Robotic Process Automation and Artificial Intelligence as Control Instruments for Knowledge Management in Virtual Teams

Oliver KOCH[1], Evi KNEISEL[2]

[1] Institute of Management & Information Systems
FOM Hochschule für Oekonomie & Management
Franklinstraße 52, 60486 Frankfurt a. M.
[2] Professur Personal und Führung
Technische Universität Chemnitz
Thüringer Weg 7, D-09126 Chemnitz

Short version: Globalization, digitalization and knowledge intensification of markets increasingly require flexible and cross-border work forms, e.g. virtual teams. The use of virtual teams enables companies to act faster and more flexible and to operate across organizational and national boundaries. Despite the high relevance of effective information and knowledge management in virtual teams, integrative concepts and tools are still missing. Results of a current study revealed the need for a central control instance for supporting virtual knowledge processes. One promising technical solution is Robotic Process Automation (RPA). RPA includes software-based robotic automation of structured and rule-compliant business processes, which have so far been mastered by human interventions. Combined with Artificial Intelligence (AI), an innovative bot-based framework is presented, which integrates required tools as well as a control system, which may help to optimize knowledge processes in virtual teams.

Key words: virtual teams, knowledge management,
Robotic Process Automation (RPA), Artificial Intelligence (AI)

1. Virtual Teamwork

Due to the current economic trends of globalization, digitization and knowledge intensification of the markets, today's companies are faced with sometimes radical changes in the corporate environment (Astor et al. 2016, Welter et al. 2014). Examples are highly dynamic market developments, knowledge intensification and individualization of services as well as increasing dissolution and virtualization of working environments (Cordes & Gehrke 2015). In order to remain competitive and innovative in this volatile environment, companies have to react quickly and flexibly to changing requirements and anticipate future trends as quickly as possible (Ludwig et al. 2016, Schulz & Riedel 2016).

To meet these upcoming challenges, more and more companies using distributed and agile forms of work organization, particular collaboration in spatially distributed teams (virtual teamwork). In comparison to co-located teams, virtual teams are characterized by the physical (geographically) separation of their team members. Communication and interactions between members mainly base on electronic media and information technology, e.g. email, phone, video conferences systems (Hertel et al. 2005, Schiller & Mandviwalla 2007).

The use of virtual teams enables companies to act more flexible across organizational and national borders (Friedrich 2016). This ensures that all customer concerns can be dealt with at any time and at any location (across borders) and that the greatest possible customer proximity is achieved. At the same time, virtual teamwork increase flexibility and autonomy of employees, as they can organize their task relatively independent of space and time.

2. Knowledge Management in Virtual Teams

A central base for the success of virtual teamwork is effective information- and knowledge management. In fact, one main reason for using distributed teams is the prospect of pooling specialized and dispersed knowledge across physical distance in order to generate synergies and innovations (Fang et al. 2014). However, the specific characteristics of virtual collaboration environments can inhibit effective knowledge processes. The dependence on information technology, the spatial separation, cultural differences and low familiarity of team members may hinder sharing, integrating and creation of knowledge (Aritz et al. 2018, Fiol & O'Conner 2005, Klitmøller & Lauring 2013). As a consequence, knowledge management in virtual environments is more prone to errors.

First results of a current study on influencing factors and conditions on knowledge sharing in virtual teams confirm a variety of challenges that need to be considered when managing virtual knowledge processes (Kneisel, Werner & Tietz 2020). The study based on 30 in-depth interviews with members of 20 virtual teams, stemming from six German companies. The interviews grounded on the Critical Incident Technique (CIT) introduced by Flanagan (1954). Participants were invited to describe situations, which they perceived as critical for effective knowledge processes, in as concrete and comprehensive a way as possible. Results show, that the physical distance of virtual team members makes it more difficult to transfer knowledge and to build common knowledge spaces and networks. In many cases, the virtual work organization leads to low transparence as to which knowledge (and information) can be conveyed to what extent. Combined with maintaining and controlling the flow of knowledge and creating of new knowledge, this is one of the most central challenges in day-to-day work of virtual teams. Furthermore, the localization of relevant sources of knowledge is more challenging. The more distributed teams are organized, the more difficult it becomes for the individual members to find or localize the expert for a specific topic or problem. Distributed team members also often use heterogeneous knowledge networks. This means that there is potentially greater access to relevant knowledge and information, but different networks make it difficult to keep track of existing knowledge. As a result, existing knowledge resources are underutilized.

In sum, current results point out, that effective knowledge management in virtual teams requires a central controlling function for coordinating knowledge flow and knowledge storage. In order to successfully implement the highly specialized and heterogeneous knowledge and expertise in virtual teams, the flows of information and knowledge must be controlled in a structured and targeted manner. Probably due to the lack of implicit control mechanisms in virtual teams (e.g. informal agreements) there is a higher need for explicit management of knowledge processes, e.g. B. by a central integrator and controller. At best, such a controlling instance has a high level of Meta knowledge about individual expertise, relevant team processes as well as rules and norms within the team, which helps to localize and coordinate relevant knowledge within the team.

3. Robotic Process Automation as promising Approach for controlling Knowledge Processes in Virtual Teams

3.1 Robotic Process Automation

Robotic Process Automation (RPA) encompasses the software-based and robot-based automation of structured and rule-compliant business processes and tasks that have so far been carried out by people. In 2017, the Institute of Electrical and Electronics Engineers (IEEE) published a standard to define the term clearly and consistently in the area of software-based, intelligent process automation. The IEEE describes RPA as "a preconfigured software that uses business rules and pre-defined activity flows to complete the autonomous execution of a combination of processes, activities, transactions and activities and the pre-defined design of activities." (IEEE 2017, p.11) Specifically, these are processes that are carried out in one or more systems which are not linked by interfaces (Kakhandiki 2017).

The bot imitates human behavior by e.g. enter, edit, copy or start programs by system calls via screen scraping in control elements of programs (Allweyer 2016, Czarnecki & Auth 2018,). The aim is to eliminate or minimize the proportion of human work in processes. A bot can emulate the user across systems, existing systems are not changed, and the depicted process is added as a supplementary layer, without any program or data technology integration (van der Aalst et al. 2018).

This also justifies the central expectations for the use of RPA in general (Bingler 2019, Czarnecki & Auth 2018) and contains recognizable potential for process optimization and cost reduction (Mendling et al. 2018, Willcocks et al. 2015,) With RPA solutions it is possible to automate repetitive tasks with only minimal intervention in applications and processes, in order to support high-volume business transactions, to complete them quickly and effectively, and to give project members time for tasks that require human intelligence. (Mendling, et al. 2018)

The current next stage of evolution is the combination of RPA with AI (Artificial Intelligence) (Czarnecki & Auth 2018, Hofmann et al. 2019). This is known as Cognitive Process Automation (CPA), Cognitive RPA, Cognitive Automation or Intelligent (Process) Automation (Berruti et al. 2017, Bingler 2019, Bremmer 2019, Huang & Vasarhelyi 2019, Safar 2019).

Virtual teams that operate across organizational boundaries are subject to the need to work with a wide variety of application systems and to exchange data between them. Due to security-related and legal framework conditions, this can rarely be achieved via technical interfaces. Due to the heterogeneity of the solutions available on the market and the short innovation cycles in the field of teamwork-relevant software, a desired solution is necessarily highly flexible and must be able to interact with any software. Classically, this is not in the nature of API-based system communication but can be solved using the RPA approach.

3.2 Parameterizable Bot Structures

In contrast to classic use cases of RPA or Workflow Management, in which the processes can be implemented in a stable and thus fixed manner, a useful application of

RPA in the context of virtual teams is only effective through highly parameterizable bot structures that are based on a knowledge database.

In a bot-based approach, a team bot supports or replaces the previous human integrator, which was necessary for the control of team processes and who had the relevant, sometimes implicit, process knowledge. The latter is explicated in the bot-based approach and persisted in a corresponding database.

The current survey initially revealed the need to store information about team members, their roles, relevant information objects, their storage locations as well as distribution scenarios for information objects. Furthermore, the flexible storage of team rules, i.e. of explicit process knowledge. These requirements can be met using the bot-based solution described below (see figure 1).

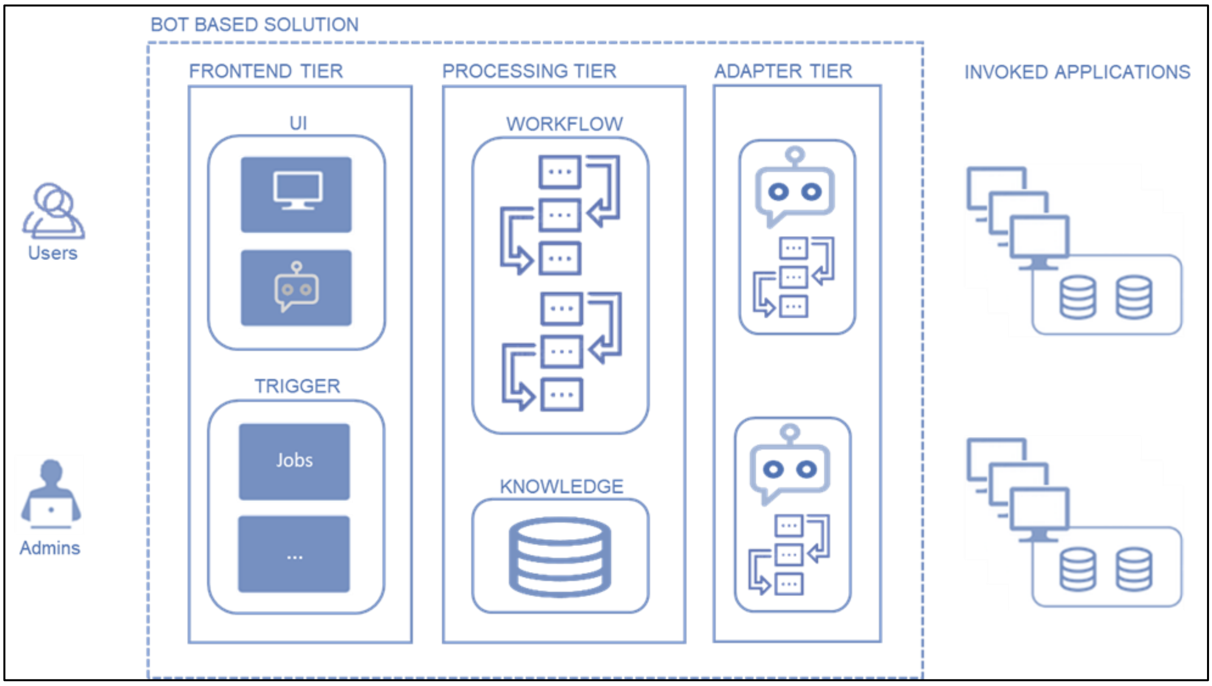

Figure 1. *Bot-based solution for knowledge management.*

End users communicate with the system via classic applications or, for example, via chatbots. Events arising from this trigger the corresponding control workflow. Such Events can also be raised by periodic jobs, for example.

However, the workflow is not a complete implementation of the process at design time, rather the relevant process information is obtained from a knowledge database. The same also applies to other necessary information such as adapters to be called up, the relevant target systems with which to interact, as well as further information on the processing of the incoming information.

The control workflow as well as the actual interaction with target systems is realized via software bots that use RPA technology. Here, a target system-specific implementation takes place at design time and the relevant execution parameters are transferred, which are obtained from the knowledge database through the control workflow, at runtime.

The persistence of process knowledge must be implemented in such a way that, on the one hand, a flexible expansion of the data structures is possible, for example the arbitrary addition of entities, and on the other hand there must be the possibility of using e.g. AI, data mining or process mining technologies on this data. In this context, implementation is based on a graph database.

Further research in the present project has to demonstrate the feasibility of a parameterizable bot framework and its performant implementation as well as maintainability, furthermore the evaluability of the graph databases, e.g. also for the further development of processes.

4. References

Allweyer, T (2016) Robotic Process Automation – Neue Perspektiven für die Prozessautomatisierung. https://www.kurze-prozesse.de/blog/wp-content/uploads/2016/11/Neue-Perspektiven-durch-Robotic-Process-Automation.pdf. Accessed 30 August 2019.

Aritz J, Walker R, Cardon, PW (2018) Media use in virtual teams of varying levels of coordination. Business and Professional Communication Quarterly, 81(2), 222-243.

Asto M, Rammer C, Klaus C, Klose G (2016) Endbericht: Innovativer Mittelstand 2015 - Her-ausforderungen, Trends und Handlungsempfehlungen für Wirtschaft und Politik, ZEW-Gutachten und Forschungsberichte.

Available at: https://www.automationanywhere.com/blog/stories-from-the-front-lines/ieee-publishes-first-standard-in-intelligent-process-automation

Berruti F, Nixon G., Taglioni G, Whiteman R (2017). Intelligent process automation: the engine at the core of the next-generation operating model. https://www.mckinsey.com/business-functions/digital-mckinsey/our-insights/intelligent-process-automation-the-engine-at-the-core-of-the-next-generation-operating-model. Accessed 16 November 2019.

Bingler D (2019) Ist RPA mehr als eine Brückentechnologie? Computerwoche. https://www.computerwoche.de/a/print/ist-rpa-mehr-als-eine-brueckentechnologie, 3547366. Accessed 22 August 2019.

Bremmer M (2019) So schöpfen Unternehmen das Automatisierungspotenzial aus. Computerwoche. https://www.computerwoche.de/a/so-schoepfen-unternehmen-das-automatisierungspotenzial-aus,3546702. Accessed 15 August 2019.

Cordes A, Gehrke B (2015) Industrielle Entwicklung und funktionale Verschiebungen in Europa – Eine empirische Analyse ausgeübter Tätigkeiten. Vierteljahrshefte zur Wirtschaftsforschung, 84 (1), 79-101. DOI: 10.3790/vjh.84.1.79

Czarnecki C, Auth G (2018) Prozessdigitalisierung durch Robotic Process Automation. In Barton T, Müller C, Seel C (Hrsg) Digitalisierung in Unternehmen (S. 113–131). Wiesbaden: Springer Vieweg.

Fiol CM, O'Connor EJ (2005) Identification in Face-to-Face, Hybrid, and Pure Virtual Teams: Untangling the Contradictions. Organization Science, 16(1): 19–32.

Flanagan J (1954). The critical incident technique. Psychological bulletin, 51(4), 327.

Friedrich M (2016) Diversity Management–Erfolgsfaktor für Unternehmen in einer globalisierten Welt. In: Buchenau P (Hrgs) Chefsache Diversity Management (pp. 43-62). Wiesbaden: Springer Fachmedien.

Hertel G, Geister S, Konradt U (2005) Managing virtual teams: A review of current empirical research. Human Resource Management Review, 15(1), 69–95.

Hofmann P, Samp C, Urbach N (2019) Robotic process automation. Electronic Markets, https://doi.org/10.1007/s12525-019-00365-8.

Huang F, Vasarhelyi MA (2019) Applying robotic process automation (RPA) in auditing: A framework. International Journal of Accounting Information Systems, https://doi.org/10.1016/j.accinf.2019.100433.

IEEE (2017) IEEE Guide for Terms and Concepts in Intelligent Process Automation. https://ieeexplore.ieee.org/document/8070671. Accessed 13 February 2019.

Kakhandiki A (2017) IEEE Publishes First Standard in Intelligent Process Automation. [Online]

Klitmøller A, Lauring J (2013) When global virtual teams share knowledge: Media richness, cultural difference and language commonality. Journal of World Business, 48 (3): 398–406

Ludwig T, Kotthaus C, Stein M, Durt H, Kurz C, Wenz J, Wulf V. (2016). Arbeiten im Mittel-stand 4.0–KMU im Spannungsfeld des digitalen Wandels. HMD Praxis der Wirtschaftsinforma-tik, 53(1), 71-86.

Mendling J, Decker G, Hull R, Reijers H.A, Weber I (2018) How do Machine Learning, Robotic Process Automation, and Blockchains Affect the Human Factor in Business Process Management? Communications of the Association for Information Systems. 43(19). 297–320.

Safar, M (2019) Wenn der Bot selbst entscheidet. Computerwoche. 30–31. 18–19.

Schiller S, Mandviwalla M (2007) Virtual Team Research: An Analysis of Theory Use and a Framework for Theory Appropriation. Small Group Research, 38(1), 12–59.

Schulz KP, Riedel R (2016) Nachhaltiger Innovationsfähigkeit von produzierenden KMU. Reihe Arbeit, Organisation und Personal im Transformationsprozess (Band 31). München: Rainer Hampp Verlag.

Welter F, May-Strobl E, Schlömer-Laufen N, Kranzusch P, Ettl K (2014) Das Zukunftspanel Mittelstand: Eine Expertenbefragung zu den Herausforderungen des Mittelstands, IfM-Materialien, Institut für Mittelstandsforschung (IfM) Bonn, No. 229.

Willcocks L, Lacity M, Craig A (2015) The IT function and Robotic Process Automation. The Outsourcing Unit Working Research Paper Series, Paper 15/05. The London School of Economics and Political Science.

Gesellschaft für
Arbeitswissenschaft e.V.

Digitale Arbeit, digitaler Wandel, digitaler Mensch?

66. Kongress der
Gesellschaft für Arbeitswissenschaft

TU Berlin
Fachgebiet Mensch-Maschine-Systeme

HU Berlin
Professur Ingenieurpsychologie

16. – 18. März 2020, Berlin

GfA-Press

Bericht zum 66. Arbeitswissenschaftlichen Kongress vom 16. – 18. März 2020

TU Berlin, Fachgebiet Mensch-Maschine-Systeme
HU Berlin, Professur Ingenieurpsychologie

Herausgegeben von der Gesellschaft für Arbeitswissenschaft e.V.
Dortmund: GfA-Press, 2020
ISBN 978-3-936804-27-0

NE: Gesellschaft für Arbeitswissenschaft: Jahresdokumentation

Als Manuskript zusammengestellt. Diese Jahresdokumentation ist nur in der Geschäftsstelle erhältlich.

Schriftleitung: Matthias Jäger
im Auftrag der Gesellschaft für Arbeitswissenschaft e.V.

Screen design und Umsetzung
© 2020 fröse multimedia, Frank Fröse
office@internetkundenservice.de · www.internetkundenservice.de