

A BSC-Based Method for the Supervision of Business Processes

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Abstract— Today, companies must be able to supervise the execution of their business processes in real time, what gives a quick adaptation and arising problems or deviations. Thus, it is possible to obtain a current overview over their processes, and subsequently their business performances. One of the difficulties of the supervision is related to the frameworks for building systems enabling a performance analysis of the adequacy of the strategic objectives of the organization. In this paper, we propose a new method for building a Business Supervision System (BSS) covering the three phases: analysis, design and implementation. First, Balanced ScoreCard (BSC) has been extended by adding a public process as a new perspective. The goal of this extension is to provide for the modern companies, a way to consider in their strategy the state of their external business processes, not only on the state of internal business processes. Second, we use Unified Modeling Language (UML) activity diagrams describing the dynamic aspects of the system, such as interaction of private (internal) and public (external) business processes. Third, Business Process Execution Language for Web Services (BPEL4WS) is used for assembling a set of discrete business processes as a set of interactions between web services. The objective is to provide to decision makers a method ensuring the agility property. This property is the ability to change and refine easily a concept of a method without involving their other concepts.

Keywords— *agility; supervision; business process; BSC; BPEL4WS*

I. INTRODUCTION

Companies use many business processes to ensure their proper functioning. A business process consists of a set of activities that are coordinated in an organizational and technical environment. These activities realize jointly a business goal. Each business process is enacted by a single organization. But, it may interact with other business processes performed by other organizations [1]. The orchestration and control of all the resources that are involved in a process to achieve a business objective is therefore an important issue.

Successive cycles of development, implementation and monitoring of business processes bring to the organization a way to integrate structural and environmental changes. Supervision of business processes is a measurement, a verification and an analysis activity of observed differences between the expected values and the measured values. Any deviation is sanctioned by conducting corrective actions on

business processes [2]. Therefore, the supervision of business processes requires a technical infrastructure implementing the ability to react automatically to some events triggered directly from the instances or its execution environment. Also, supervision permits an interaction with all the key players in the company through the taken decisions: redefinition of a process or a part of activity, interruption of the execution of a running process or improvement of the goals and strategic objectives [3].

Quality and certification management system standards are often inflected concepts in present business practice. The certification to ISO standards is a prerequisite for competitiveness in many sectors of business. These international standards constitute a normative base of Quality Management System (QMS). They create and keep mechanisms that are able of prevent undesirable behavior through internal audits [21]. Indeed, they are able to provide a supervised procedure. These standards are closely connected to Business Process Management (BPM) [17]. BPM is a disciplined approach to identify, design, execute, document, measure, monitor, and control both automated and non-automated business processes to achieve consistent and targeted results that are aligned with the organization's strategic goals. BPM creates an add-value, and enables an organization to meet its business objectives with more agility. It enables an enterprise to align its business processes to its strategy, leading to effective overall company performance through improvements of specific work activities either within a specific department, across the enterprise, or between organizations. Weske [18] states that BPM includes concepts, methods, and techniques to support the design, administration, configuration, enactment, and analysis of business processes. Indeed, our work is included in the BPM field.

Balanced ScoreCard (BSC) [4] is a performance measurement method that includes not only traditional financial measures but also such qualitative measures as employee satisfaction, corporate mission and customer loyalty. It gives a way to translate a vision into a clear set of goals that are then translated into a powerful measurement system, which effectively defines the whole strategic objectives of an organization [5]. In addition, BSC creates a reporting system that allows the progress against the strategy to be supervised and corrective actions to be taken as required. BSC also serves as a link between the operations control process and the learning and control

process for managing strategy [4]. Therefore, BSC is adopted in our solution because it is among the few methods available for widespread monitoring process. It goes beyond translating strategic objectives into operational plans, to check the alignment of business processes and to provide support to the company's strategy [2].

Web Services (WS) [6] are considered as a dominant standard for distributed application communication over the Internet. Consumer applications can locate and invoke complex functionality, through widespread XML-based protocols, without any concern about technological decisions or implementation details on the side of the service provider. The Business Process Execution Language for Web Services (BPEL4WS) [7] allows designers to orchestrate individual services so as to construct higher level business processes. The specification of the orchestration is expressed in XML-based language and it is deployed in a BPEL execution engine, making thus available for invocation by consumers.

In order to enjoy the utility of these concepts, we propose a method that aims to ensure the agility property. This method permits the development of a BSS during the three phases of its development: analysis, design and implementation. In the analysis phase, the objective is to study the environment and to determine the company's strategy. We use the UML activity diagram in order to describe the dynamic aspects of the system. In our case, we represent the interaction model of internal and external supervised business processes. After that, we use BPEL4WS as a standard executable language for specifying actions within business processes with WS. In the design phase, our contribution extends the BSC method to "Public Process" as a new perspective because the contemporary enterprises and their business processes are becoming more dynamic, distributed and complex. Thus, even a simple process may cause business transactions across boundaries of numerous business units and trigger interactions of multiple actor sand software applications [20]. Consequently, enterprises need to add also in their strategy the state of the collaborative or external business processes, not only the state of internal ones. Finally, in the implementation phase, we import both the BPEL4WS specification as XML file and the BSC extended strategic as structured table towards the BSS reference.

The rest of this paper is organized as follows. In Section II, we describe a synthesis of some research works in relation to our proposition. Section III is devoted to the definition of the concepts used in our solution. Section IV describes the proposed method description. Section V provides a case study to validate our framework related to the Algeria Gulf Bank (AGB). Section VI is reserved to a conclusion demonstrates the conformity of our solution with the agility property and proposes some prospects.

II. RELATED WORK

The combination of BSC [4] and BPEL4WS [7] is of interest for BPM research and few works combining these two concepts have been found. Derrick et al. [8] addresses

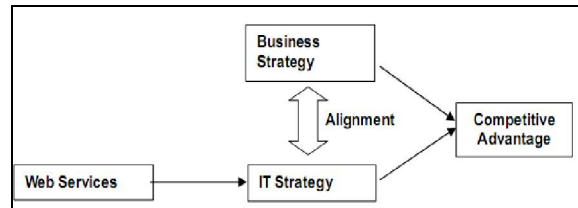


Figure 1. Integrating web services with competitive strategies [8].

the issue of deploying Web services strategically using the concept of a widely accepted management tool, BSC (see Fig. 1). It presents potential benefits of Web services with corporate BSC perspectives. Indeed, this work argues that the strategic benefits of implementing Web services can only be realized if the Web services initiatives are planned and implemented within the framework of an IT strategy that is designed to support the business strategy of a firm.

BSCs have also been used in several companies. Wang et al. [9] defines the major indicators of social sustainability for development of Sustainable Design-centered Manufacturing (SDM). These indicators permit to evaluate the weighting factors among the three pillars and the indicators used to assess each pillar. Lina et al. [10] provides valuable support for successful decision making in network hierarchical structures they adopt the traditional BSC framework that considers importance weights, performance weights and norm values. Lin et al. [11] investigate the current status of BSC application and its impact on hospital performance in China. In this work, the BSC application contributes to the improvement of organizational and personal performances. Such a contributing effect increases with the extension (level) of BSC application. Antonsen [12] shows that using the BSC to strengthen formal control, combined with advisors commitment to serve their customers, seems to contribute to high financial results for the bank. However, this study reveals shortcomings of using the BSC in promoting critically reflective work behavior and commitment among line managers and employees. Wu et al. [13] propose a research model to examine the relationships between a stage-based diffusion structure and the four BSC indicators.

Therefore, the objective of this study is to propose a method building a BSS: first, to present the benefits of BSC by adding for the original structure a new perspective that supports the study of external business processes; second, to elaborate an UML activity diagram describing the interaction of internal and external business processes to supervise; third, to specify the link of these business processes using BPEL4WS. Finally, we will prove that this study ensures the agility property.

III. BACKGROUND

In this section, we briefly provide the basic concepts that are adopted in our framework.

A. *Balanced Scorecard*

BSC is a method to measure the company’s activities [5]. It provides a more global steering with defining a rigorous framework for developing the strategy and methodology for the decline in operational terms [2]. It has evolved in three main generations. However, the third generation refines the others in order to give more relevance and functionality to strategic objectives. Other key components are strategic objectives, strategic linkage model and perspectives, measures and initiatives [16]. In our work, we adopt this last generation whose structure is represented in Fig. 2, respecting the balance in the following four perspectives:

- Financial perspective: the financial performance of an organization is based on its ability to create values by efficiently using capital.
- Customer Perspective: it illustrates the choice of the company in market segmentation, in which it makes sales and generates revenue.
- Internal business processes perspective: it identifies the business processes involved directly in the objectives.
- Learning and Growth perspective: the last of the four perspectives is the sharing and communication of knowledge in the organization leading to the achievement of individual goals. This perspective is closely linked to information from the human resources department.

For each perspective of the BSC, four parameters are controlled: the main objectives such as increasing profitability; the indicators such as observable parameters, which will be used to measure progress towards the objectives to achieve; the targets taking specific targets values to be achieved by measures; the initiatives that are projects or programs launched to meet the objective [3]. The important word in BSC is “balanced” because it equilibrates between short and medium or long-term goals, it equilibrates between financial indicators and non-financial, it equilibrates measuring indicators of past performance and indicators “forward” and it equilibrates between the external perception and conducted internal performances [2].

Thus, BSC presents a new way to monitor the performance of a company measured by the past success and set goals for the future [14]. In our method, we extend the original structure of the BSC, in order to accomplish the distributed and the dynamic companies’ requirements. Our proposed contribution adds a new perspective with "Public Process". Then, it is possible to allow a company to think so in its strategy on the status of their public and private business processes.

B. *BPEL4WS*

BPEL4WS [7] has been designed to model business processes that are fairly stable, and thus it involves the invocation of WS that are known beforehand. Therefore, the BPEL scenario designer specifies, at the time when the scenario is crafted, the exact services to be invoked for the realization of the business process.

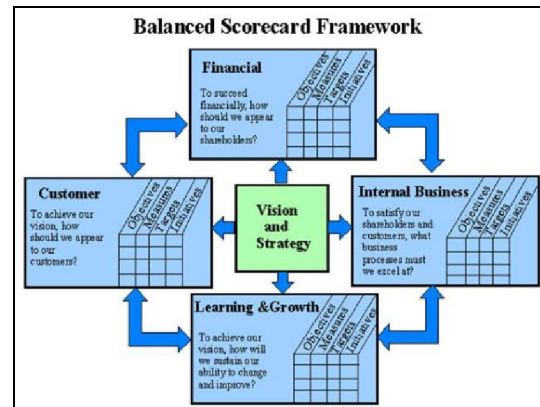


Figure 2. Original structure of BSC [3].

UML [15] UML is the most used specification and the way the world models not only application structure, behavior, and architecture, but also business process and data structure. UML is used in this method because it helps to specify, visualize, and document models of software systems, including their structure and design.

Business Process Model and Notation (BPMN) [19] is a standard that will provide businesses with the capability of understanding their internal business procedures in a graphical notation and will give organizations the ability to communicate these procedures in a standard manner. Thus, BPMN will allow for an easier and quicker move from theory to practice. In our method, and for ease of use, we elaborate an UML activity diagram for modeling the internal and external business processes interaction. According to this diagram, the cooperative behavior that links this supervised business processes as set of WS is specified with BPEL4WS.

IV. THE PROPOSED METHOD

We recall that our work has as objective the proposition of a new method for building a BSS (Fig. 3), with ensuring the agility property. This method exploits: BSC extended with Public Processes as a new perspective; UML modeling of public and private business processes interaction; and BPEL4WS specification to link this interaction. In this context, our method follows the three phases: analysis, design and implementation:

A. *Analysis Phase*

This phase provides two activities:

- Identification of the business strategy: the Board of Directors meets to target a business strategy that repents potential of the company in a definite period. In this phase, we also define the format of requested reporting, curves, graphs and statistics, respecting the hierarchical recipients. At this stage, we must also fix the degree of possible alerts, notifications and the causes triggering.
- Analysis of internal and external interaction scenarios of all the business processes to be supervised. For this, we will need to: i) Identify

company internal business processes (private) to supervise; ii) Identify company's external business processes (public) to supervise; iii) Select their supervised WS, and identify their use contract.

B. Design Phase

This phase provides four activities:

- Elaborate the dynamic behavior of business process modeling of all the interacted internal and external processes, using UML activity diagrams. The resulted representation shows the interaction from a start point to a finish point, detailing the many decision paths that exist in the progression of events contained in the activity. Activity diagrams are useful for business modeling where they are used for detailing the processes involved in business activities.
- Define the BPEL4WS specification that allows the link between WS of supervised business processes (public and private), according to the UML activity diagram.
- Extend the BSC structure, which consists of adding a fifth perspective in the original structure of BSC is that of "Public Process". This new perspective allows the company to consider its strategy on the status of their collaborative or external business processes, not only on the state of internal ones. As a matter of fact, currently companies publish some services to the outside.
- Build the new BSC, in order to identify the overall objectives of the company according to five dimensions: financial, customer, internal process, external process, learning and growth. For each objective, we should specify performance measures, targets and initiatives to develop.

C. Implementation phase

By using the most appropriate software tool, this implements the basic components of our BSS. These components provide the import of BPEL4WS specification as an XML file, and import also the new structure of BSC as a strategy table toward a reference. This system improves business efficiency (via the strategy respect); it reduces a response time to the operations of these internal or external business processes (via BPEL specification); and it allows accesses to real-time process performance indicators (via BSC measures against targets).

V. CASE STUDY: AGB BANK

In order to establish the exploitation of our method, we choose to validate it with a case study in relation with a banking company, named AGB (Algeria Gulf Bank). This choice is made because the banking domain provides the most convenient environment to prove all the aspects of this new method. Our objective is to implement in a company bank a BSS of the various transactions of internal and external business processes. Thus, the company provides the following public services (external) (see Fig. 4): e-Banking

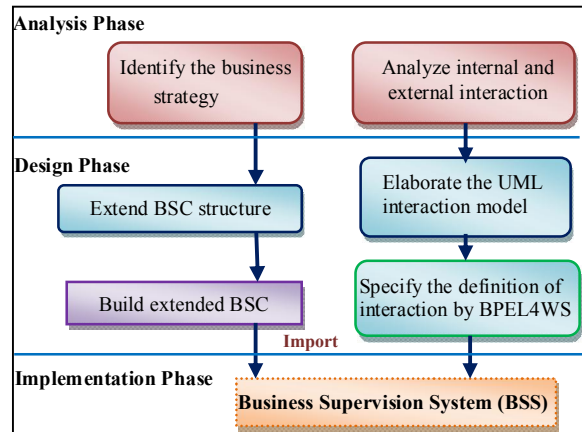


Figure 3. Overview of the proposed method.

system (website), notification system (Fax, SMS and e-mail), Automatic Teller Machines (ATM) via a Card Inter Bank (CIB) and e-Payment through Electronic Payment Terminal (EPT) also via the CIB. The following section gives the application of the proposed method:

A. Analysis phase

- Identification of the business strategy: the AGB strategy was defined the first time in early 2009 aims to achieve its mission while being faithful to the values and principles that are hers. Now, this strategy focuses on six areas: to increase profits, to increase the number of clients, to reduce credit risk, to insure qualified employees, to acquire robust equipments and platforms and finally to provide services outside the bank's headquarters boundaries (through the net).
- Analysis of the internal and external interaction:
 - Internal company business processes (private) to supervise: Human resources management; Development of balance sheets and reports (monthly, yearly); Customer Service Management.
 - External company business processes contain in WS to supervise is: E-Banking (Website); Notification (Fax, SMS, email); E-Payment (EPT) and ATM (CIB). Their user contract or service interface are:
 - a) *The WS e-Banking System:* the user contract is the Personnel Identifier Number (PIN) code and the Password.
 - b) *The WS Notification system:* the user contract is the Fax number/E-mail address/mobile number and the content of the notification.
 - c) *The WS E-Payment System:* the user contract is the PIN code, the Amount to be paid and the CIB.
 - d) *The WS ATM:* the user contract is the PIN code, the Amount to retire and the CIB.

B. Design phase

According to the AGB environment, Fig. 5 shows a part of UML activity diagram that displays the interaction of these internal and external business processes.

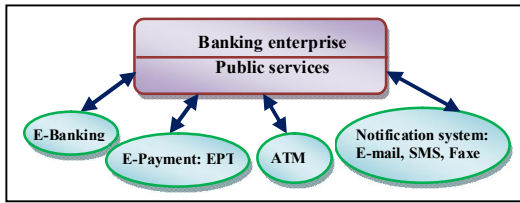


Figure 4. AGB Public Services.

In order to build a BEPLAWS specification that links all the supervised business processes, we choose to present in Fig. 6 the invocation syntax of Notification WS. According to the study of the AGB strategy and the definition of a new structure of BSC, Table 1 shows a part of our overall extended BSC, when the entire line of the new perspective is colored in blue.

In order to implement the BSS, we import the BPEL4WS definition as an XML file and the new BSC structure. This system checks in each supervision cycle the adequacy of data specified in the BSC (measures taking against targets) with the authorized interactions described in the XML file. This system aims to trigger alerts, sends notifications and provides requested reporting.

VI. CONCLUSIONS AND FUTURE WORK

In this paper, we have proposed a new method for developing a BSS, which covers three phases: analysis, design and implementation. The presented method combines the use of strategic BSC, which “Public Process” as a new perspective, the representation with UML activity diagrams for modeling the interaction of supervised private and public business processes and the specification BPEL4WS to define links of these business processes. The provided solution is validated, by applying it to an example related to the supervision of business processes in AGB banking company. Finally, we ensure that this method guarantees the agility property, which gives an added-value to this method. Agility is the ability of easy changes. Thus, we ensure the agility property because of the flexibility to manipulate in BSC objective properties, targets and measures for each dimension dashboard financial, customer, process and learning and growth independently of the other. Agility emerges also in an easy graphic modeling of UML diagrams, which are flexible to handle and easy to refine. Agility exists also in BPEL4WS abstraction, when the interface is the only visible part of these components. Consequently, we present a new agile solution when it is easy to refine a concept without involving the others. In a future work, we will investigate to find a standard structure for the extended BSC. We also want to develop a global architecture resulting from the proposed method and implementation of all the components depending on the presented case study.

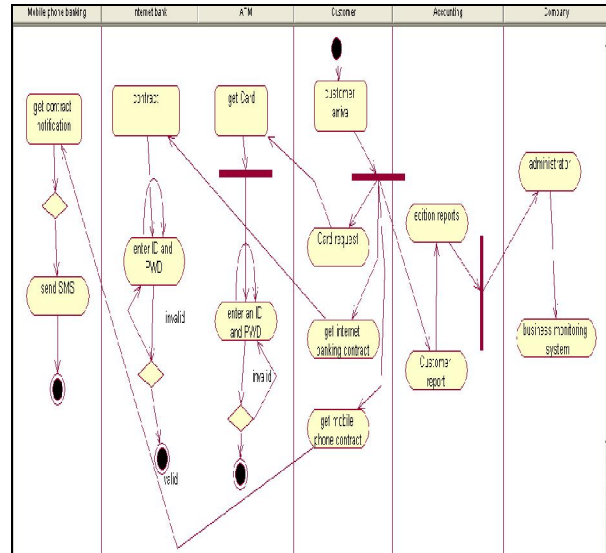


Figure 5. Activity diagram.

TABLE I. AGB EXTENDED BSC.

Perspectives	Strategy Map	Balanced Scorecard (BSC)		Action Plan
	Objectives	Measures	Targets	Actions / Initiatives
Financial	Increase in revenues	- Own capital - Total revenues - Charges - Tax	- Social capital - 20% en 2022 - ROA +3% - ROE +2%	- Increase sponsoring - Analyze reports
Customer	Evolve in customer wallet	- Number of customers - Deposits from customers	- Total accounts +5% - Credit total ±3 - Total assets+0,1% - Own Fond+1%	- Align claim with the trade - Provide available and easily service accessible
Private processes	Mark as a reference bank in terms of technology and innovation	- Critical processes - Process failed	- Critical processes = 0,001% - Process failed =<0,00 5%	- Apply information technology - Improve capacity of information systems
Public processes	Optimize the use of published web services	- SW Successfully invoked - SW invoked with failure	- Rate Failure < 0,00001%	- Reinforce the security conditions
Learning and Growth	Improve the performance of current and future collaborator	- Training Organized - Trained employee - Employee productivity	- Rate human failures = 0.5% - 80% Employee trained in 202	- Master The existing and new business in the banking industry

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<invoke partnerLink=" link "
portType="port"
operation="Notification "
inputVariable="Fax number/Adress e_mail/Mobile number,
Notification "?
outputVariable="code_notification, nbr_notification, date" ? >
<!-- adding guard -->
<catch faultName=" Declined_notification "
faultVariable=" Fax number/adress e_mail/mobile number " ?
activity
</catch>
</catchALL>?
activity
</catchALL>
<!-- compensation mechanisms in case
of cancellation of a transaction -->
<compensationHandler?>
activity
</compensationHandler>
</invoke>
    
```

Figure 6. Notification BEPL4WS syntax.

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