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# Literature review of decision models for the sustainable implementation of Robotic Process Automation

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**Abstract**

Robotic Process Automation (RPA) is a rules-based system for automating business processes by software bots that mimic human interactions to relieve employees from tedious work. It was verified in the literature that there are few works related to RPA decision support models. This technology is in great growth and, therefore, it becomes important to study the evaluation of the implementation of RPA. The objective of this work is focused on a literature review for the identification and analysis of Robotic Process Automation implementation models. This work analyses some models or studies available in the literature and, in addition, analyses it from a perspective relating to the Triple Bottom Line (TBL) related to environmental, social and economic effects. Regarding the results obtained, it appears that there is still a lot of room to improve research in this field, for example, with regard to the development of an evaluation model for the implementation of the RPA, taking into account the TBL of the sustainability concept.


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## 1. Introduction

Patrício et al. (2022) identify in their study, some important works about key enabling technologies, methodologies, frameworks, tools and techniques of smart and sustainable systems. Robotic Process Automation (RPA) can be seen as one of those tools framed with the paradigm of I4.0, to potentiate the implementation of smart and sustainable systems [1,2].

Robotic Process Automation (RPA) aims to automate business processes or parts of them with software bots (bots for short) by mimicking human interactions with the graphical user interface [3]. Software robots allow the automation of many BackOffice related jobs that were previously performed by human workers [4]. Recently, many RPA approaches were implemented and the RPA software market grew by 60% in 2018 [5]. On one hand, RPA shall relieve employees from tedious works [6]. Employees might, therefore, refuse the use of automations fearing that they lose their job otherwise [7].

The concept of sustainability has received increasing global attention from the public, academic and business sectors. The World Commission on Environmental Development (WCED) defined sustainable development as development that meets the needs of the present without compromising the ability of future generations to meet their own needs [8]. Sustainability emerges as one of the most important issues in the international market for governance and are interconnected [9]. Almeida et al. (2015) says that it is common to ignore the interdependence of the sustainability pillars for short periods of time, but history has shown that before long, mankind is reminded of it through some types of alarms or crisis [10].

The importance of social issues and the natural environment for societies and businesses has evolved dramatically over the past 50 years. Corporate managers are becoming aware of the need to expand their goals beyond traditional financial expectations. It can be seen that since the term business sustainability emerged, more and more companies have emerged that address the importance of sustainability for their business, thus improving their economic, environmental and social goals [11]. Organizations that seek to be sustainable must pay attention to their performance in three dimensions: economic performance, social equity and ecological preservation [12]. Nowadays, the challenges are related to the way how I4.0 is implemented and managed, in order to achieve the desired outcomes, economic, environmental, and social [13].

Next, according to the main aspect presented, the central research question underlying this work is formulated.

- **What are the decision models for the implementation of Robotic Process Automation that exist in the literature?**

The objective of this work is focused on a literature review for the identification and analysis of Robotic Process Automation implementation models. To achieve the objective of this work, a bibliographic analysis was first carried out, focusing on the identification of works that develop models related to this theme. In a second phase, we will carry out an analysis and synthesis of the models that address the issue of Robotic Process Automation implementation.

The rest of this paper is organized as follows. Section 2 presents the research methodology used. Section 3 presents the synthesis of the articles and analysis, summarizing the main information about the models and works found. Finally, the conclusions are presented in Section 4, together with a proposal for future work.

## 2. Methodology

The methodology underlying this work was based on the analysis of a set of considered relevant data sources. Throughout this work, relevant information for the topic under study will be put forward, based on the set of contributions analysed, from leading authors who addressed this theme or some part of it. The collection of articles found and analysed was obtained by using the database of the online “B-on” library. This platform was selected as it does enable to reach the full content of a wide range of scientific publications in relevant and indexed journals, along with publications in international scientific conferences, also indexed in ISI WOS and/ or Scopus systems. “B-on” is one of the most extensive databases, which include thousands of peer-reviewed journals in a widened range of fields of different scientific areas. Through the online scientific library “B-on”, from the Portuguese Foundation for the Science and Technologies, researchers can access to most well-known international scientific databases, thus this

library was used to carried out the search process underlying this work, based on the following three groups (Group 1, Group 2, and Group 3) of shown in the Table 1.

Table 1. Groups of searched through “B-on”.

| Group 1 | Group 2 | Group 3 |
|---|---|---|
| “RPA” Or “Robotic Process Automation” Or “Intelligent Process Automation” Or “Tools Process Automation” Or “Artificial Intelligence In Business Process” Or “Machine Learning In Business Process” Or “Cognitive Process Automation” | “Model” Or “Model Evaluation” Or “Tool” Or “Tool Evaluation” Or “Evaluation” Or “Framework” | “Sustainability” Or “Sustainable” Or “Social Sustainability” Or “Environment” Or “Environmental Sustainability” Or “Economic Sustainability” Or “Sustainable Development” |

Four research tests were carried out through the "B-on" by using the three groups and the OR operator as a connector between the Title or the Key words (KW) of the intended sets. In Table 2 are expressed the number of articles found in each research test.

Table 2. Research tests performed through the “B-on”.

| | Title | OR | Key words (KW) | |
|---|---|---|---|---|
| Set 1 | (Group 1 AND Group 2 AND Group 3) | OR | (Group 1 AND Group 2 AND Group 3) | n = 0 |
| Set 2 | (Group 1 AND Group 2) | OR | (Group 1 AND Group 2) | n = 320 |
| Set 3 | (Group 1 AND Group 3) | OR | (Group 1 AND Group 3) | n = 13 |

Next, throughout the research process, a set of filters were applied, based on the sets of publications obtained, and the results obtained, in terms of number of publications, are summarized in Table 3.

Table 3. Publications obtained through the B-on, after the application of some filters.

| | Set 1 | Set 2 | Set 3 |
|---|---|---|---|
| **Initial result:** | 0 | 320 | 13 |
| 1 - Restrict to: Peer Reviewed | 0 | 222 | 9 |
| 2 -Type of fonts: Academic Journals; Conference Materials; Books | 0 | 222 | 9 |
| 3 - From: 2000 to 2021 | 0 | 166 | 9 |
| 4 - Language: English | 0 | 160 | 9 |
| 5 - Restrict to: Full Text | 0 | 126 | 9 |
| **Final result:** | 0 | 126 | 9 |

After the applied filters, a reading of the title, the key terms and the resume of each of the articles was carried out to verify which articles were directly related to the research. From the carried-out research, 333 papers were obtained, applied the filters we verified a total of 135 articles and of which only 14 were framed with the theme. One of the reasons for the small number of framed papers is related with the fact that most of them were related with evaluation of the formation of a collaborative network that is not the scope of this work. So, evaluating the formation of a network is not the same as evaluating the participation or integration of an organization in a network. Fig. 1 represents a flow diagram of the literature search carried out, and respective screening of the methodology used in this research work.

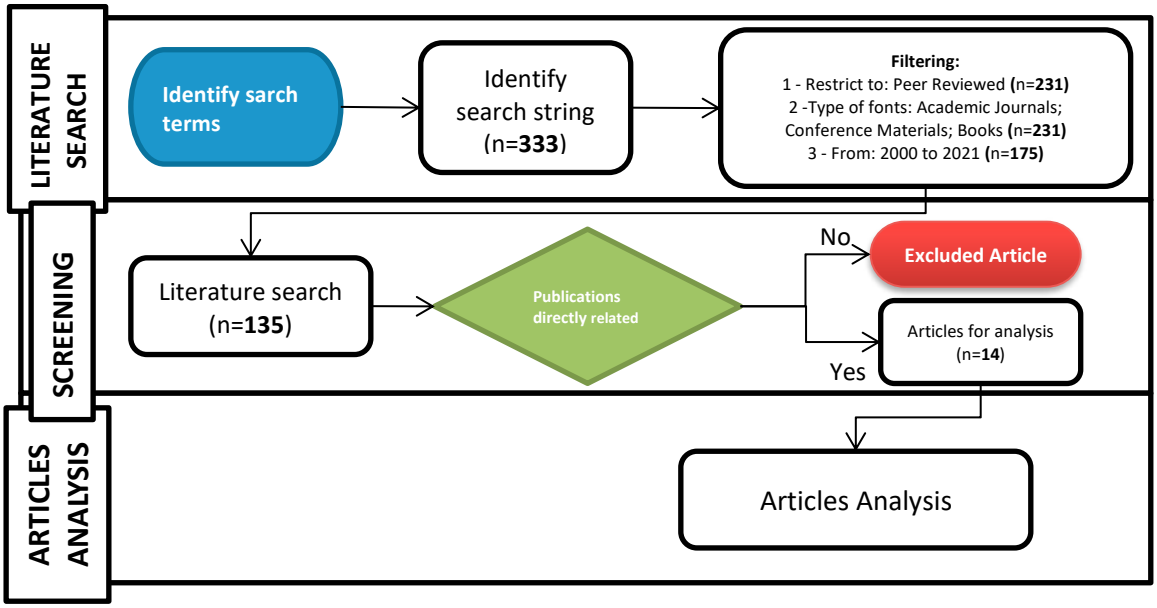


Fig. 1. Flow diagram of literature search and respective screening, adapted from [14].

## 3. Articles Synthesis and Analysis

In this section, the synthesis and analysis of the articles are presented. Data about the articles will be presented found, and which were considered the most relevant on the topic focused on in this work. Table 4 presents the 14 articles found and the themes of the identified models.

Table 4. Identified articles and the respective themes of the models found.

| Themes of the models / Articles | Decision support model for implementing RPA | Decision support template for selecting RPA tool | RPA Governance Assessment Model | RPA Financing Return Assessment Model | RPA monitoring assessment model |
|---|---|---|---|---|---|
| Silva, A. (2017) [15] | | X | | | |
| Pozdnyakov, O. (2019) [16] | X | | | | |
| Sobczak, A. (2019) [17] | | | | X | |
| Wanner, J. et al. (2019) [18] | | | | X | |
| Kopper, V. et al. (2020) [19] | X | | | | |
| Timbadia, D. et al. (2020) [20] | X | | | | |
| Wellmann, C. et al. (2020) [21] | | | | | X |
| Wewerka, J. et al. (2020) [22] | X | | | | |
| Mora, H. and Sánchez, P. (2020) [23] | X | | | | |
| Pargana, M. (2020) [24] | X | | | | |
| Amaral, M. (2020) [25] | | | X | | |
| Farinha, D. (2021) [26] | X | | | | |
| Grande, V. (2021) [27] | X | | | | |
| Hernm, et al. (2022) [28] | X | | | | |
| **% Themes p/ articles** | **64** | 7 | 7 | 14 | 7 |

It was verified among all the models found that there are 5 different themes of models related to RPA. The topic that is most studied is the decision support model of RPA implementation (64%). For this work, we will consider for a more detailed analysis the models that consider the decision support theme for the implementation of RPA. Table 5 presents the inputs, constraints, tools and outputs of the decision support models for RPA implementation.

Table 5. Articles and the respective topics of the models.

| Analysis topic / Articles | | Pozdnyakov, O. (2019) | Kopper, V. et al. (2020) | Timbadia, D. et al. (2020) | Wewerka, J. et al. (2020) | Mora, H. and Sánchez, P. (2020) | Pargana, M. (2020) | Farinha, D. (2021) | Grande, V. (2021) | Hernm, et al. (2022) |
|---|---|---|---|---|---|---|---|---|---|---|
| **Inputs** | Number of employees performing the process. | X | | X | | | X | X | X | X |
| | Degree of data structure of process inputs. | X | | X | | | X | X | X | X |
| | Number of systems. | X | | X | | | X | X | X | X |
| | Degree of process standardization. | X | | X | | | X | X | X | X |
| | Process maturity level (changed in the last 12-18 months). | X | | X | | | X | X | X | X |
| | Number of process exceptions. | X | | X | | | X | X | X | X |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Degree of value of the process to the business (high or low). | X | | X | | | X | X | X | X |
| | Number of transactions. | X | | X | | | X | X | X | X |
| | Process complexity level (high, medium or low). | X | | X | | | X | X | X | X |
| | Workflow degree (repetitive and monotonous). | X | | X | | | X | X | X | X |
| | System stability degree. | X | | X | | | X | X | X | X |
| | Current cost of the process. | X | | X | | | X | X | X | X |
| | The process is rule-based. | X | | X | | | X | X | X | X |
| | RPA user acceptance | | | | X | | | | | |
| | Facilitating conditions | | | | X | | | | | |
| | Presentation of the final result | | | | X | X | | | | |
| | Joy of innovation | | | | X | X | | | | |
| | Social influence | | | | X | | | | | |
| | Software development | | X | | | | | | | |
| | FTE savings | | | X | | | | | | |
| | Faster process | X | | | | X | | | | |
| | Availability improvement | X | | | | X | | | | |
| | Compliance improvement | X | | X | | X | | | | |
| | Higher Education Institutions with Business Process Management | | | | | X | | | | |
| | Financial / Administrative / Back-office | | | | | | X | | X | |
| | Startup, Implementation, and Scaling RPA Project | | | | | | | | | X |
| | Theoretical investigation | | | | X | | | | | |
| | Validated with criteria from 5 RPA projects | | | | | | | X | | |
| | Data from Heliotec, a Paraguayan solar and renewable energy company | | X | | | | | | | |
| **Constraints** | Validated with 1 case study | X | | X | | | X | | | |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Partial least squares algorithm | | | | X | | | | | |
| | Delphi | | | | | | | X | | |
| | Business Process Reengineering (BPR) | | X | | | | | | | |
| | Questionnaire and statistical analysis | | | | | X | X | | | |
| | Algorithm for filling in weights to criteria and decision making at pre-defined intervals | | | X | | | | | | |
| | Interviews and statistical analysis | X | | | | | | | X | X |
| | Linear Sequential Model Algorithm | | | | | | | | | X |
| **Tools** | Fuzzy Inference System Algorithm | | | | | | | | X | |
| | Economic level Evaluation | X | X | X | | X | X | X | X | X |
| **Outputs** | Social level Evaluation | | | | X | X | | | | |
| | Environment level Evaluation | | | | | | | | | |

To present the results of this work, we detail below the synthesis of the results of the in-depth analysis of the articles examined.

### *3.1. Synthesis of the results*

Analysing the previous tables, it is possible verify the following remarks:

- It was verified the existence of five themes of RPA evaluation models;
- It was found that 64% of the models found refer to the issue of RPA implementation;
- The pillar of Sustainability most addressed in the models is the economic one;
- The Social Sustainability pillar is also addressed in models;
- There are no works that contemplate the pillar of Environmental Sustainability, which leaves the door open to be one of the first works that evaluate technology in terms of this level of sustainability;
- There is no integration of the three pillars of sustainability in any of the works;
- It is important to carry out the evaluation and implementation of an RPA Project, which can integrate the three pillars of sustainability, social, economic and environmental;
- Few works were found as models;
- There is an opportunity to create a new evaluation model for the RPA and, moreover, that brings with it a joint evaluation of the three pillars of sustainability, thus managing to evaluate in a general and complete

way, in addition to the economic levels, which are already studied, the social and environmental levels for the organization.

## 4. Conclusion

The implementation of Robotic Process Automation (RPA) in a sustainable way is a topic of wide spectrum and of great interest in research, since the magnitude of the resulting value of decision support models for the implementation of RPA does not aim at the integration of three pillars of sustainability. Existing models alone assess decision making from a primarily economic perspective.

This work analysed the models and works available in the literature and identified important analysis topics for the pre-evaluation of future RPA implementations.

Considering the results of the work, the authors are convinced that there is room to improve research in this area and that a more robust evaluation model should be developed. Seems like there are not many jobs on this topic, making a link between the pillars of sustainability and the implementation of RPA, and this work aimed at this integration, considering the three pillars of sustainability. These pillars are extremely important for companies and individuals, for example, in the proper recognition and relevance of sustainability concerns.

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