Process Mining and Robotic Process Automation: A Perfect Match

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Abstract. Robotic process automation (RPA) provides a virtual workforce to automatize manual, repetitive and error-prone tasks. However, successful process automation requires knowledge about the potential for automation, effective training of the robots and continuous monitoring of their performance. Within this paper, we illustrate how process mining supports organizations throughout the lifecycle of RPA initiatives. Our process mining application provides a visual and fact-based proof for automation capabilities and enables prioritization of activities. The application further supports the user by monitoring and benchmarking robots to ensure sustainable benefits. These insights are especially valuable for process managers and miners with a special interest in process automation.

Keywords: Robotic Process Automation, Process Mining, Best Practices, Use Case

1 Process Mining as Enabler for RPA Implementation

Robotic process automation (RPA) is a fast-emerging process automation approach[1] that uses software robots to replicate human tasks. After recording a process workflow, a virtual bot mimics the actions performed by humans in the application's graphical user interface and automates their execution [1]. Multiple robots form a virtual workforce that enables automation of many knowledge-related tasks and back-office work that has been previously executed by human workers [2]. The virtual bots are integrated in existing software and repeat tasks, often across multiple systems. Their configuration is driven by simple rules and business logic. Process steps can be fulfilled independent of time and are instantly scalable, as robots can easily handle volume increases. Thereby, relevant cost savings can be achieved. RPA guarantees accuracy and consistency of activities, as well as ensures first time correctly performed tasks. Potential use cases for RPA are, among others, data transfers and processing of high volume of data.

Process mining refers to a technique of data-driven process analysis that visually reconstructs the actual flow of business processes based on transaction logs from large

[1] It should be noted that there are many ways to automate processes. RPA is one of them, which is especially focused on repetitive workflows, where proper system integrations, such as APIs, do not exist.

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IT systems [3,4]. It allows to analyze what really happens within business processes including undesired process patterns, bottlenecks and compliance issues. Via data visualization components, users of process mining software can drill down the data, spot deviations from the ideal process and detect root causes of inefficiencies. Process mining essentially enables digital transformation by identifying improvement potential with respect to key success factors like efficiency, speed, agility and compliance. Beyond that, process mining assists in detecting solution strategies (e.g. process transformation, human change or technology shift) and selecting suitable measures for strategy implementation (e.g. automation, user training or system migration). Also results of the implementation can be monitored and sustained with process mining.

Within this paper, we present an approach to use the power of process mining to enable effective RPA activities as part of automation initiatives within process transformation. For a successful symbiosis, we suggest the following three-step approach for process automation via RPA:

Fig. 1. Steps for a successful combination of RPA and process mining

Assessing RPA potential. The first decision within RPA refers to the discovery of potential for process automation. Typically, within a company there are dozens of process types and process steps with different levels of automation. For a successful RPA implementation, processes should be scalable, repetitive and standardized [2]. If an organization runs complex and non-standardized processes, automation must be implemented with extra precaution. Replicating a complex process with many variants using RPA is typically tedious and requires significant investment. Moreover, the cost of maintaining and servicing the robots could outweigh their acquired savings. It is therefore crucial to understand the maturity of business processes and decide which processes are standardized enough to benefit from RPA and which processes would benefit from harmonization and standardization prior to starting an RPA initiative.

Once processes are standardized, the highest potential for automation within an organization should be detected. Most systems have some form of automation already in place, so looking at current automation rates within processes is crucial to define RPA targets. Furthermore, there might be specific cases, by geography, vendor or material, where manual work is widespread. By comparing automation rates, users can explore, where current automation solutions might be improved and where additional automation could create benefits like reduction of throughput times or improvement of other process-related performance measures.

Developing RPA application. The next step covers the training of the RPA application. As a best practice, users should start to train robots with the existing workflow. The trained robots start their work within a pilot project and their activities are tracked by the underlying IT systems. After a sound number of executions, the generated process instances can be evaluated by using the process mining application. The

performance of different robots and the non-robotic supported processes should be benchmarked to identify the most effective RPA implementation.

Safeguarding RPA benefits. After selection and implementation of the most effective RPA applications, continuous monitoring ensures tracking the impact of the RPA initiative and especially its return on investment. Process mining enables the user to see how processes change over time due to RPA. It also immediately detects when a process evolves and how robots need to adopt to an alternating business environment.

2 Case study

For the case study, we use a demo data set of the Purchase-to-Pay (P2P) process obtained from a SAP ERP system. P2P is a common business process with many standardized and highly repetitive transactions providing potential for automation. The demo data covers 395,315 purchase orders created over one year. The application for RPA evaluation is integrated in Celonis Process Mining [5].

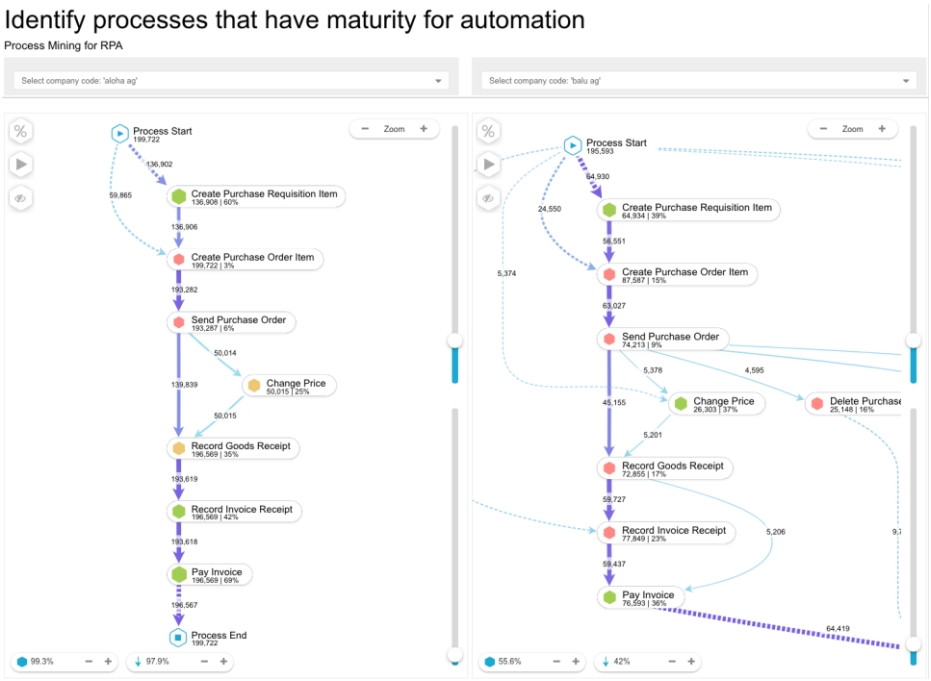

Fig. 2. Benchmarking between standardized (left picture) and non-standardized (right picture) process flows allows identification of processes with maturity for automation.

Assessing RPA potential. As automation rates become transparent, process mining allows the user to quickly and easily understand the maturity of business processes and to identify the largest automation opportunities [6]. Besides standard event log data

(case ID, activity and timestamp), which has been extracted from the SAP database tables, we also obtain information about the user type executing the process activities. In SAP, manual users are tracked as dialog users, robots are marked as system users. For each activity stored in the event log, we compute the automation rate as ratio of cases where an activity was executed by a system user divided by the total number of instances of this activity. Within the process mining application (see Fig. 2), the automation rate is added as performance indicator to the process explorer and can be seen together with the number of cases below the activity names. To identify maturity of business processes, we implemented a benchmarking analysis comparing processes of different subsidiaries. In the case study data, we see two companies: Aloha AG (left picture in Fig. 2) and Balu AG (right picture in Fig. 2).

Comparing both firms, we can conclude that process maturity level is much higher for Aloha AG. From the example, which shows 99.3% of all P2P activities of Aloha AG, we see a quite linear process flow with a low number of deviations. In contrast, just 55.6% coverage for Balu AG generates a complex and non-standardized process picture. In this case, increasing the automation rate through RPA would cost much effort to train robots such that they handle all deviations and variants in the process. Hence, we can conclude from our process mining application, that the process maturity and consequently the readiness for RPA is higher for Aloha AG.

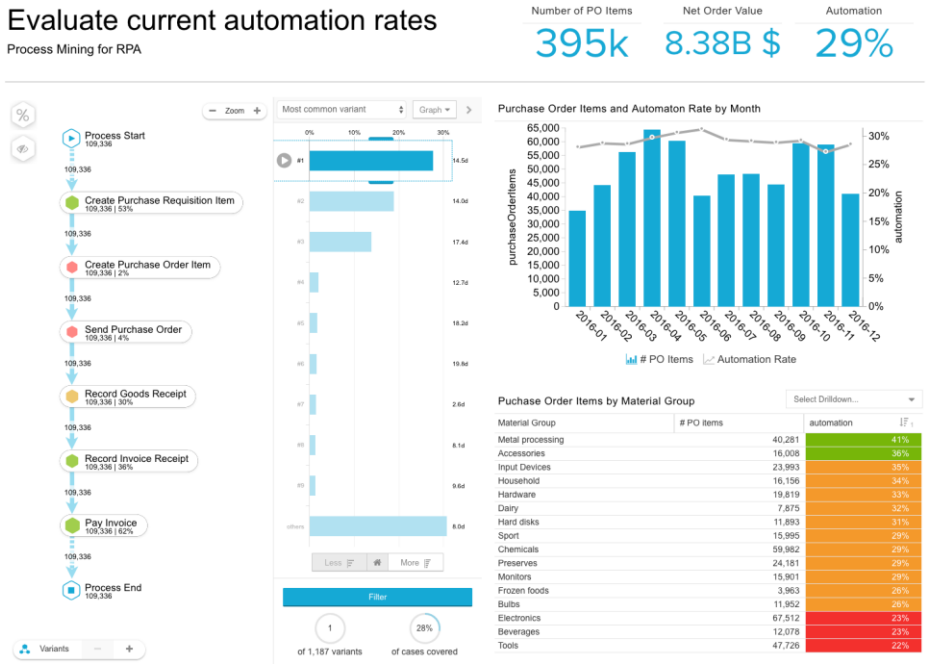

Fig. 3. Illustration of current automation rates allows identification of RPA potential.

Moreover, process mining accelerates the implementation of RPA by streamlining processes prior to an RPA initiative and thereby decreasing time and cost of the robots'

training. For non-standard processes, process mining provides insights about the root causes driving complexity, so users can standardize the process first before moving on to RPA. For example, we can see from the OLAP table in the bottom right part of the analysis in Fig. 3, that the current automation rate for specific material groups, like 'Metal processing', is already at a good level compared to other materials like 'Tools'. Starting with the low-hanging fruits, i.e. cases with low automation rates, often provides faster benefits from RPA than increasing the automation rate of already highly automatized process steps. In summary, the process mining application enables the user to detect the potential for automation, but also the business impact of automation by showing the change in throughput time and other process performance indicators when automation rates increase.

Developing RPA application. After selecting the target process and identifying as well as prioritizing the best automation opportunities, various robots can be trained by the RPA application, e.g. by recording the manual processes steps in the front-end (here: the SAP ERP interface for P2P). As it is usually unclear in advance, which process variant is most effective, different robots are trained by different process execution paths. When training is finished, the process robots are deployed in a pilot project. While common RPA applications record the performance of single robots, process mining acts as a supervisor that benchmarks different robots, compares them with non-automatized executions and therefore allows to select the best performing implementation. Via user interaction analysis as part of advanced process mining features [7], the application gives detailed information about the robots' performance. Different robots can be compared to choose the best execution pattern. Fig. 4 illustrates this performance analysis. We can see the most important process performance indicators of the different robots as well as their interaction with human users ('Cases come from' and 'Cases go to'). Users can also track the activities performed by the robot as well as compare different robots and their activities as shown in the bottom section of Fig. 4.

Safeguarding RPA benefits. When robots are trained effectively, they can be deployed and actively used in daily business operations. While running automations, users should continuously maintain and increase automation capabilities. Our process mining application for RPA enables the user to continually monitor the processes from end-to-end and to adjust the robots' behavior when systems or other conditions change.

After successful implementation, users can start the three-step procedure again by identifying new processes for automation.

3 Application: How Vodafone combines RPA and process mining

The RPA use case presented here is implemented in Celonis Process Mining and has already been applied by several thousand users around the world to deploy their RPA initiatives with the help of process mining. Also Gartner highlights in their recent Market Guide for Process Mining that process mining is a key enabler when it comes to

RPA initiatives, since visualizing and understanding the process context as well as spotting and prioritizing opportunities for task-level automation are huge success factors [8].

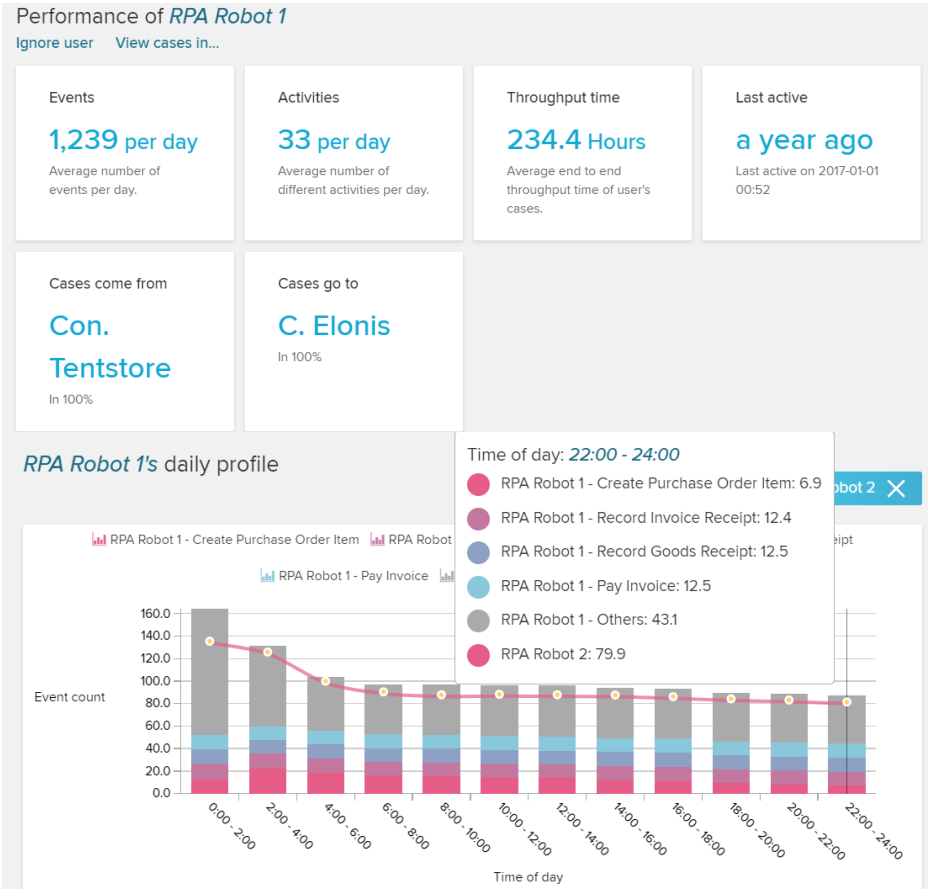

Fig. 4. Comparison of RPA applications enables the user to continuously monitor performance, to compare the trained robots and to sustain RPA success.

A successful example for the combination of RPA and process mining can be found at the global telecommunication giant Vodafone. Process mining alerted Vodafone that many orders with excessive throughput times arise due to complex deviations from the standard process before they are sent out to the supplier [9]. These non-standard cases require a high level of human interaction and thus can hardly be automatized. Via process mining, Vodafone could quickly identify these cases, adjust them and determine how RPA can easily and automatically replicate the humans' role in repetitive processes without error and at a faster speed [10]. RPA enables Vodafone to achieve a perfect order rate of 92% and through this to reduce operational purchasing costs, to realize

faster time-to-market and to have more time for strategic, value-adding activities requiring human competencies. Vodafone also conceived that challenges of an RPA implementation come with a lack of transparency as well as automating a process that is not efficient and without business impact. Thus, implementing automation based on insights that originate from transparency created through process mining is a key to successful RPA initiatives [11].

4 Best practices for a successful synthesis of RPA and process mining

Based on the application of the RPA use case, we propose the following aspects to be key drivers of a successful symbiosis of RPA and process mining:

Selection of an appropriate use case. RPA unfolds its maximum potential on rule-based processes with high volume of manual tasks and handling time; processes with fixed procedures, that are standardized and mature; and processes where a technical integration via the backend is too costly and/or impossible. In these manual processes, it helps to eradicate human processing errors. Process mining can give guidance to RPA initiatives and points at the most eligible processes for automation. Common applications to achieve fast benefits from RPA are, among many others: transferring data from one system to another, payroll processing, customer registrations, customer profile updates, generation of standard reports, or data cleansing.

Standardization before automation. To be most successful, variation in business processes should be minimized before starting RPA. This means that process variants must be standardized to generate high volumes of transactions per variant. Through such a standardization, users can avoid expensive loops during RPA realization, speed up implementation time, increase success rates and achieve maximum return on investment.

Prioritization of activities. Usually, the number of potential use cases exceeds the resources available to do all projects at once. Thus, it is important to use available resources to achieve maximum results in a short period of time. Prioritizing is a key factor of successful RPA initiatives, as it allows to realize low-hanging fruits and to generate quick wins. Experience shows that starting RPA with processes exhibiting low automation rates can generate faster benefits than increasing automation of process that are already highly automatized. Process mining supports the structured prioritization of RPA projects.

Establishment of a central, coordinating unit in the organization. Moreover, establishing a central unit or task force within an organization helps to work out an overall RPA roadmap, to evaluate a high volume of ideas coming up, to prioritize initiatives in the best way, to accumulate knowledge and to define successful projects as benchmarks for future RPA activities.

Continuous monitoring of results. An RPA initiative is not a one-time project but requires to continuously track results and to use findings for ongoing improvement.

This is where process mining provides fast and powerful insights into RPA's impact on process performance KPIs such as throughput times. This aspect also includes to constantly benchmark projects with successful prior initiatives to gain maximum value from automation.

5 Demo license

A free demo license of Celonis including the RPA use case can be accessed by academic users after registration in the Celonis Academic Cloud [12,13]. This license can also be used for academic teaching.

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