/BD applications internally.

**People**  $\rightarrow$  Role and approach of employees towards AI/BD, training level, skill development, training aligned to the AI/BD objectives of the company.

Figure 1: Maturity Level Assessment multi-level approach

### AI-CUBE impact assessment and workshop on Impact Assessment

In order to promote the use of AI & BD in the process industry, Zaragoza Logistics Center, has developed a framework to be able to measure the impact. An impact matrix with 20 impact factors has been created, based on the A.SPIRE positioning paper (which lists the potential impact to be expected in the process industry) and the desk research. An important issue here is to make sure that the number of impacts and the indicators (KPIs used to measure the associated impact) is kept at acceptable levels, not to burden decision-makers with the demanding task of collection of data and measurement of too many KPIs. Therefore, through consultations with the industry experts and an online survey, a reduced impact matrix was obtained, and only worked with 5 such factors (the most voted ones). The most voted impacts were: (1) More efficient processes - improve industrial production, (2) More effective maintenance, (3) Strengthen workforce, (4) Increased profitability, and (5) Better quality products.

In order to understand how different stakeholders value AI & BD, the MAMCA methodology was employed. The scenarios (Full Integration, Business as Usual, Divergence, and Human Free) in relation to the adaption rates and the manner AI & BD solutions are deployed in the future and the actors were defined. The criteria (the 5 impact indicators mentioned in the previous paragraph) and the associated KPIs to aid in impact evaluation were set. This framework, therefore, constitutes a practical and reasonably detailed decision support tool that would help managers make informed decisions in regard to impact evaluation under different scenarios.

The AI-CUBE workshop on Impact Assessment developed on the 8th of October 2021 was used as a pilot-test of this methodology with the participation of a number of

experts in the process industry. The workshop facilitated a discussion leading to a more objective evaluation of the impact of Al&BD technologies in the process industry. In addition to the numerical scores in relation to the potential impact, we also obtained some useful managerial insight during the workshop. The 5 impacts were confirmed as important/very important to all the stakeholders, in almost all scenarios. The lowest score (although still high) was for "increased profitability" as it was not very clear how to connect the associated operational benefits to the profits in the end and the fact profits are regulated by many other factors (e.g., political). The results are positive therefore, and point to a certain level of willingness to deploy Al & BD in the process industry.

We also received feedback in terms of the likelihood of these different scenarios happening in the medium to long term, and the potential impact and cost of deployment. Except for the "Human Free" scenario, the other scenarios are likely to happen based on our results. Participants were optimistic in the sense that machines will not replace humans, they will simply amplify the human potential, which we think is good news for society at large.

#### AI-CUBE Workshop for AI & BD Technologies Experts in the process industry – Gaps Analysis, Opportunities and Barriers

On the 23rd of February 2022, the project consortium held the AI-CUBE Workshop for AI & BD Technologies Experts in the process industry – Gaps Analysis, Opportunities and Barriers, which took place online.

The event, moderated by Alicia Martinez de Yuso from Zaragoza Logistics Center, gathered 40 experts in Artificial Intelligence and Big Data technologies applied to the 10 SPIRE sectors (Cement, Ceramics, Chemicals, Engineering, Non-ferrous metals, Minerals, Refining, Pulp & Paper, Steel, Water) to discuss and identify opportunities to do more with these technologies.

The AI-CUBE results based on desk research and previous workshops were presented during the workshop. For this purpose, the main business concerns from the SPIRE sectors were identified and introduced to the audience. Through a collaborative space (Figure 2), the experts in the workshop validated and completed the set of business concerns by sector giving AI-CUBE valuable input on the main issues to be addressed and opportunities for AI & BD technologies in the industry.

Based on a literature search of more than 150 references, AI-CUBE has identified the most representative AI & BD solutions per sector, technology, process and application. An analysis of this work served as a starting point for the experts to contribute with solutions of AI & BD technology applied in their sector according to their expertise. The collaborative space collected all the input of the experts per sector.

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Figure 2: MIRO Board used as a collaborative space

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In order to address the concerns and opportunities per sector with AI & BD applications, the transfer of technologies from one sector to another can be an enabler to ensure the successful implementation (requirements, barriers, methodology and results are already examined in the process industry). The workshop explored the transferability of the AI & BD solutions provided by the experts. All the participants had the chance to analyse the AI & BD solutions that contributed to the collaboration space and identified the sectors to possible technology transfer according to the business concerns and opportunities. This analysis has provided useful insight into the current implementation of AI & BD technologies in the industry and the possible opportunities and synergies between sectors.

Finally, the main barriers for the implementation of AI & BD solutions in the industry identified in AI-CUBE were analysed by the experts and associated with the SPIRE sectors, creating the baseline for future recommendations to overcome specific barriers for AI & BD applications and per sector in AI-CUBE.

All the results of the workshops are valuable input from AI & BD experts in the industry in view of the development of the AI-CUBE guidelines for the implementation of AI & BD solutions in the SPIRE industry.

SECTOR	PROCESS	TECHNOLGY	APPLICATION	TRANSFERABILITY
WATER	PC&O	RNN	Quality prediction	CEMENT STEEL
ENGINEERING	PM	ML	Failure prediction, reconfiguration of manufacturing lines, product quality diagnosis and optimization	STEEL CEMENT CERAMICS PULP & PAPER
ENGINEERING	PC&O	ML NLP	Optimization	CHEMICALS REFINING STEEL
STEEL	PC&O	NN	Energy optimization	CEMENT CERAMICS WATER
CEMENT	PC&O	RNN	Cooling system optimization	STEEL

Figure 3: Example of the AI & BD solutions and transfer opportunities obtained in the workshop

You can still help us with your insights! We are looking for real implementation cases in the SPIRE sectors, so if you have an artificial intelligence or big data solution implemented in your organization, we want to know all about it! Please fill in this form... it will take you just 5 minutes!

Do you want to be engaged in the digital transformation of the process industries and be involved in the next events organized by the project? Contact us!

Visit the project website to know more about AI-CUBE and to be always updated about the latest results and progresses achieved by the consortium!

Take a look at the Dissemination & Communication materials of AI-CUBE, available on the download page of the project website!

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### **STAY IN TOUCH**

www.ai-cube.eu

🖂 info@ai-cube.eu

🥑 @AICUBEProject1



Project Coordinator: Ron Weerdmeester (PNO)

ron.weerdmeester@pnoconsultants.com



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