The Role of Marketplaces for the Transformation from Robotic Process Automation to Intelligent Process Automation

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Abstract: The corporate landscape is experiencing an increasing change in business models due to digitization. An increasing availability of data along the business processes enhance the opportunities for process automation. Technologies such as Robotic Process Automation (RPA) are widely used for business process optimization, but as a side effect an increase in stand-alone solutions and a lack of holistic approaches can be observed. Intelligent Process Automation (IPA) is said to support more complex processes and enable automated decision-making, but due to the lack of connectors makes the implementation difficult. RPA marketplaces can be a bridging technology to help companies implement Intelligent Process Automation. This paper explores the drivers and challenges for the adoption of RPA marketplaces to realize IPA. For this purpose, we conducted ten expert interviews with decision makers and IT staff from the process automation sector.

1 INTRODUCTION

Digitalization is bringing profound changes to organizations and business models (Bouwman et al., 2018; Neifer et al., 2021b). Due to the increasing availability and utility of data along business processes, their automation is also undergoing a major transformation (Chakraborti et al., 2020). Traditional approaches to process automation focus primarily on processes that occur frequently and repeatedly in the same flow pattern. However, if repetitive processes do not occur frequently enough, their automation is usually considered too cost-intensive, especially if integrations of different systems and their data have to take place (Van der Aalst et al., 2018). In this case, Robotic Process Automation (RPA) technology is often discussed in companies (Neifer et al., 2021a). For example, Van der Aalst et al. (2018) highlight the question *"What should be automated and what should be done by humans?"* when implementing RPA technologies.

There is no uniform definition of RPA in the literature. In its original form, RPA refers to a technology for automating manual activities in processes that are structured, rule-based and repetitive by digital software robots, simply called bots (Kleehaupt-Roither and Unger, 2018). RPA offers many benefits, such as it allows accuracy, reliability, uniformity, and consistency by processing routine tasks in the exact same way without interruption, with a reduced susceptibility to error. This is ensured through regulatory compliance as well as work history revision control. Furthermore, productivity can be increased in two ways: First, through faster process cycle times due to automation, and second, by shifting the focus of employees on important and value-added work. Furthermore, because it is a non-invasive technology with low technical barriers, the burden on IT and the barriers to adoption are reduced (Madakam et al., 2019).

Besides the advantages, RPA also introduces new challenges. Among other things, RPA focuses on highly structured routine tasks. Further, the low implementation hurdles ensure the possibility of the use of this technology by the business departments independently of the IT department, which may promote shadow IT structures as well as IT security violations (Willcocks et al., 2015; Gadatsch and Mangiapane, 2017; Matthews and Greenspan, 2020).

Due to the primary reduction to highly structured tasks, the question about the differentiation of automation and human activities is answered by this technical limitation. Wherever unstructured data, complex tasks and decisions occur, a human must intervene. This is particularly problematic, since only about 30% of the enterprise data is structured (e.g., customer IDs, addresses, account details, etc.) the remaining 70% represents unstructured data (e.g., PDF documents, emails, images, etc.) (Taulli, 2020b). To overcome this barrier, there is an increasing re-

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liance on the use of Artificial Intelligence (AI) methods. This manifests itself in the term Intelligent Process Automation (IPA, also Intelligent Automation or Cognitive Automation) and marks a change from rule-based to intelligent process automation (Chakraborti et al., 2020). This should result in self-learning software robots that are robust and flexible in the face of complex process dynamics and have autonomous decision-making capabilities (Czarnecki and Auth, 2018).

However, this transformation is still at an early stage, which is why RPA vendors are reaching their limits with regard to the further development of their RPA tools into an all-encompassing, intelligent holistic solution, as these require a variety of technologies and functions (Taulli, 2020a) as well as an ecosystemic approach (Neifer et al., 2021a). Furthermore, for an efficient training of machine learning (ML) methods regarding the decision making of these bots, this requires an integration of (un)structured data from different sources in order to benefit from synergy effects (Dong and Rekatsinas, 2018). Currently, it does not seem possible for an RPA vendor to provide all these challenges from a single source (Türkoglu, 2020). This problem gave rise to RPA platforms, which in their function as a marketplace offer modular components from RPA providers, third-party vendors or individual developers (Mullakara, 2020).

For these marketplaces, the problem of user acceptance and trust in the provider and platform emerges, which is central to the platform economy (Clement et al., 2019). Scientific research on the transformation to intelligent process automation, however, focuses here mainly on the differentiation of RPA/IPA development stages (Lacity and Willcocks, 2018; Stoudt-Hansen et al., 2019; Ferreira et al., 2020) and providers (Le Clair et al., 2019), the strategic framework (Mohanty and Vyas, 2018; Scheer, 2020), potentials and risks (Smeets et al., 2019; Agostinelli et al., 2019), and the explanation of IPA technology and derivation of use cases (Berruti et al., 2017; Lacity and Willcocks, 2018; Burgess, 2017; Smeets et al., 2019; Taulli, 2020b; Ferreira et al., 2020; Moiseeva et al., 2020; Engel et al., 2021). Therefore, we see a research gap in the exploratory research of RPA marketplaces as a bridging technology towards IPA.

This work aims to analyze drivers and challenges for the adoption of RPA marketplaces to realize IPA. For this purpose, we conducted ten expert interviews with decision-makers and IT staff from RPA and process automation departments to address both a technical and strategic perspective. The identified factors contribute to the scientific discourse about RPA marketplaces and can be used as a basis for companies to decide whether to use RPA marketplaces. In the following, we delineate the terms RPA and IPA, provide insight into the state of the research, describe our methodological approach and then present and discuss our findings on the drivers and challenges of adopting RPA marketplaces to realize IPA.

2 ROBOTIC AND INTELLIGENT PROCESS AUTOMATION

In literature, **Robotic Process Automation** is predominantly defined by its functionality (Smeets et al., 2019). While Van der Aalst et al. (2018) define RPA as a collective term for tools that operate computer systems via user interfaces in the way a human would, Allweyer (2016) distinguishes RPA from physical machines as a type of personal assistant to support or replace employees. The basic idea of RPA is the exact imitation of manual user input by a software bot. In doing so, the underlying system does not recognize that it is being operated by software instead of a human (Smeets et al., 2019). Furthermore, the implementation and realization of RPA does not require any programming skills, there is only a configuration of rules or recordings of manual user interactions (Willcocks et al., 2015; Czarnecki and Auth, 2018). This promotes a detachment from the IT department (Czarnecki and Auth, 2018) and a tendency towards shadow IT (Gadatsch and Mangiapane, 2017; Matthews and Greenspan, 2020). Overall, RPA is focused on rule-based and stable processes with repeated execution, a low need for change, and highly structured input data (Allweyer, 2016).

Further, RPA follows an outside-in approach, whereby no changes are made to existing application systems as part of the automation process (Van der Aalst et al., 2018). While classical automation approaches access the system via an application programming interface (API), RPA usually uses the graphical user interface (GUI) (Smeets et al., 2019). This already results in the initial problem that RPA does not directly access the integration of multiple systems via the GUI (Taulli, 2020a). This would require major adjustments to the IT infrastructure and the existing processes (Czarnecki and Auth, 2018).

Intelligent Process Automation on the other hand describes the further development of RPA into a cognitive, self-learning overall solution (Smeets et al., 2019). This allows processes to be fully automated and enable human decision-making behavior as well as unstructured data (e.g. text, speech) and complex

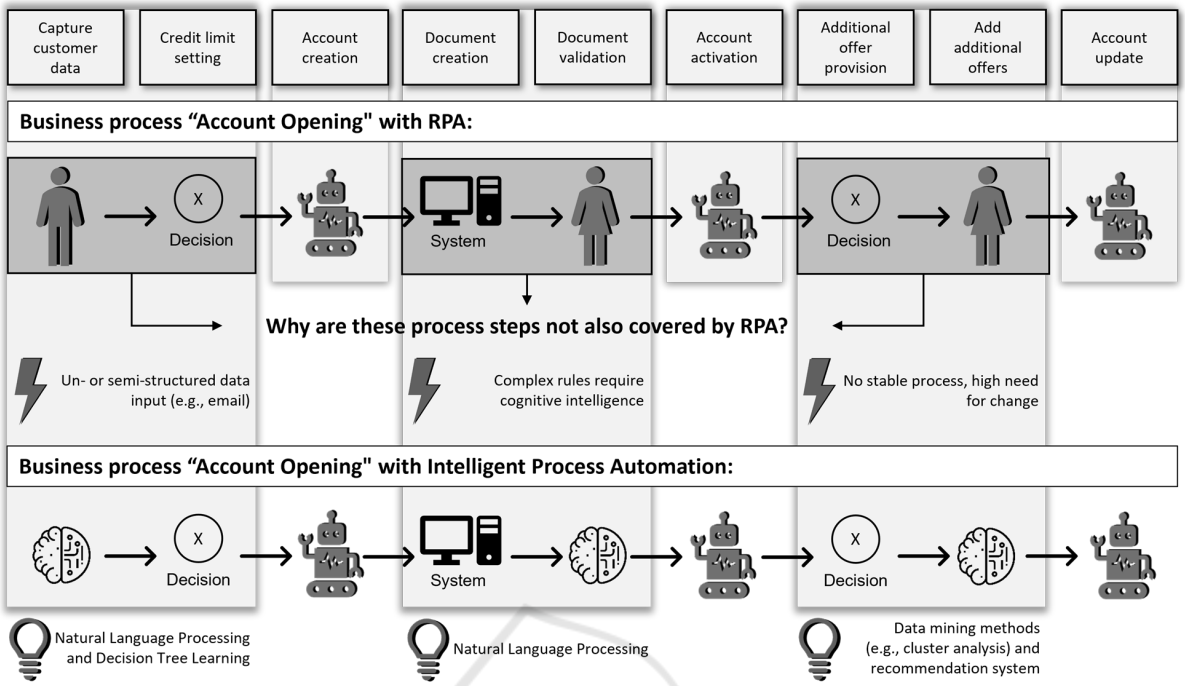

Figure 1: Account Opening Process in Transition from RPA to IPA.

issues to be mapped in the form of forecasts and analyses (Langmann and Turi, 2020). Accordingly, IPA is an RPA-based ecosystem of AI and other digitization technologies that take automation to the next level through the interaction of technologies (Berruti et al., 2017; Mohanty and Vyas, 2018; Zhang, 2019). Key technologies to enable IPA include Smart Workflow (Smeets et al., 2019), Machine Learning (ML) (Alpaydin, 2020; Smeets et al., 2019; Mohanty and Vyas, 2018), Natural Language Processing (NLP) (Mohanty and Vyas, 2018; Smeets et al., 2019; Sarkar, 2019), Natural Language Generation (NLG) (Celikyilmaz et al., 2018), Optical Character Recognition (OCR) (Langmann and Turi, 2020), Process Mining (Scheer, 2020), and Cognitive Assistants (Allweyer, 2016).

The relevance of the **transformation from RPA to IPA** can be seen in Figure 1, which shows an example account opening process. Without RPA, not only the process steps with a decision-making function (e.g., determining credit limit and additional offers) but also repetitive steps (e.g., creating an account, creating documents) are performed manually. The staff must perform routine activities with a predominantly high structural component.

RPA can be used to automate the process steps with a high degree of structure and repetitive character. Process steps with a decision-making function (e.g., determine credit limit) or unstructured data bases (e.g., validate documents), on the other hand, must still be performed manually.

Unstructured or semistructured data, e.g., in the form of e-mails, is a major problem in customer data acquisition. Since an RPA bot requires structured input, Natural Language Processing (NLP) in conjunction with a learning algorithm must be used to create an intelligent model that can also process this data in a meaningful way. In addition, clustering methods can be used to make a decision regarding the credit limit based on features within the customer data. Document validation could also be addressed by an NLP model trained on these documents. Regarding the decision on additional offers, data mining methods as well as recommendation systems can be used, which derive customer preferences based on the customer data and provide personalized recommendations for additional offers. By implementing such an IPA solution in conjunction with an integrated data architecture (Neifer et al., 2021a), it is possible to digitally map the account opening process in its entirety. Human intervention would only be necessary in exceptional cases.

Holistic IPA solutions in the form of a one tool do not yet exist. Thus, the dilemma prevails that complementary technologies of different suppliers have to be connected with each other. Thereby, the selection, as well as specific configuration represent a great challenge to the users (Taulli, 2020c). **RPA marketplaces** could enable more holistic IPA solutions, which offer pre-built bots, plugins, connectors, or even individual components and capabilities of soft-

ware robots (Taulli, 2020a) developed by platform providers, third-party vendors, or even individual developers (Mullakara, 2020). In this context, Scheppler and Weber (2020) highlight that there is a need for research in evaluating the ability of RPA marketplaces to integrate solutions through pre-built components and simplified development of bots. This goes hand in hand with the evaluation need for acceptance and trust on the part of users in both the platform and the specific providers (Clement et al., 2019).

3 RELATED WORK

The scientific literature on the shift from rule-based to intelligent automation as well as on RPA marketplaces is still relatively scarce, but recently experiences an increasing interest. Berruti et al. (2017) consider IPA under a platform idea, consisting of the five core technologies RPA, Smart Workflow, Machine Learning, NLG, as well as Coginitive Assistants, which aims at a fundamental redesign of processes. Leading platforms in this space include UiPath, Automation Anywhere, and Blue Prism (Taulli, 2020a).

According to Mohanty and Vyas (2018), companies are increasingly recognizing the potential benefits of IPA and experimenting with intelligent automation in various functional areas. According to them, RPA represents the basic building block on the path to IPA, where considering ML and RPA separately would be a step backward. While some software vendors and startups are making progress in developing applications with image and speech recognition as well as information extraction, the focus here is on complementing RPA (Burgess, 2017). Burgess (2017) argues that combining RPA and ML can enable automation of end-to-end processes, and both technologies benefit from each other: If the data is unstructured or semistructured, or if judgment is required, ML can support the RPA bots. RPA, on the other hand, can map the extraction and assembly of data from various sources, thereby acting as a data provider for ML. Smeets et al. (2019) found out that companies see more potential in combining RPA with other technologies (such as process mining and workflow management systems) than in moving RPA itself toward IPA. Stoudt-Hansen et al. (2019) observed a shift from RPA to a holistic approach of automation, which they refer to as hyperautomation. However, the dilemma here is that all the necessary technologies are not easy to link, because they often come from different vendors.

Le Clair et al. (2019) therefore see the decisive success factor in the integration of artificial intelligence (AI). For this reason, most RPA providers are trying to develop their tools in-house or with external partners. On some marketplaces, such as Automation Anywhere, companies can source suitable solutions from third-party vendors for their automation problem. Credibility and trust in the vendors therefore play a key role. Many vendors make bold claims regarding the capabilities of their respective products, which is referred to as ”RPA washing” (Lacity and Willcocks, 2018). Further, in terms of identifying suitable process candidates and providing the necessary scale, vendors must ensure that their automation solutions are user-friendly and easy to implement and deploy. Thus, supporting analytics to find the right process candidates, scalability of the bots, and centralized coordination and openness of the IPA platform have become more important (Le Clair et al., 2019).

Taulli (2020c) recommends the use of RPA marketplaces due to a non-existent end-to-end solution, as they can help shorten development times on the user side and provide a new revenue stream on the vendor side. Automation should be seen from a holistic perspective and be realized through end-to-end automation platforms or programs. These statements are consistent with those of Le Clair et al. (2019) and Burgess (2017). Mullakara (2020) agree that RPA marketplaces have great potential as part of the evolution of RPA toward hyperautomation, because these marketplaces enable the integration of a variety of new technologies. However, this integration should be as simple as possible, e.g., via drag-and-drop interfaces. They expect higher participation in the future as well as a wide range of prefabricated components.

4 EXPERT INTERVIEWS

To explore the drivers and challenges for RPA marketplace adoption and factors to support the transformation from RPA to IPA, we conducted ten semi-structured expert interviews (see Table 1) within an interpretive research stance (Collis and Hussey, 2013; Bell et al., 2018; Themistocleous and Morabito, 2012; Depietro et al., 1990). We chose semi-structured interviews because of the exploratory nature of the research question. While there is already some literature on RPA and IPA, we wanted to keep the interviews very open to give the experts more room to formulate requirements and opinions that have not been captured by the literature so far. In fact, while conducting the interviews, new aspects kept coming up that were incorporated in the follow-up interviews, which is a great advantage of qualitative surveys in

Table 1: Overview of participants.

ID	Sector	Job	Department
E01	Telecommunications	Head of Department	Service IT Conception & Automation Control
E02	Insurance	Head of Department	RPA Competence Center
E03	Insurance	RPA Expert	Organization & Coordination of Automation
E04	Retail	Team Leader	Inhouse Consulting, Process Digitization & Automation
E05	Conglomerate	Product Owner	Process Automation & API Strategy
E06	Consulting	Team Leader	Data Transparency & Efficiency
E07	Consulting	RPA Expert	Process Automation Consulting
E08	IT	Head of Department	Business Intelligence & Cognitive Automation
E09	IT	Team Leader	Process Automation
E10	IT	Head of Department	Business Intelligence

the form of interviews.

The experts were selected primarily based on their function in the company. The interviewees were RPA or process automation managers and IT staff from different large companies in Germany in order to include both a strategic and technical perspective. Furthermore, the aim was to ensure an across-industry overview. Therefore, the management consultancies provided an additional perspective through their experience with the requirements of companies for RPA marketplaces resulting from their consultancy services. The interviews lasted on average 49 minutes and followed a semi-structured guideline with the following topics:

- Practices and Experiences with RPA marketplaces to derive insights about drivers and challenges as well as to develop a common understanding of RPA, IPA and RPA marketplaces.
- Acceptance and usage of RPA marketplaces with respect to the development of IPA.
- Perception of the future impact of RPA marketplaces on IPA.

The interviews were transcribed with MAXQDA and analyzed using the inductive approach of thematic analysis according to Braun and Clarke (2006). Based on the previous experiences with RPA marketplaces, both the drivers and the challenges with regard to the use as well as the feature supporting the transformation from RPA to IPA were focused on. Two authors undertook the coding of the interview material independently and then combined the resulting code system (Berends and Johnston, 2005).

5 RESULTS

The following chapters describe the results of the interviews conducted, which are summarized as drivers and challenges for the adoption of RPA marketplaces to realize IPA in Figure 2. The results were differentiated into organizational and technical factors.

5.1 Organizational Drivers

Nine out of ten experts stated that RPA marketplaces can contribute to a **democratization of development** of RPA or IPA solutions. In principle, RPA marketplaces can simplify the development of RPA skills and lower the barrier to entry. RPA marketplaces can also provide insights into the topic of IPA, which can be used as orientation. For example, according to E06, *"standard modules or functionalities for data extraction and data classification, in particular OCR functionalities, are very interesting"*.

> *"[...] smaller and medium-sized companies can benefit from RPA marketplaces, especially if they find it more difficult to get started with RPA due to a lack of resources."* – [E05]

Further potential strategic benefits are identified in a **cost reduction** (eight experts) and **time savings** (six experts). The more ready-to-use components are reused to develop the bot solutions, the more the development costs decrease. According to E02, *"through standardized development, the bots can be scaled with low costs"*. However, E04 and E05 refer to the high training effort of AI models. According to E04, the training effort and thus the resulting costs could be *"reduced by ready-to-use AI models" and "IPA solutions could be implemented faster"*. The reuse of ready-to-use automation modules via plug & play can also significantly reduce development time. Thus, a significant increase in efficiency in bot devel-

opment is achieved through reuse and avoidance of multiple developments.

> *"If I apply a meta-bot in 25 bots, that's just great, [...] maybe an hour of development time [...] and you can plug & play that meta-bot back in and you saved a lot of time."* – [E05]

Five experts find RPA marketplaces useful for **idea generation**. For example, E03 is interested in basic frameworks of objects that provide ideas for developing solutions for company-specific systems and can be adapted accordingly. According to E05, business departments often find it difficult to identify suitable use cases, which is why *"they can use an RPA marketplace to generate ideas for suitable process candidates"*.

5.2 Technical Drivers

According to nine out of ten experts, RPA marketplaces can be useful for the development of IPA solutions through the **provision of ready-to-use intelligent automation solutions**. For example, E02 states that RPA marketplaces could *"offer additional features, such as OCR, that are not included in standard RPA solutions"*. Contrary to the promises of some RPA vendors, according to E03, E06 and E10, RPA software products have so far been only partially suitable for the development of intelligent bots. Therefore, according to E06, extending the capabilities of RPA with cognitive components is difficult, and they *"use a dedicated OCR system where the process allows it. However, this does not apply well in practice because we would then have to switch to a completely different system in a process"*. Accordingly, standardized intelligent components provided via RPA marketplaces are perceived as an improvement.

> *"If there were OCR functionalities that could be integrated into workflow modeling under UiPath, for example, that would be much more attractive."* -– [E06]

Six experts see an opportunity for **quality improvements** in the development of IPA solutions on a technical level. The reuse of ready-to-use components makes it easier to identify error sources and thus reduce them during bot development. Further, according to E02 and E07, the participation of various providers in RPA marketplaces within the framework of direct network effects ensures an increase in the quality of solutions and of IPA in particular, since *"a broad positioning increases the pressure on the individual providers and thus the quality of the solutions"*.

5.3 Organizational Challenges

All experts agree that **integration into the IT infrastructure** has a significant influence on the usefulness of RPA marketplaces. In this context, E01, E03, E04 and E08 criticize the fact that the range of marketplaces is currently *"too focused on standard software"*, but the *"system landscape of companies is characterized by a large number of in-house developed systems"* and *"[...] the modules are not suitable for automation on in-house developed systems"*. According to the experts, this is also the main reason for the low use of external RPA marketplaces and the decision to build an internal RPA marketplace. E03 sees the capabilities of AI as crucial for successful integration, explicitly to what extent *"intelligent components are customizable for specific companies"*. E04 also sees the integration of off-the-shelf AI solutions, process mining, and chatbots from RPA marketplaces as promising, but it depends on how *"standardized the use cases need to be"*. It appears difficult to use intelligent ready-to-use modules in a company-specific way, as the modules have to be trained on a use-case-specific basis and are correspondingly costly.

> *"That's where I think you run into limits very quickly in these marketplaces, because it's really difficult to offer ready-to-use models, or if they're trained models, they're utopian in price."* -– [E05]

Additionally, eight out of ten experts classify **data protection and security** as relevant factors influencing the perceived benefits of RPA marketplaces. E04 and E05 accordingly describe that the companies decided against using external RPA marketplaces due to *"internal regulations and security checks and the associated costs"*. According to the experts, security must be guaranteed by the operators of the marketplace and could be confirmed, for example, by compliance of industry-standard IT security certifications for the offered services.

> *"The listings on the marketplace should have gone through security checks and be certified by the operator, so you can be sure there's no malicious code in there."* -– [E04]

Four experts highlight the **guarantee of support** as a further influencing factor for the acceptance and ongoing use of the marketplace. The providers are seen as having a responsibility to adapt the modules and keep them up to date.

> *"[...] is there support at all the same as with official packages from UiPath or not, because that would be a problem if we unleash a lot*

of robots on different activities and then those activities don't work anymore." -– [E02]

Profitability is another factor that must be given according to four experts. E01 expects in this regard that the *"offer on the marketplaces must be more favorable than in-house development and its operation"*. Currently, this does not yet seem to be the case, since adaptation and testing of the components involves a very high level of effort compared with in-house development.

E02 and E09 further emphasize that the **number of users** has a direct influence on the usefulness of RPA marketplaces. With an increasing number of users, *"technical and innovation limits could be lifted"*.

Another aspect represents for four experts is the **risk of dependency**. Thus, the increased purchase of prefabricated components brings knowledge losses with itself. However, the maintenance effort remains, so there is more dependence on module suppliers, especially for intelligent modules.

5.4 Technical Challenges

All ten experts interviewed express expectations for the **usability** of the RPA marketplaces in order to positively influence the perceived ease of use. For E04, a *"very good documentation of the solutions by means of process flow charts and videos"* is important in order to enable a quick and simple basis for decision-making for the specialist department and the developers. Thus, it is basically possible to transfer IPA development to the business departments if the solutions from the RPA marketplaces are very well documented and easy to adapt. For E09, too, *"good and detailed descriptions of the modules are important, as well as easy downloading and integration of the solutions into the internally used RPA tool"*. For E05, the most important factors in achieving a high user experience in the company's internal RPA marketplace are *"transparency and create easy searchability and list contacts"*. Thus, filtering by bot solutions should be possible *"technology-based by system and technical by functional area"*. Furthermore, a detailed text description and flowcharts should explain the use case in more detail and the corresponding process experts should be specified as contact persons. Furthermore, according to E08, a *"possibility to categorize the solutions according to industries on the external RPA marketplaces"* has been missing so far.

Five experts also agree that the **quality and maturity** of solutions on RPA marketplaces can still be improved in order to increase their usefulness. Although the range of products on offer in the RPA marketplaces is extensive, some solutions are of insufficient quality, which means that the maturity level of the solutions needs to be increased. For example, the currently offered services are not attractive enough and plug & play modules are not yet mature.

"I think the construct behind the marketplaces and the reputation is very good. I see a perspective there, but we are still quite far away from usable modules or bots that can be downloaded and used plug & play." -– [E03]

5.5 Adoption of RPA Marketplaces to Realize IPA

Only three of the ten companies interviewed currently use an external RPA marketplace to develop IPA solutions. According to E02, this is used to source *"components for data recognition and preparation, smaller loops, automatism or algorithms for specific processing"* which can also interact with older systems. One company plans to expand further, as it sees RPA marketplaces as very promising in terms of IPA. In Fig. 2 we have summarized the most important drivers and challenges from the interviews and sorted them according to the assigned relevance in descending order in the associated category. According to the experts, these factors play a significant role in the adoption of RPA marketplaces.

Six experts are open to using an external RPA marketplace to develop IPA solutions in the future. At the same time, the establishment of an internal marketplace for the development of classic RPA solutions is being pursued. E04 sees great potential in building modules that can be flexibly incorporated into bots and states that especially *"standard AI solutions, OCR capabilities, process mining, chatbots and pretrained algorithms are of interest"*. Thus, a solution is developed once for a department and *"made available to the departments across countries in each case"*. For E06, in the context of IPA, standardized building modules for decision making, data recognition, and extraction are of interest, but only to gain insight. In the long term, the goal is to develop or enhance the modules themselves. E10 also sees the future use of RPA marketplaces as useful, especially with regard to the development of IPA.

"The world is kind of crying out to be able to buy in these kinds of solutions and reuse them, and that's [...] where we've put the priority now." – [E05]

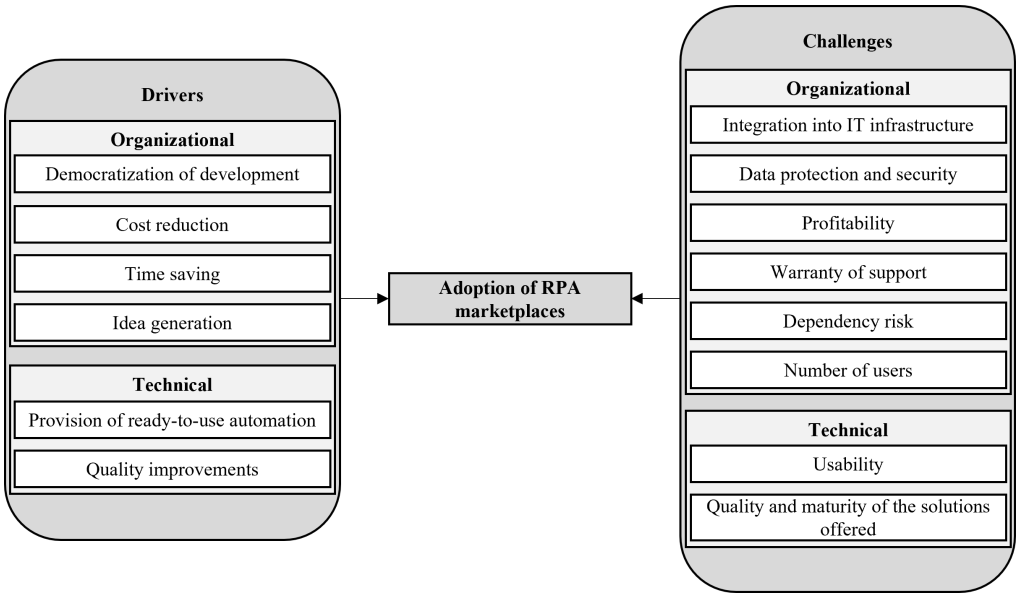

Figure 2: Summary of Drivers and Challenges for the Adoption of RPA Marketplaces.

6 DISCUSSION

6.1 The Role of RPA Marketplaces as Bridging Technology

According to the experts, RPA marketplaces can contribute to the transformation from RPA to IPA in the future. This will be made possible in particular by the provision of ready-to-use intelligent automation solutions, as RPA marketplaces can provide additional functionalities that are not included in an RPA standard solution and there will probably also be no holistic approaches (Taulli, 2020a). In addition, RPA marketplaces can in principle lead to a democratization of development by enabling the use of AI components. Developing these components in-house is seen as complex, which is why a broad range of know-how is required for this purpose (Burgess, 2017). By making them available via a marketplace, the barrier to entry into the topic of IPA can thus also be lowered. Given that IPA solutions should also be implementable by users without an IT background (Le Clair et al., 2019; Ito et al., 2020), the aspect of lowering the barrier to entry seems particularly relevant. However, the application of IPA is associated with a high level of required know-how (Scheer, 2020; Ito et al., 2020). The experts point out that RPA marketplaces address this dilemma as a bridge technology and that IPA developments could come from the specialist departments. In this regard, the business departments can benefit from the attributed ability to generate ideas via RPA marketplaces to derive meaningful use cases. Furthermore, companies with a lack of touchpoints to RPA can find an easier entry into both RPA and IPA via the use of external marketplaces (Mohanty and Vyas, 2018).

The experts believe that competition between providers on a marketplace can improve the quality of IPA solutions due to the high degree of transparency and comparability of different solutions. In addition, RPA marketplaces offer potential for cost reduction and time savings in the development, which can be achieved through the possibility of using existing automation modules by searching for the best fitting automation modules on the marketplace.

6.2 Drivers and Challenges of RPA Adoption

Nevertheless, there is a discrepancy between the positive attitude towards and the actual use of RPA marketplaces. While the use of external marketplaces is essentially limited to the implementation of intelligent building modules for data recognition and preparation, the (planned) development and use of internal marketplaces is focused on the use of classic RPA solutions. This is consistent with Taulli's view that AI is currently limited to form interpretation and intelligent data transfer (Taulli, 2020b). Furthermore, it can be assumed that the development of an internal RPA marketplace does not appear lucrative for small and medium-sized enterprises due to a lack of application

scenarios for automation as well as a lack of financial and human resources.

The low level of actual use is explained by the experts as a result of the existing challenges in regard to RPA marketplaces. The integration of the solutions into the IT infrastructure is a key factor in the decision to adopt RPA marketplaces. This results from the extent to which a company-specific adaptation of the modules can take place and how high this adaptation effort turns out to be. Here, a dissent between the experts' opinion and the literature can be observed. Mullakara (2020), for example, refers to the simple configuration of RPA components, while the expert whose company already uses an external RPA marketplace point out a high development effort. This is consistent with the literature on integration platforms, according to which data model matching is an essential problem for a holistic intelligent process automation approach (Neifer et al., 2021a). In addition, the integration of solutions is influenced by the quality and maturity of the solutions. These factors are rated as insufficient in RPA marketplaces by the experts.

Other factors that represent a hurdle to adoption are data privacy and data security of the components offered on the marketplaces and the guarantee of support. The experts have judged the guarantee of adequate support to be questionable, particularly in the case of services from third-party providers. In general, cost-effectiveness must also be ensured compared to in-house development, which is associated with additional costs due to the challenges mentioned. In addition, the risk of dependence on the module manufacturers also plays a role for the providers, especially when it comes to intelligent components, which are difficult to understand for inexperienced departments in particular. There is a fear that process failures could occur due to a lack of know-how about the functionality of the purchased components and poor support. To address the required data protection and data security aspects, RPA marketplaces should continue to certify and verify the offering to further promote acceptance among companies and reduce the fear of process failures by ensuring appropriate support.

The experts would like RPA marketplaces to be intuitive to use and clearly presented. This should be supported by suitable text and video descriptions of the components as well as categorization and filtering options. Furthermore, the IPA components should be easy to integrate into existing RPA tools. A broad positioning of the RPA marketplaces and their presentation through descriptions of the solutions and filtering by applications, processes as well as categories additionally support and simplify the generation of ideas. According to one expert, this contributes to the fact that with good documentation and simple adaptability, IPA development could also be transferred to the specialist departments. A possibility of categorization according to the specific application scenarios can additionally support the generation of ideas in the specialist departments. Furthermore, the 'Cognitive Automation Use Case Assessment Model' developed by Engel et al. (2021), for example, offers the possibility to "make more informed decisions about selecting use cases for cognitive automation or planning their implementation."

Overall, it can be stated that the experts perceive RPA marketplaces as a promising solution for the transformation from RPA to IPA. This is also reflected in the finding that three companies were open to a future use of external RPA marketplaces for the development of IPA solutions and one company wants to increase future use strongly.

6.3 Limitations

With regard to the limitations, no cross-industry statement can be made due to the sample size of ten experts, as different industries may also have additional requirements for such RPA marketplaces. The experts were also selected by contacting them via existing networks, which can certainly have an influence on the findings obtained. Nevertheless, care was taken to ensure high quality in the selection of the experts and their suitability, as the selected companies and experts deal intensively with the topics of RPA and IPA.

As far as the transferability of the results is concerned, there will be a wide variety of requirements in the corporate landscape with regard to compliance and IT security. In SMEs, other requirements might arise, especially with regard to the development of IPA solutions against the background of scarce financial and human resources and the implementation of internal RPA marketplaces. In areas with sensitive information, in-house developments are likely to remain dominant. However, it was also not the goal of this work to develop generally applicable recommendations for action for the adoption of RPA marketplaces. The purpose of this work was to identify drivers and challenges in order to better understand the adoption of RPA to realize IPA. Nonetheless, an overlap of the findings with the existing literature can be observed, suggesting that the findings are not limited only to the sample and that implications for SMEs have also been incorporated through the participating management consultancies. For this reason, it would be useful to validate the drivers and challenges identified in this paper for a follow-up study in a larger-

scale quantitative study.

7 CONCLUSION

This paper has dealt with the exploration of drivers and challenges for and the investigation of the potential of RPA marketplaces to support the transformation from rule-based to intelligent process automation. It is shown that RPA marketplaces can drive the transformation of RPA and IPA primarily by providing intelligent modules, since it can be assumed that there will be no holistic IPA standard solution. Furthermore, the development of IPA solutions can be democratized by lowering the barriers to entry through a simplified and user-friendly development environment. On the business side, this is also supported by the fact that RPA marketplaces can contribute to the generation of ideas, since, according to the experts, many small and medium-sized companies in particular lack suitable ideas for use cases. In addition, RPA marketplaces can contribute to cost reduction, time savings and increased quality of solutions through their platform structure and associated scaling effects.

However, there are also some challenges, which are mainly determined by the integration of the components into the existing IT infrastructure of the companies, the user-friendliness of the platform and its guarantee of data security and data protection. This results in an area of conflict between components that are as individual as possible and therefore not standardized, the simple development and use of these components, and corresponding cost-effectiveness and security for the companies. In their statements, the experts refer to a number of design suggestions to meet some of the challenges. For example, detailed documentation consisting of text and video descriptions as well as adequate categorization and filtering options for the components on offer should be provided for simple and user-friendly development. This would also positively influence the aspect of democratization of development for companies by reducing the complexity of implementing RPA and IPA. Furthermore, RPA marketplaces should ensure good support with regard to integration into the existing IT landscape of companies, as well as meet the demands for data protection and data security via trustworthy certificates and verification of their offerings.

The drivers and challenges identified can thus serve as a basis for decision-making in the adoption of RPA marketplaces by companies on the one hand, and as a guide for RPA marketplace operators in the design of their platforms on the other. Nevertheless, our results are limited by the sample size consisting of ten experts and the business composition. Therefore, future research should on the one hand deal with the quantitative validation of the identified factors and on the other hand investigate them for specific sectors as well as in small and medium-sized enterprises.

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REFERENCES

Agostinelli, S., Marrella, A., and Mecella, M. (2019). Research challenges for intelligent robotic process automation. In *International Conference on Business Process Management*, pages 12–18. Springer.

Allweyer, T. (2016). Robotic process automation–neue perspektiven für die prozessautomatisierung. *Kaiserslautern: Hochschule Kaiserslautern. https://www. kurze-prozesse. de/blog/wpcontent/uploads/2016/11/Neue-Perspektiven-durch-Robotic-Process-Automation. pdf. Zugegriffen am*, 3:2019.

Alpaydin, E. (2020). *Introduction to machine learning*. MIT press.

Bell, E., Bryman, A., and Harley, B. (2018). *Business research methods*. Oxford university press.

Berends, L. and Johnston, J. (2005). Using multiple coders to enhance qualitative analysis: The case of interviews with consumers of drug treatment. *Addiction Research & Theory*, 13(4):373–381.

Berruti, F., Nixon, G., Taglioni, G., and Whiteman, R. (2017). Intelligent process automation: The engine at the core of the next-generation operating model. *Digital McKinsey*, page 9.

Bouwman, H., Nikou, S., Molina-Castillo, F. J., and de Reuver, M. (2018). The impact of digitalization on business models. *Digital Policy, Regulation and Governance*.

Braun, V. and Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative research in psychology*, 3(2):77–101.

Burgess, A. (2017). *The Executive Guide to Artificial Intelligence: How to identify and implement applications for AI in your organization*. Springer.

Celikyilmaz, A., Deng, L., and Hakkani-Tür, D. (2018). Deep learning in spoken and text-based dialog systems. In *Deep learning in natural language processing*, pages 49–78. Springer.

Chakraborti, T., Isahagian, V., Khalaf, R., Khazaeni, Y., Muthusamy, V., Rizk, Y., and Unuvar, M. (2020). From robotic process automation to intelligent process automation. In *International Conference on Business Process Management*, pages 215–228. Springer.

Clement, R., Schreiber, D., Bossauer, P., and Pakusch, C. (2019). Mehrseitige märkte. In *Internet-Ökonomie*, pages 261–278. Springer.

Collis, J. and Hussey, R. (2013). *Business research: A practical guide for undergraduate and postgraduate students*. Macmillan International Higher Education.

Czarnecki, C. and Auth, G. (2018). Prozessdigitalisierung durch robotic process automation. In *Digitalisierung in Unternehmen*, pages 113–131. Springer.

Depietro, R., Wiarda, E., and Fleischer, M. (1990). The context for change: Organization, technology and environment. *The processes of technological innovation*, 199(0):151–175.

Dong, X. L. and Rekatsinas, T. (2018). Data integration and machine learning: A natural synergy. In *Proceedings of the 2018 international conference on management of data*, pages 1645–1650.

Engel, C., Elshan, E., and Ebel, P. (2021). Deploying a model for assessing cognitive automation use cases: insights from action research with a leading european manufacturing company. In *Proceedings of the 54th Hawaii International Conference on System Sciences*, page 6253.

Ferreira, D., Rozanova, J., Dubba, K., Zhang, D., and Freitas, A. (2020). On the evaluation of intelligent process automation. *arXiv preprint arXiv:2001.02639*.

Gadatsch, A. and Mangiapane, M. (2017). Vier dimensionen der it-sicherheit. In *IT-Sicherheit*, pages 17–22. Springer.

Ito, N., Suzuki, Y., and Aizawa, A. (2020). From natural language instructions to complex processes: issues in chaining trigger action rules. *arXiv preprint arXiv:2001.02462*.

Kleehaupt-Roither, B. and Unger, T. (2018). Von rpa-mythen zur automatisierungsstrategie. *Controlling & Management Review*, 62(8):48–56.

Lacity, M. and Willcocks, L. P. (2018). *Robotic process and cognitive automation: The next phase*. SB Publishing.

Langmann, C. and Turi, D. (2020). *Robotic Process Automation (RPA)-Digitalisierung und Automatisierung von Prozessen: Voraussetzungen, Funktionsweise und Implementierung am Beispiel des Controllings und Rechnungswesens*. Springer-Verlag.

Le Clair, C., Cullen, A., and King, M. (2019). The forrester wave™: Robotic process automation, q4 2019. *Forrester Research*.

Madakam, S., Holmukhe, R. M., and Jaiswal, D. K. (2019). The future digital work force: robotic process automation (rpa). *JISTEM-Journal of Information Systems and Technology Management*, 16.

Matthews, P. and Greenspan, S. (2020). *Automation and Collaborative Robotics*. Springer.

Mohanty, S. and Vyas, S. (2018). *How to compete in the age of artificial intelligence: Implementing a collaborative human-machine strategy for your business*. Apress.

Moiseeva, A., Trautmann, D., Heimann, M., and Schütze, H. (2020). Multipurpose intelligent process automation via conversational assistant. *arXiv preprint arXiv:2001.02284*.

Mullakara, N. (2020). *Robotic Process Automation Projects: Build Real-world RPA Solutions Using UiPath and Automation Anywhere*. Packt Publishing Limited.

Neifer, T., Lawo, D., Bossauer, P., and Gadatsch, A. (2021a). Decoding ipaas: Investigation of user requirements for integration platforms as a service. In *Wijnhoven, van Sinderen (Eds.): Proceedings of the 18th International Conference on e-Business, ICE-B 2021, July 7-9, 2021*, pages 47–55. SCITEPRESS-Science and Technology Publications.

Neifer, T., Lawo, D., and Esau, M. (2021b). Data science canvas: Evaluation of a tool to manage data science projects. In *Proceedings of the 54th Hawaii International Conference on System Sciences, January 4-8, 2021*, pages 5399 – 5408. ScholarSpace.

Sarkar, D. (2019). *Text analytics with Python: a practitioner's guide to natural language processing*. Springer.

Scheer, A.-W. (2020). Process mining. In *Unternehmung 4.0*, pages 85–102. Springer.

Scheppler, B. and Weber, C. (2020). Robotic process automation. *Informatik Spektrum*, 43(2):152–156.

Smeets, M., Erhard, R., Kaußler, T., et al. (2019). Robotic process automation (rpa) in der finanzwirtschaft. *Robotic Process Automation (RPA) in der Finanzwirtschaft*.

Stoudt-Hansen, S., Karamouzis, F., Villa, A., Ray, S., Dunie, R., Sturgill, N., Shotton, L., Miers, D., and Biscotti, F. (2019). Predicts 2020: Rpa renaissance driven by morphing offerings and zeal for operational excellence. *Gartner, available at https://www. gartner. com/doc/reprints*.

Taulli, T. (2020a). *RPA Foundations*, pages 1–25. Apress, Berkeley, CA.

Taulli, T. (2020b). *RPA Skills*, pages 27–51. Apress, Berkeley, CA.

Taulli, T. (2020c). *RPA Vendor Evaluation*, pages 101–114. Apress, Berkeley, CA.

Themistocleous, M. and Morabito, V. (2012). How can user-centred design affect the acceptance and adoption of service oriented healthcare information systems? *International journal of healthcare technology and management*, 13(5-6):321–344.

Türkoglu, C. (2020). *Robotik-Prozessautomatisierung mit SAP Intelligent RPA*. BoD–Books on Demand.

Van der Aalst, W. M., Bichler, M., and Heinzl, A. (2018). Robotic process automation.

Willcocks, L. P., Lacity, M., and Craig, A. (2015). The it function and robotic process automation. *The Outsourcing Unit Working Paper Series (May): 1–39*.

Zhang, C. (2019). Intelligent process automation in audit. *Journal of emerging technologies in accounting*, 16(2):69–88.