



# Introduction of AI systems in companies

Design approaches for change management

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WHITE PAPER

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## Summary

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The introduction of Artificial Intelligence (AI) in companies offers opportunities and potential both for employees, for example in the form of relief through AI systems, and for companies, for example in the form of improvements in work processes or the implementation of new business models. At the same time, the challenges in the use of AI systems must – and can – be tackled and possible negative accompanying implications dealt with. The change in the companies can only be mastered together. All in all, it is a matter of shaping a new relationship between people and technology, in which people and AI systems work together productively and the respective strengths are emphasized.

Change management is a decisive factor for the successful introduction of AI systems as well as for the human-centred design of AI deployment in companies. Good change management promotes the acceptance of AI systems among employees, so that the potential of new technologies can be used jointly for all those involved, further innovation steps can be facilitated and both employees and their representatives can be made the shapers of technological change.

The participation of employees and their representatives makes a significant contribution to the best possible use of AI systems and the interface between human and machine – especially in terms of efficient, productive work organization that promotes health and learning. Early and process-oriented participation of employees and co-determination representatives is therefore an important component for the human-centred design and acceptance of AI systems in companies.

The introduction of Artificial Intelligence has some special features which also have an impact on change management as well as on the participation of employees including the processes of co-determination in the company. With this white paper, the authors of the working group Future of Work and Human-Machine Interaction pursue the goal of sensitizing for the requirements of change management in Artificial Intelligence and to give orientation for the practical implementation of the introduction of AI systems in the different phases of the change process:

- **Phase 1 – Objective and impact assessment:** In the change processes for the introduction of AI systems, the objective and purpose of the applications should be defined from the outset with the employees and their representatives and information on how the AI system works should be provided. On this basis, the potential of the AI systems and the possible consequences for the company, the organization and the employees can then be assessed. A decisive factor for the success of a change process is the involvement of the employees and the mobilization for the use of new technologies (chapter 2.1).

- **Phase 2 – Planning and design:** In a second step, the design of the AI systems themselves is the focus. This is primarily concerned with the design of the interface between human and AI system along criteria for the human-centred and productive implementation of human-machine interaction in the working environment. Of particular importance here are questions of transparency and explainability, of the processing and use of data and of analysis possibilities offered by AI systems (including employee analysis), as well as the creation of stress profiles and the consideration of employment development (chapter 2.2).
- **Phase 3 – Preparation and implementation:** The AI systems must also be integrated in an appropriate way into existing or new work processes and possibly changed organizational structures. This means preparing employees for new tasks at an early stage and initiating the necessary qualification measures. It is also important to design new task and activity profiles for employees and to adapt the work organization to a changed relationship between human and machine. A helpful instrument in the introduction of AI systems are pilot projects and experimental phases, in which experience can be gathered before a comprehensive introduction and possible need for adaptation regarding AI systems, qualification requirements or work organization can be determined (chapter 2.3).
- **Phase 4 – Evaluation and adaption:** After the introduction of the AI systems, there should be a continuous review and evaluation of the AI deployment to ensure possible adaptations with regard to the design of the applications, the organization of work or the further qualification of the staff. In addition, the regular evaluation of AI deployment allows the experience of the employees to be used and further innovation processes – both with regard to the further improvement of (work) processes and with regard to new products and business models – to be initiated together with the employees as designers of change (chapter 2.4).

These practice-oriented requirements are aimed at all stakeholders involved in change processes and are intended to provide orientation for the successful introduction of AI systems in companies. In addition, these requirements should also inspire the further development of existing regulations – for example in legislation, social partnership or standardization – and thus enable an employment-oriented, flexible, self-determined and autonomous work with AI systems and promote the acceptance of AI systems.

# 1. Change management for Artificial Intelligence

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Artificial intelligence (AI) and self-learning systems are changing tomorrow's working environment and companies for the long term. AI systems offer a wide range of opportunities and potential for both employees and companies and for the competitiveness of Germany as a technology location – for example by relieving the burden on employees or optimizing work processes and new AI-based business models.

At the same time, the challenges for AI deployment in the working environment and in companies must – and can – be shaped together. The introduction of AI technologies is still in its infancy in many companies. The time is therefore favorable to discuss possible opportunities, hurdles and limits of Artificial Intelligence in the working environment, to illuminate design options and to use AI technologies both for the economic success of the companies and for good work in the interest of the employees.

The focus is not least of all on the design of a relationship between human and technology that is changing through Artificial Intelligence: it is important to emphasize the respective strengths of human and machine in order to enable productive interaction and support people in its work.

The aim of the white paper is to sensitize employees and companies to the specific requirements of change processes in the context of Artificial Intelligence. At the same time, it aims to identify requirements and concrete solutions to successfully introduce AI technologies in companies and to make the best possible use of the potential of Artificial Intelligence for all those involved. The existing regulations on co-determination and data protection formulate the framework for new, creative and agile approaches for the joint design of change processes in Artificial Intelligence – from the initial idea, through experimental and pilot phases, right up to its widespread introduction.

Change management in Artificial Intelligence is therefore not only about optimizing processes and working tools by introducing AI technologies, but above all about designing operational processes, the interface between people and technology, and competence development for new technologies and operational procedures. This requires a common understanding of all participants at all levels of the company. The social partners have a special responsibility in this respect.

The involvement of the employees and their representatives is of crucial importance for change management. This makes it easier to develop the best possible solutions, gain acceptance and facilitate further innovation steps. But it can also help to develop the right balance for a company between the demands of competition and the demands of working conditions. Especially important for change processes – as well as for participation – is the consideration of different levels of criticality and autonomy of AI systems.

This white paper complements the white paper "Criteria for Human-Machine Interaction with AI" (Huchler et al. 2020) by the essential aspect of the process of planning, introducing and applying of Artificial Intelligence in companies. This paper formulates design criteria for the development of AI systems in the work environment. In addition, the present white paper is to be flanked by further papers on the topics of "Competence development and competence profiles" and "Leadership and cultural change".

A further basis for the design of change processes is provided by the recommendations of the EU High-Level Expert Group on Artificial Intelligence (2018), in which the requirements for the design of trustworthy Artificial Intelligence are formulated, or the ethics briefings of Plattform Lernende Systeme (Heesen et al. 2020), which provide orientation for the responsible development and application of AI systems. Further important suggestions are provided by the Federal Government's AI strategy and the recommendations of the Enquete Commission "Artificial Intelligence – Social Responsibility and Economic, Social and Ecological Potential", which will be published in autumn 2020.

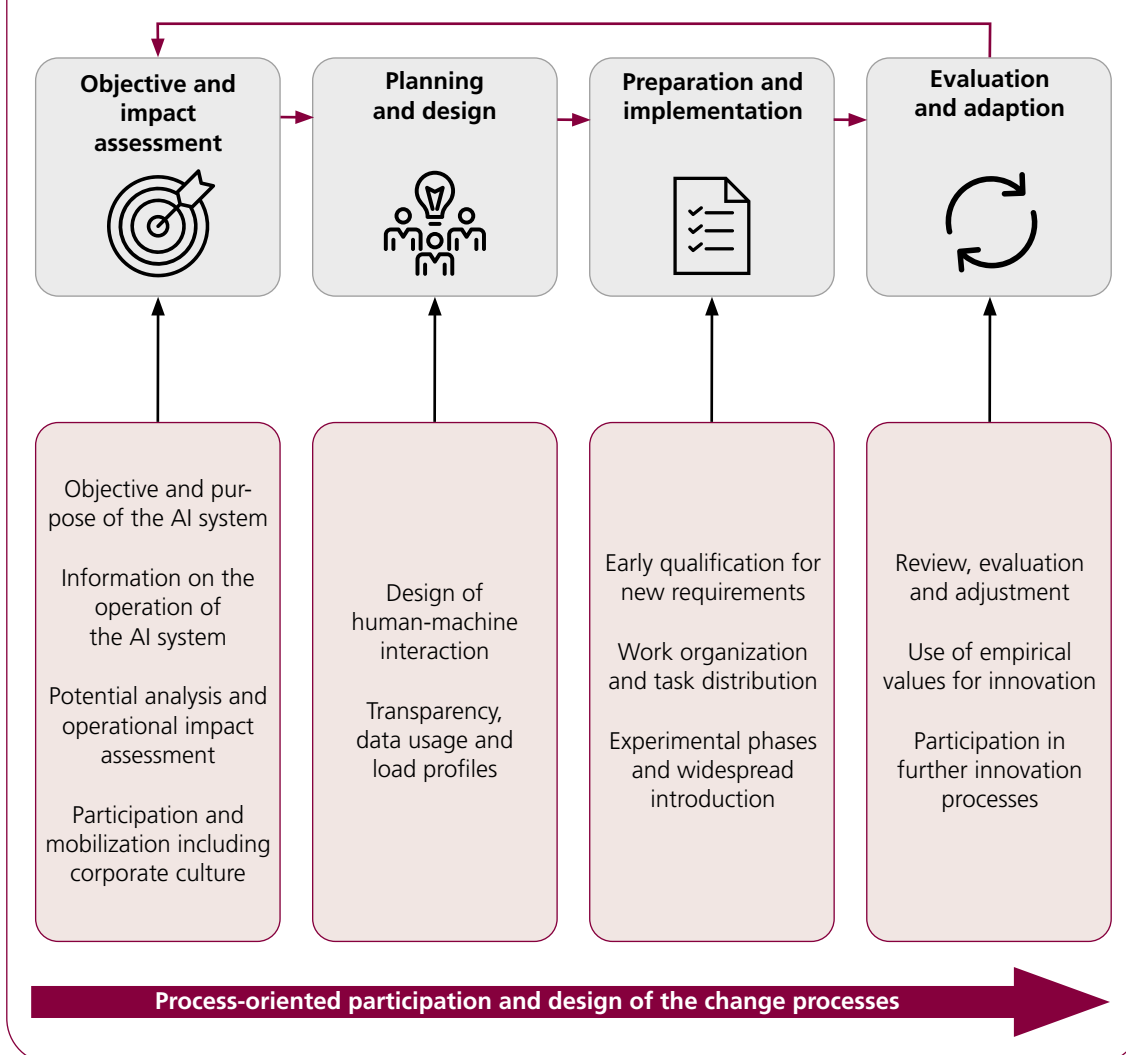
## 2. Requirements for change management

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The use and implementation of new technologies is a familiar factor in companies and in the working environment, which is based on a familiar set of change instruments and legal regulations – for example on co-determination and data protection. Nevertheless, new challenges for change processes arise from the specifics of Artificial Intelligence – such as the learning aspect in machines, robots and software systems, the use of large amounts of data as a basis for learning or predictive analytics by AI systems. In addition, questions of discrimination by data and algorithms, personal rights or the relationship between human and machine – including the scope for action and the attribution of responsibility – are also increasingly pressing into focus.

In the following, the framework conditions for change in Artificial Intelligence and the challenges it faces will be outlined and possible solutions and best practice examples will be presented. The aim is to provide orientation for a practical implementation and design of the introduction of Artificial Intelligence. Different phases of change processes are taken as a basis and the requirements including the practice-oriented solution approaches are explained (figure 1). Issues of leadership and cultural change in companies can only be discussed in passing within the scope of this white paper and will be deepened in a further paper of Plattform Lernende Systeme.

**Figure 1: Phases and requirements for change management with Artificial Intelligence**



An important success factor for the productive use of Artificial Intelligence in companies is the acceptance of AI systems by employees. This is even more important because the introduction of Artificial Intelligence is often accompanied by concerns regarding the handling of personal data and surveillance, the impact on employment, the design of humane working conditions and the training and further education for AI technologies. A transparent and comprehensible design of AI deployment and a process-oriented participation of employees and company representatives in the change process are a central element in this respect – in order to be able to address reservations at an early stage or to find and negotiate constructive solutions for conflicting objectives – for example with regard to data use. Ethical guidelines of the companies within the framework of the existing recommendations – such as the EU High-Level Expert Group on Artificial Intelligence (2018) – and along the existing (legal) framework for the use, introduction and handling of AI systems can also be a suitable instrument.



**Differentiations – autonomy levels and levels of criticality**

Artificial intelligence has many different facets. Therefore, it is also important when introducing AI technologies to take these differences sufficiently into account and to align change processes accordingly. This also has an impact on the communication of changes in the company as well as the involvement and participation of employees in the AI introduction.

Important starting points for differentiation are the differentiation of autonomy levels (Beer et al. 2014, Beyerer et al. 2020 i.E., Plattform Industrie 4.0 2020) and the concept of criticality levels (Zweig/Krafft 2019, Data Ethics Commission 2019, Plattform Lernende Systeme 2021).

With the help of different levels of autonomy – depending on the application context and the task of AI systems – the mutual proportions of human and machine in interactions can be better estimated and the attribution of responsibility can be derived. Especially due to the learning aspect of AI systems, the actors in the interaction between human and machine can change. Thus, AI systems can learn from repeated interactions and thus act more autonomously if necessary. In the work context, autonomy levels can be used to derive, for example, the roles of employees and requirements for work processes and organizational structures, but also the role that AI systems should play in the interaction.

The criticality levels in turn allow an assessment of automatic decision-making systems with learning components in particular, and of AI systems in general, according to the extent of possible violations of legal interests – including personal rights – and of human life on the one hand, and the freedom of action of the individual on the other: the higher the extent of possible violations of legal interests and the lower the freedom of action of the individual, the greater the need for regulation of a particular system in a particular application context.

The process-oriented participation of employees and their representative bodies as well as the joint design of the change process begin in the first phase of the conceptual design, development and planning, in which the objectives, purpose and limits of the use of an AI system are defined, the database is made transparent and the functioning of the AI system, including its ability to explain, is clarified. On this basis, the expected potentials can be evaluated, and possible operational consequences can be assessed. In addition, the level of autonomy, the criticality of a system and the underlying data can be assessed, and the further change process and the participation of employees can be planned. Early participation and a transparent information base can help to promote acceptance and find viable AI solutions.

**Participation – operational co-determination**

The introduction of AI technologies is also subject to the existing legal provisions on co-determination at company level. Nevertheless, the introduction of Artificial Intelligence has several special features which also have an impact on the structure and processes of co-determination at company level.

The use of Artificial Intelligence in the world of work raises new questions regarding its integration into existing company organizations, the handling of (personal) data or the organization of work with self-learning systems. Therefore, a timely and process-oriented participation of employees and their representatives is necessary as an important component for the acceptance of AI technologies.

The participation of employees and their representatives in the introduction of Artificial Intelligence can help to shape the use of new technologies and the interface between human and machine in the best possible way – for example, in terms of efficient, productive work organization that promotes health and learning. Based on forward-looking participation and co-determination processes with regard to the objectives and impact assessment of AI systems as well as transparency issues (functioning, data use), a graduated approach may also be appropriate in view of different levels of criticality and autonomy.

Employee participation can also be further developed – for example, towards a permanent support of change processes in Artificial Intelligence by the interest groups, such as in the form of an AI council with equal representation, participation agreements for the entire process chain or "living agreements" for regular adjustments of self-learning systems. Due to the complexity and dynamics of AI technologies, support services in the form of training and consulting for companies – especially for small and medium-sized enterprises (SMEs) – as well as for employees and co-determination actors should also be publicly promoted.

In the second phase of the change process in Artificial Intelligence, the planning and design of the AI systems are in the foreground. This involves the implementation of the requirements for human-centred human-machine interaction (Huchler et al. 2020) – whereby the transparency of the analytical possibilities and the explanatory capacity of the AI systems, data utilization concepts with regard to personal data and the creation of exposure profiles for employees are of particular importance.

The preparation of the introduction of the AI systems and the implementation of the AI systems are part of the third phase of the change process. The identification of competence needs and the early qualification of employees for the new technical and organizational requirements appear to be of particular importance. In addition, new technologies may lead to changes in organizational structures and the distribution of tasks within the company and between human and machine. In this context, important experiences and best practices can be developed by means of experimental phases and those affected, and

their interest groups can be involved in the introduction process – prior to a comprehensive implementation – at an early stage and in a practice-oriented manner.

### **Privacy – personal data<sup>1</sup>**

The use of AI can positively influence personnel and personality development in the work context and sustainably support employees in their tasks. At the same time, however, AI-based predictive analysis procedures can cause considerable uncertainties regarding the collection of personal data.

The legal framework for the handling of personal data and the protection of personal rights is provided by the European General Data Protection Regulation (GDPR). This focuses, for example, on the principle of "privacy by design" or, where appropriate, a data protection impact assessment. Regarding Artificial Intelligence, this means that AI systems are implemented in such a way that they protect the personal rights of employees. In addition, new technologies that are designed or offer the possibility of monitoring the behavior or performance of employees are subject to co-determination. Nevertheless, co-determination only applies to behavior and performance monitoring, but it is not designed for the possibilities conceivable through the predictive analytics of self-learning systems based on employee data.

The processing of personal data can therefore become an obstacle to the use of AI in the working environment. In order to gain acceptance, a high degree of transparency about the analytical possibilities, the intended use and the limits of the analysis of an AI system is therefore necessary. First of all, it should be clarified within the framework of the assessment of criticality whether data of employees are processed by an AI system – and if so: which data are used or assumed to what extent (such as in personalized assistance systems, in recruiting or in human-machine collaboration and active exoskeletons). It is also necessary to check and regulate which personal data are necessary and for what purpose AI systems are used.

Legally prescribed agreements and process-oriented additional measures for data-based work design or target, data use and process agreements for the informational self-determination of employees make an important contribution to the introduction of AI. This makes it easier to call up the potential of Artificial Intelligence – such as increases in productivity, needs-based skills management, targeted qualification planning or workplace health promotion – and possible negative effects – such as psychological stress or work concentration – or new conflicts can be better avoided.

<sup>1</sup> As an overarching term, the term personal data also includes personally identifiable data.

The special feature of AI systems is primarily that they continue to learn and that shorter innovation cycles can generally be expected as a result of AI use. Therefore, an evaluation, assessment and adaptation of AI systems and the use of the experience of employees and their representatives is important for further innovation steps. In this way, those affected could become owners of innovation processes and, through further participation, also act as innovation drivers. In this context, permanent support of innovation and change processes by employees and their interest groups can offer advantages with regard to the acceptance of AI systems and change processes in Artificial Intelligence (EU High-Level Expert Group on Artificial Intelligence 2018, Data Ethics Commission of the German Federal Government 2019).

## **2.1 Objective and impact assessment**

Artificial Intelligence can be used in companies in different areas and with different goals. For a successful change process – depending on the type of AI system – it makes sense to define the goal and purpose of AI systems together with the employees and their representative bodies from the very beginning and to provide information on how they work – especially with regard to criticality, autonomy level and personal data (chapter 2.1.1). Based on this, the potential and the consequences of their use for the company, the organization and the employees can then be estimated, productive interaction between human and machine can be enabled and the respective strengths of human and technology can be implemented in the working environment to support the employees (chapter 2.1.2). AI systems are usually introduced to optimize work processes and products. But in the end, it is the employees who work with the AI systems: Therefore, it is purposeful to involve the employees in the change process from the beginning and to mobilize them for the use of new technologies (chapter 2.1.3).

### **2.1.1 Objective and functioning of the AI system**

All actors responsible for the introduction of AI technology and the design of change processes – such as management and human resources departments, programmers and the IT department as well as employees and works or staff councils – should work together before the introduction of AI systems in the company in order to agree on the optimization goals for the operational use and the requirements for the AI systems and to be able to anticipate conceivable effects on the work design as early as possible.

However, the strategies can also vary depending on the AI system: For example, the introduction of an AI-supported camera for quality control, which does not collect personal data and does not endanger employees, requires different standards than those for collaborative robots, which use personal data for personalization and which are used in the immediate working environment of the employees.

An important element for the change process is sufficient transparency and agreement on

the purpose of an AI system and reliable, comprehensible information on the functioning of an AI system – especially with regard to the traceability of the machine behavior/learning and decisions of an AI system as well as the underlying database or gateway for a possible behavior and performance control (Huchler et al. 2020). Trustworthiness and comprehensibility of the AI systems are important prerequisites in the change process for the classification of the operational options for action and the foresighted work design by those involved at all levels of the company.

The key to a proper understanding of the way they operate is transparency: employees must be able to access information which – depending on their level of competence and field of activity – reflects a level of detail at a technical level that is appropriate for them. Information on the functioning of the AI system used must be balanced to be as technical as necessary and as comprehensible as possible.

### **2.1.2 Potential analysis and operational impact assessment**

Artificial Intelligence offers a wide range of opportunities and potential – both for companies and employees. In addition, AI systems can contribute to innovation, productivity, employment and prosperity as well as enabling more flexible, self-determined and autonomous work. Furthermore, AI systems can lead to an improvement in the qualification level of employees if work-integrated learning content is used in everyday work.

Nevertheless, even when AI systems are introduced, a careful analysis of potential and an operational impact assessment are necessary in order to make optimum use of potential, anticipate risks, develop design solutions and gain acceptance among employees. When designing AI-based work systems, several aspects such as (health) impact assessment, technical and social impact assessment, workplace perspectives and, finally, the employees' scope for action must be considered.

In particular, the employment effects of AI systems – for example through process optimization or the automation of tasks – are often a cause for concern for employees. One possible starting point here is the framework of Human Friendly Automation, which is being promoted by IBM, for example. The concept is based on three core components: a voluntary commitment by companies to social responsibility, an assessment of the impact – both in terms of changing job profiles, work shares and competence requirements of employees and in terms of changing processes, organizational and employment structures – and strategic organizational and personnel planning geared to these (Shatilov 2020). In this way, employment effects can also be anticipated and solutions for employment can be developed.

The design cycles for work systems according to DIN EN ISO 6385 offer further starting points for potential analysis and operational impact assessment – from the analysis of requirements, task sharing and design concept to testing, implementation and evaluation. In general, especially with the introduction of AI systems due to the change of activities,

holistic risk assessments are legally required and should be agreed upon on a binding operational basis in order to identify the risk potential at an early stage and take appropriate measures, which in turn must be evaluated.

The impact assessment in connection with the use of AI-based applications should consider the usual criteria of ergonomics – from feasibility to work-related psychological aspects. This assessment must also be made regarding long-term effects. In the technical and social impact assessment, one criterion should be that the use of AI systems leads to an improved work-life balance rather than to the removal of boundaries from work by exploiting the potential for flexibility.

In general, the use of AI systems should make work much easier for all employees by transferring routine activities and by increasing flexibility in terms of place, time and work content. Attention should be paid to a healthy level of challenging and routine activities for individuals and the preservation of their sovereignty: On the one hand, flexibility should not exceed a healthy level and, on the other hand, it should also be possible for employees to determine their own working hours.

Since AI technologies have the potential to reduce or channel the flood of work-relevant information in the area of information and knowledge work, and since AI-based robot systems and automation solutions can take over highly demanding physical activities in the area of production work, here is hope that employees in an AI-influenced working environment will tend to experience less stress.

### **2.1.3 Participation and mobilization including corporate culture**

Workforces must not only be "taken along" with change processes in Artificial Intelligence but must also be actively involved in the change process – because: The agility and innovative ability of a company is largely determined by its employees. In addition, important impulses for the innovative ability of companies can also emanate from interest groups. The success of many change processes depends not least on a change of culture in which the employees concerned are involved. The introduction of AI technologies alone does not create added value: it is therefore important to keep in mind the questions of how processes and organizational structures in the company, but also the skills and competencies of the employees, should be designed in connection with the introduction of AI systems. Only in this way can the technologies, organization and working methods of a company interlock optimally (Schuh et al. 2020). This applies not least to the central questions of leadership and cultural change in companies.

Through a process-oriented involvement of those affected, also using the planned legal instruments of co-determination at company level, all those involved should be able to contribute their ideas, views, expert knowledge and interests. In the ideal case, an important (additional) contribution can be made in this way, in order to use Artificial Intelligence in the operational arena for efficient and productive work design which is beneficial to

health and learning, to design the interface between human and machine in a humane way and to strengthen the acceptance of AI technologies overall.

In this context, various levers are interesting: On the one hand, processes of employee participation and representation of their interests could be further developed accordingly, for example by creating instruments that enable permanent support for change processes in Artificial Intelligence. In addition, additional information, qualification and counselling services could be initiated – especially for small and medium-sized enterprises (SMEs) and the co-determination bodies. At the same time, a variety of agile formats in the companies offer themselves as a means of involving those affected, but also the company as a whole – such as information offerings, discussion events or training courses through which knowledge can be made available, goals and how it works explained and application scenarios and possible hurdles of AI systems discussed (see Infineon Technologies Use Case: Regular learning and knowledge exchange formats for employees).

**Practical example (Deutsche Telekom):  
Development of self-binding AI guidelines for the company**

The development of AI guidelines makes an essential contribution to the promotion of an ethical and participatory corporate culture, the responsible handling of (personal) data and the forward-looking and trustworthy use of AI systems. In this way, employees can be sensitized and mobilized for change, informed about the technology and their experiences and feedback can be incorporated. A binding framework for the use of AI within the company is created, which also benefits the external customer.

**Setting up a central project team for Artificial Intelligence:** The development of AI guidelines is carried out by an international, interdisciplinary change team that identifies the relevant AI contacts in the company and on the market in order to use strategic-regulatory goals and technical-operational knowledge to agree on a common value culture. The iterative development of AI guidelines takes place in various design-thinking workshops on different AI topics, considering the ethical-legal and technical framework conditions as well as the interests of the company and its employees. The objective is to create a uniform understanding of AI deployment and clear responsibilities in dealing with AI systems.

**Raising awareness and collecting information from employees and management:** An important part of the process consists of workshops, AI roadshows and in-house exhibitions, where potential and risks are discussed and employee feedback on the AI-supported working environment is gathered, as well as e-learning – such as MOOCs (Massive Open Online Courses) – and face-to-face and online training. In addition, exchange and discussion rooms are offered to promote openness and a feedback culture – for example through an internal social network for the exchange of information. The change team develops an initial draft for the AI guidelines, which takes into account the feedback from the various stakeholders in the company (such as data protection, finance or IT security) as well as the specifications of the Executive Board for the development of a digital ethic at management level and the strategic interests of the company.

**Internal presentation and publication of the AI guidelines:** The internal presentation of the AI guidelines aims to create awareness of a self-interest in trustworthy AI systems as a basis for responsible AI use in the company and for trustworthy products and services. Accordingly, the AI guidelines define, for example, who is responsible for which AI system and which AI function. The presentation of the AI guidelines is accompanied by a second round of feedback to coordinate the draft with the employees. The change team uses the second feedback to further concretize the AI guidelines – for example, to define the ethical guidelines according to which programmers and technicians should act, how certain quality standards can be set and maintained, or how the operational implementation of the AI guidelines can be carried out in everyday business. In order to obtain the



overall commitment of the entire board of directors to these guidelines and thus to the strategic orientation as well as to set a "tone from the top", the AI guidelines are adopted by the board of directors and subsequently communicated.

**Helping to shape the debate on digital ethics and AI standards:** After the internal and external publication of the AI guidelines, the company uses the framework for the use of AI systems as a basis for the exchange with similarly acting companies and social actors. In addition, the company is committed to practicable, uniform and implementable AI standards along European values and in the sense of trustworthy Artificial Intelligence.

## 2.2 Planning and design

On the way to a successful introduction of Artificial Intelligence in companies, careful planning and design of the AI systems is of great importance. In the future, employees will increasingly and naturally interact with self-learning systems in their everyday work – therefore it is important to use the potentials of AI systems in a targeted manner and at the same time to design the interface between human and machine in a humane way, to support good and beneficial working environments and to organize the interaction between human and technology in the best possible way. The introduction of AI systems in companies must therefore be based from the outset on clearly defined criteria as to how the human-machine interaction between those affected on the one hand and the AI systems on the other can be designed (chapter 2.2.1). For the design of humane working conditions, questions of transparency and explainability, data use and processing by AI systems and the creation of exposure profiles are of particular importance (chapter 2.2.2).

### **Use Case (Elabo GmbH): Company agreement**

ELABO is a medium-sized company with around 185 employees. It is a specialist for intelligent solutions for the design of individual workstations as well as for assembly and testing systems for industrial series production. In cooperation with a start-up, an AI-based assistance system for workers was developed, which is also used in the assembly of Elabo products. The company's works council was informed about the development. It used its right of co-determination to find out which personal data, if any, are recorded by the assistance system and to what extent they are processed further or used by the company. In several meetings attended by developers, the works council and the company's employees, a works agreement was concluded which was examined by an expert from IG Metall and which, in particular, provides binding regulations on data protection and the handling of personal data. The AI system was subsequently developed in accordance with the data protection provisions set out in the works agreement.

### 2.2.1 Design criteria for human-machine interaction

The use of AI systems changes the relationship between human and machine in a sustainable way: Therefore, a central task in the introduction process of AI technologies is to make the interaction between human and machine human compatible. This means that certain design criteria should already be considered in the development and planning phase. A balanced relationship between the requirements for good and beneficial working conditions on the one hand and the technological and economic potential of Artificial Intelligence on the other hand increases the chances for the acceptance of AI systems in change processes.

Important starting points offer criteria for the design of human-machine interaction, which, starting from the protection of the individual and the robustness of the systems, also address questions of the trustworthiness of Artificial Intelligence and the sensible division of work between human and machine as well as the conditions for good and conducive working conditions. The aim of the catalogue of criteria is to provide practice-oriented reference points for AI development (Huchler 2020, Huchler et al. 2020)

**Figure 2: Overview of clusters and criteria for human-machine interaction in the context of work**

<p><b>Cluster 1: Protection of the individual</b></p> <ul style="list-style-type: none"> <li>■ Protection of safety and health</li> <li>■ Data privacy and responsible performance monitoring</li> <li>■ Diversity sensitivity and non-discrimination</li> </ul>	<p><b>Cluster 2: Trustworthiness</b></p> <ul style="list-style-type: none"> <li>■ Quality of the available data</li> <li>■ Transparency, explainability and consistency</li> <li>■ Responsibility, liability and system trust</li> </ul>
<p><b>Cluster 3: Reasonable division of work</b></p> <ul style="list-style-type: none"> <li>■ Appropriateness, relief from strain, and support</li> <li>■ Agency and situation control</li> <li>■ Adaptivity, error tolerance, and customizability</li> </ul>	<p><b>Cluster 4: Supportive working conditions</b></p> <ul style="list-style-type: none"> <li>■ Scope for action and richness of work</li> <li>■ Conducive to learning and gaining experience</li> <li>■ Communication, cooperation, and social embeddedness</li> </ul>

Source: Huchler et al. 2020: 3.

A first cluster of criteria deals with questions of individual protection. This concerns fundamental questions of attack and operational security, robustness and health protection. At the same time, questions of data protection, responsible performance recording and non-discrimination of AI systems are also relevant in the development. A second cluster of criteria deals with the issue of trustworthiness. The focus here is on data quality, the issues of transparency, explainability and consistency, as well as questions of responsibility, liability and system trust.

The third cluster of criteria is devoted to the relationship between human and machine and the question of a sensible division of work. This involves issues of relief and support by AI systems, situation control and the adaptivity and fault tolerance of AI systems. The last cluster of criteria in turn focuses on working conditions: Important here are, for example, the scope for action for employees, the learning and experience-promoting nature of the work or the appropriate integration of AI-based systems in an existing social and operational context (figure 2).

### **2.2.2 Transparency, data use and exposure profiles**

In change processes in Artificial Intelligence, the questions of transparency and explainability of the systems, the processing of the necessary data – especially personal data – and the determination of load profiles appear to be an essential key factor – for the functionality, reliability and performance of AI systems on the one hand, and for successful implementation in the companies and gaining acceptance among users on the other. For this reason, these issues should be considered with special care in the change process and in development and planning.

AI systems, as well as the providers of AI systems, should provide users with basic information about their principle mode of operation, their registered purposes and objectives and the output in the form of recommendations, decisions or behavior in interaction with people in order to make them explainable and comprehensible. In the change process, the information – graded according to the area of application and role in the company – should be conveyed. In concrete interaction situations, all relevant information must be prepared in such a way that it can be understood by the respective user. The starting points of explainable Artificial Intelligence (Explainable AI) – such as the ability to describe oneself and the expectation conformity of AI systems – provide assistance in development and planning. This contributes to the development of responsible Artificial Intelligence (Responsible AI), which is characterized above all by transparency, fairness, reliability and orientation towards ethical concepts (Huchler et al. 2020, Heesen et al. 2020).

In principle, the legal provisions on data protection also provide the framework for the operational use of AI systems and the involvement of stakeholders as well as certain principles and requirements – such as the principle of "privacy by design" or the requirement of a privacy impact assessment. Nevertheless, this topic deserves special attention because personal rights can be affected, and new uncertainties can arise through predictive analyt-

ics. Furthermore, the basic principle of voluntary consent in the context of dependent employment is not without problems due to the vulnerability of employees, even though AI systems may only be used for defined, clear and legitimate purposes and require a legal basis – such as collective agreements, company or service agreements. This involves questions about which options exist for data analytics and which limits are agreed upon, or who is granted which access and use options under which conditions.

One way of ensuring data control and security for employees – without impairing the functionality of AI systems – could be for employees themselves to have control over the use of personal data and its evaluation, and for the data to be stored in a "data safe" that is only accessible to those affected. In addition, voluntary consent to the use of data within the company, particularly for the processing of data that is deliberately not controllable, should be supplemented by additional agreements so that the personal rights of the employees are protected.

A further aspect for the design of AI systems and their acceptance in the operational environment is the avoidance of – above all cognitive, psychological and social – stress for the employees. A consistent and contradiction-free design of the interaction between human and machine plays an important role, for example to avoid frustration with the AI system. In addition, conflicts of objectives within the company should not be shifted to the AI systems – such as in the triangle between time expenditure, cost efficiency and quality or the typical tensions between abstract planning (target situation) and concrete implementation (actual situation). Overall, users should only be confronted with manageable situations. An important element for the preparation of exposure profiles are the legally required risk assessments, which also include appropriate measures (Huchler et al. 2020).

Overall, the design criteria for human-machine interaction and the issues of transparency, data use and load profiles should be used as options for the sustainable design of AI systems and should be used as catalysts for the participatory introduction of Artificial Intelligence and for gaining acceptance in companies.

**Use Case (BMW Group):  
Smart Data and AI in the press shop**

In the pressing plant, the Munich headquarter processes more than 30.000 sheet metal blanks into body parts every day. Since 2019, every blank has been laser-coded at the beginning. This enables the component to be clearly identified. The "iQ Press" system uses the coding to record material and process parameters such as the thickness of the sheet metal and the oiling layer, the temperature or the speed of the presses and links these to the quality of the parts produced. All this data is sent to a data cloud in real time and is immediately available to the production worker. This increases the transparency of the production process for the employees and they use the findings of iQ Press as an important tool – for example for quality control. This is because they no longer must check all body parts in detail, but only the irregularities that iQ Press has previously identified.

In addition, the use of AI offers the potential to identify recurring patterns in the process based on the acquired data and to use these for continuous optimization. The use of the system thus leads to increased plant efficiency and a further increase in hourly output in the press shop.

Robert Engelhorn, head of the BMW Group plant in Munich, is driving the use of these technologies forward: "The production of a vehicle takes about 30 hours at our plant. Within this time, each vehicle generates considerable amounts of data. With the help of Artificial Intelligence and smart data analysis, we can manage and analyze our production intelligently with this data. The technology helps us to produce our vehicles even more efficiently and to ensure premium quality for every customer. At the same time, we relieve our employees of monotonous and repetitive tasks".

The effectiveness of the innovations is always decisive. "We rely entirely on the experience and know-how of our employees in production. They are best able to judge the steps in which an AI application can provide more quality and efficiency," says Robert Engelhorn.

## 2.3 Preparation and implementation

The introduction of Artificial Intelligence in companies requires not only a careful and well-thought-out planning and development of the AI system, but especially a suitable integration into existing or new work processes and possibly changed organizational structures. For this purpose, it is necessary, on the one hand, to prepare employees and their representatives for their new tasks at an early stage and to raise the full potential of AI technologies and strengthen their acceptance with suitable qualification measures (chapter 2.3.1). Closely linked to this are the changes in the task and activity profiles of employees, which are often associated with the introduction of new technologies. This question is particularly relevant for Artificial Intelligence, as the relationship between human and machine can also change in the long term (chapter 2.3.2). For many companies, the switch to self-learning systems will not happen overnight. Especially in view of the major changes that self-learning systems can mean for many processes, it is advisable to test the new possibilities in pilot projects, involve employees and gather experience before the systems are introduced across the board (chapter 2.3.3).

### 2.3.1 Early qualification for new requirements

Competence development is a key to the successful introduction and acceptance of Artificial Intelligence. In this way, employees are provided with knowledge about the technology, which serves as an information basis for self-determined reflection on Artificial Intelligence, but in particular also enables them to handle AI technologies with confidence, thus forming an important building block for acceptance in the change process. Education and training must also go hand in hand with a cultural change within the company: The employees must be able to handle the technologies, but at the same time the company must also provide suitable structures for the use of digital technologies and Artificial Intelligence.

Employees should be able to competently handle AI-based self-learning systems in digitalized work processes. They should know, for example, what functions the intelligent software they use has based on the models of Artificial Intelligence, how to deal with them and what their advantages and disadvantages are. However, the employees do not have to become IT experts or be able to program and configure AI algorithms. What is decisive is an expertise in basic criteria in order to be able to assess the functioning of AI systems and, on this basis, to be able to deal with such systems.

Companies should create a framework and concrete training, or further education offers for their employees in dealing with AI systems, which the employees can actively and responsibly use. The acceptance of AI technology and the acceptance of the training or further training offers can be further increased by motivating employees to contribute their experience knowledge to the design processes. In addition to technical topics, interdisciplinary skills such as analytical and critical thinking, the ability to judge, creativity, complex problem solving, project and customer management will become increasingly

important in the future. Against the background of partly new forms of cooperation in teams and networks, the ability to collaborate, communication skills and conflict management will become even more important in the future. In addition, self-management and self-directed learning, willingness to change and independent thinking and decision-making will gain in importance (Jacobs et al. 2020).

**Table 3: Overview of possible AI-related competences**

Competence	Description
<b>Technical and basic knowledge</b>	
Professional competence	Employees have the necessary specialist knowledge/skills to perform everyday tasks in the right position. Depending on the position of employees, this may also include, for example, manual skills
Basic digital competences	Employees handle conventional digital media and technologies safely and confidently and can work smoothly with standard office programs and digital collaboration technologies in particular. They have sufficient awareness of digital security aspects.
Basic knowledge: machine learning*	Employees know and understand the basics of machine learning including deep learning and neural networks and can apply this knowledge to human-machine interaction.
<b>Dealing with the systems</b>	
MMI competencies	Employees have skills for the targeted handling of human-machine interaction at the current state of the art.
Process and system competence	Employees can recognize processes and procedures in the company, think in these processes and procedures and structure their own work behavior in processes and procedures. They are also able to describe, reconstruct and model these processes and other complex issues as systems and, on this basis, make forecasts and design options for action. In concrete terms, the employees realize the specifics of the influence of AI on company processes and are able to optimize their own work processes with regard to cooperation with AI.
Problem solving competence, resilience	Employees can quickly recognize unexpected situations and difficulties, deal with them and develop suitable solution strategies. This includes in particular the knowledge and, if necessary, the practical ability to intervene in AI-controlled processes.
Reflection competence	Employees can critically interpret and evaluate the information and results of AI systems. They can independently and competently assess when trust in AI systems and the data generated by AI systems is justified.

Note: Own presentation. \*Further information on the term machine learning as well as other technical terms related to the topic of self-learning systems and Artificial Intelligence can be found in the glossary of Plattform Lernende Systeme under <https://www.plattform-lernende-systeme.de/glossar.html>.

Competence	Description
<b>Design of work processes</b>	
Self-competencies	Employees have a enough degree of personal responsibility and self-organization. They have the curiosity and willingness to learn how to use new technologies and to work with them.
Social and communication skills	Employees can participate in teams of different composition. They can work with colleagues from different professional backgrounds and with different levels of experience and competence. In contact with customers and users of AI systems, employees can explain the specifics of using AI systems in a way that is appropriate for their area of responsibility.
(Personnel) management, leadership skills, change management	Employees can organize a team, coordinate and delegate tasks (bundles). They can communicate potentials and limits of Artificial Intelligence, take away fears and activate further training potentials. When integrating AI systems into company processes, they can formulate reasonable goals and thus help to shape the change process.
Decision-making authority	Employees know their responsibilities and can make reliable, well-considered decisions within the scope of their responsibilities.
Adaptability, transfer	Employees can adapt to new technical possibilities and challenges and to adjust their working methods accordingly.

The introduction of new technologies and in particular of self-learning systems based on Artificial Intelligence methods always initially leads to insecurity and uncertainty among employees. If employees do not know which introduction and development activities are planned in the company and what the AI systems to be introduced do technically (how they learn, which tasks they perform, etc.), the design process will only gain little acceptance from employees. This also limits the employees' willingness to perform and productivity. This is especially true when AI systems are used in work processes in which personal data of the employees are collected and processed.

In order to prevent a possible negative spiral of distrust and loss of productivity through the introduction of AI systems from the outset, information should be provided on the basic functioning of the AI technology used and appropriate skills in the handling and use of the systems should be taught. At the same time, employees – and managers – should be able to develop a reflexive and critical awareness of the use of AI systems. This presupposes that they have or can gain knowledge of how AI procedures work in principle and, in particular, how the software that uses AI technology works. For example, users should be aware of what data in general and personal data in particular is collected, where the data is located and who has access to it, how the data is processed by the AI system, the criteria according to which the AI system learns, who has access to the evaluated data and for what other purposes it is used. Information about the basic functioning of an AI system enables its mode of operation, actions and functions to be understood.



In addition to basic information about the AI system, employees should also be prepared for the introduction and use of an AI system in a concrete operational application. The competence development of the employees starts with the information and justification about the aim and purpose of the AI system. Among other things, employees should be told which requirements and competences are necessary to handle the AI system, how these competences can be acquired, how the AI system can be operated safely and in a health-conscious manner, which work processes change and how, which activities are newly linked to each other, whether new ways of communication and cooperation are created, whether powers of instruction and responsibilities change, whether new procedures and regulations are necessary to handle the AI system and how to deal with errors, malfunctions, attacks or other emergency situations. Exemplary competences are listed which support employees and the company in coping with the design process of AI-based work systems.

#### **Use Case (Infineon Technologies):**

##### **Regular learning and knowledge exchange formats for employees**

The digital transformation and the introduction of AI technologies as part of the digital change require a holistic and agile approach in the company, involving all employees. This involves the communication of technology potentials, the reflection of changes and opportunities in all areas, but also the development of knowledge and active discussion at all levels and through all channels (such as the intranet or internal and external events).

Under the slogan "**talk #digitalization**", for example, regular events on digitization and Artificial Intelligence take place with active and lively participation up to board level. The events are accessible to all employees, both personally and digitally, and provide information about external and internal developments as well as real-life applications of Artificial Intelligence – through lectures, poster sessions and discussions. Employees can actively participate and contribute. The events are prepared and conducted by expert groups. Through these regular information events, an explorative approach to ethics, technology and value generation is pursued, with a focus on intensive exchange between employees from all areas. The format has proven its worth as a meeting place for experts as well as a contact point for interested parties who wish to obtain an initial overview or seek contacts for the implementation of their own ideas. Use cases are always discussed – from the problem/question to data questions and approach to technical implementation and scaling. This accelerates an iterative learning curve for the entire company – from discovery and experimentation to learning and implementation. Existing technologies, processes and business models are scrutinized and adapted if necessary.

When AI systems play an increasing role in manufacturing processes and product requirements, many employees are faced with major challenges. A great deal of willingness to learn is required of them in order to master this change. Classical training phases are often not possible in their breadth and are usually not target-oriented, because the

solutions often must be worked out iteratively first. This makes it even more important to involve the employees of a company in the development and value contribution of new solutions right from the start and to give them regular learning impulses to ensure that they continue to learn from and with each other. With a **technical seminar on Deep Learning**, for example, Infineon is pursuing the goal of a sustainable exchange of knowledge for employees from different areas.

For targeted knowledge build-up in specific fields such as Big Data and Deep Learning, Infineon relies on the so-called I-Community as a network with multiplier function for the permanent exchange of knowledge within the company – also on topics related to digitalization and Artificial Intelligence. These I-Communities are networked with other internal networks on related topics and with numerous universities and research institutes. The I-Communities also prepare and conduct symposia and training sessions for other employees – thus complementing the transfer of knowledge throughout the company.

### 2.3.2 Work organization and distribution of tasks

Artificial Intelligence can – depending on the system design and the area of application – require changes in the organization of work and in the distribution of tasks within the company, but also in the relationship between human and machine. For this reason, these issues should be considered at an early stage and those affected, who usually have valuable expert and process knowledge, should be involved. In this way, frictional losses during the introduction of AI systems can be reduced, possible conflicts and reservations of employees can be better anticipated and moderated and the change process in Artificial Intelligence can be made more sustainable. An early risk assessment can also help to correct possible undesirable developments in the early stages. All in all, the aim is not to set up hurdles for AI systems, but to describe sensible instruments for productive and safe use and to define the scope of action for employees.

The scope of action for employees depends on the design – especially the work organization and adaptability of AI technology or the available alternative tools and aids. Particularly in the case of learning systems, care must be taken to ensure that enough decision-making options remain with the employees and that they do not become an appendage to "autonomous systems". Meaningful and holistic activities are an important criterion of work design. AI technologies offer the potential to achieve goals at different (impact) levels. Self-learning systems should support employees in making decisions that are not fixed as objectives (proposed decisions): For example, they should only give hints and proposals for solutions to conflicting objectives, while the decision-making authority over the execution of a (work) activity should remain with the individual.

An important question in Artificial Intelligence is the attribution of responsibility between human and machine and the resulting follow-up questions for work control and liability.

Since different levels of algorithmic decision making or decision support are possible, the responsibilities for interaction with AI systems should be regulated. Questions regarding work control (instruction) by Artificial Intelligence and questions of liability under labor law must also be clarified. It should be agreed that labor law consequences for employees, which could theoretically result from "digital guidance" or predictive analysis of an AI system, should be bindingly excluded in advance. Otherwise, acceptance problems could become a serious obstacle to the operational implementation of AI systems, even if ergonomics are improved.

In the assessment of work processes in which AI systems directly or indirectly control or influence elements of the work activity, a foresighted risk assessment is important. These work processes, which are wholly or partially controlled by an AI system, are more costly to correct than previous processes. The effects on the safety and health of the employees should therefore not only be assessed in the planning process – i.e. in the work preparation – but should – if possible – already be integrated in the acquisition or configuration of the AI system or in the specification sheet of the software to be programmed. The possibilities for an error-, accident- and failure-free, safe and health-friendly work process as well as for work ability and productivity can thus be used in a targeted manner.

A good practice to be recommended for conducting a risk assessment also for AI-based work processes is to first (1.) identify affected work areas and activities, (2.) identify risks and pressures caused by the AI system in these areas and activities, and identify changed communication, organization and cooperation processes, including necessary aspects of data security and data protection, (3.) to demand transparent, comprehensible information from the manufacturer or provider of the AI system about which data is collected and processed, where the data is stored and who has access to the data, (4.) assess the identified pressures to determine whether they cause hazards, (5.) define necessary protective measures, (6.) take the defined measures into account when procuring or programming the AI system, (7.) to investigate the possibilities of effectiveness control by the AI system itself and by responsible persons and to control the effectiveness of the measures accordingly, and finally (8.) to document the processes of risk assessment (possibly by the AI system itself) – such as access regulations and times of data access, responsible decisions of the AI system and of persons in the process etc.

### **2.3.3 Experimental phases and area-wide**

The change processes in Artificial Intelligence should increasingly include pilot and experimental phases in which experience and best practice examples can be gathered. These phases can make it possible to check the effects and interfaces of the AI systems with regard to the objectives and with a view to humane work design, as well as to exclude undesirable effects as far as possible and to gain positive experience with the systems in the working environment – for example with regard to the benefits. Within the framework of these pilot and experimental phases, employers and employees can find a suitable balance in order to reconcile the protection needs of the employees with new flexibility requirements of the company in transformation.

Pilot and experimental phases are of great importance due to the high dynamics of technological development in the field of Artificial Intelligence: trying, experimenting, evaluating, accepting – but also rejecting and learning as early as possible – should also be part of the change process in Artificial Intelligence. These phases of practical testing open up – also in the sense of a process-oriented participation of employees and their representatives – the possibility to make necessary changes before a comprehensive introduction and to integrate the experience and process knowledge of the employees even better – for example in the planning of work processes, activity profiles or organizational structures.

Trial phases also allow for a broader information base on how an AI system works and a more thorough assessment of its potential and impact. In addition, it will also make it possible to better assess competence requirements and to implement qualification measures in a more targeted manner. Pilot projects and real laboratories can thus help to minimize frictional losses during the introduction in the company, offer an important basis for the change process and process-oriented participation and at the same time contribute to the acceptance of AI systems based on practical experience among employees.

#### **Use Case (ABB):**

##### **Joint development with the customer and inclusion of employee feedback**

The quality assurance of batch processes is complex and time-consuming. ABB Ability BatchInsight automatically detects deviations so that plant operators can correct them immediately. The prototype of ABB Ability BatchInsight was developed in ABB's research center in Ladenburg and was subsequently supplemented by findings from customer interviews. The ABB developers interviewed numerous end users about their batch analysis activities and their wishes for the visualization of the large data volumes, among other things. The result was a monitoring solution tailored to the requirements of process engineers and plant operators in batch production. Intuitively operated, it enables process faults and their causes to be determined without special analytics know-how. The user interface of ABB Ability BatchInsight can be easily integrated into process control systems, so that plant operators always have all the essential information immediately. This feedback from the application of BatchInsight in the real plant, both experimental and in productive operation, in turn serves to further develop the digital services.

The Intelligent Knowledge Assistant (IKA) assistance system from ABB was also initiated as a prototype at the ABB Research Center, matured through customer feedback and further fine-tuning. IKA is specially designed for industrial use and supports employees on request and event-driven to work safely and efficiently. Thanks to user feedback prior to the nationwide introduction, the AI system could be (further) developed in such a way that the growing flood of unstructured data that accumulates in the IT landscapes of companies in the course of digitalization can be processed in a task- and role-specific manner and made usable as process knowledge. Instead of having to deal with countless applica-

tions, databases and information, employees can concentrate on their respective tasks. They receive exactly the content they need for this purpose – individually tailored to their knowledge and experience. Even the operation of the AI system could be designed intuitively through feedback during the pilot phase, so that no special IT know-how is required. In this way IKA bridges the gap between the algorithms of Artificial Intelligence and the domain expertise of employees in the process industry. Feedback mechanisms allow the digital helper to become better with every assignment.

## 2.4 Evaluation and adaption

Once self-learning systems have been introduced, a company faces a phase that is almost as important for the success of the transformation process as the planning and introduction. Plans that have been made, criteria that have been defined and tasks that have been assigned must now prove themselves in practical everyday life in the most diverse company processes. The use of AI systems and especially the defined criteria and standards for human-machine interaction geared to good work must be evaluated with the systematic involvement of the employees and adapted if necessary – initial conclusions have already been drawn in the experimental phases and have been incorporated into the design of the nationwide introduction. Over time, companies are gaining more and more experience with the use of AI systems in their products and internal processes. Making the best possible use of this experience means incorporating it into future innovation processes using suitable methods (chapter 2.4.1). Here too, the company can and should pay attention to the rich experience of those who are constantly working with the learning systems: The participation of the workforce in further innovation processes thus rounds off the cycle of the transformation process (chapter 2.4.2).

### 2.4.1 Review, evaluation and adjustment

The introduction of AI systems in a company should always take place with the involvement of those affected by the systems and their interest groups. The involvement of employees in the selection of areas of application and functionalities results in initial application possibilities in experimental phases. Here the company has the opportunity for the first time to identify the real effects on employees in pilot projects. Do the AI systems contribute to a working environment that promotes personality? Does the distribution of tasks between the person and the AI system allow for personal development of the employee? Do the systems support the employees or does the change represent an additional burden? Are agreed data protection and privacy guidelines adhered to and are they perceived as enough by the employees? What were the results of the risk assessment and what measures can be derived from it?

These and similar questions will be answered during an evaluation of the pilot projects. The evaluation must be carried out in close contact with the employees: Only they have the necessary direct insight into the work with the AI systems to be able to answer many of the relevant questions. The involvement of employees and their representatives in evaluation processes must be characterized by an open-ended character including the possibility of open and honest criticism. This objective of evaluation must be clearly communicated and transparently adhered to in order to create the necessary basis of trust that the evaluation process requires.

The evaluation accompanies the selected employees and the company during the experimental phases. At the end of these phases, the persons responsible on the company side, the affected persons and their interest groups as well as (possibly) the developers or providers of the AI systems come together to make a neutral evaluation of the systems used. This evaluation must consider the economic interests of the company in the new technology on an equal footing with the feedback from the workforce and the results of the impact and risk assessments. If discrepancies are found, the division of work, guidelines, working conditions or even the systems themselves must be adjusted. If stakeholders find that there is too wide a gap between expectations and results in the use of AI systems, it is advisable to start a further experimental phase under new and adapted conditions.

As soon as, as a result of this process, an honest consensus has been reached with the employees on the widespread use of the relevant systems, nothing more hinders the introduction into the larger corporate context. The number of people affected is growing rapidly with this step: Therefore, it is necessary to evaluate the change processes to the AI systems in the entire company again with the involvement of all affected people. Every employee has an individual personality and therefore has potentially individual difficulties with the new technologies. The evaluation, assessment and adaptation within the framework of pilot projects can therefore not replace the evaluation in a larger context. All evaluation cycles should also consider the situation of employees in training.

In contrast to conventional analogue and digital technologies, self-learning systems differ in their ability to develop independently. This means that the results of an initial evaluation of the introduction of an AI system should not be rigidly considered valid. The development of the systems should be accompanied by evaluative reviews at regular intervals. Since, logistically speaking, it is not always possible to involve the entire staff in a detailed evaluation process, suitable methods of involving those affected must be found in order to obtain the most comprehensive picture possible of the assessments. From these accompanying evaluations, the company gains experience over time in dealing with self-learning systems in company processes and products. On the one hand, these experiences are fed back to the further development of the existing systems and on the other hand can contribute to becoming an impetus for future innovations.

### 2.4.2 Participation in further innovation processes

After the introduction of self-learning systems in a company, it is mainly the employees who work with the systems daily who gain experience in using them. These experiences are a treasure that a company must use to initiate further innovations and to remain at the forefront of technological developments. Over time, the employees become experts in handling the AI systems: They know the difficulties and optimization options as well as the potential of the self-learning systems. In addition, the employees are specialists in their core areas of work, having received excellent training. They are therefore also the first point of contact for identifying new application possibilities for AI systems in their field and can thus become the driving force behind new innovations.

However, the employees themselves are not AI experts. A company that wants to use the innovation potential in its workforce must therefore develop suitable methods to integrate the experience and ideas of its employees into future innovation processes. This begins with an open corporate culture that promotes creative thinking and gives employees the space to develop ideas for new applications or systems. These can be introduced, for example, in idea competitions or with the help of other incubation instruments. Co-determination bodies also often act as "innovation promoters" – their members often have many years of experience in the company and know the company as well as the employees.

An important factor in making a meaningful contribution to innovation processes is that interdisciplinarity is practiced in the company. The various specialists do not have to become AI experts. Nevertheless, an understanding of the performance and limits of self-learning systems always at the current state of the art as well as a view beyond one's own subject-specific horizon is not only helpful, but rather necessary to develop innovative AI ideas. The exchange between different company departments is helpful for this.

At the same time, the participation of employees and codeterminants in further innovation processes offers the added value that they can participate in the design of new systems right from the start. If the ideas for an AI system, which is to optimize work processes used within the company, are based on the working reality of the employees, the developed system can ultimately be better integrated into this working reality. In this way, it is possible to avoid the need for costly adjustments.

### 3. Conclusion and outlook

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AI systems are changing the everyday working life of employees in many areas in a sustainable way. The use of Artificial Intelligence offers a wide range of opportunities for both employees and companies. At the same time, the introduction of AI poses challenges for both companies and employees – such as the handling of personal data, due to concerns about surveillance or the humane design of working conditions.

We are still at the beginning of a transition phase to AI technologies and companies have the opportunity to explore opportunities and potential as well as the risks and challenges of AI systems in good time and to discuss design options so that the use of AI benefits the economic success of the companies as well as contributing to the good work and personal development of the employees.

This opportunity must now be used in a targeted manner. The white paper shows the possibilities as well as concrete solutions and best-practice examples of how AI systems can be introduced successfully and in the interest of the employees in the company. The challenges and design options for companies are oriented to the phases of the change process: Starting with the objective and impact assessment, through planning and design, preparation and implementation, to evaluation and continuous adaptation, starting points are formulated which are directed at companies – explicitly also at small and medium-sized enterprises – and those responsible in the companies as well as employees and their representatives and management.

The involvement of employees and their representatives is a central interface for a successful transformation process in every phase of change management: Based on the employees' work reality, approaches to solutions can be designed and adapted in the best possible way in order to achieve acceptance for the use of Artificial Intelligence, changes in work organization or in the handling of personal data.

There are many options available to companies for a successful transformation process. The following table summarizes the most important design options developed and presented in this white paper, based on the four phases and their individual aspects.



**Table 4: Overview of phases, requirements and starting points for change processes with Artificial Intelligence**

<b>Objectives and Impact Assessment</b>	
Objective and functionality of the AI system	<ul style="list-style-type: none"> <li>Organize early cooperation of all responsible persons in the company</li> <li>Define and agree on the objective and purpose of the AI system before implementation</li> <li>Provide and convey appropriate information on how the AI systems work</li> </ul>
Potential analysis and operational impact assessment	<ul style="list-style-type: none"> <li>Careful potential analysis and operational impact assessment</li> <li>Perform (health) impact assessment (usability, safety and security)</li> <li>Assess employment effects and consequences for work-life balance</li> <li>Anticipate challenges early on and develop design options</li> </ul>
Participation and mobilization including corporate culture	<ul style="list-style-type: none"> <li>Use co-determination and agile forms of participation for the change process</li> <li>Actively involve employees and their knowledge in the transformation process</li> <li>Accompanying the change process with suitable information and dialogue formats</li> </ul>
<b>Planning and Design</b>	
Design criteria for human-machine interaction	<ul style="list-style-type: none"> <li>Human-Machine Interaction in Artificial Intelligence designed for the Human Being</li> <li>Ensure individual protection and trustworthiness of AI systems</li> <li>Develop meaningful division of work and favorable working conditions</li> </ul>
Transparency, data usage and load profiles	<ul style="list-style-type: none"> <li>Strengthen explainability, graded transparency and traceability of AI systems</li> <li>Implement privacy-by-design and anticipate and resolve data protection issues</li> <li>Create load profiles and design human-machine interaction without contradictions</li> </ul>
<b>Preparation and Implementation</b>	
Early qualification for new requirements	<ul style="list-style-type: none"> <li>Understanding early competence development as the key to change management</li> <li>Define continuing education goals for different profiles and create offers</li> <li>Linking (technical) professional competencies with overarching competencies</li> <li>Integrate empirical knowledge and strengthen process knowledge and reflective competencies</li> </ul>
Work organization and task sharing	<ul style="list-style-type: none"> <li>Use expert knowledge and experience for organizational development</li> <li>Maintain freedom of action for employees and enable meaningful activities</li> <li>Clarify attributions of responsibility and liability issues early and clearly</li> <li>Carry out risk assessment on design, load profiles and work organization</li> </ul>
Experimental phases and widespread introduction	<ul style="list-style-type: none"> <li>Gather and evaluate experience in pilot and experimental phases</li> <li>Derive needs for adaptation and accompanying measures for AI introduction</li> </ul>

<b>Evaluation and Adaption</b>	
<b>Review, evaluation and adjustment</b>	<ul style="list-style-type: none"><li>• Use pilot phases for evaluation and make necessary adjustments</li><li>• Consider further development of self-learning systems and accompany it with examinations</li><li>• Create continuous evaluation processes and establish a feedback culture</li></ul>
<b>Participation in further innovation processes</b>	<ul style="list-style-type: none"><li>• Using the experience and ideas of employees and interest groups as a motor for further innovations</li><li>• Establish an open corporate culture and establish incubation tools</li><li>• Promote interdisciplinarity and strengthen exchange between company divisions</li></ul>

Source: Own figure.

## Literature

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## About this white paper

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This paper was produced by the working group Future of Work and Human-Machine Interaction of Plattform Lernende Systeme. As one of seven working groups it investigates the potentials and challenges that arise from the use of Artificial Intelligence in the world of work and everyday life. The focus is on the questions of transformation and the development of humane working conditions. It also examines the requirements and options for qualification and lifelong learning, as well as starting points for the design of human-machine interaction and the interaction and the division of work between humans and technology.

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## About the Plattform Lernende Systeme

To design self-learning systems in the interest of society – this was the aim of Plattform Lernende Systeme, which was initiated in 2017 by the Federal Ministry of Education and Research (BMBF) at the suggestion of the Autonomous Systems Forum of the High-Tech Forum and acatech – National Academy of Science and Engineering. The platform bundles the existing expertise in the field of Artificial Intelligence and supports Germany's further path to becoming an internationally leading technology provider. The approximately 200 members of the platform are organized in working groups and a steering committee. They demonstrate the personal, social and economic benefits of learning systems and identify challenges and design options.

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