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Business Process Digitalization Tracking and Monitoring: An Heuristic Software-Based Approach

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Abstract. In this paper, we introduce a software-based heuristic approach for scoring the grade of digitalization for business processes modeled in BPMN: The DigiTrack tool. Our tool enables the measurement of the digitalization maturity of a business process by calculating scores for each task. This new method is shown through a case study with a simplified check in process at airport.

Keywords: Heuristic Model · Digitalization · BPMN.

1 Motivation and Introduction

The importance of digitization has just become apparent in the current COVID crisis. Conventional business models of companies were suddenly difficult or even impossible to implement in many industries - the internal organization also had to react flexibly. Companies that successfully master the digital transformation of business processes are twice as successful as laggards. This shows that companies without digital business models have lost customers and were hit harder by the crisis [1].

The world we live in is changing faster than ever. Some technologies and trends are already outdated before they can establish themselves on the market. Digitization in particular has further strengthened this trend - the circulation speed in our economy and in social coexistence has increased dramatically. With all the adjustment needs associated with the digital transformation, the opportunities and potential of new technologies are enormous. At the same time, customers are putting more pressure on companies to push ahead with digitalization. Customers already expect mature digital offers from companies.

Therefore there is a gap for approaches to track and monitor the digitalization level of companies down to the business process level.

2 Related Work

In this section we will elaborate some important definition, standards, aspects and works that help us address the problem of tracking the level of digitalization in the approach we are proposing in this paper.

2.1 Digitization, Digitalization and Digital Transformation

Digitization involves converting information from a physical format (analogue) to a digital one. This very often leads to digitization being perceived as digitalization, which results in a false perception of one's own degree of digitalization.

In digitalization, digitization is used to improve business processes. In its simplest form, this is a digital image of the analog processes. However, that should not be the ultimate goal.

Finally, the digital transformation is the transformation of business activities, processes, products and models in order to fully exploit the opportunities of digital technologies (change management). Digital transformation is more about people than digital technology.

2.2 Business Process Modeling

The overall goal of Business Process Modeling is to establish a common perspective and understanding for a business process within an enterprise between the relevant stakeholders involved. Hereby, the most common graphical representation such as flowchart [2] or similar serves as base to show the process steps and workflows. This approach is widely used to recognize and prevent potential weaknesses and implement improvements in companies processes as well as to offer a good base for comprehensive understanding of a processes in general.

2.3 BPMN

The BPMN 2.0³ is a new standard for business process specification developed by a variety of Business Process Modeling (BPM) tool vendors. This standard is one of the most important forms of representing business process models, offering clear and simple semantics to describe the business process of a business [3, 4]. This language was developed with the intention of modeling typical business modeling activities [5, 6].

2.4 BPM Lifecycle

BPM lifecycle described in [7] represents different phases of the process beginning by analysis and ending by process monitoring and controlling and process discovery. Our usage scenario in this lifecycle is placed in process monitoring part.

³ <https://www.omg.org/bpmn/>

3 Tracking Digitalization Level in a Business Process

Tracking and measuring business processes have been implemented in [8, 9]. However, these approaches do not cover digitalization maturity approaches.

As possible heuristic approach to track the digitalization in business processes we defined a set of metrics and maturity levels that will be assigned to the BPMN models of these processes.

3.1 Metrics and Maturity Levels

The metrics we are using to calculate the **digitalization level score** (DLS) expressed in percent and reflected through maturity levels: explorer, beginner, advanced, expert; considers three main aspects:

- **Digital Tool Existence (DTE)** - whether the task is operated manually or with tool (either 0 or 1)
- **Digital Tool Integration Level (DTIL)** - how far is the digitization tool integrated for specific task regarding preceding and ascending tasks, with possible values: 1 (no integration) - 5 (full integration)
- **Data Automation Grade (DAG)** - telling us how far the data processing for current task is automated, as scale with possible values: 1 (no automation/manual), 5 (fully automated data processing)

All the aspects are related into following formula

$$DLS = (DTE * (DTIL + DAG)/10) * 100 \quad (1)$$

In order to distinguish the maturity level of the digitalization for a certain BPMN modeled process we also defined intervals for overall DLS.

Overall DLS of a Process in a BPMN diagram is calculated average of task-wise DLS.

- 0% - 25% - Explorer
- 26% - 50% - Beginner
- 51% - 75% - Advanced
- 76% - 100% - Expert

3.2 Application Use Case

As use case we introduce an experimental desktop tool called DigiTrack developed by our institution(s) which allows us to manage, search and tag the BPMN modeled processes. Application based approach has been also approved in other phases of Business-Process Lifecycle as well e.g. by analysis and redesign [10].

Operating BPMN files At the current state of implementation the DigiTrack tool allows import of an BPMN file (accepted format: *.bpmn) into local repository (see figure 1), search for processes using name of processes, name of tasks and wildcards and loading into main view for labeling the process steps with task-wise DLS scores.

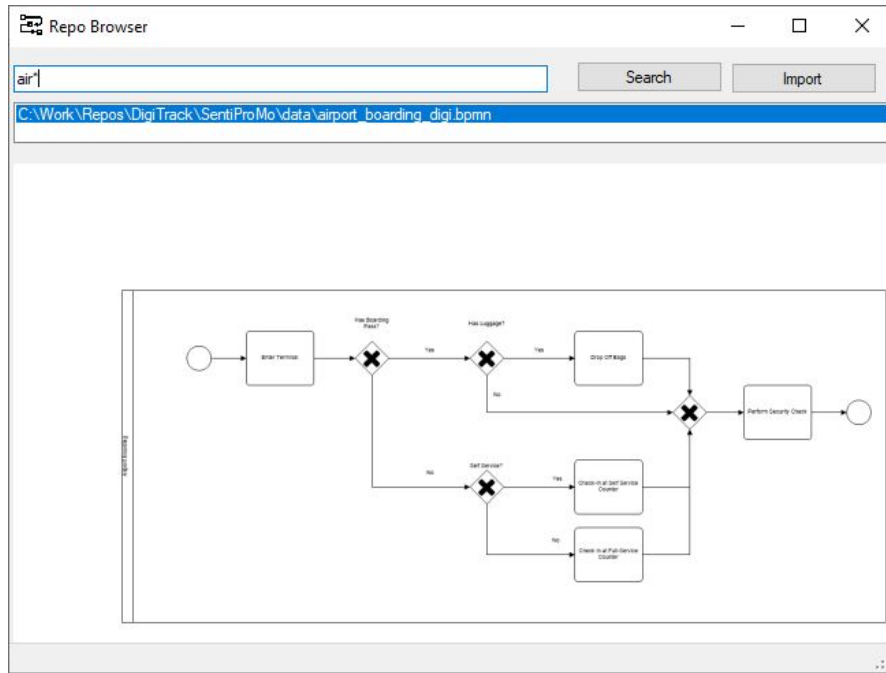


Fig. 1. BPMN process repository.

Entering DLS for Process Tasks After the project is loaded from repository the tool allows entering and editing the DLS over separate user interface. Currently the calculation of DLS happens manually and only the final score is entered. In the future we will support entering the metrics over the same window. Additionally the name of the tool can be specified. This process is depicted in figure 2 where a calculated value for DLS expressed in percent is entered for the task "Check-in at Self Service Counter" in the Airport Boarding process.

Presenting Digitalisation Level Score Depending what is the average DLS value and to which maturity interval it belongs the value is depicted as chart in red (Explorer), yellow (Beginner), orange or green (Expert) color (see figure 3). This chart is placed in the lower left corner of the DigiTrack application.

4 Discussion and Outlook

Within this paper we introduced a small use case based upon an application called DigiTrack and a heuristic approach including corresponding metrics such as Digital Tool Existence (DTE), Digital Tool Integration Level (DTIL) and Data Automation Grade (DAG) for calculating the digitalization level score (DLS) task-wise in a BPMN presentation of a business process. We also presented

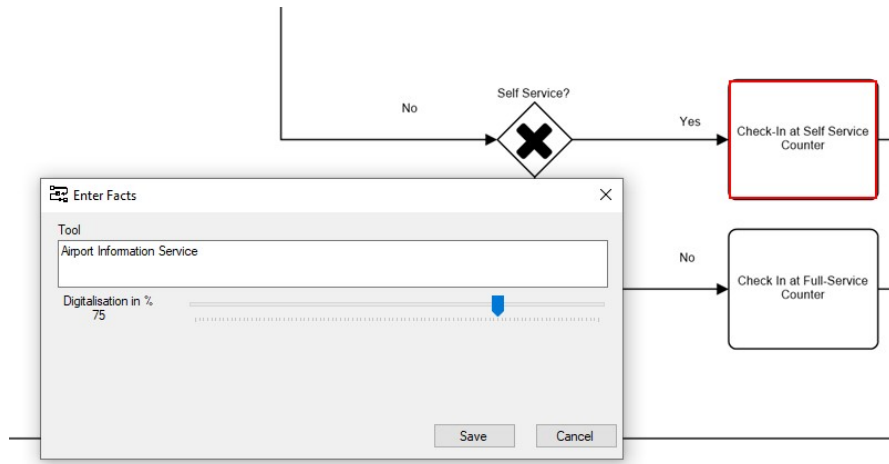


Fig. 2. Entering calculated DLS for a single task.

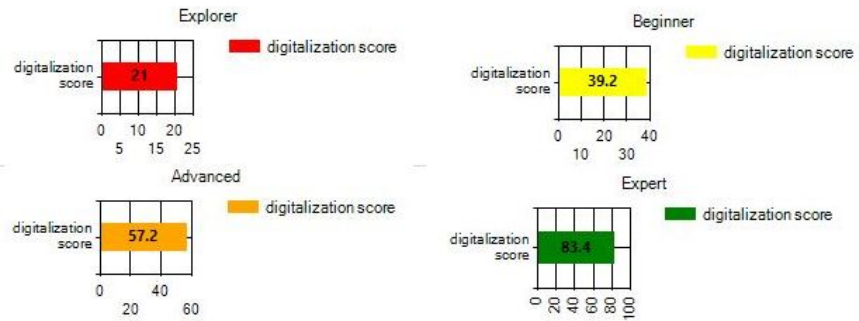


Fig. 3. Average DLS over all tasks in process with maturity level coloring.

how calculated average DLS is assigned to the one of four digital maturity levels we defined. First results are showing the potential on how simple ideas can allow us to rise the awareness of digitalization at process and task level in an very universal manner. As next steps in the future we are planning to implement the selection of calculation metrics within the user interface and further analytic charts for better monitoring. We will also integrate and adapt already existing digital maturity levels to our approach to check whether they can offer better overview and tracking of digitalization. Also as one of the potential application scenarios of our heuristic approach along with DigiTrack tool would be testing different digitalization strategies with different tools.

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