Is RPA Causing Process Knowledge Loss? Insights from RPA Experts

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Abstract. Robotic process automation (RPA) is a process automation technology that mimics human behaviour using software agents called 'bots'. This study aims to explore one of the emerging organisational challenges of RPA use—process knowledge loss (PKL), which materialises when bots start performing repetitive and rule-based tasks, replacing employees. PKL can negatively impact an organisation's continuous improvement of processes, productivity, and competitiveness. Thus, it is a critical area that requires scholarly attention. There is a dearth of studies focusing on knowledge loss issues in RPA. Hence, no empirical models or frameworks exist to explain RPA's impact on PKL. To address this research gap, we first reviewed RPA literature. Then, the findings were further investigated using seven RPA expert interviews. The RPA experts confirmed the existence of PKL in the context of RPA and explained the influencing factors. We present an empirically supported conceptual model illustrating how RPA impacts PKL, which goes beyond highlighting the phenomenon as a process-related or knowledge-management challenge. The conceptual model captures ten factors, including three positive factors that mitigate PKL (i.e., top management support, process expertise, and RPA-BPM integration), four negative factors that contribute to PKL (i.e., employee turnover, knowledge hiding, automation complacency, and continuous process redesign), and three factors with both positive and negative impacts (i.e., employee redeployment, RPA governance, and task division). These findings contribute to the knowledge base on RPA associated with PKL. This model may assist organisations in devising strategies to mitigate RPA-related PKL.

Keywords: Robotic Process Automation · Process Knowledge Loss · Process Knowledge · Expert Interviews · Conceptual Model

1 Introduction

Organisations are increasingly leveraging business process automation (BPA) to transform and enhance organisational processes [12]. Robotic Process Automation (RPA) is a task-level, low-code automation technology that uses 'bots' (a.k.a. software robots) to emulate manual, repetitive, and rule-based tasks through graphical user interfaces [42]. RPA research to date has mostly focused

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on how organisations and their employees can benefit from RPA deployments. For example, studies show that RPA increases the operational efficiency and traceability of organisational processes, ensures business continuity, and increases job satisfaction among employees [4,9,18,24,27].

Despite these benefits, recent research and practice commentary point to various challenges and negative consequences of RPA [26,30]. Process knowledge loss (PKL) is one such negative consequence of RPA highlighted by recent literature [5,6,14,26,30,45] and RPA practitioners [16]. According to Marciniak and Stanisławski [26], an organisation may experience process "amnesia" over time if a task is entirely automated with RPA and no longer performed manually. Similarly, Eulerich et al. [14] stated that PKL emerges when a bot executes an entire process, resulting in the organisation losing the ability to carry out these tasks without the support of bots. Both definitions assume that an end-to-end automation of a process without any human touch-points leads to PKL. However, practice literature [16] stated that most organisations follow a hybrid model where process execution is shared between employees and bots. Thus, the concept of PKL requires further clarification. Considering the above notion, this study defines RPA-related PKL as follows. *RPA-related PKL is the intentional or unintentional loss of knowledge related to the process resulting from using RPA, where bots start performing repetitive, rule-based tasks previously handled by employees.* The rationale behind the definition is explained as follows. First, PKL is identified as a subset of organisational knowledge loss (OKL). OKL refers to the loss of internally established knowledge intentionally or unintentionally [10,21]. Intentional knowledge loss is an organisational attempt to intentionally forget knowledge unfavourable to organisational performance. Unintentional knowledge loss refers to the accidental loss of knowledge [21]. An established form of existing organisational knowledge can be embedded in durable organisational objects such as culture, values, processes, databases, etc. [21]. Hence, it is possible to describe a great deal of organisational knowledge (more than 90% in most cases) in terms of processes [3]. Accordingly, process knowledge can be identified as a branch of organisational knowledge [3,11]. Following this line of reasoning, PKL can be defined as *the intentional or unintentional loss of knowledge related to processes*. Next, we aligned the definition of PKL to the RPA context. Our definition addresses the limitation of [26]'s and [14]'s explanation of PKL by considering the broad use of RPA in a hybrid model and end-to-end automation.

The study also differentiates PKL from the notion of deskilling [5]. Deskilling refers to reducing or eliminating skilled labour due to increased automation [1]. Asatiani et al. [4] stated that process automation may lead to deskilling as employees no longer need the skills to perform a particular task. Accordingly, the central focus of deskilling is on the loss of skills at an individual level, whereas PKL centers around the organisational-level loss of process knowledge.

PKL can result in several negative organisational impacts. One impact is that it impedes continuous improvement. Without process expertise, organisations struggle to identify process improvement opportunities. Employees' lack of process knowledge can hinder continuous improvement initiatives and limit the organisation's ability to adapt and innovate [17,37]. Decreasing organisational productivity is also a concern. RPA bots may encounter exceptions that were not explicitly covered during development [20,35]. Without sufficient process knowledge among employees, the organisation may experience difficulties in troubleshooting errors and handling exceptions [33]. This can lead to process disruptions, decreasing the process performance and negatively impacting the customer experience [30]. Additionally, an organisation may incur costs and time investment in training employees to mitigate this issues [26]. Thus, PKL remains a critical concern in the context of RPA that needs to be addressed.

To date, the research on RPA-related PKL has been limited to anecdotal evidence from industry reports such as [16] and a few empirical studies that highlight selected facets of the phenomenon [5,6,14,26,30,45]. The existing studies also have limited evidence with a high-level observation describing PKL in the context of RPA as a process-related [5,6,30] or knowledge management challenge [14,26,45]. Hence, there are no empirical models or frameworks that systematically capture the potential impact of RPA-related PKL. However, PKL is a phenomenon that can have significant negative consequences on organisations [17,37]. Thus, it necessitates the need for empirical validation to strengthen the understanding of the phenomenon in order to optimise the use of RPA as a technology investment. Therefore, this study sets out to answer the following research question: *how does RPA impact PKL in organisations?*

The study presents an empirically validated conceptual model. First, an initial conceptual understanding was developed using RPA literature. Next, primary data was collected from seven RPA experts. Then, a conceptual model was developed with ten factors impacting the RPA-related PKL. This study contributes to the RPA knowledge base by exploring the impact of RPA on PKL, which can also be generalised to other BPA initiatives. This model will help organisations strategise to tackle PKL-related challenges.

The rest of the paper unfolds as follows. Section 2 summarises the study design. Section 3 presents related work within RPA literature. Section 4 provides a synthesis of interview findings. Section 5 presents a discussion of the developed conceptual model with the limitations of the study. Section 6 concludes the paper with suggestions for future work.

2 Study Design

The study design is comprised of 2 stages. Firstly, a systematic literature review [7] was conducted to build the foundational knowledge. Figure 1 depicts the number of articles that resulted in the literature search process. The queries used for the literature search incorporated the following keywords and synonyms, namely, robotic process automation (synonyms included desktop automation, low code automation, and software robots), knowledge loss (or knowledge management), and process knowledge. In total, 51 articles were analysed and inductively coded following the guidelines of [36]. The analysis resulted in a total of nine themes from the literature, which is briefly discussed in Sect. 3.

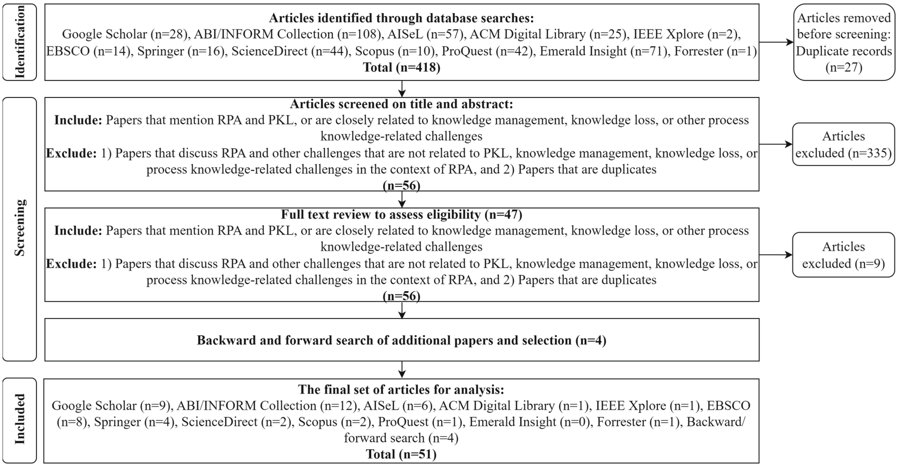

Fig. 1. Literature Search Process

Literature findings were further investigated using seven RPA expert interviews.[1] We employed purposive sampling to select experts from different sectors, as shown in Table 1. A hybrid approach combining an inductive and deductive approach was used to analyse primary data [36,44]. First, nine themes discovered using literature were used to deductively analyse and classify open codes generated via primary data. All themes that emerged from the literature were confirmed using primary data with additional insights. Next, coding was performed inductively by grouping the new open codes. An additional theme - continuous process redesign emerged at this stage. By combining the findings of both primary and secondary data, a conceptual model was developed with ten positive/negative themes as depicted in Fig. 2 and explained in detail in Sect. 5. During code extraction, a coding rule book was developed to ensure a formalised approach [36]. All coding rounds relied on coder corroboration with a second coder and a third coder using a critical review process.

3 Literature Review Findings

Although there are no studies specifically examining how RPA impacts PKL, several studies have discussed various aspects of PKL as process-related or knowledge-management challenges caused by RPA. This has paved the way for reviewing RPA literature. Accordingly, nine themes emerged from the literature, namely, 1) employee turnover, 2) knowledge hiding, 3) automation complacency, 4) top management support, 5) employee redeployment, 6) RPA governance, 7) task division, 8) process expertise, and 9) RPA-BPM integration. All related references for each theme are provided in the supplementary material - Part B.[2]

[1] Supplementary Materials - Part A - Interviewee Profiles and Details.
[2] Supplementary Materials - Part B - Evidence of Themes from Literature.

Table 1. Interviewee Details.

Role	Sector	Duration	Experience	Code
Automation Architect	Healthcare	50 min	6 years	I1
Principal RPA Developer	Education	55 min	5+ years	I2
Senior RPA Developer	Healthcare	45 min	4 years	I3
Business Improvement Consultant	Local Government	35 min	7+ years	I4
Head of Automation	IT Consulting	45 min	7 years	I5
Project Lead	Insurance	50 min	5+ years	I6
Project Manager	Insurance	50 min	3+ years	I7

Employee turnover emerged as a theme defining RPA-related PKL. RPA was considered to cause employee layoffs due to the replacement of software bots with human workers [13,15,30]. Employee turnover was discussed as a general cause of knowledge loss within organisations, which can also be seen in the RPA context. Typically, departing employees carry subject-matter expertise. This also disrupts social networks, ultimately impacting organisational knowledge exchange [14,16,38,39]. Accordingly, the existing literature demonstrates that RPA causes employee turnover, which results in PKL.

Knowledge hiding or employee resistance to sharing knowledge was identified as a driver of PKL. Intra-organisational knowledge flows are hindered by knowledge hiding due to poor knowledge-sharing practices [38,39]. Job insecurity is a major concern that can trigger resistance to knowledge sharing in RPA. Employees believe that having process expertise will prevent them from being replaced by bots [25,28,30]. As a result, knowledge hiding can be identified as a factor impacting PKL in the context of RPA.

Automation complacency occurs when human agents are less likely to exert supervisory control as a result of excessive reliance on automation [5]. Several studies noted that automation complacency causes employees to lose their fundamental understanding of the process logic and their hands-on end-to-end understanding of the process [5,30]. Despite a brief discussion in the literature, there is a clear link between automation complacency and RPA-related PKL.

Top management support was identified as a critical success factor (CSF) in RPA [33], but little was discussed on how the involvement of senior managers impacts knowledge management in RPA initiatives [5,28,30,33,38]. Proactive engagement of senior management in skill development and continuous knowledge management was acknowledged as reducing knowledge retention issues within RPA initiatives [28,30,33]. However, no study has specifically investigated how top management's support could impact the RPA-related PKL. Thus, the field warrants further empirical studies to support and clarify the existing link between top management support and PKL in the context of RPA.

Employee redeployment emerged as a theme that refers to changing job profiles and reemploying employees within the organisation or in the same team. Studies highlighted that employees' job profiles changed when they were replaced by bots [4,13,15,27,30,31,46]. RPA enables employee upskilling and reorientation into more creative and value-adding roles, which include supervising bots and maintaining task control [4,15,27,30]. Despite the absence of directed studies that examine RPA's real impact on PKL due to employee redeployment, existing literature suggests that it may have a positive impact on RPA-related PKL. However, further empirical data is required to validate the emerging link between employee redeployment and RPA-related PKL.

RPA governance was identified as a mechanism to overcome the issue of RPA-related PKL [16,26,42]. Ensuring RPA governance through audit trials and detailed process documentation was suggested as a solution to overcome the issue of PKL [14,16,26,42]. A general discussion of RPA governance established through a centre of excellence (CoE) was found in the literature pertaining to knowledge management of RPA projects [5,15,19,20,29,30,32]. There are three types of RPA governance models: centralised, decentralised, and federated [22,29]. In a centralised governance approach, knowledge is centralised in knowledge repositories in terms of process designs, automation rulebooks, and algorithms [5,19]. Due to this, centralised governance was favourably viewed toward knowledge management in RPA [26]. In contrast, studies also revealed that the centralisation process of governance hinders collaboration between local units and the central hub and does not immediately attend to knowledge requirements [5]. Accordingly, the literature views centralised governance both positively and negatively. According to the literature, decentralised RPA governance negatively impacts knowledge management since capabilities are spread across departments [29]. It was found that federated governance was more effective in maintaining and disseminating knowledge among RPA projects as it could benefit from both centralised and decentralised structures [29]. Therefore, it was identified as having a positive impact on knowledge dissemination in RPA. However, the literature lacks evidence to support how each governance model specifically impacts PKL.

Task division refers to assigning appropriate tasks to employees and bots [2,4–6,8,13,14,16,25,26,28,30,35]. The most common way of dividing tasks among employees and bots is based on mindfulness, where mindful tasks (that require creativity) are assigned to employees and mindless tasks (routine tasks that do not depend on human cognition) are assigned to bots [5]. As RPA is equally capable of retaining implicit process knowledge in the form of workflow specifications, a task division among employees and bots appears to be favourable for retaining process knowledge [8,13,34,38–40]. Several studies [5,6,14,26,30,31] and industry insights [16] counter-argue that task division leads to PKL, specifically due to task visibility issues that result from black box nature of tasks or fragment of the process executed by bots [5,6,30,43]. Therefore, there is no consensus regarding task division and PKL in the literature.

Process expertise must be preserved for maintaining and transferring critical process knowledge [5,18,19,30,33,42,46]. Plattfuat et al., [33] emphasised expert support and process knowledge as two CSFs in RPA. Typically, when employees with such process expertise are replaced by bots, they are redeployed in different roles as 'process champions' or 'process leaders' to retain their knowledge within the organisation [30,32]. The support of these process experts then becomes necessary when training new employees or disseminating knowledge in RPA projects [19,31,42]. As a result, process expertise is identified as having a positive impact on mitigating knowledge management issues in RPA.

RPA-BPM integration is an emerging discussion [19,23,24,35,41]. RPA does not replace BPM, but rather complements it [23]. Several studies proposed that, as a more established research field, BPM has the potential to provide an environment for technologies like RPA to thrive [19,23]. BPM synergises knowledge management and processes [41]. Thus, when RPA is integrated into BPM, the limitations of RPA can be overcome, and the process knowledge needed for successful RPA realisation can be provided [23]. It has been briefly discussed how RPA-BPM integration can mitigate knowledge management issues, but the evidence indicates that there is a weak link between RPA-BPM integration and PKL, requiring further research.

In summary, several themes have clear evidence that points to their impact on PKL, while others have limited evidence requiring further empirical validation.

4 Interview Findings

The following section summarises the empirical findings from the seven RPA expert interviews. The analysis supported validating all nine themes identified in the literature while revealing an additional theme - continuous process redesign. Each theme is supported by relevant evidence from primary data.

Due to **employee turnover**, organisations face difficulties maintaining the process due to a loss of process-related knowledge. *"Once that person [process expert] leaves, no one will actually be able to maintain that process"* (I5). A participant highlighted that process expertise could be lost due to employee turnover. *"If a particular resource is, moving or moving out of the organisation, resigning, or moving to a totally different job role, then that person is taking away the entire knowledge of how the rules, how the process was designed, and how the bot is working, and that entire knowledge is removed from that environment"* (I7). Accordingly, employee turnover was discussed as a common phenomenon that occurs independent of RPA adoption but can negatively impact PKL.

Knowledge hiding refers to the unwillingness of an employee to share their knowledge acquired through experience. A participant highlighted this concern, stating that employees hide their knowledge due to job insecurity concerns caused by technologies that mimic human behaviour, such as RPA. *"The previous team may not necessarily disclose the information about the process as necessary, because maybe, you know, he wants to protect the job or whatever"* (I5). Findings reveal that RPA adoption can trigger employee knowledge-hiding behaviour, which can eventually result in PKL.

Automation complacency was manifested among employees as a state of feeling relaxed and not having to pay much attention to or take responsibility for the tasks performed by bots. *"Due to that [relying on RPA], the major* *knowledge-related issue happens...I saw a decline in responsibility because they have it in their mind that the bot is there and the bot is doing the job"* (I7P). Employees who become complacent lose their process knowledge due to a lack of hands-on execution, resulting in an inability to recall steps. *"If you're not doing the process and you don't talk about that process anymore, letting the bot do everything...within six months or a span of one year of time, you tend to forget how to do that [process]"* (I1). Accordingly, high reliance on RPA can result in PKL.

Top management support for reducing PKL in the context of RPA was highlighted by several participants. Top management support includes the proactive engagement of senior managers for knowledge management across RPA initiatives in terms of setting up documentation standards, conducting knowledge audits, and providing necessary training for RPA stakeholders. *"When we hand over the bot for the first time when the process is going into production, we were asked [by senior managers] to give a training or workshop to the business stakeholders"* (I1). Accordingly, top management support was conferred as a factor that mitigates knowledge management challenges associated with RPA.

Employee redeployment refers to the concept of reassigning employees to different processes to maximise their value when bots replace employees. *"When you have sold out your processes saying these are the benefits [of RPA], they completely eliminate those resources from that process itself, not from the organisation, I would say from that process, and they try to deploy those resources onto the other processes. So that's where the biggest problem lies because now you don't have a dedicated resource working on that particular process"* (I1). As a result of employee redeployment, there is a possibility that no one in the team possesses end-to-end process knowledge due to reduced hands-on involvement. *"...later down the line when there are so many iterations of employees going here and there, nobody on the business side is 100% aware of the process, how it works, or how it was working before so that...knowledge gradually reduces at either one point it might disappear"* (I7). Consequently, PKL was highlighted as a major risk that resulted from employee redeployment due to RPA.

RPA governance was highlighted by all participants as an essential aspect of ensuring comprehensive knowledge management across RPA initiatives. A strong emphasis was placed on documentation as a mechanism to tackle the issue of PKL materialising within the context of RPA. *"With strong documentation of each process...anyone who is given the documentation can easily understand how the process has been defined... We are mitigating it [PKL] with those factors, but how much of our documentation we have hands-on experience with, you can't beat that"* (I7). In organisations with an established CoE for RPA governance, documentation standards and the maintenance of process knowledge are ensured by the CoE. *"When we make a change actually, we document that...It's the standard set by the CoE"* (I3). Accordingly, RPA governance was discussed as a positive factor associated with PKL that ensures the creation, maintenance, and accessibility of knowledge for all parties involved in RPA.

Task division was referred to as the allocation of tasks between employees and bots. RPA-related PKL was observed both in end-to-end automation (e.g., I1), and in task-level automation, where processes were hybridised among employees and bots (e.g., I2). *"PKL is happening because you're not working on the process anymore. If you work on something every day. You keep remembering it"* (I1). *"When we go back and ask business, they say, nobody in our team has done this task for the last two years. So, the knowledge within the core team, which should be the expertise of their process, is missing"* (I2). Furthermore, PKL depends on the number of tasks assigned to bots. *"I personally think it actually challenges knowledge issues. It depends on the degree of automation of tasks as well"* (EI4-RB). Participants revealed that a fragmented process due to task division could scatter process knowledge across employees and bots, reducing the knowledge retained by employees. *"As we proceed with RPA, it [process knowledge] will get further scattered. So that knowledge, that process knowledge, as it is getting scattered and scattered as we go along. There could be a negative impact on knowledge down the line"* (I7). As a result, task division was highlighted as a factor that negatively impacts RPA-related PKL.

Maintaining **process expertise** was emphasised to bring positive results for knowledge dissemination across business process re-engineering initiatives using RPA. *"Without the business process experts and their expertise, we are actually blind because, without their support and their cooperation and their assistance, we will be unable to re-engineer business processes that can be automated through RPA"* (I7). Some participants argued that process expertise could be documented and preserved (e.g., I6), but others argued that it could not be fully captured and documented because it implicitly resides in employees (e.g., I4). *"I don't think the process knowledge will be lost even if experts leave as we have already documented it"* (I6).*"We haven't captured all of the information about the process, in which case you obviously need a human in that which tells you that the loss is very minimal in terms of knowledge"* (I4). Accordingly, participants highlighted that process expertise is a factor that positively impacts PKL.

Combining systematic methods of BPM with RPA (**RPA-BPM integration**) was revealed to have a positive impact on RPA-based knowledge management. Some participants highlighted that, for RPA-related knowledge management, methods in BPM can be used for stakeholder engagement when monitoring and maintaining processes. *"I think COVID has taught us a lot... We should have some process in place where businesses or stakeholders should be engaged throughout the journey, even though you have handed over the bot to them... We tell our BAs [business analysts], you go back to the business, make them understand what they need to do."* (I1). Other participants highlighted that BPM and RPA use similar methods while showing the potential to integrate those. *"That actually is a business rule that needs to be incorporated in BPMS because they're doing much more than just one step...I would assume bots are also geared toward doing something similar. Methods are pretty much the same"* (I4). Likewise, RPA-BPM integration was suggested as a means of overcoming PKL.

Continuous process redesign was identified as an additional theme that emerged through primary data. This theme refers to ongoing and iterative improvements that are made to automated processes, adapting them to changing needs and desired outcomes. *"This new security regulation came in. Previously, you only needed to do a single ID check with just a single driving license number. Now, you will be required to enter the card number. So that's the process change, so the board needs to perform additional extra steps to input new data to satisfy that security or regulatory impact"* (IN4). Participants highlighted that when an end-to-end RPA-integrated process undergoes frequent changes, it might challenge employees to stay updated and gain a comprehensive understanding of the updated process. This happens because employees are not as involved in executing a process while bots that are in place undergo rigorous changes to conform with the updated workflows. Consequently, the risk of PKL increases. *"In RPA, how it [PKL] is getting impacted because now a bot does most of the tasks, and you are not aware of these process changes most of the time. In RPA, these changes are rigorous and align with modifying a bot frequently"* (IN4).

5 Discussions

In this section, we present a conceptual model with factors impacting RPA-related PKL derived from the primary interview data and secondary data synthesis from the literature. This is followed by a brief discussion about limitations.

5.1 A Conceptual Model for RPA-Related PKL

Figure 2 depicts ten factors and their positive/negative impact on RPA-related PKL. All factors are classified under three themes, namely, human factors (HF), organisational factors (OF), and process factors (PF).

We identified four factors, namely, employee turnover (HF1), knowledge hiding (HF2), automation complacency (HF3), and continuous process redesign (PF5), that contribute to or negatively impact the phenomenon of RPA-related PKL. **Employee turnover** is highlighted as a common occurrence that also has a negative impact on the employees' understanding of processes in the context of RPA. In line with the literature [38,39], primary data revealed that **knowledge hiding** impacts formal and informal knowledge networks (e.g., social groups) within the organisation. Interview findings confirmed **automation complacency** or high reliance on RPA contributes to an employee's reduced understanding of the overall process, which leads to an inability to accurately execute the process in the absence of a bot. **Continuous process redesign** was discussed as a factor that increases the risk of PKL as frequent changes are introduced to processes integrated with RPA.

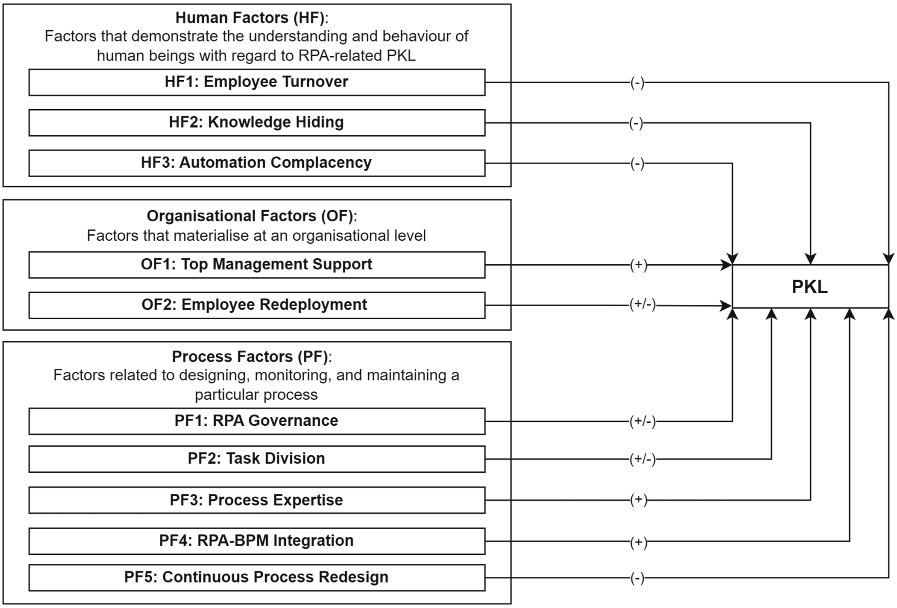

Fig. 2. A conceptual model with factors impacting RPA-related PKL

There are three factors that positively impact RPA-related PKL, namely, top management support (OF1), process expertise (PF3), and RPA-BPM integration (PF4). According to the empirical study of [31], the senior management acknowledges the employees' concerns and invests in training and internal roadshows to ensure efficient human-machine collaboration. Likewise, participants emphasised that **top management support** facilitates continuous knowledge management and upskilling of employees who are replaced by bots. Furthermore, both primary and secondary data confirmed that **process expertise** facilitates process knowledge visibility and exchange within organisations. **RPA-BPM integration** was discussed as an approach to optimise BPM's capabilities and insights with RPA to positively influence knowledge management in RPA projects [23]. As per the primary data, integrating systematic BPM methods with RPA can facilitate knowledge management when monitoring and maintaining RPA-integrated processes. Accordingly, the existing relationship between RPA-BPM integration and PKL is substantiated based on the primary and secondary data.

There are three factors, namely, employee redeployment (OF2), RPA governance (PF1), and task division (PF2), that appear to vary across different organisations, demonstrating both positive and negative impacts on RPA-related PKL. **Employee redeployment** contributes to a reduction of end-to-end process knowledge within the team, followed by reduced human involvement in the automated process. Employee redeployment, however, has often been linked to the retention of critical knowledge within organisations. While RPA literature agreed with the positive outcomes of employee redeployment, empirical data stood on the negative side of it. Similarly, **RPA governance** is identified as a factor that impacts PKL both positively and negatively, warranting further empirical validation of its sub-factors. According to findings, RPA governance can play a critical role in mitigating PKL primarily by maintaining proper documentation and ensuring employees have adequate task control capabilities. However, the evidence of relationships between governance models and PKL is limited to the literature that shows both positive and negative links to the phenomenon. In literature, the discussion related to **task division** was split between having positive and negative impacts on PKL in the context of RPA. Primary data indicated that the use of RPA scatters process knowledge due to process fragmentation, eventually resulting in employees losing their end-to-end process knowledge. Accordingly, task division was identified as a factor that impacts PKL both positively and negatively, necessitating additional empirical research.

Overall, the analysis revealed how the identified factors/themes impact RPA-related PKL. Participants emphasised that RPA-related PKL is a significant contemporary phenomenon that requires further investigation. All nine themes that emerged from the literature were enriched with insights from the RPA experts. Primary data revealed an additional contributory factor - continuous process redesign. According to literature and expert interviews, among all the factors, task division was found to have a significant impact on RPA-related PKL. Thus, focusing on task division when developing strategies may help organisations to significantly mitigate RPA-related PKL. Furthermore, primary data showed that RPA-related PKL is present in both task-level and end-to-end automation.

5.2 Study Limitations

There are several limitations of this study. First, the literature review was based on academic publications and white papers. However, the white papers lack academic rigor limiting the quality of insights. Second, the search criteria might be incomplete. For example, keywords used to search literature might have not covered all related terms as some papers may have omitted or not referred to the search terms used in this study in their keywords or abstract. Thus, these papers might not have been included in the literature review. Third, the scope of the literature review was limited to low-code automation to extract the most relevant literature related to the phenomenon under study. However, literature related to other forms of BPA has not been considered in this study. Fourth, the current conceptual model was developed based on the findings in RPA literature, along with expert insights. As RPA experts were originally from different industries with varying years of experience in the context of RPA, evidence might reflect difficulties in capturing a holistic view of the phenomenon. One such example is an RPA expert from a technical background who may approach the phenomenon under study strongly from purely a technical perspective. As a result, their responses might not be as well-rounded, reflecting all perspectives of the phenomenon. Fifth, despite adhering to a critical review process, data analysis may have been subjected to researchers' bias due to their varying backgrounds.

6 Conclusion and Future Work

This study investigated how RPA impacts PKL. RPA-related PKL is becoming an area that demands scholarly attention, as it adversely impacts an organisation's continuous improvement efforts, competitive advantages, and productivity. There are very few empirical studies specifically focusing on PKL in the context of RPA. Thus, to date, the area remains largely unexplored. The existing studies are also limited to identifying PKL as a process-related or knowledge-management challenge in RPA. We addressed this research gap by conducting a comprehensive literature review followed by seven RPA expert interviews. The study's most important finding is that PKL exists in the context of RPA. We identified ten factors that can impact the phenomenon either positively or negatively, out of which one factor emerged as an additional theme through primary data. Accordingly, this study primarily distinguishes itself from other related studies in that it identifies empirically validated factors that specifically impact RPA-related PKL. This research also signals to future researchers the existence of negative consequences of the use of RPA technology which require further investigation. Furthermore, PKL can be mitigated if organisations invest time and resources in improving the factors that positively impact the phenomenon, such as process expertise and RPA-BPM integration. Likewise, organisations can use these findings to develop strategies in line with the inherent outcome of each factor on RPA-related PKL to potentially mitigate the negative effects.

The existing conceptual model is empirically validated with rich insights from RPA experts. In future work, an exploratory case study will be conducted to further refine the model in terms of identifying the interrelationships among these factors. Exploring the relevant phenomenon in the context of an organisation will be beneficial to further examine the contextual nuances of factors within a homogeneous setting. Furthermore, we will conduct multiple case studies to enrich these insights and use cross-case analysis to construct a theoretical framework for explaining RPA-related PKL.

References

1. Adler, P.S.: Automation and skill: new directions. Int. J. Technol. Manage. **2**(5–6), 761–772 (1987)
2. Alcover, C.M., Guglielmi, D., Depolo, M., Mazzetti, G.: "Aging-and-tech job vulnerability": a proposed framework on the dual impact of aging and AI, robotics, and automation among older workers. Organ. Psychol. Rev. **11**(2), 175–201 (2021)
3. Amaravadi, C.S., Lee, I.: The dimensions of process knowledge. Knowl. Process. Manag. **12**(1), 65–76 (2005)
4. Asatiani, A., Penttinen, E.: Turning robotic process automation into commercial success – case OpusCapita. JIT Teach. Cases **6**(2), 67–74 (2016)
5. Asatiani, A., Penttinen, E., Rinta-Kahila, T., Salovaara, A.: Implementation of automation as distributed cognition in knowledge work organizations: six recommendations for managers. In: ICIS, vol. 7 (2019)

6. Asatiani, A., Penttinen, E., Ruissalo, J., Salovaara, A.: Knowledge workers' reactions to a planned introduction of robotic process automation—empirical evidence from an accounting firm. In: Hirschheim, R., Heinzl, A., Dibbern, J. (eds.) Information Systems Outsourcing. PI, pp. 413–452. Springer, Cham (2020). https://doi.org/10.1007/978-3-030-45819-5_17
7. Bandara, W., Furtmueller, E., Gorbacheva, E., Miskon, S., Beekhuyzen, J.: Achieving rigor in literature reviews: insights from qualitative data analysis and tool-support. Commun. Assoc. Inf. Syst. **37**(8), 154–204 (2015)
8. Cewe, C., Koch, D., Mertens, R.: Minimal effort requirements engineering for robotic process automation with test driven development and screen recording. In: Teniente, E., Weidlich, M. (eds.) BPM 2017. LNBIP, vol. 308, pp. 642–648. Springer, Cham (2018). https://doi.org/10.1007/978-3-319-74030-0_51
9. Costin, B.V., Anca, T., Dorian, C.: The main benefits-risks of adopting robotic process automation in big four companies from Romania - a case study. In: ICSTCC, pp. 340–345 (2021)
10. Daghfous, A., Belkhodja, O., Angell, L.C.: Understanding and managing knowledge loss. J. Knowl. Manag. **17**(5), 639–660 (2013)
11. Davenport, T.H., Prusak, L.: Working knowledge: how organizations manage what they know. Harvard Business Press (1998)
12. Dumas, M., Rosa, M.L., Mendling, J., Reijers, H.A.: Fundamentals of Business Process Management, 2nd Edn. Springer, Heidelberg (2018). https://doi.org/10.1007/978-3-662-56509-4
13. Eikebrokk, T.R., Olsen, D.H.: Robotic process automation and consequences for knowledge workers; a mixed-method study. In: Hattingh, M., Matthee, M., Smuts, H., Pappas, I., Dwivedi, Y.K., Mäntymäki, M. (eds.) I3E 2020. LNCS, vol. 12066, pp. 114–125. Springer, Cham (2020). https://doi.org/10.1007/978-3-030-44999-5_10
14. Eulerich, M., Waddoups, N., Wagener, M., Wood, D.A.: The dark side of robotic process automation (rpa): Understanding risks and challenges with RPA. Account. Horiz. **38**(1), 1–10 (2023)
15. Figueiredo, A.S., Pinto, L.H.: Robotizing shared service centres: key challenges and outcomes. J. Serv. Theory Pract. **31**(1), 157–178 (2021)
16. Forrester consulting: the forrester wave^{TM}: robotic process automation, Q2 2018. Tech. rep., Forrester Consulting (2018). https://www.uipath.com/hubfs/The_Forrester_Wave_RPA_2018_UiPath_RPA_Leader.pdf
17. Gernreich, C.C., Bartelheimer, C., Wolf, V., Prinz, C.: The impact of process automation on manufacturers' long-term knowledge. In: ICIS (2018)
18. Hallikainen, P., Bekkhus, R., Pan, S.: How OpusCapita used internal RPA capabilities to offer services to clients. MIS Quart. Execut. **17**(1), 41–52 (2018)
19. Herm, L., Janiesch, C., Helm, A., Imgrund, F., Hofmann, A., Winkelmann, A.: A framework for implementing robotic process automation projects. Inf. Syst. e-Bus. Manag. **21**(1), 1–35 (2023)
20. Hofmann, P., Samp, C., Urbach, N.: Robotic process automation. Electr. Markets **30**(1), 99–106 (2020). https://doi.org/10.1007/s12525-019-00365-8
21. de Holan, P.M., Phillips, N., Lawrence, T.B.: Managing organizational forgetting. MIT Sloan Manag. Rev. **45**(2), 45–51 (2004)
22. Kedziora, D., Penttinen, E.: Governance models for robotic process automation: the case of Nordea bank. JIT Teach. Cases **11**(1), 20–29 (2020)
23. König, M., Bein, L., Nikaj, A., Weske, M.: Integrating robotic process automation into business process management. In: Asatiani, A., et al. (eds.) BPM 2020. LNBIP,

vol. 393, pp. 132–146. Springer, Cham (2020). https://doi.org/10.1007/978-3-030-58779-6_9
24. Lacity, M.C., Willcocks, L.P.: Robotic process automation at telefonica O2. MIS Quart. Execut. **15**(1), 21–35 (2016)
25. Looy, A.V.: A quantitative and qualitative study of the link between business process management and digital innovation. Inf. Manag. **58**(2), 103413 (2021)
26. Marciniak, P., Stanisławski, R.: Internal determinants in the field of RPA technology implementation on the example of selected companies in the context of industry 4.0 assumptions. Information **12**(6), 222 (2021)
27. Meironke, A., Kuehnel, S.: How to measure RPA's benefits? A review on metrics, indicators, and evaluation methods of RPA benefit assessment. In: Wirtschaftsinformatik 2022 Proceedings, vol. 5 (2022)
28. Modliński, A., Kedziora, D., Jiménez Ramírez, A., del Río-Ortega, A.: Rolling back to manual work: an exploratory research on robotic process re-manualization. In: Marrella, A. et al. (eds.) Business Process Management: Blockchain, Robotic Process Automation, and Central and Eastern Europe Forum. BPM 2022. LNCS, vol. 459, pp. 154–169. Springer, Cham (2022). https://doi.org/10.1007/978-3-031-16168-1_10
29. Noppen, P., Beerepoot, I., van de Weerd, I., Jonker, M., Reijers, H.A.: How to keep RPA maintainable? In: Fahland, D., Ghidini, C., Becker, J., Dumas, M. (eds.) BPM 2020. LNCS, vol. 12168, pp. 453–470. Springer, Cham (2020). https://doi.org/10.1007/978-3-030-58666-9_26
30. Oshri, I., Plugge, A.: What do you see in your Bot? Lessons from KAS bank. In: Oshri, I., Kotlarsky, J., Willcocks, L.P. (eds.) Global Sourcing 2019. LNBIP, vol. 410, pp. 145–161. Springer, Cham (2020). https://doi.org/10.1007/978-3-030-66834-1_9
31. Oshri, I., Plugge, A.: Introducing RPA and automation in the financial sector: lessons from KAS bank. J. Inf. Technol. Teach. Cases. **12**(1), 88–95 (2022)
32. Plattfaut, R., Borghoff, V.: Robotic process automation: a literature-based research agenda. J. Inf. Syst. **36**(2), 173–191 (2022)
33. Plattfaut, R., Borghoff, V., Godefroid, M., Koch, J., Trampler, M., Coners, A.: The critical success factors for robotic process automation. Comput. Ind. **138**, 103646 (2022)
34. Rehr, D., Munteanu, D.: The promise of robotic process automation for the public sector. Tech. rep., George Mason University Center for Business Civic Engagement (2021). https://cbce.gmu.edu/wp-content/uploads/2021/06/The-Promise-of-RPA-For-The-Public-Sector.pdf
35. Ruiz, R.C., Ramírez, A.J., Cuaresma, M.J.E., Enríquez, J.G.: Hybridizing humans and robots: an RPA horizon envisaged from the trenches. Comput. Ind. **138**, 103615 (2022)
36. Saldana, J.: The coding manual for qualitative researchers. SAGE (2021)
37. Seethamraju, R., Marjanovic, O.: Role of process knowledge in business process improvement methodology: a case study. Bus. Process. Manag. J. **15**(6), 920–936 (2009)
38. Serenko, A.: The great resignation: the great knowledge exodus or the onset of the great knowledge revolution? J. Knowl. Manag. **27**(4), 1042–1055 (2023)
39. Serenko, A.: The human capital management perspective on quiet quitting: recommendations for employees, managers, and national policymakers. J. Knowl. Manag. (2023). https://doi.org/10.1108/JKM-10-2022-0792

40. Siderska, J.: The adoption of robotic process automation technology to ensure business processes during the COVID-19 pandemic. Sustainability **13**(14), 8020 (2021)
41. Stravinskienė, I., Serafinas, D.: Process management and robotic process automation: the insights from systematic literature review. Organ. Vadyba Sist. Tyrimai **85**(1), 87–106 (2021)
42. Syed, R., et al.: Robotic process automation: Contemporary themes and challenges. Comput. Ind. **115**, 103162 (2020)
43. Syed, R., Wynn, M.T.: How to trust a Bot: an RPA user perspective. In: Asatiani, A., et al. (eds.) BPM 2020. LNBIP, vol. 393, pp. 147–160. Springer, Cham (2020). https://doi.org/10.1007/978-3-030-58779-6_10
44. Thompson, J.: A guide to abductive thematic analysis. Qual. Rep. **27**(5), 1410–1421 (2022)
45. Zelenka, M., Vokoun, M.: Information and communication technology capabilities and business performance: the case of differences in the Czech financial sector and lessons from robotic process automation between 2015 and 2020. Rev. Innov. Compet. **7**(1), 99–116 (2021)
46. Zhang, C.A., Thomas, C., Vasarhelyi, M.A.: Attended process automation in audit: a framework and a demonstration. J. Inf. Syst. **36**(2), 101–124 (2022)