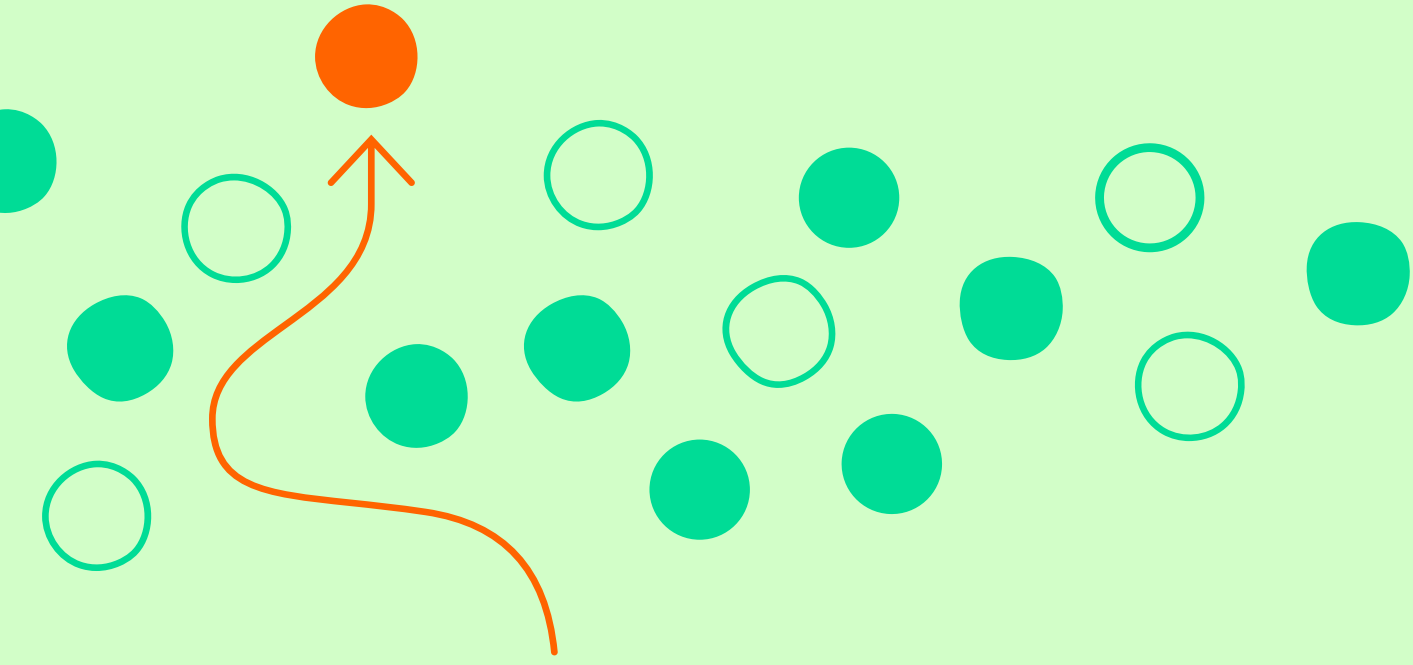
Revolutionizing IT operating processes

The potential of merging RPA and AI

January 2024



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1 Introduction

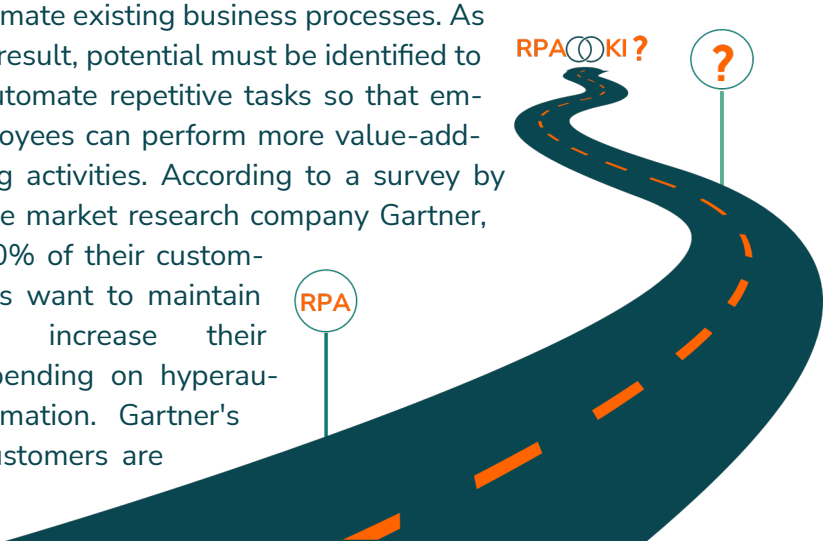
IT operations comprise the daily processes of an (IT) department. This includes the processes of implementing, managing, providing and supporting IT services to meet the business requirements of internal and external users. They form a central component of information technology operations [15].

The core tasks include resource management, optimizing the IT infrastructure, ensuring application performance and supporting the service desk. The aim of IT operations management is to ensure that a department works smoothly and efficiently and meets the company's requirements [16].

In the course of the digital transformation that many companies have been undergoing for years, the number and complexity of digital processes are increasing. In addition, increasing cost pressure requires process efficiency to be increased. This means that processes should only go through the necessary steps in the shortest possible time.

It is therefore crucial to define methods that contribute to increasing process efficiency.

One way to meet these challenges is to automate existing business processes. As a result, potential must be identified to automate repetitive tasks so that employees can perform more value-adding activities. According to a survey by the market research company Gartner, 80% of their customers want to maintain or increase their spending on hyperautomation. Gartner's customers are therefore striving for increased development of hyperautomation [17].



Hyperautomation is a comprehensive approach to automating business processes that integrates technologies such as artificial intelligence, machine learning, robotic process automation and analytics. It aims to automate not only repetitive but also complex tasks to increase the efficiency and agility of companies [24].

To provide an insight into forms of hyperautomation, this study looks at two such technologies: robotic process automation (RPA) and artificial intelligence (AI).

RPA is a technology that has been established for several years. It is currently used to automate simple processes. However, it has been shown that RPA is currently still prone to errors and therefore has potential for improvement [18].

Compared to RPA, AI is a newer, emerging technology that could have a disruptive impact on automation processes in companies [19].

The aim of this study is to answer the question of whether and how RPA and AI technologies can work together in the future to automate business processes. To answer this question, a distinction is made between the near and medium-term future.

2 Technical introduction

To provide an overview of RPA and AI technologies, they are first defined in the following chapter and then their strengths and weaknesses are explained.

2.1 Robotic Process Automation

"Robotic Process Automation is a general term for computer programs that mimic and replicate human activities by imitating manual, screen-based manipulations" [1]. Essentially, RPA is the operation of a computer system with mouse and keyboard inputs, analogous to the actions of a human user. Modern RPA tools are developed by various companies. They contain a graphical user interface (GUI) and can be operated without any knowledge of programming.

> **Robotic Process Automation is a general term for computer programs that mimic and replicate human activities by imitating manual, screen-based manipulations.**

In practice, the use of RPA often merges with other forms of automation, e.g. control of program-internal automation such as Excel VBA. This is also supported by the common RPA software providers, which allow other forms of automation to be integrated into an RPA workflow. Therefore, it is important to understand that process automation created using RPA tools can also include other automation solutions for individual applications.

The executing instance of a process automated with RPA is referred to below as an RPA bot.

RPA bots work across all applications and regardless of whether there is a software interface (API) or program-internal automation. This is particularly relevant for applications for which there are no interfaces, meaning that there is no other option for automation.

The potential for RPA bots lies particularly in repetitive, straightforward tasks. It is important that the process to be automated is analyzed and documented very precisely so that process variants and exceptions are known.

Generally, increased complexity of the process, e.g. due to a high number of process steps and/or a high number of applications, is not an obstacle to the applicability of an RPA bot. This applies as long as the process remains straightforward, and the bot can follow the manual input of a human user. With increasing complexity, however, the implementation effort and susceptibility to errors increase. Even the smallest process deviation - be it an unexpected pop-up, a minimal shift of a button in the GUI, a changed file path or spelling mistakes - will cause the bot to issue an error message and require human intervention to correct the error. This is one of the reasons why, in practice, more stable automation options such as scripts and program-internal automation are often used for automation if possible.

For processes that involve several applications, a combined solution in which a workflow is controlled by an RPA bot and consists of RPA modules and other types of automation is a good option. Decisions that cannot be made with an if-then query are also an exclusion for the use of an RPA bot.

Many of the weaknesses of RPA technology are based on its lack of flexibility and intelligence. This is a possible starting point for AI.

2.2 Artificial intelligence

The term "artificial intelligence" refers to a large field of software technology. The European Parliament defines artificial intelligence as "the ability of a machine to imitate human abilities such as reasoning, learning, planning and creativity. AI systems are able to adapt their actions by analyzing the consequences of previous actions and working autonomously" [2].

As this definition is very broad and not all AI-solutions are relevant for process automation, it is necessary to narrow down which sub-areas of AI are considered for this study.

In the context of RPA, AI can be used on the one hand to collect and record information and data. On the other hand, it is used to process information. This includes capabilities for analyzing, interpreting, learning and automated reasoning [1].

In the field of data acquisition, computer vision (CV) is used to extract information from image and video files. CV uses algorithms to recognize complex patterns in images and videos. Areas of application are wide-ranging and include face and object recognition [3]. One area of CV is Optical Character Recognition (OCR). OCR enables the extraction of text from images, scanned documents and even images with text elements such as traffic signs [1]. This technology can be used whenever information to be processed is not available in machine-readable form, e.g. PDF documents or scanned documents.

In the field of data processing, one well-known technology is machine learning (ML). To process data, ML uses existing data to recognize patterns and correlations to generate new knowledge or train algorithms [4].

The fourth technology considered is Large Language Models (LLMs), which belong to the category of Natural Language Processing (NLP) [5]. LLMs are trained using extensive data sets and can fulfill a variety of language-related tasks. They are characterized by the fact that they generate contextually relevant and coherent texts, understand and interpret natural language and provide answers to queries. LLMs demonstrate a high level of linguistic competence. Their performance on tasks that require a deep understanding of a real-world context is largely determined by the data on which they have been trained and can therefore be limited. A well-known example of an LLM is ChatGPT. This LLM represents a deep learning algorithm based on large datasets and is called a neural network (NN), inspired by the functioning of the human brain [6, 7, 8].

> **Artificial intelligence is the ability of a machine to imitate human abilities such as logical thinking, learning, planning and creativity. AI systems are able to adapt their actions by analyzing the consequences of previous actions and working autonomously.**

These additional skills can be used to automate more complex processes in the future. Complex process preparations can also be simplified as, for example, data does not have to be converted into a machine-readable form but can be used directly using NLP and CV/OCR.

One challenge of AI is that external servers and systems are accessed for many applications, as they require high computing power. When sensitive data is used, this raises concerns about data protection and data security. Appropriate framework agreements must be drawn up or data must be anonymized beforehand. This

statement refers to the application in Germany; in other countries such as the USA and China, other conditions may apply.

Some applications in the field of AI are also not yet fully mature. These include market-leading applications such as ChatGPT, which are still experiencing initial difficulties [24,25].

Even if AI technology is not yet fully developed, there is still great potential in the field of automation [26]. This potential could lead to AI supporting RPA technology to a greater extent in the future. To make the best possible use of the potential of both technologies, it makes sense to combine them. In the literature, the combination of RPA and AI is usually referred to as Intelligent Process Automation (IPA) [27, 28]. AI components are usually integrated into the RPA workflows as support.

2.3 Technology classification RPA and AI

When assessing the future development of a technology, it is important to place it in the context of other technologies and to consider the maturity level of the technology. The Gartner Hype Cycle is suitable for assessing the maturity level.

RPA technology already reached its "peak of inflated expectations" in 2018. As of 2023, it is on the "slope of enlightenment" (see Illustration 1). This means that the technology is being used by an increasing number of companies. In this context, the potentials, risks, strengths and weaknesses can be assessed, and the number of practical application examples is increasing [29].

In contrast, generative AI is at the "peak of inflated expectations" in 2023. This means that expectations of the technology are at their peak. At this stage, there are many positive predictions about the impact of the technology, but also some exaggerated predictions that may lead to failures due to unfulfilled promises [29].

This illustration clearly shows that RPA and AI are at different stages of maturity and are therefore perceived differently. As RPA already has the most hype behind it, but AI is currently at the forefront of the hype, it is natural that AI enjoys greater attention. It remains to be seen which of the announced potentials can ultimately be

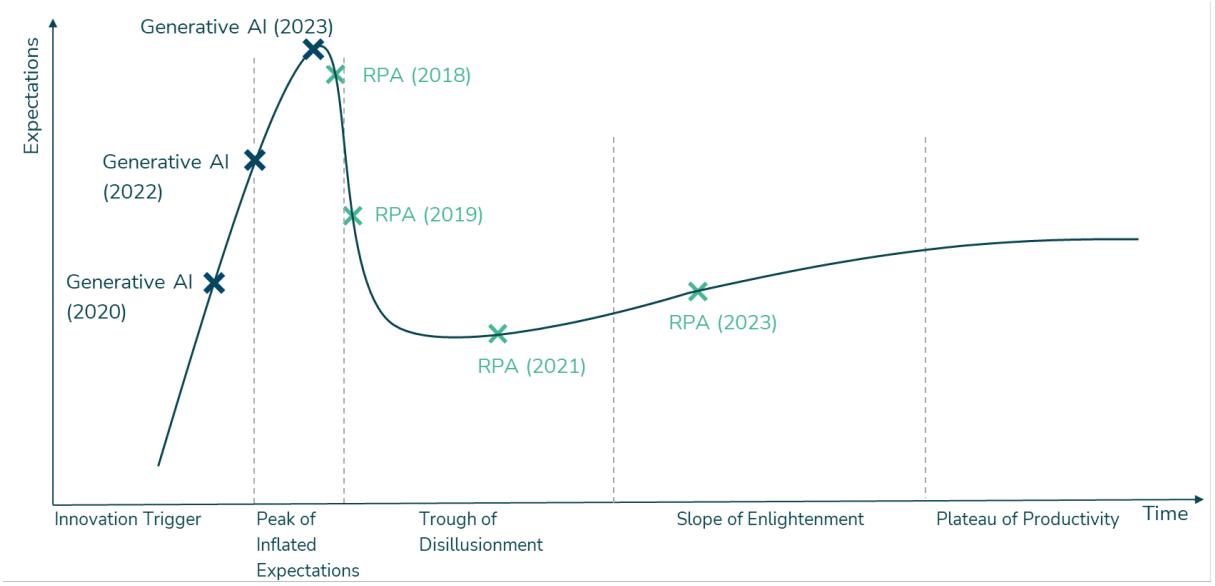


Illustration 1: Gartner hype cycle RPA and AI; own illustration based on [9, 10, 11, 12, 13, 14]

exploited. This study will therefore look at the actual application of the two technologies to understand how they are used operationally.

3 Case Study

A real use case at a corporation was analyzed to identify the potential and limitations of RPA in operational implementation and possible solutions using AI. This ensured that even the hidden operational problems became apparent.

In order to identify a suitable use case, interviews were conducted with ten experienced AI and RPA users.

The interviews revealed that AI users did not consider RPA to be a topic of great relevance in the future (see Illustration 2). They saw a strong potential for RPA to be replaced by AI applications in the future. This was also justified by the currently very high investments in generative AIs and LLMs.

However, discussions with RPA users revealed a different picture. They emphasized that there is still further development potential for RPA technology, which is also reflected in the ongoing developments on the part of RPA software providers in recent years. It was also emphasized that the widespread use of RPA is slow and that many organizations are only now starting to implement it. From this, the RPA users formed the hypothesis that there are still many processes that can be automated with little effort using RPA and do not require complex AI tools for automation.

The selected use case is explained in more detail in the following section.

3.1 Real use case: "SAP document storage"

The automation use case comes from the controlling department of a corporation.

The following is a rough description of the process flow (see Illustration 3; Note: the process itself was not questioned). When a customer order is received, it must be entered into the SAP system. A work breakdown structure (WBS) is created for this purpose. The received order documents are then manually downloaded to the local computer and finally attached to the SAP order.

The last two sub-processes are well suited to automation with RPA, as the process

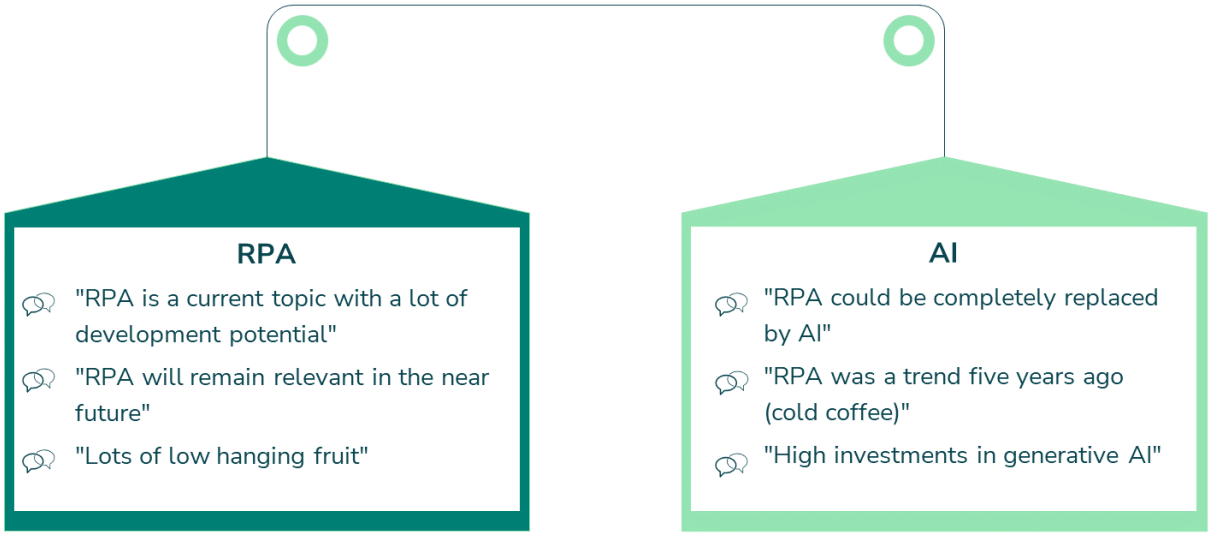


Illustration 2: Selected statements from the interviews with AI and RPA users; Own illustration

steps are always identical and do not require any decisions. In addition, the savings potential in the company is considerable due to the high time expenditure of up to 267 hours (33 working days) per year. Due to the confidentiality agreement with the case study partner, the exact derivation of the savings cannot be explained in more detail.

The automation of the process using RPA poses the challenge that the preceding process must be error-free. This is because if an error occurs when sending the document (e. g. a wrong document is being sent), this incorrect document is stored in SAP. If a human user carries out the process, they will perform a plausibility check and avoid the incorrect filing.

Generally, a comparison by an RPA bot would also be possible. For this, the documents would have to be machine-readable and always follow the same schema. Attributes such as the order number in the email and document could then be compared. If there is a match, the document is stored and otherwise an error message is issued. However, as the documents in this use case come from different companies and have different formats, this requirement is not met and a comparison by RPA bots would be complex to implement and very error prone.

The use of AI modules is therefore recommended in this case. The information from the documents can be converted into a machine-readable form using OCR. CV components can be used to recognize company logos in documents and then categorize them. This information can then be transferred to an LLM to carry out a target vs. actual comparison between e-mail, order documents and information in the SAP system. The document is then only stored after a positive comparison. In addition, the LLM can be improved over time using ML by training the LLM with existing and newly added order documents.

3.2 Suggestions for further use cases

Within the same use case, WBS creation represents further potential for the use of AI components.

In this process step, the user manually creates a WBS for each order based on the information from the order documents and their experience in past projects. This is a time-consuming process that takes up an increasing amount of time as the complexity of the project increases. On average, it takes around 933 hours (116 working days) per year for the company in question.

To support the processor, a LLM could be trained with ML, which suggests the structure for the WBS to the processor. The processor would then only make minor adjustments. This would save around 70 percent of the workload, resulting in a reduction of 666 hours (83 working days).

Another advantage is that the high number of past orders would form a good training basis for the ML. This data set would be continuously supplemented by new orders.

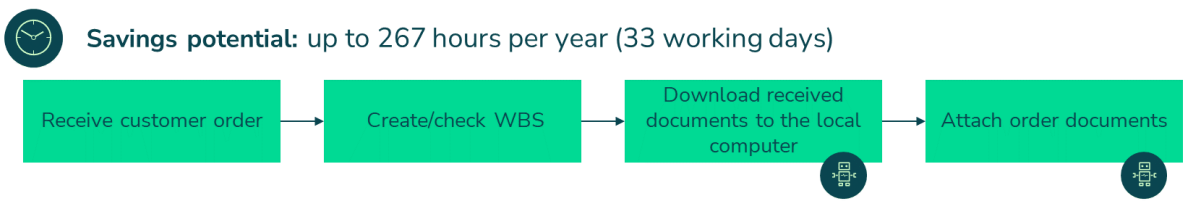


Illustration 3: SAP process document storage; Own illustration

This is an advanced AI application with greater complexity than the applications mentioned so far. In this example, the share of the RPA bot in process automation also decreases in comparison to AI. This increasing AI share in the value creation of automation is a direction in which RPA technology in conjunction with AI could increasingly converge.

In addition to the two use cases mentioned so far, a third use case is shown below, which is in the area of ticket systems. As soon as new tickets are entered into the system, e.g. change requests, they must be assigned to the relevant departments. Each ticket must be read and then categorized accordingly. This process step can be automated using IPA, as it always follows the same process steps. The AI can be trained using ML to categorize the tickets correctly. Past tickets would provide the training data for the database. In the process, the RPA bot is used to correctly categorize the tickets using the AI and assign them to the departments.

As it is common practice in collaboration projects for each company to operate its own ticket system, it is necessary to transfer tickets from one system to the other. It may be necessary to check the ticket content for compliance-critical issues. To prevent the transfer of critical data, an AI can be trained to act as a data filter.
Insights into collaboration projects can be found in another C4D study, see [30].

4 Findings of the study

The following section summarizes the findings of the study. The collected knowledge is first presented in the "Overview" chapter. The following two chapters highlight the potential and limitations of AI that were identified in this study in connection with RPA applications. Recommendations for the implementation of RPA bots are also provided. An implementation checklist is presented for this purpose. The role of RPA with AI today, in the near future and in the medium term is then explained. It should be noted at this point that the results relate to the RPA provider UiPath, as the case study partner uses this tool.

4.1 Overview

RPA and AI represent two fundamentally different forms of automation. While RPA processes fixed routines, AI acts intelligently and flexibly. Currently, RPA tools are mainly used to automate applications that are operated via a GUI and do not offer any automation options of their own. Although the automation of more complex processes is being planned, it requires adaptability to be successfully implemented. This shows the potential of AI to complement RPA in the area of automation [20].

Due to their susceptibility to errors, RPA tools are often supplemented by alternative automation methods. Based on said susceptibility to errors, RPA processes must be carefully analyzed and documented before the bot is executed. This allows possible process variants and/or exceptions to be identified at an early stage. External companies that are involved in internal business processes must consider licenses and access authorizations for internal systems.

There are no fixed rules for the amortization period, as each company must determine this individually. The case study partner gave a guideline value of around one year.

4.2 The potential of AI

Considering when it makes sense to use AI tools requires weighing up various factors. The structuring of the data, its quality and data protection play a decisive role here.

The efficient functioning of an ML model depends largely on the structure of the data. Well-structured data, such as clearly formulated texts and clearly recognizable symbols in documents, enable more precise pattern recognition. These points are equally helpful for the efficiency of LLMs.

4.3 Limits of AI

There are challenges in the application of RPA where even AI does not provide a solution. This can be the case when it comes to dealing with the high dynamics of incoming or outgoing documents (e.g. by email), the transfer of files on shared network drives, the insufficient availability of input data, changes to external systems (e.g. software updates from manufacturers) or errors in the programs used. It is also important to observe data protection, especially when dealing with customer data. Each company must examine this individually, but C4D's general recommendation is that this data should not be used directly by generative language models and should be anonymized before being used in such models.

Data protection must also be taken into account in the context of AI. Generative language models can process data in external clouds, which may not be permitted for customer-related and confidential data - as regulated by the case study partner. It must therefore be ensured in such cases which data may be processed in the models. Solutions such as "ChatGPT Enterprise" now make it possible to influence where the data is processed [21,22].

4.4 Implementation checklist

The implementation checklist is divided into four categories: Basic Requirements, Process Complexity and Stability, Benefits of Automation and Information Security/Compliance.

The implementation of RPA bots requires certain basic prerequisites. On the one hand, it is crucial that identical processes are used consistently in every step without allowing dynamic changes. In addition, the data to be processed must be available in a machine-readable format.

Process complexity and stability require thorough knowledge of all possible exceptions that could affect the smooth running of the RPA process. Prior identification of the applications in the process and the influence of external processes are essential.

Several factors play a role when it comes to the benefits of automation. These include the number of users, the frequency of process execution, the time saved per process and, last but not least, the number of unquantifiable benefits. These help to calculate the payback period.

Aspects such as data classification, the clear assignment of responsibilities for the bot and the precise definition of access authorizations in the area of bot and RPA development are of great importance for information security and compliance.

This results in the following checklist (based on [31] and case study partner):

Category	Question	Supplement
Basic requirements	Are the process steps always the same?	If no: Design process steps identically and define a uniform standard.
	Is the required data available in machine-readable format?	If no: Convert data into a machine-readable format (.csv, .xml, etc.).

Category	Question	Supplement
Basic rqrmts.	Is the data structured or unstructured?	The more structured the data is, the more efficiently AI can help.
Process complexity/stability	Can the information be provided or does it have to be added manually?	
	Are there any known exceptions?	Identify exceptions to avoid disruptive factors in the process.
Process complexity/stability	How many applications are addressed within the process? Which are these?	Check possible correlations between processes.
	Which external processes influence the process steps?	Identification of external systems that interact with the current system
Advantages of automation	For how many people is the process automated?	
	How often is the process carried out?	
	How long does the manual execution of the process take [min.]	
	What are the qualitative advantages? (higher data quality, employee satisfaction due to the elimination of administrative tasks)	
Information security / Compliance	Are additional permits required?	Important for external companies so that maintenance and development can be carried out on internal systems. The bot's access authorizations are also crucial.
	What data classification is the process based on?	
Technical criteria	Is there an alternative software to automate the process?	Check whether alternative is less error-prone.

4.5 The role of RPA and AI today

RPA is in operational use today. The identification of weaknesses in the daily use of RPA is common practice. The integration of RPA and AI applications has not yet progressed to any great extent, and the separate use of both technologies is still widespread. Due to the limited availability of fully developed AI tools, companies are still hesitant to implement them in existing business processes.

In addition, AI as a new technology will initially be increasingly tested in smaller applications based on internal company test data. This suggests that RPA tools will retain their less flexible mode of operation for the time being until AI tools are sufficiently developed to be seamlessly integrated into RPA processes.

4.6 Role of RPA and AI in the future

In the near future, RPA processes will be improved by AI approaches. This means that existing RPA processes can be made more intelligent and flexible. RPA and AI tools will continue to develop and will be able to be used in combination in the first automations. It will be possible to automate more complex processes. First of all, errors and potential stumbling blocks in RPA processes must be eliminated.

In the medium-term future, RPA and AI will be more deeply integrated with each other, as AI technology will then be more mature. RPA tools will remain relevant as the executing instance, but AI will increasingly determine the dynamics in the individual process steps so that the process does not necessarily have to run in a completely straight line and can react more flexibly to changes.

It is also conceivable that the creation of RPA workflows will become easier, as AI components can recognize process sequences and therefore do not need to be given every step in detail.

5 Conclusion

In the area of IT operations, companies are under increasing pressure to manage the growing number and complexity of digital processes as a result of digitalization. To do so, it is necessary to increase process efficiency. One suitable way is to automate these processes using RPA. However, a major weakness of this technology is its susceptibility to errors. It requires careful process selection and documentation as well as the identification of process exceptions.

AI components can be added to counteract the weaknesses of RPA technology. Here it is important to focus on the relevant subareas of AI that can support RPA technology, especially in the collection and processing of information and data. CV, OCR, ML and LLM were considered in this study.

CV and OCR can be used to extract information from image and video files.

In data processing, ML can be used to recognize patterns and correlations in existing data.

LLMs understand and interpret natural language and can provide answers to queries. They are trained using extensive text datasets.

All these components enable the processing of complex data and help to automate more complex processes in the future.

In the case study presented, the limitations of RPA technology and corresponding AI solution approaches were examined. The use case demonstrates the need for AI components to overcome the limitations of RPA, e.g. when processing differently structured documents.

The results of the study show that RPA will be improved by AI approaches in the near future and that a deeper integration of RPA and AI can be expected in the medium term.

The findings and statements presented in this study do not claim to be exhaustive. They only represent the information that could be gathered during the case study and in the limited time period.

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Authors

Shayan Keramati-Pasikhani - Analyst

William Oatley - Analyst

Simon von Rüden - Consultant

Wassef El Chami - Manager

Daniel Grebesich - Partner

Contact us

+49 30 39978-9787

info@consulting4drive.com

www.consulting4drive.com

Helmholtzstraße 2-9, staircase J

10587 Berlin

Managing Directors: Michael Junger, Wolfgang Wukisiewitsch