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# Selecting a BPM platform: beyond traditional evaluation criteria

## *Selección de una plataforma BPM: más allá de los criterios de evaluación tradicionales*

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**Abstract:** Business Process Management (BPM) improves efficiency, adaptability, and competitiveness by aligning processes with technology, supporting agility, reducing costs and errors, and enhancing customer satisfaction. With abundant data and integration tools, using a BPM system (BPMs) has become essential. Objective: This study proposes a methodology for selecting a BPMs that score well on traditional criteria and in criteria for global presence and community. Procedure: we used the Multi Criteria Decision Analysis method, for selecting the criteria and assigning value to each one. Next, we consulted in two sources the BPMs platforms to compare and apply the criteria. Results: Using the criteria usability, coverage, expert opinion, community and trend, Camunda was the selected BPM platform. Conclusions: Camunda is the BPM platform that best fits our evaluation criteria (it is free, open source, is widely used in many countries, and has the largest community around it). We arrived at this conclusion after comparing 107 BPM platforms. This study offers a differentiated perspective to help practitioners and academics choose BPM tools beyond traditional evaluation criteria.

**Keywords:** BPM, BPMs, BPM platform, software platform comparison.

**Resumen:** La Gestión de Procesos de Negocios (BPM) mejora la eficiencia, la adaptabilidad y la competitividad al alinear los procesos con la tecnología, favorecer la agilidad, reducir los costos y los errores y mejorar la satisfacción del cliente. Con la abundancia de datos y herramientas de integración, el uso de un sistema de gestión de procesos de negocio (BPMs) se ha vuelto esencial. Objetivo: Este estudio propone una metodología para seleccionar BPMs que cuenten con una buena puntuación en los criterios tradicionales y en los criterios de presencia global y comunidad involucrada. Procedimiento: utilizamos el método de análisis de decisión multicriterio para seleccionar los criterios y asignar un valor a cada uno de ellos. Acto seguido, consultamos dos fuentes

sobre sistemas BPM para compararlas y aplicar los criterios establecidos. Resultados: Utilizando los criterios de comparación de usabilidad, cobertura, opinión de expertos, comunidad y tendencia, Camunda fue la plataforma BPM seleccionada. Conclusiones: Camunda es el sistema BPMS que mejor se ajusta a nuestros criterios de evaluación (es gratuita, de código abierto, se utiliza ampliamente en muchos países y cuenta con la mayor comunidad a su alrededor). Llegamos a esta conclusión después de comparar 107 sistemas BPM. Este estudio ofrece una perspectiva diferenciada para ayudar a los profesionales y académicos a elegir sistemas BPM más allá de los criterios de evaluación tradicionales.

**Palabras clave:** BPM, BPMs, plataforma BPM, sistema BPM, comparación de plataformas de software.

## 1. INTRODUCTION

Business Process Management (BPM) has become a key discipline for organizational improvement by focusing its efforts on business processes. Its implementation relies on BPM platforms that support the full process lifecycle; however, the diversity of available solutions makes objective selection difficult. Traditionally, BPM platform selection has been approached from a perspective almost exclusively focused on technical performance, assessing functionalities in an isolated and fragmented manner. This approach is limited, as it overlooks key factors such as perceived usability, expert validation, community strength, and real-world adoption dynamics. In the face of this fragmented view, the coexistence of heterogeneous criteria such as these requires an approach capable of structuring, normalizing, and weighing them coherently.

For this reason, this study adopts a Multi-Criteria Decision Analysis (MCDA) approach, which provides a formal and transparent framework for the comprehensive evaluation of complex alternatives.

The study is limited to a comparative analysis of freely accessible BPM platforms, taking into account considerations of cost, technological independence, and reproducibility. Given that these platforms implement well-established BPM standards and share essential functional capabilities, their evaluation under an MCDA framework enables the comparison of actual performance without biases associated with licensing models.

From a research perspective, this work constitutes the first stage of a broader investigation into the evolution of business process–based software. Although the study was conducted using data up to June 2023 and its publication was delayed due to administrative and funding processes, its relevance remains current considering the continued growth of BPM and the sustained adoption of digital transformation initiatives.

The relevance of this study is further reinforced by the absence of widely accepted systematic methodologies for BPM platform selection. In this context, the MCDA approach enables the problem to be addressed in a structured, reproducible, and justifiable manner, aligning the needs of the BPM field with a rigorous evaluation process.

This article is structured as follows: Section 2 presents the theoretical foundations of BPM platforms; Section 3 describes the methodology and evaluation criteria; Section 4 presents the results obtained; Section 5 analyzes threats to validity; Section 6 reviews related work; and Section 7 presents the conclusions.

## 2. BACKGROUND

This work compares several free and open-source Business Process Management Systems (BPMS) that support the BPM lifecycle. These systems are designed to operationalize BPM by providing technological support for the continuous improvement of business processes through their discovery, design, analysis, execution, monitoring, and optimization. BPM is a set of principles and techniques for the continuous improvement of business processes; in other words, it focuses on coordinated events, activities, and decisions involving multiple actors and resources that together produce valuable outcomes for an organization or its customers [1]. BPM facilitates the integration of new technological advances to reduce time-to-market, control costs, time, and quality, and consequently improve the efficiency of an organization’s business processes [2]–[9].

The BPM lifecycle requires the coordinated interaction of people, information systems, data, and

events to support business operations. In this context, BPMS enable the coordination of information systems by linking business process activities, decisions, and events with the software components that support their execution, while also facilitating alignment between information technology and business objectives [10].

## 3. METHODOLOGY

To conduct this study, we followed the MCDA method proposed by Pacheco Cárdenas [11] for selecting criteria applicable to the evaluation of software products. Cárdenas' proposal aims to enable evaluators to make methodologically sound and transparent decisions. We adapted this method to our specific context by following these steps: (a) compiling a list of all possible criteria, (b) defining the evaluation approach for each criterion, (c) assigning a numerical score to each criterion, and (d) weighting the criteria.

### 3.1. Criteria List

Traditional criteria used to compare software tools include functionality, usability, performance and efficiency, reliability, maintainability and extensibility, portability and compatibility, cost and licensing, community, and vendor support [12]–[14]. However, in this study, a key consideration when selecting a BPM platform is ensuring that it has the greatest possible impact within both the academic community and industry. Therefore, in addition to the aforementioned criteria, we incorporate expert opinion, community, and trend as evaluation dimensions, with the aim of ensuring that the selected BPMS achieves the broadest possible reach. It is worth noting that *community* refers to developers, while *trend* refers to the search popularity of a given term in Google, measured using Google Trends.

To assign numerical scores to each criterion, we followed the methodology proposed by Bryson et al. [15], which consists of structured, rubric-based quantitative scoring of qualitative evaluations through collaborative consensus processes among researchers.

At this stage, we emphasize that the researchers agreed that the most important aspect of this study is the selection of the BPM platform with the greatest global presence, both in academia and industry. Nevertheless, we agreed to assign equal weights to all criteria. *Table 1* presents the normalized criteria.

***Table 1:*** *Criteria Normalization Mapping*

| Criteria | | Normalization | |
|---|---|---|---|
| | | **Range or Rule** | **Value** |
| **Usability** | Technical Support | Yes | 5 |
| | | No | 1 |
| | Documentation | Available | 5 |
| | | Not Available | 1 |
| | Own forum | Yes | 5 |
| | | No | 1 |
| **Coverage** | Available operating systems | 4 | 5 |
| | | 2–3 | 3 |
| | | 1 | 1 |
| | | No information | 1 |
| | Languages | 1 to 4 | Number of languages |
| | | ≥ 5 | 5 |
| | | Not specified | 1 |
| | Countries | 1 to 4 | Number of countries |
| | | ≥ 5 | 5 |
| | | Not specified | 1 |
| | Success Stories | 1 to 4 | Number of stories |
| | | ≥ 5 | 5 |
| | | None | 1 |
| **Expert Opinions** | Forrester | Evidence-based evaluation | {1,2,3,4,5} |
| | Gartner | | |
| **Community** | LinkedIn | Benefit type (min-max) | {1,2,3,4,5} |
| | Stack Overflow | | |
| **Trend** | Google Trends | | |

***Source:*** *Author´s own elaboration*

In this table, scores range from 1 to 5, which allows us to construct a decision matrix:

$$X = [x_{ij}] \in R^{mxn}$$

to compare $m$BPM platforms across $n$ criteria. We obtained scores in three ways: (i) rule-based scoring, (ii) evidence-based evaluation, and (iii) benefit-type normalization (min = 1, max = 5). Rule-based scoring was applied to usability and coverage, as shown in *Table 1*. Examples of the rules include "Available → 5, Not available → 1," "number of countries ≥ 5 → 5," and "None → 1."

We used evidence-based evaluation to normalize *expert opinion* as follows:

$$x_{ij} = f_j(evidence) \in \{1,2,3,4,5\}$$

Finally, benefit-type normalization was applied to community and trend.

In the evaluation matrix, the score per criterion for each platform is computed as:

$$S(a_i) = \sum_{j-1}^{n} w_j x_{ij}$$

where $w_j$denotes equal weighting (set to 1), and $x_{ij}$is rubric-normalized on the same scale. When information was not available, we applied a penalty by assigning the minimum value on the scale ($x_{ij} = 1$) in order to preserve comparability and avoid bias.

Subsequently, we followed the stages below to apply the selected criteria: (i) identifying information sources on BPM platforms, (ii) selecting open and free BPM platforms that provide a BPM engine, (iii) applying the criteria to the platforms, and finally (iv) applying the MCDA criteria to compare the BPM platforms. The next sections describe each step of the process to facilitate review and subsequent replication.

### 3.2. Sources and Selection of BPM Platforms

Our primary sources were Hesse's BPMN Tools Matrix [16], which lists 75 BPM tools, and Gartner's report on BPM platform reviews and ratings [17], which includes 65 BPM platforms. Both sources were consulted on June 8, 2023.

From Hesse's matrix, we extracted all data available at the time of consultation. For the Gartner report, we initially selected platforms that had received at least five user ratings in Gartner's list. We then compared this selection with Hesse's list and obtained a consolidated set of 65 BPM platforms, which was published online by Vega-Márquez [18].

Subsequently, we selected the free and open-source platforms. *Fig. 1* summarizes the platform selection process. After applying these preliminary filters, we obtained the 10 BPM platforms presented in *Table 2*. Platform data from both the BPMN Tools Matrix and Gartner were collected in June 2023.

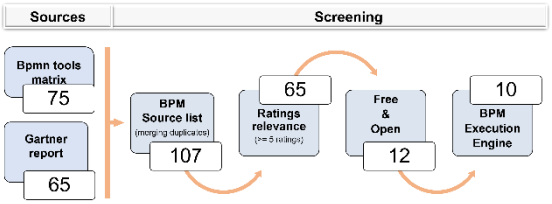



***Fig. 1*** *Platform selection process for comparison*
*Source: Author´s own elaboration*

***Table 2:*** *BPM Platforms Selected for Comparison*

| Id | Name | URL |
|---|---|---|
| 1 | Activiti Modeler | *https://www.activiti.org/* |
| 2 | Bonitasoft | *https://www.bonitasoft.com/* |
| 3 | Camunda | *https://camunda.com/* |
| 4 | Flowable | *https://www.flowable.com/* |
| 5 | Imixs-Workflow | *https://www.imixs.org/* |
| 6 | jBPM | *https://www.jbpm.org/* |
| 7 | Modelio | *https://www.modelio.org/* |
| 8 | RunaWFE | *https://runawfe.org/RunaWFE_Free_Workflow_System* |
| 9 | simpl4 | *https://github.com/ms123s/simpl4-deployed* |
| 10 | XML Frames | *http://xmlframes.com/* |

***Source:*** *Author´s own elaboration*

### 3.3. Application of Criteria

The established selection criteria were applied. Only simpl4 and XML Frames did not provide information regarding (i) technical support. By contrast, all evaluated platforms met the criteria for (ii) documentation availability, (iii) own forums, and (iv) available languages. A detailed description of this information is available on the corresponding *GitHub* page.

Mentions in expert reports (vii) are typically indicated on the official website of each BPM platform. However, when this information was not available, we used Google to search for studies or analyses that evaluated or mentioned the platforms.

In addition to Gartner's *Business Process Management Platforms Reviews and Ratings* [17], we used two other reports to evaluate each of the candidate BPM platforms: the *Market Guide for Business Process Automation Tools* [19] and the *Magic Quadrant for Intelligent Business Process Management Suites (iBPMS)* [20].

*Table 3* presents the Gartner results. Platforms not included in the table are not mentioned in any of the reports.

***Table 3:*** *Gartner Evaluation*

| Gartner Reports | Bonitasoft | Camunda | Flowable |
|---|---|---|---|
| Gartner Magic Quadrant for iBPMS | ✓ | ✗ | ✗ |
| Market Guide for Business Process Automation Tools | ✓ | ✓ | ✓ |

***Source:*** *Author´s own elaboration*

From all available Forrester reports, we selected the most recent one related to BPM, The Forrester Wave™: Digital Process Automation Software [21]; the Camunda-commissioned study, *Total Economic Impact of Camunda* [22]*;* and a blog publication tangentially related to Activiti Modeler, *Hyland Accelerates Its Path to Cloud by Acquiring Alfresco Software* [23].

***Table 4:*** *Forrester Study/Report*

| Forrester Study/Report | BPM Platform |
|---|---|
| The Forrester Wave™: Digital Process Automation Software, Q4 2021 | BonitaSoft |
| Total Economic Impact Of Camunda, July 2021 | Camunda |
| Hyland Accelerates Its Path To Cloud By Acquiring Alfresco Software, 2020 | Activiti Modeler |

***Source:*** *Author´s own elaboration*

*Table 4* lists the reports or studies consulted that mention at least one of the BPM platforms included in our list. The LinkedIn search configuration used in this study is shown in *Fig. 2*.

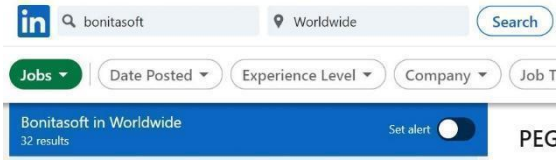



***Fig. 2*** *LinkedIn search configuration*
***Source:*** *Author´s own elaboration*

For example, to evaluate BonitaSoft, we searched for job postings that included the term “BonitaSoft” with the location set to Worldwide. In this case, LinkedIn returned 32 job postings. A summary of the results of this search for all the BPM platforms considered is presented in the second column of *Table 5*. Camunda, jBPM, and Flowable yielded the highest number of results in the LinkedIn search.

For Stack Overflow, we conducted a comprehensive search using the name of each BPM platform.

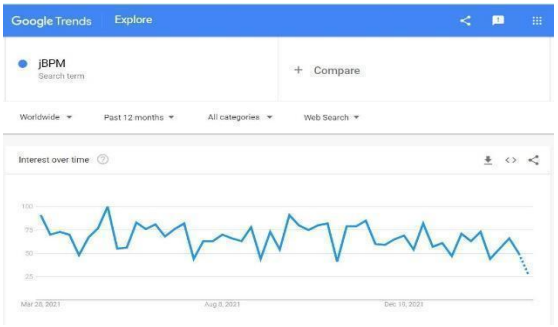
***Table 5:*** *LinkedIn Job Postings and Stack Overflow Issues per BPM Platform*

| BPM Platform | LinkedIn Job Postings | Stack Overflow Issues |
|---|---|---|
| Activiti Modeler | 13 | 187 |
| BonitaSoft | 31 | 72 |
| Camunda | 1000 | 500 |
| Flowable | 596 | 112 |
| Imixs-Workflow | 0 | 23 |
| jBPM | 924 | 500 |
| Modelio | 14 | 227 |
| RunaWFE | 0 | 0 |
| simpl4 | 0 | 0 |
| XML Frames | 0 | 0 |
| YaoqiangBPMNEditor | 0 | 3 |

***Source:*** *Author´s own elaboration*

To this end, we developed a software tool that uses the Stack Overflow API to retrieve all issues related to a given BPM platform. We named this tool *Stack Overflow Issues Searcher – SOFIS* [24]. The tool queries discussions created from January 14, 2014 (the publication date of the BPMN standard) on a specific topic up to a defined cutoff date.

To reproduce this query, the name of the BPMS of interest must be provided to the tool as the *search_topic* parameter (issue flag –i), and June 30, 2023 must be specified as the end date (*date flag – f*). The repository documentation, published in the README file, describes the different ways to access the tool, which can generate results either as a .CSV file or in a database. The tool can be used via the command line or through a graphical user interface in Windows. Based on the Stack Overflow queries, the BPMS Camunda and jBPM tied for first place, followed by Modelio and Activiti Modeler. Subsequently, we used Google Trends, a Google service that provides search trend data for a given term or concept, to compare the number of searches performed for each platform over a specified period across different locations. *Fig. 3* shows an example of a Google Trends results page using jBPM as the query term [25].



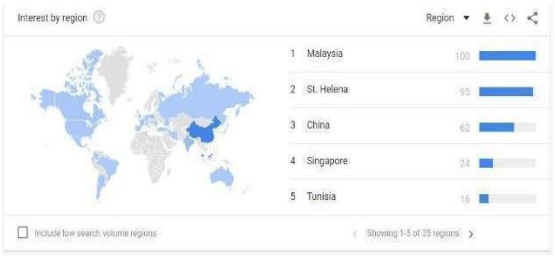


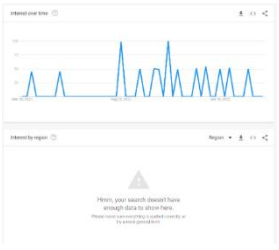
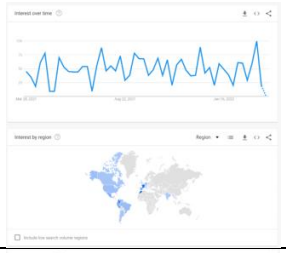
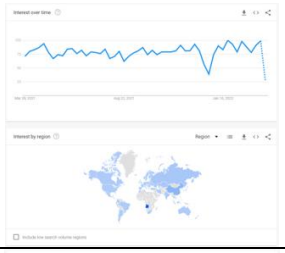
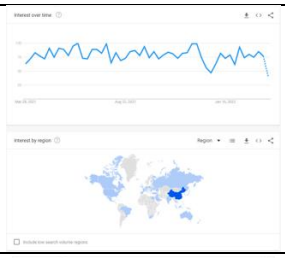
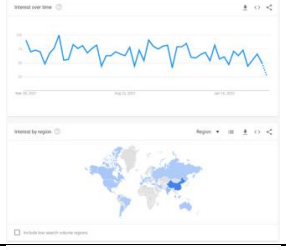
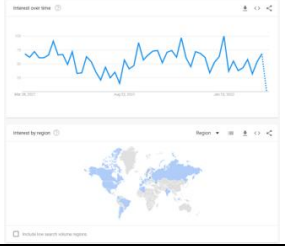
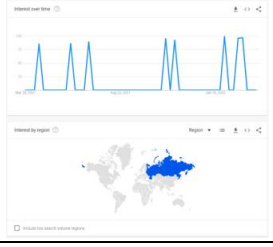
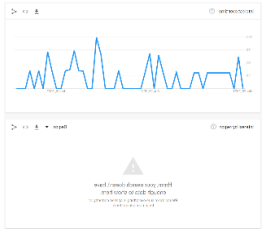

***Fig. 3*** *Google Trends results for a BPM platform*
***Source:*** *Google Trends [25].*

All queries were conducted in June 2023, using the previous 12 months as the reference period.

The resulting Google Trends pages for each platform are presented in Table 6. It is worth noting that this tool provides a geographical breakdown of search activity for each BPM platform. Insufficient data were available to generate a trend overview for Imixs-Workflow, and it was therefore excluded from this table. Because the tool allows the comparison of a maximum of five terms at a time, we selected the five most widely used platforms for our analysis.

Based on the maps presented in Table 6, the platforms selected for comparison were (a) BonitaSoft, (b) Camunda, (c) Modelio, (d) Flowable, and (e) jBPM. The results of this comparison are shown in *Fig. 4*, which indicates that Camunda is the most frequently searched BPM platform worldwide, followed by Flowable, jBPM, BonitaSoft, and Modelio.

***Table 6****: Google Trends by BPM Platform*

| BPMS | Google Trends Geographic Searches | BPMS | Google Trends Geographic Searches | BPMS | Google Trends Geographic Searches |
|---|---|---|---|---|---|
| Activiti Modeler |  | BonitaSoft |  | Camunda |  |
| Flowable |  | jBPM |  | Modello |  |
| RunaWFE |  | Simpl4 |  | XML Frames |  |

***Source:*** *Author´s own elaboration*

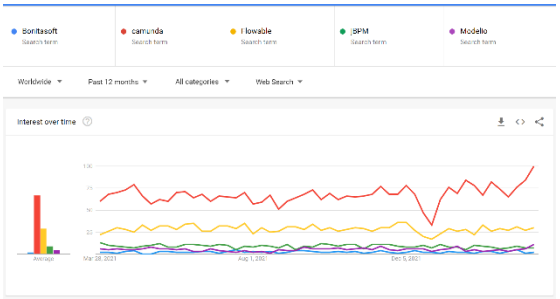



***Fig. 4*** *Comparison of BPM platform trends*
***Source:*** *Author´s own elaboration*

## 4. RESULTS

The normalization defined previously and presented in the Methodology enabled us to assign comparable numerical values to each criterion for the selection of a BPM platform. As a result, we obtained the decision matrix presented in *Table 7*.

### 4.1. Analysis

We decided to use a radar chart to facilitate the analysis, as this type of chart presents the information in a clear and comprehensive manner, allowing us to directly observe the differences among all platforms across all relevant criteria. A larger area in the chart clearly indicates which platform achieved the best overall score.

Subsequently, to simplify the interpretation of the chart, we decided to remove criteria that did not exhibit significant differences in this comparison. For example, the criteria Documentation, Technical Support, Own Forums, and Languages were not useful, as all platforms received the same score for these dimensions.

The normalized values for the criteria Languages, Success Stories, Forrester, Gartner, LinkedIn, Stack Overflow, and Google Trends for RunaWFE, simpl4, and XML Frames indicate that these platforms received substantially lower scores (1 on a 1–5 scale) than the other platforms. Therefore, the co-investigators agreed that excluding them would not affect the overall outcome of the comparison.

***Table 7:*** *Normalized BPM Platform Comparison Criteria*

| BPM Platform | Tech. support | Documentation | Own Forums | Operative Systems | Languages | Countries | Success Stories | Forrester | Gartner | LinkedIn | Stack Overflow | Google Trends |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Activiti Modeler | 5 | 5 | 5 | 3 | 1 | 1 | 1 | 3 | 4 | 2 | 4 | 1 |
| Bonitasoft | 5 | 5 | 5 | 3 | 5 | 5 | 5 | 4 | 4 | 2 | 2 | 2 |
| Camunda | 5 | 5 | 5 | 3 | 1 | 5 | 5 | 5 | 3 | 5 | 5 | 5 |
| Flowable | 5 | 5 | 5 | 5 | 1 | 5 | 5 | 1 | 4 | 4 | 3 | 4 |
| Imixs-Workflow | 5 | 5 | 5 | 5 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 |
| jBPM | 5 | 5 | 1 | 5 | 1 | 1 | 1 | 1 | 1 | 5 | 5 | 3 |
| Modelio | 5 | 5 | 5 | 3 | 1 | 1 | 1 | 1 | 1 | 2 | 4 | 2 |
| RunaWFE | 5 | 5 | 5 | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| simpl4 | 1 | 5 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| XML Frames | 1 | 5 | 1 | 3 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

***Source:*** *Author´s own elaboration*

The BPM platforms Imixs-Workflow, jBPM, and Modelio also obtained the minimum possible score in half of the relevant criteria and could be excluded without concern that these low scores would be offset by higher scores in the remaining criteria (as shown in *Table 7*).

Regarding Gartner's expert evaluation of Camunda, it is important to clarify that although Gartner did not include Camunda in its Magic Quadrant for iBPMS [20], Camunda is classified as a Representative Vendor in the *Market Guide for Business Process Automation Tools* [19] and appears in the *Business Process Management Platforms Reviews and Ratings Report* [17], both published by Gartner. For this reason, the co-investigators assigned a value of 3 to this criterion.

Thus, the selection criteria considered relevant for the final ranking of the BPM platforms are shown in *Table 8*.

***Table 8:*** *BPM Platform Ranking for the Radar Chart*

| BPM Platform | Success Stories | Forrester | Gartner | LinkedIn | Stack Overflow | Google Trends | TOTAL |
|---|---|---|---|---|---|---|---|
| Activiti Modeler | 1 | 3 | 4 | 2 | 4 | 1 | 15 |
| Bonitasoft | 5 | 4 | 4 | 2 | 2 | 2 | 19 |
| Camunda | 5 | 5 | 3 | 5 | 5 | 5 | 28 |
| Flowable | 5 | 1 | 4 | 4 | 3 | 4 | 21 |

***Source:*** *Author´s own elaboration*

Since the MCDA model produces, for each alternative (BPMS platform), a vector of scores by criterion, the radar chart (*Fig. 5*) facilitates the visual comparison of these multidimensional profiles and the identification of criterion-specific strengths and weaknesses, complementing the quantitative analysis of the aggregated score without replacing it.

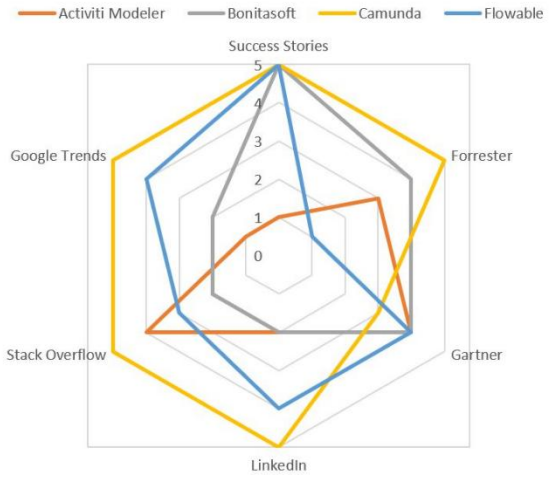



***Fig. 5*** *BPM Platforms Comparison Radar Plot*
***Source:*** *Author´s own elaboration*

We used the radar chart as a multivariate visualization tool to simultaneously represent the relative performance of the evaluated platforms with respect to the set of normalized criteria presented in *Table 8*.

We acknowledge, however, that the radar chart has limitations. In particular, this representation does not explicitly incorporate criterion weights nor reflect their contribution to the overall score; therefore, visual differences along the axes should not be interpreted as having a direct impact on the ranking. Likewise, polygon overlap and area-based interpretation may lead to non-linear perceptions when the number of criteria or alternatives increases. For these reasons, we use the radar chart solely as a descriptive visual aid, while the study's conclusions are grounded in the MCDA model and the sensitivity analysis of the results.

As can be observed using both instruments, Camunda emerges as the leading alternative.

### 4.2. Sensitivity Analysis

In order to assess the robustness of the proposed MCDA model, we conducted a sensitivity analysis by considering controlled variations in the main methodological assumptions of the evaluation process. The baseline scenario assumes equal weights for all criteria, that is, $w_j = 1/n$, the use of a weighted additive model as the aggregation function, and a conservative strategy for handling missing values.

First, we analyzed the sensitivity of the results to variations in the criterion weights. To this end, we defined perturbed scenarios by increasing by 20% the weight of criteria considered relevant (e.g., usability, coverage, expert opinion, and trend), while proportionally redistributing the remaining weights in order to preserve the normalization condition:

$$\sum_{j=1}^{n} w_j = 1.$$

For each scenario, we recalculated the overall score of the alternatives using the following expression:

$$S(a_i) = \sum_{j-1}^{n} w_j x_{ij}$$

Next, we evaluated the sensitivity of the model with respect to the treatment of missing values. We compared the penalization of missing evidence by assigning the lowest value of the scale with the alternative of excluding these criteria from the aggregation process and renormalizing the weights over the subset of observed criteria.

Additionally, we rescaled the discrete scores $\{1, 2, 3, 4, 5\}$ to the continuous interval $[0, 1]$, with the purpose of verifying the influence of the evaluation scale on the resulting ranking.

The results are summarized in *Table 9*. In all evaluated scenarios, the top-ranked alternative

remains invariant, while only minor variations are observed in the intermediate positions of the ranking.

***Table 9:*** *Sensitivity Analysis of the MCDA Ranking under Different Scenarios*

| Scenario | Model Modification | Leading Platform | Ranking Changes |
|---|---|---|---|
| Base | Equal weights $w_j = 1/n$; penalization of missing values | Camunda | — |
| S1 | 20% increase in the weight of the Usability criterion | Camunda | No |
| S2 | 20% increase in the weight of the Coverage criterion | Camunda | No |
| S3 | 20% increase in the weight of the Community – Stack Overflow criterion | Camunda | Minor changes in intermediate positions |
| S4 | Alternative handling of missing values (no penalization) | Camunda | Marginal variations |
| S5 | Rescaling of score to [0,1] | Camunda | No |

***Source:*** *Author´s own elaboration*

These results demonstrate that the proposed MCDA model is robust to reasonable variations in criterion weights, the handling of missing values, and the evaluation scale, thereby supporting the consistency and reliability of the conclusions derived from the comparative analysis.

## 5. THREATS TO VALIDITY AND LIMITATIONS

In this work, we deliberately set aside some of the traditional criteria commonly used in software evaluation, such as robustness, security, usability, portability, or ease of implementation, among others. Under different circumstances, this could be considered a weakness in a study of this nature. However, the BPM platforms considered in this study exhibit characteristics that allowed us to confidently exclude some of these criteria. First, these platforms are not emerging software. Their widespread and sustained use indicates that they are sufficiently mature according to traditional evaluation criteria.

Second, we conducted a meta-analysis of multiple studies produced by well-recognized expert firms, which provided confidence in the validity of the evaluation criteria we selected. Moreover, the criteria used in our comparison ensure that the chosen BPM platform will enable our future traceability research to achieve a significant impact. The selected methodology may also prove useful in addressing potential technical issues that could arise in the course of this research, as it guarantees the availability of a broad repository of responses to technical questions (Stack Overflow). Finally, it ensures the existence of a sufficiently large pool of experts in the selected BPM platform whom we may approach for assistance or collaboration if needed (LinkedIn). For these reasons, we consider that prioritizing these criteria over traditional ones was the most appropriate decision for conducting this study.

Finally, we acknowledge that aspects such as interface presentation and installation complexity of BPM platforms were not considered in our comparison. For example, the exclusion of Bizagi [26] a platform known for its intuitive and visually appealing interface—might at first glance appear to be a significant omission. However, compliance with the BPMN 2.0 standard (to which all evaluated platforms adhere) already guarantees an adequate level of interface clarity and usability. In addition, Bizagi could not be included in our evaluation because it is not fully free or open source, and, as previously stated, one of our primary objectives is to achieve the greatest possible impact within the BPM-based software development community. It is also worth noting that our approach is adaptable and could be applied to any other platform.

Regarding the installation complexity of the selected platform, it should be noted that although the Camunda modeler and engine are decoupled, requiring separate installation (the modeler through a simple download, and the engine either via an application container—Docker in this case [27]—or by downloading and compiling the source code), this configuration is increasingly common in software deployment, as it facilitates continuous deployment.

## 6. RELATED WORK

To contrast our study with other proposals, we conducted a review of both scientific sources and grey literature, the latter based on sources of recognized prestige in the technology domain.

Within the scientific literature, the study conducted by Lyakhovich [30] establishes a search for tools for business process implementation primarily based on aspects such as documentation, analysis, evaluation,

development, and implementation, facilitating operational excellence and transformation, workflow management—including real-time management—optimization, and automation. These are common characteristics that all BPM platforms must meet in order for an organization to achieve its business objectives. However, the article presents the analysis only at a very general level and in largely theoretical terms with respect to the BPM platform market.

In the undergraduate thesis by Quirant [31], we found a comparison of BPM tools in which, from a list of 10 BPM platforms selected by the author as the most prominent (with no justification provided for this selection), only three platforms were ultimately analyzed: WebRatio, BonitaSoft, and Oracle BPM Suite. Two of these were selected because the author was already familiar with them, and the third was chosen based on expert recommendation. The evaluation was reported using general software product quality criteria according to the ISO 25000 model: functionality, performance, compatibility, reliability, usability, security, maintainability, and portability, in addition to three other criteria defined based on the author's experience with the platforms. The evaluation was conducted qualitatively, and the conclusion regarding the most suitable platform depended on the type of business process to be implemented.

Other comparisons of BPM platforms have been reported in the scientific literature; however, they are often based on traditional selection criteria, which limits their usefulness for our purposes. For example, Jiménez [32] describes a set of internal characteristics of the BPM platforms evaluated and subsequently applies a weighted scoring scheme to obtain an average score for each platform. It is worth noting that these criteria are assessed qualitatively.

Mesa, Lochmuller, and Tabares [33], for their part, conduct a qualitative analysis of seven BPM platforms but do not present their selection criteria. Moreover, although they describe the criteria used for comparison, they neither normalize qualitative values across different criteria nor provide a unified scale that would allow heterogeneous data to be compared.

In contrast, Gallego, Giraldo, and Hitpassy [34] propose a framework known as the PBEC-OTSS approach (Process-Based Evaluation and Comparison of Off-the-Shelf Software). This method organizes evaluation data by assigning weighted numerical values to different characteristics of the BPM platforms being compared. However, the final score for each platform in that study was based on the opinions of several experts for each evaluated platform, which limited the total number of platforms that could be considered. For this reason, given the large number of platforms evaluated in our study, applying this method was not feasible. Similarly, because the methods proposed by Hou, Song, Yang, and Hao [35] and Silva, Poleto, de Carvalho, and Costa [36] also rely heavily on expert involvement, we likewise excluded them.

The last set of proposals for comparing BPM platforms that we reviewed (Papademetriou and Karras [37] and Serrano and Castellanos Granados) are not applicable to this study, as these authors did not consider aspects that are crucial for our purposes, such as platform coverage, whether the platforms are open source, and whether they are supported by a significant user community.

Within the grey literature, several recent BPM comparisons exist; however, we cannot guarantee the independence of their evaluation processes, and many are sponsored by unknown actors. This partially contradicts our objective of selecting a widely used, free, and open-source platform. Nevertheless, we reviewed some of these comparisons to assess their potential relevance.

TrustRadius [28], for example, ranks BPM platforms according to criteria such as *Best Value for Money*, *Best Feature Set*, and *Best Customer Relationship*. The website explains that these criteria are based on factors such as: (a) whether customers would repurchase the platform, (b) whether the platform meets customer expectations, and (c) sales and marketing promises. The comparison data are derived from customer surveys and analyst reviews. While this comparison may be useful for organizations seeking to implement a BPM strategy, it does not provide relevant insights for analysts, developers, or practitioners interested in open-source tools.

We also reviewed PeerSpot's BPM platform comparison, which is based on opinions, comments, and reviews from professionals registered on its platform (approximately 576,000 users) [29]. In this report, Camunda is ranked as the best BPM solution. However, the fact that only platform-affiliated users participated in the comparison makes this source somewhat limited. In addition, as in the case of TrustRadius, this analysis does not consider whether

the evaluated platforms are widely used or open source.

In a closely related context, we identified relevant evidence in technology market reports and analyses highlighting the increasingly significant role of BPM platforms in the modernization and digital transformation of organizations toward 2024–2025, particularly in terms of workflow automation, support for hyperautomation initiatives, and the enablement of advanced analytics capabilities within business processes, alongside a customer experience–centered perspective that is profoundly reshaping process management. Organizations that adopt next-generation BPM solutions will be better positioned to increase operational efficiency, enhance customer satisfaction, and respond to global regulatory requirements.

Although the study presented in this paper remains valid, the most recent comparative and market trend studies (2024–2025) for BPM platform selection continue to exhibit the same traditional characteristics, with some additions related to AI integration, intelligent automation, and new disruptive actors (hyperautomation and integration with other technologies such as IoT). Once again, these evaluations rely primarily on traditional, technically focused criteria and therefore remain limited.

## 7. CONCLUSIONS

According to the analysis conducted in this study, Camunda is the BPM platform that best fits our needs and evaluation criteria. It is free and open source, which allows its application in research processes without requiring additional investment. Regarding the evaluation criteria, it achieved the highest overall score by combining the data obtained from web search queries (Google Trends), the active community on platforms such as Stack Overflow and LinkedIn, and expert opinions (Forrester and Gartner). We reached this conclusion after comparing the 107 BPM platforms included in the exhaustive list we developed by cross-referencing two sources: (i) the BPMN Tools Matrix and (ii) Gartner's Business Process Management platform reviews and ratings page.

Subsequently, we selected the free and open-source platforms for a more focused comparison. We then compared the remaining 10 platforms using the following criteria: (a) Usability, composed of (i) Technical support, (ii) Availability of documentation, and (iii) Dedicated forums; (b) Coverage, composed of (iv) Operating systems, (v) Programming languages, (vi) Countries, and (vii) Success cases; (c) Expert opinions drawn from (viii) Forrester and (ix) Gartner; (d) Community, measured by the number of job postings on (x) LinkedIn requiring knowledge of a specific BPM platform and by the number of threads initiated on (xi) Stack Overflow mentioning it; and (e) Web search trends, estimated through the analysis of information provided by (xii) Google Trends.

Following an initial analysis of the resulting data, we reduced our group of platforms to Activiti Modeler, BonitaSoft, Camunda, and Flowable, and narrowed our comparison criteria to Success Cases, Forrester, Gartner, LinkedIn, Stack Overflow, and Google Trends. The former was done because the remaining platforms obtained significantly lower scores compared to the others; the latter because the reduced platforms had identical ratings across the other criteria.

Finally, we represented the score of each of these BPM platforms according to the comparison criteria in a radar chart in order to simultaneously visualize their relative strengths and weaknesses. The platform with the highest combined score and the largest area in the radar chart was Camunda. Therefore, this will be the BPM platform we use in our next research project. We thus aspire to contribute to a significant international community in the evolution of business process–based software. In the meantime, we hope this study will assist other researchers who need to identify which current free and open-source BPM platforms have the greatest global presence and the largest surrounding community. Likewise, we expect that the methodology developed for this study — our preference for criteria beyond traditional ones — will support researchers and software industry professionals in conducting similar analyses in other contexts.

Given that platforms evolve and new proposals continuously emerge, a possible direction for future work is the creation of a BPM platform observatory that applies this evaluation framework to describe how these platforms change over time with respect to the different criteria proposed here.

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**Data availability statement**

The data collected for this study are available (anonymized) in the following Git repository: *https://anonymousga.github.io/bpm_pc/*.

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