

Session A3

Artificial Intelligence and the Future of Work and Education

Chairs: Michal Pazour, Martin Fařun (Technology Centre of the Czech Academy of Sciences)

Artificial Intelligence (AI) is no longer a science fiction, but has become a part of our everyday life. Due to the increase in computing capacity, data availability, and progress in algorithm development, AI has become one of the strategic technologies of the 21st century. The need for an active engagement in the deployment of AI technologies stems from the assumption that the economic growth in the following period will heavily rely on the use of new technologies. Digital technologies and AI have a leading role in this respect. High urgency of the relevant policy response related to the deployment of AI results from the expected disruptive impact of AI technologies on the labor market. This will impact not only low and mid-level qualification jobs, but practically all types of employment, including high paying jobs that require a high level of qualification. Therefore the crucial need is to provide vulnerable workers with the option of professional assessment of their skills and abilities, and offer them a retraining program corresponding to their abilities, skills and motivation (the concept of protection of the particular worker rather than the workplace). However, the upswing of AI will require adaptation not only of the social security and retraining system but also of the whole process of education. The transformation of the education system at all levels is a key task that will have a crucial role both for providing top scientists and researchers and for delivering a quality and adaptable workforce. The importance of specific knowledge is decreasing in favor of the importance of complex skills, especially so-called 21st century skills, along with the computational thinking. The aim of this session is to discuss suitable policy responses that can help the society to prepare for the upcoming digital future.

Setting the scene on case study of modelling the impact of Artificial Intelligence on the labor market in Czechia

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With increased computing capacity, data availability, and progress in algorithm development, AI has become one of the most strategic technologies of the 21st century. The development of AI and its impacts is a hot topic for the EU as a whole, as well as for individual member states. An important reason why this topic is tackled with such a high urgency nowadays is the expected disruptive impact of AI technology on the labor market. That is, the impact not only on low-skilled and middle-skilled work, but practically on all types of employment, including professions requiring high qualifications with high wages. The strong involvement of AI in manufacturing and services will require radical changes in organization of work in companies, in process of workforce learning and retraining and last but not least in setting of the system of social security.

An original economic model developed by the team of the Technology Centre CAS for estimating impact of Artificial Intelligence on the labour market in Czechia will be presented. On the contrary to the previous estimates, this model is based on comparison of projected future technical capabilities of AI with the mix of capabilities needed in different job categories. Both importance as well as level of capabilities is taken into account in order to assess the impact of AI on jobs in three different time horizons. Based on the model calculations it can be expected that on the five-year horizon the technology will be able to replace more than 50% of the required capabilities in 11% of the occupations in Czechia. On the thirty-year horizon, AI can replace over 50% of capabilities in the vast

majority of the current professions. At the same time, new professions will continuously emerge, though they will place different demands on their performers and will require different skills and capabilities in comparison to current professions. The model and its results may be effectively used for efficient adaptation of education, lifelong learning and retraining to the changing nature of work, and related new demand for workers' capabilities.

Pros and Cons of AI in Education and Research – Learnings from a TA study on AI

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The increasing use of Artificial Intelligence (AI) is a key characteristic of digital transformation that is profoundly changing modern society. In addition to research, education is an essential driving force for the innovative and economic power of a country. In order to play a pioneering role internationally, the framework conditions for education and research, be they structural or content-related, must be continuously developed in line with social challenges. Complex challenges in the system of global and local interdependencies (resource consumption, climate change, poverty...) must be taken into account, as must ethical and legal issues (justice, access to knowledge...). AI poses new challenges for society on the one hand, and opens up new opportunities for using AI for innovation processes in education and research on the other.

On behalf of the TA-Swiss Foundation for Technology Assessment, a Swiss / Austrian research team is currently investigating the challenges and opportunities of Artificial Intelligence in the fields of work, education, consumption, media and administration. The project started in autumn 2018 and the resulting policy recommendations will be presented in January 2020.

This presentation will provide insights into the methodology of the work, including in-depth interviews, online surveys and expert workshops, as well as results on the opportunities and risks of AI in education and research. The study refers to two aspects of the study:

- a) The AI applications used in education and research (online tutors, learning programs, individualization, sensors, data mining,...) and
- b) The necessary measures to be taken in education to develop the current education system in such a way that future employees are prepared for a labor market shaped by AI (AI competencies).

The presentation will also provide a global viewpoint referring to the UNESCO initiatives on AI in education, including policy guidelines in this regards that will be published in the course of a ministerial conference in Beijing, China, May 2019.

The project is led by the Digital Society Initiative at University of Zurich and co-lead by the Technology and Society Laboratory at Empa and the Institute for Technology Assessment at the Austrian Academy of Sciences. Beside researchers focusing on the application fields of AI, the team comprises researchers from the fields of law, ethics and informatics.

Another level of talent? Digital literacy for construction industry – Upskilling and deskilling in human-machine interaction

Authors: Kathrin Braun, Cordula Kropp, Ann-Kathrin Wortmeier (University of Stuttgart)

The digitisation of the industry, also known as industry 4.0 is imminent and will probably not stop at the construction site which has remained rather low-productive and low-technology-oriented until now (Butzin/Rehfeld 2013; ECSO 2019). Yet, incorporating digital technologies and cyber-physical systems in building processes will require employees to enhance their skills regarding the handling of robots as well as to improve their knowledge about collaboration processes with a multitude of heterogenous agents. In addition to the presumed upskilling (upgrade of skills) it also raises the critical issues of skills polarisation and deskilling. By deskilling, we mean the process of workers or professionals becoming less competent over time or losing skills through the implementation of digital technologies (Hirsch-Kreinsen 2016). To date, there has been little research into possible deskilling processes accompanying the use of digital technologies or as the relationship between upskilling and deskilling in the context of digitisation.

Taking upskilling and deskilling into account, a key question from a social science perspective in this context is which competencies and skills are required to enable a responsible and resilient interaction of humans, machines and information technology (IT) in cyber-physical systems and how these skills can be acquired? This paper makes the case for a new repertoire of technical and non-technical skills which we call digital literacy. Digital literacy, we argue, is an indispensable precondition for generating a future high-quality, liveable and sustainable digital building culture. Digital literacy, as we understand it, includes the ability to use the technologies in a responsible way, to assess their opportunities and limitations and to critically consider their possible implications in the larger work environment (see Gallardo-Echenique et al. 2015).

In this paper, we will present analytic concepts for an interdisciplinary investigation of digital literacy for close human-machine interactions under conditions of distributed agency and shared control. This focus forms the starting point for an interdisciplinary research project on "Reconfiguration of training, skills and digital literacy in the context of cyber-physical fabrication platforms" which is part of the Cluster of Excellence on "Integrative Computational Design and Construction for Architecture" at Stuttgart University. The Cluster aims to harness the full potential of digital technologies for the construction industry through a series of interdisciplinary research projects which will explore not only the technological feasibility, but also the social and institutional embedding of computational technologies for design and construction. Starting from a stakeholder survey on requirements and required skills, we will then, in collaboration with engineers and computer scientists, conduct experimental tests in handling cyber-physical systems (e.g. exoskeletons, AR technology and telehandlers) to explore the dimensions of digital literacy for construction.

As we can assume that human-machine interactions will increase in every realm of social life. Under conditions of closer human-machine interaction, digital literacy is becoming a key concept to safeguard human decision-making criteria and control capabilities in the 21st century. Therefore, the research aims to enhance socially and technically robust human-machine interactions in construction by supporting necessary development of competencies.

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