

## The Application of Business Process Model Notation to describe a Methodology for the Recognition, Tagging and Acknowledge of Informal Learning Activities

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**Abstract.** Learning is a process that takes place anywhere and at any moment of our life. That means that not all learning happens linked to an institution. However, that kind of learning, known as informal learning, is usually invisible for people in charge of organizations. This is because either the learner is not aware of having learned something or because he/she is not able to show or make visible this type of learning to other. In order to facilitate the exploitation of this knowledge, TRAILER project poses a methodology supported by a technological ecosystem. This methodology is quite complex; it involves different stakeholders and components. For defining the methodology, a flexible and understandable notation was used, Business Process Model Notation. It helps in the designing and implementation of the solution and it also has been used to guide experts during the methodology testing.

**Keywords.** Informal Learning; Methodology; Model; Business Processes; Learners.

### 1. Introduction

Learning and teaching are processes that take place anytime and anywhere. They are present during people whole life and are not constrained by an institution, a course, or a degree. People can learn in the context of an institution such as the school, the university, etc.; but also during their daily life, at home, talking or exchanging experiences with others, using the Internet. This last kind of learning, which is known as informal learning, is not structured (in terms of learning objectives, learning time or learning support), typically does not lead to certification and may be intentional but in most cases it is non-intentional (or “incidental”/random) [1].

Informal learning, as other kind of learning, facilitates learners’ acquisition of competences. The recognition of those competences can enhance employability of workers and facilitate knowledge management by the institutions [2, 3]. In fact, Bologna process gives special attention to informal learning [4]. However, given the nature of this kind of learning, the recognition and acknowledge of informal learning is not easy. It is difficult to demonstrate learning that in many cases is obtained by observation and experience [5]. The Information and Communication Technologies (ICT) application to different areas, and specially the application of trends such as the Internet, Mobile Technologies, Web 2.0 tools, opens new ways to increase the visibility of the Informal Learning activities that individuals carry out throughout their lives [6-8].

Recognizing potential benefit to learners, employers and the organization of education, national and international guidelines have sought to create a framework whereby individual activities not leading to formal educational certification might be recognized, and how this recognition may be exploited through the internal reflexive processes within businesses [9]. For example, the CEDEFOP [10] “European Guidelines for validating informal and non-formal learning”; the ECOTEC Inventory of validation of non-formal and informal learning [11]; or the OECD Recognition of informal learning [12]. There are also several initiatives related to competence recognition in the European Union, such as National Qualification Systems and EQF (European Qualifications Framework) [13].

Also several ICT solutions have been developed in order to enable such recognition, just by providing support to make informal learning evident; some projects in this sense are the Tencompetence Project [14, 15] –which provides a set of tools to support lifelong learning–, or Open Badges [16].

These approaches for the recognition of informal learning and the ICT solutions that support them make clear the importance of such kind of learning both for individuals and institutions. However, the recognition and acknowledge of informal learning require defining what to recognize, how, in what context, levels, etc. These issues should be discussed among the main stakeholders of the recognition process. That is, it is necessary to define ways that facilitate a dialogue to support informal learning recognition among learners and people in charge of institutions.

In order to achieve this, TRAILER project [17, 18] was defined. It is an ICT multilateral project funded by the European Commission, started on January 2012. The project is based on the premise that though technology may afford practical solutions to problems of personal learning, technological approaches can present new issues of ownership and control. The desire is that learning processes are under the control of the learner, and this entails that integration of informal learning with formal approaches balances personal inquiry and coordination with the need for institutional accreditation of evidence of competency [19].

The main objective of the project is to incorporate the consciousness of informal learning as part of an individual's development; this starts with the identification by the learner of informal learning activities and the subsequent process in which these activities are made visible to the institution. This task will be done by developing methodologies and tools that facilitate the accreditation of informal learning evidences in a transparent way both for learners and institutions and allowing all the stakeholders involved to make the most out of these processes [20].

However, this kind of methodology should deal with: 1) the stakeholders, learners and institutions have not always the same perspective of recognition (what is important for some of them can be useless for the others); 2) how information and interaction can be exchanged between the stakeholders; and 3) the existing learning contexts and the new technological frameworks that should integrate tools to facilitate gathering informal learning evidences. The description of the methodology is not an easy task but it is a critical issue in order to guarantee the success of the solution.

This work presents how the description has been carried out by using Business Process Modelling Notation (BPMN) diagrams [21] and it also summarizes how the methodology is validated. In order to do so, first the TRAILER methodology is introduced. The technological framework is described and, later, the process for the framework to recognize informal learning is explained (section 2). After that, the methodology is described using BPMN (section 3). Later, some of the results of testing the methodology are posed (section 4) and, finally, some conclusions are posed (section 5).

## **2. - TRAILER Methodology**

The TRAILER project involves learners and institutions. Learners may be workers in a workplace, or traditional learners in an educational institution. Through transparency of communication, the TRAILER environment enables discussion between the different stakeholders and institutions concerning informal learning activities, the associated competences and how this information can be exploited. In order to achieve this, a staged methodology, supported by a software architecture, has been deployed [19].

In order to better understand how the methodology works, it is necessary to introduce the software architecture developed as a proof of concept.

### **2.1. TRAILER architecture approach**

The architecture facilitates the integration of informal learning activities in the institution by using interfaces that make possible the dialogue among learners and people in charge of institutions. It takes into account the different components included in the framework, the existing communication interfaces and the information exchanged among them, and the possible ways for these interactions.

The main components of the architecture are shown in Figure 1. They are the PLN (Personal Learning Network), which includes different tools used to learn in an informal and non-formal way and a portfolio to store evidences; the ILC (Informal Learning Collector), to gather the information related with informal learning activities; the Competence catalog with the competences to associate to the informal learning activities; and the institutional environment, which allows the exploitation of the informal evidences published by learners.

**Insert Figure 1 here.**

The PLN includes different learning tools that the learner can use in an informal way to learn (games, 2.0 tools, remote labs, LMS, mobile apps, a portfolio etc.). In order to implement the system and gather the informal learning evidences obtained by using such tools, several type of experiences have been considered:

- Informal activities carried out through browser, (for example the use of online tools, the use of forums, searches of resources in repositories, use of remote labs in informal contexts, etc.).
- Informal activities carried out with a widget container (that could combine different kind of tools)
- Informal activities carry out by playing games, through a mobile device browser, etc.
- Informal activities that could have been performed without the use of the ICT.

With all these possibilities, the TRAILER project takes into account a wide range of tools with which the learner could learn in an informal way and it is open enough to include new ones. As commented before,

the ILC is the subsystem that handles the gathering of references to the items in the informal learning activity stream. They can happen anywhere on the Net. The ILC gathers this informal learning evidences for a specific user, allows their tagging and sends them to the Portfolio.

The data gathered about informal learning activities is associated by the learner with a set of competences that he/she thinks has achieved by carrying it out. These competences are included in a predefined catalog. It is part of the institutional system and it includes some competences at a 'general' level that are in any institutional catalog, competences related specifically to the institution and other competences provided by the users. Each of the competence levels can feed the others. For example, if a competence in the institutional level appears in several institutions and several times, it can be incorporated to the 'general' level. A similar process applies to students' individual competences. The catalog facilitates the management of the competences at the different levels and provides a list of tags to the ILC and the collector to associate them to informal learning activities.

The portfolio is a space in which the learner can include the activities she has carried out in an informal, formal, or non-formal way. This space receives the information of users' informal learning from the ILC. The portfolio facilitates organizing and editing information related to an activity, add competence tags to the activities, and enrich the information with comments, and the level at which a competence has been acquired. This space also provides a functionality to manage information. It includes a 'showcase system', which allows the user to publish information included in his/her portfolio and to make such information visible to different target groups (other learners, the people in charge of the companies, etc.). In addition, the portfolio provides a functionality to search peers with similar interests and worries, by exploring the public information of the learners. Moreover, the portfolio facilitates not only the dialogue with the institution through the information views, but also the possibility to export the personal information to other contexts by using "standard" formats.

The Institutional Environments is based on a set of analysis tools that exploit the public information provided by the portfolio. The institution can read the data from the portfolio and exploit it by using information visualization and data mining techniques, in order to facilitate making decisions. The data exploitation tools included in this environment are Tageloud tools, Treemaps, Timelines, etc. [22, 23]. With those tools, the people in charge of the institutions have more clear knowledge about the institution workers competences and can begin face-to-face or online discussions with learners in order to clarify different issues that lead to a better and common understanding of the institution learning needs.

All the components mentioned above should facilitate the exchange of information in order to define the communication channels required for this project, this is done by using web services that provide independence of the technology in which each component is developed [24].

## **2.2. TRAILER methodology**

With the technological framework and the data gathered, a first draft of the methodology was defined. It is a first iteration that can evolve in the future with stakeholders' feedback. This draft can be seen in Figure 2.

The starting point of the TRAILER methodology is the moment in which the user carries out an online activity, which may have a bearing on a competence. The learner can identify and match an activity with the set of possible competences presented by TRAILER, or store it and identify it later. The processes of collection, inspection and reflection result in a methodology with 3 stages [9]:

1. **Identification and Storage:** This stage implies that the user classifies the activity taking into account a competence catalog that includes general competences, institutional competences and competences defined by the user. After that, the identified activity is recorded in the portfolio. This stage involves the use of the ILC, the PLN, the catalog and the Portfolio components.
2. **Organization:** Once the information of the informal learning activity is stored, it can be enriched with additional data about the associated competences. In addition, this information can be classified into the portfolio in different categories or views. When the information is properly organized it can be published to the institution, with the learner determining what is published and to whom it is visible. With this data, institutions can conduct analyses on competencies, or the user could find peers with similar interests and/or worries. This stage involves the use of the Catalog and the Portfolio components.
3. **Analysis:** The publically published information can be analysed in order to make decisions about the learning requirements, tools and contents used by the institution and the skills a user has, taking into account a specific individual or a group. The publication of information and the views of the portfolio facilitate a common analysis of the gathered information, which can make possible a dialogue among the stakeholders. The analysis system can produce recommendations regarding institutional skills or knowledge gaps or personal recommendations for the learner/employee. With this dialogue and the recommendations, a global portfolio of knowledge

can be co-created between the user and the institution. The components involved in this stage are the Portfolio, the Catalog and the Institutional Environment components.

**Insert Figure 2 here.**

### **3. BPMN Description of the methodology**

The description of the methodology can be a complex process because it involves different components, communication interfaces and actors. The best way to do this is by using a graphical representation of the different stages that form the methodology. BPMN diagrams are used to do this [25]. This type of modelling technique is a standard owned by the OMG. It is quite simple and has a very high power of expression to model business processes [26].

For each of the methodology stages, several BPMN diagrams are used in order to describe all possible scenarios. Some examples can be:

- Identification and storage (Figure 3). During this phase there are mainly three actors involved; the learner, the ILC and the PLN. The learner, while using the browser, a game, a widget discovers an informal learning activity to consider. He/she pushes the activity to the ILC where it is queued. The learner can also add manually an informal learning activity and send it to the ILC where it would be also enqueued. When the learner decides to edit the activity or send it to the portfolio, she can access the pending activities list in the ILC, can associate extra info to it, and send it to the portfolio.

**Insert Figure 3 here.**

- Organization. The activities gathered through the ILC and stored in the portfolio can be later managed. This is done through the portfolio component. It is a complex and powerful tool that facilitates managing competences, activities and showcases. Additionally it makes possible finding peers with similar competences. The activities can be edited (i.e.: user can create, remove, or update and activity), organized in categories and published for them to be visible to the institutions. The competences can be edited, associated to an activity and published for the institution. In addition, the portfolio facilitates managing showcases that include informal learning evidences (competences and activities) and can be shared with others. The BPMN of these processes is shown in Figure 4. The diagram describes that the learner decides to manage his/her informal activities and competences; he/she selects what to do with the portfolio and, depending on the functionality, one of the sub-processes or tasks is activated. For activities, competences and showcases management, the user should specify the information and operation to carry out (it should be noted that not all the messages between the different sub processes and the learner are shown in the diagram to make it readable). Once the task is finished, the user is informed and he/she should decide to continue managing his/her portfolio or not.

**Insert Figure 4 here.**

- Analysis. The institutional tools facilitate making decisions from general data gathered by using the methodology and also with the information published by learners. This tool provides services to access different kinds of analysis. In the BPMN diagram (Figure 5) the HR manager requests a set of making decisions services to the institutional environment. This component gathers data from the portfolio (information about the competences published by the users and about the selected tags in the ILC) and the competence catalog (general information about the competences related to the informal learning activities). This information is processed and several services are provided: distribution of competences in the catalog (by categories and type of competences), distribution of competences used by the learner (by categories and type of competences), a tag-cloud with the tags associated by the learners of an institution to the informal learning activities, and a searching service to find users with a set of competences. This set of services can be expanded to include some more.

**Insert Figure 5 here.**

Previous figures show how with BPMN diagrams it is possible to describe TRAILER methodology and this description helps in the definition of the methodology, the development of the components and interfaces, and provides a tool to facilitate future testing actions (by describing different testing scenarios).

#### 4. Testing the methodology

The validity of the methodology should be tested. It is a critical issue in order to guarantee the success of the project, so this is done in different evaluation activities and with different perspectives. These evaluation activities were:

- During the definition of the system, an expert committee validates the methodology testing the different methodology stages by completing some possible scenarios. From each partner of the project at least two persons (if possible with different familiarity with the framework) should test the system. The methodology proposed is based on inspecting techniques, direct and indirect techniques. The inspecting technique used is the Cognitive Walkthrough - CW [27] complemented with other techniques such as a direct technique known as Think Aloud - TA [28]. Both techniques explore several scenarios, take into account the stages of the methodology and use the technological framework developed. The experts should complete some tasks using the technological framework. For instance, some of the tasks they should carry out were:
  - To gather an informal activity with the ILC, tag and classify it, and send it to the Portfolio;
  - To complete the information of an Informal Learning Activity (ILA) that has an associated competence publishing the ILA and the competence to the institutional context;
  - To define a showcase with ILA and profile information and share it with others.

With this testing it was possible to detect and solve errors before the development and testing was completed. Specifically, 52 moments of breakdown were identified. They were classified in different severity levels following Nielsen scale and solved taking first into account those that were more critical [19, 29].

In addition, some indirect techniques were used, such as surveys to gather the users perception of the system, System Usability Scale (SUS) form [30] to know the final user satisfaction; and TAM3 to gather the perception of ease of use (PEOU) [31]. From these tests, average results were returned, something normal because when the expert testing was carried out, the methodology and framework were still being developed.

- During the pilots. TRAILER project involves two different pilots, one of them taking into account the learners perspective [32] and the other considering the institutional one. They involve learners and institutions from each of the partners' countries. Both pilots use surveys, pre and post questionnaires and the information stored in the framework, as the result of activities the learners carried out during the pilots. From both pilots it is possible to see that the idea of a tool to recognize informal learning and facilitate a dialog between institutions and learners is positive and the methodology seems to be efficient, however the tool should be easy to use and very straightforward.

#### 5. Conclusions

Informal learning is being increasingly appreciated from different contexts, but in order to make it useful it is necessary to make it visible from the learner context to the institutions in which he/she is involved. This would benefit both the learners and the institutions. The learners could, in this way, provide evidences of their non-institutional knowledge and experiences to the institutions, which can use such information to promote learners, assign them tasks that they can develop easily, etc. Institutions would benefit because they would have more knowledge and can make better decisions. However, to make this possible, a dialogue between institutions and learners is needed. This paper describes a methodology that tries to articulate such dialogue about informal learning between learners and institutions. Learners gather, store, classify and organize informal learning activities and the people in charge of the institution can check this information and interact with the learners in order to make decisions. This methodology was defined taking into account a technological framework and also information about how institutions deal with informal learning activities. Given these contexts, several stages were defined and modelled by using BPMN diagrams and activity diagrams.

The methodology has been tested successfully in several pilots. One has been carried out with experts from the institutions that participate in the project. Other pilots allow learners from different educational institutions and companies to apply the methodology and use the framework. Finally, several experiences have been carried out with the HR managers of companies and institutions. They have used the DSS and the other making decisions services. With the feedback gathered from the different stakeholders it is possible to improve the methodology and facilitate a proper dialogue among learners and institutions. In order to represent these changes, once the pilots were finished, the framework completed (not only as a proof of concept) and the outcomes analysed, it will be possible to change the BPMN diagrams as a



second iteration of the methodology and to enrich the methodology description with other design techniques.

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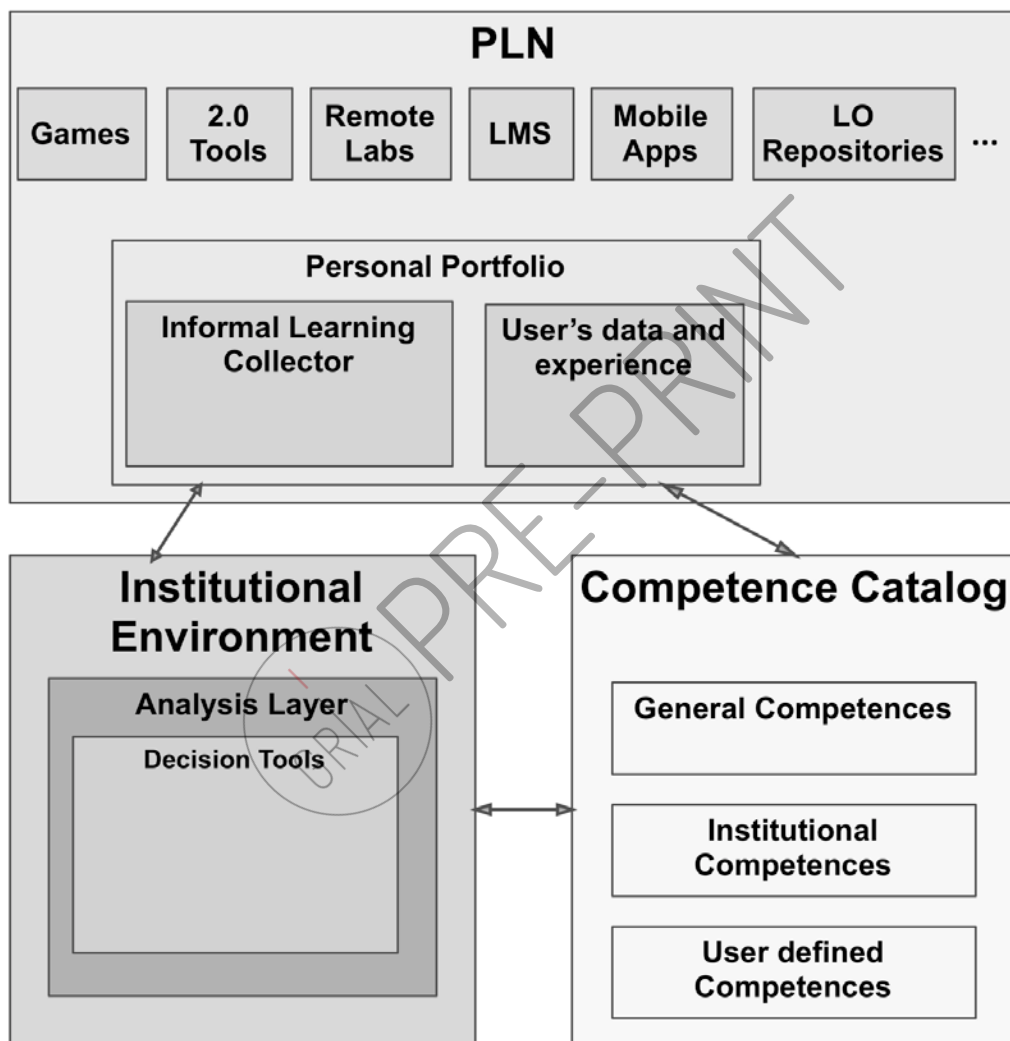


Figure 1. – TRAILER main components. It includes the PLN with different tools that can be included into it, the Institutional Environment and the Competence Catalog [18].



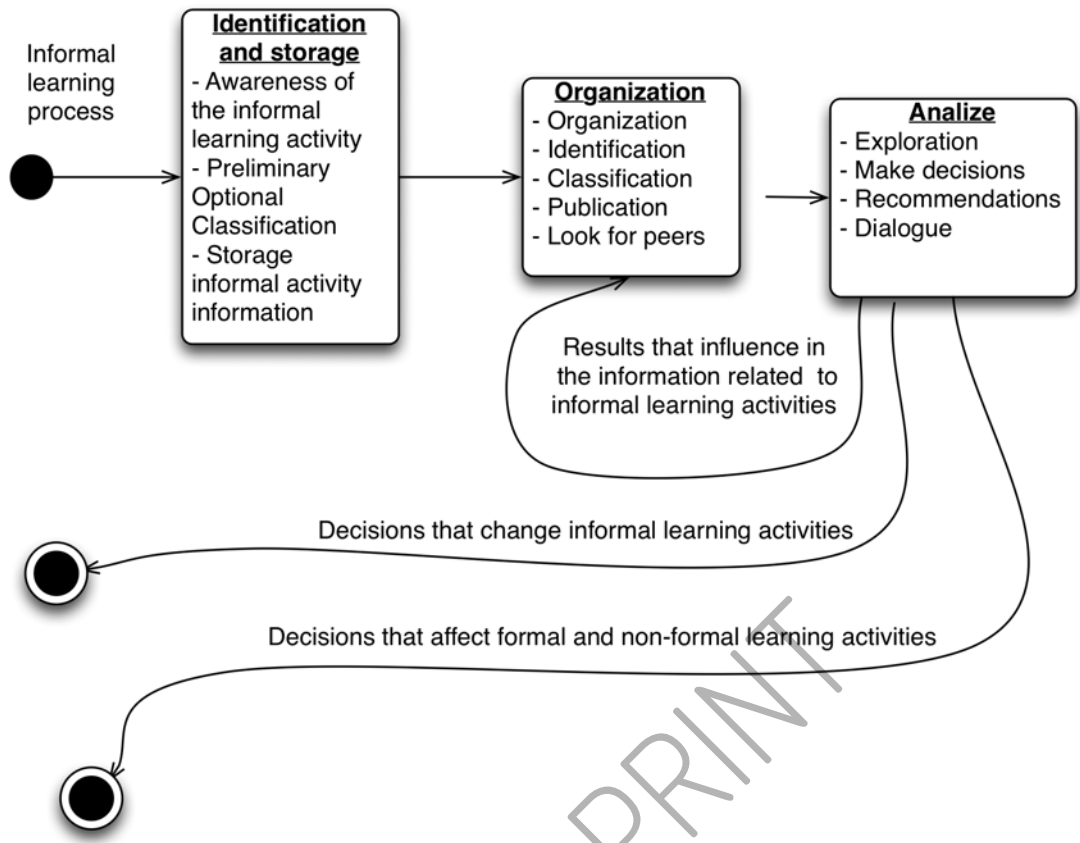


Figure 2. - TRAILER methodology with the main stages to make visible informal learning [33].

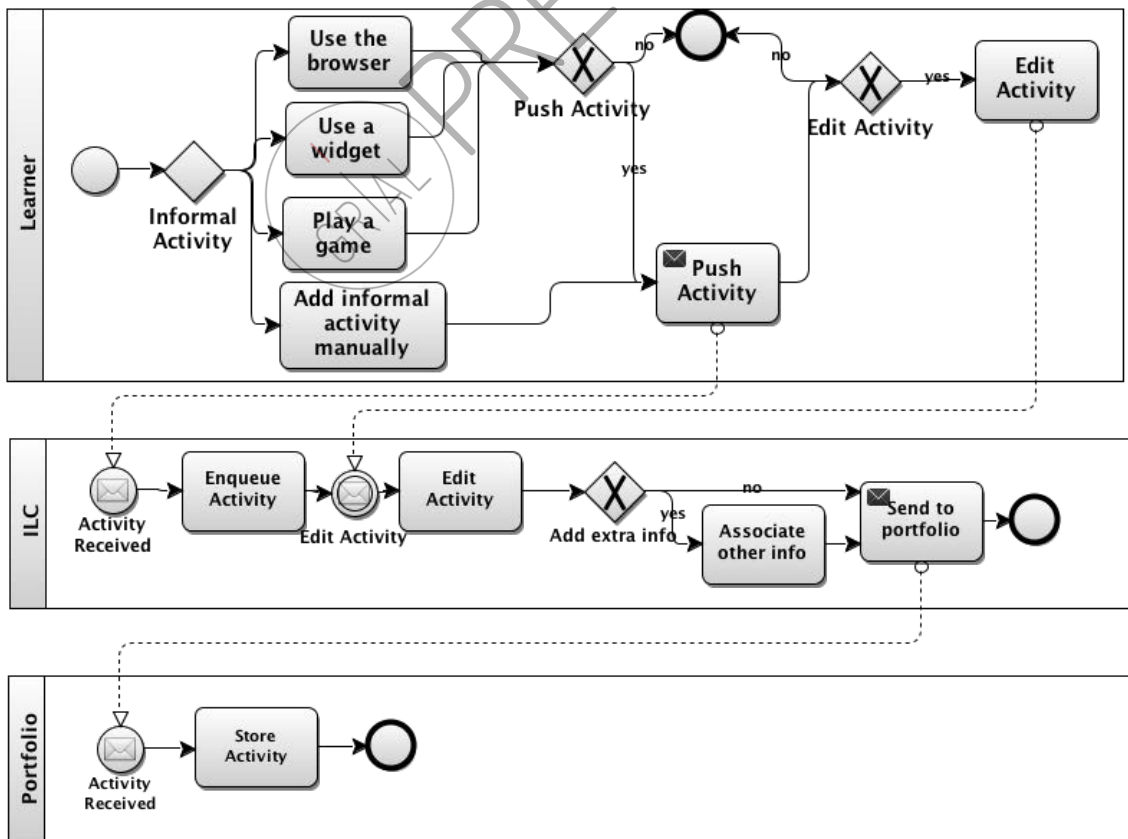


Figure 3. – BPMN diagram describing the Identification and Storage stage.

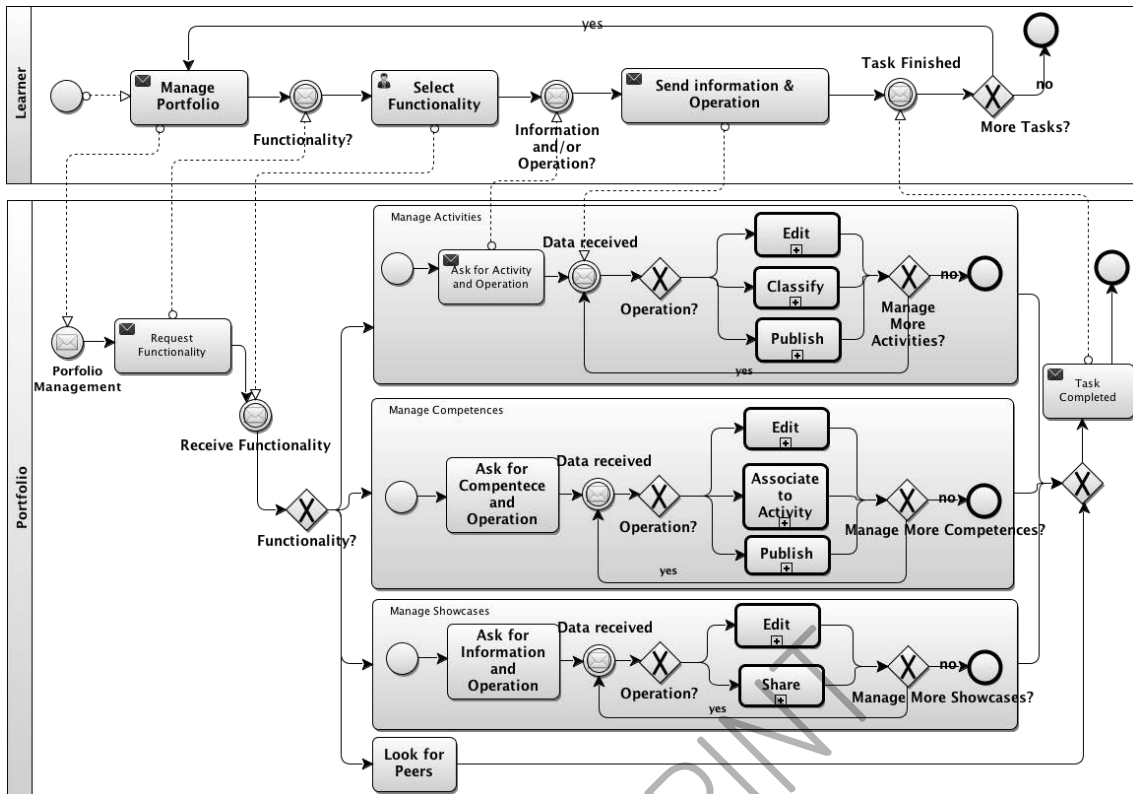


Figure 4. BPMN diagram describing the organization stage

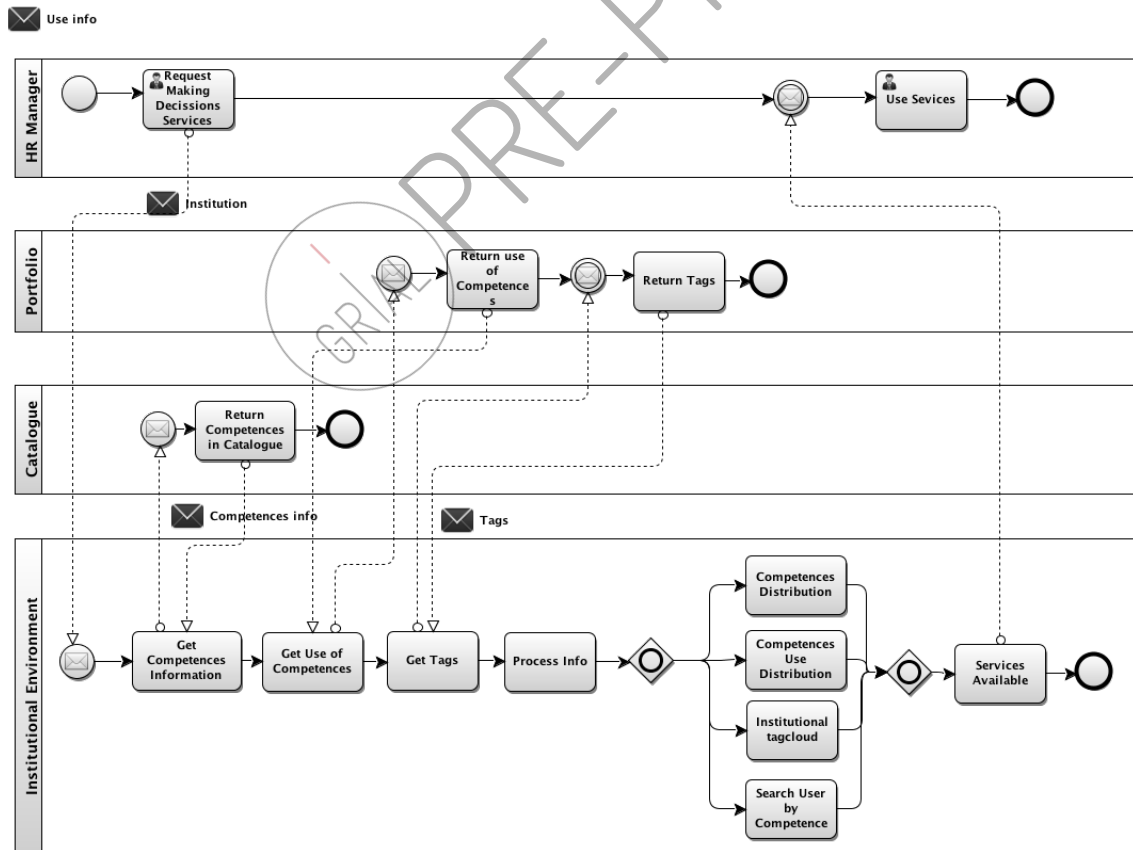


Figure 5. BPMN diagram describing the Analyse stage