

# **ACCELERATING DIGITAL TRANSFORMATION IN HIGHER EDUCATION WITH ROBOTIC PROCESS AUTOMATION**

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## **Abstract**

Although the process of digitization in higher education began a long time ago, unfortunately, as various studies have pointed out, many higher education institutions are not yet fully prepared, facing challenges associated with the need for accelerated digitization caused by pandemic. However, the COVID-19 crisis has provided an opportunity to find digital solutions that are inexpensive and can be applied as soon as possible. Leveraging digital development opportunities in education is supported by emerging technologies. In this regard, this paper aims to present how Robotic Process Automation (RPA) technology can help higher education (HE) institutions in their journey of digital transformation, taking into account the different perspectives of teachers and students, researchers, and administrative staff. Although currently there are some studies and scientific papers dealing with the adoption of RPA to solve some of the issues related to higher education and to support teachers, there is little previous research on how RPA-based solutions could help streamline researchers' activities, administrative staff and students. According to a report published by Gartner, Inc. in September 2020, global RPA software revenues are expected to reach \$ 1.89 billion in 2021, registering an increase of 19.5% over 2020. Moreover, various researchers estimated that the global RPA market will continue to grow by double digits until 2024. The paper presents some of the main possibilities that open up with the application of such solutions in higher education institutions. Moreover, we present some of the key issues and challenges posed by the adoption of RPA in higher education. In order to ensure the adoption of RPA, several solutions need to be taken into consideration by different higher education stakeholders. For instance, a digital transformation strategy should be developed, to encourage open-mindedness towards automation. Given the potential that RPA offers for higher education institutions, we estimate the intensification of RPA adoption in higher education.

**Keywords:** Robotic Process Automation (RPA), higher education, digital transformation.

## **1 INTRODUCTION**

The current challenges of the global context and technological development emphasizes the need for higher education institutions (HEI) to find new ways of digital transformation. By digitizing paper-based system, universities already start their digital transformation and increase operational efficiency. Although this was a great way to start on a digital transformation journey, it has limited potential to scale. Thus, according to [1], "the pandemic has reshaped expectations of higher education—but it's also created an opportunity for institutions to accelerate their digital transformation." It is time to put into practice new ways of thinking and working, using technology to automate and optimize activities. Using Robotic Process Automation (RPA) higher education institutions could quickly make headway on their digital transformation initiatives. In 2019, "Forrester predicts that automation will become the tip of the digital transformation spear, impacting everything from infrastructure to customers to business models" [2]. The RPA industry is currently considered one of "the fastest and most dynamic in technology". In recent years, RPA implementations are increasing due to the savings in money and resources that can be achieved by adopting RPA solutions. According to Gartner [3], worldwide robotic process automation software revenue is expected to reach US\$1.89 billion in 2021, an increase of 19.5% from 2020, according to the latest forecast. Researchers at Hadoop estimate that

by 2025, “RPA software is expected to perform the same output as 140 million full-time employees, having a potential impact of \$5 to \$7 trillion” ([3]-[5]). In this context, the market interest for robotic process automation (RPA) has increased.

Although there are studies and research papers presenting RPA application in industries, however, despite the significant improvements RPA can create, few studies have been focused on the RPA adoption in higher education. In higher education, various examples of RPA implementation can be found, from the simplest ones, such as generating mass emails for specific students to more sophisticated ones, such as using optical character recognition (OCR) techniques to automatically extract the data from paper-based application forms and to automatically enter them into a data processing system.

The aim of this paper is to present the contribution that RPA can have for higher education to face various challenges in the conditions of digitalization. In this regard, we tried to provide a perspective on the potential of RPA for various stakeholders in higher education, presenting some examples of how RPA can be used by students, teachers, researchers, and administrative staffs alike. Following this, the feasibility of RPA solutions in higher education was demonstrated by implementing a pilot project that applies RPA in prospective students’ admission system and students’ management system. A new wave of automation opportunities, Intelligent Process Automation (IPA) is coming, offering new digitally inspired ways of thinking and working. The last section concludes the paper.

## **2 METHODOLOGY**

The research objective of this paper, i.e., accelerating digital transformation in higher education with robotic process automation, has been broken down into the following research questions:

RQ1. What is Robotic Process Automation (RPA)?

RQ2. What advantages would the adoption of RPA bring in the higher educational process?

RQ3. How could university research benefit from RPA?

RQ4. What are the challenges facing administrative staffs in universities, to which RPA could provide solutions?

Next sections of the paper try to provide answers to the above questions.

## **3 ROBOTIC PROCESS AUTOMATION BACKGROUND**

In Robotic Process Automation (RPA), robots, or “bots” in short, are “software agents capable of interacting with software systems by mimicking user actions” [7]. Replacing users in performing certain tasks, these robots allow reducing the workload of employees. Below are other definitions, which can be considered relevant for understanding this concept.

- “Uses software to complete repetitive, structured, rules-based tasks to automate business processes at scale” [8].
- “A software-based technology designed to automate processes by mimicking human behaviour” [9]
- “Describes a relatively new type of software that replicates the transactional, rules-based work that a human being might do” [10]
- RPA could be described as an “emerging form of business process automation technology based on the notion of software robots or artificial intelligence (AI) workers. RPA has become the new language of business. This technology is more powerful among the 21st century technologies” [11].

The RPA has already seen significant implementations in practice. It can also be mentioned that many providers already offer different frameworks for RPA-based solutions. In contrast to this early practical adoption, one can notice the relative lack of attention in the academic literature. Consequently, the RPA does not have the solid theoretical foundations to allow an objective reasoning around its application and development. In turn, this hinders initiatives to make significant progress in this area. Various studies show that many RPA-based projects have not been successful. Thus, according to HFS Research, almost half of the RPA implementations did not live up to expectations, not meeting all the requirements. The reason is not the technology itself, but simply the lack of rigor in selecting the

right tool and in designing and implementing solution. But analysing some of the most important international databases, it can be noticed that in recent years an increase in scientific research in the field has been registered.

RPA technology has the ability to "upgrade" old software systems with expensive, error-prone, manual and repetitive operations, improving process quality, efficiency, scalability, reliability, and accuracy. Also, it offers solutions to the problems caused by the use of disparate IT systems and the lack of integration between applications.

Currently, there are many RPA platforms available, including Another Monday, Automai, Automagica, Automation Anywhere, Blue Prism, Contextor, Foxtrot, G1ANT, Jacada, Kryon, Nintex RPA, OpenConnect, Pega, Redwood, UiPath, WinAutomation, WorkFusion, etc. The authors of [12] conducted an in-depth evaluation of the products offered by 12 major RPA providers. The rapidly growing number of RPA platforms is a powerful enabler for new opportunities and feasible models for various fields, including higher education.

## 4 HIGHER EDUCATION USE CASES FOR RPA APPLICATION

During this research, when we investigated the scientific literature on robotic process automation, we found that many researchers were more concerned with RPA applications in industry and less with the adoption of RPA in higher education or, more generally, in education.

The presence in higher education institutions of old, complex and expensive information systems, which cannot be easily adapted for integration or digitization, slows down the pace of transformational changes necessary for digitization. Robotic process automation is important for digital transformation efforts by enabling these institutions to make cost-effective improvements quickly without replacing existing software systems. Thus, the adoption of RPA provides solutions with lower implementation costs and much lower risk than large IT transformations.

We need to identify how RPA can contribute to shape a digital future for the betterment of higher education. The key aspect of successful RPA adoption is to allow applications to be tailored to the needs of users. Thus, we aim to outline RPA applications in higher education from the key stakeholders' perspectives as follows: a) student-oriented, b) teacher-oriented, c) researcher-oriented and d) admin-oriented. Various higher education processes were assessed in terms of complexity and business rules in order to identify potential operations that could qualify as RPA candidates. Next, we present some of these processes that are suitable for automation (Table 1).

*Table 1. Applying RPA.*

	Students	Teachers	Researchers	Admin
High-volume processes		X	X	X
Extracting data from emails, forms, documents of various formats (PDFs, scanned documents, etc.), images (JPEG, BMP, etc.)	X	X	X	X
Data updates	X	X	X	X
Data validation		X	X	X
Generating mass e-mails		X		X
Filling out various forms	X	X	X	X

Next, we try to highlight some specific actions performed by education actors that could benefit from the adoption of the RPA.

### 4.1 Students

Current students Generation Z are embarked on their journey in higher education. Universities could take RPA to a student-facing level. Thus, for example, students can benefit from RPA as follows:

- Fast performing of various IT operations required for personal computers.

- Extracting data required for projects, homework, papers, etc. from web, documents of various formats, images, etc.

Moreover, learning about RPA can help graduates to pursue successful careers. According to LinkedIn [6], it is a fast-growing field of employment, providing opportunities for junior individuals. Thus, listings of jobs that require RPA expertise and skills have seen some of the highest growth in job listings around the world. For example, in 2019, RPA roles are the second fastest growing position in Singapore, third in the U.K., and fourth in India and Australia [6].

## 4.2 Teachers

Teachers want to streamline administrative tasks to focus on teaching. RPA could be used to support the teacher and reduce his or her workload by automating tasks such as: student assessment and grading; feedback management; plagiarism detection; attendance tracking, data analytics for teaching or research paper, etc.

Adopting RPA free teachers to focus to more complex challenges requiring human strengths, such as, creating digital texts and quizzes or spend more time interacting directly with students, etc.

## 4.3 Researchers

Academic research, focused on making new discoveries for the scientific community and creating knowledge, contributes to progress. However, in the last years the administrative burden has increased. RPA can help researchers to perform various tasks, such as: merging data from multiple sources; website scraping; data mining; data analytics, etc.

By automating tasks performed by researchers, RPA allows the release of human creativity. Thus, by reducing time spent on repetitive and tedious computer tasks, researchers can focus on higher-value activities, like innovation.

## 4.4 Administrative staffs

RPA could be used across almost all administrative departments of a university, including secretariats (for university, for faculties, for the PhD school), finance, human resources, etc. Some use cases, in addition to those presented above, take into account the following:

- RPA enables a university to connect their silos across multiple departments, and thus reduce duplication of work and increase visibility for the management of university and faculties or central administration with regards to general administrative issues, to implementation of various tasks on time and within budget, etc.
- Preparing documentation for accreditation of study programs.
- Exploiting an efficient system to manage the student servicing process (class schedules, attendance, reminders, dorm room allocation, internship, job applications, etc.
- Using RPA, secretariat staff could provide accelerated responses to emails sent by teachers, undergraduate, graduate or postgraduate students, enabling a better communication.
- IT department staff could reduce time spent on basic low-level tasks, simple, but time-consuming: updating user information; faster and simpler installations of complex systems with interdependent components on multiple computers in various laboratories.
- Financial department staff could use RPA to replace manual invoice processing, tracking payments.

## 5 HIGHER EDUCATION CASE STUDY FOR RPA ADOPTION

There are several strengths with using the RPA in higher education. To illustrate some benefits of the RPA adoption in the higher education area, we consider a case study conducted on the student information management system used in Ștefan cel Mare University of Suceava, Romania. This system is a PeopleSoft solution that includes Human Resources Management System (HRMS) and Student Administration (student financials, student records, etc.). Unfortunately, this system used in our university does not include the admissions module. We used a specific application for student admission. A prospective university student applying for admission to our faculty can access the

admission application from the faculty website. No registration or logging is required in order to apply. The applicant must fill the Applicant Form in the application and upload online all required documents specified in the admission regulations. All required documents, such as, identity card, graduation certificates/ diplomas, etc., must be uploaded electronically as PDF-file within the application deadline. The Faculty Admission Committee will examine all official documents and data entered in order to validate the candidate's registration. Thus, the submitted files are checked and the information entered by the candidate, such as full name, date of birth, address, personal identification number, grades obtained at the baccalaureate and other information are verified with the registered information. If a discrepancy between the records in the admission system and the information in the submitted documents is identified, the information in the system is corrected. If there are no issues, the registration is manually validated. But the processing of candidates' documents involves large volumes of documents. It is a time-consuming process for secretariat staff and members of the admission committee. We propose that the verification of the applicant information from submitted documents and data should be performed using RPA. For the presented case study, we have opted for the UiPath platform. Thus, we developed a solution based on RPA equipped with Optical Character Recognition (OCR), that accelerates the process of document verification by extracting pertinent data from submitted documents such as identity card and compare them with data retrieved from admission system. Any discrepancies are reported. It should be noted that the information on the applicants' identity cards may contain diacritics in Romanian. In the light of that, we have developed and tested several solutions based on UiPath OCR engines, such as: Google OCR, Microsoft OCR, and other OCR software like: Online OCR, Free Online OCR, i2OCR, Convertio ([13]-[16]). The best results were obtained using Convertio [16]. The Fig.1 shows an example of flowchart developed to read and extract information from an identity card. The obtained unstructured data is converting into structured data which feed into admission applications.

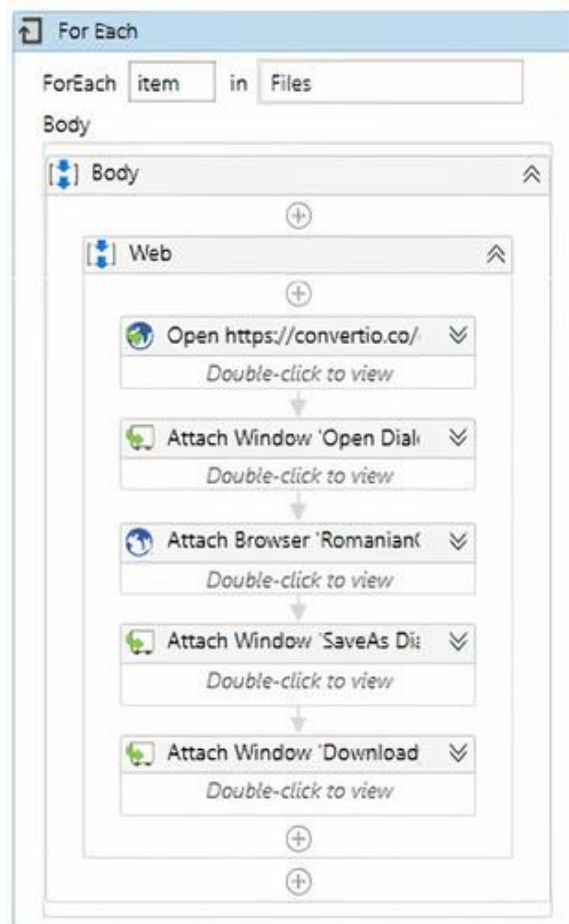


Figure 1. Example of flowchart for OCR.

Updating student management system with information regarding new students requires accessing databases of both systems (admission system and student management system). Without this access

and a way of linking them, we deal with the so-called 'swivel chair' work, clicking on two systems (Student admission and Student administration), getting data from Student admission system, and entering them into the student information management system. These activities are repetitive, time-consuming and prone to errors. But because these inefficient operations are based on structured data and are easy to break down into simple, easy-to-follow, rule-based steps, with no risk of ambiguity or misinterpretation, an RPA-based solution is suitable. Thus, an automation agent or robot simply mimics the above presented human activities, such as logging into the admission system and retrieving information about newly admitted students, like full name, date of birth, address, personal identification number, grades obtained at the baccalaureate and other information. Next, the robot updates the student information management system with this information. Application of this solution does not require Application Programming Interfaces (APIs) for data exchange or changes of the two involved systems. In fact, RPA is applied on the user layer, performing tasks by simulating keystrokes and mouse controls. The usage and integration of an RPA solution enables eliminating this swivel chair work, significantly improving efficiency and reducing errors.

The proposed solution has been vetted to ensure the correct processing. Thus, we evaluate the implemented RPA with documents of different formats. Thus, in our experiments we used PDF files and picture/image files (PNG, JPEG, BMP, GIF, etc.). The experimental results show that in order to extract correct information, images must be clear and legible, and the documents must appear 'right-side up'. Under these conditions, the proposed solution accelerates the process of document verification with higher accuracy. Also, good results were obtained in case of updating student information management system with information regarding new students.

A limitation of the conducted research is given by the fact that the demonstration of the case study was performed using only the UiPath platform. Further research is needed using different RPA platforms to identify other case studies in the field of higher education that may be covered by the adoption of RPA.

## **6 FUTURE RESEARCH**

We have to mention that the proposed robot has no cognitive skills and cannot guarantee the successful performance of tasks in exceptional situations, such as, for example, weak, inconsistent data. However, with significant recent technological advances, including the AI revolution, processes that can be automated with RPA will be less limited by the quality and consistency of input data. Combining the robotic process automation strategy with the power of intelligent technologies marked the beginning of the age of Intelligent Automation. Artificial intelligence and related new technologies, including machine learning, data analytics, computer vision, cognitive automation, brings great intelligence and decision making to the RPA moving it to a higher level and enabling so-called cognitive RPA. This mix enables a wider digital transformation.

## **7 CONCLUSIONS**

The purpose of this paper is to present the contribution that RPA can have to enhance digitalisation of higher education. In this sense, some problems that may occur in this process, but also possible RPA-based solutions, were presented. Thus, we identified some tasks relevant for different actors in higher education, which can be easily solved with the help of RPA.

Through the case study implemented and presented, it was demonstrated that RPA can fulfill some of the basic pre-processing tasks undertaken in the field of education. However, it should be noted that the implementation of operations in this field requires specific planning within a higher education institution to ensure the correct definition of the requirements to be met. Another important aspect is related to the platform used for the implementation of RPA. Before choosing a specific platform, it is necessary to select the RPA platforms to be analysed regarding the facilities offered, the advantages brought, but also the disadvantages of each considered platform.

In order to achieve wider adoption, RPA must have the capability of handling tasks of various complexity, unstructured data, etc. The next generation of 'smart' robots that involves the inclusion of AI elements is underway.

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