Insights and proposals for RPA implementations

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Abstract: *This article presents a comprehensive bibliometric analysis of research articles focused on Robotic Process Automation (RPA) project management. By analyzing a large dataset of scientific papers, this study aims to identify trends and gaps of this subject. To better understand the real-life implications, this study also analyzes different opinions coming from people actively working with this technology. The bibliometric analysis aims at identifying several key themes often addressed in scientific papers and correlations, while also understanding the interest in this field among re-searchers. The analysis is based on a correspondence between Intelligent Automation concepts and methodologies for projects' development. The analysis continues with the results of a survey completed by a more detailed series of interviews at the beginning of 2023 that focuses on a real-life perspective, with the objective to identify project phases where teams are often experiencing challenges.*
Implementation of Robotic Process Automation initiatives depends heavily on the project lifecycles, however RPA in the context of project methodologies is a topic not sufficiently researched at the moment. RPA teams are expressing different preferences regarding implementations, Agile developments being one of them, as it seems that Agile principles are closely matching RPA criteria. Furthermore, based on the findings, this article proposes a set of practical suggestions to enhance the success of RPA implementations in different project phases. The originality of this paper is reflected in the methodology adopted, that includes different techniques, in the attempt to complete each other: the literature overview and current perspectives.
Keywords: *RPA, Intelligent Automation, Lightweight IT, software lifecycles, Agile*

1 Introduction

Robotic Process Automation (RPA) is a technology that uses software robots to automate routine, rule-based actions in corporate processes. RPA bots execute tasks including data entry, data extraction, form filling, data manipulation, and more by simulating human interactions with digital systems and applications. RPA bots are de-signed to interact with user interfaces of existing software applications, just like a hu-man user would. They can navigate through different screens, input data, retrieve in-formation, perform calculations, and execute predefined actions. RPA technology does not require changes to the underlying systems or applications; instead, it leverages the existing user interface to interact with them.

RPA is one of the most advanced technologies of the moment that can change the way business processes are carried out within organizations [1] emerging as a vital and strategic catalyst for sustainability [2]. As a result of the situation generated by the COVID-19 pandemic, many companies have switched to business workflow automation, which has accelerated the increase in demand in this field. According to some market studies [3,4], the global RPA market size was valued at 2329.9 million dollars in 2022, and is expected to rise at a CAGR of 35% from 2022 to 2030.

Organizations use RPA to automate manual and repetitive tasks across various industries and departments. It helps improve operational efficiency, reduce errors, and free up human workers to focus on higher-value activities. RPA can be particularly beneficial in areas such as data entry, data migration, invoice processing, customer service, finance and accounting, HR

processes, and more. This type of software robots can be scheduled to run at specific times or triggered by events. At the same time, RPA platforms often provide monitoring and analytics capabilities to track the performance and effectiveness of the automated processes.

RPA is different from traditional software development [5], as it focuses on automating tasks within existing systems without requiring significant changes in the underlying infrastructure or applications. It provides a quick and flexible solution for automating repetitive processes, allowing organizations to achieve efficiency gains and cost savings.

Considerations such as process complexity, scalability, and ongoing maintenance should be carefully evaluated to ensure successful implementation and long-term sustainability. Overall, the sustainability of RPA depends on how it is implemented, managed, and integrated into an organization's broader sustainability strategy. When implemented responsibly, RPA can contribute positively to environmental, economic, and social aspects of sustainability [6]. By automating tasks that typically involve printing or handling physical documents, RPA can help organizations reduce their need for extra printouts and promote eco-friendly practices that are saving time and energy. As a result of RPA implementation, resources will be redistributed and strategic priorities could take precedence, as employees are refocusing their allocation on higher value activities.

As RPA benefits and sustainability have been increasingly emphasized and noticed in more and more industries and RPA started to gain a non-negligible importance, today it has reached a point which places it as a technology with a huge potential for future implementations [3,4]. The maturity of the technology itself, as well as the future perspectives for RPA developments are automatically setting the need of a methodology that will define a set of principles and procedures, with the aim to con-tribute to the optimum performance of the software robot implementation.

To ensure adequate coordination, resource allocation, risk management, and on-time delivery throughout the RPA project lifecycle, effective project management and governance are crucial. Project lifecycles in IT developments offer a structured framework for organizing, carrying out, and managing the complete project from initiation to closure. Adopting a project methodology facilitates collaboration between business users, RPA developers, and other stakeholders, resulting in a seamless and effective automation implementation. Dividing the workload into project lifecycles and adopting specific ideologies also enables businesses to improve continuously, by learning from each project iteration and applying the best practices and lessons gained to new RPA efforts.

Our study has significant value for research and practice in IT, RPA and RPA project management because it provides a comprehensive synthesis of the existing literature on the relationship between RPA and software implementation methodologies. This paper is based on the following research question: “What life cycles does an RPA project follow and what are the main specifications for these?” , and aims to identify these concepts in the specialty literature on the one hand, and based on the specialists' experience in practice, on the other hand.

To start with, in order to first get a better understanding of the topic, a literature review is developed, to identify to what extent this subject has been addressed by re-searchers. In order to achieve the same objective, a bibliometric analysis is performed. Moreover, the methodology is completed with an overview of RPA implementations nowadays, described by analyzing a set of data gathered after conducting a questionnaire and a series of

interviews. These approaches are meant to identify: what are the main challenges that RPA teams are facing, during what project phases are challenges identified, and what best practices could be followed in order to minimize the number of these. Finally, the study proposes a set of suggestions, gathered during the survey, interviews and by analyzing the current literature, with the aim to propose a set of recommendations that can minimize challenges and contribute to the success of an RPA implementation.

2. Foundations of RPA implementation process

UiPath [7] states that "the emergence of the term "robotic process automation" can be dated to the early 2000", even if "the origins of the term "workflow automation" dates back to the 1920s during the industrial era and emergence of manufacturing" [7].

Gartner defines RPA as "a tool that performs "if, then, else" statements on structured data, typically using a combination of user interface interactions, or by connecting to APIs to drive client servers, mainframes or HTML code" [8]. The benefits generated by the use of RPA are numerous and have sparked a wave of enthusiasm and many followers. Some of the advantages that RPA contributes to are: ensuring that corporate procedures and operations adhere to rules and compliance standards, drastically boosting the rate of processing, and increasing effectiveness through process data auditing and digitization [9-10]. But there is a lack in the area of theoretical re-search and conceptual frameworks [11].

An important number of RPA projects fail, generating concern for studying the success factors and the challenges encountered in their implementation [12]. The skepticism of many comes from the idea that the use of robots will lead to job losses and massive layoffs, which has not happened until now. In addition to this, the misunderstanding of RPA features, compatibility issues with IT infrastructure, skill sets and security protocols, are elements that affect and hinder the implementation of RPA in companies [13].

When discussing implementation of IT projects, one topic that is essential to the subject is how the development is going to be carried out, what is the methodology that the team is going to adapt to and what are the main phases that will ensure the project success. Different RPA vendors and researchers [14-16] are promoting Agile as the best methodology that should be followed in order to achieve most of the automation potential. The definition provided by Atlassian (https://www.atlassian.com/agile) is that "the Agile methodology is a project management approach that involves breaking the project into phases and emphasizes continuous collaboration and improvement. Teams follow a cycle of planning, executing, and evaluating". In a few words, the rea-son why Agile is promoted among RPA teams is that several principles of Agile Scrum can provide a better framework to deliver RPA software. First of all, RPA aims to re-place the work performed by human agents, so an RPA automated solution must replicate the human component as much as possible. Since the collaboration with the end-user during the implementation is preferable, Agile can promote this approach as it focuses on the collaboration between team members, stakeholders being included as well. Also, it is considered that RPA "does not respond well to change" [16], and the Agile approach is definitely covering this weakness, as it is based on iterative implementations, always leaving room for improvements and prioritizing feedback. Agile also offers a strategy that encourages early conceptualization and design to ensure flow optimization. With requirements being detailed in an early stage, the RPA robot is less likely to suffer major changes in the logic. Moreover, the option of a Backlog

gives the RPA teams the possibility to take into consideration the remaining work and split the effort into multiple iterations, while Agile specific meetings (Planning, Retrospectives) are giving the teams the option to reprioritize the remaining work and better function during the following Sprints.

A traditional software development is characterized by manager-led teams that are organized in a hierarchical structure and have multiple layers of authority [17]. In contrast, Agile teams are designed to be democratic teams, where all members are treated as peers on an equal level and there is no formal hierarchy. This comes as a result of the Agile methodology that focuses on social interactions and on people collaboration, this being one of the Agile manifesto values: "Individuals and interactions over processes and tools" [18]. For an Agile team to work, there are only three roles that should be covered: Product Owner, Scrum Master and the Development team [19]. Schwaber defines the Product Owner as the person "responsible for representing the interests of everyone with a stake in the project and its resulting system" [20]. The Product Owner is responsible for the funding of the project, return on investment (ROI) objectives and also "ensures the most valuable functionality is produced first and built upon". A Scrum Master acts as a "servant leader", as the Agile literature de-fines this role [19]. It is a key player as it coaches the team members, helps remove the impediments and ensures all Scrum events take place. The Development Team includes several different roles, such as: Developers, Solution Architect, Business Analyst, Tester, but all are collectively responsible for the project as a whole. Solution Ar-chitects design the overall technical vision, while guiding Developers who are involved in delivering the technical solution. The Business Analyst clearly defines and communicates the requirements, acting as an interface between departments. Agile practitioners consider the team to develop by passing through four stages: forming, storming, norming and performing, this being a cycle that repeats every time a change is introduced [21].

Even if, in practice, companies and teams in general are having different approaches in terms of organizing the development workload, generally speaking, carrying out the software process typically follows six main phases: project planning, analysis, design, development, testing, and roll-out [22].

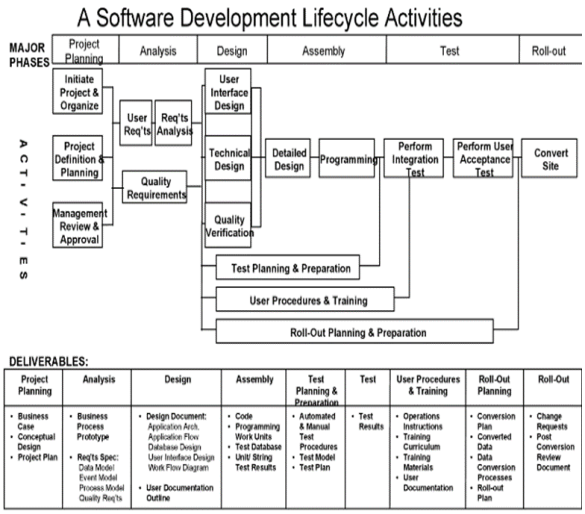

Fig. 1. Software development life cycle activities and deliverables [22]

To describe a general approach of life cycles, the process begins with the Project Planning phase, which involves the identification of Information Technology requirements resulting from business objectives. The next step is the development of an action plan or work breakdown structure to specify specific initiatives to achieve the defined goals. This phase determines the conceptual design's development strategy, advantages, and an estimate of development expenses. In order to complete this phase, it is essential to: initiate and organize the project, create a definition, project scope and a planning, as well as seek management review and approval. The business case's result, which was generated during the project planning phase, provides the justification for the

system and project decisions, and becomes the primary set of business objectives used to govern and direct the project. The relative importance of competencies shifts throughout a project's closing phase, and "negotiation" and "managing stake-holders" are now among the top two competencies [23].

The Analysis phase focuses on gathering and documenting functional requirements that are researched in detail. The degree of automation and the complexity of the process are established. As a result, the advantages and results of automation are immediately highlighted. It is also the stage when the "Solution Design Document" or "Functional Specification Document" is created, based on the previous requirements analysis. This document comes as a detailed definition of the business process that will later be confirmed and approved by the business representatives (the team requesting the implementation). As main topics addressed as part of this documentation, the following items are defined: a description of the entire process, detailing each step that will be implemented in the development, technical details, business requirements, process exceptions, elements identified as out of scope. Researchers [23] are considering this stage to be marked by three main competences: “managing stakeholders”, “communicating” and “planning”: “Here the project managers build lines of communication and facilitate communication with the client and other stakeholders to capture and create a clear and comprehensive requirements statement”.

The Design phase is essential in order to create solid workflows that incorporate all technical constraints and, at the same time, respect the business requirements previously agreed on. In order to create solid RPA workflows that will be later implemented by RPA developers, it is imperative that the process is described in depth, with as many potential exceptions (both technical and business) understood as feasible. These specifics may include screen designs, databases, data transfer flows, system interfaces, and prototypes, depending on the project.

As part of the Development phase, teams are implementing the technical solution, with reference to the previously created Solution Design Document and all use cases and business rules confirmed. The process is divided into smaller, sequential or parallel steps, so that the product management is improved and the workload fractionated correspondingly.

The Testing stage is essentially divided into different other phases. Not only different environments should be tested, but also the approach would differ from one stage to another, from testing functionalities individually, to observing an end to end flow. In any case, this stage is performed after the implementation of all process flows, based on test data according to those used in reality and previously defined test scenarios. The solution is tested in a pre-production environment to confirm that it meets the process requirements. If defects are discovered at this point, the development phase is restarted to fix all existing issues, an approach that could potentially characterize this as a cyclic flow. This phase is completed with the User Acceptance Testing, a testing phase conducted by the business representatives, initiated with predefined data and seeking approval from the client.

Last but not least, the last stage of a project, known as the "Go Live" phase, marks its completion with the Deployment phase. This is the state when all components are integrated and verified as a whole in the production environment, with a high rate of involvement from the client/ stakeholder side. At this point, the previous work is moved to the actual Production system, and the anticipated advantages, such as cost savings and improved process quality, are tested in real-world operations. After the deployment in the Production environment, it is essential to establish an intensive period

of Hypercare, when the development team will monitor the proper execution of the robot. If a defect is discovered in the application, the team is ready to provide on-going support and maintenance for minor bugs. Studies have determined that this phase registers most of the costs involved with correcting potential errors that may appear in a software system [24]: "Finding and fixing a software problem after delivery can be upwards of 100 times more expensive than finding it and fixing it during the requirements and early design phases".

Approximately 98% of the implementation of an RPA project is related to business rules, so business process experts play an essential role in implementation. As a result, RPA implementation cannot be equated with classical software implementation [25]. Within the IT sector, Robotic Process Automation is known to be a lightweight IT technology [26]. Lightweight IT is the new paradigm of mobile apps, sensors and bring-your-own-device, also called consumerization or Internet-of Things. The key aspect of lightweight IT is not only the cheap and available technology as such, but the fact that its deployment is frequently done by users or vendors, bypassing the IT departments ([27]). To better understand the concept of "lightweight IT", it is also essential to mention he definition of "Heavyweight IT", which, in comparison, is the main-stream IT as currently delivered by IT departments over the world: back-end solutions such as ERP and other transaction systems, based on databases servers and integration software, such as bus architectures [28].

Table 1. Heavyweight and lightweight IT [28]

	Heavyweight IT	**Lightweight IT**
Profile	Back-end: Supporting documentation of work	Front-end: Supporting work processes
Systems	Transaction systems	Process support, apps, BI
Technology	Servers, databases, enterprise bus technology	Tablets, electronic whiteboards, mobile phones
IT architecture	Centralized or distributed	Meshworks
Owner	IT department	Users and vendors
Development culture	Systematics, quality, security	Innovation, experimentation
Problems	Increasing complexity, rising costs	Isolated gadgets, security
Discourse	Software engineering	Business innovation

As described in Table 1, even if the difference between these two concepts are obvious, they can be considered complementary and mutually dependent. Lightweight IT may not have the full control on data repositories and platforms, as Heavyweight IT does, but it brings the innovation and agility that can be considered as out of scope for the Heavyweight IT.

That being said, RPA can be easily framed as a Lightweight IT as it simply inter-acts with IT systems' presentation layer in order to simulate human behavior. Fundamentally, RPA is a technology that connects all other IT applications non-invasively and seamlessly. As such, as Moayed states in the "From pilot to full scale RPA deployment" whitepaper [29], it is possible for RPA solutions to become the "platform" or "backbone" through which all other automation technologies will eventually be connected/ organized, be it Chatbots, Optical Character Recognition or simply other soft-ware platforms. Even if RPA classifies as a component of the IT sector, and the delimitation between projects' phases can be applied as for any other software project, the distinction between Lightweight and Heavyweight is one reason which needs to be considered when rethinking implementation phases in the RPA context. The organization's ongoing business and IT alignment, as well as the

overall limited utilization of RPA in an organization [30] are factors that could add different specifications, com-pared to the traditional Heavyweight IT approach.

3. Methodology

The current study is based on two different methodologies that were adopted in order to better understand the subject and develop several conclusions and recommendations: a bibliometric analysis and a questionnaire conducted among RPA companies.

First of all, a bibliometric analysis was carried out in order to gain insight into current research trends and the extent of study in certain research topics. This particular statistical analysis of publications tracks researchers' output and impact and publication relationships can also be understood by visualizing the bibliometric data. It is a remarkable tool for the measurement of academic and organizational performances based on various indicators such as the number of publications and citations, collabo-ration networks and examines the research productivity, most keywords and publication trends in a particular research area [31]. It also allows easy identification of re-search gaps in a particular research field.

In terms of data collection, the study was conducted by utilizing data from the Scopus database, in order to identify a set of bibliometric indicators, such as quantitative indicators and qualitative indicators that specify citations. Scopus is a multidisciplinary citation database of peer-reviewed literature with tools to track, analyze, and visualize research [31] and so it is considered to be a reliable source that offers accurate information. Identifying various research-related publications' sources and recognizing trends in annual publications were the main objectives considered when applying this type of research. A total of 268 publications were analyzed as part of the data collection with the use of Scopus database, having a timeline, from 2009 to 2023. The data was filtered by specific criteria (detailed in the next chapter) and then ex-ported in a Comma-Separated Values (CSV) file. The tool used to perform the analyses on the exported data was VOS Viewer [32], chosen in order to perform the bibliometric analysis, with outputs in the form of visual components based on mapping techniques. The data stored in the CSV file was translated into clusters and diagrams, with the aim to assess relevant information about the publications.

Furthermore, in order to provide a clear statistical analysis regarding RPA implementations today, the study uses the results gathered as part of a questionnaire ad-dressed in February 2023, with the aim of getting a better understanding of how RPA tools are used to develop different projects, in order to identify how this technology is currently affecting internal business processes and it is expected to evolve in the near future.

The questionnaire was addressed to 150 respondents that are closely working with the RPA technology and received a total of 122 unique responses, having an 81,33% response rate. The 122 respondents are using RPA in 15 different industries. All 122 responses have been validated, as the criteria based on which an individual was chosen as a potential respondent was to have been working with RPA at least for the last two years, regardless of the company or role.

The questionnaire was created using Google Forms and has been shared online, mostly by email and on a professional social media platform. Results were later interpreted by displaying the data in a visual format such as pie charts and bar charts. While bar charts only highlight the number of responses and differences between answers are easier to remark, pie charts represent each result as a percentage of the whole sample.

The complete study was based on a total of 22 questions, divided into three sections: the profile of the respondents, a theoretical approach of the RPA technology on a

conceptual level and applying these concepts in real life projects using different RPA vendors. However, for the objective of the current paper, only six of the total questions were taken into consideration and analyzed, in order to understand possible draw-backs of the technology that could reside in potential areas of improvement. A more detailed analysis has been conducted as part of a different research paper [33].

Responses gathering did not imply any personal data collection as the profile of the respondents was built as part of the first section of the questionnaire. This one has been defined by questions analyzing the following topics: the industry to which their company belongs, the department they are working in, their location, experience with the RPA technology, role and the number of RPA projects they have experienced in the last 12 months. All this information was later correlated with the results observed on the other questions. All questions were mandatory, with multiple choices but single answer and the option to add a different response, if needed for the company industry, department, or role. Respondents are mainly located in Romania (95%) and have been working with RPA technologies for different periods of time: 2-5 years (59%), less than 2 years (29%) or more than 5 years (12%).

Having the survey, which aims to understand the way RPA teams work nowadays, as a starting point, a series of more in-depth interviews have been conducted in the same time period. The objective of this interview series was to get a better under-standing of some of the topics raised by the questionnaire. The "interview" method has been chosen as an appropriate tool to collect detailed and contextual information from individuals. As Barbour mentioned, the interview aims at having an 'in-depth information' about a certain topic or subject, and through which a phenomenon could be interpreted in terms of the meaning's interviewees bring to it [34]. This way, the inter-views intended to allow some of the questionnaire's respondents to provide subjective experiences insights, while also providing the opportunity to address follow-up questions, to better understand participants' viewpoints and resolve ambiguities.

4. Results and discussions

The Bibliometric analysis was developed based on complete data collection and data filtering procedure. To begin with, the primary goal of the research was set to analyze the trends in publications linked to Robotic Process Automation and methods of Project Management, in the Scopus database. The research was done utilizing the document examination method within the context of descriptive analysis. The data was retrieved on May 7th, 2023, using "Robotic Process Automation" and "methodology" as main keywords and "phases" and "implementation" as secondary keywords. A total of 268 documents were retrieved following this procedure, these being publications that are addressing these defined topics.

The inclusion criteria were the document type and language, in order to make sure the publications complied with academic norms. Results were filtered to exclude non-English publications and the following document types: erratum, retracted papers, conference review. Only the following have been analyzed: articles, conference papers, book chapters, books and reviews, which led to a total of 251 publications, after ap-plying the initial filters. The analysis showed that the majority of documents were journal articles (a total of 117), as well as a remarkable number of papers published in different Conferences (97 out of the 251 total).

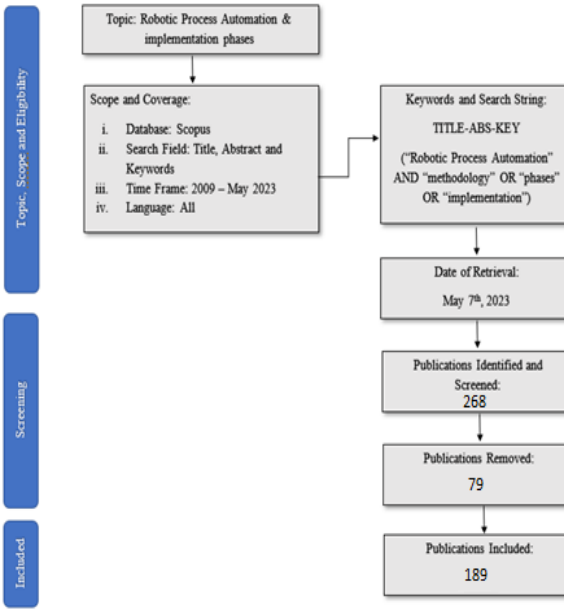

Fig. 2. Selection strategy and research protocol

In order to ensure the relevance of the results, a manual review process was conducted. During this phase, the title, abstract and keywords of each research publication were evaluated for potential relevance to the study, to validate that the paper's con-tent is developed based on the set of keywords provided in the search criteria. As a result, a number of 62 documents have been excluded from the data set, as the abstract proved to be irrelevant for the context of analyzing Robotic Process Automation implementations.

After this additional filter, the timeline considered has been affected as well. For example, without excluding any papers, the initial unfiltered results show that the first article that follows the direction input in the search query was published in 2009. However, by analyzing the abstract it is clear that the article focuses on robotics and process automation as hardware configurations and a methodology is suggested to de-sign only these kinds of systems. With that being observed, the final timeline addressed turned out to be 2017 - 2023.

It is interesting to see how the interest in this topic developed during these five years. With first initiatives on analyzing the implementations of RPA technologies in 2017 and only two relevant documents retrieved by the search for that year, the interest has drastically increased during the next few years, with a maximum of 57 publications in 2021. In this rapid evolution, it can be assumed that the topic will continue to gain interest around researchers for the next year as well, considering that, until this moment, there is a number of 31 documents published until May 2023. However, important to mention is the fact that these numbers are not reflecting only publications that follow the initial filtering based on all keywords exactly. Most of these results have as a central point the concept of "Robotic Process Automation" itself, and de-scribe a specific implementation, use case in an industry or highlight a specific RPA concept indeed. In spite of that, they are not suggesting a specific methodology or framework that maximizes the implementation of RPA processes by following a project methodology. Moreover, the concept of "RPA" in the context of methodologies or implementation phases is addressed in just a few publications from this set of results, and it details specific behaviors of RPA implementations (i.e.: Jimenez-Ramirez, A. et al., 2019, A method to improve the early stages of the robotic process automation lifecycle).

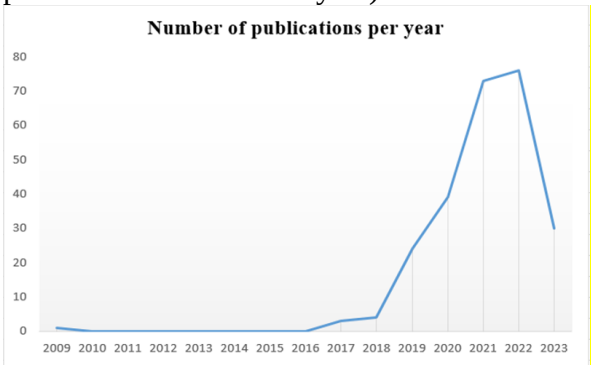

Fig. 3. Number of publications per year, unfiltered results (a total of 268 publications)

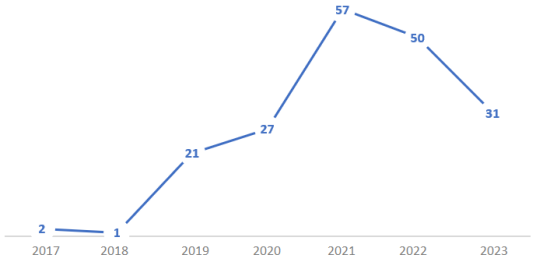

Fig. 4. Number of publications per year, results filtered by document type, language and abstract relevance (a total of 189 publications)

Keyword	Occurrences	Total link strength
robotics	89	1161
automation	42	519
rpa	47	445
artificial intelligence	32	372
business process	27	352
intelligent robots	19	292
enterprise resource management	19	269
digital transformation	20	245
robotic process automation (rpa)	21	195
business process management	17	169
data mining	11	166
decision making	10	163
machine learning	15	151
information systems	12	149
intelligent automation	11	149
process mining	14	144
information use	10	140
botnet	9	136
life cycle	8	123

Fig. 5. List of keywords filtered for the bibliometric analysis

As the tool (VOS Viewer) used to create data visualization representations is creating analysis based on identifying the most used terminology (keywords) and the number of occurrences, for the co-occurrence analysis the tool automatically identified a number of 1465 keywords that were later filtered to only cover the RPA technology and any possible relation with implementation phases or methodologies, as it can be observed in Fig. 5. As a result, the all keywords co-occurrence visualization shows a network diagram of keywords, in which nodes, font size and color are describing the relationship with one another. Fig. 6 only shows a selection of this network, where one of the most popular keyword ("rpa") is grouped into a cluster with other keywords with a medium occurrence, such as: "business process", "enterprise resource management", "business process management" or "process analysis". The membership to the same cluster is represented by the same color used for the connecting lines, and grouping these concepts into one cluster demonstrates that RPA is closely related to the idea of improving business processes and managing projects. However, no clear evidence could be observed between RPA and specific project methodologies concepts, concluding that this is still a topic not sufficiently researched.

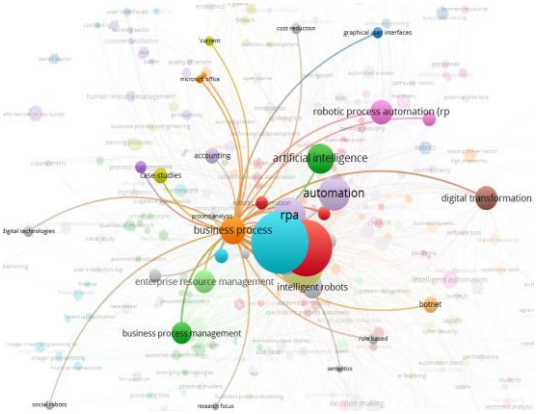

Fig. 6. All keywords co-occurrence

Fig. 7 is a representation of a co-authorship analysis by countries, in a density visualization, showing how the maximum research around this topic took place in: Germany, India and the United States.

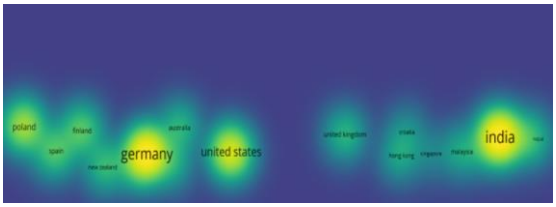

Fig. 7. Main countries associated with publications

While the bibliometric analysis highlighted the necessity of deepening this specific topic as it couldn't provide a clear input on the research question stated in the beginning, the questionnaire conducted managed to identify actual business needs and get an understanding of the current approaches when it comes to RPA development. One topic addressed as part of the questionnaire conducted was related to the usual RPA

project lifecycle, with a focus on the project phases in which teams are often facing difficulties. A majority of 30% of respondents are considering the Analysis phase to be the most error prone. Design and Development phases are the next preferred options, with a 20% choice rate each. By analyzing these numbers, it is also important to mention that most of the respondents are working as a Developer/Architect (74%), the difference between the other existing roles being remarkable: Business Analyst/ Product Owner (13%), Management positions (8%), Project Manager/Scrum Master (2%). In this context it is interesting to notice to what extent the initial phases of a project (Discovery, Design) are considered to be the most challenging in terms of the number of risks that could potentially affect the whole project implementation.

Going even more into this subject, the fact that the initial phases of a project are usually the most demanding is confirmed by responses received to a different question: "What are the challenges that may be experienced during a project development?".

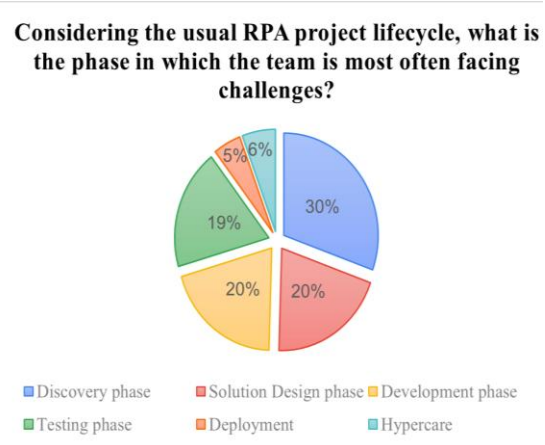

Fig. 8. Project phases where teams are having most of the difficulties

Respondents were allowed to select multiple choices, and the results show that the top three most difficult aspects are faced when: the initial manual process is not clear enough or is lacking adequate documentation (with a reference to the first phases of the project implementation), customers are expressing reluctance or adding complexity to the implementation during the process and when edge cases are not covered by the software robot (which, again, can be referenced to the same Analyze and Design phases).

Among responses, 25,71% of the results are targeting the adoption of an unsuited project methodology. The "Pulse of the Profession" study conducted by the Project Management Institute (PMI) in 2018 concludes that 71% of organizations were choosing the Agile approach, even if applied to different methods, based on each team's needs. This number was a result of a survey that highlighted feedback from 5702 Project Managers and other management roles, from a range of industries, including In-formation Technology. "More and more organizations are recognizing that agility - the capability to quickly sense and adapt to external and internal changes to deliver relevant results in a productive and cost-effective manner - is helping them stay competitive" [35].

The same conclusion can be highlighted considering the study that made the subject of this paper, as 72% of respondents considered that Agile methodologies can best be associated with automation processes.

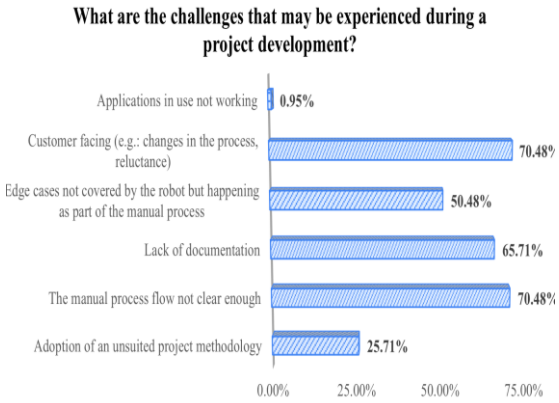

Fig. 9. Challenges experienced during an RPA project development

Having as a starting point the topics addressed as part of the questionnaire, the most relevant responses provided have been

detailed by some of the participants as part of a more comprehensive interview. Participants have been asked "What are the best practices that teams are adopting during each project lifecycle, when automating processes using RPA?", in order to understand what particularities can be considered when discussing Project Management for RPA driven projects. By analyzing the general project life cycle of a software implementation, as detailed in the Literature Review section, and by understanding challenges identified in RPA projects development in real life implementations, Table 2 describes a set of recommendations, with the objective of capturing a series of additional requirements that RPA projects have, compared to a usual IT process. The following ideas and recommendations can be viewed as a theoretical framework for RPA implementation, considering the generality of each action.

Table 2. RPA projects' requirements for each implementation phase, in addition to general software development need

Project Phase	RPA projects' requirements, in addition to general software development needs
Project Planning	Highlight the weaknesses of a manual process and propose a new, more efficient way of achieving the same or even better results. Anticipate use cases that are occurring in day-to-day business, but may not be obvious from the beginning. If scenarios are not considered from the planning phase, then the RPA robot's configuration will have to be adjusted or the scope of the automation would have to be expanded, in order to include these unknown cases. This results in affecting the project's timeline, resources and costs, not to mention the customer satisfaction.
Analysis	To better understand the process flow, develop process diagrams: a diagram that will include the steps described in the initial non-automated flow and another diagram of the automated process.
Design	Create an architecture that follows a tactical approach and consider using RPA benefits at its full extent. For example, if none of the processes chosen for the automation are not performed at night, having an RPA robot working 24/7 may not have a visible impact.
Development	An RPA software selection process is mandatory: the selection of appropriate RPA software for automation is the main emphasis of this step. Fortunately, the market appears to be maturing swiftly, and so some essential considerations in the decision-making process include: the cost of the vendor, required skills, vendor support, vendor reputation, the capability to use low-code programming, security, license flexibility and so on.
Testing	The test environment should be an exact replica of the Production system in order to ensure efficiency and avoid rework in configuring the robots. A robot might fail to recognize a field in the production system if it differs from the one in the test environment, throwing an error that would ultimately interrupt the process. RPA robots are dependent on User Interface components that are set as triggers when creating the logic behind the automated process, so it is essential that these components that are used initially in the development are matching exactly the real ones.
Roll-out	Anticipate customers' resilience when it comes to being open to adapt to RPA automated

Project Phase	RPA projects' requirements, in addition to general software development needs
	technologies, which is also confirmed by the questionnaire conducted for this study. Regarding the customer relationship involved in RPA processes, 76,19% of people that are often facing the end user's reluctance are connecting this with the lack of knowledge that the customer may have towards this technology. They also reported the idea that RPA robots could take over their tasks, or they don't believe in minimizing or excluding manual work. It is important that the end user understands from the beginning the logic behind the implementation, RPA implications, and see the concrete results and benefits of the automation. It is also important for the end user to understand the limitations and have a clear image of what are the out-of-scope elements, so that expectations are realistically set. Consider an Agile approach for moving robots to Production, in order to provide efficient deployment and close monitoring of processes. As a best practice it would be recommended to transfer to the Production environment a smaller number of robots to carry out (a part of) a process, identify and implement the potential adjustments/ bug fixes, then transfer into production other RPA robots, until the target system is accomplished.

5. Conclusions

With the concrete classification of RPA as part of the IT segment and the theoretical definition of Software development phases, it can be observed that there are no limitations when having to decide on a methodology for an RPA specific project. Like any other project in the IT field, organizing the workflow and resources based on a specific methodology is the element that adds value to the implementation and may conclude in the success or failure of the project.

Software development methodologies, from traditional to agile approaches, are available for organizations to choose from. Even if some are taking a hybrid approach, their methodology preference is related to specific organizational projects and team traits. However, different sources cited in this paper are recommending implementing RPA in an Agile approach, as Agile principles are closely matching RPA criteria: the need to define functionalities from the beginning of the project, flexibility that allows improvements in the flow, opening to the stakeholders' feedback, being just a few.

By consolidating and analyzing knowledge from the research field, this paper provides valuable insight for organizations that want to achieve good RPA project management and improve their efficiency at the project level. The obtained results provide a foundation for continuing research in the direction of the most appropriate methodologies for RPA projects.

Despite the fact that the bibliometric analysis reveals that RPA project management research has experienced significant growth in recent years, indicating the rising interest in this field, based on the data acquired during this study project, it was determined that there is still insufficient information on this subject, at least in what scientific papers are concerned. However, as any other IT field, the creation and implementation of Robotic Process Automation initiatives depend heavily on the project lifecycles. Project lifecycles offer a methodical method of controlling RPA advances, ensuring that automation initiatives are carefully planned, carried out, and maintained throughout time. Even if the preference for the addressed methodology may not be directed towards Agile, the recommendations suggested as part of this study can be considered regardless, as these can be viewed as best practices for any RPA implementation.

The choice of a project management technique for RPA projects should ultimately be made based on the specific requirements and characteristics of the project, as well as the preferences and experience of the project team and other stakeholders. However, the available options to choose from do not differ from the ones that can be applied to any other development technology. The suggestions that have been documented as part of this research are following the general project life cycle of a project, and are giving an overview on some specific actions that can maximize RPA automations' efficiency.

Following these recommendations during various project phases can help RPA projects succeed, leading to increased process effectiveness, cost savings, and improved customer experience. These insights can help practitioners and researchers better navigate the challenges of RPA project management, as RPA is a continuously developing technology.

A future improvement would be to expend the area of analyzed papers with the use of multiple databases and additional sources, as the study was based only on the articles provided by the SCOPUS database (the recognized and highly valued source of scientific literature) and only included journal articles and conference proceedings.

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