New usages for knowledge management through collaborative platforms

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Abstract—The work reported here relates to collaborative platforms used in the knowledge management domain. Although these environments provide substantial help, first-time users are disinclined to use them because they are data- (or document-) centred. In this article, we study how new collaborative platforms for knowledge management can be more “user-centred”. The approach is based on observation of the collaborative activities in which the users are involved, in order to regulate the process better. The “traces” of the activity left by the different users of the platform are central in our approach, in order to exhibit specific indicators. Opposing a techno-centred and a user-centred approach, based on a real case study, a methodological framework to construct these indicators according to the real users’ needs is thus proposed, as well as a tool.

Keywords—Collaboration, Indicator, Awareness, Regulation, User-centred approach, Collaborative Platform

I. INTRODUCTION

Knowledge Management remains a central issue for companies. This topic has generated a complete and very active research field. Dedicated environments are already in use in large companies in order to acquire, to share and to broaden knowledge. They can be considered as collaborative platforms allowing people to manage information. Although these environments provide substantial help, first-time users are disinclined to use them because they are data- (or document-) centred.

The French Government Research Agency has thus launched a new project in order to study how new collaborative platforms for knowledge management can be more “user-centred”. The company Knowings, prime contractor of this project, sets up knowledge management platforms on many clients’ sites, and considerable and valuable feedback is produced. This project approach is to observe the collaborative activities in which users are involved, in order to regulate the associated processes better. The approach is based on the “traces” of the activity left by the different users of the platform. These traces are collected and transformed to increase the users’ awareness of the on-going activities for all the participants. One can provide the interested users with this awareness related to many attributes through “calculated indicators”.

In this paper, we first describe how the platforms currently in use work, and we focus on how these platforms develop awareness through “metrics tools” (tools providing indicators). These tools are used both by the users and by the administrators of the platforms. Two views of this tool are compared: the techno-centred view and the user-centred one that we support. Then a methodological framework to construct these indicators according to the real users’ needs is proposed. As developing adequate new indicators can be costly, the problem of the reuse of indicators is also addressed. Finally, a quick overview of a tool supporting this approach is given.

II. "KNOWLEDGE MANAGER": A COLLABORATIVE PLATFORM FOR KNOWLEDGE MANAGEMENT.

In this section, the most important functionalities for a knowledge management platform are presented. They are then illustrated through a description of a platform in use: “KnowledgeManager”.

A. Most important functionalities for a Knowledge Management Platform

In order to set up an appropriate Knowledge Management Platform in a company, Davenport suggests considering four main items, as in [1].

The first one deals with “Knowledge Storage”. The users should of course be able to create documents containing knowledge, such as memos, reports, presentational aids or articles, and to store them in the platform. Appropriate tools should also provide additional help to assist with accessing the documents.

The second one is related to access to knowledge. Finding the right person who has particular knowledge, and transferring this knowledge to another person involve very complex processes.
The third one concerns mostly the tool itself and its functionalities. The motivation of the people using the platform is a key issue and improved environments must ensure this motivation. From this point of view, the designers should consider awareness issues and social aspects.

The last item relates to the usefulness of the follow-up of the available knowledge. Again, this item is closely related to collaborative work. This work would be extremely helpful for the contributors since they can check how important their contribution is. It can also help in evaluating the level of maturity of the transferred knowledge.

The companies addressing the issue of Knowledge Management have general strategies that are usually classified in six categories [2]:

- **Business Strategy**: The knowledge is a central product and the companies support knowledge management, since they are convinced that it will result in a strong positive impact on the profitability of the company.
- **Transfer of knowledge and best practices**: This is the most widely-spread strategy. Reuse of knowledge and good practice exchanges are used to improve the products and services of the company, leading to better efficiency.
- **Customer-Focused Knowledge**: The clients’ needs, preferences, problems constitute the central knowledge for the companies pursuing this strategy.
- **Personal responsibility for knowledge**: The employees of the company are the engines of the knowledge management procedures. They are responsible for supporting the knowledge approach, identifying the appropriate knowledge and maintaining it.
- **Intellectual asset management**: Particular attention is paid to patents, technologies developed, operational practices, and the structural organisation of the company; all the knowledge that is recognized as formally belonging to the company. An efficient use of this source of knowledge helps to enhance technological advantages.
- **Innovation and knowledge creation**: This last strategy draws attention to innovation and the generation of new knowledge thanks to fundamental or applied research. The development of such unique expertise often provides the company with competitive advantages.

As stated previously, the research work presented in this document is being carried out in a national project, in which the prime contractor owns a collaborative platform: “KnowledgeManager”. In the following part, this platform is described and its strong points and weaknesses are pointed out.

**B. An example of a collaborative platform: KnowledgeManager**

Existing platforms answer (generally partially) the needs expressed above. Knowings is a company that proposes an integrated solution for Knowledge Management, by fulfilling the basic requirements of data management and by providing the users with a collaborative platform. This platform has been set up in different business areas (Industry, Services, and Economic Development) (fig. 1).

The proposed platform meets the first requirement (“Knowledge Storage”) well. The second and the third items (“access to knowledge” and “improved environments”) are only partially attained. Indeed, although it is possible to identify different roles (expert, project manager) involved in the knowledge management process, it is currently unfeasible to identify and to set up social networks on the platform. The “improvement of the environment” is related to the platform personalisation. For instance, homepages, dashboards, or forums can be adapted. The last item, associated to the “follow-up of the available knowledge”, is also approached through a supervision tool offered to the platform administrators.

![KnowledgeManager Interface](image)

**Fig. 1: KnowledgeManager Interface**

KnowledgeManager can be set up in diverse situations and enables the application of any of the six strategies set out above.

When integrated with a collaborative portal, KnowledgeManager allows each user to access easily, through a simple browser, all the knowledge bases, or the tools through which people exchange on this knowledge. This knowledge can be structured around communities (interest, practice, project). KnowledgeManager also controls the qualification and the flow of information according to the domain processes (flexible workflows), to
the management rules of the company, and to the user profile. These are the main ideas developed in this platform to reach the objectives of storage and access to knowledge.

KnowledgeManager also personalises access for each employee according to his/her role (reader, author, expert …), to his/her language (multilingual), to his/her responsibilities, to his/her topics of interest, and to his/her skills. Specific search engines assist the user in finding the relevant information. New information on a given topic is automatically distributed to users who have mentioned this topic of interest in their profile.

It is important to notice that this platform is specific from the “observation” point of view. A complete module called “Metrics” is available to the users willing to have tools to measure the evolution of a community (through the follow-up of actions of their members).

These two last points contribute significantly to the improvement of the environment. However, providing the users with such new environments, and new technologies, causes the emergence of new needs. These new requirements are presented in the next part.

C. Emergent needs from these new practices

Acquiring information, organising it, and accessing it are not the only items that underlie Knowledge Management [3]. The knowledge is also closely linked to human cognition and knowledge management only takes place in a structured social context. That is why it is essential to consider human and social aspects when producing or using knowledge. Indeed, knowledge management is not an individual task, but it implies many interactions within poorly structured networks and people communities.

Users thus need information on the on-going activity to help them to better create, transfer, share and use knowledge. Activity indicators can efficiently support the users to perform these complex processes.

First of all, these indicators are needed for supervising the community activity: for instance, reports on activities can identify tricky situations where people are unable to communicate, or point out groups that are successful. In this context, actors with an administrator role or platform animators can use this information.

Second, those indicators are actually useful for the users’ awareness. The information provided through the indicators can help the users to be aware of their workspace. This issue is of primary importance in cases of collaborative work, as is the case when using KnowledgeManager. Indicators are pieces of information that may to some extent motivate the actors to further collaboration.

Sometimes, the indicators are used in an unexpected way and themselves generate new usages. For instance, as indicators allow managers to know in a quantitative way how much the platform is used, a new economic model for maintenance is proposed. The platform developers can propose maintenance estimations according to the functions actually used and can also reinforce the most important parts of the software for a given company. This side effect is quite useful, since the final clients require adapted maintenance and costs. Indicators provide also the community animator with hints for identifying the domains where the knowledge should be extended. In that case, s/he will ask contributors to formalize knowledge in the identified domain.

In the KnowledgeManager platform, the “Metrics” module offers different pieces of information on the activity with these goals. This module and the techno-centred approach of its conception are now presented, as well as a comparison with a user-centred approach.

III. TECHNO-CENTRED VERSUS USER-CENTRED APPROACH

The first version of the Metrics module was designed by engineers in a techno-centred approach. This choice raises some difficulties.

A. Techno-centred approach

Basically, the main goal of the Metrics module (fig. 2) is to display statistical data. The displayed information can be linked with states and activities about the workspaces, with the actors, with the documents and with the functionalities of the platform such as search and data/information push. Although this information is useful, it is sometimes difficult to manipulate it, and users should access it from an external environment and should even export the data in a spreadsheet format in order to exploit the results in an adapted way (personalised dashboards for instance or a general dashboard aiming at proving the Return On Investment of the Knowledge Management Application.).
The designers of this module decided to propose some generic indicators, adapted for all sorts of communities using the platform. They defined the list of indicators from the objects of the platform: for each main entity (database, actors, documents, functionalities, etc.), and listed the relevant associated indicators.

This resulted in 41 indicators divided into 4 parts:
- The image of the community;
- The connections;
- The contributions;
- The alternative usages of the platform.

Each part is composed of categories allowing the indicators to be divided according to different views. For example, in the part “Image of the community”, the indicator “evolution of the community size” belongs to the category “Bases”, while the indicator “number of subscriptions by role” depends on the category called “Actors and subscriptions”.

The problem here is that some indicators can be classified in one category or in another, since the semantics of a category is not always clear. Indeed, the choice of the categories associated with the indicator is not always relevant.

It highlights that the choice of indicators set up according to platform abilities (functionalities and manipulated elements) causes difficulties in their classification and makes their description difficult in terms of observation objectives. As a matter of fact, having the part and the category of some indicators does not help to understand their meaning.

When the users and the designers of this module were interviewed, advantages and drawbacks have been listed.

Advantages

From the user point of view, the Metrics module presents an important added value for the supervision of the base. Information concerning “users’ connections” or “number of available documents” is accessible. As a matter of fact, it allows one to set quantified and measurable objectives concerning the platform use. The Metrics module is then seen as a powerful tool for capitalisation control within the company. Moreover, these functionalities enable concrete elements for platform and community management to be obtained. One can observe, for instance, that certain groups of people use the knowledge platform less than others. This information allows an analysis that can lead to explanation meetings by the management or to training for these groups.

Drawbacks

The first observation of Metrics users concerns the meaning of the proposed indicators, which is not obvious: the name is either too ambiguous or too unclear, or some words may even have different meanings. Sometimes, the users misinterpret the indicator by simply imagining a different meaning and conclude that the indicator is wrong (computations are incorrect). Finally, they just do not use this indicator. Sometimes, interactions with the designers helped to understand the indicator thanks to the collected traces used for its computation.

The second problem is related to the fact that some users cannot exploit the indicators in their initial state. Currently, the administrators are thus obliged to use them in their initial state, to export them and to apply some automatic or manual routines or treatments in order to elaborate specific dashboards. The latter may then be sent to project managers, animators and experts. Moreover, concerning these transformations realised from the spreadsheet format, at the beginning, they required the expertise of the designers in order to exploit the indicators, to understand the traces, extract the data and finally construct the desired indicators.

The third observation shows that the state indicators do not really interest the users. Most of the time, the users wish to use activity indicators in order to follow the platform’s evolution, for supervision and awareness purposes. “This will help to animate collaborative activities,” said a client in the last interview section. The state indicators are mainly useful for administrators in order to get static information concerning the use of the platform (number of documents in the base, number of users).

The next point which makes interpretation complex for the Metrics users is the amalgamation of different natures of indicator into the same dashboard. The metrics are composed of activity and state indicators. The activity indicators represent users’ actions within the platform over time while the state indicators provide information concerning the platform at a specific moment (“snapshots of the current activity”). These two types of indicator are not interpreted or used in the same way. In the metrics
module, the two views are mixed without stipulating it for the user. A new difficulty appears for the user when s/he has to shift frequently from one view to another: the user must be careful in order not to misinterpret the data provided.

A final problem must be pointed out. When users express the need for a new indicator, the process to set it is rather hard. As a matter of fact, administrators are obliged to export relevant data into a spreadsheet and apply some specific transformations in order to be able to exploit these new pieces of information.

To conclude this part, our general feeling is that the platform users’ view is important to get information about the activity via the Metrics module. They are interested in and satisfied with the content proposed (the traces collected), but the means to exploit them is rather complex and requires too much additional work. In the following part, all the needs linked to the implementation of this kind of tool are listed.

B. Identified needs

In order to identify the needs for a tool supporting indicator construction (such as the one available in the Metrics module), the whole life cycle of an indicator is inspected and for each step, the possible problems are identified.

Fig. 3 sketches the life cycle of an indicator (inspired by the life cycle of a classical object in computer science).

![Fig. 3: Life Cycle of an Indicator](image)

1) The first phase is the **requirements acquisition**. In this phase, the designer elicits their requirements from the users. This phase is often supported by formal or informal elicitation tools (structured interview, brainstorming). The result of this phase is the list of identified indicators obtained from all these actors and considered useful for this collaborative activity.

For this study, this step has been achieved differently: The choice of the designers was to provide indicators corresponding to KnowledgeManager platform entities (the “techno-centred approach”).

This phase is essential since it is the starting point of the life cycle. *Elicitation methods* must be applied to achieve this task. The objective is to avoid developing useless indicators in the platform.

2) The second phase concerns the **construction** of the indicators included in the list. For each indicator, one needs to define the construction of the indicator by specifying what the relevant traces (or elementary indicators) are, what the type of this indicator is and which calculation will be made in order to set a coherent value for the indicator.

One of the most important problems identified by the designer and by the user concerns the difficulty in interpreting an indicator. As a matter of fact, the user needs to appropriate an indicator to understand it: s/he must know their semantics in order to be able to use it correctly. Therefore, it is far better to involve the users in this phase of construction, too. They can thus describe the indicators as they conceive them (with their own vocabulary) and co-construct them: Consequently, they will have confidence in the indicator because they will have a clear view of the information needed for the calculation of its value.

3) The third phase deals with the **contextualization** of these indicators. The user will have to instantiate the construction rule for a particular situation. S/he will choose in which context such an indicator will be used (spaces, rights, user role), how it will be named, described and visualized. This phase allows the description of the semantics of the indicator.

It is also important for the user to achieve all these tasks in order to control and thus accept the indicator that s/he is elaborating.

4) The last phase is the **use** of the indicators. New tasks appear which are more tangible than conceptual: the launching, the update, the visualization and the personalization of the indicators. The visualization of the indicator is significant because it provides the user with the presentation of the indicator result. The personalization of the indicators allows the different users to observe the same indicators with different views according to their preferences but also rights or roles.

During this phase, the users must remain immersed in the platform in order to get quick and easy access to such information.

The indicators have thus to be well organized according to their representation. If several categories of indicators exist, it is important to maintain coherence in their visualization in order to facilitate their use.

A cycle appears in the life cycle of the indicators. At any moment, it is possible to return to any elaboration phase of
an indicator: for instance, if the user realizes that the computation does not provide the expected values, the construction phase should be carried out again. It is also possible to go back to the requirements acquisition phase: the needs for indicators evolve with the community in the platform.

As said before, during the elaboration and contextualization phase, the users’ involvement helps them to understand the indicators and their use. After interviewing the Metrics designers, it seems that new required indicators are quite similar to existing ones (slight modifications). Consequently, the indicators’ reuse is a key issue that needs to be considered in the construction process.

The user being central in designing and setting up such platforms, the following part is dedicated to a user-centred approach. The objective is to improve the Metrics module, particularly by addressing the problems identified in the previous part.

C. User-centred approach

A methodology to perform the requirements acquisition according to a user-centred approach is now proposed. It is thus important to consider how to provide users with a tool for the construction of indicators in such a way that their reuse is facilitated.

Requirements acquisition

The requirements acquisition enables the identification of the indicators needed by the users. It concerns a process of elicitation of knowledge when the knowledge to be collected is still vague for users.

Furthermore, indicators are semantically rich and complex. A methodological framework to model and to build them must be set up. Because knowledge management is based on collaborative processes, the indicators which supply information closely related to the collaborative activities are particularly interesting.

The first stage of this approach is to use a classification of indicators stemming from a state of the art, which will help the users to describe their needs. In this case, a user-centred approach is used: every item of the classification corresponds to an element of description of the indicator, which the user or the designer must address during the requirements acquisition.

In order to obtain a reliable classification, the description and the use of indicators in various domains such as chemistry, economy [4], computing [5], or geography [6] have first been studied. The objective was to produce a list of invariant items characterizing an indicator in any domain.

Then, the collaborative activities [7], [8] are studied to discover the fundamental aspects to be taken into account with indicators for observing this type of activity.

Finally, these elements were brought together in six large independent categories allowing the representation of an indicator of collaboration [9] (fig. 4):

- **The dimension** (action, social, emotional);
- **The point of view** (collective, individual, differentiated);
- **The nature** (activity, impact, result, state);
- **The type** (number, discrete interval, threshold, …);
- **The context** (working environment, contents of the activity, user profiles);
- **The structure** (elementary, composite).

![Fig. 4: Classification of Indicators of collaboration](image)

The classification can be used as a support for the acquisition of the users’ needs. The first 3 categories (**Dimension, Point of view and Nature**) will help in describing the objectives of observation of the indicator.

For example, if the indicator “level of consultations by working space” is proposed, some details have to be added in order to place only one possible interpretation on it:

- It is an indicator of dimension action because it is linked to the process. It allows the observation of the interactions of the users with the contents.
- The point of view of the indicator is collective. Only the consultations of all the actors in the specified knowledge base are used.
- It is an indicator of impact. Indeed, the organizers of the knowledge bases will use it to estimate the membership and the users’ interest for the contents of the knowledge bases.

Then, the user and the designer need to define the shape of the indicator: for instance, it is important to know if it is a figure or a text, if the value of the indicator should be visible for a certain period or only at a given instant. The **type** contains this kind of information.
The context allows the user to choose the use of the indicator. S/he marks the perimeter in which the indicator can be used. For example, the indicator “Number of consultations by base” is not relevant in a base where only forums and chats are set up. This element helps the users in targeting the situations in which the indicator is needed.

Finally, the structure will mainly involve the designer. He needs to identify the data necessary for the construction of the indicator.

At this stage, the classification becomes a methodological framework to set up an exhaustive list of the indicators. This methodological tool is helpful for completion of information. It is often the case that some characteristics are not defined. For instance, it may be the case that all the existing indicators belong to the dimension action. This is easy to identify with our framework and an additional interview can be conducted in order to discover whether this results from a lapse of memory or is deliberate.

After this stage, the list of indicators the users wish to set up in their application has been obtained. The next step is the construction of these indicators.

**Construction process**

In the current state of the Metrics module, the users have difficulty in appropriating indicators either because their names are not very significant, or because the data that enable them to be calculated are not clearly identified. The users sometimes need to transform the indicators, since they do not meet their expectations. These transformations can be evolutions of existing indicators.

For all these reasons, it seems that the user must also participate in the construction phase. In that case, it is likely that the designed indicators will be used and accepted by the community. A tool that allows the users to build and to reuse their own indicators is thus proposed.

Considering the complexity of the use of these indicators, a unique indicator model which corresponds to all our needs is given for the representation. The supporting tool has to take this model into account in the process of construction of indicators.

In the following part, the indicator model containing all the items necessary for the use of indicators (identification, construction, contextualisation and visualization) and which enable their re-use is presented.

IV. CONSTRUCTION OF INDICATORS

To present this model, the process for designing indicators is investigated deeply in order to determine the elements contained in the model. Then, a quick overview of the prototype for generating indicators is given.

**A. Process for designing indicators**

In line with other research work concerning the modelling of indicators [10], a model based on four modules corresponding to four phases in the design process is proposed:

**First phase: the Definition**

When defining an indicator, the author provides several basic pieces of information, such as its name, its description, its date of creation and modification as well as its author and its modifiers. The result of this phase is thus the Definition module, containing the information describing the indicator, providing it with semantics, and that can be considered as the basis of the indicator model. This module also includes the data linked to the classification such as the dimension, the point of view and the nature.

Now, let us consider the Construction phase.

**Second phase: the Construction**

In this phase, the user defines how to obtain the elements needed to calculate an indicator and how to calculate it. Two types of indicators are distinguished: the elementary indicators and the composite ones (gathering several indicators).

At the end of this phase, the Construction Module of the indicator is obtained. It models the construction process independently of its use. In this module, the elements needed to build the value of an indicator are taken into account.

It is expected that the module related to the calculation of the attribute will assert the type (number, threshold, and interval) associated with the indicator. The fact that the indicator is elementary or composite is also presented here through the “structure attribute”. Finally the process of calculation of the indicators is described through rules operating on indicators or traces.

The third phase is dedicated to contextualisation.

**Third phase: the Contextualisation**

In this phase, the user clarifies the context of execution of the indicator built in the previous phase. The result is the Contextualisation module including the elements that describe the situation in which the indicator is set up.
“Context of execution” means the actions, the objects, and the people involved in the indicator’s construction. The definition of a validity scope is necessary in order to specify the situations when the indicator (and the values which it returns) makes sense. Finally, it is possible for the user to attribute rights to a category of people for the indicator being described.

The visualization phase is now detailed.

**Fourth phase: the Visualization**

At this stage, the user has already defined the objectives of the indicator, the elements for its elaboration and its use. The result of the calculation must be transmitted to the users through visual means. The aim of the Visualization phase is to specify these visual means.

From the current systems of visualizations and in particular from indicators [11], [12], many needs were detected, leading to a large variety of methods of visualization.

The module contains elements defined in this stage: the user chooses the views associated with the indicator (according to its type). Then, it is possible to choose different views for actors according to their rights, needs or profiles. Preferences are thus associated with the people that are going to use the indicator.

From this model, all the indicators elaborated during the requirements acquisition phase can be represented. This distinction in four modules (definition, construction, contextualisation and visualization) facilitates the reuse of indicators as well as adaptation to the various computing environments. Indeed, the designers of Metrics have identified that demands for new indicators were based on evolutions - transformations of the existing indicators. This is a significant statement and the support tool for defining indicators must take it into account. As in the field of software engineering [13] and the reuse of objects, it is possible to reuse an indicator totally or partially.

A preliminary version of the prototype of the support tool that allows users to manage their indicators during all the phases of the design process is shortly presented.

**B. A tool for designing the indicators**

The tool for designing indicators enables users to build, contextualize, visualize (with possible customization) and reuse indicators. A first prototype has been developed, and a refinement is on progress, with addition of new features.

The space to build a new indicator is broken down into
• A classification of indicators of collaboration to help actors during the requirements acquisition;
• A unique indicator model allowing the description of the definition, the construction, the contextualisation and the visualization of an indicator;
• A tool for co-construction (users participate in the process) of indicators implementing this model.

Now, let us verify that our solution answers the problems identified:

• The first report was that the meaning of the indicators proposed was not obvious. The vocabulary used could be interpreted differently by a user or by a designer. The classification proposed during the requirements acquisition clarifies elements, since the definition of the indicator is much more complete and does not rely solely on the name of the indicator.

• Then, it is crucial to mention that the indicators proposed did not match the users’ expectations. The user-centred approach helps the users to define and to build only the indicators needed.

• Furthermore, the users no longer depend on designers to know the data (tracks and indicators) used to calculate the indicator. From now on, users co-define the rules of construction.

• Then, the classification allows users to organize their dashboards in a structured way. For instance, we can distribute indicators in various dashboards according to their dimension.

• Finally, the last difficulty is linked to the cost of development of new indicators. Currently, our tool allows the reuse of indicators or parts of indicators and thus reduces the errors and the associated costs.

V. CONCLUSION

In this article, the advantages of a user-centered approach vs. a techno-centred one were demonstrated. It is strongly recommended for the designers of collaborative platforms that they adopt a co-conception approach, in which the users / animators must be deeply involved. As a matter of fact, now, end-users are expecting new tools for collaborating, focusing more on people’s behaviour than on data or documents. This can be realized by providing specific indicators.

Nevertheless, awareness indicators are fundamental for collaborative activity, but are evolving according to users’ or administrators’ needs while using the platform.

From the METRICS module analysis of the Knowledge Manager platform and with the help of the Knowings Company designers, some advantages and drawbacks were pointed out and some specific requirements leading to a new, more user-centred, approach have been identified.

This user-centred approach is based on a methodological framework that allows us to design awareness or collaborative indicators computed from traces left by the users. The four phases composing the life cycle of an indicator are addressed and are implemented into a dedicated tool for elaborating indicators and reusing existing ones. Within the next few months, several experiments are scheduled in order to validate this framework for different domains (industrial, economic, communities of practice).

Other results are expected from collaborative indicators enhancing the platform use. For example, interesting collaborative patterns may be sought within traces in order to evaluate or detect good practice and effective collaboration between particular users. A Trace Based Management System (open source) will also be available to the community, in order to enable further research work by other teams.

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