e-VOL BPMN: A Technique to Support the Evolution and Learning of BPMN Diagrams Systematic Mapping

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Abstract: In the software maintenance, business process models help practitioners understanding of the software, because it represents the organizational process in which software is embedded. BPMN (Business Process Modeling and Notation) is the standard notation for business process modeling. However, it is common for the BPMN diagrams to be outdated, which, among other possibilities, may be caused due to the lack of adequate knowledge of some practitioners about the notation. It is important to provide means to stimulate the evolution of these models and, consequently, to aid in the learning of BPMN notation. With this focus, we proposed and evaluated the e-VOL BPMN, a technique that supports the evolution of BPMN diagrams and on learning BPMN notation. In this evaluation, we compared e-VOL BPMN with the BPMN 2.0 Poster, an artifact used commonly to support BPMN notation in companies. Participants who used the e-VOL BPMN in a scenario of diagrams evolution presented more correct BPMN diagrams and had a higher learning perception of the notation. In addition, in a written exam on BPMN notation, participants who used e-VOL BPMN scored higher. From these results, we notice that e-VOL BPMN support both learning and evolution of BPMN diagrams.

1. e-VOL BPMN – digital version

We have created a digital version of e-VOL BPMN that follows the same pattern as the booklet format. This version aims to be easier to be disseminated and shared among professionals who wish to use the technique. The digital version of e-VOL BPMN is also composed of the Summary, Comprehension Questionnaire for the current diagram version e Evolution Scenarios.

1.1. Summary

The Summary is the initial section of e-VOL BPMN whose purpose is to assist the user in finding the desired evolution scenarios. In order to make the summary more interactive with the user, we created "Guide Questions" to direct the user to the correct page of the technique. To be directed to the page corresponds to the Guide Question, just click on the Guide Question. To return to the table of contents, simply click on the title of any e-VOL BPMN page. Figure 1 shows the e-VOL BPMN summary.

Figure 1 - e-VOL BPMN Summary

1.2. Comprehension Questionnaire for the current diagram version

This part was created to understand the BPMN diagram that should be evolved, since understanding is the initial task of maintenance in software artifact [1]. Based on this, we devised a form of technique to instigate the user to understand the diagram before modifying it. To do this, we developed a Comprehension Questionnaire. Figure 2 presents the comprehension questionnaire, which we named "Initial Evolution Guide" in the e-VOL BPMN.

The Comprehension Questionnaire contains four questions. We created these questions based on an adaptation from the Directives of Communicability (DCs), seeking to improve communication through software models, developed by Lopes et al [2]. DCs can be used by both, experienced or novice software modeling practitioners. These directives were developed drawing from theories that investigate different aspects of communication [3]. This adaptation aims to identify risks of communication failures from software diagrams that may impact the communication between producers (who produce the diagram) and consumers (who understands the diagram to perform other software development activity).

Thus, the Comprehension Questionnaire questions prompt e-VOL BPMN users to analyze the diagram that will be evolved, understand it, and identify possible correction points in it. In this way, the diagram will be understood and corrected before being modified.

In order for the user to correctly understand the diagram, all the answers in the questionnaire must be green. If any answer is still red, he should analyze the diagram a little more, and if necessary, correct it. When finally, the answers are green, he can go on to the next step which is the modification and evolution of the diagram.

INITIAL EVOLUTION GUIDE

1. **Are the required information that is described in the scenario represented in the diagram?**

| ☐ Yes | ■ **Not.** In this case, add the missing scenario information in the diagram. |

2. **Is there unnecessary information in the diagram?**

| ☐ Not | ■ **Yes.** Remove unnecessary information so that the diagram has objective content. |

3. **Are the activities represented in a logical and coherent manner? Do you easily identify what the next step should be at each point in the diagram?**

| ☐ Yes | ■ **Not.** Organize the information in a logical way so that the diagram presents information with consistency. |

4. **Are the activities clearly represented? Do you clearly identify in the diagram who the actors are responsible for the activities? Are the activities clearly named? Do you clearly identify the beginning and end of the process?**

| ☐ Yes | ■ **Not.** Make the necessary corrections to leave the diagram with clear information. |

Figure 2 - Initial Evolution Guide - Comprehension Questionnaire for the current diagram version

1.3. Evolution Scenarios

The structure of this section of e-VOL BPMN was inspired by the format of reading techniques [4], which provide a defined set of instructions that should be executed according to a specific scenario. These instructions were grouped into evolution scenarios.

In a table format, each row represents an Evolution scenario (see Figure 3). For the construction of the evolution scenarios, we evaluated the elements of BPMN notation. For each element, we verify the contexts of use and application in the real environment. Then, based on the application context of each element, we created a corresponding evolution scenario. The columns of the table (see Figure 3), which are the elements of the evolution scenario, are as follows:

1. **Evolution scenario:** represents the scenario that needs to be modified in the problem domain, in the actual process.
2. **Modification:** this column represents the instruction to make the modifications in the diagram.
3. **How it was:** represents an example of an old scenario, which may be represented in the current diagram (if there is already an initial diagram).
4. **How it becomes:** an example of how the diagram can stand after the execution of the instructions, that is, the evolved diagram.
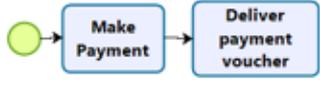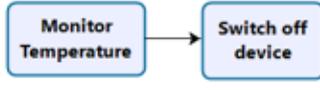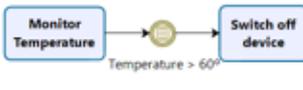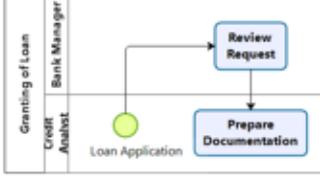
Change scenario	Modification	As it was	As it happens to be
C12. If a process always starts on a particular day of the month.	- Change the default start event for an initial time event	Make Payment → Deliver payment voucher	Make Payment → Deliver payment voucher. Every 5th business day of the month
C18. If an activity only starts if a given condition is satisfied	- Include a conditional event to represent the condition before the activity.	Monitor Temperature → Switch off device	Monitor Temperature → Switch off device. Temperature > 60°
C22. If an external participant became involved with the modeled process, but the activities of that external participant are not known	1. Create an Abstract Pool 2. Name this new Pool according to the external participant it represents 3. Connect pools through message streams	Granting of Loan / Bank Manager: Review Request; Credit Analyst: Loan Application → Prepare Documentation	Granting of Loan / Bank Manager: Review Request; Credit Analyst: Loan Application; SPC → Prepare Documentation. The SPC participates in the process "Loan Concession", but its activities are unknown.
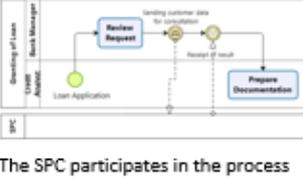
Figure 3 - Examples of evolution scenarios
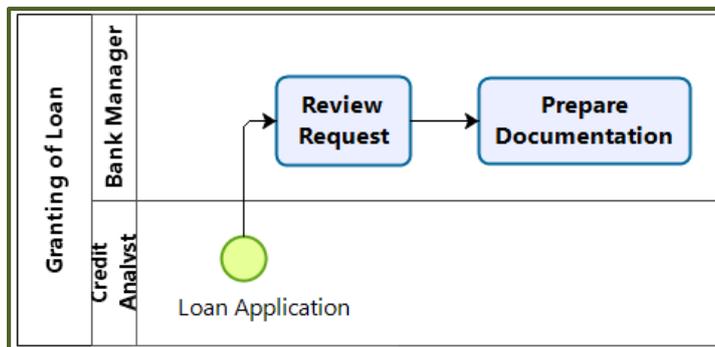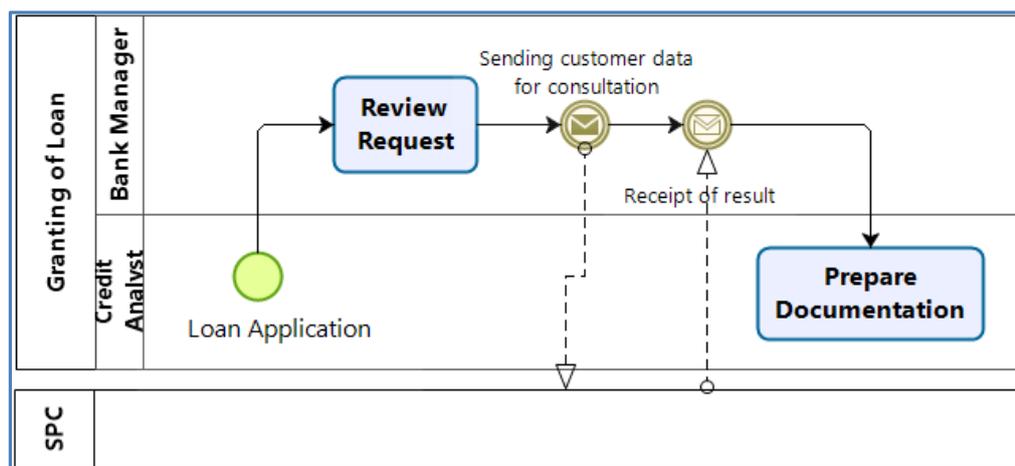
In Figure 3, we will analyze the scenario "C12" which is about a start event of Timer type. The evolution scenario asks if the change that occurred in the real world refers to a process that always starts on a certain day of the month. If yes, then the user should make the following modification: "Change the default start event for an initial time event". Then, in the column "How it was" an example is presented, where a payment process starts but is not specified when it starts. Then, the "How it becomes" column shows the modification that the user must make so that the process will specify when this process starts. In this example, on the 5th business day of each month.

The full digital version of the e-VOL BPMN technique can be found at the following link: http://uses.icomp.ufam.edu.br/wp-content/uploads/2017/08/evol_BPMN_digital.pdf

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