Robotic Process Automation: A case study in the Banking Industry

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Abstract — **Robotic process automation (RPA) is the use of software with artificial intelligence (AI) and machine learning capabilities to handle high-volume, repeatable tasks that previously required only humans to perform. In short, there is at least a problem with traditional Business Process Management (BPM) systems, as they cannot suggest the best combination of tasks, people and timings, which can increase the benefits of running them, while reducing the costs and risk factors. Yet, it is an irrefutable fact that the current business environment is highly dynamic. On the one hand, we need to be more efficient to execute what is operational and obvious, releasing scarce resources for more critical areas. Then, dealing with business process management and automation, a common claimed benefit is associated with the improvement of performance. In addition to this and other potential benefits, we also highlight some potential operational risks from the adoption of AI-based systems like RPA. The acceleration in the business context makes it more difficult to predict what changes will occur and how they can affect the technological solutions used in the increasingly automated business processes. We point out the fact that immature or not well-trained models can eventually decrease productivity and increase errors from unsupported or even wrong decisions. We present a case study in the banking sector, which illustrates some examples of benefits and risks arising from BPM solutions that use AI-related agents/artifacts.**

Keywords - *Business Process (BP); Business Process Management (BPM); Business Process Automatiom (BPA); Robotic Process Automatiom (RPA); Artificial Intelligence (AI).*

I. INTRODUCTION

Dynamics of business environment is pressing organizations to become more competitive. In this context, a process-based approach became popular in the context of organizational management. Business Processes (BP) are the set of coordinated tasks or activities performed by people and/or artifacts in order to achieve organizational goals and related objectives. Besides, BP are subjected to organizational governance rules and policies, seeking an alignment or balanced integration between business, Information Technology systems and working practices [21]. BP need to be designed according to those business and alignment requirements. Over time, given the growing dynamism of business environments, BP are redesigned and/or reengineered as a response to those external transformations or even because companies want to be operating with more agility.

Business Process Management (BPM) is a relevant topic focused on managing organizational processes using different methods, techniques and software solutions to analyze, control and manage tasks and organizational activities, using assets like people, skills, applications, documents and other related data and information [22].

An identified problem of current BPM solutions is that they do not leverage the amount of data to create insights to solve the most challenging aspects of a BPM System, what task to execute, When the task should be completed (SLA) and by Whom the task should be made. These 3W's has been usually defined by Process Managers, with tiny or any contribution of a learning mechanism that could increase the probability of a best outcome. So, they cannot suggest the best combination of tasks, people and timings in order to increase the benefits of running them, while reducing transaction costs and associated risks. [25][26]

Nowadays, either researchers and practitioners propose that BP must be gradually optimized and automated. In extending the scope and sophistication of automation, some pertinent questions arise, such as: (1) What are the main benefits and risks associated with new solutions that deepen BP automation with greater "intelligence" in BPM? (2) Is an automated and intelligent mechanism more appropriate to define and decide who should perform a task, reducing the risk and the cost of its execution, while increasing the desired result? (3) Can an automated and intelligent mechanism be used to define who should perform a task, at an early stage of a BPA / RPA, when no learning outcomes are still available?

This article is developed over the following sections. Section II presents the background of some of these research areas by addressing subjects like business process management and business process automation. Although superficially, we also identify the application of artificial intelligence in this context. Section III provides a description of the concepts related to robotic process automation (RPA) and its usage in different

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contexts. In section IV we briefly discuss the challenges of attaining benefits and avoiding risks related to business process management, business process automation and robotic process automation. Then, section V outlines a brief case study from the banking industry. This case allows us to identify possible advantages and risks derived from RPA implementations, providing partial answers to the research questions set out above. These answers are covered and discussed in section VI. Finally, section VII presents the conclusions.

II. BACKGROUND

A. Business Process Management

The importance of business process redesign became especially crucial as a consequence of IT development. In this context, several researchers stressed the importance of organizations is growing focuses on process management ([2][4][3]). It is also in this context that several organizations appeared and development. According to one of those organizations Business Process Management (BPM) "is a discipline involving any combination of modelling, automation, execution, control, measurement and optimization of business activity flows, in support of enterprise goals, spanning systems, employees, customers and partners within and beyond the enterprise boundaries." [20]. According to the Process Management Common Body of Knowledge, BPM is a management discipline that treats business processes as assets. It presumes that organizational objectives can be achieved through the definition, engineering, control and dedication to continuous improvement of business processes [1].

B. Business Process Automation

Business process automation (BPA) is defined as the automation of complex business processes and functions beyond conventional data manipulation and record-keeping activities, usually through the use of advanced technologies. It focuses on "run the business" as opposed to "count the business" types of automation efforts and often deals with event-driven, mission-critical, core processes. BPA usually supports an enterprise's knowledge workers in satisfying the needs of its many constituencies. [19]

C. Artificial Intelligence

The idea of an intelligent artificial being is very old. It can be found in the Greek mythology (Pygmalion), Muslim Jewish tradition (like Takwin or Golam) or English or Czech literature (Frankenstein or R.U.R.- Rossum's Universal Robots). But the Dartmouth Conference of 1956 was the seminal event for artificial intelligence as a scientific field. It was organized by Marvin Minsky, John McCarthy and two senior scientists: Claude Shannon and Nathan Rochester of IBM [8].

III. ROBOTIC PROCESS AUTOMATION

Robotic process automation (RPA) is the use of software with artificial intelligence (AI) and machine learning capabilities to handle high-volume, repeatable tasks that previously required humans to perform [7]. As BPM tools have begun taking characteristics of business process management. But they get more sophisticated and start to include artificial intelligence characteristics. These tasks can include queries, calculations and maintenance of records and transactions. RPA is the expression used for software tools that fully or partially automate human activities that are manual, rule-based, and repetitive. RPA works by replicating the actions of an actual human interacting with one or more software applications. Tasks performed may consist of data entry, process standard transactions, or respond to simple customer service queries. Indeed, the chatbot that has started to become ubiquitous on websites is often a robotic process automation tool. It can handle standard queries like "where is X on the website", "how do I reset my password", and the like. RPA tools are not replacements for the original business applications; instead, they automate the already manual tasks of human workers. Those tools look at the screens that workers today look at and fill in and update the same fields in the user interface by adding the relevant data from the appropriate location. [18].

RPA serves several purposes: it frees humans from monotonous tasks, it helps to ensure that outputs have more quality, and improve speed. RPA frees humans from tedious, low-value-added tasks like data entry. It makes them available for higher-value tasks that require human creativity, ingenuity, and decision making. RPA helps to ensure that outputs are complete, correct, and consistent between jobs and between human workers. RPA helps to ensure that tasks can be completed faster because the robotic process automation tool can find and retrieve any necessary data in the background. [18][24].

One of the critical benefits of robotic process automation is that the devices do not alter existing information systems or software infrastructure. Numerous other process automation tools interact with systems using APIs. Summarizing, in practice, there are severe limitations on what a robotic process automation tool can do. It must be programmed to perform a repetitive task. To do that a subject matter expert (SME) who understands how the work is performed manually must be employed to map out those steps. Also, the data sources and destinations need to be highly structured and unchanging. Robotic process automation tools do not deal with errors, exceptions or the typical confusion of human interactions well at all. But even with these considerations, organisations are seeing tangible, concrete benefits from robotic process automation.[23]

This allows them to become even more efficient and could, for example, lead to a point where the tool could analyse the sentiment within a customer query or correspondence and make a recommendation about a discount [18].

With RPA, the organization can automate the routine tasks quickly and cost-effectively. RPA bots can easily integrate with other broader automation initiatives — such as process and decision automation, or data capture initiatives — to expand the value of the automation program. RPA contribute to accelerate time to value, reduce human error, and increase throughput. Accelerate time to value is possible as long as it is possible to create, test and deploy new automation schemes in hours, instead of days or months. Reduce human error is possible

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because RPA virtually eliminates all copy-and-paste mistakes that result from swivel-chair integration. Complete automated tasks in seconds or minutes, around the clock, to deliver higher value for your customers, which allows increasing the amount of material or items passing through a system or process.[25]

Several examples are subject of study in what concerns the usage of RPA. One example is Xchanging [6] . It was also used successfully in Telefonica [5]. Another example is Banco Popular. Banco Popular deployed the IBM Robotic Process Automation with Automation Anywhere solution to automate repetitive, manual tasks and processes. The answer runs in the cloud, allowing Banco Popular to quickly scale it as needed [17].

IV. Benefíts and Risks

As mentioned above, AI is nowadays a very broad field of research. So, any sound definition is not straightforward. There have been many designations for AI-related artifacts, such as the ancient notion of "agent". An agent is something that perceives and acts in a certain environment. An ideal agent is the one that always takes the action that is expected to maximize its performance measure, given the sequence of percepts it has seen so far [15].

When dealing with business process management a common direct benefit is associated with the improvement of performance. Actually, if for example we opted for a machine learning agent, that improvement is based on its perceptions made in the environment. In this case, the agent can detect patterns, which are functions relating inputs with outputs, that have remained unnoticed by humans. Performance can then be related to measures on accuracy, precision and recall, here regarded as quality criteria of a learning algorithm.

Still considering business processes, starting from patterns it is possible to detect divergent behaviors. For example, in the banking industry, it becomes easier to detect credit card fraud, or target customers for the purpose of marketing campaigns. Another benefit of machine learning over business processes lies in their greater flexibility, for example, it becomes easier to fit the assessment of a certain case to varying external inputs according to new context changes.

In the context of AI, theories of decision and utility are also subjected to in-depth research. These theories allow us to calculate preferences and determine the actions an agent must take to maximize a certain utility function. By taking advantage of decision-theoretic models any decision made in a business process can be grounded, for example, buying or selling stocks or making a recommendation to a client. In these cases, the benefit comes from better dealing with uncertain data and finding out what questions need to be asked so that decision models improve their knowledge about the business context. There are today commercial applications such as personal digital assistants (e.g. Siri, from apple) or cognitive computing, made possible by the use of this approach.

For a long time the area of operational research has been studying and researching algorithms to optimize planning and scheduling solutions [12] [11]. A classic example comes from production management, where it is necessary to distribute tasks by a set of machines for lowering production cycles, production runs and costs of a certain product. This tradition from mathematics has later been incorporated by AI, which has been developing several search techniques, which are used alone or incorporated in powerful techniques of optimization and problem solving.

In summary, the value of search algorithms to solve and optimize planning, scheduling, and other issues in business process management is undoubtedly and there are nowadays many successful applications in logistics, manufacturing, and other domains.

In the banking sector, and taking into account the current regulatory context [10], there is a huge focus on operational risk, as it can generate significant losses resulting from failures in internal processes and unpredictable people's behavior, vulnerabilities of technological infrastructures and the absence of controls on the application systems. Additionally, unexpected external events may increase the risk of inadequate responses to new market conditions.

The vulnerabilities are diverse, for example, the selection of data may be biased, or the data may be inaccurate or very different from what was expected [9]. On the other hand, decisions carry the inherent risk of becoming obsolete because the initial forecasts have changed in the context and hence their input data. In addition, when transactions in a computer-based application are automated, we accelerate decision making, and with that, the non-observance of possible changes in the conditions and business assumptions, which may already be observable in the business context, but not yet reflected in the models and automated decision rules.

In summarizing this brief presentation of potential benefits and operational risks from AI-based systems, we can say that the strong dynamism of today's business can lead to much tighter decision-making horizons. Accelerated change affects, among others, the data on which processes are based, making it more difficult to predict what changes will occur and how they can affect the technological solutions present in the increasingly automated business processes [13]. It seems that the sophistication we can adopt in BPA, via AI-related solutions, should always take into account a reasonable balance between the desired rewards for businesses and the unforeseen risks affecting them.

V. Case study

Currently, the development of Business Process Management Systems (BPMS) are mainly based in a process model (normally in a Business Process Management Notation - BPMN) where the actors or agents (normally humans and application systems) cooperate to orchestrate a desired output based on a set of pre-defined inputs.

This scenario can be easily understood in the AS-IS model (figure 1), where a certain BPMS orchestrated a requester and an executor and where we can have some application systems to assist and execute specific tasks.

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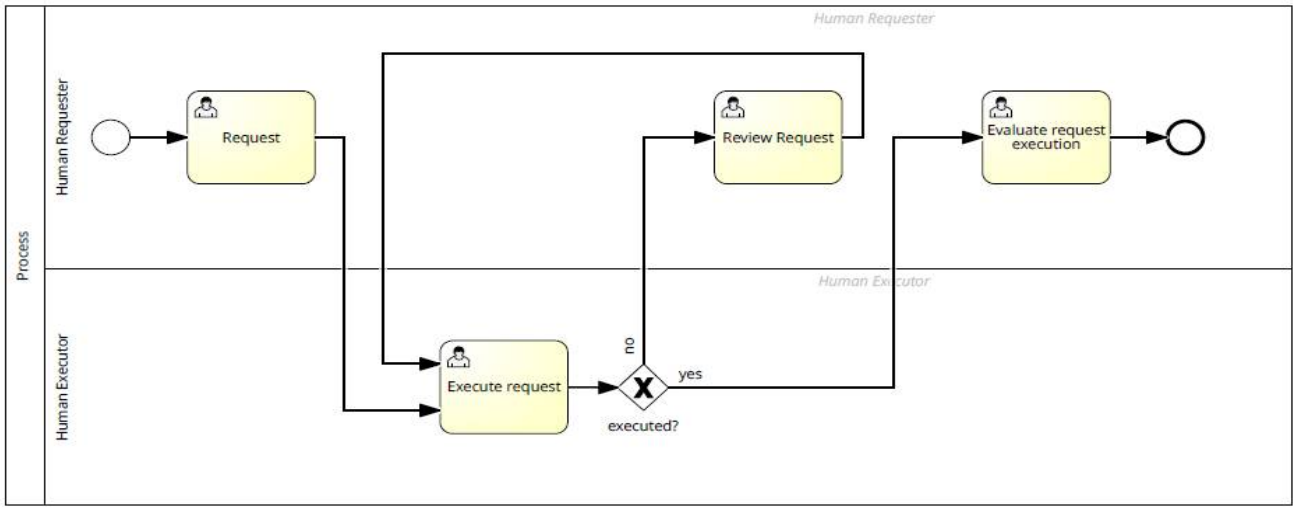

Figure 1. Scenario AS-IS of a banking process

The challenge nowadays is not only how these systems could help Business Process Managers to better understand the way processes are running but also how we can help Business Process Managers to reach an increase in productivity, better compliance and overall risk management.

As stated before, at least a limitation has been described in current BPM solutions as they are not yet able to leverage the amount of data to create insights to solve the most challenging aspects of a BPM System, What task to execute, When the task should be completed (SLA) and by Whom the task should be made. These triple W, usually defined by Process Managers, had no visible contribution of a learning mechanism meant to increase the probability of a best process outcome. So, traditional BPM solutions could not suggest the best combination of tasks, people and timings in order to increase the benefits of running them, while reducing transaction costs and associated risks

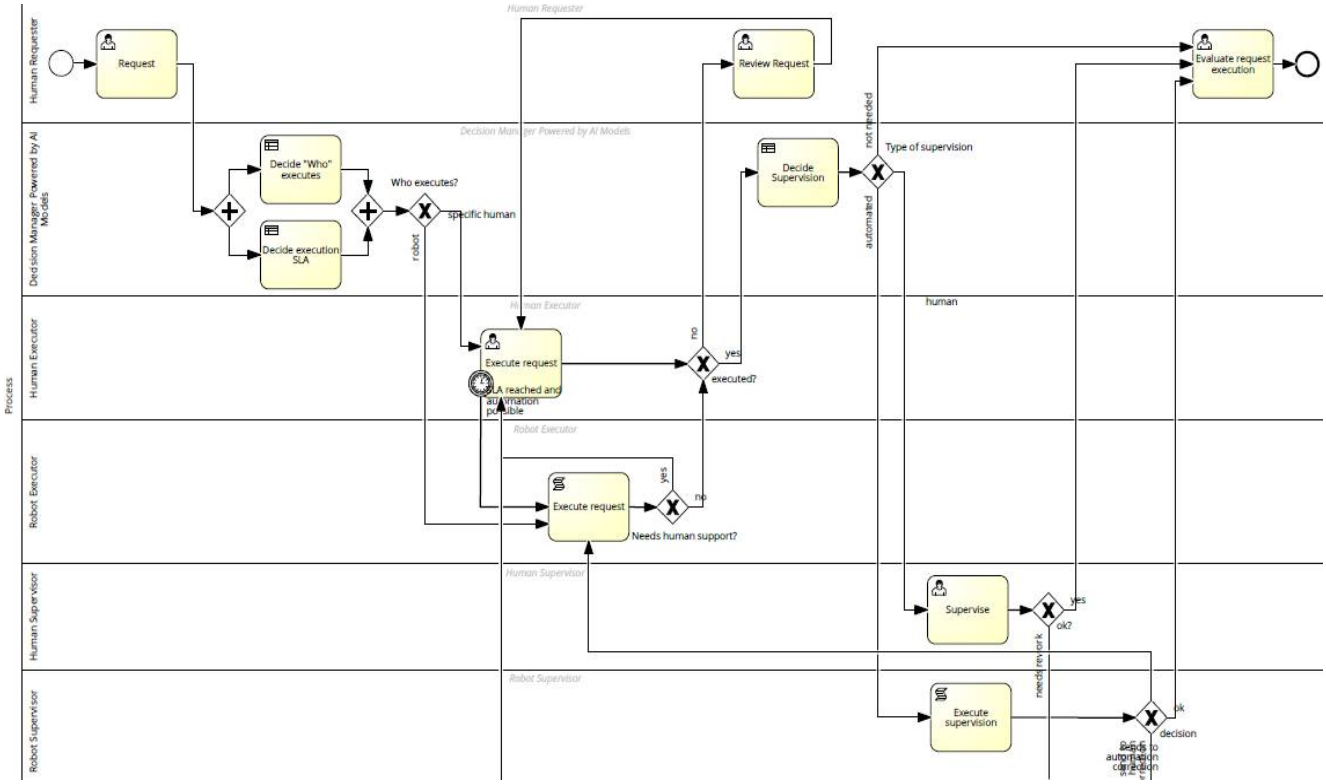

Figure 2. Scenario TO-BE of a banking process

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New approaches could then lead to a system where the Who, When and What (triple W) can be dynamic and based on a set of learned answers.

The so-called TO-BE approach, depicted in figure 2, presents the same process as in AS-IS. However, the new approach would allow a trained model to define Who is going to execute (e.g. human A vs human B, human executor vs human superior and human X vs Robot), What (e.g. if the next activity could be skipped based on a risk model, if the next activity should be the supervision of the previous one and if the task should be executed) and When (e.g. assigning Service Level Agreements and urgency levels based on the learned model).

One clear benefit of this new approach, because it is based on a trained model, is that it will allow Business Process Managers to use a fact-based approach for the triple W and an enforced certainty that these models will be dynamic, evolutionary and based on the organization's own data.

While this new approach adds perceived benefits, it also poses some risks. Among of them we point out the fact that an immature or not well-trained model can actually, even if temporarily, decrease productivity and increase errors from unsupported or even wrong decisions. We also point out the fact that training based on historical data has its own risks (e.g. lack of accurate and low-quality historical data), as described in the above risks' description review.

VI. DISCUSSION

The case study described above is a simple example of BPM in a well-known Portuguese banking institution. At this moment, the TO-BE scenario is in a phase of conceptual tuning and subsequent mapping in a sophisticated software solution under acquisition. Some limitations were identified in the current BPM situation, mapped in the AS-IS scenario. We set three research questions for which we sought answers.

In the TO-BE scenario, a couple of potential benefits were identified. Actually, as it is based on a trained model, it will allow Business Process Managers to use a fact-based approach for the triple W and an expected reliability that these models will be dynamic, evolutionary and based on the organization's own data. It has been possible to anticipate some risks, for instance the fact that an immature or not well-trained model can actually, even if temporarily, decrease process execution productivity and increase errors from unsupported or even wrong decisions. An answer to question (1) has then been provided.

In the current adoption phase of the new BPM approach, we recognize that it is still premature to have sound answers to questions (2) and (3). At this very moment, the processes are already redesigned to contemplate a specific model for decision-making, supported in an algorithm of AI. The first redesigned processes have been deployed in the BPMS engines using the execution standard BPML (quality/testing environment). There are concrete proposals for robot executors and a proposed case of supervising robot under these tests. But these are issues within the working group responsible for the transformation project of the BPM model. Although the literature highlight results obtained from similar cases, it will now be necessary to test the conditions under which the new BPM operating model will work, hence deriving the answers based on concrete results from the specific context of the bank. Summarizing, questions (2) and (3) still do not present results, only predictions based on similar cases, that allow the team to anticipate good results, but not yet visible.

VII. CONCLUSIONS

The article briefly discusses the background, concepts and definitions in the area of business process management, namely BPM and BPA. We highlighted the contexts of great dynamism, complexity and volatility in which businesses are being managed. Therefore, there is a high potential to take advantage of more "intelligence" in automating the management of business processes. The objective is straightforward, be more efficient in the management of the most obvious process components and, at the same time, get more differentiation from modelling and technical approaches in the components that give business process management its key differentiation.

We reinforce that the challenge is no longer just a matter of analyzing and understanding how efficiently processes are running. Now we have to let Business Process Managers reach an effective increase in processes productivity, along with better levels of compliance and a risk management with acceptable levels of probability and impact.

The article presents three research questions, applied to a case study of BPM in a banking institution. The answers obtained are partial and incomplete, since the project of modeling these processes, imbued with greater intelligence, is still in an implementation phase. The case study aims to promote more intelligent approaches for BPA, leading to a software solution where the Who, When and What could be dynamic, evolutionary and based on a set of learned answers within the new used decision models.

However, it should be noted that the adoption of AI-related technology in BPM / BPA calls us to consider the two sides of the same coin. Actually, benefits maximization is usually accompanied by an increase in the probabilities vs impacts of existing risks, with the emergence of new risks arising from contexts that are more unstable or/and from a greater complexity of integration among heterogeneous technological components.

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