POLICY BRIEF #66

20 April 2023

Industry 4.0 technologies: benefits, adoption and acceptance of employees.

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SMIT STUDIES MEDIA INNOVATION TECHNOLOGY

Industry is digitally transitioning to the so-called Industry 4.0. Industry 4.0 promises improved flexibility and customisation in production processes by capturing and analysing live data supported by (new) technologies. Key technologies are: cobots, digital work instructions, artificial intelligence, exoskeletons and the Internet of Things (IoT).[1] The successful adoption of industry 4.0 depends on well-designed technologies and involved workers that went through a change management process. Forgetting about the second part might lead to lost investments and slow adoption rates. In this policy brief, we share the lessons learned from two projects focused on the adoption of new technologies. We also reflect on the current stage of Industry 4.0 implementation, challenges that companies face and suggest concrete solutions that can help achieve success.

Highlights
● New digital technologies are promising to improve production processes by increasing flexibility and customisation.
● We share the lessons learned from two projects focused on the acceptance of new technologies: the TECH4WW project and the ESF BOOT project.
● Communication with and involvement of employees from an early stage of the implementation process are the foundation of successful adoption of new technologies.
● To ensure the use and acceptance of new technologies, it is essential to engage with employees by providing clear information, having conversations, listening to their concerns, co-creating solutions and collaborating on different tasks.

1. Tech4WW project and ESF BOOT project

The **Tech4WW project**[2] focuses on encouraging the **implementation of new technologies in Flemish companies**. The project aims to let companies experience the technologies and reflect how successful adoption could improve the quality of work. The vision of this project is that these technologies are not replacing workers, but enriching tasks, making them less repetitive but

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[1] You can learn more about these technologies in this brAInfood of the Knowledge Centre Data & Society.

[2] Proeftuinproject Industrie 4.0 - Werkbaar Werk is a collaboration between Flanders Make, imec-IDLab, imec-SMIT, KULeuven - HIVA, Flanders Make@Universiteit Hasselt-EDM and Sirris in which 9 demonstrators of industry 4.0 technologies are developed and tested with companies. The project is funded by VLAIO.

easier to execute. However, simply purchasing the technology does not necessarily equal success and acceptance. Active involvement of employees in this implementation trajectory encourages acceptance among these employees. In the **ESF BOOT project**[3], we investigate what the best ways are to actively involve employees. We created several **training modules** as part of this project such as modules that focus **on the acceptance of operator assistance technology (digital work instructions, cobots and robots)** by employees and other relevant stakeholders (teamleader, IT department, etc.). In these modules employees and stakeholders are involved in the implementation process. They are invited to share their experiences, thoughts and fears with regard to the technology and the impact of it on their work and well-being at work.

2. What is the current situation?

According to a survey by Flanders Make in 2021, Flemish companies see the biggest potential in using AI and big data, robotization and Internet of Things. Within the Tech4WW project, we contextualised this survey and reflected on best practices together with Flanders Make. We spoke to early adopter companies, technology suppliers and consultants from Flemish industry sectors in 15 interviews.

What we learned:
- IoT applications, such as machine monitoring sensors, are already a standard practice in half of the companies.
- The active use of AI, cobots, virtual reality training, or exoskeletons is rather rare in the current landscape of digital technologies on the workfloor.
- The most discussed technology during our interviews were digital work instructions[4].

For many interviewed companies, digital work instructions are seen as a first step towards digitisation. They do not require big changes in the company but they increase worker flexibility. There are possibilities to make the implementation cheaper by using existing tools, such as PowerPoint instead of special software, that can be easily adapted. More concrete recommendations that were identified during interviews specific to digital work instructions can be found in *Figure 1.*
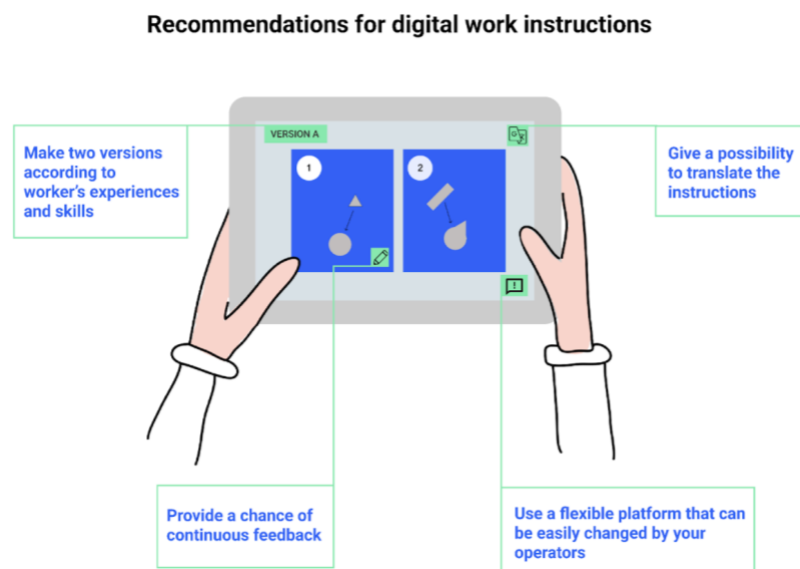

Figure 1: Four recommendations for digital work instructions

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[3] ESF BOOT is a collaboration between the Knowledge Centre Data & Society, Flanders Make and VDAB in which a guidance program for the implementation of operator assistance technology, focused on the improvement of work, is developed. The project is funded by the European Social Fund (ESF).

[4] Digital work instructions are instructions to perform a process via a digital medium such as a table, augmented or virtual reality.

Reasons for implementation of Industry 4.0 technologies that were mentioned during our interviews are often related to the actual effect of the technology, such as **saving time** or **maintaining the quality of products**. Nevertheless, the decision to implement the technology is also driven by **changes in tasks within the company**, for example tasks requiring more complex skills and more steps in the process. External factors like **increasing digitisation in the industry** also push companies forward to make technological changes. In addition, the **COVID-19 crisis** accelerated the structural changes and motivated the companies to act quickly (*Figure 2*).
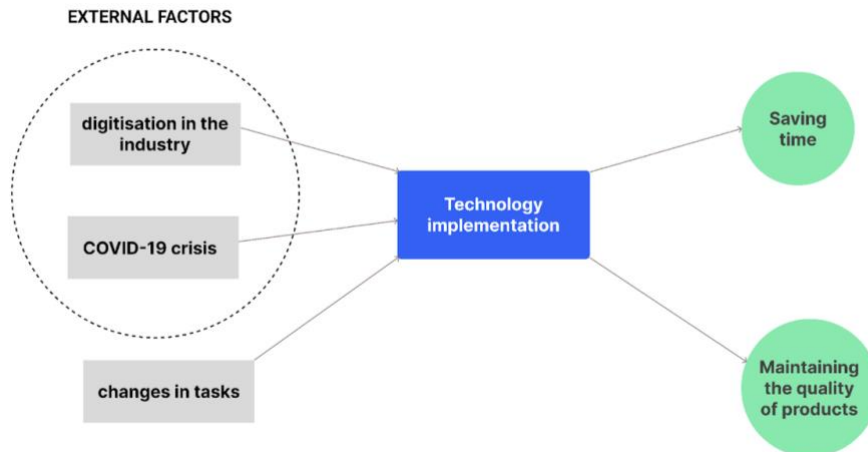

Figure 2: Motivators for technology implementation - shows how the implementation is influenced by external factors such as digitisation in the industry and the COVID-19 crisis and factors within the company like changes in tasks. Effects on an implementation, like saving time and maintaining the quality of products, also influence the decision.

3. Recommendations for technology acceptance

Based on the interviews, we divided the technology implementation process into three main phases: *the planning phase, the testing phase and long-term implementation phase.* For each phase, we identified risks our interviewees mentioned and potential solutions and best practices (*Figure 3*).

	Planning phase	Testing phase	Long term implementation
Objectives	Gather necessary information	Find out what does (not) work	Sustain the success
Risks	• The struggle to decide • No interest from employees • Not suitable environment	• Downsizing • Not suitable environment	• Keeping information up to date • High cost of retraining • Cybersecurity and data transparency
Best practices	• Identify your problem • Involve your employees in a co-creation process	• Communicate clearly with your employees • Approach the employees with high interest in technologies first	• Track employees' skills and keep them in passports/dashboards • Implement iterative evaluation

Figure 3: The overview of risks and best practices according to the stage of implementation

3.1.   Planning phase

Recommendation/Action 1.1 – Identify your problem

Deciding which and whether a technology could help your company can be a challenge. It is important first to analyse which problem you want to solve and to evaluate if technology can help solve that problem. Many companies are still digitalising and may not have an environment to support Industry 4.0 so an evaluation of their digital maturity level may help.

Recommendation/Action 1.2 – Involve your employees in a co-creation process

The bottom-up approach is a successful way to engage your employees and address their concerns. All stakeholders affected by implementation decisions should be involved (or thought of) in the process from the very beginning. Their involvement will help you identify challenges such as digital maturity before the start, which will save investments that are simply too early.

3.2.   Testing phase

Recommendation/Action 2.1 – Communicate clearly with your employees

To avoid confusion and disagreement among employees, early communication about a technology's benefits is necessary. Inform your employees in time and listen to their remarks. At this point, it should be clear that the technology you are testing is here to stay, employees are invited to consider under what circumstances this works best for them.

Recommendation/Action 2.2 – Approach the employees with high interest in technologies first

It is recommended to start with employees who are interested in technology. They will often encourage others to follow if they see that the technology is a success and more reluctant employees are more open to listen to an equal to adopt something new than their managers.

3.3.   Long term implementation

Recommendation/Action 3.1 – Track employee's skills and keep them in passports/dashboards

To prevent unnecessary downsizing, retraining the employees is key. To make the process easier, it is a good idea to have an overview of an employee's skills. Agoria created DigiSkills Passport to evaluate individual skills. Matching with new tasks can be more effective and less costly.

Recommendation/Action 3.2 – Implement iterative evaluation

Most technical solutions are presented as if they are plug and play. There is a lot of hidden work in order to make sure that these technologies run smoothly and are worker friendly. Especially in the case of digital work instructions, it is important to check on provided information and make sure this is up to date. Most participants emphasised the importance of a bottom-up approach and communication with employees during the implementation as a factor for success in our interviews. Therefore, we will provide you with concrete tips on how to involve the employees in the next section.

4. Involve employees in development and implementation process of new technologies

For successful implementation of new technologies, employees must be involved in the planning, testing and (long term) implementation process of new technologies, as they will work with the technology daily. By involving them in an early stage, the acceptance and adoption rate of the technology will increase in the long term. Employees feel they have more control over their work and the way it will change, which impacts their wellbeing and willingness to work with new technologies.[5] [6]

There are different ways in which you can involve employees in your digitalisation processes. These are dependent on, for example, the abilities of the organisation (time, effort, …), the availability of the employees (workload, …) and the expected impact of the technology on work. When involving employees is impossible, there exist several quick methods and brainstorm tools to consider ethical and social aspects of new technologies (Tarot Cards of Tech, AI Blindspots, and many more tools). It is however always better to engage with employees themselves.

Within the ESF BOOT project, we use different levels of employee involvement (see *Figure 4*), which can be applied in different combinations throughout the process:
- **Informing** employees about the plans and future changes is key: make sure they know what adaptations are coming, how it will impact their work and when the adaptations are expected to be implemented.
- When **having a conversation or discussion** with employees about the aims of the organisation with the implementation of the technology and how it might impact their work, you allow employees to give feedback and ideas on how the implementation process can be done in the best way possible.
- By involving the employees even more, for example in a **co-creation** setting, you can brainstorm and ideate together to improve the implementation process of the technology (e.g., conditions, agreements, timing, etc.).
- Another possibility is to **collaborate** and give employees **ownership** over certain tasks within the implementation process of the technology (e.g. making digital work instruction videos themselves).

Figure 4: Overview of the different levels of employee involvement

When involving employees in the design, development, and implementation process of a technology, it is important to **consider the following aspects**:
- Be aware of your role as organisational lead and how the **balance of power** might influence the openness of employees to give feedback or ideas. A person with a more neutral position might create a higher feeling of trust which can be beneficial for the involvement process.
- Make sure that the boundaries of involvement are **clearly communicated** to the employees, so disappointment and misunderstanding is avoided. Communicate clearly

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[5] Vereycken, Y., Ramioul, M., Desiere, S., & Bal, M. (2021). Human resource practices accompanying industry 4.0 in European manufacturing industry. Journal of Manufacturing Technology Management, 32(5), 1016–1036

[6] Bal, M., Benders, J., Dhondt, S., & Vermeerbergen, L. (2021). Head-worn displays and job content: A systematic literature review. *Applied Ergonomics*, *91*, 103285.

on what aspects employees are invited to give their input and what features are already decided and cannot be changed.

- The **group of employees** you want to involve might be very **diverse.** Think about possible barriers in terms of language, openness to communicate, etc. and consider this in the design of your involvement process.

5. Conclusion

New digital technologies are promising to improve production processes and are slowly being adopted in Flanders with digital work instructions as a frontrunner technology. Within the Tech4WW project, several best practices are identified to mitigate the risks and obstacles that the implementation of new technologies might encounter. Communication with and involvement of employees are an important cornerstone of successful adoption of the new technology. The ESF BOOT project provides practical modules with which the transition towards Industry 4.0 can be made by involving employees and other stakeholders. To ensure the use and acceptance of new technologies, it's essential to engage with workers by providing clear information, having conversations, listening to their concerns, co-creating solutions, and collaborating on different tasks.

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