

How Workflow Systems Facilitate Business Process Reengineering and Improvement

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Abstract

This paper investigates the relationship between workflow systems and business process reengineering and improvement. The study is based on a real case study at the “Centre Régional d’Investissement” (CRI) of Marrakech, Morocco. The CRI is entrusted to coordinate various investment projects at the regional level. Our previous work has shown that workflow system can be a basis for business process reengineering. However, for continuous process improvement, the system has shown to be insufficient as it fails to deal with exceptions and problem resolutions that informal communications provide. However, when this system is augmented with an expanded corporate memory system that includes social tools, to capture informal communication and data, we are closer to a more complete system that facilitates business process reengineering and improvement.

Keywords: *Workflow Systems, Flex-Flow, Corporate Memory, Business Process Reengineering, Business Process Improvement, Social Tool.*

1. Introduction

Nowadays, there is consensus on the necessity of using information and communication technologies (ICT) in order to improve business processes. Among the methodologies used to achieve this goal, business process automation (BPA), business process improvement (BPI), and business process reengineering (BPR), have become common in the jargon of actors involved in the field.

BPA aims to increase the efficiency of the work of the users without intending to change the work in an organization, but automates the existing processes. In the development context, this often implies that manual processes are supported, or replaced, by automated processes. This means for example that data is no longer stored in paper files, but a database management system is introduced to manage information. However, the same information as before is stored without considering its quality and usefulness [1].

BPI aims at retouching processes through incremental changes but without creating new processes or new tasks [2]. The new practice is enhanced both through making the users more efficient and by changing how processes work in order to make them more effective. In practical terms,

this means that processes are examined carefully to see whether existing problems can be eliminated during the introduction of ICT [1].

BPR focuses on the fundamental and critical rethinking of an organization’s processes. The organizational processes are evaluated, changed or eliminated, and new processes are added in order to improve performance in terms of costs, service delivery, quality and speed [1]. A typical BPR involves four steps that are: (1) planning, (2) analysis, (3) reconfiguration, and (4) accompanying changes [3]. Planning refers to the collect of information on the process, and the initialization of the process description. Analysis refers to the crucial rethinking of the process in order to emphasize and analyze serious dysfunctions. Reconfiguration concerns the construction of the new process, with actors, customers and process providers. Accompanying the changes means to accompany people to make them appropriate to the new process, by training, help documents that guide them through the process etc... The three concepts defined above (BPA, BPI, and BPR) implicitly assume that the workflow of the considered process business is already available, especially for BPI and BPR; which is not always the case. This task is done by workflow system designers who have the crucial task of finding the good fragmentation of a process into many steps, in order to automate it [4].

In [4], the author argues that workflow systems are an ideal technology response that fits BPR main goal, which is to improve customer satisfactory. In fact, workflow applications are a set of proactive software enabling to manage work procedures, to coordinate costs and resources and to supervise the sequence of tasks [5]. For example, in [6], the authors proposed a workflow reengineering methodology (WRM) which uses workflow management automation to enable BPR. Authors argue that the main advantage of this approach is that, unlike proposed BPR methodologies that use historical and estimated process data gathered from process participants, WRM uses the accurate real-time process measurements gathered by the workflow tool to improve workflow efficiency, effectiveness, and flexibility. The methodology consists of 5 phases and 32 component steps, together with associated data collection forms to facilitate its implementation. The proposed methodology was applied

to a case study to improve the processing of on-line equipment manuals and electronic discrepancy reports for a naval organization. Authors claim significant reduction in cycle time, costs as well as personnel required to manage the process.

We established in our previous work that a workflow system can be a powerful tool to execute BPR strategy [7-8]. Our study focused on a case study in Marrakech, Morocco, where an institution called “Centre Régional d’Investissement” (CRI) is entrusted with many administrative procedures among which the attestation of non agricultural vocation (ANAV), the permit of mining exploitation, the temporary occupation of forest domain, etc...[9]. However, we only considered the ANAV (AVNA in French, or just VNA) procedure.

As far as business process improvement is concerned, our aim in this paper is to show that workflow alone as a tool is insufficient to achieve it. Even when we couple workflow system with corporate memory (CM) system [10], it is still insufficient. However, when we further augment the workflow system and CM system with social tools to capture informal communication and data, we are closer to a more complete system that facilitates continuous business process improvement. Section 2 is dedicated to the description of the general process at the CRI. In the third section, workflow methodology is presented as a base for business process reengineering. Section 4 presents the deployment of the workflow system, called Flex-Flow, at CRI. Section 5 tackles the extension of Flex-Flow with traditional CM to include informal communications, and shows how this extended CM can help in improving continually the process at CRI.

2. Description of the General Process at the CRI

Marrakech, Morocco, has experienced a great growth in investments in the past few years; which has essentially increased the number of work cases handled by the CRI. Furthermore, the concept of “guichet unique” has been introduced. The goal of this latter is to facilitate, for potential investors, all administrative procedures for investments by creating a single institution that communicates with the investor. This institution (CRI) is now entrusted to coordinate all the administrative procedures with other government institutions to execute the proper procedure and facilitate this process for the investor. More details about the CRI of Marrakech can be found online, at [9].

The initial general process at the CRI is given by figure 1 showing many administrative procedures P_1 to P_N . All the procedures have some common activities (A_{1i} to A_{iR}). More details will be given in the reengineering phase

which is the aim of the following section where we present the general process that has been implemented at the CRI.

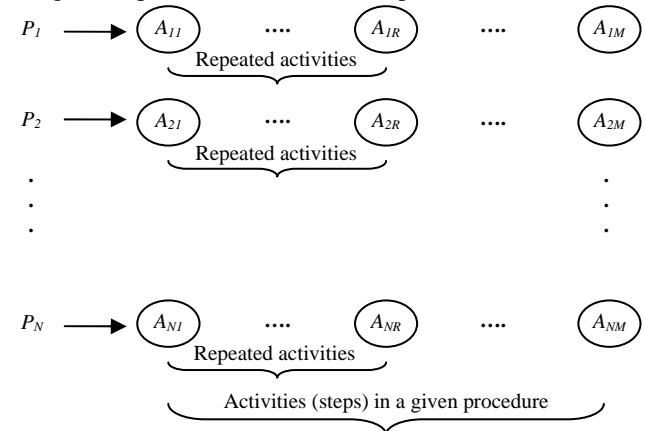


Fig. 1 Schematic representation of the general process at the CRI of Marrakech, before the streamlining.

3. Workflow Methodology as a Basis for Process Reengineering in CRI

Before the implementation of Flex-Flow, a reengineering of processes was necessary. This was done based on workflow approach due to the following reasons:

- The procedures have many steps, and need coordination among 3 to 9 independent autonomous and dispersed institutions in the region of Marrakech, which need to work together for a common goal. This fits workflow systems’ aim, because these latter are designed to assist a group of people working together to carry out a work procedure [11].
- There is also a need to track each work case (dossier d’investissement), share information and synchronize it with the different stakeholders. The goal is to inform the investor and resolve any potential hurdle that may occur at some steps, with certain government institutions.
- There is a need for providing statistics about all the steps; which can be used for further improvement of the procedures.

As an example, we present the process reengineering that was undertaken for the ANAV procedure whose workflow is given in figure 2 and whose steps are defined in table 1 [7]. The model presented is based on workflow methodology (see figure 2). This model is inspired by Information Control Net (ICN) [12]. ICN was created and designed specifically to model office procedures. It captures the control flow, the data flow, goals, actors, roles, and information repositories.

The output of the ANAV procedure is the delivery of an attestation that is required for any land outside the urban

perimeter to be held by a foreign physical person, or enterprise, whose capital is held totally, or partially by foreign persons [9]. This attestation essentially allows an investor to convert an agricultural land to an investment project like a hotel. This procedure involves 10 steps, and some of those steps may be unnecessary, depending on the type of attestation required. In fact, as one can see in table 1, an applicant can trigger one among 5 types of ANAV procedures.

The type of procedure triggered by the applicant depends on the characteristics of the land under consideration. In fact, the land can be (i) nude, (ii) already occupied by a project, or (iii) situated in an area covered by a town planning document. In the first case, when the applicant triggers the procedure, he receives a temporary ANAV. Upon the completion of the project in a predetermined deadline, noticed by a committee, the applicant receives a confirmative ANAV. In the second case, a committee notices the existence of the project, and the applicant receives a definitive ANAV. In the third case, the applicant is provided with an exemption ANAV.

Figure 2 shows the initial workflow of ANAV procedure, where all steps are executed in sequence, but with some conditions stating whether a particular step is needed. Those conditions are represented by small diamonds; each one having two outputs, representing two eventualities.

The workflow model given in figure 2 has the merit to give a clear view of the procedure in concern, and all steps are transparent for the customer who is a potential investor. This model also facilitates the reengineering phase that is the aim of this subsection.

Table 1. Required steps for an ANAV procedure, depending on its type. Needed steps are checked.

The steps appearing in table 1 are defined as follows:

Step 1: Admissibility of a case file.

Step 2: Sending of the case file to administrations.

	<i>Types of application for ANAV</i>				
	Exemption	Definitive	Confirmation	Prolongation	Temporary
Step 1	✓	✓	✓	✓	✓
Step 2	✓	✓		✓	✓
Step 3	✓	✓		✓	✓
Step 4		✓	✓		
Step 5		✓	✓		
Step 6	✓	✓		✓	✓
Step 7	✓	✓		✓	✓
Step 8	✓	✓	✓	✓	✓
Step 9	✓	✓	✓	✓	✓
Step 10	✓	✓	✓	✓	✓

Step 3: Reception of administrations' response.

Step 4: Convocation of the commission of official report.

Step 5: Decision of the commission of official report.

Step 6: Convocation of the committee entrusted with some land operations.

Step 7: Decision of the committee entrusted with some land operations.

Step 8: Sending of the attestation to the Wali (top authority in a region) for signature.

Step 9: Reception of the attestation signed by the Wali.

Step 10: Notification of the investor.

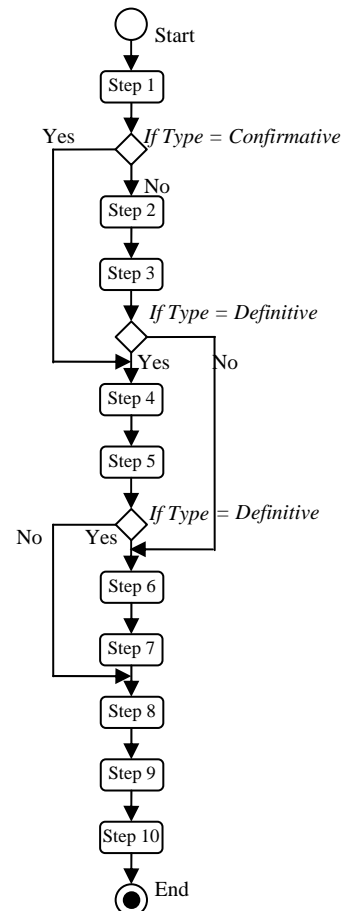


Fig. 2 Initial workflow of ANAV procedure.

The ANAV procedure presents many opportunities to reengineer and improve the processes. Before undertaking this, let us first remind ourselves what it entails to reengineer a business process. In fact, one has to contribute in one, or many of the following items [4]:

- Increase customer satisfaction by reducing internal costs
- Increase customer satisfaction by improving the quality of products and services
- Increase customer satisfaction by using optimally the skills of everyone
- Increase customer satisfaction by decreasing delays
- Increase customer satisfaction by improving the added value rate

- Increase customer satisfaction through increasing the reactivity, by crushing hierarchical levels.

After analysis, we have identified the following opportunities for a business process reengineering, using a workflow methodology as a tool, to define, coordinate, and execute the new processes.

3.1 Opportunities for parallelism

A closer look at the previous described procedure leads to the following remarks:

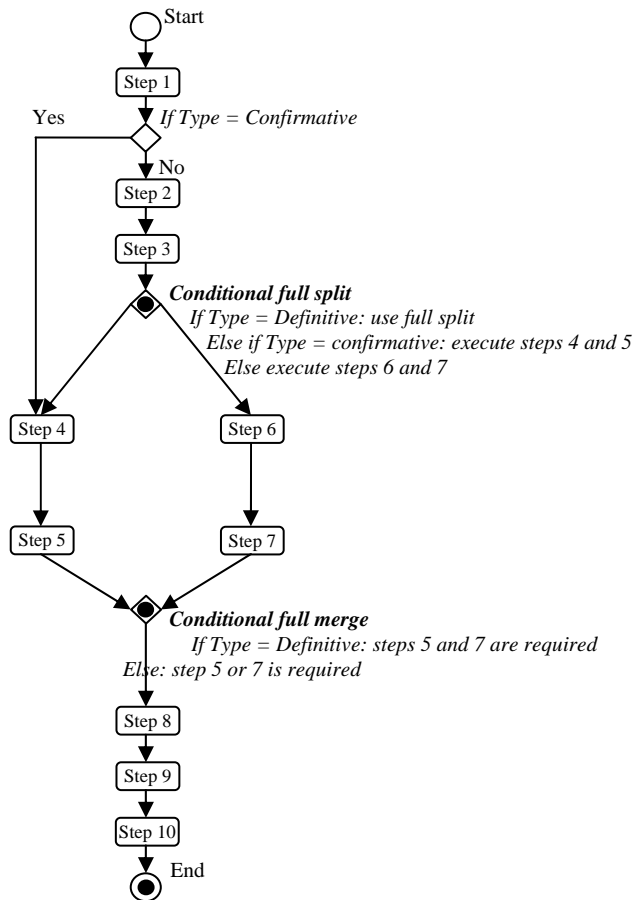


Fig. 3 Workflow of the ANAV procedure after reengineering.

- The first step is required for all cases.
 - Steps 2 and 3 are tightly coupled, but sequential.
 - Steps 4 and 5 are tightly coupled, but sequential.
 - Steps 6 and 7 are tightly coupled, but sequential.
 - The couple (2, 3) must precede the couple (4, 5).
 - There is no dependency between couples (4, 5) and (6, 7).
 - Steps 8, 9, and 10 have to be executed in sequence.
- Based on the above remarks, we propose to execute the couples (4, 5) and (6, 7), simultaneously. Thus, we obtain the workflow of the new procedure, given in figure 3,

where the diamonds with black circles mean that a full split, or a condition rule leading to only one output, can be used, depending on the cases. The parallelism introduced here will improve the delays; which is one of BPR's aims.

3.2 Normalizing the process

In fact, during the ANAV procedure, a customer may need to switch to another procedure called ADHOC. In the initial ANAV procedure, if such a switching happens, it is up to the customer to remember coming back to the initial procedure, to finish the remaining steps. This scenario is described in figure 4 where the procedure II is triggered without any dependency to the ongoing procedure.

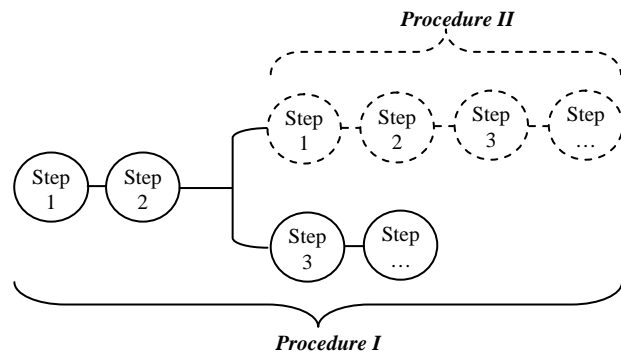


Fig. 4 Initial ANAV procedure (procedure I), in presence of ADHOC procedure (procedure II).

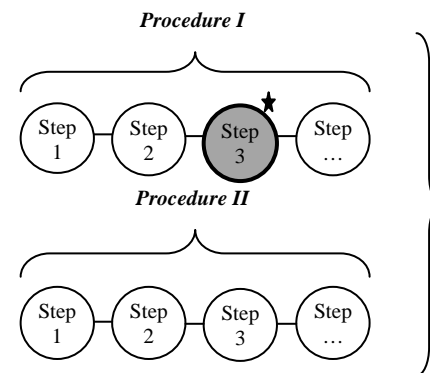


Fig. 5 ANAV procedure, with dependency between the main procedure (procedure I), and the ADHOC one (procedure II).

Because the above scenario can be error prone, we proposed that the workflow system must have one beginning and one end. Our contribution, here, is to render the coming back to the ANAV procedure automatic by defining, clearly, the dependencies between procedures and let the system track it and remind the user if needed. This prevents from any blockage in the procedure execution. A scenario emphasizing this fact is given in

figure 5 where the execution of step 3 in procedure I is conditioned to the completion of procedure II.

This normalization obtained by creating the above dependency between the two procedures, will increase the satisfaction of the customer, by improving the delivered service.

3.3 Necessity of managing alarms and rules

An efficient workflow system should propose a solution for the management of rules concerning the dependencies among steps in the procedure, the dependencies among procedures, the methods of synchronisation, and the management of alarms.

In the case of the CRI of Marrakech, we have noticed that there is law and regulation framework that governs:

- The delays of certain procedures.
- The dependencies between the different procedures, and the steps of the same procedure.
- The delays of steps in the same procedure.
- The dependency of certain procedures with respect to other ones.

Introducing alarms will facilitate the task of persons involved in the procedure, and will prevent from unnecessary delays by alerting them when this is necessary. The management of rules will mainly facilitate the task of persons involved in the procedure.

3.4 Necessity of defining roles

In the initial procedure, only the role of a project chief was defined. However, a closer look at the overall process shows that the CRI needs to define different roles, the access control for each role, and the responsibilities behind each role. Namely, four roles are proposed; (i) the administrator, (ii) the manager, (iii) the project chief and (iv) the follow up manager.

The administrator manages overall fixed parameters as:

- The information about all institutions involved in the CRI procedures.
- The information about the 240 communes that belong to the region of Marrakech.
- The user accounts access.

The manager creates the projects and assignments, and activates the proper administrative procedure. He is the only person who has access to preliminary data, necessary before beginning any CRI procedure. In fact, the manager has to:

- Execute an internal procedure called “project creation” whose data are necessary for all CRI procedures.
- Once these data are available, the manager assigns the new project to a project chief.

- Receives periodic updates on the status of procedures handled by project chiefs.

The project chief has the task to:

- Manage ongoing projects for a specific administrative procedure.
- To present reports on ongoing projects.

The follow up manager informs the manager about the status of a completed procedure.

It is important to note that although the project chief can view data related to his current assigned projects, he cannot modify these latter; he can only modify data related to his/her procedure. Finally, it is important to notice that projects are assigned to project chiefs, based on their skills.

By defining these roles, the ANAV procedure will be more transparent for the CRI employees. Customers can then easily track the status of their procedures from both the manager, and project chief. Hence, the service offered to the customer will be improved. Furthermore, the attempt of using optimally the skills of everyone by assigning projects to project chiefs based on skills, will avoid unnecessary delays due to mistakes or misunderstandings. This also increases the satisfaction of the customer.

3.5 Streamlining common tasks

Regardless the reengineering of one specific procedure, we have also been concerned by the reengineering of the general process at the CRI. In the initial process, when an investor wants to trigger any administrative procedure, among nine, at this time¹, the project chief entrusted with this latter, always enters information related to this procedure, and the investor himself. The stored information related to the new procedure can be some details about a land, the sector of activity, the procedure goals etc...Those related to the investor concern his name, nationality, passport number (for a foreigner), national card number, whether there is a single investor or an associated group etc...Figure 1 gives a schematic representation of the general process with many procedures P_1 to P_N . Notice that all the procedures have some common activities (A_{i1} to A_{iR}) which are repeated needlessly for each procedure and thus leading to redundant works and sometimes erroneous data.

To improve the general process at the CRI of Marrakech, we have consolidated common activities (A_{i1} to A_{iR}) in a new internal procedure we named “project creation”. This procedure is executed before any administrative procedure which will benefit from the same data moving forward. This procedure has 6 steps and holds key data that need to be consistent for all administrative procedures. These data

¹ In fact, they are forecasting to add other ones as the centre expands.

concern the identification of investor, the identification of project, the investment program, the identification of the land and the infrastructure around the project.

When creating a new project, all needed data about the investor and investment are stored, and a unique² project identifier (ID) number is generated by the system. This ID can be used, later, by the investor, for inquiries and triggering of new procedures; which can leverage existing and historical data. The CRI can also use this ID number for tracking and reporting. This facilitates the task for both the investor and government institutions including the CRI. Hence, the information redundancy has been eliminated. This fact is emphasized in figure 6, where activities A_1 to A_R are the same as those repeated in figure 1. After these common steps or activities, any specific procedure is completed depending of its nature (for example A_{1R+1} to A_{1M} , for the first procedure).

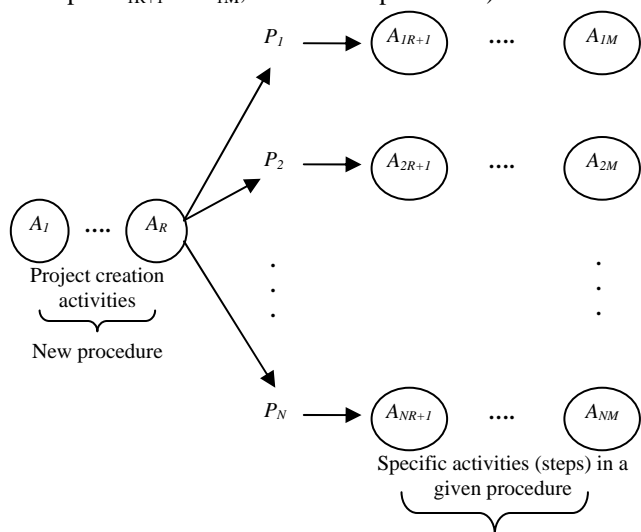


Fig. 6 Schematic representation of the general process at the CRI of Marrakech, after streamlining the procedures.

As shown above, the workflow system provided us with the formal methodology and tools for reengineering the general process in the CRI. Things like role specifications, alarm settings, traceability, parallelism and normalization, presented above repackage the government services the CRI provides to investors. The outcome of the reengineering we implemented is essentially better services for investors and better accountability from government institutions, and these are key ingredients for process improvement.

² So long as the triggered procedures belong to a same domain of activity; otherwise, another ID will be needed.

4. Deployment of the system

Before showing some screens of Flex-Flow, we first give, in figure 7, the framework interactions among the different stakeholders involved in its management, through time (from T_0 to T_7). The administrator first configures the system and creates the manager account. After, upon the request of an investor, the manager creates a new project, triggers the requested procedure and affect it to a project chief. The project chief handles the procedure and sends, continuously, information about the current status to the manager, as well as the final status when the procedure is achieved. Thus, the manager affects the procedure to a follow up manager which will inform him, later, about it. However, this follow up is not the focus of this paper.

By now, we aim to present the deployment of Flex-Flow by showing some screens (figure 8 to figure 13) referring to different phases of the process.

When an investor requests the triggering of a procedure at the CRI of Marrakech, a manager creates the object “investisseur” and enters data related to the investor such as first name, family name, nationality etc... The manager also identifies the “chef d’ouvrage” who is entrusted to execute needed tasks in the terrain. This step is given by figure 8.

Figure 9 shows the creation of a new project and its affectation to the “investisseur” object created in the preceding step. Notice also the bottom of this screen giving the status of the different steps, where a completed step is emphasized with a green color and a non triggered step is assigned a red color. Another color is used (see figure 11) for an ongoing step. This visual indication renders the ongoing process transparent to the manager and the project chief to which the manager will assign the handling of a specific procedure. Figure 9 also shows the ID number generated by Flex-Flow.

In figure 10, information for the above created project is entered. The stored data concern the nature of the project, its realization deadline, its localization, the amount and the type of financing, the number of generated jobs, and the sector of activity.

In Figure 11, data related to the land where the project will be executed, is entered. The data information are (i) geographical situation of the land, (ii) technical, giving general information about the land, and (iii) proprietor, giving information about land owner(s).

Figure 12 shows a key step, where the manager triggers the first procedure. The screen shows that the manager has chosen the “VNA” procedure (ANAV in English) between others like DPE, OTDF, OTDP, OTDM. The four later procedures refers, respectively, to a request of selling/renting of state private domain, request of temporary occupation of state private domain, request of temporary occupation of state public road domain, request

of temporary occupation of state public maritime domain. One can notice that the bottom of the screen shows two steps with a red color; this is because these latter are not needed for the specific case of “VNA” procedure. Figure 12 also shows the affectation of the above procedure to the project chief Ikram whose account has been created by the manager, although this is not shown, here. After this affectation, the project chief Ikram can handle this procedure after her login. As an example, we put a screen showing the receipt of administration response accepting the VNA request, in figure 13. Notice that some screens present the field “Observations” allowing to put some remarks.

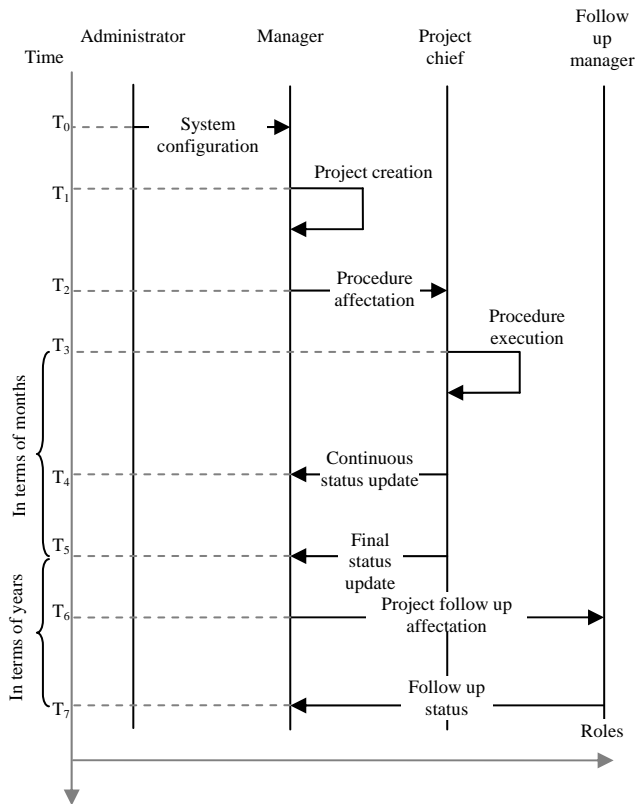


Fig. 7 The framework interactions among the different stakeholders involved in the management of Flex-Flow.

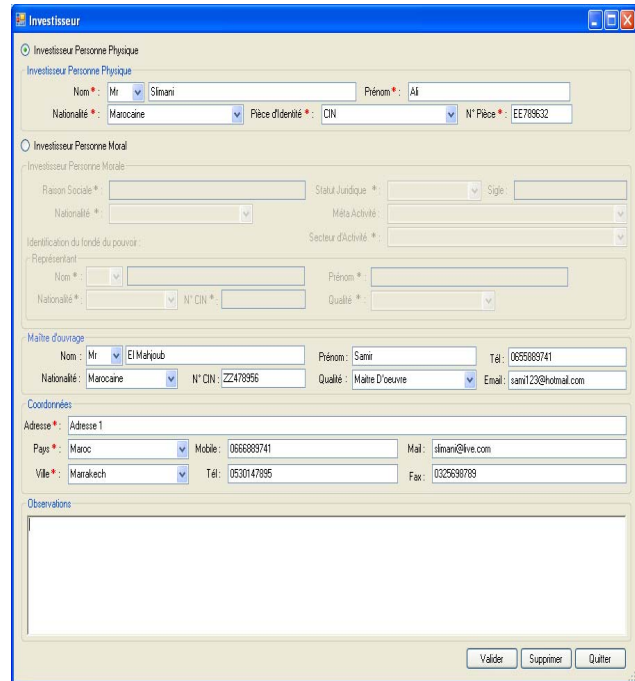


Fig. 8 Sample screen, project creation: creation of an investor object.

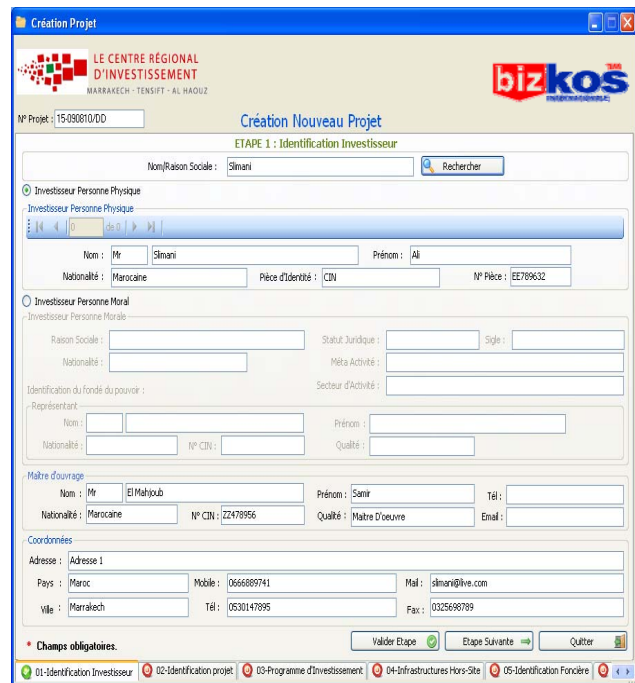


Fig. 9 Sample screen, project creation: identification of the investor.

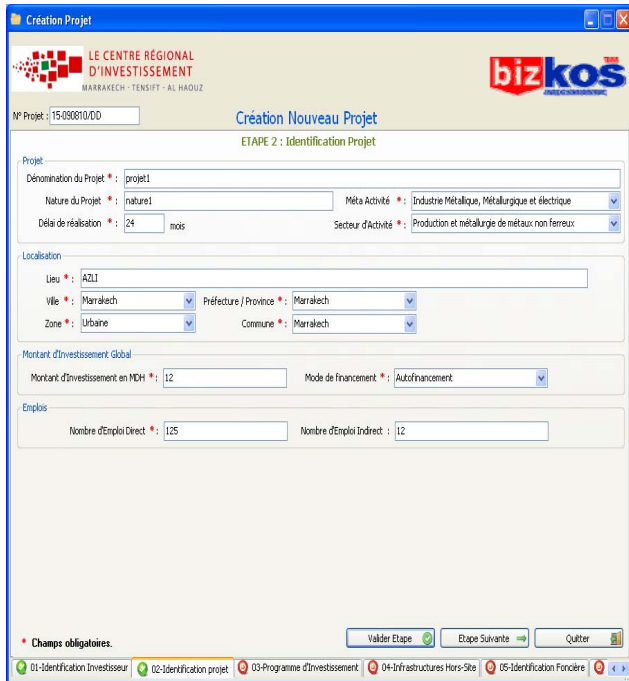


Fig. 10 Sample screen, project creation: filling of project information: identification of project.

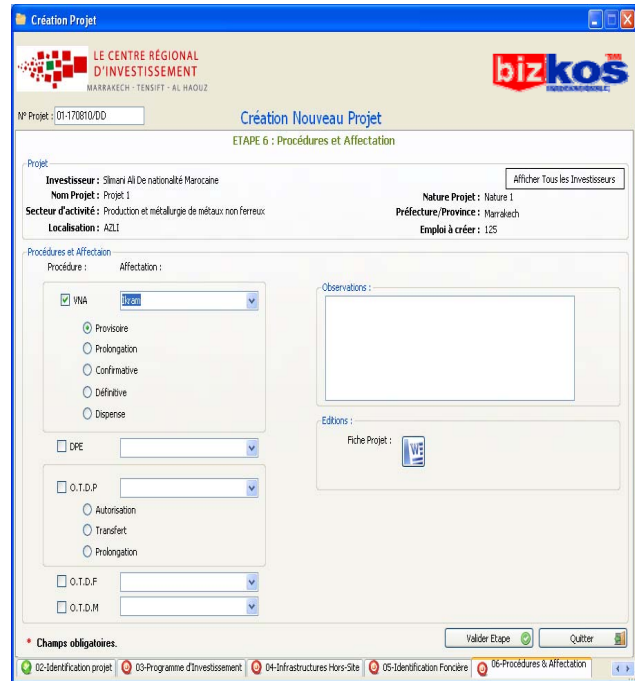


Fig. 12 Sample screen, project creation: assigning the project to AVNA project chief.

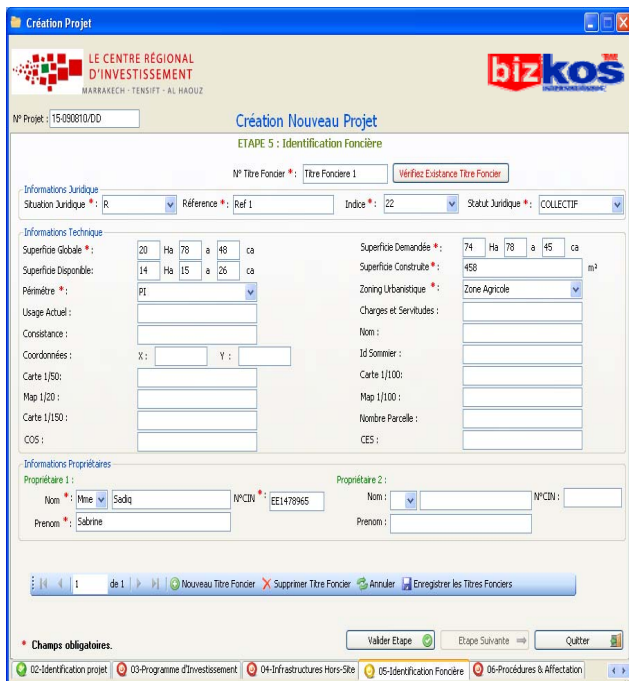


Fig. 11 Sample screen, project creation: filling of project information: identification of land.

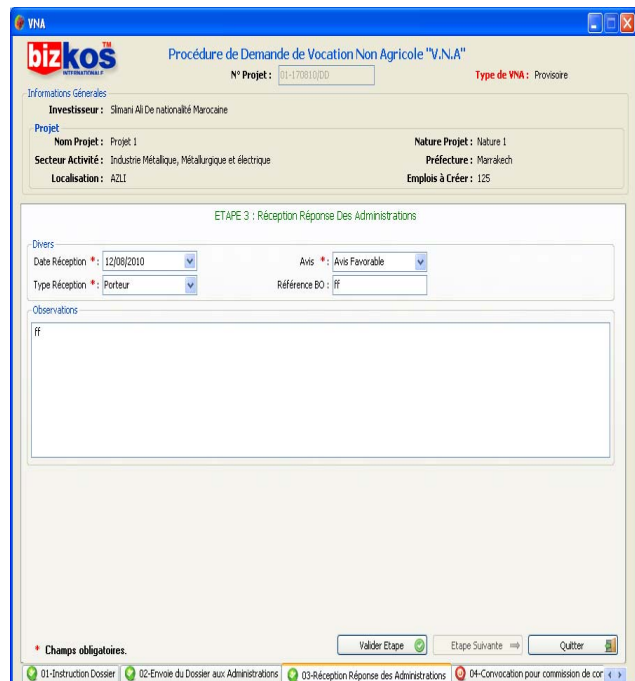


Fig. 13 Sample screen, ANAV procedure: receipt of administration response accepting the ANAV request.

5. Continual business process improvement thanks to Flex-Flow's corporate memory

This section introduces Flex-Flow's CM structures and shows how these important data are used for continuous improvement of business processes. The following three subsections describe in detail each of the tree types of CM. After, we will also show how various CM structures of Flex-Flow, more precisely organizational, use cases and social data, facilitate the continual improvement of business processes at CRI.

In our previous research [10], we divided CM into two types; (1) organizational memory, and (2) work cases memory. The first one provides us general information about how an organization should work (or more precisely, how it is configured to work), while the second one emphasizes how it actually works by giving details about current work cases. Figure 14 shows the stack of Flex-Flow implementation, emphasizing how CM is achieved. This stack emphasizes that the whole system reposes on a support layer (servers and databases filled through time and accessible to clients through a local area network). Once this support is obtained, the core components of Flex-Flow can then be deployed. The core includes Flex-Flow system services which are an integrated set of software modules for managing roles/rights, sessions, project creation, alarms, and procedures.

Recently, we have added a new module that allows to capture informal notes of Flex-Flow users [13]. This IN tool captures informal communications which are a significant component in a work environment. In fact, these social interactions might be a key ingredient for executing formal processes as they serve in addressing unusual situations, solving problems, and coordinating the exception handling. This section explores the extension of a workflow system by introducing a social space for informal communications and shows how these latter enhance traditional CM. In our case, we developed a software module, called Internal Notes (IN), which is Flex-Flow's implementation of a social tool.

The following three subsections describe in detail each of the three types of CM. After, we will also show how the various CM structures of Flex-Flow, more precisely organizational data, use cases data and social data, facilitate the continual improvement of business processes at CRI.

5.1 Organizational corporate memory

This is the type of information provided by workflow systems in general and Flex-Flow in particular [10], before running any instance or work case. In general, it shows

how an organization is configured to work in terms of its mechanisms and policies.

Figure 15 shows the organizational structure of Flex-Flow's CM, showing the relationship between Flex-Flow conceptual entities. From this model, one can see that Flex-Flow allows to trigger many procedures in parallel. One procedure can have many activities, as one activity can be part of many procedures. Furthermore, one role can be responsible of many procedures. Many actors can play the same role, as one actor can play many roles. One role can execute many activities, as one activity can be executed by many roles. The activities within a procedure are executed within certain precedence. An activity can use many data, as one data can be used by many activities. Before the execution of any work case, some key information about the organization at hand, which is the CRI of Marrakech, is available. Notably, one can have access to information about:

- Roles and access right: The provided information concerns the number of roles at hand, and their access right. With Flex-Flow, we have four roles, which are administrator, manager, project chief and follow up manager. The interface available to the three roles, and their respective access rights, are different.
- Procedures: The provided information specifies the number of procedures, the number of activities within each procedure, the deadlines and expected delays related to procedures or activities, the roles that perform a specific procedure.
- Persistence of the system: In fact, it is possible to know the persistence of the workflow system, which is the information preserved by this latter, at the different stages. Specially, all the information stated above, is persistent, as all the information in the database of Flex-Flow.
- Traceability: In fact, the system is intended to give complete information about a user session, as the date of his account creation, the date and time of his logins/logouts and timestamps for the activities executed. The granularity of the system is at the activity and role levels.
- Alarms: It is possible to know if a specific procedure allows the setting of alarms. This further tells us about the administrative deadlines for various activities.

As an example, the screen of figure 12 shows the affectation of a VNA procedure to the project chief Ikram. One can also see the list of procedures and their different types, in the current implementation. Hence, this screen emphasizes the existence of an organizational structure before the run of any work case.

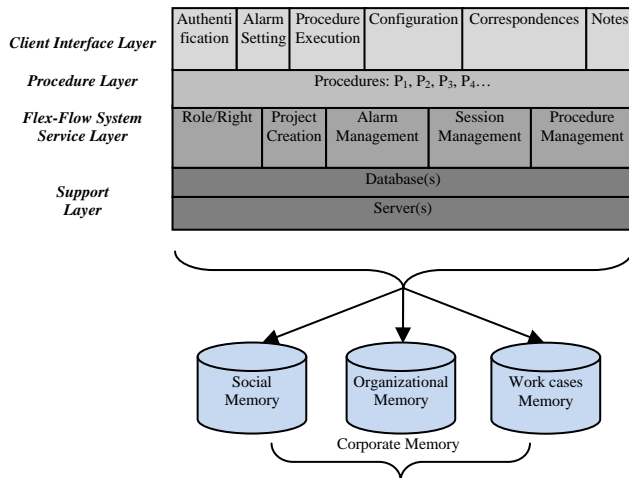


Fig. 14 Stack of Flex-Flow implementation.

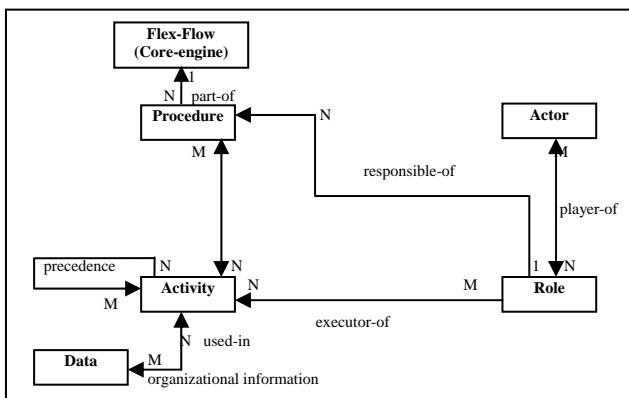


Fig. 15 Entity relationship (ER) diagram for the organizational structure of Flex-Flow's corporate memory.

5.2 Work (use) cases corporate memory

Work cases CM is defined as the collection of information related to instances or use cases that were run, and are currently running, in the system [10].

Figure 16 shows the use cases structure of Flex-Flow's CM.

As an example, figure 17 shows a screen of information related to an investment program, giving details such as investment type, sector classification, investment objectives, etc... Use cases memory is achieved using such kind of information.

Once a new project is created and identified by an ID number, procedures owned by the same investor can be added, as needed. The ID number is a key identifier of the project, and will be needed for all future correspondences between the investor and project chiefs working at the CRI of Marrakech. Through time, we end up with a work cases memory that can be used for monitoring, or decision-making. In fact, one can deduce information about:

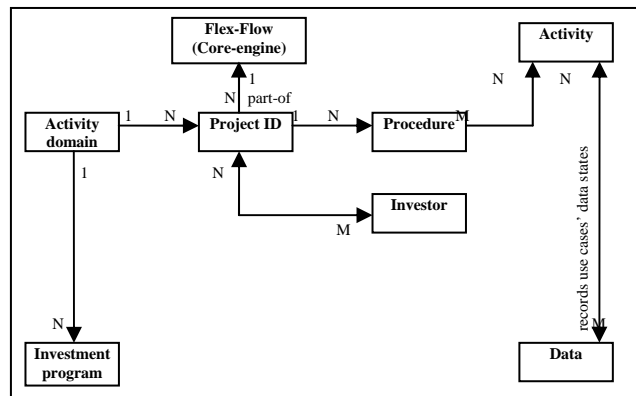


Fig. 16 ER diagram for the use cases structure of Flex-Flow's corporate memory.

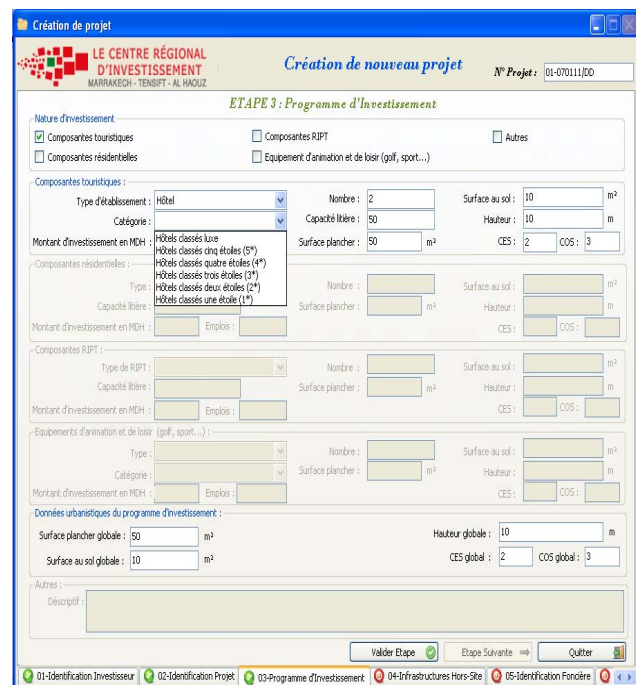


Fig. 17 Sample screen, project creation: information about an investment program.

- Average number of work cases handled by the system or roles, for a given period, time of execution of a work case, etc...
- A specific investor, whether he has already triggered a new project or not.
- The list of specific procedures that have been triggered, e.g for the ANAV procedure.
- The list of procedures triggered by a specific investor, identified by an ID number.
- The list of triggered procedures for a specific activity domain.
- The list of triggered procedures for a specific commune in the region of Marrakech.

- The infrastructure and geographic positioning information about any site in the region of Marrakech.

As a result, use cases structure of CM provides us with historical data regarding what procedure was executed for what investor by what project chief, how long the project execution took, or investment exceptions, etc...; essentially, how the process works in real world.

5.3 Social corporate memory

This section explores our extension of a workflow system by introducing a module for informal communication. In our case, we developed a software module, called IN, which is Flex-Flow's implementation of a social tool [13]. This section will introduce the structure of Flex-Flow's social CM and how a social tool like IN provides the additional information missed by the formal system.

IN is a software module that we have implemented to interface with our current workflow system, Flex-Flow. It is essentially a communication tool which allows all the users of the system, regardless of their roles within an organization, to write up notes to any other user in the system. The notes are intended to mimic "yellow stickers". In fact, our objective is to have internal notes replacing "yellow stickers". IN module is integrated with Flex-Flow so that it is aware of the system organizational and use cases information. Namely, the following information:

- current use case ID: this is the project ID from which IN was invoked.
- roles: these are all the roles that are currently specified in the system.
- procedures: these are procedures specified in the system.

Having access to the above organizational and use cases information, makes IN workflow aware. This "workflow awareness" gives our extended system some new opportunities for sharing contextual information between the core workflow system and the informal communication tool. This information sharing provides a context for IN at start up. It is the equivalent of finding a "sticker note" in a page within a book. The physical location of the sticker note, which is within a chapter, in a given book, is a good contextual information. So, invoking IN notes within Flex-Flow's various interface scenarios provides us with good contextual information such as:

- the role of the author of the note (see "De" field in figure 18).
- the procedure and the activity from which the note was written (see "Pertinent" field in figure 18).
- the project ID which is the use case ID that is concerned by the note (see "Code projet" field in figure 18).

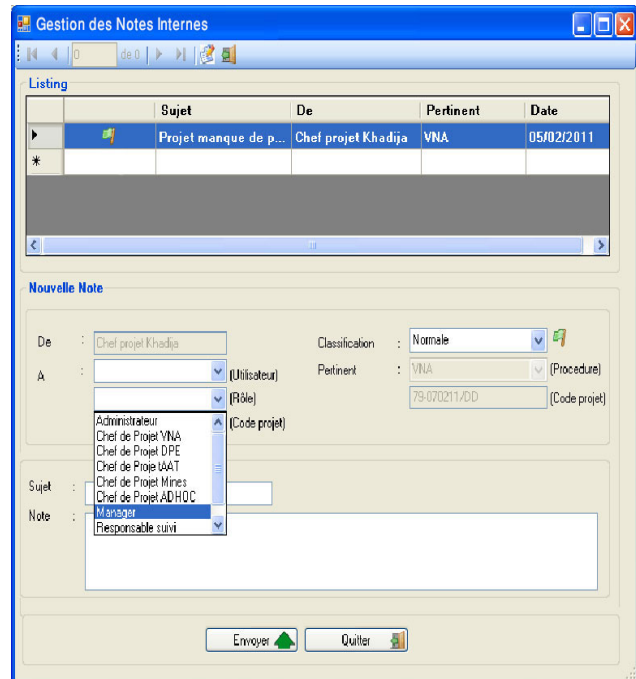


Fig. 18 Sample screen, ANAV procedure: the sending of an internal note.

These above information provide us with the pertinence link between the notes and the rest of the system. As shown in figure 18, the field "De" is automatically filled by the system, and so are the pertinence fields. For example, in this case (see figure 18), it makes that note relevant to the VNA procedure and to a specific project ID.

IN also allows specifying any combination of target users like (see the "A" field in figure 18):

- user: it can be any user in the system.
- role: allows specifying a mini-list of users sharing the same role as the recipients.
- project ID: this allows attaching a note to a specific project ID, regardless of the users or roles involved.

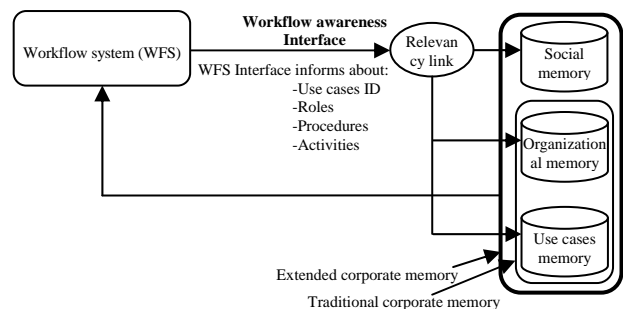


Fig. 19 Flex-Flow corporate memory extension.

In summary, the workflow system allows the IN tool to dynamically pull organizational and use cases information, to create a pertinence link between some informal communications and the rest of the workflow information.

Figure 19 provides a summary of the above information flow.

Once a note is written, a note ID is created. This note ID is determined to be relevant to the project ID and procedure ID as shown in figure 18. This essentially makes the note ID relevant to all Flex-Flow user interface instances that pull that project ID, as shown in figure 20.

Code projet	Nom projet	MetaActivite Projet	GNI	GPA
22-301210/DD	souk de tamesloht	Services		
05-241210/DD	station de service et sol..	Services		
10-291210/DD	escale porte de la vallée	Tourisme		

(a): Sample screen, ANAV procedure: project list interface scenario.

Procédure d'Attestation de Vocation Non Agricole "A.V.N.A"

N° du projet: 001-01071100

Investisseur: Nabil Kamal

Nom du projet: Marrakech Garden Restaurant

Nature du projet: Hôtel

Secteur d'activité: Tourisme

Localisation: Marrakech

Statut juridique: SARL

ETAPE 1 : Recevabilité du dossier

Référence	Statut	Sup globale	Sup demandée	Zoning	Propriétaire
118205	PRIVE	1Ha 1a 1Ca	1Ha 1a 1Ca	S2	

(b): Sample screen, ANAV procedure: procedure execution interface scenario.

Fig. 20 Relation between workflow system and social workflow-aware tool.

In both interface scenarios (figure 20.a, b), the visual indicator, when darkened, informs the user that there is a relevant note to the current use case (project). The user can then click on the visual indicator (icon), to read the note and contribute to it if necessary. Hence, our new module allows us to selectively integrate relevant informal communication to the formal workflow system which is Flex-Flow.

Social memory structure in Flex-Flow is a collection of information that is detected, collected, distilled, and

rendered pertinent to the processes defined by the Flex-Flow system. This information is collected from a variety of so called "social tools".

The workflow awareness provides our extended system with the ability to capture structured and distilled informal communication and making it part of the enterprise CM. Without the relevancy link, this social memory could have been lost (see figure 21).

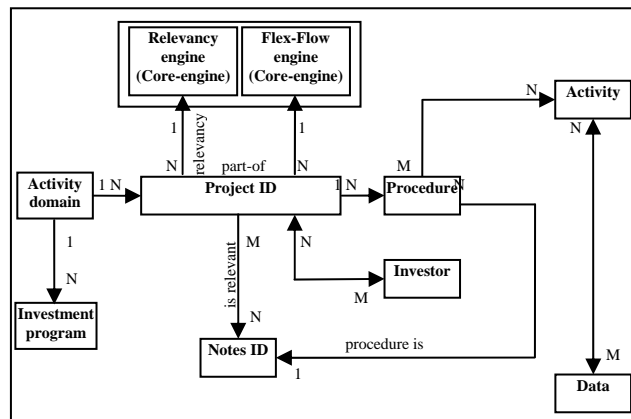


Fig. 21 ER diagram for the social structure of Flex-Flow's corporate memory.

The extended data structure contains information relevant to the project, but has no place holder in the formal structure or model. This data is important because it has discussion forums and potential resolutions for exceptions throughout the process and generally useful information on how to handle special circumstances.

5.4 How corporate memory structures contribute to process improvement at CRI

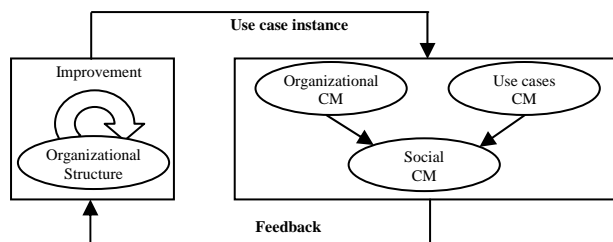


Fig. 22 Framework for process improvement at CRI.

The previous sections showed the three types of CM structures. They provided in some detail, the nature of the data for each type. This section provides some examples of how the three CM structures are used for improving continuously the processes. While the different types of CM structures contribute differently to process improvement, we have come to notice that they are all linked by common framework for the process improvement. Figure 22 shows the framework for process improvement. In fact, it emphasizes how a use case

instance becomes a component of organizational and use cases CM, as it references organizational structure parameters such as roles, rules, procedures, deadlines, etc... It also gives us a picture of how the same use case was actually executed in the real world such as project ID, the name of investor, his country of origin, the type of investment, business classification, timings, etc., and this provides us with data regarding exceptions that come up. This combined data in turn becomes the basis for social CM, which provides us a forum for exception handling and problem resolutions through informal communication. And this constitutes a rich feedback for process improvement.

The following subsections provide some examples of how the framework of figure 22 is carried out.

5.4.1 Reconfiguration of delays

The investor, when engaged in a project and to maintain the various incentives that the state provides, must respect some specific deadlines with regard to project execution. Sometimes, the investor encounters some extraordinary circumstances which block the execution of the investment project. For example, sometimes, there are strikes in some public institutions, which present a hurdle for the investor to meet a specific deadline. Sometimes, certain public institutions simply do not respond in time for some reason or other. While the use cases CM structure provides good data to identify exceptions, the social CM structure provides the forum to discuss those exceptions and potential remedies. These formal communications have a direct relevancy link to project IDs, investor, procedure, etc...Also, management has access to the same forums and contributes to it like all users. And when an exception type persists, the management of the CRI has the ability to reconfigure this aspect of the organization structure and modify the deadlines between certain activities (steps) to make the process closer to the real world experience and does improving the process for both project chiefs and customers (investors).

5.4.2 Improving workload

When Flex-Flow was initially deployed at the CRI, the manager was entrusted with the execution of the creation project procedure (6 steps), for all procedures. This procedure insures that management validates the key objectives of the investment; which will set the stage for all future administrative procedures undertaken by the investor. While this procedure consolidates the whole process and makes it more efficient for future administrative procedures, it burdens the manager with a lot of works and as a result, the historical use cases clearly showed a slow down of procedure execution at the

managers level. As a result, it was decided to reconfigure the organizational structure and create the new role of under manager. This new role expanded the right of project chiefs to undertake the task of project creation in their area of expertise, thus distributing the workload cross the various project chiefs and taking advantage of their expertise to expedite the process. It is the feedback from historical use cases and organizational structure that highlighted the need for this reconfiguration and guided the process designers through this improvement.

5.4.3 Handling of required fields and related issues

The management has initially requested that the "*" fields must be provided by project chiefs in any given procedure. To give an idea about the impact of this requirement, we recall from our previous contributions [7, 8, 10] that the CRI handles about 10 procedures, currently. Each procedure has between 3 and 20 activities (see table 2), and each procedure must be preceded by the project creation procedure which involves 6 activities. If we assume that each activity has an average of 10 fields, and also that 50% of the fields are required, one can imagine the impact of such a requirement. Hence, we have seen many internal notes complaining that users of the system don't have the needed information to complete this procedure. The management of the institution reacted swiftly and asked the consulting company to provide the mean for handling these exceptions.

The consulting company introduced a solution that allows the user to input "0" for numerical required fields and "*" for character required fields. The system will then interpret the data for these required fields as not currently available. As a result, the user should be allowed to carry on the procedures and generated documents that are currently over 60, will show "ND" for not available data.

This relation helped all the parties to embrace the new system. Project chiefs now execute the use cases. In fact, in a 6 months period, they have entered over 700 projects in the system, and have great appreciation of the system as it helps them automate various tasks.

Six months later, management started exercising a new module called "statistics". The workflow provider and the management encountered various exceptions as the output of the statistics sometimes provides erroneous data. When the consulting company investigated the issue, it was found that some of the required fields are really necessary to obtain accurate statistical data. Those fields, whose number is about 14, were then identified with double stars "**" in the user interface. This modification has triggered many paper IN notes from project chiefs, such as:

- how can I estimate the investment amount for a specific project?
- what is the investment origin? In fact, sometimes, an investor can have a passport X from country Y and he

resides in country Z. And it is more complicated for a group of investors.

- what is the projected number of jobs?
 - what is the classification type of the project? Sometimes, the project activities are in various fields and do not follow the norms of business classification as defined by the chamber of commerce, which are the basis of the current system configuration.

The management quickly responded to this concern by replying to these notes and helping users by providing them with guidelines information to estimate some unavailable data.

The internal notes clearly showed that users did not have enough training to make the proper estimates and identified the source of confusion.

5.4.4 Dynamic procedures and documents

One of the issues faced by the CRI is that the first step (admissibility of a case file) for certain procedures is changing through time due to the government updates. To handle this problem, the consulting company made this step dynamic by providing project chiefs with means allowing them to handle correctly this step and choose the required documents.

This was also the case for generated documents which are, for most cases, in standard format. However, project chiefs have encountered exceptions as they needed to modify generated documents. Management responded to this concern by relaxing the rules, providing project chiefs with the ability to generate documents for special circumstances and this required the reconfiguration of the system. To have an idea about the necessity of such a decision, one can see in table 2 that each procedure at CRI generates between 4 up to 19 administrative documents.

Table 2: Procedures implemented in Flex-Flow.

<i>Procedures</i>	<i>Number of steps</i>	<i>Number of administrative documents to generate</i>
DPE	23	8
AVNA	10	10
OTDPX :		
-OTDPR	7	19
-OTDM	8	2
-OTDF	17	5
ADHOC	3	8
AAT	7	18
CONVENTION	19	16
ÉNERGIE ET MINES	7	4

Hence, the CM obtained by capturing informal communications has helped improving the process at CRI.

6. Conclusions

This paper was concerned with the investigation about the relation between workflow systems and business process reengineering and improvement. In fact, the workflow systems provided us with the formal methodology for reengineering the process at the CRI, by repackaging the government services provided to investors. However, to achieve continuous process improvement, the paper emphasized that there was a need to couple workflow systems with an expanded CM system that includes social tools to capture informal communication and data. These tools provide us with a good forum for exceptions handling and problem resolutions, which in turn provides us with a rich feedback for process improvement.

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