

Investigating the adoption of autonomous processes in the context of organizations

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1 Abstract

The technological enablers for process automation have experienced a fast-paced development in the past decades (Omohundro, 2014). In organizations, the adoption of autonomous technologies could bring many benefits, as they offer the potential to increase the efficiency and precision of operations (Jovanovic et al., 2019; Mallam et al., 2020), to compensate human workers' limitations in uncomfortable and repetitive physical tasks (Kadir et al., 2019), or to reduce labour-related costs (Jovanovic et al., 2019; Omohundro, 2014). Nevertheless, new challenges emerge when implementing autonomous technologies in organizational processes, such as human element issues (Mallam et al., 2020; Nazir et al., 2014), new weaknesses within the system (Behymer & Flach, 2016; Mallam et al., 2020; Omohundro, 2014), or emerging regulatory, liability, and security concerns (Mallam et al., 2020), which make adoption hard to achieve.

This PhD research aims to understand the organizational tensions among workplace innovation, human workers, and process automation, in order to create guidelines that will favour a sustainable and long-term adoption of the technology. The focus will be set in human-automation teaming (O'Neill et al., 2023; Xu & Gao, 2023); we believe that investigating and designing the configuration of those teams will enable future automated scenarios. In that objective, we aim to ultimately promote human-centered approaches to automated processes (Capel & Brereton, 2023; Shneiderman, 2020; Xu, 2019).

The project is framed within the collaboration between an international airport (i.e., the Royal Schiphol Group (RSG)) and the Industrial Design Engineering faculty of the TU Delft. An action research methodology is followed (Cassell & Johnson, 2006), meaning that the PhD researcher is embedded in the organization and actively participates in daily practice. The RSG is currently working towards the implementation of autonomous operations in the airside of Amsterdam Airport Schiphol; Schiphol's airside (i.e., the side of an airport terminal dedicated to supporting airplanes and their inherent baggage, passenger, and resource flows) is a multi-stakeholder ecosystem, characterized by high degrees of instability, uncertainty, and unpredictability, which makes it an especially complex and worth studying context for automation.



In a context where technology has radically changed the way how we live and frame human work (Kadir et al., 2019), our research aims to contribute to the understanding of the role automation can have in organizations. Methods and tools from design research will be used, as the approach is suitable not only to understand the problem from multiple perspectives (i.e., technological-, organizational-, and human-perspectives) but also to provide a systemic vision of the challenge, that is necessary to transform organizational cultures towards the future.

The PhD researcher is currently in their 1st year. As a first study, the PhD will be inquiring about the organizational tensions that currently hinder the adoption of autonomous processes. In that aim, an interview study will be conducted with different stakeholder clusters of the organization, with the aim to map the imaginaries (Mlynar et al., 2022; Verma et al., 2023) that each group has around human-automation teaming. Once those imaginaries are mapped, and the tensions and synergies between them are surfaced, intervention studies will be proposed with the aim to design and validate strategies that leverage them and facilitate a sustainable implementation of the technology.

References

- Behymer, K. J., & Flach, J. M. (2016). From Autonomous Systems to Sociotechnical Systems: Designing Effective Collaborations. *She Ji: The Journal of Design, Economics, and Innovation*, Volume 2 (2), 105-114, <https://doi.org/10.1016/j.sheji.2016.09.001>.
- Capel T., & Brereton, M. (2023). What is Human-Centered about Human-Centered AI? A Map of the Research Landscape. In *Proceedings of the 2023 CHI Conference on Human Factors in Computing Systems (CHI '23)*, April 23-28, 2023, Hamburg, Germany. ACM, New York, NY, USA, 22 pages. <https://doi.org/10.1145/3544548.3580959>
- Cassell, C., & Johnson, P. (2006). Action research: Explaining the diversity. *Human Relations*, 59(6), 783–814. <https://doi.org/10.1177/0018726706067080>
- Jovanovic, S. Z., Duric, J. S., & Sibalija, T. V. (2019). Robotic process automation: overview and opportunities. In *International Journal "Advanced Quality"*, volume 46, n. 3-4.
- Kadir, B. A., Broberg, O., & Conceição, C. S. d. (2019). Current research and future perspectives on human factors and ergonomics in Industry 4.0. *Computers and Industrial Engineering*, 137. <https://doi.org/10.1016/j.cie.2019.106004>
- Mallam, S. C., Nazir, S., & Sharma, A. (2020). The human element in future maritime operations - perceived impact of autonomous shipping. *Ergonomics*, 63(3):334–345. <https://doi.org/10.1080/00140139.2019.1659995>
- Mlynar, J., Bahrami, F., Ourednik, A., Mutzner, N., Verma, H., & Alavi, H. (2022). Ai beyond deus ex machina - reimagining intelligence in future cities with urban experts. In *proceedings of the 2022 CHI Conference on Human Factors in Computing Systems*. Pages 1–13 <https://doi.org/10.1145/3491102.3517502>
- Nazir, S., Kluge, A., & Manca, D. (2014). Automation in the process industry: cure or curse? How can training improve operator's performance. In *Proceedings of the 24th European Symposium on Computer Aided Process Engineering – ESCAPE 24 June 15-18, 2014, Budapest, Hungary*.
- Omohundro, S. (2014). Autonomous technology and the greater human good. In *Journal of Experimental and Theoretical Artificial Intelligence*, volume 26, pages 303–315. Taylor and Francis Ltd. <https://doi.org/10.1080/0952813X.2014.895111>
- O'Neill T.A., Flathmann C., McNeese N.J., & Salas E. (2023). Human-autonomy Teaming: Need for a guiding team-based framework?, *Computers in Human Behavior*. <https://doi.org/10.1016/j.chb.2023.107762>.
- Shneiderman, B. (2020). Human-centered artificial intelligence: Reliable, safe & trustworthy. *International Journal of Human-Computer Interaction* 36, 6 (March 2020), 495-504. <https://doi.org/10.1080/10447318.2020.1741118>
- Verma, H., Mlynar, J., Schaer, R., Reichenbach, J., Jreige, M., Prior, J., Evéquoz, F., & Depeursinge, A. (2023). Rethinking the role of ai with physicians in oncology: Revealing perspectives from clinical and research workflows. In *proceedings of the 2023 CHI Conference on Human Factors in Computing Systems*. Pages 1–19. <https://doi.org/10.1145/3544548.3581506>

- Xu, W., & Gao, Z. (2023). Applying human-centered AI in developing effective human-AI teaming: A perspective of human-AI joint cognitive systems. 10.13140/RG.2.2.19349.70887.
- Xu, W. (2019). Toward human-centered AI: a perspective from human-computer interaction. *Interactions* 26, 4 (July-August 2019), 42–46. <https://doi.org/10.1145/3328485>