Future of Work
Working Group Report

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GPAI | THE GLOBAL PARTNERSHIP ON ARTIFICIAL INTELLIGENCE

Please note that this report was developed by experts of the Global Partnership on Artificial Intelligence's Working Group on the *Responsible Development, Use and Governance of AI. The report reflects the personal opinions of GPAI experts and does not necessarily reflect the views of the experts' organizations, GPAI, the OECD or their respective members.*

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The Executive Summary

In the GPAI Future of Work Working Group (FoW), 27 experts with multiple backgrounds and expertise from 15 countries collaborate to support a collective understanding of the impact of AI on work and to build a collective intelligence on this issue. The group has decided to develop its contribution in two directions: one focusing on existing real cases and the second turned toward the future vision. The FoW investigates how the deployment of AI can affect workers and working environments, how job quality, inclusiveness, health and safety in the workplace can be preserved, and how workers and employers can prepare and better design the future of work.

As a major activity of the first 5 months, the FoW has gathered and analyzed use cases of AI applications at the company level. For this empirical work, the experts have developed a questionnaire to query the general characteristics of AI use cases together with their underlying motivations and objectives, the participation of workers and representatives in the design and development of AI systems, the role of Human-Machine Interfaces, the ethical aspects involved and the impact on employment, work conditions and organization. From an initial overview of 53 use cases, the group has observed in an exploratory manner some trends that can be summarized as follows:

- AI applications can help organizations to produce new knowledge based on data.
- Certain AI applications can contribute to the employees' wellbeing and decent working conditions.
- Effective collaboration between AI and humans is essential for success. This refers to AI supporting human work rather than replacing it and to AI requiring human developers, trainers and supervisors.
- AI uses in the industry require more dialogue with the social partners[1] and a greater awareness and understanding of ethical aspects.
- AI can take on certain human work tasks and, therefore, will have an impact on employment, recruitment, and the skills required for future jobs.

Further use cases will be collected in the future to provide a better basis for more detailed analyses and empirically substantiated guidance and best-practice approaches.

The collected use cases will also serve as an overarching starting point for the focused activities in the specific sub-groups of "AI and training", "human-machine collaboration", "bias management" and "work conditions". In the meantime, these respective sub-groups have started their work by specifying and refining their work priorities, intended outcomes and action plans.

Moreover, beyond the scope of the FoW, the collected AI use cases can provide good opportunities for coordinating and networking the technical work of GPAI across all working groups.

Another key activity of the FoW is the design and setting up of a Living Lab for AI in the workplace. The Living Lab is thought of as an open space for innovation and learning. Initial concepts conclude that it is important for the Living Lab to be a predominantly virtual space for global exchange and collaboration, together with one or more complementary physical real labs.

For the longer-term perspective, the FoW proposes the following vision:

- *AI Observatory:* Further develop the collection of AI use cases to a continuously growing and permanently updated empirical data base for any kind of analysis with regard to AI in the workplace.

[1] The social partners are the grouping of representatives of the world of work: those of the employees on the one hand (the employees' unions) and those of the employers on the other (the employers' organizations).

- *Guidelines:* Push the work in the topic-specific sub-groups towards guidelines and recommendations for policy-makers, industrial decision makers and social partners as well as researchers to allow them shape AI in a way that promotes economic growth and social welfare. In line with the current scopes of the sub-groups, the main thematic areas will include qualification and training, societal cohesion and counteracting inequalities, decent working conditions as well as the relationship between humans and increasingly intelligent technology.
- *AI Showcase:* Making the virtual AI living lab a unique global web-based platform for knowledge transfer and transdisciplinary innovation in the field of AI in the workplace. In addition to offering manifold opportunities for global networking and collaboration, the virtual living lab should give access to extensive information resources and utilize the latest technologies in order to provide inspiring experience and insight on beneficial AI use cases and best-practice approaches. Lastly, the virtual living lab might connect a large network of physical real AI living labs around the globe. These physical living labs could be set-up in collaboration with regional governments, companies and foundations to take advantage of regional particularities and provide rich opportunities for broad dissemination, on-site demonstrations and local networking.

PRESENTATION OF THE FUTURE OF WORK WORKING GROUP SCOPE AND MANDATES

1. Introduction

The Global Partnership on AI (GPAI) was created as an international and multistakeholder initiative with the mandate to guide the responsible development and use of AI in a way that is consistent with human rights, fundamental freedoms, and shared democratic values, as reflected in the OECD Principles on Artificial Intelligence[2]. The initiative was launched by Canada and France along with Australia, the European Union, Germany, India, Italy, Japan, Mexico, New Zealand, the Republic of Korea, Singapore, Slovenia, the United Kingdom and the United States of America.

GPAI's mission, as agreed by its member countries, is to "support the development and use of AI based on human rights, inclusion, diversity, innovation, and economic growth, while seeking to address the United Nations Sustainable Development Goals."[2] After its launch in June 2020, GPAI has brought together experts from diverse sectors into four specific Working Groups: Data Governance, Responsible AI, the Future of Work, and Commercialization and Innovation - and given them the task to support GPAI in its mission.

This report has been drawn up by the GPAI Future of Work Working Group (FoW). Its objectives and scope[3] are to:

- conduct critical technical analysis that contributes to the collective understanding of how AI can be used in the workplace to empower workers and increase productivity.
- address how workers and employers can prepare for the future of work, and how job quality, inclusiveness, and health & safety can be preserved.

The FoW brings together leading experts from industry, civil society, unions, governments and academia to bridge the gap between theory and practice in AI by supporting cutting-edge research and applied activities on AI-related priorities.

The report is structured around the following six deliverables within the mandate, each one drawn up by a dedicated sub-group:

- ***Deliverable 1 (D1-Use cases in the workplace):*** Compilation and analysis of ongoing/concluded experiments and real use cases of AI at the company level; insights into the current state-of-the-art in AI interfaces and AI-driven processes from the workers' perspective.
  The sub-group in charge of Deliverable 1 is chaired by ***Yann Ferguson*** and its members are:

Laurence Devillers	Arisa Ema	Olivia Erdelyi	Carl Benedikt Frey
Sean Hinton	Anne-Marie Imafidon	Seongwon Park	Lorenzo Rosasco
Oliver Suchy	Lay Lim Teo	Petra Weingerl	

[2] http://www.oecd.org/going-digital/ai/principles/

[3] **Cf. annex GPAI Future of Work Working Group Illustrative Mandate.**

- ***Deliverable 2 (D2-Training):*** Assessment and development of best AI-based technical training methods to train workers for skills, including for jobs of the future (immersive learning, Moocs, adaptive learning, blended learning, etc.). The sub-group in charge of Deliverable 2 is chaired by ***Michela Milano*** and its members are:

  John Hepburn Sean Hinton Elanor Huntington
  Paola Ricaurte Quijano Lorenzo Rosasco

- ***Deliverable 3 (D3-Human Machine Collaboration):*** Analysis of technical capabilities for Human-Machine collaboration (HMI), co-evolution and automated decision delegation within the workplace, and their impact both on workers' physical and mental health as well as on the organization itself. The sub-group in charge of Deliverable 3 is chaired by ***SeongWon Park and Laurence Devillers*** and its members are:

  Uday B. Desai Michela Milano Oliver Suchy

- ***Deliverable 4 (D4-Bias management):*** Insight on biases and inequalities generated through AI; and political, ethical and technical insight on how to correct it. The sub-group in charge of Deliverable 4 is chaired by ***Marianne Wanamaker*** and its members are:

  Rodrigo Castañeda Miranda Sean Hinton Anne-Marie Imafidon
  Michela Milano Petra Weingerl

- ***Deliverable 5 (D5-Work conditions):*** Analysis of how decent and positive work conditions can be operationally fostered in working situations characterized by the increasing use of AI systems. The sub-group in charge of Deliverable 5 is chaired by ***Mark Graham and Anne-Marie Imafidon*** and its members are:

  Stijn Broecke Oliver Suchy

- ***Deliverable 6 (D6-Living lab):*** Setting up a living lab on the future of work as a platform, a place, or network for exchange on applied experiments at both the individual and company levels relating to the impact of AI tools. The sub-group in charge of Deliverable 4 is chaired by ***Uday B. Desai*** and its members are:

  Laurence Devillers Yann Ferguson John Hepburn KingWang Poon

2. Deliverable 1: Use cases of AI in the workplace

2.1. Motivations: Open questions and challenges

Deliverable 1 builds a catalog of use cases of AI systems deployed in workplaces and organizations. The catalog is built from questionnaires and interviews where respondents provide feedback on the implementation of a specific AI system. From this catalog, experts of the dedicated sub-group expect to draw empirical recommendations about "*how AI can be used in the workplace to empower workers and increase productivity, how workers and employers can prepare for the future of work, and how job quality, inclusiveness, health & safety can be preserved*".

The questionnaire studies the process of social integration of AI systems around five dimensions:

- Motivations for the AI system implementation
- The participation of workers and representatives in the process of defining, designing and developing the AI system
- The role of the Human-Machine Interaction (HMI) in the implementation of the AI system
- Consideration of ethics in the design process
- The impact of the AI system on employment, work and organizations

The first challenge of Deliverable 1 is to develop a survey method common to the different experts, who come from different countries and have different professional and academic backgrounds. These differences in culture have an impact on the very idea of a survey, on the way it is deployed and how its results are processed. They also influence the relationship to AI, technology, work, social relations and the economic world in general. This challenge is at the same time the difficulty, the main interest and the richness of the survey.

The second challenge is to capture what is happening in the real context of the workplaces. With this concern, we decided to give priority to collecting use cases that are as diverse as possible in terms of actors, users, experiences and use of AI systems, rather than seeking the representativeness of cases. After six weeks of survey, we have received many responses from actors committed to the development of AI. They see it as an important opportunity for organizations, workers and for themselves. With a view to providing a critical technical analysis that contributes to a collective understanding of the effects of AI systems on work, it is essential to broaden the number and the spectrum of cases. This challenge will be the focus of our future efforts.

2.2. Definition of the mandate

This deliverable is focusing on the compilation and analysis of ongoing/concluded experiments and real-world cases of AI at the company level; providing insights into the current state-of-the-art in AI interfaces and AI-driven processes from the workers' perspective.

2.3. Target audience(s) and major objectives of the deliverable

The objective of Deliverable 1 is to build a global catalog of real-life use cases of AI systems integration in work and organizations. Its motivation is therefore more empirical than conceptual. It builds a snapshot of AI at work based on answers to a questionnaire from actors in AI systems integration, executives, designers, managers, employed in different sectors and organizations of different types and sizes: public, private and non-profit sectors, large groups, small & medium enterprises, and start-ups.

This catalog will then have a real empirical value to feed the other working groups and, eventually, to discuss the dominant theories on the future of work. It can also be useful for anyone interested in how AI systems are implemented in the workplace.

2.4. Related work (and how this deliverable will go beyond)

Over the past decade, the impact of AI on the future of work has been the subject of much research by academics, governments, experts, non-governmental organizations, professional federations, international organizations, philosophers, essayists and others. It is not the intention here to list them all. However, from a worker's point of view, we can organize the anticipated effects of AI into five categories (Ferguson, 2020):

- The replaced worker: AI systems will massively replace workers and destroy jobs.

Several studies or essays tend to show that many jobs should disappear (more than 40%), with the machine performing tasks more efficiently and at lower cost than humans (*Frey, 2019; Frey, Osborne, 2017; Elliot, 2017; Ford, 2017*). From a "job-based approach", they estimate that many occupations are at high risk of automation. Previously machines, such as steam or combustion engines or electrical systems, produced more power, without affecting the human monopoly of decision making. In the Second Machine Age (*Brynjolfsson, McAfee, 2014*), the automation of cognitive tasks and control systems became possible to the extent that some machines proved capable of making better decisions than humans. Consequently, machines - i.e. computers, software, applications or robots - are no longer mere complements but can be substitutes.

- The complemented worker: workers will be complemented by AI in the execution of their tasks.

Other studies prefer a "task-based approach" (Autor, D. 2015) focusing on the complementarities between automation and labor. According to these authors, substitutable tasks are routine tasks, both manual and cognitive, meaning that there is a limited number of tasks that can be defined with the explicit rules of a program. Conversely, for non-routine, more complex tasks, computer capital is more complementary than substitutable for the worker. From this perspective, AI will destroy few jobs (around 10% depending on each country) but will transform many occupations (around 50%).

- The dominated worker: AI systems will dominate workers by reducing their empowerment.

Beyond the "technological singularity" hypothesis, many studies are concerned about the effects of AI on workers' autonomy, due to the development of an "algocracy":

- Increased rationalization of work (Head, 2014)
- Development of the worker's passivity through overconfidence in AI or complacency (Ganascia, 2017; Devillers, 2017; Muir, 1988; Carr, 2014)
- Submission to an algorithm by obedience, fear of error and punishment
- Loss of freedom of choice (Garson, 1989; Crawford, 2016; Devillers, 2020)
- Loss of expertise and adaptability (Bainbridge, 1987; France Stratégie, 2016)

To overcome these pitfalls, three requirements are most often mentioned: (1) developing AI systems that keep humans in the loop, (2) vocational training and (3) ethics by design, in particular the explainability, loyalty and accountability of algorithms (Cerna, 2017; O'Neil, 2016). Important aspects are related to the participation of workers, transparency about the mode of action of AI systems and an impact assessment to deal with the consequences for the company (Plattform Lernende Systeme: 2020; DGB 2020).

- The augmented worker: workers' empowerment is strengthened by AI.

Combined with AI, the enhanced human being would reach a level of performance normally unattainable, thanks to a good partnership between man and machine, with man bringing his true added value. AI would therefore shift the added value of humans. Humans can thus free up time to better master certain subjects, acquire new knowledge, devote themselves to tasks where AI helps them make decisions, develop a critical mind, educate and learn intelligent systems and then give way to their creativity (Levy, Murnane, 2013, Villani, 2018).

- The divided worker: “winner-take-all-economy”, the polarization of labor.

Many studies suggest that AI may polarize the labor market. On the one hand, an "aristocracy of intelligence" with a high level of complementarity with artificial intelligence occupy highly qualified and stimulating jobs. On the other hand, workers in low-skilled jobs have precarious and uninteresting work (Jainovich, Siu, 2012; Autor, 2010; Brynjolfsson, McAfee, 2014; Arntz, Gregory, Zierahn, 2016; Goldin, 2017; Anthes, 2017; Graham, Woodcock, 2019).

- The rehumanized worker: workers focus on properly human skills.

According to Douglas Hofstadter (1995), "*it sometimes seems that instead of producing a result that everyone agrees is real intelligence, each new step towards AI only reveals what intelligence is not*". "The automation of tasks and trades could be an opportunity for the “de-automation” of human work. It would allow the development of human capacities: creativity, manual dexterity, abstract thinking, problem solving, adaptability, emotional intelligence (Villani, 2018; Christian, 2011). “*What the world wants*, says Bill Gates, *is to take this opportunity to make all the goods and services we have today, and free up labor, let us do a better job of reaching out to the elderly, having smaller class sizes, helping kids with special needs. You know, all of those are things where human empathy and understanding are still very, very unique*.”

The concept of "bottleneck" used by Carl Benedikt Frey and Michael Osborne (2017), among others, makes it possible to specify the competences in which the human being retains a major comparative advantage:

- **Perception and manipulation**. Tasks related to an unstructured working environment, for which the recognition of a plurality of irregular objects is necessary or for which mobility is constrained by narrow spaces.
- **Creative intelligence.** The main obstacle to the automation of creativity is to clearly define creative values in order to be able to code them in an algorithm. This exercise is all the more difficult as these values change over time and vary between cultures.
- **Social intelligence.** Requires capacities of negotiation, persuasion or including a dimension of care that the machine stumbles over, by default of "common sense".

These studies and reflections have largely inspired the structure of our survey, which also deals with the subjects of job destruction/creation, job satisfaction, ethics by design and human-machine interactions. Our study collects stories from different actors in AI who are involved in its implementation at work and organizations. From this bottom-up approach, we do not aim to build a theory about the future of work but try to investigate how these different narratives can form units of meaning, patterns, in order to;

- better understand the motivations of those who integrate AI into organizations and work.
- better understand how AI is deployed in the field.
- highlight the issues and social effects of AI integration.
- highlight the convergences and divergences in the feedback according to the nature of the respondents.
- highlight "good practices" from the field that could outline a method for implementing AI.

Every individual’s feedback obviously involves a degree of subjectivity that can be related to the different personal, social and professional positions of the respondents. However, by compiling a quantitative and qualitative catalog, we hope to be able to identify salient points that will go beyond this subjectivity.

2.5. Current progress

2.5.1. Methodological considerations

The experts of the FoW, especially those involved in the sub-group in charge of Deliverable 1, have built a questionnaire to serve as a basis for all experts. Several templates of this questionnaire were developed and tested before reaching at a final version.

The questionnaire starts by entering information about the respondents (general data). It is then structured in nine parts:

1. AI system definition
2. Process of planning
3. Employees' personal data
4. Human-Machine Interface
5. The ethical factors considered while designing the AI system
6. Implementation
7. Impact assessment (Ex. Anterior Analysis)
8. Reviews and adjustments (Ex. Post Evaluation)
9. Any other comments

Experts of the FoW specify that the answers to the questions refer to a specific professional application of AI (and not to an AI technique in general). Indeed, many questions relate to uses, organizational and social contexts or design methods.

The questionnaire was used in two different ways:

- Either as a standalone questionnaire: the respondent answers to the questions on the template or through an online version (https://www.soscisurvey.de/GPAI-FoW/).
    - If the respondent does not know the answer, he/she must write "I don't know", as this is also an important piece of information.
    - If the respondent does not understand the question, he/she must write "I do not understand".
    - An additional exchange between the respondent and the expert may complete or clarify some of the answers.
- Or as a guide for an exchange between the respondent and the expert, who fills in the questionnaire himself.

Anonymity is guaranteed. No personal data or company data is required in this questionnaire.

The question "What sort of AI is used? "relies on the OECD definition of AI system (2019):

"An AI system is a machine-based system that is capable of influencing the Environment by making recommendations, predictions or decisions for a given set of Objectives. It does so by utilizing machine and/or human-based inputs/data to: i) perceive real and/or virtual environments; ii) abstract such perceptions into models manually or automatically; and iii) use Model Interpretations to formulate options for outcomes".

Focus: The survey questionnaire

GPAI Future of Work Working Group: Criteria used to analyze real use cases in the workplace

1- General data

- Respondent: designer/employee/manager/employer
- Gender, Age, Years of experience in digital, Ethnicity (optional), Country
- Sector and Size of the company, Company's Service
- Approximate date when use case was implemented or launched
- Application

2- AI system definition

- What sort of AI system is used? (Taxonomy from JRC Technical reports-AI watch Defining AI)

3- Process of planning

- Process of planning existence (yes/no)? If yes:
- What are the purposes and goals of AI application in the company?
  (Process or product optimization, new business model etc., automation/substitution of jobs?
- Are workers/representative bodies involved in setting the goals?
- Is cooperation with researchers / developers and external experts given?
- Are there Social Partners' guidance – on what level?
- Are there approaches regarding collective agreements
  (Co-government) on goals and possibly conflicting objectives? What is the starting point of information and bargaining? Are there regulations on co-determination and if so, in what respect?
- Are there general agreements on AI usage in the company (ethic boards, codes of conduct etc.)?

4- Employees' personal data

- Are employees' personal data required for operational use or affected by operational use?
  (if yes, what kind of data …).

5- Human Machine Interface

- Is HMI intended? In what respect?

6- The ethical factors considered while designing the AI system

- To what extent and at what time transparency of the AI system for the company
  (and for the user in the company) is required and given?
- Who in the company is involved – workers and representatives?
- Is the required information logged?
- Who has got access to information?
- Sort of AI: Functions / Analytic opportunities?
- Usability, Fairness, Data quality, technics and methods used (learning capability)?
- Options of intervention and limits?
- Questions of accountability?

7- Implementation

- What are the measures put in place (for training / required skills, safety, responsibilities (HMI)?
- Are employees involved in the development of measures?
- Is there Social Partners' guidance – on what level?

8- Impact assessment: Ex Anterior Analysis

- What working areas / working groups are affected regarding the number and quality of jobs (reorganizations etc.)?
- Are there Impacts on qualification demands and skill management?
- Are there impacts on the workload, working conditions and health management?
- Are there impacts regarding the use of personal data of workers (privacy, data protection and trade-offs; realize benefits to employees)?
- Are there regulations on using personal data and if so, in what regard?

9- Reviews and adjustments (Ex Post Evaluation)

- Are there experiences, reviews and adjustments (Ex Post Evaluation)?
- How is success for this use case measured? What worked less well in the use case?
- Effects on the number of jobs, quality of jobs, job satisfaction, workload, skills?
- Are there unintended outcomes for workers' situation and prospects?
- Are there opportunities and ways to redesign the AI system and work organization?
- Logged principles of transparency?
- Usage of employees' personal data (Surveillance)
- Predictive analytics?
- Are there feedback and participation opportunities for the employees?

10- Any other comment

2.5.2. General data on the survey (October-November 2020)

After two months of research, the catalogue consists of 53 use cases, spread over 8 countries.

For this first stage of the survey, the objective was to collect as many use cases as possible, rather than targeting the comprehensiveness of their coverage. The use cases come mainly from directors, managers and designers. It is also noted that the respondents are mostly men.

Within these 53 use cases, a few major functions dominate.

The most regularly mentioned function is an aid to decision-making function. It could also be said that this function is the umbrella for almost all the others: generating or creating new knowledge, generalizing knowledge, matching and predicting. All of these functions assist the worker in understanding the problems he/she must solve. They contribute to cognitive enhancement or relief. We can speak of "epistemic mediation" brought by AI systems.

The other regularly mentioned function is more like a tool function. The AI system does not build new knowledge or new representations. It facilitates the execution of the usual task by making it simpler, more accessible, less tedious, faster and more efficient. It does not necessarily appear as an intelligent technology for users, but as a more or less practical tool. We can speak of "pragmatic mediation" brought by AI systems.

Table 1 summarizes the main functions of AI systems collected in our use cases and gives some examples.

FUNCTIONS OF AI SYSTEMS	EXAMPLES OF USE CASES
Creating new knowledge *The AI system generates a new kind of knowledge*	Converting demand signals across a supply chain expert into a proposed transportation plan for all facilities (Industry). Preventing temporary workers from moving to other staffing companies (Human Resources).
Generalizing knowledge *The AI system reproduces existing knowledge*	Prioritizing citizens' requests to the city services during the non-working periods (Public action). Better animal care by identification of animal distress and illness ahead of time (Health).
Matching *The AI system evaluates a level of correspondence between several databases.*	Identifying the adequacy between soft skills and professional project within the company (Human Resources). Check that training purchases match employers' needs (Vocational training).
Predicting *The AI system makes a prediction based on historicized data*	Anticipating the needs of clients and identifying target opportunities (Marketing). Predicting likely preterm delivery for case management interventions (Heath).
Performing a task *The AI system helps/guides workers to achieve better performance*	Identifying billing errors in retirement homes (Accounting). Facilitating quality control via a voice interface for low educated workers (Industry).

2.5.3. First observations from the survey

The first synthesis allows us to extract some trends in the use of AI and must be understood as a snapshot. These observations will be extended with the additional use cases that we will collect over the next months. They are given in this report for illustrative purposes and should not be considered as final conclusions.

2.5.3 A) The studied AI systems target three different forms of "augmentation"

A.1 AI systems could enhance organizations by producing new knowledge and complementing human tasks

Many of the AI systems studied aim to strengthen the power of organizations. This new power comes essentially from the progress of the learning machine, which largely supplants traditional programs on problems of reproduction of unconscious or non-describable processes. Several opportunities are therefore opening up for organizations:

- Simplify tasks so that they can be done without much training:

AI system "aims to accumulate knowledge so a young worker or newly assigned technician can handle work that requires the knowledge of a highly skilled technician (highly skilled, can operate specialized equipment, etc.) This AI application supports the quality of work equivalent to that of high-skilled workers by incorporating the tacit knowledge of high-skilled workers into AI" (Private - Big firm - General construction - Deep learning - Raising the skills of young worker [4]).

- Compensate for the lack of human expertise (e.g. massive data processing):

"This AI application addresses a cybersecurity problem: too many documents produced by different departments. Humans are no longer able to tag them. This is a data governance problem. Because of the evolution of professional practices, one can be identified anywhere in the world with confidential data. We need to secure data outside its traditional security perimeter" (Private - Big firm -AI development for cybersecurity - Web service - Securing data outside its traditional security perimeter).

- React almost instantly to new information:

"The objective of this AI system is to provides instant answers to employees regarding Human Resources related topics: holidays, training, trips, policy of the company about pay rises" (Private - SME -Software - NLP -Providing instant answers to employees regarding HR related topics).

- Design programs that detect subtle differences or anomalies (such as non-quality):

"It identifies billing errors in retirement homes" (Public -Big firm -Public Administration -Machine learning - Identifying errors).

- Produce new and predictive knowledge to increase the efficiency of the organization:

"This AI system creates a machine- learning model to predict future calls. Due to the increase in insurance contracts, the number of calls from customers increased by 120% (compared to the previous year), there was a need to provide the same service level without increasing call center personnel. In order to do so, they needed a way to predict increases/decreases in phone calls" (Public - Big firm - Finance/Insurance--Machine learning - Call-center: predicting future calls).

A.2 AI systems improve the "employee experience" through new human resources applications

Many researchers estimate that AI systems could destroy a large number of jobs and degrade working conditions by developing alienating relationships between humans and AI systems. Our survey notes, however, that a significant number of AI uses are designed to improve the "employee experience" and are employee-oriented: career management, happiness measurement, skills management, recruitment choices, better access to information, professional training more adapted to the needs of employers. Thus, if AI is a problem for the future of work, these applications seem to show that it is also part of the solution.

[4] Here and in the following, the items in parentheses indicate (sector - size - industry - sort of AI used - goal of the AI system) of the corresponding use case.

"It calculates the skills and specializations of our people to connect them with a more personalized employee experience. It uses both internal and external data to be able to predict if skills will be trending or waning in the future and what necessary actions could be taken to reskill our people employee experience through recommendations for better growth and career opportunities "(Public - Big firm -Professional Services - data mining - Personalized experience through recommendations).

A.3 AI systems augment workers by supporting them to do their jobs

AI systems would produce a new combination between capital and labor resulting in an augmentation in human labor. This recombination would take place according to three principles.

- The first is based on a new division of labor between human and machine:

"This AI application recovers, scans, checks in its database that the product "on hand" is the one to be tested. It opens the product and duplicates the protocol of an operator until the end of the preparation phase. The analysis belongs to the operator" (Non-profit - Big firm - Agri-food - Cobot, Visual recognition, Adaptive learning for movements - Cobot that increases worker productivity).

- The second principle is based on the improvement of human-machine interactions, based in particular on an extension of the senses, especially hearing and sight:

"This AI application optimizes machine usage by providing a system that allows the employees to control machines through speech or text interaction" (Private - SME - Software development - Natural Language Processing - Optimizing machine usage through speech or text interaction).

- The third principle of the augmentation of the worker is based less on a division of labor than on a human/AI association from which would emerge a worker equipped with new capacities, a "*synthesis of the best of man and machine*". In 1960, Joseph Licklider theorized this "symbiosis" in a founding text describing a partnership that " *will think as no human brain has ever thought and process data in a way not approached by the information-handling machines we know today*":

"*The main idea is to look for the bottleneck in calculation programs, where computation times take longer, and replace that part of the code by a digital twin. There is a compromise to be made between precision and time saving. Some people want more speed than accuracy, and others the opposite. Sometimes it is better to know results in 1 hour for instance instead of 3 weeks*" (Private - SME - Data sciences - Deep Learning - Digital software twins to increase the speed of calculations).

2.5.3 B) *Some meanings of a "human-centric" AI system*

B.1 In most cases, business experts are essential to design & train AI systems

In the majority of cases studied, AI systems consist of generalizing expertise. Thus, as was previously the case for expert systems, the actors of the profession are essential to design and improve AI systems.

"*The companion has a very important role because we rely on him to educate AI, without his return, we are blind. I try to remain humble because I fundamentally believe in the intrinsic value of professions. I'm talking more about "increased intelligence" than AI, and that's what understanding is all about. You can't work without trade experts. That's why all the big AI companies are recruiting trade experts. Unsupervised learning bricks are specific and redundant, always start with an expert system approach"* (Non-profit - SME - Start-up on Augmented intelligence - Computer vision with standard and specific methodologies - Increasing the speed of fault analysis).

B.2 The use of AI systems strongly involves humans

In almost all of the cases studied, AI systems are not intended to automate an entire process or task. Rather, the goal is to improve the performance of the human worker. In this sense, respondents emphasize the notion of a "decision making tool" and that the final decision is always human.

"*There is the human-in-the-loop and human makes the final decision. The AI-alerts and recommends only*" (Private - SME - FinTech - Machine Learning, NLP - Automation of the surveillance).

The reasons are not ethical but are related to "probabilistic" or "empirical" AI. AI systems built on this type of algorithms provide only probabilities based on limited knowledge of the environment and contexts. Humans can provide this information and correct possible errors in order to make the decision.

Therefore, the value generated by AI systems in organizations would not come from increasing the organization's control over its human resources by automating work. It would not come from increasing the power of the organization through machines or processes. The value created by AI systems would come from trust in human work.

"*There are two approaches to AI: one which values the worker, one where he is excluded, because he is fragile and limited. Either we build trust, or we build control. This gives a moral compass on a path that can be paved with rupture. Putting the human at the center is an incantatory discourse...it must not be said, it must be done. Engineering schools must open up more to the humanities, question their political responsibility"* (Non-profit - SME - Start-up on Augmented intelligence - Computer vision with standard and specific methodologies - Increasing the speed of fault analysis).

According to the respondents, current AI is nothing more and nothing less than a human decision support tool. In this sense, they believe that AI's capacities are highly overestimated, which simultaneously generates irrational fears and hopes and, sometimes, frustration.

"It is more about having a machine plus human system, it is better both for efficiency and acceptability. In the end you will always keep a human in the process, mainly because of the high amount of spending decision in case there is a problem. You have someone to complain to if anything goes wrong. The difference is that AI makes different mistakes than humans, and sometimes they also seem stupid ones. There are some people that imagine a magic wand and they have impossible expectations but in the end the experts' knowledge is needed, and everything is aligned" (Private - SME - Energetic - Defect detection, failures detection - AI for image processing and defect detection on industrial structures. Qualification of defects on wind turbines).

B.3. A dialog to be built with the social partners

While workers are always involved in the design of AI systems, the social partners are, according to the use cases received, rarely taken into consideration.

"*Representatives were invited to user assessment testing sessions to test and provide feedback on the operational workflow, results accuracy, reporting, etc*." (Public - Big firm - Public Healthcare Institute - Deep learning - Performing automatic detection of diabetic retinopathy).

"Representatives were not initially involved in goal setting. Participation and negotiation had to be forced by the works council based on the Works Constitution Act. There was a planning process over two years, but without involvement of the works council. The planning process only referred to data that were necessary for the AI-system. Effects on employees were not considered at the beginning of the planning. The negotiation process started after two years of planning; then it took three months to achieve successful results. There were no collective agreements to guide the process. Starting point of information and bargaining was an initiative of the works council after the company had started the planning process" (Private - SME - Food Industry - Perception/audio processing - Increasing pickers' productivity).

In one use case, the designer was involved in social dialogue. But this participation was above all strategic:

"We were invited to workshops to understand and involve the CSE (Social & Economic Committee) beforehand. Question-and-answer sessions where we mobilized students, which made the presentations less suspicious, less worrisome for the operators. They were "used" for this. There were forbidden words. You couldn't talk about intelligence. It is the operators who are intelligent, not the machines" (Non-profit - Big firm - Agri-food - Cobot, Visual recognition, Adaptive learning for movements - Cobot that increases worker productivity).

Respondents, especially designers, do not participate in exchanges with the social partners. They are generally unable to answer the question about the prior existence of guidance from the social partners.

"*We do not currently use social partners. If social partners were involved, they would be part of the AI committee and provide visibility and perspective on AI initiatives and where transparency, inclusion, and communication would be required to permit systems users understanding of how AI is used to impact outcomes of services*" (Private - SME - Human capital management - Reasoning, Learning and Communication Systems - Automating collection, processing and classification of data).

On the other hand, many clients ask them for advice to facilitate this dialog.

"We were not consulted. However, sometimes they ask for advice on how to set up a project while limiting social risks" (Private - SME - IT Services - Machine learning - Visual recognition of equipment damage to facilitate maintenance).

2.5.3 C) *Ethical issues in AI systems are interpreted differently*

C.1 Questions interpreted differently by respondents

The questionnaire includes six questions on ethical factors. Generally, when respondents are not helped, they seem to interpret these questions differently. The question on the transparency of AI systems is occasionally related to issues of explainability and interpretability of AI systems.

"*Transparency is very limited. We do not share details of this system with external users, and internally information is also quite confidential. We also do not license this system for other uses. Additionally, we do not indicate to users whether a decision on their content was the result of AI or human review. However, we do produce detailed transparency reports on the ultimate decision reached for a given URL*" (Private - Big firm - Technology - Machine Learning - Determining whether a particular URL likely contains copyright infringing or pirated content).

Sometimes respondents feel that transparency is relevant to their own practice.

"We have built trust through our method, with our client and the final organizer taking into account their needs. We don't publish the code. We are on a very complex level of engineering" (Non-profit - SME - Start-up on Augmented intelligence - Computer vision with standard and specific methodologies - Increasing the speed of fault analysis).

It appears that the level of technical mastery of ethical factors is quite low. This may seem paradoxical considering the number of committees, declarations or ethical charters that accompany the current development of AI. However, two criteria are better understood. In European cases, questions of personal data are always referred to the GDPR regulation[5].

"*Every picture has to be destroyed. It has to be GDPR compliant. This is a motivation to do embedded, it does not transit the internet. Our analysis is done only when the object to be detected passes. A human can be caught when the object passes. The customer defines the duration of the history. At the end, only statistics are left. He can keep "evidence" in case of procedure*" (Private - SME - IT Services - Machine learning - Visual recognition of equipment damage to facilitate maintenance).

[5] GDPR: General Data Protection Regulation, https://gdpr-info.eu/

The question of accountability is also an issue for AI systems. Who is responsible? The developer of the application? The user? A manager? The answers are quite different. Some are related to the type of application.

"*No machine learning, only symbolic. We wrote all the answers. The program is able to generate all the formulations of questions. Our customer wanted to avoid the black box and a "Tay" experiment, i.e a chatbot becoming racist and sexist. It works with a matching system, if for instance the system does not recognize Volvo then more vocabulary about cars must be added*" (Private - SME - Software - NLP - Provide instant answers to employees regarding HR related topics).

Others are associated with the professional culture that integrates an AI system:

"*An analysis was done on the issue of upstream responsibilities. The project was left at a stage where analyses were systematically duplicated. This is part of the integration process, to see the good success rate before accepting the automation. In this industry, operators are very quality conscious and cannot guarantee an automated result. There are strong stakes on the responsibility between production, quality and laboratory. Today, the production operator puts the product in the fridge and a laboratory operator becomes the manager with a tracing software. The QR code read by the AI allows a tracing that allocates responsibilities. To allow the project to move forward, the quality manager has agreed to act as guarantor, following a negotiation*" (Non-profit - Big firm - Agri-food - Cobot, Visual recognition, Adaptive learning for movements - Cobot that increases worker productivity).

C.2 Clients are results-oriented and do not challenge designers in terms of ethics

Many clients do not have specific demands on the transparency of AI systems. If the application performs well, they are satisfied and do not ask questions.

"*The client did not demand transparency. What we detect does not pose an ethical problem. He is more interested in performance. There was a lot of outreach work on our part. We explained how it works and why it is better than a normal program, but also its limitations*" (Private - SME - IT Services - Machine learning - Visual recognition of equipment damage to facilitate maintenance).

C.3 Positions on AI ethics are contrasted

- Ethical questioning would diminish societal acceptability

For many respondents, ethical issues are intellectual concerns that do not arise at the operational level. At the operational level, it is mainly the utility and effectiveness of the AI system that matters. Ethical issues would complicate the integration of AI by spreading anxiety rather than confidence.

"*Debates at the political and academic level are very theoretical, far removed from the issues on the ground, which complicates things more than they should. There is a real gap between production and the rest of the system that are speculating, understanding AI through big debates. For production, AI does not exist. They do not use it, they talk about tools, it is a tool that helps. I don't talk about AI much. The closer you get to production, the less we talk about AI*" (Private - SME - Software - NLP - Facilitate quality control via a voice interface for low educated working).

- The issues of transparency, explainability and interpretability would not fit the paradigm of probabilistic AI.

For some respondents, these questions do not correspond to the probabilistic paradigm of the learning machine. This paradigm would imply giving up certain forms of control in order for AI systems to bring real added value to organizations. The challenge would be more to understand the behavior of AI systems in order to enable users to better "co-evolve" with it, in particular to grasp its limits, correct its errors and "feel" AI.

"*It's counterintuitive for someone in the business to talk about explicability. A Machine Learning algorithm, the more complex it is, the more efficient it is, the less explicable it is, impossible to theorize. For me, it is a response to a relatively legitimate anxiety, inflated by the media. It is the transposition of an old paradigm, computer science, which was natural in classical computing. AI brings an additional non-linear layer in which we lose this trajectory. We have the same expectations for reassurance, reliability and certifiability. We have a very basic intelligence that is developing, which can help us manage millions of pieces of data, but to the detriment of explicability. In our job, we develop a feeling for the system, for how it works, and we manage to understand it, and we change its relationship with respect to a purely deterministic machine. The important thing is not to explain but to understand. To do this, you have to spend time with a system"* (Private - Big firm - AI development for cybersecurity - Web service - Securing data outside its traditional security perimeter).

- Ethical questioning is perceived as disproportionate and unfair

For some respondents, ethical questioning is therefore inappropriate and counterproductive.
For others, it is disproportionate when other industries would have much more serious impacts.

"*Why are ethics about people who do AI and not others? I don't understand why people are asking so many ethics I don't fully understand why we not go so deep into other industries, that they could have the same impact on ethics, such as the chemical industry. Ethical concerns are everywhere, not only in AI. The big issue that the industry is discovering is that we are very far from being able to deliver what they expect. AI is not simple, today, what we do, it's very simple, I don't even think it's AI. We talk about Automation of Administrative Processes. And today, what we are capable of doing does not really involve ethics. I am involved in groups of the European Commission, for defense issues, AI in weapons, automation of the lethal load. That is clear. Otherwise, it is not clear. Even surveillance, what is changing is mass surveillance, not algorithms. Ethics is about the conditions under which it can be used. A car is a weapon. It's also a way of getting from point A to point B. The way you use it is ethical. The problem is not the technology, but its use. So, we must have a driver's license. We are not talking about the development of the technology itself, whereas we are doing it for AI.*" (Public - Big firm - Public Administration - Machine learning - Identifying billing errors).

- Ethical issues are more clearly understood in the public sector

The public sector, as a client of AI systems, is distinguished by its high ethical standards. "Black Boxes", discrimination and traceability are of great concern.

"*On the analysis of the word cloud, questions are asked about the risk of discrimination. There was a lot of discussion to avoid producing a non-discriminatory AI. It took us a long time. The algorithm was readjusted a lot around the matches. In what way are they discriminatory? This was managed by the IT Services*" (Public – Local community - Employment & Youth Pole - Machine learning - Checking that training purchases match employers' needs).

2.5.3 D) The impacts of AI systems on the number of jobs and quality of work life

D.1 Replacing human work is rarely the motivation invoked

The deployment of AI systems in organizations is often associated, in research as well as in common representations, with a threat to employment. However, in our survey, AI systems are almost never described as a short-term opportunity to reduce the number of jobs in order to increase productivity (except in one case). Some respondents are aware, however, that AI systems can have an impact on the number of jobs.

"*We were on new needs. We came to something that humans don't know how to do but where there is a need. We don't come as a replacement, but as a complement, as a crutch*" (Private - Big firm - AI development for cybersecurity - Web service - Securing data outside its traditional security perimeter).

"*De facto it was a job cut (25%)*" (Private - SME - Food Industry - Perception/audio processing - Increase pickers' productivity in a warehouse with a pick by voice-system).

D.2 However, indirect impacts on employment are emerging

- A quantitative impact on the need for low-skilled temporary workers

The integration of AI systems can eliminate tasks that require little expertise. These tasks could be performed by temporary workers.

"*We don't lay off anyone in the company but we no longer take interims because they no longer have the level to carry out this work as it is now redefined*" (Non-profit - Big firm - Agri-food - Cobot, Visual recognition, Adaptive learning for movements - Cobot that increases worker productivity by refocusing them on high value-added tasks).

- A quantitative impact on external service providers

AI systems integration can strengthen the organization's relationship with external suppliers. This may lead to reducing or better specifying its needs and thus eliminating jobs within these suppliers.

"It *can scan the front of a vehicle and determine its level of degradation. It then sends an estimate and generates a quotation for the service providers who will clean the façade. Previously, the management of these situations was very approximate and very unfavorable for our customers*" (Private - SME - IT Services - Machine learning - Visual recognition of equipment damage to facilitate maintenance).

- A quantitative impact on future recruitment needs

The integration of AI systems, without eliminating existing jobs, can automate certain tasks. This automation will free up time for some workers who will be reoriented towards new needs. This reorientation may be to the detriment of recruitment.

"Moreover, we work for public administration and in many countries, you cannot fire public employees, it is not possible, so we do not look at quantity of jobs, this is why we did not make any analysis on this. What we know is that there is a lack of people in public action, so they find a way to reallocate resources because they do not have enough money, this is why they are not hiring, they try to improve the back office and get people on the front office, the citizens want to interact much more now" (Public - Big firm - Public Administration - Machine learning - Identifying billing errors).

D.3 AI systems would most often lead to improved working conditions

- Automation of daunting tasks

Respondents almost always believe that AI systems have a positive impact on working conditions because they automate tasks that are tedious, boring or physically demanding.

"It *reduces 50% of manual reads by human graders (tier 1 screening), and only abnormal and a percentage of normal cases (for audit purposes) are escalated for manual reads (tier 2 review)*" (Public - Big firm - Public Healthcare Institute - Deep learning - Performing automatic detection of diabetic retinopathy).

One case shows that social partnership is helping to avoid increasing the workload and to improve working conditions.

"The system was redesigned after the involvement of the works council: initial functions were not allowed to be introduced to ensure that the workers set the pace and not the machine (no pressure to perform)" (Private - SME - Food Industry - Perception/audio processing - Increase pickers' productivity in a warehouse with a pick by voice-system).

- Job satisfaction can however deteriorate and the workload increase

Some use cases point to a degradation of the work: appearance of boring tasks, risk of work intensification. "*The model doesn't perform well it can drive massive swings in the workload of my team and our contractors. This has a massive impact on employee wellbeing because the content re-viewed by the system is often graphic in nature, and decaying performance leads to a higher human exposure to that content. This has a direct impact on retention, mental health needs, and moral*" (Private - Big firm - Technology - Machine Learning - The model is designed to combine multiple URL and domain level signals to determine whether a particular URL is likely to contain copyright infringements or pirated content).

"*There was no impact assessment. Result: "loneliness at work". Work relief, but more monotony at work*" (Private - SME - Food Industry - Perception/audio processing - Increase pickers' productivity in a warehouse with a pick by voice-system).

D. 4 A reallocation of human labor

According to many respondents, the integration of AI systems produces a shift in the value of human work along two dimensions:

- Towards more rewarding tasks with higher added value:

"*Zookeepers could save up to one hour a day on watching video footage to assess animal behavior. This allows them to focus on better animal care and interactions with the animals*" (Non-profit - SME - AI software/Intelligence services - Computer Vision - Object Recognition - Computer Vision for wildlife management).

- Towards tasks related to the development of the AI system (co-determination and use):

"*Employees are constantly engaged in the performance of the system, which gives many opportunities to provide feedback to management and to engineering teams. Contractors do not have as many opportunities for this engagement*" (Private - Big firm - Technology - Machine Learning - The model is designed to combine multiple URL and domain level signals to determine whether a particular URL likely contains copyright infringing or pirated content).

D. 5 The impact of AI systems on human expertise is heterogeneous

- A shift in value that can reinforces the status of the business expert:

According to some respondents, AI systems, by shifting human work to high value-added tasks, strengthen the position of experts.

"It changes the organization with automation of the handling phase and refocusing on the reading and statistical analysis of the results. This was possible because the operators were experienced" (Non-profit - Big firm - Agri-food - Cobot, Visual recognition, Adaptive learning for movements - Cobot that increases worker productivity by refocusing them on high value-added tasks).

"*No impact on number of jobs, no destruction. Quality of job (blade experts) is higher* "(Private - SME - Energetic - Defect detection, failures detection - AI for image processing and defect detection on industrial structures. Qualification of defects on wind turbines).

- An association "novice + AI system" that can weaken the status of the business expert:

Many use cases show that AI systems can be used to compensate for the limitations of some workers.

"It *can also help lessen the difference between experienced coordinators and newer coordinators*" (Public - Big firm - HR, staff agency - Word2vec - Preventing temporary workers from moving to other staffing companies).

"It stops doing this activity manually in Excel and to start recording the data with a voice recognition system. Saving time, reduction of errors, greater control are three examples of benefits. We can tell if we are within the tolerance levels, within the standards. If not, the operator has to say why. The academic level of the workers is low with a problematic written relationship. The use of voice is empowering" (Private - SME - Software - NLP - Facilitate quality control via a voice interface for low educated working staff).

This compensation may be deliberately designed to weaken business experts. With AI systems, business experts would become less indispensable in the long term, after the design and training of the AI system which becomes more autonomous. It would strengthen managers' positions.

"*Negative results predominate because qualification and work experience are no longer necessary because the AI takes over. Only a short period of training is required to use the system. With regard to the quality of the work, there was a simplification (the system speaks all languages, knows all calculations, processes and products); the AI thus led to a de-qualification of the workers because no previous knowledge was required. There is no further development of the workers because it is not necessary and also impossible, e.g. the workers unlearn calculating and product knowledge. The result can be described as the dumbing down of the workers. They act like machines*" (Private - SME - Food Industry - Perception/audio processing - Increase pickers' productivity in a warehouse with a pick by voice-system).

2.6. Action plan and next steps

Our survey currently includes 53 use cases. We are aiming for a minimum target of 100 use cases in the first year. But quantity is not a sufficient target. Our catalog is currently very unbalanced. It does not sufficiently reflect the perspective of employees, ordinary users or employee representatives. In the short term, therefore, we must focus our efforts on the representativeness of respondents in order to create a full picture of the social effects of AI systems in workplaces and organizations, and eventually to observe convergences and differences between these actors.

In the medium term, we need to develop a collaborative working method between the different sub-groups of FoW. Indeed, the catalog contains questions relating to all the other five deliverables. For the time being, this sharing is not organized, it is carried out informally, which is easy with 53 cases. But the more cases there are, the more essential it will become to structure the sharing of information. The catalog will thus be able to empirically feed the other deliverables, which intend to proceed to an in-depth analysis of their issues.

The FoW brings together experts from many countries. This creates an opportunity to develop cultural observations and analyses. At present, we have not carried out an analysis that would allow us to highlight cultural specificities in the way AI is implemented in workplaces and organizations. Cultural analysis requires a very large number of use cases from each country or cultural area. Without it, it would produce inaccurate generalizations and stereotypes. Moreover, the opportunities for cultural analysis have not yet been the subject of a real discussion within the group. We have not decided whether this should be an objective.

This survey, if it succeeds in establishing itself over time, will also be able to produce longitudinal observations. The FoW will then be able to observe possible changes in the way AI systems are implemented at workplaces and in organizations.

3. Deliverable 2: Training and education

3.1. Motivations: Open questions and challenges

Artificial Intelligence is a disruptive technology that is currently changing, and will continue to radically change, all aspects of our life: the way we work, education and training, and the way we organize work and business models. It is clear that in this setting there is a strong need to identify:

- the skills that are needed to prepare for the AI impact on the workplace.
- the AI methods that can contribute effectively to skills training and education.

The first aspect concerns what we call **Training for AI**, namely how we need to change, adapt, improve the training system in schools and universities (with the definition of curricula for STEM and non-STEM courses) and also for what concerns training on the job.

The second aspect instead is related to what we call **AI for Training**, meaning AI tools, methods and techniques for improving the learning process, the way courses are delivered, along with exams and ways to evaluate the competences achieved.

Clearly, there are a number of key open challenges for both aspects. For Training for AI, one open question is how reliably we can predict future AI developments over the next 5-10 years so that we can direct the training and education system toward useful content. A second key challenge is to understand how to target various groups (students in schools, teachers, university students, workers, managers, policy makers) with proper content and proper training methods.

On the AI for Training side some of the main challenges are the following:

- How much of the expected value of AI for education is hype?
  (recall the revolution MOOCs were supposed to create).
- Is there a value added for truly AI-based methods compared with more “traditional” digital methods?
- Are there any good case studies or controlled experiments?
- How can we address training considering different contexts and needs?

3.2. Definition of the mandate

The mandate of the sub-group on Training is twofold:

- provide a comprehensive overview of the needs, possibilities, and challenges of training for AI considering contextual variables, different stakeholders and priorities.
- analyze the potential of AI tools for training, by understanding the advantages with respect to traditional digital methods and their ability to provide different forms of training for different groups of stakeholders.

3.3. Target audience(s) and major objectives of the deliverable

The main target audience for the deliverable can be divided into three categories:

- **Policymakers**: in particular, we need to target policymakers in the field of education and training and in the field of labor policies. It is essential to provide good practices for both areas, the first as producers of training and educational resources and content, the latter as consumers of this content.
- **Schools and Universities:** the whole education system should be targeted, in order to produce a coherent strategy for education and training. It should start from the design of curricula that can adapt to the current situation, to the increasing adoption and use of AI technology in industry and in the public sector and to the skills needed by the workforce. Also, the education system could possibly benefit from the use of AI-based training tools to improve the way courses, seminars, classes and exams are delivered and run.
- **Businesses:** these are the main consumers of training and educational content, thus providing requirements, skill gaps and important areas to cover. Tech and low-tech companies are completely different targets, requiring customized training and educational material.

The main objective for the moment is to outline the r**eport plan on Training for AI:**

- **Introduction**: the objective here is to identify needs, possibilities and challenges.
- **Evolving contexts:** the objective is to understand how requirements for professional training resulting from the use of AI are changing.
- **Literature review**: the objective is to identify how AI changes the skills workers need.
- **Education overview:** the goal is to provide an overview of AI-based training/education tools that are currently available, as well as possible developments over the next 5 years.
- **Education approaches**: we aim to understand the limitations of AI, and the ethics of the use of AI, beyond technical training for AI professionals, assessing the effective use of AI tools, understanding biases and ethical issues involved in their use.
- **Case Studies:** the objective is to identify possible case studies where training in AI has been successfully implemented and to extract recommendations and insights.
- **References.**
- **Appendix.**

3.4. Related work (and how this deliverable will go beyond)

These elements have been identified to help structure the deliverable:

- **OECD report on Trustworthy AI in Education[6]*:***

The OECD report concludes that the rapid adoption and diffusion of AI in the economy raises new challenges for governments and education stakeholders: what knowledge and skills should formal education systems develop given the ongoing developments? Recent research estimates that 14% of existing jobs could disappear as a result of automation in the next fifteen to twenty years, and another 32% are likely to change radically. (OECD, 2019, p.15[1]) This implies that the relative demand for skills will change, and so should the supply as well. In the digital era, complex skills that are less easy to automate become increasingly important. Creativity and critical thinking are becoming increasingly important in the labor market, and contribute to a better personal and civic life. (Vincent-Lancrin et al., 2019, p.18[10])

- **Elements of AI**

This course is for citizens and all stakeholders that do not have any knowledge of IT topics. This course was conceived and created in Finland, and has been translated into several languages.

[6] https://www.oecd.org/education/trustworthy-artificial-intelligence-in-education.pdf

3.5. Current progress

The group has organized a number of meetings to discuss the content of the deliverable and has defined a roadmap for the coming months.

In addition, we foresee connections with other sub-groups:

- With the sub-group of Deliverable 1 on use cases of the use of AI in the workplace, we could possibly extract the skills needed in the workplace, and in addition, possibly have a use case on training.
- With the sub-group of Deliverable 3 on human-machine interaction, we could understand if it impacts the way training is given and how courses are delivered.
- With the sub-group of Deliverable 6 on living labs, we could explore the possibility of creating a living lab on training.

3.6. Action plan and next steps

The group has identified two important deliverables. The first is to produce a report on Training for AI. For this we propose a waterfall approach as follows:

- Open questions and challenges
- Evaluation of the conditions, context and readiness for AI (public policy and market needs)
- Literature review
- Identification of the current offer in formal, non-formal and informal education (curricula, lifelong learning, specialization, etc.) in Italy, Mexico, and Canada (countries of the members of the group): content, skills, changing work environment and technologies, ethics, equity and inclusion
- Fieldwork: interview with academics, managers and public sector employees
- Analysis of the different approaches to training
- Triangulation of information: needs, conditions, offer and approaches (also taking into consideration the results of Deliverable 1)
- Case studies
- Results and recommendations

The second step will be to produce a report on AI for Training by analyzing the main AI tools and techniques for education, training and evaluation.

4. Deliverable 3: Human Machine Collaboration

4.1. Motivations: Open questions and challenges

Collaboration between humans and machines is by no means a new topic; since machines were first invented, humans have been able to do difficult work with their help. In the collaboration between humans and machines that we discuss in this report, machines are not just machines, but ones that communicate with humans in the human's language within the shared workspace.
In this deliverable, we will consider robots that are physically embodied, but also avatars or on-screen synthetic social characters, which are not embodied and with which the users communicate with a representation of the face on the screen.
Among others, we specifically focus on cooperative robots defined by *The International Federation of Robotics* (IFR, 2018) as well as on synthetic social agents and chatbots, which are related to the third and fourth types below:

1. Co-existence: human and robot work alongside each other, but with no shared workspace.
2. Sequential collaboration: human and robot share all or part of a workspace but do not work on a part or machine at the same time.
3. Co-operation: robot and human work on the same part or machine at the same time, and both are in motion or in conversation, and the machine is able to adapt to the human.
4. Responsive collaboration: the robot responds in real-time to the worker's motion or in conversation, and is able to adapt to the human.

The first and second types of robot are familiar, but the third and fourth ones are just emerging in real or virtual workspaces. When the GPAI investigates collaboration between humans and machines, this will concern the third and fourth types of collaborative robot or chatbot.

We raise key questions regarding the situations where robots and humans work in the same workspace at the same time, and both are in motion[7]:

- Occupational health and safety in the workplace
- Workplace safety standards for maintenance, operation, and interaction with human workers
- Proactive approaches for establishing risk profiles of robotic workplaces
- Redundant safety measures while performing maintenance tasks on robot workers.
- Co-evolution with collaborative robots: What should humans do if collaborative robots disagree with human worker's preferences? Humans sometimes behave irrationally while AI robots are likely to be more rational than humans. When humans stop working for any of various reasons, AI robots could interpret this behavior as being irrational and ask humans to continue working. What should be done to the AI robots in this case? Can we just turn it off? Or, should we program AI robots to flexibly interpret the human behavior? (Russell, 2019) (Devillers 2017, 2020).

4.2. Definition of the mandate

The mandate of the sub-group on human-machine collaboration is twofold:

- to review articles and reports that deal with human to machine collaboration, co-evolution and automated decision-making within the workplace, and its impact on workers' physical and mental health and on organizations. For this purpose, we will study the interaction between humans and machines (not robots but cobots) and human-machine co-evolution. Cobots, a shorthand term for collaborative robots, are machines designed to work alongside their human colleagues, assisting them with tasks. They can be complex, life-sized mechanisms that aid human partners, or they can be tools like chatbots.

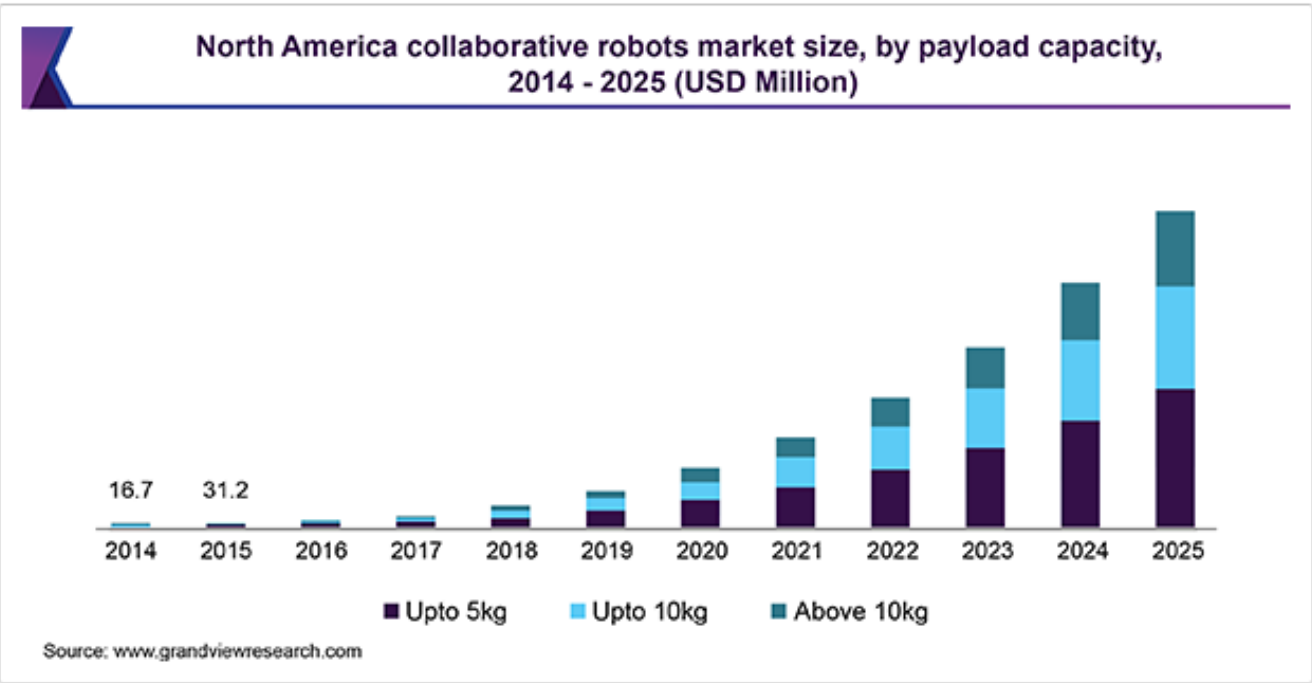
[7] https://blogs.cdc.gov/niosh-science-blog/2015/11/20/working-with-robots/

- to forecast the future of collaborations between humans and cobots by providing 2-by-2 scenarios of the future. The methodology of the scenarios of the future is described below. We are going to explore what changes in the collaborations and interactions between humans and cobots in the workplace would occur, while considering opportunities and risk factors.

4.3. Target audience(s) and major objectives of the deliverable

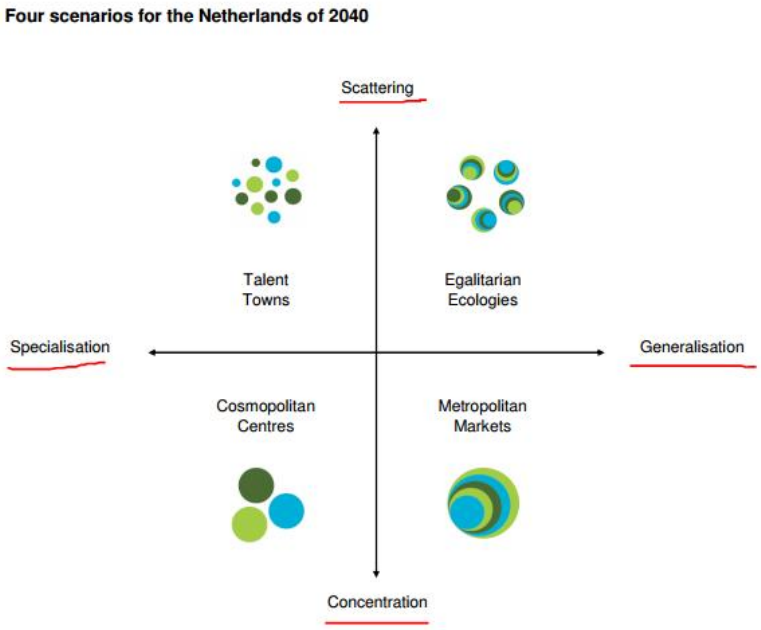
The collaborative robot market still maintains a high growth rate of more than 30% (32.1% in revenue terms and 31.3% in shipment terms). With the further development of new application scenarios and breakthroughs in technology bottlenecks, the cobot market (physical robots) is projected to reach $ 5.6 billion in 2027[8]. Virtual robots and chatbots have a huge potential market.

The target audiences are companies and workers using cobots. In addition, there are other potential audiences, such as policy makers who are interested in the market of cobots (physical and virtual) and regulations on cobots.



One of the main outcomes of the sub-group on Human-Machine Collaboration is 2-by-2 future scenarios, which are further used to forecast the four exclusive possible futures. As an illustration, suppose you want to forecast future jobs for each type of city. You first assume two main city types: a concentrated city and a scattered city, and you place both on either side of the first axis. Then you also assume specialists and generalists as two different job types, and place both on either side of the second axis. This leads to 1) the future in which specialists are preferred in the concentrated urban form, 2) the future in which generalists are preferred in the concentrated urban form, 3) the future in which specialists are preferred in the scattered urban form, and 4) the future in which generalists are preferred in the scattered urban form. The following figure displays that reasoning (Weel et al., 2010):

[8] https://www.interactanalysis.com/the-collaborative-robot-market-2019-infographic/



The poles of the axis that can be thought of when forecasting the future of collaborations between humans and machines are: replacement v. augmentation, and creativity v. dependency.

4.4. Related work (and how this deliverable will go beyond)

In connection with the sub-group of Deliverable 1, we will extract and enrich the catalog of AI use in the workspace parts on Human-Machine Collaboration real use cases.

4.5. Current progress

We are reviewing some use cases of human-machine collaboration and we will discuss the list of axes needed to create future scenarios. By the end of this year, we will review the case of collaboration and start working on future scenarios from next year. Each quadrant scenario seems to be able to provide answers to the five questions mentioned above in Section 4.1.

4.6. Action plan and next steps

There is not much literature yet on active collaboration between humans and machines. There are still only a handful of places where machines are regarded as human coworkers and collaborators rather than just machines. Therefore, while collecting evidence, the small seeds that can now be found, our work should focus on forecasting what kind of work environment could be created, what potential risks lie ahead, and what opportunities will exist under conditions that enable human-machine collaboration. For this purpose, an online survey can also be conducted for GPAI members.

The results of our study will be useful for policymakers, industrials and broader workers, managers/HR; We identified several avenues of collaboration, for example:

- For designing new training/education in collaboration with the D2-training deliverable.
- For conducting real use cases tests with the sub-group of D6-living lab.

5. Deliverable 4: Bias management

5.1. Motivations: Open questions and challenges

Biases and inequalities resulting from the use of artificial intelligence are a concern for AI practitioners and policy makers alike. Bias in outcomes, discrimination against particular groups, and unequal outcomes can emerge for many reasons. However, the most common case is machine-learning technologies, where algorithms may systematically produce decisions that violate desired principles of fairness, equality, non-discrimination, and/or anti-bias.

When artificial intelligence is used in human resources management functions, the concerns are perhaps heightened. A machine-learning technology that screens job applicants can quickly embody the biases of past human resources workers if training data are not appropriately monitored. Promotion, salary, and performance evaluation processes have similar risks.

Once biases, inequalities, and discriminatory processes are identified and categorized, potential solutions can be evaluated. The solutions to these biases, inequalities, and discriminatory processes will require social and political will to enact. A complete bias mitigation analysis would include an evaluation of the social and political challenges to implementing these solutions.

The biggest challenge to studying bias mitigation is the lack of a consistent definition of bias or discrimination across nations represented in GPAI. An international set of experts, such as the FoW, will bring a diversity of perspectives to this work. Common themes or definitions across countries can define a lowest common denominator definition of bias, inequality, and discrimination, taking into consideration countries where the definitions differ.

5.2. Definition of the mandate

This group will provide insight on fairness, biases, inequalities, and discriminatory practices generated through AI in human resources contexts. In doing so, it will first produce a systematic survey of these concepts, including cross-country comparisons and multiple cultural viewpoints. Relying in part on the use cases produced in Deliverable 1, the group will provide a taxonomy of biases, inequalities, and discriminatory outcomes, categorizing these undesirable outcomes so that solutions can be more easily investigated.

Once the problems have been more clearly defined and categorized, the team will produce technical insights on how these problems can be addressed, along with political, ethical, and technical insight on the challenges to adopting these solutions.

5.3. Target audience(s) and major objectives of the deliverable

The sub-group will produce a white paper addressed to policymakers and practitioners.
The paper will have four major chapters:

- Chapter 1: Review of fairness, equality, and equity concepts, plus definitions of discrimination.
- Chapter 2: Taxonomy of biases, inequalities, and discriminatory outcomes (related to concepts of fairness, equality, equity, and discrimination).
- Chapter 3: Technical insight on how to take corrective action against biases, inequalities, and discrimination.
- Chapter 4: Political and social challenges to correcting biases, inequalities, and discrimination with proposed solutions.

5.4. Related work (and how this deliverable will go beyond)

The group will benefit from an existing glossary, from the Glossary Committee of the IEEE Global Initiative, and from the foundational work given in the Institute for the Future of Work's working paper "Equality Through Transition". "Indigenous Protocol and Artificial Intelligence", produced by the Initiative for Indigenous Futures and the Canadian Institute for Advanced Research, provides a model for thoughtful consideration of AI applications in a cultural context.

5.5. Current progress

The work has already begun with a review of fairness, equality, and equity concepts, plus definitions of discrimination, across GPAI member countries. The gathered information will be synthesized and reduced to a set of common themes, and these themes will inform a taxonomy of biases, inequalities, and discriminatory outcomes. With this groundwork in place, we will proceed to assessing the possible solutions to identified problems.

6. Deliverable 5: Work conditions

6.1. Motivations: Open questions and challenges

The primary open question and challenge is what AI means for the balance of power between labor and capital. There are significant concerns that increasing integration of AI into labor processes will kill jobs, commodify work, deprive workers of agency, and generally disempower workers. As such, we need to better understand what the key risks of AI might be for workers and how we can best guard against them.

A main objective is to analyze how decent and positive work conditions can be fostered in working situations characterized by increasing use of AI systems. Therefore, a focused issue is the question of empowerment (transparency, co-determination, skills).

6.2. Definition of the mandate

The sub-group's mandate is to co-develop a set of principles and best practices for AI in the labor process. These principles will be used by researchers, workers, managers and regulators as benchmarks for evaluating whether or not the use of AI in the workplace deviates from best practices.

6.3. Target audience(s) and major objectives of the deliverable

By establishing benchmarks, the key objective of the deliverable is to set an ambitious but realistic set of goals for the integration of AI in labor processes around the world. The private sector, the labor movement, and the regulators will all be able to use these benchmarks/guidance.

6.4. Related work (and how this deliverable will go beyond)

The sub-group plans to develop the roadmap for this deliverable in the next few months.

6.5. Current progress

The sub-group is discussing the working method and the planning for benchmarking.

6.6. Action plan and next steps

The next step will be to finalize the workplan and to submit it to the FoW. Through our work, we expect to facilitate a tripartite dialogue among representatives of the private sector, the labor movement, and the regulators.

7. Deliverable 6: The living laboratory

7.1. Motivations: Open questions and challenges

AI advances are accelerating, and many companies and countries are experimenting and implementing AI. It is worthwhile learning from these experiences -- successful, unsuccessful, and in-progress -- so that one is better equipped to use AI for the betterment of humanity.

One way to learn from these experiences is to have an AI Living Laboratory, wherein we can observe how AI is impacting work, how individuals are coping with AI-enabled work environments, how peer-to-peer relations are changing in an AI enabled work situation. The Living Lab will also focus on data integration in AI platforms and connection to Industry 4.0.

There are multiple challenges to developing an AI Living Lab. The biggest challenge is with regard to resources and a physical location. AI Living Labs currently exist on academic campuses, but they have more of an R&D flavor. While we can learn from these Living Labs, we have to move one step further to conceptualize the architecture of the AI Living Lab. The sustainability of the AI Living Lab is also of major importance.

Another issue is to identify partners, companies, and industries who will share their experience with AI at work, data at work and agree to incorporate some of this in the virtual living lab.

Below are some suggestions on possible architecture for AI Living Lab.

7.2. Definition of the mandate

Living Lab is basically an open innovation and learning space that can take one of several possible forms. It could be a physical lab, a virtual one, or even one bound by shared ideas. These are not mutually exclusive. For example, virtual labs could be complemented by physical labs. And shared ideas could become the impetus for forming virtual and physical labs.

7.3. Target audience(s) and major objectives of the deliverable

The target audiences concern private and public sector practitioners, MSMEs, (micro, small and medium enterprises), and Startups who are leading AI initiatives and those who explore the possible use of AI and data science.

The major objective of the Living Lab is to give an experiential feel to those who want to enable their company/industry activity with AI or those who want to enhance existing AI enablement in their company/industry. Moreover, researchers focusing on the Future of Work should be able to benefit from the AI Living Lab.

7.4. Related work (and how this deliverable will go beyond)

The team is currently exploring several options.

For example, the Living Lab could be a Virtual Lab brought to life by videos from all over the world. Member countries and others can be invited to post videos related to AI enabled workplaces. A Virtual living-lab could function as an expertise management system, a software that provides the opportunity to structure, enhance, and make the most of the data and technical knowledge. The virtual AI Living Lab could be an open platform where people can collaborate to present their ideas on the Future of Work in a multimedia format.

The Living Lab could also focus on key people and their ideas, as a complement to the interesting case studies, tech topics, and concepts. We could look at the lived experiences of how people work with, feel about, and respond to AI. We could also look at how people are adapting to AI and testing new solutions. We will understand from those who are pushing back the boundaries with piloting, testing etc. to understand what, why, and how they are pushing the boundaries. One way to do this is to start a series of short interviews linked to the different areas in the FoW. That way, there will be synergies across sub-groups, and the interviews will give details and examples of some of the ideas and principles emerging in the other sub-groups.

We should also consider setting up a real AI Living Lab. This lab will complement the virtual lab. The architecture of the physical living lab will involve the use of sensors, robots, cameras, AI tools, workflow measurement tools and many more such things. The physical Living Lab could explore how AI will unite virtual and physical workspaces seamlessly. For example, can the environment sense and perceive interactions in the physical workplace, and seamlessly transfer the context to an online/virtual interaction? The context could be: (i) a topic being discussed; (ii) identities of people involved; (iii) status of progress of a particular task, etc. Can these be identified by an environment and automatically registered to contextualize an online follow-up interaction? The Physical lab could also have software that can track the use of information on the computer; for e.g. one could be on a specific task, but one moves from one action to another and then another and then comes back to the first task. AI-based study of asynchronous information access and integration of such information could suggest behavior of humans in a digital environment.

Two main challenges to setting up a physical AI Living Lab are (i) Resources and (ii) physical location and availability of space.

7.5. Current progress

There have been several email discussions among members of the sub-group on Living Lab. We have started sharing ideas and thoughts on the AI-based “Future of Work Living Lab”.

7.6. Action plan and next steps

The immediate next step will be to focus on how to set up the virtual living lab. The architecture of this lab and collecting resources for this lab will be the key action items, as they will be essential to enable the Virtual AI Living Lab.

8. References

Deliverable 1

AI strategy in France: working group 3.2 (March 2017):
https://www.strategie.gouv.fr/sites/strategie.gouv.fr/files/atoms/files/ia_annexe_1_21032017.pdf
ANTHES, E. (2017), « The shape of work to come », in *Nature*, vol. 550, p. 316-319.
ARNTZ, M., GREGORY, T., ZIERAHN, U. (2016), « The Risk of Automation for Jobs in OECD Countries: A Comparative Analysis », OECD Social, Employment and Migration Working Papers, No. 189, OECD Publishing, Paris.
ATKINSON, R. (2013), « Stop Saying Robots Are Destroying Jobs—They Aren't », in MIT Technology Review.
AUTOR, D., LEVY, F., URNANE, J.-M. (2003), « The skill content of recent technological change: an empirical exploration », in Quarterly Journal of Economic, 118(4), p. 1279-1333.
AUTOR, D. (2010), « The Polarization for Employment and Earnings », *Center for American Progress*.
AUTOR, D. (2015), "Why Are There Still So Many Jobs? The History and Future of Workplace Automation", Journal of Economic Perspectives, vol. 29, no. 3, Summer 2015, p. 3-30.
FREY, C.B., OSBORNE, M. (2017), « The Future of Employment: How Susceptible are Jobs to Computerization? » in *Technological Forecasting and Social Change*, vol. 114, issue C, p. 254-280.
FREY C.B. (2019), The Technology Trap: Capital, Labor and Power in the Age of Automation. Princeton University Press.
BRAINBRIDGE, L. (1987), "Ironies of automation", in RASMUSSEN, J., DUNCAN, K.D., LEPLAT, J. (ed.), *New Technology and Human Error*, Chichester (UK), Wiley, p. 271-284.
BRYNJOLSSON, E., McAFEE, A. (2014), The Second Machine Age, USA, Norton & Company.
CARR, N. (2014), The Glass Cage: Automation and Us, New-York, W.W. Norton & Company, Inc.
CHRISTIAN, B. (2011), *The Most Human Human: What Artificial Intelligence Teaches Us About Being Alive*, Doubleday.
CERNA COLLECTIF (2017), « Éthique de la recherche en apprentissage machine », *Rapport de recherche*, CERNA, ALLISTENE.
CRAWFORD, M. (2009), *Shop Class as Soulcraft: An Inquiry Into the Value of Work*, Penguin Press.
Devillers L., (2017). Des robots et des Hommes (Plon).
Devillers L., (2020). Les robots émotionnels (L'observatoire).
DGB - German Trade Union Confederation (2020): Artificial Intelligence (AI) for Good Work
ELLIOT, S.W. (2017), *Computers and the Future of Skill Demand, Paris, OECD Publishing.*
FERGUSON, Y. (2020), "Une intelligence artificielle au travail- Cinq histoires d'Hommes", in BARRAUD, B.(ed.), *L'intelligence artificielle dans toutes ses dimensions*, Paris, L'Harmattan, p. 129-144.
FORD, M. (2015), *Rise of The Robots,* USA, Perseus Books Group.
FRANCE STRATÉGIE (2016), *Anticiper les impacts économiques et sociaux de l'Intelligence Artificielle. Annexe 1 : L'intelligence Artificielle en quête d'acceptabilité et de confort*.
GANASCIA, J.-G. (2017), *Le mythe de la Singularité. Faut-il craindre l'Intelligence artificielle*, Paris, Seuil.
GARSON, B., (1988), *The Electronic Sweatshop: How Computers Are Transforming the Office of the Future into the Factory of the Past*, USA N.Y. Simon & Schuster.
GRAHAM, M., WOODCOCK, J. (2019), *The Gig Economy: A Critical Introduction*, Cambride: Polity.
Head, S. 2014. Mindless: Why Smarter Machines are Making Dumber Humans? Basic Books, New York.
GOLDIN, I. (2017), « The second Renaissance », in *Nature*, vol. 550, p. 327-329.
HOFSTADTER, D. (1995), *Gödel, Escher, Bach: an Eternal Golden Braid*, *BasicBooks*.
INTERNATIONAL DATA CORPORATION (2017), « Worldwide semiannual big data and analytics spending guide ».
JAIMOVICH, N., SIU, H. (2012), « The Trend is the Cycle: Job Polarization and Jobless Recoveries », NBER Working Paper, 18334.
LEVY, F., MURNANE, R. (2013), « Dancing with robots: Human skills for Computerized Work », NEXT.
LICKLIDER, J. (1960), "Man-Computer Symbiosis", in *RE Transactions on Human Factors in Electronics*, volume HFE-1, pages 4-11, March 1960.
MISSION VILLANI (2018), « Donner un sens à l'Intelligence Artificielle ».
MUIR, B., (1988), « Trust between humans and machines, and the design of decision aids", in HOLLNAGEL, E., MANCINI, G., WOODS, D.D. (ed.), Cognitive Engineering in Complex Dynamic Worlds, London, Academic Press, p. 151-171.
OECD (2019), *Artificial Intelligence in Society*.
OPECST (2017), *Pour une Intelligence Artificielle maîtrisée, utile et démystifiée*.
Plattform Lernende Systeme (2020): Introduction of AI systems on company level. Approaches for change management
RUSSEL, S., DEWEY, D., TEGMARK, M. (2015), « Research Priorities for Robust and Beneficial Artificial Intelligence".
WHITE HOUSE (2016), *Preparing for the future of Artificial Intelligence*, October 2016.

Deliverable 2

The future of work. (2017). *Nature, 550*(7676), 315. doi:10.1038/550315a
World conference on information systems and technologies, WorldCIST 2019 (2019). Retrieved from www.scopus.com
Ahmad, T. (2019). Scenario based approach to re-imagining future of higher education which prepares students for the future of work. *Higher Education, Skills and Work-Based Learning, 10*(1), 217-238. doi:10.1108/HESWBL-12-2018-0136
Bailey, D. E., & Barley, S. R. (2020). Beyond design and use: How scholars should study intelligent technologies. *Information and Organization, 30*(2) doi:10.1016/j.infoandorg.2019.100286
Benhamou, S. (2020). Artificial intelligence and the future of work. *Revue d'Économie Industrielle, 169*(1), 57-88. doi:10.4000/rei.8727
Bhattacharyya, S. S., & Nair, S. (2019). Explicating the future of work: Perspectives from India. *Journal of Management Development, 38*(3), 175-194. doi:10.1108/JMD-01-2019-0032
Brougham, D., & Haar, J. (2020). Technological disruption and employment: The influence on job insecurity and turnover intentions: A multi-country study. *Technological Forecasting and Social Change, 161* doi:10.1016/j.techfore.2020.120276

Brundage, M. (2015). Economic possibilities for our children: Artificial intelligence and the future of work, education, and leisure. Paper presented at the *AAAI Workshop - Technical Report, WS-15-02* 28-32. Retrieved from www.scopus.com
Bruun, E. P. G., & Duka, A. (2018). Artificial intelligence, jobs and the future of work: Racing with the machines. *Basic Income Studies, 13*(2) doi:10.1515/bis-2018-0018
Caruso, L. (2018). Digital innovation and the fourth industrial revolution: Epochal social changes? *AI and Society, 33*(3), 379-392. doi:10.1007/s00146-017-0736-1
Chan, S. (2020). *The future of trades learning* doi:10.1007/978-981-15-2129-4_9 Retrieved from www.scopus.com
Chen, W. (2019). Now i know my ABCs: U.S.-china policy on AI, big data, and cloud computing. *Asia Pacific Issues, 2019*(140), 1-9. Retrieved from www.scopus.com
Choudhury, P., Starr, E., & Agarwal, R. (2020). Machine learning and human capital complementarities: Experimental evidence on bias mitigation. *Strategic Management Journal, 41*(8), 1381-1411. doi:10.1002/smj.3152
Das, S., Steffen, S., Clarke, W., Reddy, P., Brynjolfsson, E., & Fleming, M. (2020). Learning occupational task-shares dynamics for the future of work. Paper presented at the *AIES 2020 - Proceedings of the AAAI/ACM Conference on AI, Ethics, and Society,* 36-42. doi:10.1145/3375627.3375826 Retrieved from www.scopus.com
De Stefano, V. (2020). *Algorithmic bosses and what to do about them: Automation, artificial intelligence and labour protection* doi:10.1007/978-3-030-45340-4_7 Retrieved from www.scopus.com
De Villiers, R. (2020). Seven principles to ensure future-ready accounting graduates – a model for future research and practice. *Meditari Accountancy Research,* doi:10.1108/MEDAR-04-2020-0867
Degryse, C. (2017). Aligning the digital economy with a reinvented social model. [Conformer l'économie digitale à un modèle social réinventé] *Reflets Et Perspectives De La Vie Economique, 56*(3), 47-56. doi:10.3917/rpve.563.0047
Ernst, E., Merola, R., & Samaan, D. (2019). Economics of artificial intelligence: Implications for the future of work. *IZA Journal of Labor Policy, 9*(1) doi:10.2478/izajolp-2019-0004
Fox, S., & Kotelba, A. (2018). Principle of least psychomotor action: Modelling situated entropy in optimization of psychomotor work involving human, cyborg and robot workers. *Entropy, 20*(11) doi:10.3390/e20110836
Frank, M. R., Autor, D., Bessen, J. E., Brynjolfsson, E., Cebrian, M., Deming, D. J., Rahwan, I. (2019). Toward understanding the impact of artificial intelligence on labor. *Proceedings of the National Academy of Sciences of the United States of America, 116*(14), 6531-6539. doi:10.1073/pnas.1900949116
Franzini, M. (2018). Artificial intelligence and the future of work: The role of economic institutions. [Intelligenza artificiale e prospettive del lavoro: Il ruolo delle istituzioni economiche] *Giornale Italiano Di Psicologia, 45*(1), 125-130. Retrieved from www.scopus.com
Frost, M., Jeske, T., & Terstegen, S. (2019). Shaping the future of work with artificial intelligence. [Die Zukunft der 1rbeit mit künstlicher Intelligenz gestalten] *ZWF Zeitschrift Für Wirtschaftlichen Fabrikbetrieb, 114*(6), 359-363. doi:10.3139/104.112106
Héry, M., & Levert, C. (2017). The future of work: The impact of technology on employment and its arduousness. [L'avenir du travail: L'impact des technologies sur l'emploi et sa pénibilité] *Futuribles: Analyse Et Prospective, 2017-September*(420), 5-18. doi:10.3917/futur.420.0005
Hirsch, J. M. (2020). Future work. *University of Illinois Law Review, 2020*(3), 889-958. Retrieved from www.scopus.com
Howard, J. (2019). Artificial intelligence: Implications for the future of work. *American Journal of Industrial Medicine, 62*(11), 917-926. doi:10.1002/ajim.23037
Jarrahi, M. H. (2018). Artificial intelligence and the future of work: Human-AI symbiosis in organizational decision making. *Business Horizons, 61*(4), 577-586. doi:10.1016/j.bushor.2018.03.007
Jevnaker, B. H., & Olaisen, J. (2019). The dynamics of societal and corporate ideas: The knowledge work design of the future. Paper presented at the *Proceedings of the European Conference on Knowledge Management, ECKM, , 1* 565-573. doi:10.34190/KM.19.055 Retrieved from www.scopus.com
Johnson, B. D. (2017). Sentient tools and the future of work. *Computer, 50*(5), 99. doi:10.1109/MC.2017.127
Jussupow, E., Spohrer, K., Dibbern, J., & Heinzl, A. (2018). AI changes who we are - doesn't it? Intelligent decision support and physicians' professional identity. Paper presented at the *26th European Conference on Information Systems: Beyond Digitization - Facets of Socio-Technical Change, ECIS 2018,* Retrieved from www.scopus.com
Lapointe, J. -L., Molyneaux, H., & Allili, M. S. (2020). *A literature review of AR-based remote guidance tasks with user studies* doi:10.1007/978-3-030-49698-2_8 Retrieved from www.scopus.com
Link, M., Dukino, C., Ganz, W., Hamann, K., & Schnalzer, K. (2020). *The use of AI-based assistance systems in the service sector: Opportunities, challenges and applications* doi:10.1007/978-3-030-51369-6_2 Retrieved from www.scopus.com
Lipnjak, G. (2020). Robotics as part of occupational safety. [Robotika u funkciji zaŠtite zdravlja na radu] *Sigurnost, 62*(2), 115-126. doi:10.31306/s.62.2.6
Moore, P. V. (2019). *OSH and the future of work: Benefits and risks of artificial intelligence tools in workplaces* doi:10.1007/978-3-030-22216-1_22 Retrieved from www.scopus.com
Morgan, J. (2019). Will we work in twenty-first century capitalism? A critique of the fourth industrial revolution literature. *Economy and Society, 48*(3), 371-398. doi:10.1080/03085147.2019.1620027
Mujtaba, D., & Mahapatra, N. (2019). Towards data-enabled career planning with the occupational information network (o∗net). Paper presented at the *Proceedings - 6th Annual Conference on Computational Science and Computational Intelligence, CSCI 2019,* 1547-1549. doi:10.1109/CSCI49370.2019.00290 Retrieved from www.scopus.com
Nash, C., Jarrahi, M. H., Sutherland, W., & Phillips, G. (2018). *Digital nomads beyond the buzzword: Defining digital nomadic work and use of digital technologies* doi:10.1007/978-3-319-78105-1_25 Retrieved from www.scopus.com
Neary, B., Horák, J., Kovacova, M., & Valaskova, K. (2018). The future of work: Disruptive business practices, technology-driven economic growth, and computer-induced job displacement. *Journal of Self-Governance and Management Economics, 6*(4), 19-24. doi:10.22381/JSME6420183
Niederman, F., Kaarst-Brown, M., Quesenberry, J., & Weitzel, T. (2019). The future of iT work: Computers and people. Paper presented at the *SIGMIS-CPR 2019 - Proceedings of the 2019 Computers and People Research Conference,* 28-34. doi:10.1145/3322385.3322403 Retrieved from www.scopus.com
Olhede, S., & Wolfe, P. J. (2019). Artificial intelligence and the future of work: Will our jobs be taken by machines? *Significance, 16*(1), 6-7. doi:10.1111/j.1740-9713.2019.01224.x
Reddy, N. D. (2020). Future of work and emerging challenges to the capabilities of the indian workforce. *Indian Journal of Labour Economics, 63*(2), 199-224. doi:10.1007/s41027-020-00227-4

Santos, S., Kissamitaki, M., & Chiesa, M. (2020). Should humans work? *Telecommunications Policy, 44*(6) doi:10.1016/j.telpol.2020.101910
Sarin, P., Kar, A. K., Kewat, K., & Ilavarasan, P. V. (2020). Factors affecting future of work: Insights from social media analytics. Paper presented at the *Procedia Computer Science,* volume 167, 1880-1888. doi:10.1016/j.procs.2020.03.207 Retrieved from www.scopus.com
Shestakofsky, B. (2020). Stepping back to move forward: Centering capital in discussions of technology and the future of work. *Communication and the Public,* doi:10.1177/2057047320959854
Simmons, E., & McLean, G. (2020). Understanding the paradigm shift in maritime education: The role of 4th industrial revolution technologies: An industry perspective. *Worldwide Hospitality and Tourism Themes, 12*(1), 90-97. doi:10.1108/WHATT-10-2019-0062
Smith, N., Teerawanit, J., & Hamid, O. (2019). AI-driven automation in a human-centered cyber world. Paper presented at the *Proceedings - 2018 IEEE International Conference on Systems, Man, and Cybernetics, SMC 2018,* 3255-3260. doi:10.1109/SMC.2018.00551 Retrieved from www.scopus.com
Stojanova, H., Lietavcova, B., & Raguž, I. V. (2019). The dependence of unemployment of the senior workforce upon explanatory variables in the european union in the context of industry 4.0. *Social Sciences, 8*(1) doi:10.3390/socsci8010029
Sung, S. Y. (2020). *Information sources, early-career worker activities, and workplace learning in large technology organizations: Developing a new framework for the future of work* doi:10.1007/978-3-030-43687-2_57 Retrieved from www.scopus.com
Tamers, S. L., Streit, J., Pana-Cryan, R., Ray, T., Syron, L., Flynn, M. A., . . . Howard, J. (2020). Envisioning the future of work to safeguard the safety, health, and well-being of the workforce: A perspective from the CDC's national institute for occupational safety and health. *American Journal of Industrial Medicine,* doi:10.1002/ajim.23183
Trigo-Guedes, R., & Palma-Dos-Reis, A. (2019). Essays on the post-artificial intelligence society: Potential effects of its diffusion. Paper presented at the *Iberian Conference on Information Systems and Technologies, CISTI, 2019-June* doi:10.23919/CISTI.2019.8760879 Retrieved from www.scopus.com
Vicsek, L. (2020). Artificial intelligence and the future of work – lessons from the sociology of expectations. *International Journal of Sociology and Social Policy,* doi:10.1108/IJSSP-05-2020-0174
Weng, Y. -. (2018). On policy and legal impacts to the future of work. *Jusletter IT,* (February) Retrieved from www.scopus.com
West, D. M. (2018). The future of work: Robots, AI, and automation. *The future of work: Robots, AI, and automation* (pp. 1-205) Retrieved from www.scopus.com
Wolf, C. T. (2020). *AI models and their worlds: Investigating data-driven, AI/ML ecosystems through a work practices lens* doi:10.1007/978-3-030-43687-2_55 Retrieved from www.scopus.com

Deliverable 3

CNPEN Ethical issues of chatbots - consultation (2020): https://www.ccne-ethique.fr/en/actualites/cnpen-ethical-issues-conversational-agents.
Devillers L., (2017). Des robots et des Hommes (Plon).
Devillers L., (2020). Les robots émotionnels (L'observatoire).
IFR (International Federation of Robotics). (2018). Demystifying Collaborative Industrial Robots. Frankfurt, IFR.
Russell, S. (2019). Human Compatible: Artificial Intelligence and Problem of Control. Vikings.
Ramirez, R. & Wilkinson, A. (2014). Rethinking the 2 X 2 scenario method: Grid or frames? Technological Forecasting & Social Change, 86, 254-264.
Weel, Bas ter., Horst, Albert van der., Gelauff, George. (2010). The Netherlands of 2040. CPB.

Deliverable 4

IEEE Global Initiative. 2020. Ethically Aligned Design: First Edition Glossary.
Institute for the Future of Work. 2018. Equality Through Transition: A Discussion Paper.
Lewis, Jason Edward, ed. 2020. Indigenous Protocol and Artificial Intelligence Position Paper. Honolulu, Hawaï: The Initiative for Indigenous Futures and the Canadian Institute for Advanced Research (CIFAR).

Deliverable 6

https://www.youtube.com/watch?v=wPiFhSvashw
https://smartfactory-owl.de/ki-reallabor/?lang=en AI Living Lab – an open data platform for collaborative Research of Artificial Intelligence in Industry 4.0
https://www.dfki.de/en/web/technologies-applications/living-labs/smartcity-living-lab/ SMART CITY LIVING LAB – SCLL: Technologies for the City of the Future
https://www.channelnewsasia.com/news/singapore/singapore-wants-to-be-a-living-lab-for-global-ai-solutions-12109270 Singapore wants to be a 'living lab' for global AI solutions
https://ailivinglab.com/ AI ADVISORY & THINK TANK: Promoting the positive impact of AI
Human Dynamics/Connection Science: http://connection.mit.edu/
Collaborative Creation with Customers: https://www.hitachi.com/rev/archive/2019/r2019_02/19/index.html
Artificial Intelligence Research Center (AIRC - Japan) http://www.airc.aist.go.jp/en/intro/

APPENDICES

GPAI Working Group on the Future of Work Illustrative Mandate

Illustrative list, to be discussed and prioritized by the working group members.

Scope of the Working Group:

- Critical technical analysis that contributes to the collective understanding of how AI can be used in the workplace to empower workers and increase productivity,
- How workers and employers can prepare for the future of work, and how job quality, inclusiveness, health and safety can be preserved.

Deliverables to be presented at the Multistakeholder Experts Group Plenary

- Compilation and analysis of ongoing/concluded experiments and real use cases of AI at the firm level; providing insights into the current state-of-the-art in AI interfaces and AI-driven processes from the worker perspective.
- Assessment and development of best AI-based technical training methods to train workers for skills, including for jobs of the future (immersive learning, Moocs, adaptive learning, blended, etc.).

Deliverables to be advanced in the Medium-Term

- Analysis of technical capabilities for Human to Machine collaboration (HMI), and coevolution and automated decision delegation within the workplace, and its impact on worker physical and mental health and on organization.
- Insight on biases and inequalities generated through AI; and political, ethical and technical insight on how to correct for it.
- Analysis of how decent and positive work conditions can be operationally fostered in working situations characterized by increasing use of AI systems.
- Setting up a living lab on the future of work as a platform, a place, or network for exchange on applied experiments at both the individual and firm levels about the impact of AI tools.
- Review the technical applicability of AI experiments conducted in the private sector to public employment and social services.
- Identify emerging issues that should be taken into account when establishing further AI experiments at the firm level, including criteria for successful and inclusive execution.
- Develop experiments on delegation of decision-making to AI systems and human-to-machine collaboration with a focus on trust.