Supplementary documentation

This document supplements the following article:

Flechsig, C., Völker, M., Egger, C., Weske, M.: *Towards an Integrated Platform for Business Process Management Systems and Robotic Process Automation*. Submitted to the 20th Business Process Management Conference: Blockchain and Robotic Process Automation Forum (2022)

For more information, please contact the first author: christian.flechsig@tu-dresden.de

The following table substantiates the requirements of an integrated BPMS-RPA platform, as presented in Sect. 5.1 of our article, with empirical data, i.e., representative quotes of the particular coding category from the conducted interviews.

For an overview and allocation of the participating organizations and informants, we refer to Table 1 on page 5 of our article.

Appendix A. Requirements of an integrated BPMS-RPA platform and representative quotes

Code	Requirement	Sample quotes
O1	BPM maturity	"In the past organizations were not fully prepared to integrate their business processes into such platforms. But now, they are thinking in terms of digital services and couple smaller applications rather than building large systems. And that's why RPA, and in this context BPM, come back to light." (Org. C)
		"Especially large organizations use both technologies. They have been using a BPMS platform for a long time, but then the RPA hype emerged. And then the different departments talked to each other, and that's how the whole integration thing came up. It's simply driven by the market." (Org. G)
		"Many organizations are not yet ready in terms of maturity. Therefore, an integrated solution is difficult to sell." (Org. H)
		"Such an integration is a topic that you only discover when you've already gone a certain way because it's just not that present yet. Hopefully, this will change with your research. Because integrating BPMS and RPA is the smart way." (Org. I1)
O2	Mindset	"The biggest challenge we have is the understanding of potential customers. Because most of them say: I don't even have this topic yet. They just can't imagine integrated process automation and interpret things into it that they don't understand. On the other hand, they leave a lot of potentials behind because they don't use the technology for what it actually is." (Org. I2)
		"Because we were very early on the market with our approach and the hyperautomation topic, we had a lot to explain. We had to train the customers and tell them that integrated process automation is not a topic of some sub-department, but it's a central topic where business and IT always have to work together, and you also have to consider security and compliance issues." (Org. B)
		"RPA is like coffee: you can boost something in the short term. You can wake up and so on, but you can't solve an accumulated sleep deficit with coffee. And therefore, RPA is a bridging technology, a supplement for the development or deployment of basic systems. RPA must not be seen as a backbone. That's foolish and dangerous, in my opinion." (Org. A2)
		"RPA is neither a panacea nor the 'new' BPMS, but it's a complementary technology which makes sense for certain things." (Org. C)
O3	Economic efficiency	"Organizations need a certain size to afford systems for integrated process automation and establish efficient structures." (Org. G)
		"A current project where we implement such an integrated system involves a 30-man team. That requires a tremendous amount of effort, and that's why only our biggest customers can afford it, and only in strategic projects. Because the cost driver is not the acquisition, but the operation." (Org. A2)
		"An integrated platform definitely costs something. You have the acquisition, but the operation is also not a 'no-brainer'. You have to orchestrate the RPA bots, and you need some kind of governance on which bot does what. The system also needs to be integrated into the company's IT." (Org. H)
		"The more bots you use, the greater the efforts and needs for orchestration and monitoring." (Org. D)
		"Costs, or the return on investment, are definitely a challenge, but also an opportunity. With RPA, it's a bit easier to show the ROI: costs now versus costs in the future and so on. With BPMS or an integrated system, it's somewhat more difficult to calculate the ROI." (Org. E1)
O4	Integrated organizational structure	"Process automation with RPA runs on a very technical level, whereas with BPMS it's more business-oriented. […] BPMS projects are often initiated by business departments rather than IT." (Org. C)
		"The problem with such an integrated approach is that it's not integrated organizationally. You need several people and different roles. Business experts who know the process works and people who can automate it. And bringing them together is currently one of the biggest challenges." (Org. A1)

		"You need people who have knowledge about process management and process definition. You also have to deal with the technical details of BPMS and RPA systems and need somebody who understands that." (Org. H)
		"The main question is: Is the organizational structure appropriate so that the organization can handle the integration topic well? That means, is there a center of excellence for process automation that is staffed by both process experts and IT developers? […] You have to set up certain procedures with multiple loops until you go live with your automation, such as analysis, adaptation, optimization, and monitoring. That's natural with BPMS, but with RPA, it's still in its infancy" (Org. I1)
T1	BPMS fundament	"BPMS is always the basis, or at least it should be. RPA can stand alone, but it must correspond to a reasonable process management." (Org. E2)
		"RPA is nice to automate single tasks, but if you want to automate processes end-to-end, you need a supervising system. And that's where a BPMS comes into play." (Org. I1)
		"I really think that the BPMS can be very important for the process definition and analysis." (Org. J)
		"The business process is depicted with the standard language via the process engine. And then, RPA is added to execute a certain task within the process flowchart. The process engine controls the operation, scales up and down, and pays attention to the correct execution. […] If you have many different automated processes, then it simply makes sense to control them via the process engine of the BPMS." (Org. B)
		"The BPMS is the clamp over the various RPA bots, which just execute sub-processes." (Org. H)
		"Scalability, error handling, monitoring – that's where you need a BPMS to trigger the corresponding activities." (Org. G)
T2	Concerted task orchestration	"The bot has to communicate with the platform to share its status. But the required interfaces are currently not transparent." (Org. B)
		"The challenge when connecting the two systems is to provide appropriate interfaces." (Org. G)
		"We always say: if you come from the BPMS corner, you can increase your potential by adding RPA as an additional tool. And vice versa, if you come from the RPA corner, at some point, you won't be able to avoid an orchestration layer for your bots because they've just become so complex." (Org. I1)
		"Sometimes, I would like to use the BPM logic to model RPA processes. Because you need it anyway." (Org. A1)
		"Who ensures that the automated processes in a seamless way? What if suddenly some leading system has changed? That's the main challenge where I say: I can only yield potential through professionalization and holistic orchestration. In this context, I like the buzzword 'hyperautomation' because it means that everything is connected and integrated: the process engine, the RPA bots, other automation technologies, and the human process operators. In my opinion, that's important to increase the application possibilities." (Org. B)
T3	Consistent process modeling	"I think business modeling with BPMN is very easy to understand. Of course, it can become complex, depending on what kind of business processes you map, but I think it makes sense to have a uniform language to make the process model really understandable and readable for everyone. And when you switch between different tools, then it's simply uniform. So if you have modeled the business process and now set up the RPA bots, it just looks similar or the same." (Org. D)
		"From a vendor point of view, I think it has massive advantages to have a standardized modeling language like BPMN 2.0 for RPA bots because it would simplify several things as the rules are just the same. First of all, you need transparency and an understanding of which processes exist in the company, what they look like, who does what, and which resources are required. And if you have this understanding, you can model the process and design the bots accordingly, which also improves the monitoring and reporting." (Org. E1)
		"We already do this and directly model our RPA bots in BPMN 2.0. We also use the XML notation." (Org. K)

		"I think it's very smart to build the bot already in BPMN so that you can read out the process information directly and use the bot accordingly. As I said before, the better something is integrated, the smoother it usually runs. And if we could wrap the relevant process information for one of the most important emerging technologies [RPA] in BPMN, we could have a good representation of the business process and generate great value." (Org. J) "From the customer's point of view, it would be great if BPMN would be used as the sole standard, like 'when I have a modeling tool, I'm only allowed to use the BPMN standard, and no one is allowed to deviate from it'. Then I could import the whole model right away in my BPMS and parts of it into specific bots." (Org. G)
T4	Limited complexity	"BPMN was defined with a different objective than RPA. With RPA, you're very close to the actual user interface technology. You have to deal with HTML, JavaScript, and some DOM [Document Object Model] structures of the browser. And that makes it a bit difficult for me to imagine how this could be integrated into BPMN." (Org. H) "The modeling inside RPA systems is technical modeling. It's not business process modeling. That means you model input variables, you model output variables, you model intermediate buffers, and therefore have to think pretty technically, even though it's a graphical editor." (Org. C) "In order to use BPMN for our RPA bots, we had to extend the whole notation with things that are no longer BPMN 2.0 compatible because these modules don't even exist in BPMN 2.0. For example, the interaction between bots and human operators or certain inputs which are required to, let's say, find a field on the screen. Or the modeling of complex decision trees and use of artificial intelligence." (Org. K) "BPMN works fine up to a certain level of detail. It gets difficult when we talk about status-affected objects, for- or while-loops, and recursive function calls." (Org. A2)