Capitalization of enterprise's business in e-learning context

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***Abstract*—Business processes are widely used at the point where the enterprise can be seen as a multitude of business processes each one relative to a given service; these business processes hold business and production aspect but also another aspect oriented knowledge and skills related to the way in which the work is done. Thus, this paper wants a proposed capitalization of knowledge and know-how contained in business processes for the construction of an e-learning capital. For this, we consider a process in H which summarizes and gives an illustrative overview of our work; it presents the design, modeling and implementation of business processes and learning processes, introduces a knowledge-based analyses method at the meta-level followed by a technical approach taking into account the standards and design's phases of both processes. Then, we present a technical implementation of our approach followed by a case study and we finish with summary and future work.**

***Index Terms*—Business processes, business entities, cognitive entities, learning process.**

I. INTRODUCTION

Business processes (BPs) are widely used in various services (e.g. front office, back office) and levels of the enterprise's pyramidal hierarchy (e.g. industrial BP, BP control). BPs are widely used at the point where the enterprise may even be defined as a multitude of BPs [1]. These BPs, specifying how the work is done within the enterprise [2], have the advantage of being not only the container of business entities (BEs) (e.g. activities, employees, resources) but also of cognitive entities inherent in producing of the business services expected. These cognitive entities correspond to theories of production, principles, business rules and experiences expressed and translated into practical ways to get the job done within the enterprise for better results under a good conditions. BPs contain the set of knowledge and know-how; the knowledge (i.e. who, what, when, why) describe the capacity of BPs to the definition of BEs for a certain business service (i.e. which are the employees to be chosen, the resources to be made available, activities to be performed, conditions and business rules to be used); know-how or know-produce (i.e. how these BEs are implemented) characterizes the capacity of action, monitoring and fault management (e.g. exceptions, errors, discontinued activities). These skills and knowledge are expressed in: (1) the business activities which shows how work is accomplished with which type of employees and resources; (2) the employees who hold experience accumulated over the years; (3) the conditions and business rules that are a vital resource in decision-making and exception handling; and finally (4) the flow control showing how all these BEs are being implemented.

We explore and analyze the BPs not for a business purposes but rather for training purposes, i.e., capitalize the knowledge and know-how to build a capital e-learning. We therefore propose the design of the learning process (LP) e-learning for training and updating continuously the knowledge and skills of employees on the enterprise's business in order to increase their productivity and enable faster and less expensive integration in the production chain. Experienced or qualified employees are invited to assume the role of trainer for non-experienced, which is seen as a way of sharing knowledge and experiences among employees (i.e. non-experts and experts). This allows to deal with problems of loss of knowledge and experience due to qualified employees' departures (e.g. retirement, dismissal, resignation, death).

II. RELATED WORK

In a knowledge management, the BPs have been the subject of several studies that is in a general or specific way. In a general way means that BPs are considered among the enterprise's knowledge resources for which several methods are developed (e.g. REX Merex, MASK, QOC, KADS) [3]. In specific way, we find the work of [4] and [5]. Reference [5] was interested in building cartography's knowledge using a mapping method guided by the strategy. Reference [4], as for him, presents an analysis process identifying sensitive BPs using a set of criteria (e.g. time, cost, quality), to distinguish the determining problem (i.e. identify critical activities, identify constraints, the malfunctioning and issues) and focus the critical knowledge (i.e., to answer the questions: who uses what knowledge in which phase of the process' cycle).

Unlike these methods which are interested in building knowledge's archived capital, we propose a process of branches in H to create a learning capital (i.e. LP). This process of branches (1) presents the different standards and phases of design and implementation of both processes (i.e., BP and LP) in two distinct branches, (2) introduced the method of analysis and study at the meta-level in a dedicated branch and (3) exposes in another branch a technical approach for creating LP from BPs at the implementation level, i.e., considering standards and phases of design and implementation of both processes.

III. PROCESS IN H

For the creation of LPs from the business enterprise, i.e. its BPs, we propose to follow a process in H. This one consists of two vertical branches and two horizontal branches giving a form resembling the character H (cf. Fig. 1). The first vertical branch, dedicated to BP, has two

stages: the first stage discusses the need of a consensus for BP's definition; the second stage describes the phases and standards of design and implementation of BPs. The second vertical branch is for the LP, defines it via a metamodel which describing its learning entities (LEs) in a first stage and describing its phases of design and implementation in a second stage. The first horizontal branch, occurring at the metamodel level of the both processes (i.e. BP and LP), expose a method for designing LEs from BEs independently of the languages and phases of design and implementation of the two processes. The second horizontal branch presents a technical approach, which is a technical description of the method taking into account the languages and phases of design and implementation of both processes.

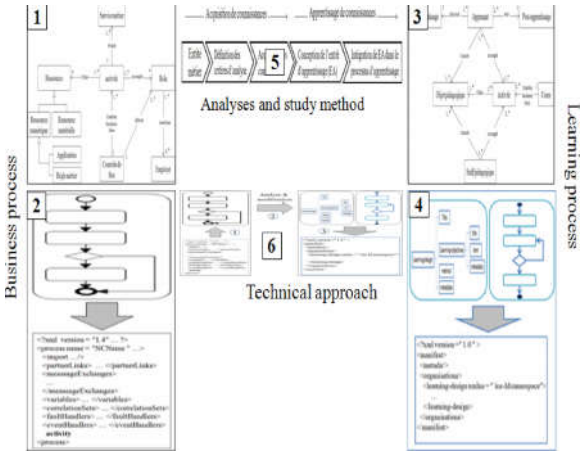

Figure 2. Process in

In the following, we present a definition of BPs followed by a discussion of their design and implementation; then we introduce a definition of LPs followed by discussion of their design and implementation; and then we describe the knowledge-based analyses method; afterwards, we present the technical approach of creation of LPs from the BPs.

A. BP's Definition

In the literature, there are several definitions for the BPs, each one approaches them according to the technology (e.g. workflow, web service), the context used (e.g. industrial, administrative) or the level of abstraction (e.g. conceptual or implementation level). The BP is defined as a structured and measured set of activities designed to achieve a product for the market or to a particular customer [2]. A BP is a well-understood interplay of activities that targets a certain business objective [6]. It consists of activities, conditions of start / end of activities and transition between activities, human participants and data used in the work [7]. A BP is identified in terms of beginning and end, interfaces, and the unity of the organization involved [8]. It is an orchestration of partners (i.e. web services) with the definition of variables and handlers of faults and events [9].

Thus, there is no consensus on the BPs' definition where the need for a common BPs' definition. In this paper, we consider the following definition, a BP is a connection series and / or parallel of activities performed automatically or by business roles, ensured by employees, using physical resources (e.g., industrial machinery) and / or digital (e.g. software applications), and using flow control to produce a business service (cf. Fig. 2).

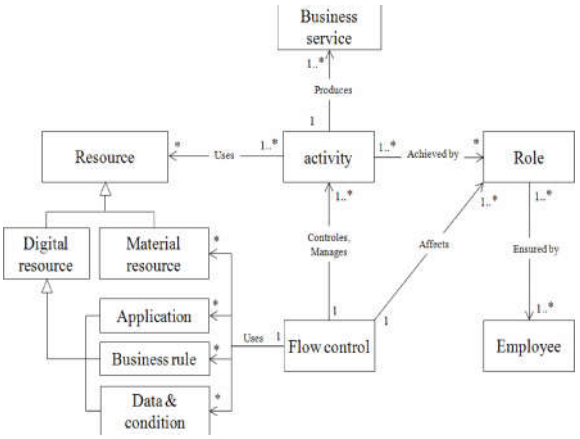

Figure 1. Conceptual model of BP

The BP is an aggregation of business service and flow control that ensure the fulfillment of BEs. The BP is composed of a multitude of activities, physical and digital resources, roles and employees. These one are not considered as a resource in the sense that they play an important role (i.e. learner, trainer) in the LP. We present now the different BEs:

Business service**:** the service is produced at the end of the execution of BP; it may be a service (e.g. a loan agreement of credit) or a tangible product (e.g. delivery of an order).

Business activity**:** the business service is the expected result of the sum of several sub-services; each one is carried out in one activity and this activity describes how this sub-service is produced.

Business role**:** the role specifies and determines the qualifications, competences and knowledge inherent in the execution of business activities assigned to this role.

Employee: is the person responsible for carrying out the roles which are assigned to him according to its qualifications and skills. There are two types of employees: experienced and non-experienced.

Material and digital resources**:** business resources mean the physical facilities and tangible materials (e.g. manufacturing machine in industry BP). The digital resources correspond to computer applications, data & conditions and business rules (e.g. if the salary of lendable does not exceed a certain threshold then not to grant the loan to him).

Flow control**:** for a smooth execution of the BP to produce the expected business service, handle errors that may occur, and consider activities for compensation in case of deserted activities, flow control is founded. This one defines the flow of activities (sequential, parallel, conditional and repetitive), the conditions for the start / end of activities, the conditions of transitions between activities.

B. Design And Implementation Of The BP

The BP is usually performed through three stages: design and definition, implementation and execution and finally analysis and improvement [10]. During which the BP is designed and modeled in a first phase, and then

transcribed and mapped, in a second phase, to a notation derived from XML and executable by a computer application (cf. Fig. 3). Le BP definition can be seen as the static description of BP, whereas the execution of a BP is coined a BP instance [6].

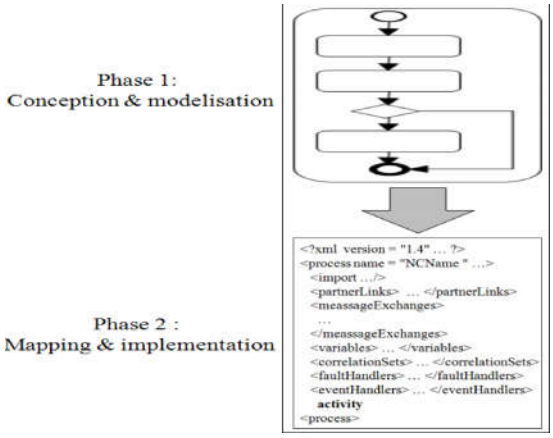

Figure 4. Design and implementation of BP

The first phase, design and modeling, allows the definition and modeling of different BEs that will contain a BP through graphical models. Many standards are used; each one is dedicated to model business aspect of BP, such as Business Motivation Model (BMM) provides a scheme for the development, communication and management of business plans in an organized manner, etc. [11]. The standard used for analysis and design is the language BPMN [12] which is adopted by the OMG and is a graphical notation developed from a plethora of specifications; it provides a Business Process Diagram (BPD) to define graphical models describing the BPs.

The second phase (i.e. transcription and mapping) represents and transcribes the various BP's graphical models in a language executable by the machine; different BEs are written in this language with more implementation details. The most widely used standards are BPEL and XPDL [9]-[13]. XPDL is widely used because of its history, it defines a metamodel and a rich vocabulary of semantic concepts to describe the BEs of a BP; this one is described in an XML file that serves as an interchange format and can store information related to the BPMN. The second derived from XML is the standard used for executable BPs, it is based on the orchestration of web services, the BP is a web service consists of an orchestration of partners, each one is run separately to provide a service to BP.

C. LP's Definition

We define an LP as a course in series and / or parallel learning activities (e.g. reading activity) performed by learners with prior knowledge (prerequisites), and / or trainer while referring to a set of learning objects to achieve a given learning (cf. Fig. 4).

The LP is centered on the community of learners and trainers for which it defines and makes available all appropriate EAs. These EAs are presented now.

Prerequisites**:** This element describes the minimum knowledge required of learners in preliminary before taking part to the LP to ensure a minimum of understanding.

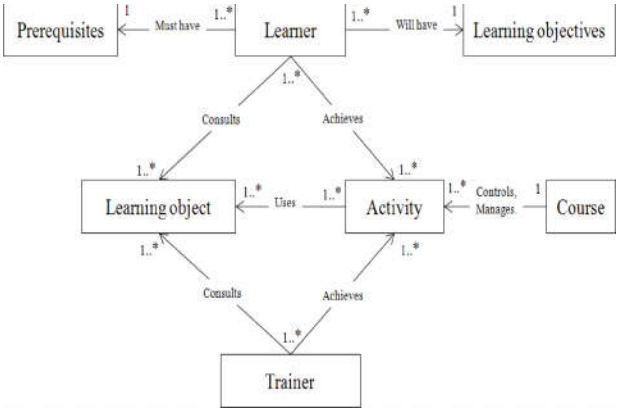

Figure 3. Conceptual model of LP

Learning objective**:** to match the whole of knowledge and skills which must have learners had participated in the LP. This plays an important role in defining the different EAs to be involved.

Learning activity**:** they constitute the essential element of LPs; the activities describe the tasks to be accomplished by learners and / or trainers to achieve the learning objectives. We distinguished the activities performed only by learners (e.g. writing a report), or by trainers (e.g. mentoring) or by the two communities (e.g. debate).

Learner**:** it represents the core of the LP for which learning activities are defined and resources are being provided.

Trainer**:** The trainer provides a function of support and assistance for learners to complete their learning activities and achieve their learning objective.

Learning object**:** indicates the referenced physical and digital resources, physical resources are the means and materials (e.g. paper, computer) used. Digital resources correspond to computer applications and digital media accessed and used during the course of the LP [14].

Course**:** it represents the dynamic aspect of the LP. To achieve the goal of learning, the course will determine the order (i.e. sequential, conditional, repetitive parallel) of learning activities, the learners and trainers involved and the resources to use for each activity.

D. Design And Modeling Of The LP

Learning design is the use of pedagogical models to specify the learning objectives, the community and the targeted area of knowledge. A pedagogical model, as for him, is a set of rules specifying how learners effectively reach a set of educational objectives in a given area of knowledge (e.g. problem-based learning) [15].

Compared to the other specifications, AICC, SCORM, Dublin Core, the IMS specifications allow the designing of most learning's aspects (e.g. learner profile, Metadata, Content Packaging, Binding) [16]. Thus, for the design and implementation of LP, we refer to the concept of learning unit (LU) for which a specification is developed (i.e. IMS-LD). A learning unit is defined as a scenario where a set of learning activities performed in series and / or in parallel by learners or trainers, it defines the learning objectives, prerequisites and environments consisting of a collection of learning objects and services [17].

The Educational Modeling Language (EML) [18], developed by Rob Koper, has been the subject of work and review, it was adopted under name IMS Learning Design (IMS-LD) by Learning Design Working Group of IMS Global Learning Consortium after several iterations of development and analysis. IMS-LD is considered a layer integrating several specifications, IMS Content Package, IMS Simple Sequencing, IMS / LOM Meta-Data, etc. It provides a metamodel and a wide vocabulary of simple semantic concepts for the design of pedagogical models supporting different pedagogical approaches [17]-[15]-[19].

With IMS-LD, a LU is designed and modeled in two stages, the first is dedicated to the design and modeling of different elements of LU and the second specifies it in an executable and portable specification by learning management systems (cf. Fig. 5) [20].

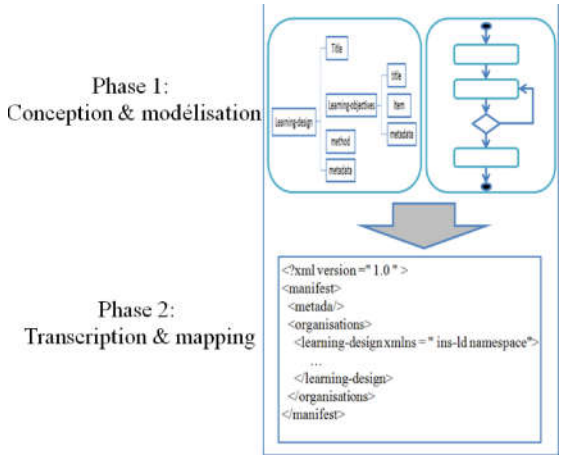

Figure 5. Design and implementation of LU

The first phase uses graphical models to model the LUs, the standard IMS-LD defines two graphical models developed from a UML profile, the conceptual model and information model. The first uses three models: the aggregation model that describes how the components and elements are designed, the structure model specifies the organization of elements and relations of compositions, and the last model describes the encapsulation of LU in an XML file via the IMS Content Package (IMS-CP). The information model describes the components, properties and relationships of elements defined in LU.

Once the various elements of the LU are defined, designed and modeled, their information models are transcribed and represented by a set of XML elements according to IMS-LD XML Schema [21], which will take place in the second phase. LU is incorporated into IMS-CP package, called Package Interchange File. This is a compressed folder (e.g. ". Zip") containing two elements: the first is an XML manifest whose name is imsmanifest.xml, possibly with his control document (e.g. DTD, XSD); the second element corresponds to the physical files referenced in the manifest file (e.g., media file, text file, web page, etc). The manifest file contains four elements: *Metadata* describing the compete manifest file; *Organizations* that contains the item "learning-design", containing the LU; *Resources* containing references to all resources used in the LU and finally *Submanifest* to contain a sub-LU [22].

E. Knowledge-Based Analyses Method

The BP is a container for BEs as well as entities cognitive inherent and necessary to the production of business services expected. Thus, if we analyze, study and exploration based on knowledge on these BEs, intended for production, we can obtain LEs forming the LP intended for training.

A BE in a business context, is related to performance (i.e. services) that realizes, it is seen in terms of inputs it uses and outputs it produce to customers. However, LE is related to learning, education and training, she is seen in terms of knowledge, skill and information it provides to learner on a given field. Thus, for the design of LEs from BEs, we propose to subject the BEs to a series of phases of knowledge acquisition and knowledge learning (cf. Fig. 6).

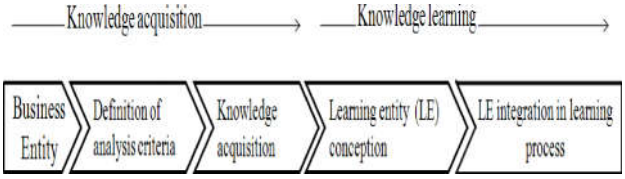

Figure 6. knowledge-based analyses method

Firstly, we define a set of criteria and indices for analysis and study that are appropriate to BE's type and that identify, locate and recognize the skills and knowledge contained in this BE. These criteria and indicators are to extract business knowledge and information. Thus, it should be noted that we must first define the knowledge being sought before defining these criteria.

Information and knowledge being sought from the BEs are those used to train less qualified employees. In learning environments, information has to be perceived and processed into knowledge [16]. Trivially this information and knowledge are many and varied, the table TABLE I presents them.

TABLE I.
TYPES OF KNOWLEDGE

Knowledge type	Quantity
Know which	Name of the BE.
Know what	Type of BE, e.g., type of activity (e.g. activity of calculates, delivery, etc.), type of employee (e.g. worker, technician, etc.), types of physical and digital resources used.
Know why	What makes or produces the BE.
Know how	How the BE makes its result, its execution time, conditions of triggers / end of the BE execution.
Know manage	In case of abnormality (e.g. error, unavailability of resources, deserted execution), how BE is managed and compensated.

Secondly, once all of these information and knowledge being sought from the BEs are determined, the next phase consists to consider them as targets, indices, guides and drivers of analysis and acquisition of knowledge and information by harnessing and the documents describing and specifying the BPs. Business experts are also involved in this phase to provide further information and details about the BEs;

Thirdly, after acquiring and collecting knowledge describing the LE, this one will be designed, modeled and represented through models accompanied by textual descriptions.

Finally, at this stage, the LE is being used and integrated into the LP.

The table TABLE II tries to explain the LEs that can be obtained from the BEs according to their type of knowledge.

TABLE II.
BP VERSUS LP

LP	BP	Comments
Prerequisites	Role	From the role entity, we can obtain the qualifications to be fulfilled by the employees of this role, in other words, it is used to describe the prerequisites of learners attending the LP.
Learning objective	Business service	The business service entity will be used to describe the service must be able to produce LP learners, i.e., the learning objective.
Learning activity	Business activity	Business activity may be a learning activity where the work ahead in business activity can be used to extract information and knowledge, as is always the case.
Learner / trainer	Employee	Experienced employees can involve in the LP's creation and LP's progress by playing the role of trainer for the less qualified or new recruits who plays the role of learner.
Learning object	Material and digital resource	The business resources can be referenced in the LP in order to allow learners to practice on real cases. Business rules are an essential resource in decisions making.
Courses	Flow control	Flow control participates largely in the course design (e.g. chaining learning activities associated with business activities, employees of business activities will be learners or trainer for learning activities, etc.).

F. *Technical Approach*

For the design of LPs, we are interested in BPs executables that are already operational rather than BPs described with graphical models. This for two reasons: (1) the first are already productive, their knowledge are already being tested, while the second are not yet validated, they are less reassuring and which we do not yet know the results once inserted in the production chain. (2) The standards for the implementation phase, provide a detailed and exhaustive description, i.e., containing all entities and information necessary for the execution of BPs, they are more descriptive than the graphical models.

The LP and the BP are first designed and modeled by graphical models and then transcribed and mapped to a description derived from XML. Thus, the proposed technical approach consists of 3 steps. In the first, the executable BPs described in an executable notation are subjected to the method of analysis and study based knowledge presented previously, and then they are remapped and translated to BPMN notation which was developed from several specifications of which UML. The business graphical models obtained (i.e. BPMN models) are then transformed and represented to pedagogical graphical models through the IMS-LD diagrams of UML, which will take place in the second step. So these pedagogical models are mapped and transcribed in the third step to the XML format of IMS-LD (cf. Fig. 7).

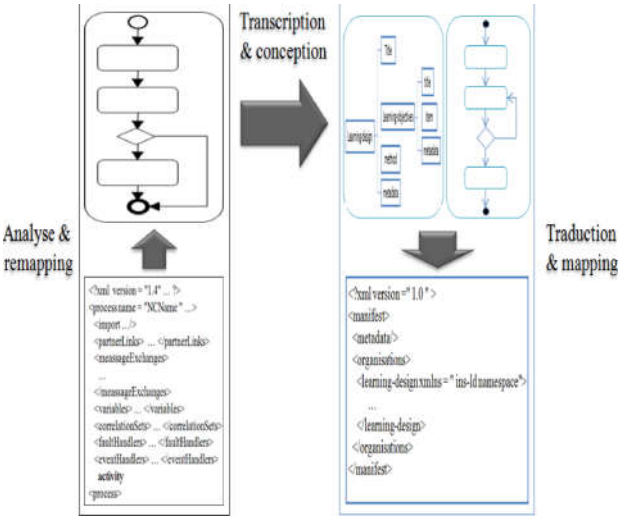

Figure 7. Technical approach's phases

This technical approach imposes a process of steps to identify and recognize what can be used for learning from what does not. Thus, each BE undergoes 3 steps:

Firstly, the executable BE is subjected to a knowledge-oriented study, then it is described through a graphical BPMN model accompanied with a textual description through a natural language describing the details of this entity. Secondly, BPMN models obtained are presented in pedagogical and graphical models of IMS-LD (i.e., class diagrams and activity diagram of UML). Thirdly, these pedagogical and graphical models are mapped to XML elements of IMS-LD; the LE will have like description the textual description obtained in step 1.

IV. TECHNICAL IMPLEMENTATION

For the implementation of our technical approach, we chose for the design and modeling phase of BPs, the BPMN which is a standard used for analysis and modeling purposes. BPEL is also chosen for the implementation phase for two reasons: (1) the fact that is standard, it is based on the orchestration of web services increasingly used, (2) the fact that BPEL based on web services that are now provided with ontologies describing and specifying them. Ontology Web Language-Semantic (OWL-S) is a standard ontology, consisting of three sub-classes: *Service Profile* class describes what the service performs, *Service Model* class describes how the web service works, and *Service Grounding* class describes how to invoke the Web service [23].

In this context, we developed a tool (LearningBP) to assist in the creation from the operational BPs (i.e. BPEL BP), of e-learning LPs formatted according to IMS-LD. The tool offers a wizard of several screens to gather more business information about BPs and its various entities. It should be noted that the current version of our tool that takes as input BPEL documents and does not consider the OWL-S ontologies describing the web service, these ontologies require whole work to get what we expected for the future.

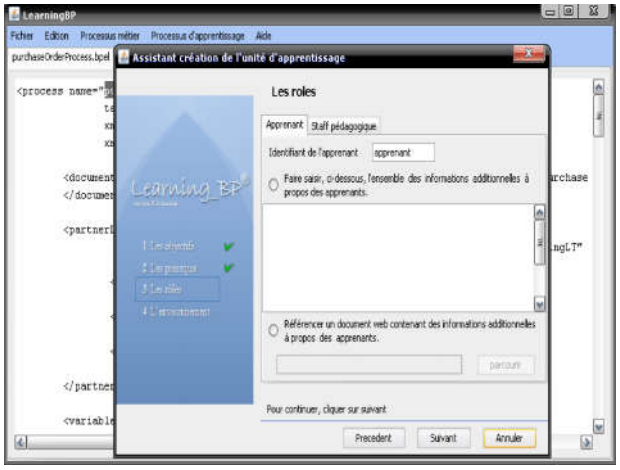

Figure 8. LearningBP

V. PRESENTATION OF USE CASE

We will be interested in BP of an enterprise operating in the telephony field. The BP relates to the installation of telephone antennas; it comprises three complex phases: identification and location of sites, installation of telephone antennas and finally implementation and monitoring. In this case study, we are compelled to part of the BP, namely the identification of sites that could be used for installation. This part of the BP has a set of business activities performed by an employees consists of radio engineers. They work both individually and collectively.

The transformation of BP into LP remains of paramount importance in the training of engineer's radios, newly recruited on the enterprise' business; it allows them to make a gradual introduction to the enterprise's practices.

Phase 1 (remapping BPEL / BPMN): in this phase, we considered only BPEL's documents describing BP and the ontology documents describing Web services are not considered. TABLE III provided BPEL's code of BP.

TABLE III.
BPEL'S CODE OF BP

```
<process     name=" antennasInstallationProcess "
                targetNamespace="
http://example.com/antennasInstallation "
                xmlns:lns="
http://www.operateur.org/Installation/purchase ">
   <documentation xml:lang="EN"> the installation process of the
telephone antennas is for cover the new zone or area.
   </documentation>
   <partnerLinks>
      <partnerLink name="Chef" partnerLinkType="lns:ChefLT"
              myRole="SA2Requester"  partnerRole="SA2Service" />
      …
      <partnerLink name="Installation"
partnerLinkType="lns:InstallationLT"
                        myRole="InstallationService"/>
   </partnerLinks>
   <variables>
      <variable name="EIR"       messageType="lns:EIRMessage" />
      …
   </variables>
   <faultHandlers>
      <catch faultName="lns:cannotCompleteInstallation"
faultVariable="EIRFault"
              faultMessageType="lns:EIRFaultType">
         <reply partnerLink=" Installation "  portType="lns:EIRPT"
            operation="sendEIR" variable="EIRFault"
faultName="cannotCompleteInstallation" />
      </catch>
   </faultHandlers>
   <sequence>
      <receive partnerLink="Installation"  portType="lns:EIRPT"
           operation="sendEIR" variable="EIR"
createInstance="yes">
      <repeatUntil>
         <invoke partnerLink="RadioIngineers"
portType="lns:RadioActivitiesPT"
                  operation="EtudierA1"
inputVariable="EIR" />
         …
         <condition condition
expressionLanguage="URI">SA2Realisation<condition>
      </repeatUntil>
    <REPLY PARTNERLINK="INSTALLATION"
PORTTYPE="LNS:EIRPT"     OPERATION="SENDEIR"
VARIABLE="SA2"/>  </SEQUENCE></PROCESS>
```

After conducting a knowledge-oriented analysis and study for each BP's activity, we made a remapping to the BPMN notations, the BEs are represented through the BPMN models and textual descriptions in natural language (cf. Fig. 9).

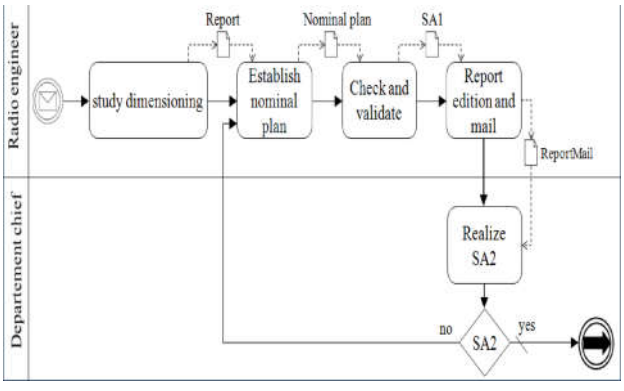

Figure 9. BP's BPMN representation

At this stage, experienced radio engineers are invited for interviews to provide further information and details about the BEs of BP. The table TABLE IV shows the different activities and employees of this process.

TABLE IV.
BP'S ACTIVITIES

BA[a]	Description	Input	output	E[d]
Act [b]1	Study the dimensioning of the network in term of cover	Report of an internal study	Report on the cover network	RET
Act 2	Establish a nominal plan and a technical study according to the report	Report on the cover network	National nominal plan	RET
Act 3	Check and validate the nominal points	National nominal plan	SA1 formulary	RET
Act 4	Treat SA1, edit table, report and mail SA1 à traiter	SA1 formulary	Excel file, report and mail	RET
Act 5	Realize SA[c]2	Excel file, report and mail	SA2	DC

[a] BA (business activities), [b]Act (activity); [c] SA (site antenna); [d] E (employees), [e] RET (radio engineer team), [f] DC (department chief).

Phase 2 (creation of LP's design models): the BPMN diagrams modeling and specifying the BP are translated into pedagogical and graphical models describing the LP obtained. This latter is designed through the UML activity diagram, but long before, a textual description is introduced to describe the various entities participating in learning.

LU's Title: LP for the installation of antennas telephone.

Provided by: The radio engineers experienced

Pedagogy / type of learning: self-directed and individual learning.

Description / context of use: the LP will be for the training of learners (i.e. new radio engineers) on the installation of antennas telephone. The learner is supposed to be a graduate of radio engineering before attending the LP.

Learning Objective: Learners, who took the course, must be able to ensure business activities related to the installation of antennas telephone.

Roles: one role is defined, that of inexperienced radio engineer who will participate in learning activities performed by business radio engineers or by the department chief.

List of learning contents: the course of the LP consists of two structured learning activities, the first state how it handle errors, the second itself has three activities: receiving a report containing an internal study being the subject of an application for installation of radio antennas, the second activity is an activity consisting of a dozen learning activities conducted sequentially, and the last learning activity can be sent to the concerned result of BP (i.e. SA2).

List of services / tools: MS Excel, MS World and messaging tool.

List of collaborative activities: none.

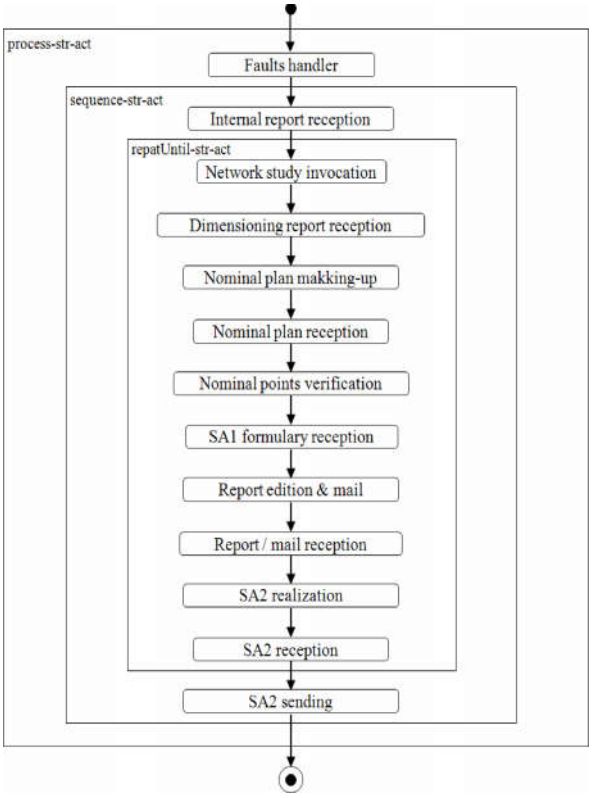

Figure 10. Conceptual model of LP

Phase 3 (mapping to IMS-LD): The LP's IMS-LD code is introduced in table TABLE V.

VI. SUMMARY AND FUTURE WORK

We have presented the definition, design and implementation of two processes, exposed knowledge-based analyses and study method at the metamodel level followed by a technical approach of creation of LP from the BPs taking in account the different standards and phases of design and implementation of these two processes; introduced a technical implementation of our approach followed by a case study.

Creating LPs from BPs wants a way to capitalize knowledge and know-how in informative and instructive capital (i.e. e-learning capital) rather than in materialized or archived capital (e.g. knowledge base).

As perspective, we intend to conduct experiments and evaluation on samples professionals in order to measure the effectiveness of the approach.

Currently, many specifications are dedicated for modeling and describing the various BP's aspects, this allows bettering capitalizing them. Ontologies are developed to specify and describe web service what led us to reconsider and review all theses specifications and ontologies for learning purposes.

TABLE V.
LU'S CODE

```
<?xml version="1.0" encoding="UTF-8"?>
<imscp:manifest> <!--Commentaire sous la racine-->
<imscp:metadata/>
<imscp:organisations>
<imsld:learning-design identifier=" antennasInstallationProcess "
level="A">
<imsld:title>  the installation process of the telephone antennas is for
cover the  new zones or area.
 </imsld:title>
<imsld:learning-objectives>
<imsld:title>Les objectifs d'apprentissage</imsld:title>
<imsld:item identifier="LO-learning-Objectives" identifierref="RES-
Learning-Objectives"/>
</imsld:learning-objectives>
<imsld:prerequisites>
<imsld:title>Les prerequis d'apprentissage</imsld:title>
<imsld:item identifier="Preq-prerequisites" identifierref="RES-
prerequisites"/>
</imsld:prerequisites>
<imsld:components>
<imsld:roles>
<imsld:learner create-new="allowed" identifier="ingénieurRadio">
<imsld:title> </imsld:title>
<imsld:information/>
</imsld:learner>
<imsld:staff create-new="not-allowed"
identifier="chefDepartement">
…
</imsld:learning-activity>
<imsld:activity-structure identifier="repeatUntil4-str-act" number-to-
select="10" sort="as-is" structure-type="sequence">
…
</imsld:activity-structure>
<imsld:activity-structure identifier="process-str-act" number-to-
select="3" sort="as-is" structure-type="sequence">
<imsld:title>Activite globale</imsld:title>
…
</imsld:activity-structure>
</imsld:activities>
<imsld:method><imsld:play identifier="play1" isvisible="true">
<imsld:title> Premiere piece </imsld:title>
<imsld:act identifier="act1">
<imsld:title> Premier acte </imsld:title>
<imsld:role-part identifier="role-part1">
<imsld:title>Premiere partition</imsld:title>
<imsld:role-ref ref="apprenant"/>
…
</imsld:method>
</imsld:learning-design></imscp:organisations>
<imscp:resources>
<imscp:resource identifier="RES-Learning-Objectives"
type="webcontent"/>…</imscp:resources>

</ IMSCP:MANIFEST >
```

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