Rolling Back to Manual Work: An Exploratory Research on Robotic Process Re-Manualization

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Abstract. Robotic process automation (RPA) is a technology that is presented as a universal tool that solves major problems of modern businesses. It aims to reduce costs, improve quality and create customer value. However, the business reality differs from this aspiration. After interviews with managers, we found that implementation of robots does not always lead to the assumed effect and some robots are subsequently withdrawn from companies. In consequence, people take over robotized tasks to perform them manually again, and in practice, replace back robots—what we call 're-manualization'. Unfortunately, companies do not seem to be aware of this possibility until they experience it on their own, to the best of our knowledge, no previous research described or analysed this phenomenon so far. This lack of awareness, however, may pose risks and even be harmful for organizations. In this paper, we present an exploratory study. We used individual interviews, group discussions with managers experienced in RPA, and secondary data analysis to elaborate on the re-manualization phenomenon. As a result, we found four types of 'cause and effect' narrations that reflect reasons for this to occur: (1) overenthusiasm for RPA, (2) low awareness and fear of robots, (3) legal or supply change and (4) code faults.

Keywords: Robotic process automation · RPA · Software robot · Investment · Information systems · Work manualization

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1 Introduction

Robotic process automation (RPA) is an emerging technology in the business sector. Syed et al. define RPA as: *technology that comprises software agents called bots—or software robots—that mimic the manual path taken by a human through a range of computer applications when performing certain tasks in a business process* [1].

In the digital era, companies compete aggressively on price and efficiency [2]. It requires adapting so that solutions (1) improve their overall performance, (2) bring value to the customer, and (3) reduce both operational expenses and lead time [3]. All of this is possible due to the concept of 'intelligent competitive advantage' which is based on three elements: business analytics and intelligence [4], modular software development [5], as well as big data and cloud computing [6]. RPA embraces all these elements and may be adapted into existing information systems (IS), providing fast reimbursement [7]. For this reason, RPA has become one of the most popular technologies for delivering customer value [8]. Moreover, it brings several benefits to modern business: cost savings [9], increase in efficiency [10], value co-creation [8], quality improvement, work facilitation [11], increase in production, stable and accurate performance [2], and fast increase in RoI (Return on Investment) [9].

While robots are promoted as universal tools that mainly bring success to companies, our field observations suggest otherwise, that often this is rather an oneiric narration that does not have much in common with business reality. Moreover, sometimes robots need to be withdrawn and the related processes are taken over by a human workforce to execute them manually again. We call this the process *re-manualization* phenomenon. There is some recognition of the challenge of RPA readiness in a company, which somehow suggests the possibility of RPA not being appropriate in certain circumstances [12]. However, we found that the literature is scarce on unsuccessful implementation of robots and the reasons behind it. Therefore, the objective of our investigation was to discover what happens when robots do not work in accordance with a company's expectations. In particular, our research question is:

RQ: What are the reasons for RPA withdrawal in a company?

To answer this question, we performed an exploratory study involving three companies in Poland. The results suggest that process re-manualization occurs when (1) people are too enthusiastic about RPA and do not understand in which circumstances it works best, (2) employees' fear of software, (3) the internal procedures or supply are changed and the company is not able to adjust the robot accordingly, and (4) code faults exist and there is no one capable to repair it. In addition, we elaborate on cause and effect sequences of these four reasons.

The remainder of this paper is built as follows. Section 2 describes the main concepts of RPA and its advantages for business. In this section, we cite reports suggesting that RPA is sometimes withdrawn from the companies but a substantial research gap exists regarding why it happens. Building on this lacuna, in Sect. 3 we show the design of the exploratory study that help address the

research question. Section 4 presents the original findings. Section 5 describes our contribution to both theory and practice as well as the limitations of the work. Finally, Sect. 6 concludes and set the future research lines.

2 Research Background

The initial application of RPA was limited to repetitive and error-prone processes, based on simple logics that added little value to business [13]. In the past few years, software for robots has been enhanced by technologies linked to artificial intelligence, such as process mining, sophisticated computing algorithms, data analytics, machine learning, natural language processing and optical character recognition [11,14]. All of these have helped robots perform more complex tasks [15]. As a result, they are already capable of handling payroll tasks, recruitment processes, accounting operations, inventory management, invoicing, reporting, software update, and data migration, among others. Though robots were first primarily used within IT-companies, they are now commonly adopted in banks, telecommunications, energy industries [16], judiciary processes [17] and outsourcing companies [3]. Moreover, it is foreseen that further dynamic adoption of RPA in other market areas will occur as cognitive RPA continues to develop. This technology will help to perform tasks that demand cognitive abilities, which so far have been perceived to be reserved only for humans. It is expected that such RPA will enable robots to 'see and read' unstructured text, learn, detect anomalies, forecast, and make decisions [1].

RPA helps to improve work accuracy and reduce complicated tasks [18]. It also facilitates data collection and processing [19] and helps to reduce the effort employees put into repetitive and simple tasks [2]. Consequently, time previously spent on routine and wearisome tasks can be saved and allocated elsewhere, and employees can focus on value-adding activities, resulting in innovative business solutions, services, and products [20].

Over the past decade, employee attitudes toward robots have been changing, which encourages companies to adapt RPA in their organizational space. Trust in robotic performance is systematically growing, as evidenced by the report from Oracle [21], in which 64% of respondents declared they would trust robots more than their own managers and 82% of employees said that robots are able to perform certain tasks better than humans. Wright et al. (2017) conducted research on 400 executives around the world and found that 53% use RPA in their companies, which has helped them improve compliance, quality/accuracy, productivity, Everest Research Group notes that not only large companies invest in RPA, but small- and medium-sized companies as well [20]. These findings across various types of companies confirm that the growing trend to invest in robots will shape the future of business in the coming years.

Although RPA offers numerous advantages for business, it also has limitations and creates challenges for managers. First of all, robots fail due to the lack of designing, executing, analytic tools or IT and business knowledge [22]. Secondly, there are still not enough experts who are able to design or redesign robots to perform their tasks optimally [22]. Consequently, companies delay RPA's

implementation or modification for too long. Moreover, such investments demand financial resources that not every organization is able to provide. Wright et al. inform that only 3% of companies using RPA are able to scale their digital workforce and only 14% of the 424 executives interviewed expressed familiarity with RPA [23]. In addition, choosing suitable tasks to be robotized may be difficult as each company has a huge amount of data that should be analyzed before adoption [24]. A wrong decision may result in work disorganization and chaos. If RPA fails, it may cause several risks for a company, including (1) rapid mistakes without sufficient control, (2) using robots to cover symptoms, rather than root cause, of a problem, and (3) significant manual rework, overcompensating the automation benefits [25]. In addition, LLamberton et al. suggest that when RPA fails it is due to the internal environment of an organization, and point out the following reasons: (1) wrong processes targeted for robotization, (2) wrong methodologies used, (3) robot prototypes moved to full production without sufficient consideration, (4) too much of a process is being automated, (5) the IT infrastructure of the company is not taken into account, (6) the thinking that RPA is perceived as the only way to achieve a great ROI, (7) RPA being IT-owned, whereas it's best being owned by the business, (8) scaling past proof of concepts or pilots is not considered, (9) robots are left unsupervised after processes have been automated, and (10) RPA is not treated as a change program, with a focus on realizing benefits [26]. While industry reports suggest why RPA fails on a macro scale, they neither show what the consequence of robot's withdrawal is nor what logical strings lead to this.

3 Research Design

Two primary factors triggered this work: observations of RPA's reports [22], and feedback received during interviews with participants for a separate project, which pointed to the re-manualization phenomenon. Hence, the foundation for this research became a so called, 'window of opportunity', described by Czarniawska [27] as a situation when researchers observe the field and start posing questions about a reality that he/she does not understand. In line with the methodological approach proposed by Czarniawska [27], the authors aimed to understand and describe the phenomenon observed in business. After reading the literature the authors found, surprisingly, that none of the papers focused on process re-manuzalized yet.

To overcome this gap, the research procedure depicted in Fig. 1 was conducted. It consisted of six stages, with the use of mixed methods: individual interviews, group discussions, and secondary data analysis.

In the first stage of the research, data related to the companies' digital transformation and robotics was explored by analysing industry reports to find which of the biggest companies adopted RPA, and when they did it. We identified nine international companies in Poland that implemented RPA, three of which agreed to take part in this research on the condition their names would not be disclosed.

We, authors, signed a confidentiality agreement which regulated the conditions of the research works, paying attention to the code of research ethics

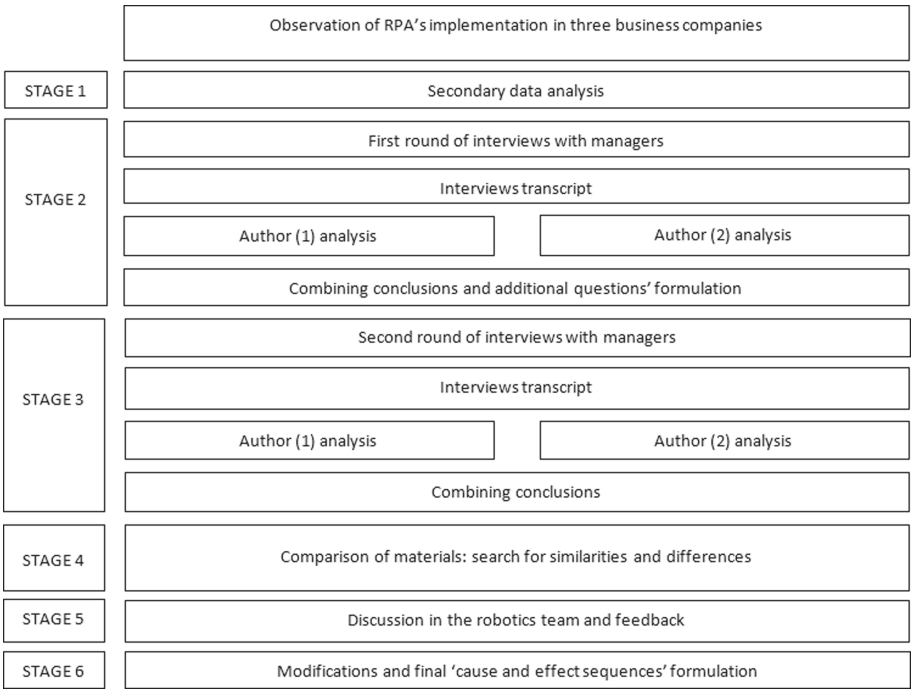

Fig. 1. Research process.

suggested by Taylor [28]. The common features of the companies which agreed to take part in the research were that they are (1) international, (2) business-oriented corporations, (3) employ over 250 people, and (4) RPA was used for at least 5 years. The primary difference was in their individual field of operations, including banking, IT-services, and production (cf. Table 1).

The second stage of the research started with the first round of interviews. It was conducted by one author of the paper with managers of the companies. The interviews were conducted in Poland; one took place in the headquarters

Table 1. Participants of the research

Participant	Gender	Age	Company	Company profile	Tenure (years)	Interview duration (minutes)
A	Female	36	1	Banking	10–15	47
B	Male	39	1	Banking	10–15	31
C	Female	34	1	Banking	5–7	25
D	Male	44	2	IT-Service	5–7	42
E	Male	42	3	Production	5–7	21
F	Female	31	3	Production	5–7	29

of the company and the other five outside of office space. The interviews were recorded with consent and lasted between 21 and 47 min. The format for the interviews was constructed according to the guidelines for unstructured questionnaires, which consisted of a set of research questions determined by the problem and situation in the field (cf. Table 2). This approach allowed for in-depth questions to be asked when new or unknown information appeared.

Table 2. Interview guide

RQ What are the reasons for RPA withdrawal from the company?
- How did you organize the robot's withdrawal process?
- Why did you withdraw the robot?
- Who decided that the robot should be withdrawn and why?
- How did you organize your work after the robot was withdrawn?

The transcripts of the interviews were made, the material was analyzed independently by two researchers to decrease the subjectivity of qualitative research [29], and conclusions were subsequently combined. That resulted in finding three types of narrations linked to 'cause and effect' sequences leading to re-manualization: a) overenthusiasm for RPA, b) low awareness and fear, and c) legal and supply changes. However, after the first round of interviews, other questions surfaced as some facets were not explained fully. Therefore, the topics needing more explanation were listed and a next round of interviews planned.

During the third stage, the second round of interviews was conducted, all of which took place outside the office, via Skype, Teams, or mobile phone. Again, transcripts of the interviews were made and analyzed independently. As a result, it was identified the fourth narration linked to 'cause and effect' sequences leading to re-manualization: d) robot failure.

During the fourth stage, a comparative analysis was conducted of all the empirically collected material. This allowed for the similarities and differences in the perception of re-manualization to be explored from the perspective of each interviewee. During the fifth stage, the conclusions were shared with the interviewees to reflect and discuss their accuracy. Ultimately, in the sixth stage, the feedback from interviewees was analyzed and included in the analysis. Eventually, all interviewees received the final results of the paper to assess if the anonymity conditions were kept properly.

4 Results

The outcome of the research process is discussed in this section to answer our Research Question: "What are the reasons for RPA withdrawal from a company?". The current study identified four cause-related narrations concerning why robots are withdrawn (also referred to as "retired" during the interviews).

More precisely, overenthusiasm for RPA in the company (cf. Sect. 4.1), low awareness and fear linked with robotics (cf. Sect. 4.2), legal and supply changes that have an impact on particular processes or tasks in the company (cf. Sect. 4.3), and robot's failure (cf. Sect. 4.4). Consequently, the cause and effect sequences representing employees' experiences have been constructed.

Nonetheless, besides answering the RQ, the conducted study gave rise to general findings regarding the complexity and the implications of process re-manualization (cf. Sect. 4.5)

4.1 Cause 1: Overenthusiasm for RPA

Adopting innovation may help a company gain a competitive advantage over the market, but it may expose business to trouble as well, especially when the downsides and upsides of innovation are not fully considered:

Some people perceived RPA as such an exciting process that they did not think logically about its consequences. We have seen just the positive side of it [robot]. (B)

The overenthusiasm of innovators and early adopters may blunt business reality. Some managers do not carefully consider the value a robot is going to bring, as well as the consequences of its introduction:

We did not think if it [task] is a good option for automation. I'm not sure if I was aware that something is a wrong option for automation at all. It [task description purposefully hidden] was something we did not like to do, so we decided to use robots. (F)

Our interlocutor suggested that his team faced two consequences related to overenthusiasm for robotics: (a) underestimation of robot costs and/or (b) misunderstanding of robot capacities. For some employees, robotics is associated with a total reduction of costs. Hence, managers may perceive the investment in robots just as a one-time expense. However, its maintenance often generates an unexpected expenditure:

We did not check how much it costs - at first, there was some money for robots because companies have money for innovations. They invest in a robot's creation, but they did not take into account how much money they will need to run a robot in the company. It was an extremely visible tendency [to not consider the total cost of robot] at the beginning - when the company started investing in robotics. (A)

Some managers with low awareness about robotics may be so fascinated with the promises of RPA implementation that they do not consider the specifics of robotics and propose to automate tasks which robots should not perform:

We did not know what are the barriers for robots. I experienced that managers think that bots can be used for any task and process. But it is not really true. (F)

Both underestimation of RPA costs and misunderstanding of RPA limitations may lead to disappointment:

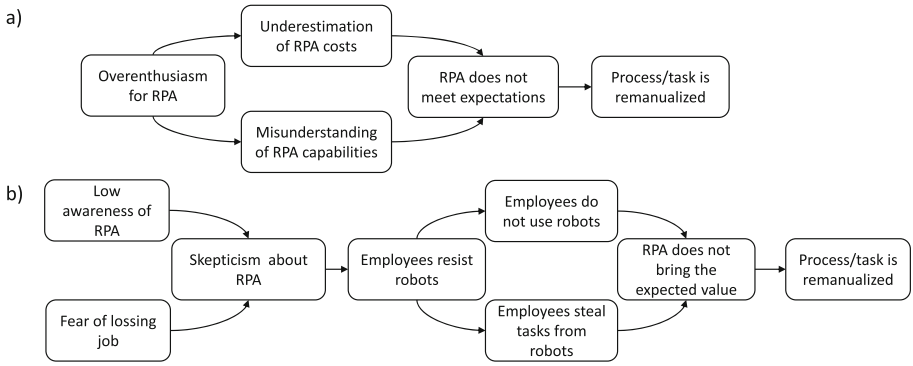

Fig. 2. Cause and effect sequence leading to re-manualization: a) Overenthusiasm for RPA. b) Low awareness and fear (source: own elaboration).

Robot did not bring the value that we expected before its implementation and it caused frustration in the team. (D)

The question about the value that people expect from RPA is of inordinate importance. We believe this value may be both objective as well as subjective. In the literature, no clear proposals on how managers should measure RPA value and classify robot success or failure was found. Even though it was not an intended subject of this research, we believe it could be a starting point for further investigation. As a result of the disappointment from unmet expectations for robot performance, the tasks were moved back to human processing:

After implementation, however, they [managers] discovered that they couldn't spend so much money [on robots] and [tasks] had to be manualized. Robots could not bring the values everybody expected. (A)

To conclude, overenthusiasm for robotics can lead to failure during implementation, especially if it is not supported by thorough knowledge of the robot's cost and capabilities. Ultimately, the company bears double costs, that of creating and retiring a bot. This cause-related narration, summarized in Fig. 2a), was mentioned by three companies.

4.2 Cause 2: Low Awareness and Fear

In collective imaginations, narrations related to threats posed by robots to humans are widely encountered [30,31]. One of our interlocutors claims that, among employees with low awareness of robotics, bots are perceived as their direct competitors:

At the beginning [of RPA implementation] some people were terrified that robots would take their place. They knew nothing about robots but were really terrified and they were those ones the most skeptic about this idea [RPA]. (F)

For some employees, the fear of RPA may derive from their belief that RPA is a complicated technology, reserved only for technically advanced users:

Robots are really easy and even a child is able to learn working with them. But before they came to our company, some people associated robotics with math and physics that a person with humanistic background would not understand. (E)

Both low awareness and fear of losing one's job may lead to employee skepticism and resistance towards RPA:

Sometimes people's awareness about robots was low so they did not use them. We found that they did not want to use them [robots] because they expected that the more a robot produces, the bigger the chance they will lose their jobs. (A)

High awareness and trust towards robots does not have to lead directly to lower skepticism towards them. There are 'pure skeptics' who oppose any change because of their values and/or previous experiences [32]. This approach was noticeable in the narrations provided by the interviewees:

It happened that people just did not like robots and nothing could change their views. (B)

The interviewees claimed that people who are reluctant to robots do not use them even if they are already implemented. Surprisingly, we found that they even take back the task from robots purposely:

We experience that sometimes people who performed some task that was taken [by a robot], they still try to perform this task on their own, stealing the job from the robot. (A)

Consequently, robots do not fulfill their function or are not used at their whole capacity. In such cases, double costs may be generated by employees who stay in the company and are assigned to perform a different task, but still take the work from robots. Ultimately, humans cannot focus on their new assignments and work subpar, while the robots generate maintenance costs and work subpar as well. As a result, the task returns to human operators and the robot is withdrawn:

We decided to retire our robot after some time because people did not use them as we planned, and the robot generated costs we had to shoulder (C)

This cause-related narration, represented in Fig. 2b), was mentioned by three companies.

4.3 Cause 3: Legal and Offering Changes

We found that the external and internal environment of an organization can have an impact on a company's decision to withdraw a robot. Our interlocutors experienced situations where a process or task had to be modified due to (1) new legal regulations on the market and (2) new products being introduced by the company. Both became triggers to finally withdraw a robot:

Both systems and processes change. In our company a product was modified, and robot got outdated. We intended to rebuild it. However, it was not an easy story. (D)

It was the law introduced by the government that started the whole story with retirement. (A)

Each human organization is an open system that adapts to its environment to survive [33]. Governments which act as an organization's stakeholder impose legal frames and borders which regulate how an organization fulfills its functions [34]. Companies adapting to their external environment need to modify their internal environment as well. As a result, tasks or processes must be adjusted to new realities:

The task was changed so the robot was not valid anymore. We started to think how to modify it and we found some challenges in that process. (B)

Adapting an existing robot to a new or modified task demands both money and knowledge. It was found that rebuilding a robot in accordance with new regulations may be too expensive for a company:

The cost to rebuild the robot was too high and we decided to not cover it. So, we gave it [a task] to a human, which was cheaper because we did not have to pay to make another robot. (B)

The other factor which prevents a company from adjusting existing robots to a modified task is the lack of capacity of people (or technicians) who prepared the prototype:

They [people who constructed the robot] were not working anymore with us and the new ones did not know how robot was made. We had codes and maps but it's visible that they [the new robotic team] were not the robot's creator and preferred to do the new one that rebuild the existing one. But it [making a new robot] costs money and time. So, it was better to do it manually. (C)

From this statement we concluded that people who created robots are perceived to have more capabilities or readiness to rebuild them. This assumption may be linked to the fact that people who design a product are more willing to modify it than abandon it [35]. This suggests that maintaining trustworthy members in robotic team could provide some benefits for the company as they may be more willing to modify an existing robot than new machine. To conclude, we found that if a company does not have people who are able to rebuild a robot or managers perceive the cost of a new robot as too high, it may lead to re-manualization. This cause-related narration, depicted in Fig. 3a), was mentioned by two companies.

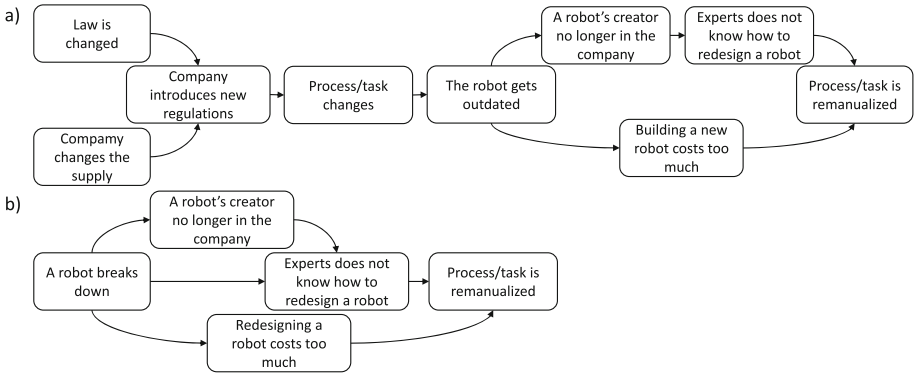

Fig. 3. Cause and effect sequence leading to re-manualization: a) New law and new supply. b) Robot failure (source: own elaboration).

4.4 Cause 4: Robot Failure

The last of the reasons for process re-manualization identified in this research relates to situations when a robot stops working as expected or breaks down:

With time, our robot lost its functionality and we decided that it is cheaper to retire it. (A)

All started [manualization] when one day robot reported an error and we were not able to revive it. (F)

A robot may work for a company for a long time and suddenly loses its functionality. It may be related to human-related or coding errors, as well as system hacking. In the review of literature, no report was found which summarized the most frequent reasons for robot accidents. Our interlocutors experienced a situation when a robot failed and there was no one in the company cable of repairing it, and/or the cost of such repair was perceived as too high:

It was impossible to repair the robots by a person who was not building it. And X [name anonymized] who was building it, was no longer working in the company anymore. (E)

The other situation experienced by the interviewees was that experts capable of rebuilding the robot were ready to do it, but the cost of repair was perceived as too high:

The scale of error was enormous, and it cost more money than to build a new one or manualize the task/process (F).

As a consequence, the robot was withdrawn, and the task returned to manual processing. This cause-related narration was mentioned by two companies and can be seen in Fig. 3b).

4.5 Implications of Re-Manualization

It is important to note that is is complicated to precisely fix the scale of robot withdrawal from companies or/and managers who were not willing to disclose such information, perceiving it as internal taboo:

It's hard to say how many robots [are withdrawn], we do not calculate it. It was our defeat, but we learned this lesson. (C)

Just one of our interviewees (A) estimated that about 10% of all robots are withdrawn. However, it was not our intention to investigate in which tasks RPA fails or how much time passes from robot implementation to withdrawal. We found, however, that this phenomenon is widespread enough to have its own name. The interviewees used collocations 'process re-manualization' (person D) and 'robot's retirement'(person A, B, C, E) to name a situation when a robot gets replaced by human. The narrations identified during the research suggest that RPA's withdrawal may be linked to both loss of control and financial risks, especially if such actions were not foreseen by managers during the robot's implementation phase:

In consequence, we were completely lost and did not known what to do in that case. (D)

When a robot gets withdrawn, a company may lose the money that was invested to build, test, and deploy the robot, in addition to the resources needed to train employees developing or configuring the code. The companies of the interviewees used two approaches for a robot's withdrawal, either replacing the retiring robot with (1) a new robot, or (2) with a human operator. In the second scenario, a process or task is re-manualized and comes back to human operators who start processing it manually again. We found that re-manualization process may bring about concern:

It's not easy to manualize the task, as it's not easy to understand a robot. You should know how the task was made by humans before the robot was implemented. However, the people who did it may not work with us anymore. So, we need to map the process and design it from the beginning. (A)

It would also be interesting to study good practices when implementing RPA that might later be useful to guide companies in situations of re-manualization.

5 Discussion and Limitations

The intention of this paper was to explore the logics of unsuccessful RPA implementation, resulting in 're-manualization'. It was not an intention of this research, however, to investigate the quantitative data linked to these phenomena, nor to make general conclusions about RPA or robotic process re-manualization, but rather to signal that such a phenomenon as robot withdrawal exists and needs further investigation.

This paper contributes to both research and practice in three areas. First, it addresses phenomena which had not been described in the literature before. It was demonstrated that people may not be aware that robots are not a universal technology for any task and team. This lack of awareness may pose risks and even be harmful for organizations. To avoid this, training for employees presenting both downsides and upsides of RPA should be provided. Robotics may offer benefits to the company only if it is applied according to proved and objective methodologies. Secondly, the perceptions depicted in our study suggest that robot withdrawal is assessed by employees in terms of failure. It was visible that our interviewees felt uncomfortable talking about task re-manualization and referred to it as something embarrassing. We believe this was mainly due to the fact that robot withdrawal was an unexpected event that a team had to face unprepared. We discovered that robot withdrawal may be caused by errors as well as change coming from the environment. Even if an organization cannot influence the environmental changes, it may prepare itself for them by fixing procedures and rules concerning eventual re-manualization process. Thirdly, we found that robot redesign may be impeded due to the human fluctuations in the robotic team. People who had not constructed the robot's prototype may not know how to repair, redesign or simmply maintain it. To avoid robot withdrawal, managers should elaborate strategies that will ensure 'knowledge continuance' in their robotic teams. The maps of processes and tasks should be made before they are robotized. It may help to re-manualize the task based on precise data even if people who mapped the processes are no longer working for the company. We believe that there are many potential strategies and further research is needed. Undoubtedly, the RPA's scope within the company, internal and external environmental factors, as well as a task's specifications will play an important role.

All cause-related sequences provided in our paper are in line with findings provided by Lamberton et al., presented in the research background [26]. We found, however, that RPA withdrawal may be caused not only by people who adopt this technology, but by environmental factors as well. Therefore, the locus of risk should be considered when crisis plans are constructed by teams.

The results obtained in this study are subject to certain limitation and threats to validity. First, the results reflect the experiences of three companies. According to social science methodology, there are no premises to generalize our conclusions toward other companies, where such phenomena may not occur or be perceived differently. Nonetheless, these initial results will help to create some hypothesis to be validated in broader studies. In addition, the direct observation of this phenomenon faces several constraints. First, it is a challenge for employees to foresee which robot will be withdrawn. Hence, it is also a challenge for researchers to capture and describe the exact moment when decisions are made by the team when a robot is being withdrawn. Retrospective, post-factum studies are always linked to the recall limitation as there is always a chance that research participants may not recall all the details of an incident they experienced. Future studies are encouraged to try to depict ethnographically the process re-manualization just in time it occurs. Secondly, the access to

data linked to robot implementations is limited due to internal policies and legal restrictions throughout many organizations. Signing confidentiality agreements regulating which data may be disclosed was a substantial limitation of this work. Thirdly, robot withdrawal is perceived by employees as an emergency situation. According to Coombs [36], research to be conducted on phenomena perceived by employees to be an emergency is particularly challenging, as interviewees are less willing to share data and spend time on consultations with researchers when they feel they must work under pressure. What is more, companies may wish not to disclose situations in which they did not succeed. We are aware that the narrations, which became the base for the cause and effect sequences leading to re-manualization, are not the objective constructs. They were made according to subjective experiences of employees who faced such problems in the past. This subjectivism juxtaposing of the narrations of independent managers from various companies, as well as analyzing interviews independently from each other, was a challenge in this research. Nonetheless, to mitigate this threat, the material presented in the paper is based on secondary observations and reflects the experiences of certain groups of employees.

6 Conclusions and Future Work

This paper presents an exploratory study to shred light to the end-of-life phase on RPA. Three Polish companies agreed to participate in this study. As a result four main cause-related sequences of events to explain the process re-manualization were identified. Furthermore, an extensive discussion of the factual contribution of this study to industry and academia is included.

Nonetheless, in order to address the limitations identified in Sect. 5, some future works are planned. First, to work on a common model that includes the different cause and effect sequences to help managers identify the main roots of 'failure'. Secondly, to generalize the results, we plan to replicate this study including a broader set of companies from different countries so that the previous model can be validated or updated. Lastly, an additional study is planned to complete the current results with guidelines for preventing these situations or address them when they happen.

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