
IDENTIFYING A SUBSET OF BPMN FOR IDM DEVELOPMENT

Young Hyun Park, Ph.D. Student, nuyhyun@yonsei.ac.kr

Chi Yon Cho, Graduate student, silvury@naver.com

Ghang Lee, Ph.D. Associate Professor, glee@yonsei.ac.kr, Corresponding Author
Building Informatics Group, Department of Architectural Engineering, Yonsei University, South Korea

ABSTRACT

The purpose of this paper is to propose a subset of business process modeling notation (BPMN) to improve the information delivery manual (IDM) development process. The information delivery manual (IDM) (ISO/DIS 29481-1, 2008) currently recommends using BPMN for describing process maps (PM). The BPMN model is a generic graphical representation standard for specifying business processes targeted at a wide range of industry sectors. In its present form, it includes an unwieldy number of symbols and rules (currently over 160 notations) in order to cover a wide range of uses. Consequently, many process models use only a small number of these notations. This study collected and analyzed BPMN notations used in 54 processes in 14 existing PMs developed by various organizations. It was found that only 36 notations are used in IDM development. Based on these 36 notations, a subset of BPMN for IDM development is proposed.

Keywords: Information delivery manual, BPMN, Exchange requirement, Process map, BIM

1. INTRODUCTION

The information delivery manual (IDM) (ISO/DIS 29481-1, 2008) is the international standard for defining the information that should be exchanged between project participants in the AEC project lifecycle. The IDM process consists of three parts: the process map (PM), exchange requirement (ER), and functional part (FP). IDM recommends using business process modeling notation (BPMN) for defining a PM (ISO/TC59/SC13, 2008).

BPMN is a standard graphical representation for specifying business processes targeted at a wide range of industry sectors. However, because BPMN was initially developed as a general purpose model based on several different notations, it is impractical to use in specific cases; currently, the number of notations exceeds 160. Many studies reported practical usability issues in modeling with BPMN, such as a great number of graphical symbols, complex and ambiguous representation rules, lack of practical guidance, and confusion with disparate use of symbols by different modelers (Ko et al. 2009; Recker et al. 2007; Recker 2008; Recker 2010; Recker et al. 2006). Consequently, most process models, in fact, use only a small set of BPMN to model business process and rules. Due to the complex representation rules related to over 160 BPMN notations, many modelers are not confident in specifying business processes accurately using BPMN (Recker 2010).

As IDM development team members in South Korea, the authors also faced similar problems during the use of BPMN in PM development because a number of BPMN symbols seemed to be superfluous and unnecessary. Our investigation of previously developed IDMs for reference confirmed that our experience was common in this area. We also found that several BPMN notations were inconsistent with certain BPMN usage rules. This motivated us to study the use of BPMN in IDM development

practice and to find a subset of BPMN notations required for specifying business processes in the architecture, engineering, and construction (AEC) industry.

In this study, we analyze 54 processes in 14 existing PMs collected from IFC Solution Factory (buildingSMART_International) and the IDM official website (BuildingSMART_Norway). The 54 processes are analyzed to identify which BPMN symbols have actually been used and how often they have been used. As a result, we propose a subset of BPMN required for IDM development.

2. BUSINESS PROCESS MODELING AND BPMN

Business process modeling notation (BPMN) version 1.0 was first released in May 2004 by the Business Process Management Initiative (BPML.org.). In February 2006, OMG adopted BPMN 1.0 specifications as a process modeling notation standard. It was initially developed as an agreement between vendors who used multiple different process modeling notations for the benefit of end-users' understanding and training (White 2006). The latest version, BPMN 2.0, was published in January 2011 (OMG 2011). Although BPMN is a recent proposal, it has already been widely accepted by many practitioners (Ko et al. 2009; Recker 2010) and also by the IDM developer community.

BPMN version 2.0 covers three basic sub-models of BPMN models: processes (Orchestration), choreographies, and collaborations. Processes are subcategorized into private non-executable (internal) business processes, private executable (internal) business processes, and public processes. Within and among these BPMN sub-models, many types of diagrams can be created.

BPMN elements are grouped into five basic categories: flow objects, data objects, connecting objects, swimlanes and artefacts. Flow objects, such as events, activities and gateways, are the most basic elements in BPMN. Data objects provide "information about what activities require to be performed and/or what they produce" (OMG 2011). Data objects include input, output and collection data objects, and data stores. Connecting objects are used to connect the flow objects to each other or other information through four types of arrows, such as sequence flows, message flows, associations, and data associations. Swimlanes consist of pools and lanes. They are used to group activities into separate categories for different functional capabilities or responsibilities. Artifacts may be used to provide additional information about the process as groups and text annotations.

BPMN elements are also categorized into basic modeling elements and extended modeling elements. There are 12 basic modeling elements: event, activity, gateway, sequence flow, message flow, association, pool, lane, data object, message, group, and text annotation. The extended modeling elements are extensions of these twelve basic modeling elements. For example, there are three types of events, called Flow Dimensions, in the extended modeling elements set. For further information on BPMN, refer to OMG (2011).

However, due to BPMN's initial goal of providing fully featured vocabularies for process description and analysis covering a wide range of uses, the number of symbols and rules in BPMN has increased to the point that BPMN 2.0 includes over 160 notations. The large number of BPMN elements and their associated rules has increased modeling complexity.

Recker et al. (2007; 2010) conducted a world-wide survey with 590 BPMN adopters from over thirty countries. Recker's study showed that, in practice, no users in practice used the full set of BPMN. Thirty-two percent of respondents used the BPMN basic modeling set only, and 23.4% of respondents used an extended but not the full set of elements. Recker (2010) found that this result was caused mainly by the widened coverage of version 1.0 in addition to its complex and ambiguous rules, such as the ambiguous specification of lanes and pools and the provision of multiple event types.

This study focuses on the minimum number of BPMN elements required for developing IDMs. The next section analyzes the BPMN elements used in previous PM development.

3. USE OF BPMN IN EXISTING PROCESS MAPS

The subset of BPMN must be defined carefully so that it can provide all the semantics described in processes involving AEC projects. To derive a subset of BPMN required for IDM development, 54 diagrams in 14 PMs defined for IDM development were analyzed. The 14 PMs were developed by various organizations such as US PCI, buildingSMART Norway, US GSA, Statsbygg, and Senate Properties.

Since BPMN 2.0 was published in 2011, all PMs were developed using BPMN version 1.0 or version 1.2. Even BPMN versions 1.0 and 1.2 include over 100 elements. The frequency of use of each element in each diagram was counted. Figure 1 shows the frequency of occurrence of BPMN elements in previously developed PMs. The analysis results showed that only 36 elements among over 100 BPMN versions 1.0 and 1.2 elements were used in existing PMs. Moreover, more than a half of the 36 elements were rarely used. Approximately 70 BPMN elements appeared to be unnecessary for defining PMs for IDM development.

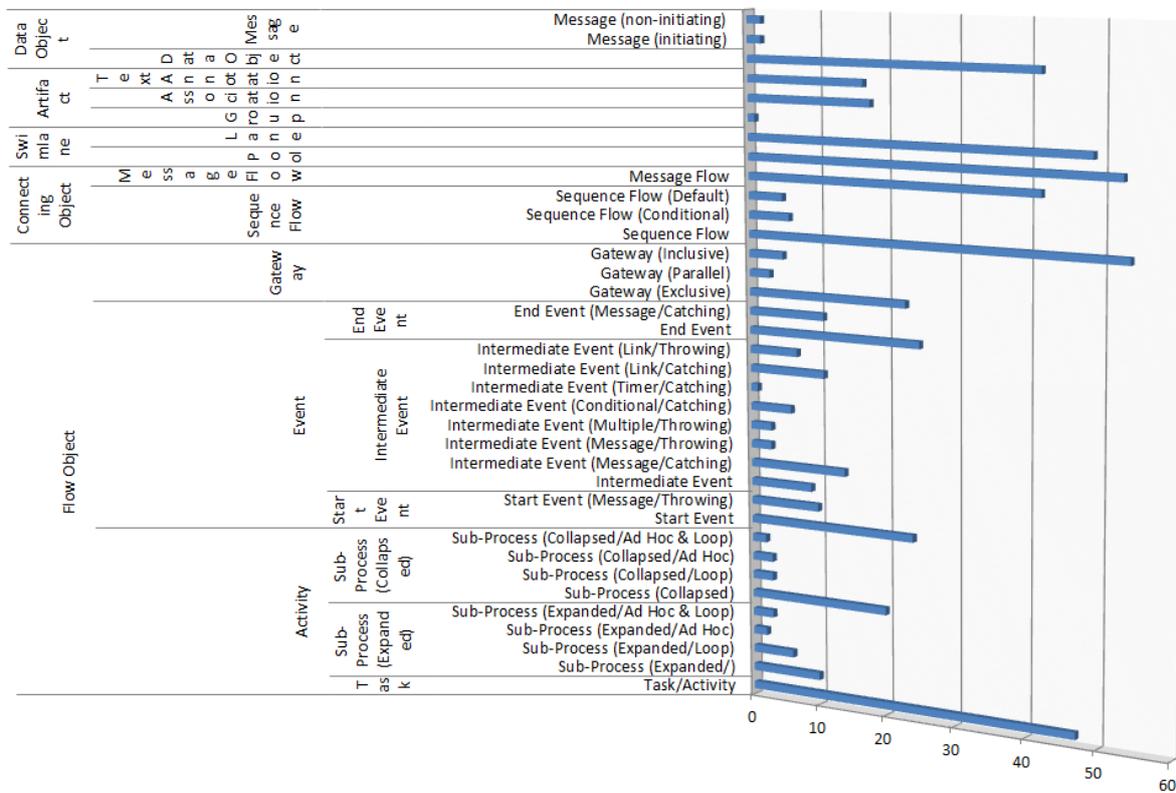


Figure 1. Frequency distribution of BPMN element usage in IDM

The most frequently used BPMN elements for representing business processes in the AEC industry were sequence flow, pool, lane, task/activity (exclusive), gateway, and message flow, which are all basic BPMN modeling elements. Extended modeling elements such as end event, start event, and sub-process were also used. However, it must be noted that in basic modeling elements, start and end events are used as a flow dimension instead of event, and a sub-process is necessary for defining higher-level of processes that contain activities for modeling complex processes. Most extended modeling elements are used much less frequently than the basic modeling elements. Table 1 summarizes the types of BPMN elements used in existing PMs.

Table 1. Summary of the BPMN Elements Used in Existing PMs

Frequency of Use BPMN Element Type	High Frequency Elements	Low Frequency Elements
Basic Modeling Elements	<ul style="list-style-type: none"> • Task, Gateway (Exclusive) • Pool • Lane • Association • Text Annotation • Sequence Flow • Message Flow • Data Object 	<ul style="list-style-type: none"> • Group • Message (initiating, non-initiating)
Extended Modeling Elements	<ul style="list-style-type: none"> • Sub-Process (Collapsed) • Start Event • End Event • Intermediate Event (Message/Catching) 	<ul style="list-style-type: none"> • Expanded/ Collapsed Sub-Process: Loop, Ad Hoc, and both • Sub-Process (Expanded) • Gateway: Parallel, Inclusive • Start Event (Throwing): Message • Intermediate Event • Intermediate Event (Throwing): Message, Multiple, Conditional, Timer • Intermediate Event (Catching): Multiple, Conditional, Timer • End Event (Catching): Message • Off-Page Connector (Throwing/ Catching) • Sequence Flow: Conditional, Default

However, because all previous PMs were specified with BPMN 1.0 or 1.2, some elements in BPMN 2.0 might be useful in future PM development. The next section discusses some new concepts introduced in BPMN 2.0 that should be considered.

4. POTENTIALLY USEFUL CONCEPTS INTRODUCED IN BPMN 2.0 FOR IDM DEVELOPMENT

In BPMN version 2.0, a new choreography and conversation model and additional event and data types were introduced. The concepts of data input, output and collection object and data store were added in BPMN 2.0. The choreography and conversation diagrams were added to cope with issues in complex processes and collaborations between various individuals and organizations. In modern AEC projects, an efficient methodology to support collaborative business processes across the participants is crucial for strengthening competitiveness. As the importance of collaboration and choreograph between project participants increases, it would be beneficial to include the elements related to choreography and conversation among BPMN 2.0 elements. The conversation model provides a simpler way to depict complex, reciprocal, and/or long-learning message exchange. A conversation node defines a set of logically related message exchange between participants (pools) in a related domain. On the other hand, choreography is defined outside of any particular pools. Choreography represents a “sequence” of message exchanges among participants.

5. A PRACTICAL BPMN SUBSET FOR EFFICIENT IDM DEVELOPMENT

Based on the elements shown in Table 1, the subset of BPMN elements collected from existing PMs, and additional elements chosen from BPMN 2.0, a BPMN subset for IDM development is derived as shown in Figure 2. The proposed BPMN subset is divided into two groups, the essential subset and the supplementary subset. The essential subset consists of most frequently used BPMN elements in PM definitions, and the supplementary subset is composed of BPMN 1.0 and 1.2 elements that are not used frequently in previous PM development or the new BPMN 2.0 elements. The essential subset consists of not only types of basic BPMN modeling elements but also three extended BPMN modeling elements, that is, start event, end event, and collapsed sub-process. The remaining elements are included in the supplementary subset. The supplementary subset can be expanded if necessary, while the essential subset is fixed.

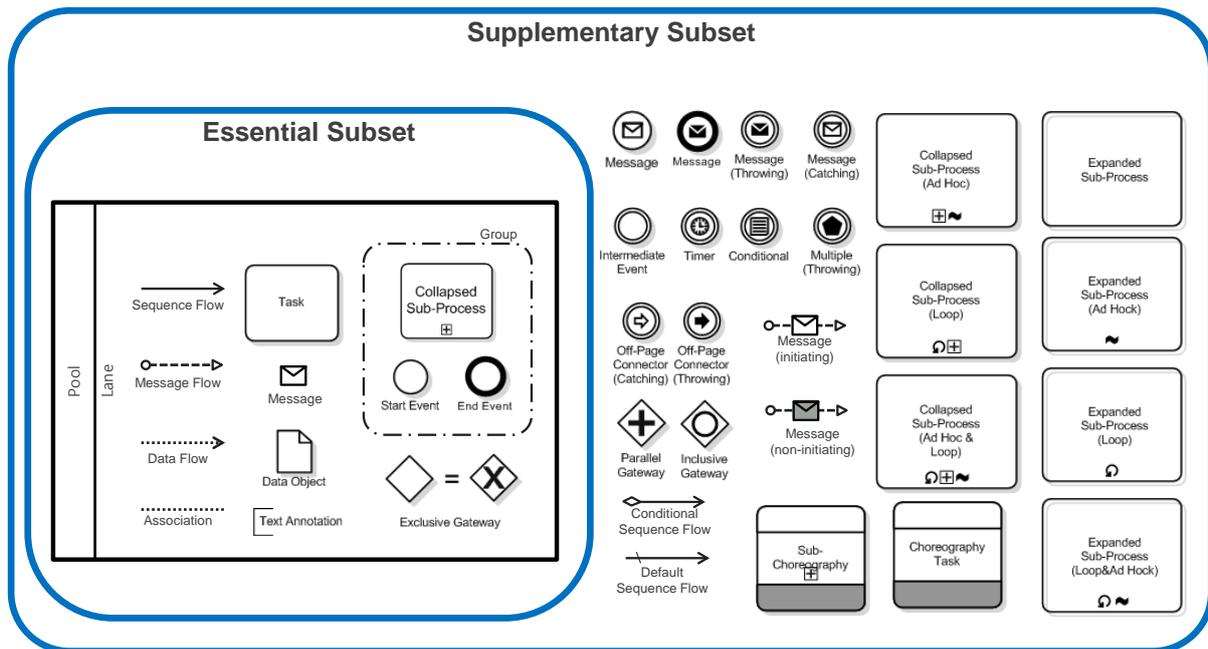


Figure 2 Proposal for the Essential Subset and the Supplementary Subset of BPMN for IDM Development

6. SUMMARY AND FUTURE WORK

This study proposed a subset of BPMN for specifying PMs in IDM development. Many BPMN modelers have been hindered by the large number of BPMN elements and associated rules (Recker 2010). We investigated how users from various organization deploy BPMN in the actual act of defining PMs in previous IDM development cases. We found that only 36 BPMN elements were actually used in existing PMs. In particular, five basic elements—sequence flow, pool, lane, task/activity, and message flow—were used most often. Since previous PMs could not reflect the elements in BPMN 2.0, which was published in 2011, we reviewed BPMN 2.0. Considering the increasing importance of collaboration and choreographing among project participants and the data exchanged among them, we added the concepts of choreography and data objects that were introduced in BPMN 2.0. By combining previously used elements in BPMN 1.0 and 1.2 and the new elements in BPMN 2.0, we proposed a subset of BPMN for IDM development. Currently, the validity of the proposed subset is being adopted and tested through IDM development projects in South Korea. In this paper, we focused only on the subset of BPMN for IDM development, and placed less stress on other issues, such as inconsistencies in the use of BPMN elements and rules. These issues will be the subject of future studies.

ACKNOWLEDGMENTS

This research was supported by grant "06-Unified and Advanced Construction Technology Program-E01" from the Korean Institute of Construction & Transportation Technology Evaluation and Planning (KICTEP).

REFERENCES

- buildingSMART_International. "IFC Solutions Factory (The Model View Definition site)." <http://www.blis-project.org/IAI-MVD/> (Accessed 2011).
- BuildingSMART_Norway. "Information Delivery Manual official website." <http://www.iai.no/idm> (Accessed 2011).
- ISO/TC59/SC13 (2008). "ISO/DIS 29481-1: 2008 Building information models. Information delivery manual, Part 1: Methodology and format."
- Ko, RK, Lee, SSG, and Lee, EW (2009). "Business process management (BPM) standards: a survey." *Business Process Management Journal*, 15(5), pp. 744 - 791.
- OMG (2011). "Business Process Model and Notation (BPMN) Version 2.0.", Object Management Group, Needham, MA. <http://www.bpmn.org>
- Recker, J, Indulska, M, and Green, P (2007). "Extending Representational Analysis: BPMN User and Developer Perspectives." *Business Process Management*, G. Alonso, P. Dadam, and M. Rosemann, eds., Springer Berlin/Heidelberg: pp. 384-399.
- Recker, JC (2008). "BPMN Modeling? Who, Where, How and Why." *BPTrends*, 5(3), pp. 1-8.
- Recker, JC (2010). "Opportunities and constraints: the current struggle with BPMN." *Business Process Management Journal*, 16(1), pp. 181-201.
- Recker, JC, Indulska, M, Rosemann, M, and Green, P (2006). "How Good is BPMN Really? Insights from Theory and Practice." 14th European Conference on Information Systems, J. Ljungberg and M. Andersson, eds.
- White, SA (2006). "Introduction to BPMN." http://www.bpmn.org/Documents/OMG_BPMN_Tutorial.pdf.