

Measuring the Effects of AI in the Workplace: Co-Creating a Research Approach with Companies

Citation for published version (APA):

Fleck, L., Fregin, M.-C., & Steens, S. (2024). *Measuring the Effects of AI in the Workplace: Co-Creating a Research Approach with Companies*. (pp. 1-7). ROA. ROA External Reports Vol. 007 No. ai:conomics Policy Brief October 2024

Document status and date:

Published: 07/10/2024

Document Version:

Publisher's PDF, also known as Version of record

Document license:

Free access - publisher

Please check the document version of this publication:

- A submitted manuscript is the version of the article upon submission and before peer-review. There can be important differences between the submitted version and the official published version of record. People interested in the research are advised to contact the author for the final version of the publication, or visit the DOI to the publisher's website.
- The final author version and the galley proof are versions of the publication after peer review.
- The final published version features the final layout of the paper including the volume, issue and page numbers.

[Link to publication](#)

General rights

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal.

If the publication is distributed under the terms of Article 25fa of the Dutch Copyright Act, indicated by the "Taverne" license above, please follow below link for the End User Agreement:

www.umlib.nl/taverne-license

Take down policy

If you believe that this document breaches copyright please contact us at:

repository@maastrichtuniversity.nl

providing details and we will investigate your claim.

Download date: 03 Dec. 2024



October 2024

ai:conomics policybrief



Measuring the Effects of AI in the Workplace: Co-Creating a Research Approach with Companies

Lara Fleck, Marie-Christine Fregin, Sanne Steens

Highlights

- Companies are under growing pressure to implement artificial intelligence (AI) applications to remain competitive.
- Co-creation between researchers and companies enables to tailor research instruments that measure the impact of AI in the workplace.
- This brief provides details on a successful co-creation process following one of the use-cases in the ai:conomics research project, in which workers' preferences for working with AI are measured.
- These insights make the co-creation process transparent and the research process comprehensible. This way, the process insights can inspire researchers as well as stakeholders in the economy and politics, showing how a co-creative project can be successfully implemented.

Introduction

In the current highly digitized economy, companies are under growing pressure to implement artificial intelligence (AI) applications to remain competitive (e.g., Makridakis, 2017). Therefore, the share of the working population directly interacting with AI in their workplace is likely to increase drastically in the upcoming years. In 2021, 20% of all employees in Germany stated that they were regularly using AI at work. However, when asked on the use of specific systems with AI technology, this percentage is twice as high (Giering et al., 2021). With capabilities increasingly replicating human cognition, AI is continuing to transform the working world by, e.g., substituting or complementing workers in a wide array of tasks (Fregin et al., 2023). This transformation can have various implications for workers' well-being, job satisfaction, perceived job security, economic prospects as well as the need for upskilling, among others (Cramarenco et al., 2023; Giuntella et al., 2023; Lane et al., 2023). Although understanding workers' perceptions of AI implementation in their job becomes of vital importance for researchers, employers and policy makers, to date, the empirical evidence is still scarce. Establishing such an evidence-based understanding of AI at work would enable ...

1. ... **researchers** to further contribute to understanding the effects of AI implementation on work and provide insights on successful, human-centric AI use,
2. ... **workers** to imagine several AI scenarios in their job, participating in AI implementation by uttering their preferences, and flag workplace consequences of AI.
3. ... **employers** to align AI implementation to workers' needs and thereby increasing the chances for successful AI implementation in line with workers' interests.
4. ... **policy makers and regulating bodies** to ensure human-centric AI use and adoption in the labour market through the design of a supportive societal infrastructure.

The current body of literature mainly describes workers' perceptions of AI based on surveys and interviews. The public perception of AI based on the 2019 and 2021 World Risk Poll shows that the majority of globally surveyed individuals perceive AI as being helpful, while there still is a considerable share of workers who have concerns about AI being harmful (Lloyd's Register Foundation, 2021; Neudert et al., 2020). Applied to the working context, this impression is partly mirrored in the recent OECD report by Lane et al. (2023) showing that workers in finance and manufacturing sectors are overall positive about the impact of AI on their work, reporting performance gains as well as improvement of working conditions. Yet, in the same report, workers indicate concerns about their job security in the coming 10 years, particularly if they are already working with AI.

In order to successfully accept AI in the workplace, workers need to perceive AI as an opportunity rather than a threat (Bhargava et al., 2021). Qualitative studies in organizational settings have shown that organizations need to organize AI implementation well – both prior to and following the implementation – to reduce the perceived threat and increase workers' willingness and acceptance to work with AI (Bhargava et al., 2021; Hasija & Esper, 2022). The current body of literature largely aligns on recommendations to account for workers' perceptions in the AI implementation process (Bhargava et al., 2021) and tailor AI-induced changes in work design to their needs (Berretta et al., 2023; Parker & Grote, 2022). This is supported by workers and employers alike reporting that consultation with workers or worker representation for the implementation of new technologies is linked to positive outcomes in performance and working conditions (Lane et al., 2023).

Measuring the Impact of AI on Work and Workers' Preferences

The ai:conomics research project examines the implementation of specific AI applications in companies and investigates the effects on workers and productivity. The case study described in this policy brief particularly aims to understand how workers perceive the use of AI in their own workplace and what effects the use of AI has on their well-being. ai:conomics is investigating AI-related changes in work design and workers' perceptions of these. Among other things, it quantitatively examines how workers evaluate hypothetical, future versions of their jobs that will be changed by AI. This will enable the company to research which AI-induced workplace changes are preferred by workers. This policy brief focuses on concrete process insights based on this case study and does not describe study results¹.


The collection of firm-level data is facilitated by one of the unique features of this research project: "co-creation"². Borrowed from marketing and product development, the term co-creation describes a working mode centered around innovative multi-stakeholder processes, benefitting from diverse inputs from various different perspectives to create value and novelty.

In ai:conomics specifically, the transdisciplinary team of social scientists and communication experts collaborates with various stakeholders from the participating companies to gain a deeper understanding of the specific AI use-cases to be studied and tailor the research approach, instrument and communication to the unique organizational contexts. The stakeholders from the corporate teams represent various levels of management involved in the company's AI strategy and implementation, worker representation and the operational workforce.

The involved companies are highly engaged in these studies to improve their understanding of their employees' perceptions and needs in the specific context of their AI implementation. The independent results produced in this study are viewed as a part of their strategy surrounding the implementation and evaluation of the AI tool. The outcomes there-

¹ A scientific publication of the findings regarding workers' preferences for AI in the workplace will be announced via the ai:conomics media channels.

² ai:conomics brief "Co-creation in business practice: Implementing AI together at eye level" outlines co-creation from a conceptual perspective and presents AI implementation as an organizational design task that calls for co-creation. Other ai:conomics deliverables to be published at the end of 2024 are deriving learnings from the co-creation processes by presenting its complexities.



fore help to add value to the company's measures to precede, accompany and evaluate their AI implementation. In this way, the organizations can actively shape the effect of AI on work design, and increase workers' trust towards AI, and hence, promote its use (Parker & Grote, 2022).

For researchers who lack the initial in-depth understanding of the specific working context, this type of "insider econometrics" collaboration with the private sector is vital (Shaw, 2009). Researchers benefit from this collaboration by gaining practical and firm-specific knowledge necessary to accurately design and tailor research instruments to measure the impact of AI at the workplace. Furthermore, co-creation serves as a tool to enhance the impact and meaningfulness of the results for the companies, as the corporate stakeholders support to bridge the gap between scientific and corporate languages and forms of effective communication of information. This has shown to be necessary as well as powerful across all ai:conomics use-cases. The remainder of this brief outlines the process of co-creative research in one of these companies.

The Case Study: The Potential Future of Quality Controllers

The research team studies the effect of AI on workers for a specific, yet highly relevant job in the manufacturing sector by focusing on quality controllers responsible for visual inspection of electronic components on printed circuit boards. These workers interact with an existing optical inspection technology, verifying or falsifying the technology's rule-based classification of a given component being functional or not. This is a mundane and repetitive task, requiring sharp focus and accuracy. Simultaneously, it is cognitively fatiguing, as the speed of these visual checks amounts to seconds per component. The AI application is integrated into this process as an additional decision-making instance, lifting the burden of verifying components that are clearly classifiable as functional. Thus, it aims to free up quality controllers' time and energy, enabling them to focus on more complex errors that require more time and technical understanding.

The AI is being implemented in two distinct stages, with different decision-making authorizations per stage.

1. In its first implementation stage, quality controllers are prompted to revise their classification of a component when it differs from the

AI classification. The final decision then stays with the quality controller.

2. In the following stage, the AI is enabled to autonomously classify components, only over a very high threshold of certainty and if the customer company allowed for it. In case the AI component is not classifiable because it does not exceed this threshold value, it is forwarded to the quality controller who makes the final decision.

In both AI implementation stages, the quality assurance process will require a human-in-the-loop.

Co-creating the Research Instrument

When introducing this AI application, the company anticipates some potential changes in the quality controllers' tasks that lead to a re-design of the task content of workers' jobs and related changes in working conditions. The aim of this study is to investigate how these AI-induced changes in work design affect quality controllers' preferences for working with AI.

Adding to the unique character of this study, the entire development of the research instrument can be categorized into process steps from Design Thinking – a concept based on co-creation which formalizes process steps and serves as "a methodology for innovation that systematically integrates human, business and technical factors in problem-forming, problem-solving, and design" (Meinel et al., 2011, p. 52). Subsequently, the process of co-creating the survey instrument is presented in six stages adapted from a typical Design Thinking process: (1) empathizing, (2) defining, (3) ideating, (4) prototyping, (5) testing and (6) field phase.

1. Empathize

Studying AI implementation and its implications for workplaces requires a fundamental understanding of corporate structures, the AI technology, the job affected by the AI and workers interacting with the AI. The research team therefore engaged in numerous activities to gain this deep, firm-specific knowledge. The research and corporate team exchanged the necessary practical and scientific information to conduct a study together successfully. The corporate team provided information on the AI, the workers and their jobs, and organized interviews with various corporate stakeholders in different positions regarding the AI implementation.

2. Define

These interviews between the researchers and various stakeholders were crucial for the research. Among others, the research team interviewed executives, AI experts and developers, factory managers, quality controllers and other production workers, to understand the context and dynamics between all involved stakeholders. Furthermore, there were company and factory visits informing the researchers about the study setting, enabling them to understand the points of view of all parties involved in this AI implementation. Above all, it was essential to understand the quality controllers as a target group for the survey. The interviews revealed that the sample corresponds to a female-dominated employment group with low to medium qualifications. The majority of the sample was already familiar with the pop-up window triggered by the AI at the time of the survey, i.e. they were already working with the AI in its first implementation phase.

3. Ideation

The teams jointly brainstormed multiple scenarios for data collection via an employee survey, to be conducted by quality controllers in the company's production locations across eight countries. Additionally, a randomized discrete choice experiment* was to be embedded in the employee questionnaire. Compared to regular cross-sectional surveys, this reveals respondents' underlying preferences determining their choices. Concisely, the quality controllers were repeatedly presented with multiple future scenarios based on their current job and asked to choose which scenario would give them the highest well-being at work.

* A discrete choice experiment is a scientifically strong method suitable for studying the acceptance of respondents for hypothetical scenarios. It is preferable to using observed outcomes because (1) choice options vary exogenously and (2) all available choice options are observed, including the options that respondents do not choose. For example, they can be used to measure employees' attitudes towards future career scenarios that could arise as a result of a transformation process. The design of the study can simulate conceivable changes in occupations due to the introduction of new technologies, for example. Once the data has been collected, it can then be calculated whether and under what circumstances respondents prefer

certain scenarios. By investigating workers' preferences for different scenarios in such a randomized choice experiment, it is possible to identify the causal effect of scenarios of their work with AI as well as which working conditions play a particular role in their acceptance of the changes.

The discrete choice experiment is based on the assessment of scenarios that are built in a way that is realistic, tangible and conceivable for the workers. For achieving this, corporate stakeholders' insights and their understanding of the quality control job and the AI were vital to design the survey instrument. Most crucial in this process was the translation of the AI implementation into its potential effects on the design of the quality control job.


Together, the research and corporate teams translated the different implementation stages of the AI into its concrete consequences for the quality controllers' main task. This main task was defined in terms of three dimensions: (1) the number of components they have to assess within a certain time frame, (2) the difficulty of the task and (3) available decision-making support to fulfil the task.

Then, the determination of the three dimensions was inspired by the three AI implementation phases:

1. The initial job without AI support. This represents the baseline value.
2. The first AI implementation stage, where the AI serves as a decision-making support to the quality controller. This reflects the current work mode in most plants.
3. The job tasks when the AI operates in autonomous mode. This refers to the most realistic scenario in the near future in which only more complex cases are left to the quality controller, resulting in a more cognitively challenging job.

The hypothesis is that a more challenging job might leave the quality controllers more fulfilled with their daily tasks and make them appreciate the changes the AI created in their work. A preference for these tasks would show workers' acceptance of their future job when AI is introduced, as predicted by the corporate stakeholders.

Furthermore, the company's representatives first agreed on including four other possibly relevant job characteristics from a pre-selection made by the researchers: breaks, autonomy, training and remuneration. Second, they agreed upon the specifications of these characteristics (1) having short breaks without



a schedule, (2) freedom to choose their own tasks within the production area, (3) having more advanced training opportunities in order to make more complex classification decisions. The latter indicates workers' willingness to acquire new skills that might be more relevant in the future job. As usually done in the literature, options for slight salary increases were added to study to what extent workers would demand a salary increase if their job would become more complex in future.

4. Prototyping

Based on the outcomes from the ideation phase, the research team re-aligned the five selected job characteristics and their defined levels with the scientific literature. In addition, the scenarios were revised to design them as concisely as possible. This was vital to avoid ambiguity and to reduce the cognitive burden for the respondents, thereby facilitating the comprehensibility of the choice experiment.

Ultimately, the co-creation process resulted in a discrete choice experiment with six different choice tasks per respondent, in which they have to choose between two distinct hypothetical jobs. These jobs consist of five job characteristics. Each of these five job characteristics has two to three specified values which are randomized across the characteristics.

Apart from understanding the overall preferences of the workers, the research approach also enables to study whether these preferences differ between various groups of workers. Therefore, the research team designed a survey in which the discrete choice experiment was complemented with a background questionnaire on demographic characteristics such as gender, age, work tenure and level of education. Moreover, the questionnaire refers to other attitudes that could increase or decrease workers' preference for working with AI, such as technology acceptance (Venkatesh & Bala, 2008), job satisfaction, and employment prospects.

5. Testing

The researchers then programmed the draft questionnaire and the discrete choice experiment into the online survey tool Qualtrics to yield a prototype to be tested. Among the testers were other researchers and research data specialists. Moreover, representatives from the regional works' council went through the survey together with the research team and checked adequacy and comprehensibility of the survey. The same procedure was repeated with a representative from the quality controllers' line management as well as a quality controller. This testing was highly valuable to finalize the wording and the order

of questions to ultimately ease the comprehensibility and feasibility of the survey for the relevant workers in the company and include topics that workers deemed relevant.

Together, the research and corporate team further agreed upon the languages in which the survey should be produced. The survey had to be distributed in eight countries. In these countries, the company employs workers with various migration backgrounds. Therefore, the survey was translated into 15 different languages by a translation agency and programmed into the Qualtrics environment, so that respondents could switch to their preferred language at any time throughout taking the survey.

Going live with the employee survey with the embedded discrete choice experiment to measure quality controllers' preferences for AI relative to other working conditions in their jobs, marked the next stage of the study: the field phase.

6. Field Phase

Entering the field phase with the final employee survey once again required close collaboration with the corporate team, especially regarding the coordination of the survey rollout process as well as accompanying communications. Each surveyed plant location distributed the online survey centrally through the plant manager who received instructions by high-level management. The plant managers were instructed to invite the quality controllers to voluntarily take the survey during working hours and to adjust the shift schedules accordingly. They had to provide a quiet room and a laptop or tablet on which the quality controllers could partake in the survey anonymously and without interruptions.

Co-Creation: A Critical Assessment

Hardly any project can be implemented according to its original plan. In fact, even though the above presented approach of co-creating the research instrument appears to be a seamless, harmonious process, it does not reveal the entire process: The outlined process was not our first approach. Following the initial definition phase (2), there was an entire process following the steps from ideation to the field phase of a different research approach and respective questionnaire.³ To our knowledge of the

³ For further information on the lessons learnt from the ai:conomics project and additional insights for researching technology effects in companies, please refer to the ai:conomics deliverable to be published towards the end of 2024 on www.aiconomics.eu/en.



AI implementation context at the time, it was the most suitable approach to study the effects of the AI use-case in the workplace. Only after closing the first field phase in the pilot plant, were we able to discover substantial shortcomings in our initial approach, requiring us to start over a re-think our research methodology. With the insights gained from stages (1) empathize and (2) define, we were able to return to a second ideation phase and brainstorm the outlined, alternative approach. Consequently, we repeated all process steps from (3) ideation to (6) the field phase in the previously described way. Ultimately, it is important to highlight that failure and joint learning are central elements of co-creation. Only with its focus on iterative feedback loops and joint reflection moments, testing and experimentation and a strong partnership on eye-level supporting the process, can co-creation be successful and lead to innovation.

Conclusion

Overall, studying the impact of AI in workplaces in a co-creative framework is highly relevant for researchers, workers, employers as well as policy makers. Researchers benefit from these studies by acquiring unique data on workers' perceptions of AI-induced changes in their jobs. Workers can understand the potential impact of AI on their work, help shape the implementation through their participation and voice the (positive as well as negative) consequences of AI implementation and use. The findings enhance companies' understanding of their workforce's needs and AI attitudes and serve as a basis for firm-level strategies on AI implementation.

From the outcomes of co-creative research, policy makers and regulatory bodies can learn how to enhance human-centric AI implementation across companies, thereby shaping the overall future of work for society.

In order to successfully produce these firm-level insights, co-creation between science and companies is highly valuable. In this study in particular, effective communication, short feedback loops, and multiple iterations within and between teams enabled the joint development of a way to study the effect of AI on workers and their well-being. Furthermore, it is likely that the co-creation of the communication and processes surrounding the rollout of the survey contributed to a high accessibility and acceptance of the research among the workers involved. Ultimately, conducting science in co-creation provides an opportunity to acquire the specific corporate language to ...

1. ... enable insider studies so that all involved parties can learn from each other how to best conduct open-ended, scientifically high-level, state-of-the-art research in companies.
2. ... align all stakeholders on the mission and the need for studying the effects of AI on workers in their company and transferring this knowledge to society.
3. ... encourage optimal communication throughout the company to increase participation in the survey.
4. ... deliver the results of the study in an accessible way to enhance their impact and usefulness for organizations and public policy.

References

- Berretta, S., Tausch, A., Peifer, C., & Kluge, A. (2023). [The Job Perception Inventory: Considering human factors and needs in the design of human–AI work](#). *Frontiers in Psychology*, 14.
- Bhargava, A., Bester, M., & Bolton, L. (2021). Employees' Perceptions of the Implementation of Robotics, Artificial Intelligence, and Automation (RAIA) on Job Satisfaction, Job Security, and Employability. *Journal of Technology in Behavioral Science*, 6(1), 106–113.
- Cramarenco, R. E., Burcă-Voicu, M. I., & Dabija, D. C. (2023). [The impact of artificial intelligence \(AI\) on employees' skills and well-being in global labor markets: A systematic review](#). *Oeconomia Copernicana*, 14(3), Article 3.
- Fregin, M.-C., Koch, T., Malfertheiner, T., Özgül, P., & Stops, M. (2023). [Automatisierungspotenziale von beruflichen Tätigkeiten: Künstliche Intelligenz und Software – Beschäftigte sind unterschiedlich betroffen](#) (IAB-Kurzbericht 21/2023; p. 8). Institute for Employment Research.
- Giering, O., Fedorets, A., Adriaans, J., & Kirchner, S. (2021). [Künstliche Intelligenz in Deutschland: Erwerbstätige wissen oft nicht, dass sie mit KI-basierten Systemen arbeiten](#). *DIW Wochenbericht*, 88(48), 783–789.
- Giuntella, O., Koenig, J., & Stella, L. (2023). [Artificial Intelligence and Workers' Well-Being](#). *SSRN Electronic Journal*.
- Hasija, A., & Esper, T. L. (2022). [In artificial intelligence \(AI\) we trust: A qualitative investigation of AI technology acceptance](#). *Journal of Business Logistics*, 43(3), 388–412.
- Lane, M., Williams, M., & Broecke, S. (2023). [The impact of AI on the workplace: Main findings from the OECD AI surveys of employers and workers](#). OECD.
- Lloyd's Register Foundation. (2021). [World List Poll 2021: A Digital World. Perceptions of risk from AI and misuse of personal data](#).
- Makridakis, S. (2017). [The forthcoming Artificial Intelligence \(AI\) revolution: Its impact on society and firms](#). *Futures*, 90, 46–60.
- Meinel, C., Leifer, L., & Plattner, H. (Eds.). (2011). [Design Thinking](#). Springer Berlin Heidelberg.
- Neudert, L.-M., Knuutila, A., & Howard, P. N. (2020). [Global Attitudes Towards AI, Machine Learning & Automated Decision Making - Implications for Involving Artificial Intelligence in Public Service and Good Governance](#). Oxford Commission on AI & Good Governance.
- Parker, S. K., & Grote, G. (2022). [Automation, Algorithms, and Beyond: Why Work Design Matters More Than Ever in a Digital World](#). *Applied Psychology*, 71(4), 1171–1204.
- Shaw, K. (2009). [Insider econometrics: A roadmap with stops along the way](#). *Labour Economics*, 16(6), 607–617.
- Venkatesh, V., & Bala, H. (2008). [Technology Acceptance Model 3 and a Research Agenda on Interventions](#). *Decision Sciences*, 39(2), 273–315.