- ORIGINAL ARTICLE -

# BPM and socialization tools integrated to improve acquisition and management of information during design and execution of business processes.
# BPM-Social Tool: a proposal

## Herramientas de BPM y de socialización integradas para mejorar la adquisición y gestión de información durante el diseño y ejecución de procesos de negocio
## BPM-Social: una propuesta

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## Abstract

   The use of BPM (Business Process Management) has matured over the years, reaching high levels of acceptance and utilization. Despite this, there are still points that BPM does not fully resolve. One of the main limitations of the use of BPM is the lack of a complete acquisition of valuable information during the design stage, taking place in contexts where communication between the stakeholders is not appropriate and it is not possible to fully collect essential data. At the execution stage, the participation of users has not been studied in depth to record detected problems or indicate improvements in business processes.
The emergence and development of Web 2.0 opened a way to solve these problems. This work proposes to base how the socialization tools can solve current problems in BPM through a theoretical analysis added to the practical development of a socialization tool integrated to a BPMS (Business Process Management System).

**Keywords:** Business process, BPM, Web 2.0, Social BPM, BPMS, Social Software.

## Resumen

   La utilización de BPM (Business Process Management) ha ido madurando a lo largo de los años llegando a altos niveles de aceptación y utilización. A pesar de esto, todavía existen puntos que BPM no termina de resolver en su totalidad. Una de las principales limitaciones del uso de BPM es la falta de una completa adquisición de información valiosa durante la etapa de diseño, dándose en contextos donde la comunicación entre los actores involucrados no es apropiada y no se logra recopilar por completo los datos esenciales. En la etapa de ejecución no se ha profundizado en la participación de los usuarios para registrar problemas detectados o indicar mejoras en los procesos de negocio.
El surgimiento y desarrollo de la Web 2.0 abrió un camino para resolver estas problemáticas. Este trabajo propone fundamentar cómo las herramientas de socialización pueden resolver problemáticas presentes en BPM mediante un análisis teórico sumado al desarrollo práctico de una herramienta de socialización integrada a un BPMS (Business Process Management System).

**Palabras claves:** Procesos de Negocio, BPM, Web 2.0, BPM Social, BPMS, Software Social.

## 1. Introduction

   A large number of organizations choose to implement BPM incorporating its methodology, standards and associated technologies, thus benefiting from its management. Despite this, there are still points that BPM does not fully resolve.
One of the main limitations of the use of traditional BPM is the lack of a complete acquisition of valuable information during the design stage, taking place in contexts where communication between the actors involved is not appropriate and it is not possible to fully collect essential data. This causes inconsistencies between the designed processes and those that the organization that implements them actually requires. These inconsistencies in many cases end up favoring that the processes do not have

the expected level of acceptance, or even end up being informally complemented by actions external to what was designed.

On the other hand, in the execution stage, user participation has not been studied in depth to record detected problems or indicate improvements in business processes. These, if carried out, are handled through informal channels, losing traceability, making monitoring difficult and causing the information source to not be fully used.

BPM's tools are weak in centralized communication and collaboration between different actors involved at each stage. The correctness, integrity and usefulness of business process management can be fine-tuned if relevant stakeholders are actively involved in contributing information and knowledge.

Web 2.0 opened the way to a large number of possibilities to solve these problems. The approach based on users as content generators, has allowed to establish practical and dynamic means of communication, favoring the interaction, diffusion, learning and collaboration of a group of users or virtual communities.

In this sense, social software used in a complementary way to BPM can favor the acquisition of knowledge during the design stage and improve communication channels in all stages, being this also a source of valuable information for the continuous improvement cycle.

The present work is organized in the following way. Section 2 presents a review of the bibliography of works related to this research, categorizes them and describes their contribution. In section 3 central concepts and definitions are analyzed together with the description of the problems of BPM and its relationship with BPM Social. Section 4 analyzes the application of BPMS in the BPM life cycle, its limitations and its relationship with BPM Social. Section 5 describes how socialization tools are included in BPMS components and presents the architecture of the developed application. Section 6 exemplifies through a case study how the tool developed solves a series of problems during the life cycle of a business process. Finally, section 7 establishes conclusions.

## 2. State of art

In order to analyze the background of this work, some publications were searched and studied according the key words related with "bpm" and "social".

These works are summarized and grouped in three categories: 1 – Theorical framework [1][2][3][4], 2- Issues identified in BPM Social tools [5][6][7][8][9] and 3- Using socialization tools in organizations [10][11].

In [1][2] a process design methodology, supported by a set of tools, is presented to address the extension of business processes with social characteristics. It exposes a BPMN extension to capture social requirements, plus a gallery of BPM design patterns that represent reusable solutions for process socialization requirements.

These works provide: 1- A classification of levels of social characteristics in BPM, 2- An extension of the BPMN 2.0 notation enabling social activities, events and process flows conditions, 3- An extension of the WebML (Web Modeling Language) to express web applications that interact with social platforms, through abstract operations and 4 - A technical framework for generating social BPM applications directly from specifications encoded in the BPMN 2.0 social extension, based on model transformations.

Likewise, this work conform to three characteristic outlined by [1][2]: 1- *Participatory design*: stakeholders can participate actively in process design and can collaborate between them, 2- *Participatory enactment*: social tools are integrated and the process execution is socialized and 3- *Social enactment*: process execution is opened to actors not considered at deployment time (assignment activities to participants in execution).

On the other hand, in [3] a proposed prototype is presented to include functional characteristics for a BPMS, and it shows how to consider new traces of execution, as well as the advantages of enriching the collaboration and participation of the actors.

In [4] a requirements specification is made for a prototype of a process management tool that incorporates aspects of distributed software to enrich the traces of execution and incorporate social characteristics into its management. It also raises the benefits of traces by socializing workflows primarily in complex, unstructured processes. It is proposed that the tools of socialization of processes allow collaborative work and alter the classic structure of traditional processes, adapting to each scenario.

According to [5] the most important characteristic of social software technologies, from BPM perspective, is that they aim to improve the exchange of information by communities within organizations as well as fostering collaboration. These technologies are suitable for solving the problem of knowledge exchange and its application at various stages of the process life cycle. It poses the problem caused when many people contribute information about collaborative BPM modeling since in certain cases the large volume of contributors can be harmful. As a solution to this problem, control measures are proposed to ensure the quality of the contribution promoted by the community.

In [6] the problems generated by a large number of contributions during BPM stages are analyzed and in [7] it is stated that most definitions of Social BPM

mainly emphasize the role of collaboration during the design stage of the BPM life cycle process and neglect its application during the execution of processes. Also poses that Social BPM can increase the flexibility of processes and the capacity to respond to changes.

In [8] it is exposed that there is a lack of focus on the use of social BPM for workflow management, simulation and certification. The paper indicates how Social BPM is used in practice to facilitate risk management, but still without exploiting its full potential.

In [9] it is indicated that no study delves into the benefits of social media for BPM or in the orientation of the processes of an organization. Discuss how social media can add value in different areas of BPM's ability to appreciate and enhance the features of social media. The documents analyzed suggest that social media may be suitable for including clients in the planning process or for generating ideas.

Related to the practical application of socialization tools in organizations in [10], the actual use of BPM Social in Brazilian organizations was analyzed. It is reported that for high-cost issues, small organizations do not use socialization throughout the life cycle and choose to use it only at the design and modeling stage with low-cost tools not integrated into BPMS.

In [11] the impact of socialization tools used by a Portuguese airline called TAP is analyzed. These tools were part of marketing strategies, public relations, communication between employees and with their clients. Positive changes in the company are marked by improving the level of service and customer acceptance. An increase in interest in customer problems is described by employees as they have more personalized communication. On the other hand, it is exposed that the organization achieved favorable changes through internal and external contributions. Internally, space was given to its employees to propose improvements in the organization - externally, through the collaboration of consultants in forums and groups on social networks. Although the number of investigations and bibliography on this subject has been increasing in recent years, there are still points that have not been analyzed in depth. It is clear that, according to the bibliography analyzed, there are problems in BPM that can be solved with socialization tools, but there is little research that reflects this with concrete examples and, to a lesser extent, with success stories in real organizations.

Despite the fact that several studies analyze socialization in BPM, in most of them improvements are studied theoretically. Many of the analyzes also do not propose a concrete integration of social tools in the BPMS. In a large part of the analyzed documents, it is not described how the BPMS can include social tools in a transparent way and how with

their use the solutions to the BPM problems are specified. Regarding the generation of traces that socialization can provide for a subsequent analysis, no mentions and examples have been found about how the analyzes of these traces influence decision-making and continuous improvement within an organization.

## 3. BPMS. Concepts, issues and Social BPM

BPMS are software systems to implement executable business processes but its software components are limited and, usually, not include extensions that make socialization possible.

Despite the wide acceptance and use of BPM as a discipline, there is no single concept that defines it. A set of definitions that group characteristics to the general idea of BPM were selected.

Kilmann [12] refers to BPM as a principle of practical process management with a focus on the competitive improvement of companies. Ross [13] defines it as a management philosophy and agrees with Hammer [14] that its objective is related to continuous improvement. Hammer adds defining BPM as a way to increase efficiency. Lee & Dale [15] define it as an approach and a platform that includes the use of measurements to improve processes. Weske [16] refers to BPM as a concept, method, techniques and agrees with Filipowska [17], in that he supports the design and analysis of processes. Filipowska, Van der Aalst and Brocke [18] associate it almost directly with the application of information technology, Brocke & Sinnl [18] add that BPM requires a global vision to generate organizational culture. Finally, Palmer [20] groups the majority of features present in BPM such as modeling, automation, execution, control, measurement and optimization of business processes.

The first mentions that relate BPM with socialization tools arose from analyzing BPM and its potential integration in WEB 2.0. Several lines of study have emerged from relating these issues and one of them is that of BPM Social. Given the analysis variants, the very concept of BPM Social comes to have different definitions.

Despite the variations in definitions collected, the concept of BPM Social aligns with the idea of using collaborative and social tools in the world of BPM. This enables direct actors and external collaborators to share, and enhance their knowledge in order to apply it within the BPM life cycle.

Associating the BPM methodology with information technology derives in a software category defined as "BPMS" Business Process Management Suite, also called Business Process Management System. BPMS are made up of a set of software tools that facilitate

the management of business processes in the stages of their life cycle. The first systems that laid the groundwork for BPMS digitized the representation flow of person-to-person scanned documents through a predetermined process map. In the early 1980s the term "workflow" began to be used. In this type of software any direct integration between systems was made to measure, it was expensive and not very flexible. Workflow systems evolved slowly during the 1990s into much more functional and flexible products, targeting client-server platforms, and providing some basic process monitoring and modeling tools. Towards the beginning of 2000, with the development of web technologies, many BPMS relied on these technologies to develop their modeling environments, user portals, and execution of workflow logic.

One of the most important aspects of BPM is its practical application in an organization using computer systems. Beyond the defined methodology and growth with each theoretical contribution, it would be meaningless if it could not be applied concretely. Despite this, there are a set of limitations during the developments made with BPMS that highlight unresolved issues in BPM. It is in solving some of these problems that BPM Social, as the integration of socialization tools and BPM can make its contribution.

## 4. BPMS and limitations during life cycle business process.

BPMS are technological tools that aim to serve the needs of the different stages of the BPM life cycle. According to [16], BPM paradigm is structured in stages or phases which constitute business process life cycle and are resumed briefly: 1- Design and Analysis: business process are identified, reviewed, validated and represented as a process model 2- Configuration: once a process is modeled have to be implemented as a software system, 3- Enactment: after the configuration, the process is executed and the process instance are enacted, that is, the actual run time of the business process, 4- Evaluation: the information produced in phase 3, is considered to improve business process model and their implementations.

To meet the needs of each stage of the life cycle, BPMS are divided into different software components whose functionality focuses on some of them. As mentioned, there are limitations in BPM and they do not escape practical application through a BPMS. It is suggested that some of these can be resolved through the use of BPM Social.

BPMS have weaknesses to generate centralized communication that allows group collaboration and learning between the different actors involved at each stage. The correctness, integrity and usefulness of business process management can be fine-tuned if relevant stakeholders are actively involved in contributing information and knowledge.

According to Bazan et al. (2019) [22], that kind of centralized communication can be approached by social software – defined by Keller et al. (2015) [21] -. Social Software (SS) is defined as software relying on three governing principles: social production – the solution to problems appears from the experience of people and their community, weak ties – maintaining contacts with casually-known people and granting them power to influence in decisions and collective decisions – allows to un-correlate errors by overlay in a large number of independent judgements.

Also, Bazan et al. (2019) [22] argue that within an organization, both BPMS and SS contribute to workflow management. Their integration, so-called Social BPM, has a series of advantages, such as (Erol et al., 2010) [23]: 1- knowledge management, using knowledge that is captured in SS helping to improve task execution, 2- participation, favoring participation of business process actors, enabling them to increase their commitment and collaboration in process design and execution, 3 – monitoring, improving traceability of process execution using information of SS, and 4 – collaboration, following the collaborative nature of work, providing a more flexible approach than traditional process design and execution.

The following describes the application of the components of a BPMS within the BPM life cycle and how they are impacted by BPM Social. The components where it is more valuable to apply socialization are those where the greatest impact of BPM Social falls.

### 4.1. Design and modelling business process

Business process are modeled after to analyze requirements and usually graphic tools BPMN 2.0 based are used.

BPMN 2.0 standard allowing to describe participants, activities and the path that the workflow must contemplate.

One of the main limitations of the use of traditional BPM is the lack of a complete acquisition of valuable information during the design stage, taking place in contexts where communication between the stakeholders is not appropriate and it is not possible to fully collect essential data.

During modelling stage, the interaction of different actors plays a fundamental role. This interaction and collaboration are focused to improve the resulting models, which are the basis for the success and acceptance of business processes. The modeling components can add a set of socialization tools such as chats, forums, groups, shared annotations and other

channels that have as a common focus of work achieving better models. The collaborative modeler application is another variant of applying socialization, in which several users can interact simultaneously modeling the same object.

That is based on principles of integration SS techniques with BPM, that confronts the hierarchical model of BPM as defined by Taylor (1983). In particular, the application of SS enables an organization to define processes that do not strictly follow a hierarchical line and to stimulate actors to embark on the use of SS as an incentive for them to qualify within a scheme of rewards and to participate in a collaborative environment. As opposed to this model, in many BPMSs, users have a limited understanding of the processes in which they participate, missing contextual information, like ignoring other actors involved in the process, results of previous executions and lessons learnt from them (Bazán, 2015).

Business process are modeled after to analyze requirements and usually graphic tools BPMN 2.0[1] based are used.

## 4.2. Deployment and execution business process

Once the processes are modeled, the BPMS allow the deployment of these so that they can be executed. Business Process Deployment Tool is the component that developers use to transform modeled processes into executable processes. This component allows applying technical configurations related to IT profiles in the organization.

The BPMS Workflow Engine is the component in charge of translating the workflow logic represented in the graphic model and allowing a software execution that complies with what is indicated in the business process model. It is the heart of a BPMS, it allows to link, connect and manipulate the data of business objects. Based on the modeled conditions, he is in charge of analyzing this data and selecting the path to be followed by the workflow.

The Business Rules Engine is the component that allows the execution of rules that describe the policies, rules, operations, definitions and restrictions present in an organization; they are of vital importance to achieve the objectives. A business rule engine is a software system that runs one or more business rules in a production environment at runtime. With this engine, BPMS allows business logic and other operational decisions to be programmed, tested, executed and maintained separately from the code of the BPMS itself.

User portals are the component that allows users access to execute modeled and deployed processes from an interface.

Regarding the problems in the execution stage, the participation of users has not been studied in depth to record detected problems or indicate improvements in business processes. The same, if carried out, are managed through informal channels, losing traceability, making monitoring difficult and causing said source of information not to be fully used.

Social BPM can be considered a mechanism to support the needed flexibility many times required in business processes. Several techniques applied in SS can be considered as a shortcut for producing more flexible business processes. Although, there are already approaches for managing some flexibility in business processes, like "case handling", the flexibility requires a different approach, one that can consider changes from the conceptualization of the business process, to the process activities, and not from the data and case management perspectives only [22].

At this stage, the user portals of a BPMS are the area where socialization can be exploited to a greater extent in relation to the volume of users, since they are usually the environments in which more users participate. Users can take advantage of the tools and have interactions like in a classic social network, this includes: receiving notifications, sending messages, participating in groups, tagging other users, commenting on workflow activities, categorizing words via hashtags, rating other users, sharing documents and other content. All this applied to activities related to the organization and the objective of the business processes.

## 4.3. Monitoring and control business process

Once the processes are deployed and their executions begin to generate data, the monitoring stage allows management users to track indicators of interest. Simulation and test execution tasks are also related.

A business process simulator is used to simulate execution results and measure the efficiency of processes, in terms of average time to optimize their flow and cost.

There are also report generators, tools that allow you to process business information belonging to the data set within the processes and deliver reports as the output of that analysis. On the other hand, there are monitoring boards, components that allow the monitoring of BAM (business activity monitoring). This monitoring extracts data from processes and activities and presents them in graphs allowing management users to identify performance, design and implementation problems.

Regarding the usefulness of BPM Social at this stage,

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[1] https://www.omg.org/spec/BPMN/2.0/

applying socialization tools allows us to have a new source of data to quantify, analyze and graph on the monitoring boards. These data are those generated by the use of socialization tools, for example: number of comments, typified hashtags, level of participation of users or users with the highest scores in their collaborations.

# 5. BPM-Social Tool

The solution proposed applies socialization techniques to solve some lacks and weaknesses of the BPM. The integration points are described in the different software components of a BPMS where social interaction provides solutions.

To achieve the aim of concretely demonstrating the benefits of including socialization tools in BPM, an application is developed capable of integrating, adding social characteristics, and providing the analysis of the traces generated by socialization on a BPMS, such application is called "BPM-Social".

## 5.1. Adding socialization techniques to BPMS

Most BPMS have modeling, execution, and management sections. This purpose pursues to apply socialization techniques in some BPMS's and to analyze the traces generated by socialization as solutions to the identified problems.

### 5.1.1. Modeling

BPMS have modeling environments in which a modeling user following different specifications can represent the structure of business processes and their variables using graphic components. This is done through the use of figures that comply with the BPMN 2.0 standard.

In order to apply communication channels at the modeling stage, one of the integration points between the BPMS and BPM-Social was the modeling environment. This proposal considers the implementation of functionality that allows the modeling user to publish topics with questions related to the modeled business process, which can be resolved by other users of the organization who are notified of the creation of new topics.

### 5.1.2. Task execution

In the process execution environments provided by BPMS, users must perform the tasks modeled on the process activities assigned to them.

This proposal considers process executing where users can leave tagged comments with hashtags related to the task they must complete. These comments aim to establish a channel so that an end user of the modeled process can report their proposals for improvement, alerts, errors or any information they consider relevant. The comments in turn generate new traces to be analyzed by influential management users in the organization's decision making.

### 5.1.3. Management and analysis of metrics

Another BPMS component is which monitors the metrics that are extracted from data generated by the execution of processes. Generally, these data are
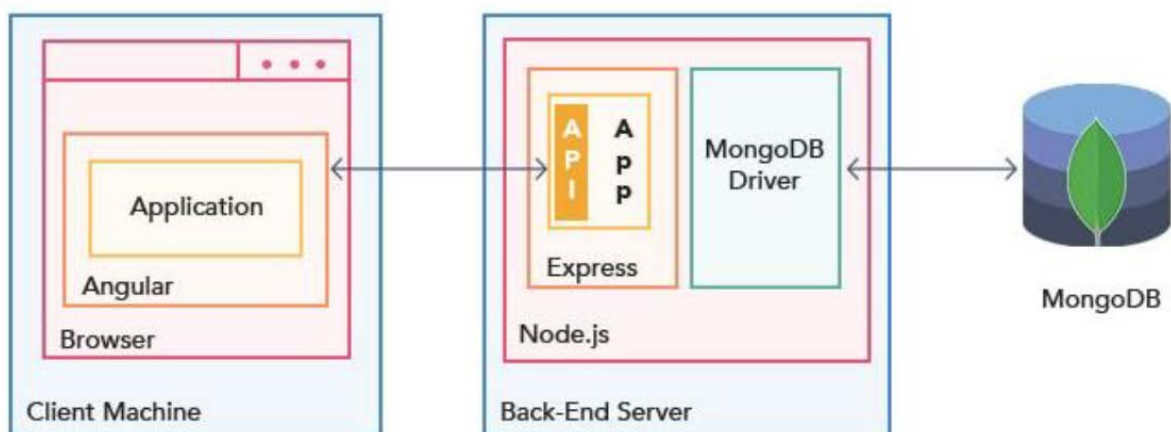


Fig. 1 MEAN STACK Technology Platform

taken into account in decision-making for the organization.

Related to this point, BPM-Social also generates new data that can be analyzed as any of those already taken into account in BPM. In the developed tool, the comments typified with hashtags associated with the activities carried out are taken into account. All of this information is displayed on dashboards with simple charts to analyze by business users.

## 5.2. Solution developed with BPM-Social

In order to validate the proposed solutions, an application called "BPM-Social" has been developed capable of integrating with a BPMS. BPM-Social adds BPMS socialization techniques in the components detailed in the proposal and allows the analysis of the traces originated by socialization.

The application is implemented under the set of technologies that make up the MEAN STACK platform that includes MongoDB, Express, Angular, Node (Fig 1.) and adds a token-based authentication scheme and an asynchronous notification mechanism using websocket technology.

The BPMS chosen to be integrated with the developed application was Activiti[2]. The selection was made based on the evaluation of the characteristics of interest such as, available documentation, active community, compatible technology, supporting the BPM standard.

This open source BPMS has all the components for which it was necessary to integrate socialization techniques. Its process modeler supports the BMPN 2.0 standard, which allows the process modeled in any other tool compatible with that standard to be imported. It has a very complete and easy to understand documentation in both functional and developer-oriented sections. The extensive documentation is complemented by a very active community that contributes knowledge by posing problems and collaborating on their solutions. It is developed with Java language for the web platform complemented with Angular 1 and supports the MySQL, DB2, HSQL, Oracle and Postgres database engines. Another important characteristic for the selection of Activiti was the existence of extensions that allow modifying the workflow applying logic programmed using Java classes.

### 5.2.1. BPM-Social Architecture

The solution is based in two layers:
- Restful Socialization API. Includes the functionality necessary to carry out the socialization of BPM objects, implemented in the backend and published as a service through a Restful API.
- Graphical WEB components. Include web components developed with Angular that consume the socialization API and allow users to interact with it through the BPMS to socialize.

For the design of the data model, the objective was to be able to represent the information in a way that allows it to be integrated into most of the BPMS, which contain basic components for modeling and executing business processes. For this purpose, the `User`, `Process`, `Activity` and `Execution` objects were modeled. On the other hand, the objects necessary to apply socialization tools were modeled, these being `Topic`, `Commentary` and `Hashtag`.

The integrations between the BPMS Activiti and the BPM-Social application were made by adding calls to Angular components in the html templates that Activiti has in its sources. In this way, the components are integrated in a transparent way, simulating being the same application even if they are uncoupled, on the one hand the BPMS Activiti and on the other BPM-Social.

Fig 2 shows a sequence diagram followed by the execution of `Topic` of a process and, also, includes the application components.

## 6. Product repair process: a proof of concept

The advantages of using socialization techniques in a BPMS are validated by means of a example where the application of these solve certain limitations that BPM has.

The problems to be solved during the life cycle of the "Product Repair" process carried out in an electrical appliance company are exemplified. A scenario is presented where the use of the socialization platform is applied to solve a series of problems. The exemplified business process was modeled and executed in the BPMS Activiti and in certain sections the functionality of "BPM-Social" was invoked.

### 6.1. Modeling process with social techniques

Given the information collected in the analysis stage, the modeling user can identify the set of activities of the "Product Repair" process. A problem within the scope of process modeling is described, together with the example of socialization that solves the problem.
- **Problem:** insufficient functional definition in the documents delivered raise questions for the
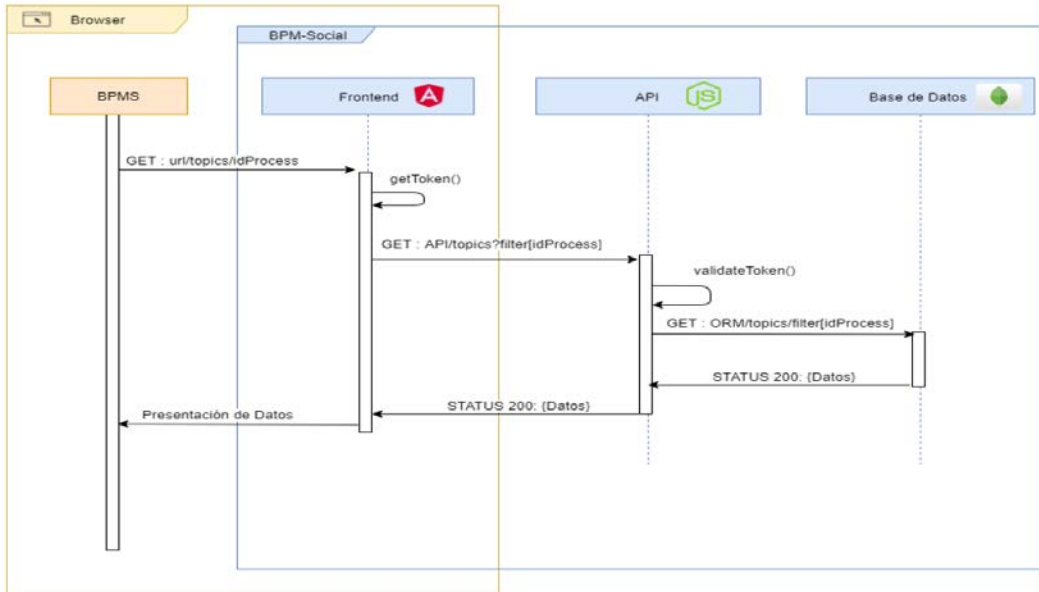
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[2] https://www.activiti.org/

Fig 2. Topic of a process request execution



Fig 3. Topic related with the process modeled

modeler about how the workflow should be modeled.

- **BPM-Social solution**: In reviews made by the modeler with documentation, there are some documents that report on repair orders even when the warranty does not cover the repair. The existing documentation is not enough to include this variant in the process. The modeling user before this doubt in the definition of the process

will use the functionality of BPM-Social to obtain this information. From the modeling interface you access the BPM-Social functionality that allows you to open topics to answer questions or collect information that has not been clarified in the previous analysis. For the proposed example, the modeler raises the question on a new topic [Fig 3]. Users are notified about the question posted on the topic

and clarify the modeling user's questions with their comments on the topic.

## 6.2. Executing process with social techniques

When business process is executed, social techniques can be applied to solve problems as the following:

- **Problem**: during process execution can be necessary the registry of notes or comments, by the participants in process activities in centralized way.

- **BPM-Social solution**: to record the information mentioned above, the participants access one of the functions provided by BPM-Social, where in each activity comments are allowed to be associated and hashtags are included in them to categorize them [Figure 4]. In the process executing users use pre-defined hashtags such as # recommendation, #error, #alert, #info.

The problem raised is solved using the socialization platform. BPM-Social provides a means to record information obtained from executing users, which is very valuable for improving the organization. This information is not dispersed and is centralized within the platform.

## 6.3. Monitoring process with social techniques

Monitoring and control business process as a stage of the life cycle are also modified when social techniques are incorporated.

- **Problem**: new information added to process during modeling and execution is not considered by the monitoring component.

- **BPM-Social solution:** as is showed in Fig. 5, a management user enters the dashboard where the graphs with the data generated by socialization are displayed. In the pie chart, each color represents a type of hashtag used in the activities of the "Product Repair" process. In the hashtag's totalizer graph, you can see several requests for recommendations. To retrieve the information based on the recommendations, clicking on the graph loads the messages associated with each activity. The "Delivery Notification" activity has many hashtags of type "# recommendation". It is observed that several users recorded in the
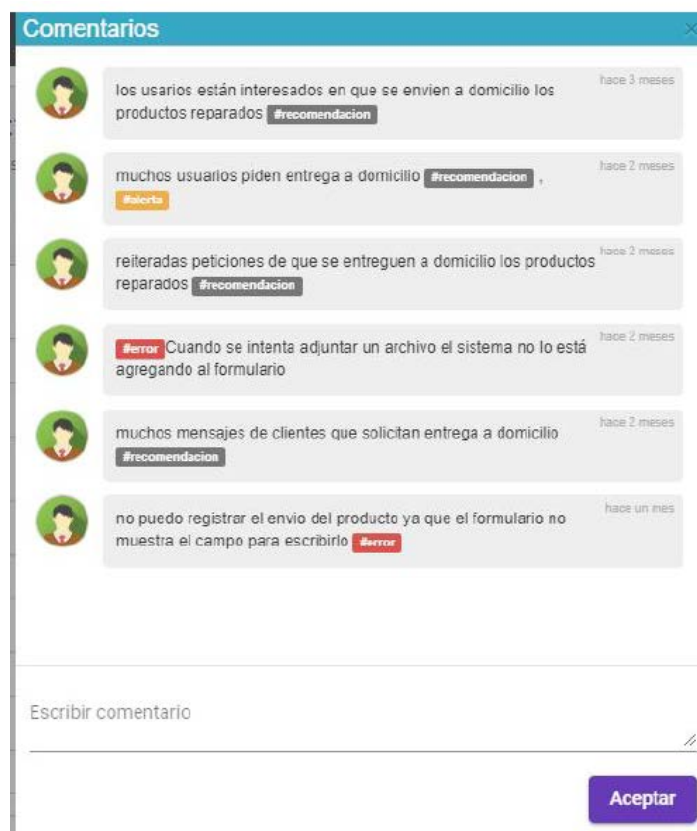


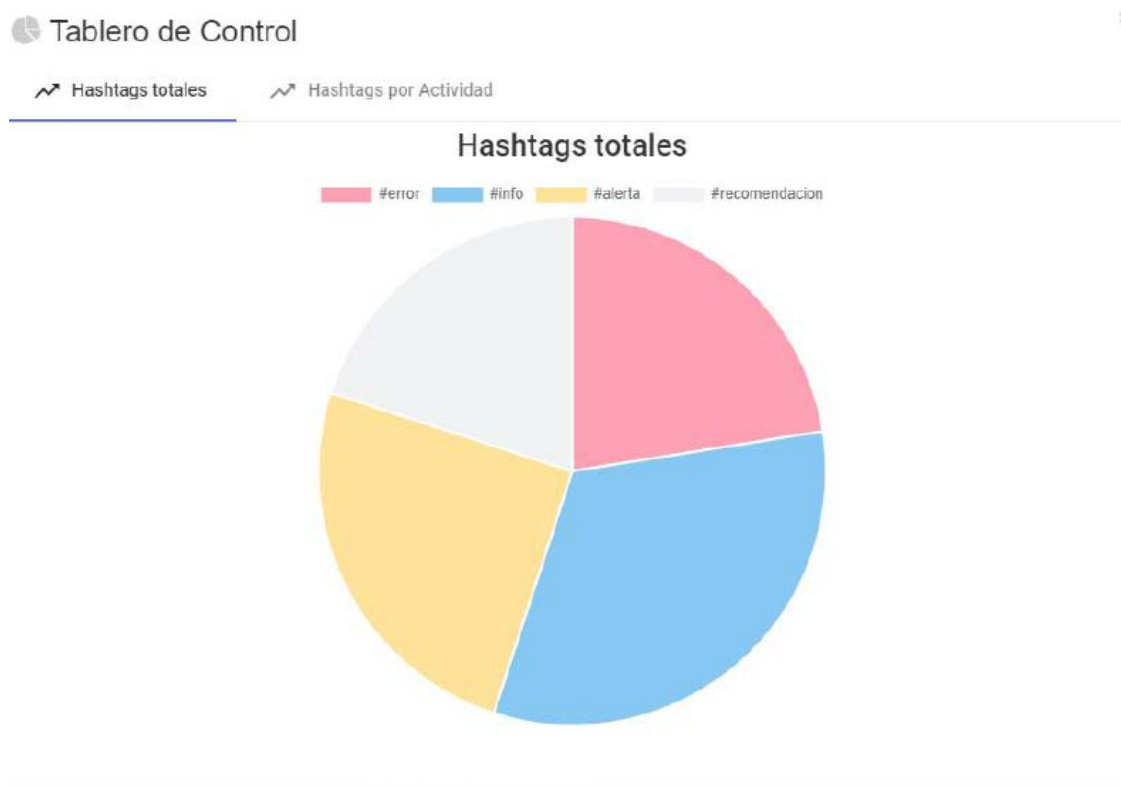Fig. 4. Comments in activities categorized with hashtag

Fig. 5. Dashboard section with total hashtags

comments a request made by customers. The order is that customers request the home delivery of the repaired product even if they have to pay shipping costs [Fig. 6].

This data is taken into account by the management user who reports this to management. Management sees this as a business opportunity since they can obtain benefits from providing this service. It is then determined to add the home delivery for customers who want it.

With the new requirement, changes are made in the process. The users' address data record is added and they are given the possibility of requesting home delivery in case they want to pay the shipping costs.

After the change has been applied for a time, it I s analyzed that the vast majority of customers actually request home delivery and the organization has higher income based on offering that service.

The data that was generated with each social interaction is very useful and allows us to have new metrics that without being centralized in the tool would be lost. Users in charge of management can enter the tables where informative graphics are presented based on data generated by socialization. Using this data, you can identify useful information for management, which can make decisions, make improvements and apply quality, favoring continuous improvement in the organization.

## 7. Conclusions and future working plan

Based on the experiences obtained integrating a specific BPM tool with social techniques, arise naturally some future work lines and improvements to BPM-Social. These lines can contribute to elaborate research agenda to guide next developments.

### 7.1. Real-time event and notification functionality extension

The socialization tool could gain greater usability if broadcast channels are considered for the entire organization such as walls where to publish common information or give general announcements for the organization.

Dashboards could also centralize information detected in real time and, in the event of changes in execution, the graphics could mark trends in hashtags,
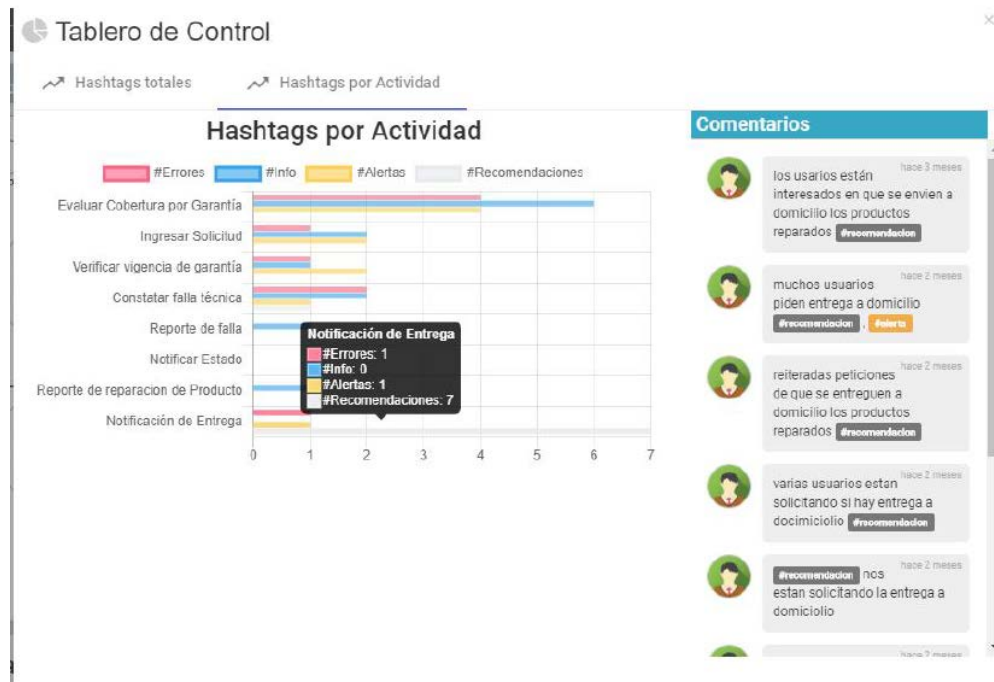
Fig. 6. Dashboard with total hashtags by activity and associated comments

levels of user participation or any other trace of socialization.

## 7.2. Social networks integration

The most important social networks such as Facebook, Twitter, LinkedIn, etc. have APIs that allow them to be integrated with other systems. An extension of the socialization platform could be considered to communicate with these APIs and adding functionality.

As examples, a topic published from BPM-Social could be automatically published in a Facebook group of the organization, so that its content can be commented by users of that group and increase the reach of the recipients, or a comment from an activity could generate a Tweet in the sender user's Twitter account.

## 7.3. Collaborative modeling tools

Collaborative tools have gained ground in any field involving group work. A specific case is Google Docs, which allows a document to be shared, edited and commented on by several participants in real time.

Modeling within a BPM could be thought of in a similar way, allowing collaborative process and form modeling environments to take advantage of this functionality and streamline their development.

This work proposes and establishes foundations about how the application of socialization techniques can solve existing problems in BPM. Through the development and analysis of this theme, it is possible to conclude that BPM Social improves BPM in several aspects and positively impacts its life cycle. Although there are still problems to solve, it is undeniable that collaborative tools and social interactions have great potential applicable in the context of business process management, improving the acquisition and management of information.

To validate the theoretical framework, the BPM-Social application was developed through which the solution to each exposed problem is exemplified. The decoupled way in which the BPM-Social tool is developed and the fact that it can be independently integrated into another BPMS validates the idea that it applies not to a particular product but to BPM.

Through the practical case each one of the integrations in the different software components of a BPMS leaves a clear example of the problem solved and this allows us to validate the premises set forth in the objective of this work.

## Competing interests

The authors have declared that no competing interests exist.

## Authors' contribution

PM and JCMB wrote the program, conducted the experiments, analyzed the results and wrote the manuscript;

PB conducted the project, analyzed the results and revised the manuscript. All authors read and approved the final manuscript.

## References

[1] Brambilla, Marco & Fraternali, Piero & Vaca, Carmen. *BPMN and Design Patterns for Engineering Social BPM Solutions*. 99. 219-230. 10.1007/978-3-642-28108-2_22. 2011.

[2] Fraternali, Piero & Brambilla, Marco & Vaca, Carmen. *A Model-driven Approach to Social BPM Applications*. Social BPM: Work, Planning and Collaboration Under the Impact of Social Technology, 95-112. 2019.

[3] P. Bazan, R. Giandini, E. Estevez, Elsa, J. Díaz. *Socializar el despliegue y seguimiento de procesos de negocios*. In WBPM 2014: Chilean Workshop on Business Process Management (BPM). Talca, Chile. ISBN 978-956-353-814-4. 2014.

[4] P. Bazán, J. M. Garro, R. Giandini and J. Diaz, *Mejora de la monitorización y ejecución de procesos de negocio con integración y socialización*. Latin American Computing Conference (CLEI), Arequipa, pp. 1-12.doi: 10.1109/CLEI.2015.7360015. 2015

[5] A. Filipowska, M. Kaczmarek, A. Koschmider, S. Stein, K. Wecel, W. Abramowicz. *Social Software and Semantics for Business Process Management Alternative or Synergy?* Journal of Systems Integration, 2(3), 54-69 URL: https://core.ac.uk/display/25971211. 2011.

[6] N. Pflanzl and G. Vossen, *Challenges of Social Business Process Management*. 47th Hawaii International Conference on System Sciences, Waikoloa, HI, pp. 3868-3877. doi: 10.1109/HICSS.2014.480. 2014.

[7] M. Kocbek Bule, G. Jošt, G. Polančič, *Introduction to Social Business Process Management*. Lecture Notes in Business Information Processing. 224. 10.1007/978-3-319-21009-4_33. 2015.

[8] D. Suša Vugec, K. Tomicic-Pupek, V. Vuksic. *Social business process management in practice: Overcoming the limitations of the traditional business process management*. International Journal of Engineering Business Management. 10. 184797901775092. 10.1177/1847979017750927. 2018.

[9] J. Prodanova, Jan, A. Van Looy, Amy. *A Systematic Literature Review of the Use of Social Media for Business Process Management.* In International Conference on Business Process Management (pp. 403-414). Springer, Cham 10.1007/978-3-319-74030-0_31. 2017.

[10] M. Batista, A. Magdaleno, M. Kalinowski. *A Survey on the use of Social BPM*. In International Conference on Business Process Management (pp. 403-414). Springer, Cham. 2017.

[11] A.R. Vieira, J. Jaklic, *Business Process Management and Social Networks: A Case Study in an Airline Organization*. In the International Scientific Conference on Management of Knowledge and Learning MakeLearn (pp. 151-158). 2013.

[12] R. Kilmann. *A holistic program and critical success factors of corporate transformation*. European Management Journal, 13(2), 175-186. 1995.

[13] J.E. Ross. *Total Quality Management: Text, Cases and Readings*. Florida, USA: St. Lucie Press. 1999.

[14] M. Hammer, M. *Beyond Reengineering: How the Process–Centered Organization is Changing Our Work and Our Lives*. New York: Harper Collins. 1996

[15] R. Lee, B. Dale. *Business process management a review and evaluation.* Business Process Management Journal. 1998

[16] M. Weske. *Business Process Management: Concepts, Languages, Architectures*. Berlin, Germany: Springer. 2007

[17] A. Filipowska, M. Kaczmarek, M. Kowalkiewicz, X. Zhou, M. Born. *Procedure and guidelines for evaluation of BPM methodologies*. Business Process Management Journal. 2009

[18] W. Van der Aalst. Business process management: a personal view. Business Process Management Journal. 2009

[19] J. Vom Brocke, T. Sinnl. *Culture in business process management: a literature review*. Business Process Management Journal. 2011.

[20] N. Palmer, P. Schooff, L. Dugan, C. Farina. Passports to Success in BPM; Real-World, Theory and Applications. Future Strategies Inc. Publication. 2014.

[21] Keller, B., Schmidt, R., Möhring, M., Härting, R.C. and Zimmermann, A. (2015), "Social-data driven sales processes in local clothing retail stores", International Conference on Business Process Management, Springer, Cham, August, pp. 305-315.

[22] Bazan, P., & Estevez, E. (2019). Social business process management. Business Process Management Journal.

[23] Erol, S., Granitzer, M., Happ, S., Jantunen, S., Jennings, B., Johannesson, P., Koschmider, A., Nurcan, S., Rossi, D. and Schmidt, R. (2010), "Combining BPM and social software: contradiction or chance?", Journal of Software Maintenance and Evolution: Research and Practice, Vol. 22 Nos 6-7, pp 449-476.