What Makes BPMN Complex?
by Gregor Polancic

Introduction

While the objectives of BPMN are to be expressive, widely understood, interchangeable and executable, it has also become rich and complex. Besides, to stay competitive to related standards such as Business Process Execution Language (BPEL), an execution semantic and the corresponding elements were introduced into the BPMN 2.0. BPMN was arguably already a complex notation prior to the addition of these new elements, thus many studies were done with the aim of decreasing its complexity. In this paper, we will firstly define complexity from a general perspective and from a perspective of a notation and a model. Secondly, we will define what makes BPMN complex and finally, we will analyse the previous studies addressing the BPMN complexity.

Notation vs. Model Complexity

When addressing complexity of modelling notations, there are two aspects: the complexity of a notation and the complexity of a model. The complexity of a notation can be defined also by the number of unique elements and the rules of their usage. BPMN 2.0 includes 100+ unique elements and an advanced set of rules regarding their usage. On the other hand, even if we use just a small scope of available elements, we can still produce a complex model. This is evident in Figure 1, which represents an official example provided by the OMG of a small but fairly complex model, which incorporates approximately 20 elements. Semantically, it describes e-mail voting process, used for resolving issues through e-mail votes.

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We can conclude that complexity can be considered subjective and it applies to both the notation and the model. This is important when defining complexity of a notation, since the number of elements and relations alone may not be enough to characterize complexity. A large number of elements and relations can still present a simple system. On the other hand, a few elements and relations can still produce a complex model (Padilla et al. n.d.).

What Makes BPMN Complex?

When we are addressing complexity, we have to take into the consideration that it is hard to measure and is considered to be subjective. Therefore, we cannot measure complexity with a methodological description of the system. However, we can look for signs of complexity, which are similar to the signs used by doctors to confirm the diagnosis. Accordingly to Saltzer & Kaashoek, there are five signs of complexity, which are summarized in Table 1, along with the examples from BPMN and its corresponding Business Process Diagram (BPD).

<table>
<thead>
<tr>
<th>Sign of Complexity</th>
<th>BPMN / BPD</th>
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<tbody>
<tr>
<td>Large number of components</td>
<td>BPMN 2.0 has over 110 elements.</td>
</tr>
<tr>
<td>Large number of interconnections</td>
<td>In a BPD, BPMN elements need to be interrelated into a graph.</td>
</tr>
<tr>
<td>Many irregularities</td>
<td>We can have a large number of components and interconnections, yet they can still form a simple system. However, if there are many exceptions or irregularities in the system, we can perceive this as a sign of complexity.</td>
</tr>
<tr>
<td>Vertical BPMN domains, the meaning of non-standardized elements, the meaning of colours, etc.</td>
<td></td>
</tr>
<tr>
<td>A long description</td>
<td>To avoid complexity a methodological description of the system is advised. A shorter, systematic specification is favoured over a long description of the system's properties.</td>
</tr>
<tr>
<td>A team of designers, implementers or maintainers of a system</td>
<td>Business process modelling involves different business and technical roles.</td>
</tr>
</tbody>
</table>

As can be seen from Table 1, BPMN is showing all five signs of a complex system and can be thus pronounced as complex.

What do Others Say?

The complexity of BPMN is a widely discussed topic also among the researchers. Many studies were done with the goal of analysing how complex BPMN notation is in both theory and practice. Many concluded that BPMN is still perceived as complex and not easy to learn, even for business analysts.

More specifically, Recker performed a worldwide survey in 2007, regarding the usage of BPMN 1.0 in practice, where 590 users responded. The results showed that 36% of respondents used only the core BPMN set, 37% used the extended set of BPMN and only 27% used all of what BPMN has to offer. As to which symbols are used in practice, the author additionally interviewed 20 BPMN users. The results are summarized in Figure 2.

As can be seen from the figure above, Normal Flows, Links and Text Annotations, were rated as essential for process modelling. Contrarily, the most unused BPMN elements were Off-page connector, Group, and Multiple. They were classified by over 50% as being "not in use", "not understood" or "not aware".

Based on the findings above, BPMN has been recognized as being rich yet complex, and not easy to learn. Additionally, some concerns were raised by the author about the necessity to extend the BPMN element set in BPMN 1.2, especially Events. Author questioned: "Really, is this necessary? Isn't there enough already?"
This was later confirmed in 2010 by Leymann, where a study argues that the complexity of BPMN has further increased in BPMN 2.0. This is primarily due to the support of execution of BPMN models and the addition of elements required by domain users. Figure 3 illustrates how the goals of different versions of BPMN are related to its complexity.

BPMN was again identified as being rich in a case study of its use in practice, done by Muehlen and Ho in 2008. The focal point of the case study was to analyse the service management process in a truck dealership. The as-is and to-be processes were documented in BPMN, whereas the financial impact of the proposed changes was done using a BPMN-based simulation tool. Even though the study reports that the participants were being able to read the diagrams with relative ease, it should be noted that the layout of the process was designed as simple as possible and a limited set of BPMN constructs were used, as is represented in Figure 4.

Also, despite the introduction of the entire set of BPMN elements, the audience remembered only the basic elements. That users usually limit themselves to only basic constructs was once again confirmed in a study by Meuhlen and Recker, where the authors analysed 120 BPMN models. The study has shown that the average model consisted of only 9 different elements, which translates to roughly 20% of all BPMN 1.x elements. Additionally, BPMN was compared to Unified Modeling Language (UML), where the complexity of the language has forced modellers to reduce the set of elements they use to a very basic group. Similar was concluded for BPMN, too. Authors have concluded that complexity of BPMN in practice differs from its theoretical complexity.

Based on the previous researches that have been done in the field of BPMN usage, we can conclude that BPMN is a rich yet complex notation. The theoretical complexity of BPMN is high, especially with the introduction of new diagraming techniques and new elements. However, in practice, only a small subset of elements are used, suggesting that the complexity in practice is not as severe as the complexity in theory.

Figure 3: Complexity conflict between different BPMN objectives

Figure 4: An excerpt from the as-is model

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Conclusion

BPMN is the de facto standard for business process modelling, which enables users to model from completely basic to advanced business process models. As such, it provides a rich notation with a well over 100 symbols, covering from basic modelling to advanced execution requirements. Consequently, it shows the signs of complexity, and has been reported as such by many business users. Much of research was done in light of exploring the theoretical and practical complexity of the notation and the results consistently indicate that BPMN is indeed a complex notation, especially not understood well by beginners. However, it has been shown in practice, not many elements are used, displaying that the theoretical complexity is much higher than the practical one. In light of successfully addressing the complexity, Saltzer and Kaashoek proposed four complexity management techniques, namely modularity, abstraction, layering and hierarchy, which will be discussed in following papers.

References


