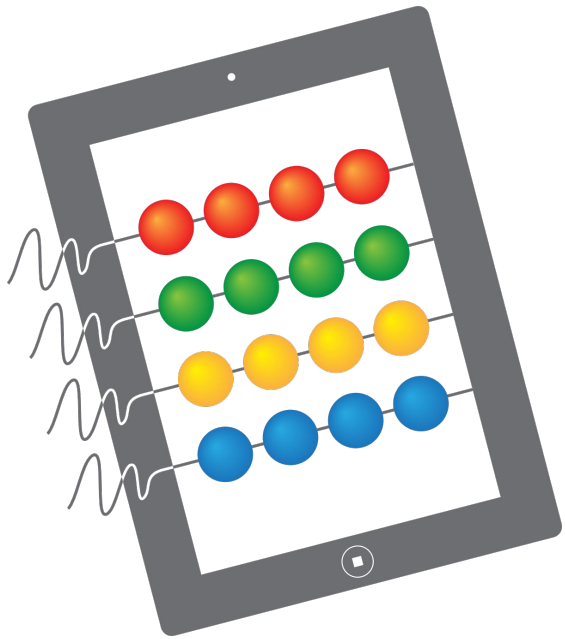# BPMN Modeling Guidelines

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    - Learn PAd
    - Understandable models
    - Literature

- BP modeling guidelines
    - Examples
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    - Measures
    - Thresholds

- Validation
    - Questionnaire

The context...

Learn PAd

Model-Based Social Learning for Public Administrations

EU Programme
FP7-ICT-2013.8.2 Technology-enhanced learning
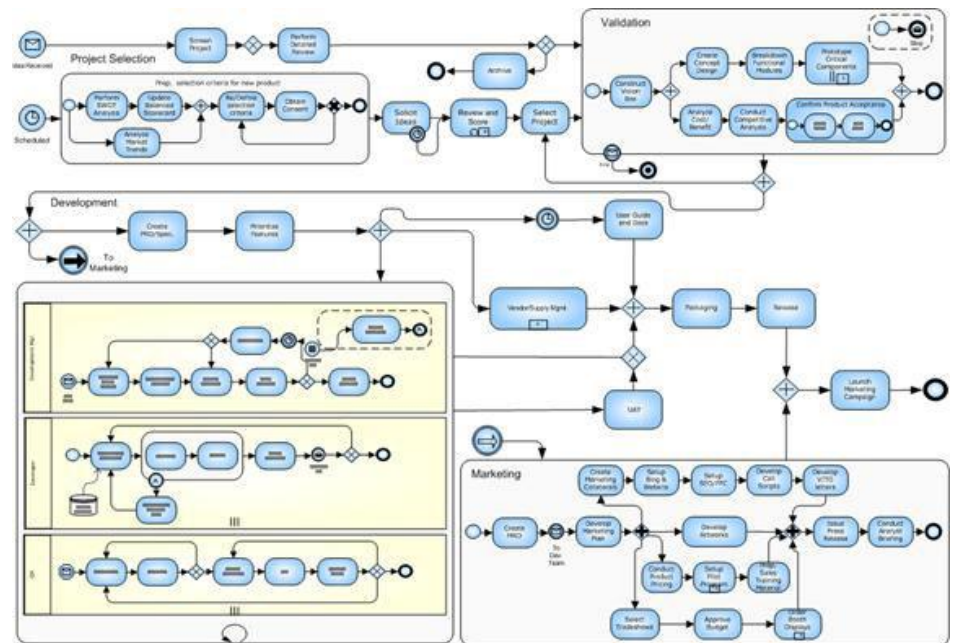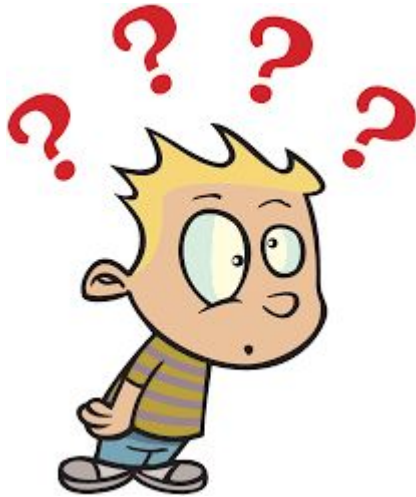
Learn PAd main goal

To provide a social and collaborative learning platform for civil servants.

Key aspects:

- e-Learning platform
- Wiki
- Business Process Models (BPMN)
- Web 2.0

Our job (in collaboration with the CNR of Pisa)

To guarantee that models used in the Learn PAd platform are <u>UNDERSTANDABLE</u>.

What happens?

It usually happens that someone studies the BPMN notation and "becomes a modeler". So he/she starts using the BPMN notation to model everything (and this is good) but in the wrong way.

He will probably design models that are too large, with too many BPMN elements and maybe they are used in the wrong way. Or there may be too much details, too much annotations which doesn't allow for a nice view of the process.

Note: if you use the BPMN syntax as it is described in the BPMN specification your model cannot be considered wrong. But if you want the model to be understandable by others you can say that there are "errors" in the model or at least that they could be improved.

So...

How can we guarantee that a model is

UNDERSTANDABLE?

&

How can we help the modeler to design

UNDERSTANDABLE models?

Literature - (1)

Silver, B.: BPMN method and style: with BPMN implementer's guide. 2. ed edn. Cody-Cassidy Press, Aptos, Calif (2011)

White, S. A. (2008). BPMN modeling and reference guide: understanding and using BPMN. Future Strategies Inc..

Silingas, D., & Mileviciene, E. (2011). Refactoring BPMN Models: From 'Bad Smells' to Best Practices and. BPMN 2.0 Handbook Second Edition: Methods, Concepts, Case Studies and Standards in Business Process Management Notation, 125.

Mendling, J., Reijers, H. A., & van der Aalst, W. M. (2010). Seven process modeling guidelines (7PMG). Information and Software Technology, 52(2), 127-136.

Mendling, J., Sanchez-Gonzalez, L., Garcia, F., & La Rosa, M. (2012). Thresholds for error probability measures of business process models. Journal of Systems and Software, 85(5), 1188-1197.

Literature - (2)

Guidelines - general rules which the modeler should follow to ensure the model he designs results to be understandable.

Metrics or **Measures** - what we use to refer to the amount or the size of something (e.g. the amount of BPMN elements used in a BP Model).

Thresholds - values that measures should not exceed to guarantee the BP Model is understandable.

What we did...

We collected and refined

- Guidelines (50)
- Measures
- Thresholds

Measures

Measure	Description	U*	M*
Measures of Rolón [72]			
TNSF	Total Number of sequence flows	X	
TNE	Total Number of events	X	
TNG	Total Number of gateways	X	
NSFE	Number of sequence flows from events	X	
NMF	Number of message flows	X	
NSFG	Number of sequence flows from gateways	X	X
CLP	Connectivity level between participants	X	
NDOOut	Number of data objects which are outputs of activities	X	
NDOIn	Number of data objects which are inputs of activities	X	
CLA	Connectivity level between activities		X
Measures of Cardoso [11]			
CFC	Control flow complexity. Sum over all gateways weighted by their potential combinations of states after the split	X	X
Measures of Mendling [52]			
Number of nodes	Number of activities and routing elements in a process model	X	
Gateway mismatch	Sum of gateway pairs that do not match each other, e.g. when an AND-split is followed by an OR-join	X	X
Depth	Maximum nesting of structured blocks in a process model	X	
Connectivity coefficient	Ratio of total number of arcs in a process model to its total number of nodes	X	
Density	Ratio of total number of arcs in a process model to the theoretically maximum number of arcs		X
Sequentiality	Degree to which the model is constructed from pure sequences of tasks	X	X

U*: Understandability, M*: Modifiability

Thresholds

Model Metric	Very Inefficient	Rather Inefficient	Rather Efficient	Very Efficient
N°nodes	65	50	37	31
GatewayMismatch	29	16	6	1
Depth	4	2	1	1
Coefficient of connectivity	1,7	1,1	0,6	0,4
Sequentiality	0,1	0,35	0,6	0,7
TNSF	72	49	34	20
TNE	20	12	7	2
TNG	17	10	5	0
NSFE	28	13	4	0
NMF	27	15	7	1
NSFG	40	22	11	0
CLP	7,5	4,23	2,2	0,2
NDOIN	31	14[5]	4	0
NDOOUT	23	11	3	0
CFCxor	30	17	8	1
CFCor	9	4	1	0
CFCand	4	2	0	0

Laura Sanchez-Gonzalez, Felix Garcıa, Jan Mendling, and Francisco Ruiz. Quality assessment of business process models based on thresholds. In *On the Move to Meaningful Internet Systems: OTM 2010*, pages 78–95. Springer, 2010.

Guidelines

- **General**: they impact on different aspects of the overall BPMN modeling practice

- **Notation**: they focus on the usage of the BPMN Syntax

- **Labeling**: the correct use of names/labels, assigned to BPMN elements

- **Patterns**: specific arrangements of BPMN elements

- **Appearance**: refers to a clear disposition of the BPMN elements in the entire model

BP Modeling Guidelines - General (1)

- Minimize model size

Guideline Name	Guideline ID
Minimize model size	2
Description	
The modeler should try to keep models as small as possible. Large process models are difficult to read and comprehend. Additionally, they tend to contain more errors. Defining the correct scope of tasks and level of detail of processes is key to reduce the overage of information.	
Source	
[7, 8, 27, 28, 29, 30, 31, 32, 26, 33]	
Associated Metrics and Thresholds	

$$MinimizeModelSize(x) = \begin{cases} 0 & if \quad SN <= 31 \\ 1 & otherwhise \end{cases}$$

where:
$x \in$ Nodes of BPMN Model $\wedge$
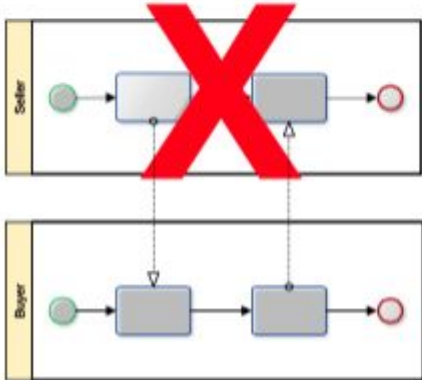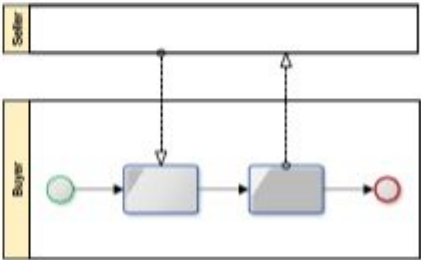SN is the number of nodes: number of activities and routing elements in a process model.
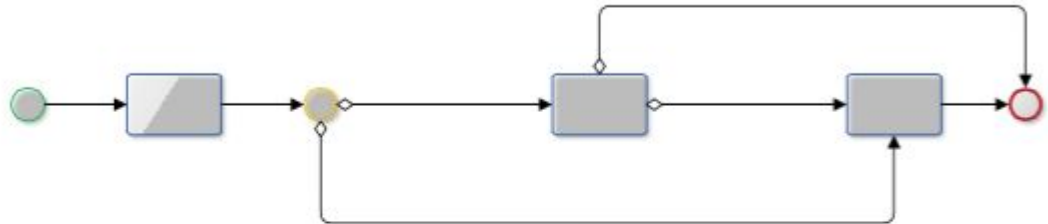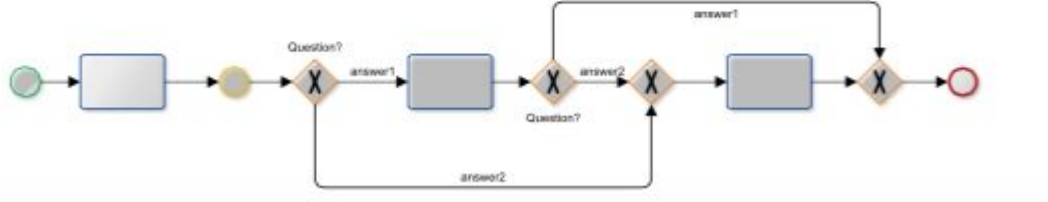
BP Modeling Guidelines - General (2)

- Apply hierarchical structure with SubProcesses

Guideline Name	Guideline ID
Minimize model size	2

Description

The modeler should try to keep models as small as possible. Large process models are difficult to read and comprehend. Additionally, they tend to contain more errors. Defining the correct scope of tasks and level of detail of processes is key to reduce the overage of information.

Source

[7, 8, 27, 28, 29, 30, 31, 32, 26, 33]

Associated Metrics and Thresholds

$$MinimizeModelSize(x) = \begin{cases} 0 & if \quad SN <= 31 \\ 1 & otherwhise \end{cases}$$

where:
$x \in$ Nodes of BPMN Model $\wedge$
SN is the number of nodes: number of activities and routing elements in a process model.

BP Modeling Guidelines - Notation (1)

- Explicit usage of gateways

Guideline Name	Guideline ID
Explicit usage of gateways	16

Gateway

Description

The modeler should split or join sequence flows always using gateways. The modeler should not split or join flows using activities or events. This includes that an activity can have only one incoming sequence flow and only one outgoing sequence flow.

Source

[36, 11, 7, 8, 26, 38]

Convention on the modeling

Bad Modeling

Good Modeling

BP Modeling Guidelines - Notation (2)

- Consistent usage of pools

Guideline Name	Guideline ID
Consistent usage of pools	10

Description

The modeler should define as many pools as processes and/or participants. Use a black-box pool to represent external participant/processes. The modeled pools need to be in relation with each other and have to be linked to the main process through message exchange.

Source

[36, 11]

Convention on the modeling

Bad Modeling

Good Modeling

BP Modeling Guidelines - Labeling (1)

- Labeling Activities

Guideline Name	Guideline ID
Labeling Activities	30

Convention concerning the name

Label activities with one verb, and one object. The verb used should use the present tense and be familiar to the organization. The object has to be qualified and also of meaning to the business. Multiple activities should not be labeled with the same name, except for same *Call Activities* used many time in the process.

Source

[9, 11, 7, 8, 39, 32, 26, 40, 41, 38, 33]

BP Modeling Guidelines - Labeling (2)

- Labeling XOR Gateway

Guideline Name	Guideline ID
Labeling XOR Gateway	34
Convention concerning the name	
Label XOR split gateways with an interrogative phrase (do not label XOR join-gateways). Sequence flows coming out of diverging gateways of type exclusive, inclusive and complex should be labeled using their associated conditions stated as outcomes.	
Source	
[11, 26, 40, 41]	

BP Modeling Guidelines - Patterns

- Use subprocesses to scope attached events

Guideline Name	Guideline ID
Use subprocesses to scope attached events	42
Description	
A subprocess with attached event enables to clearly define the scope of an event. If the response to the handling of an exception (in the use of boundary events) is the same for every activity within a contiguous segment of the process, the modeler should not attach the same boundary event to each of those activities and he should not represent the same exception flows multiple times. The correct way to model it is to enclose that segment in a subprocess and attach a single boundary event to the subprocess boundary.	
Source	
[38]	

BP Modeling Guidelines - Patterns (example)

- Before
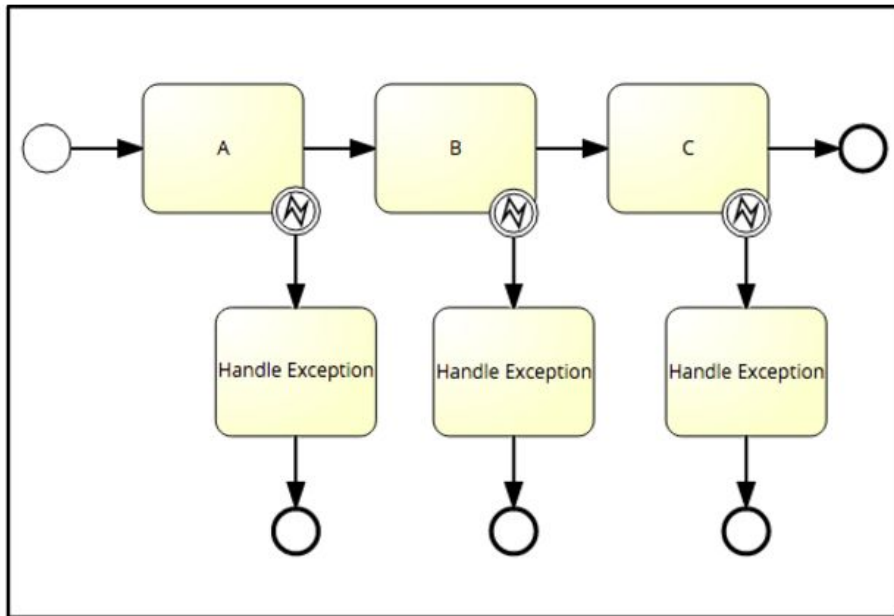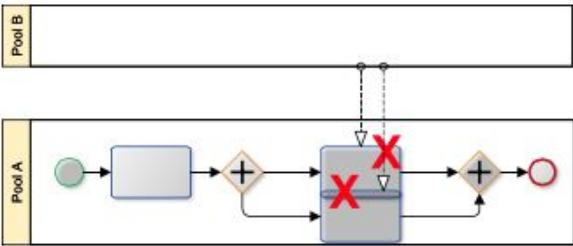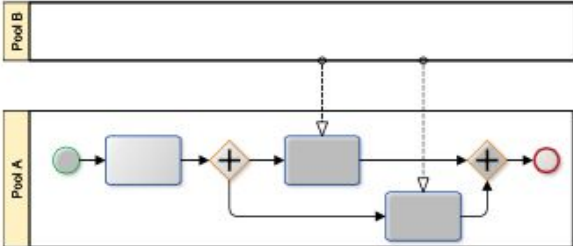
- After
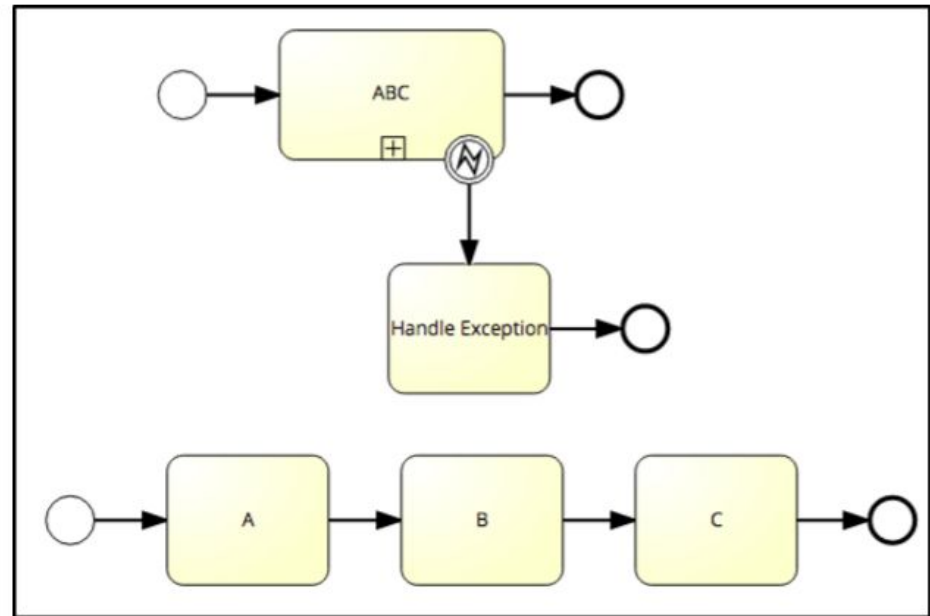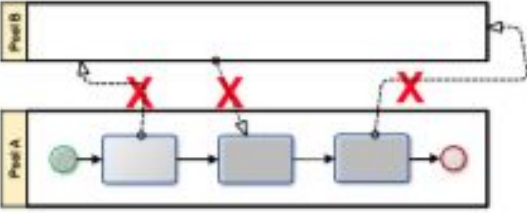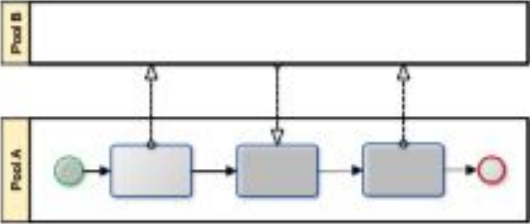
BP Modeling Guidelines - Appearence (1)

- Absence of overlapping elements

Guideline Name	Guideline ID
Absence of overlapping elements	44

Description

The BPMN elements should not overlap one another. Which means, avoid overlapping, or crossing, tasks, control flows, message flows etc.

Source

[36, 11, 26, 33]

Convention on the modeling

Bad Modeling

Good Modeling

BP Modeling Guidelines - Appearence (2)

- Linear Message flows

Guideline Name	Guideline ID
Linear message flows	46

Description

Linear message flows without useless foldings help to maintain the model clear.

Source

[36, 11, 33]

Convention on the modeling

Bad Modeling

Good Modeling

Guidelines Application
EPBR* scenario (e.1)
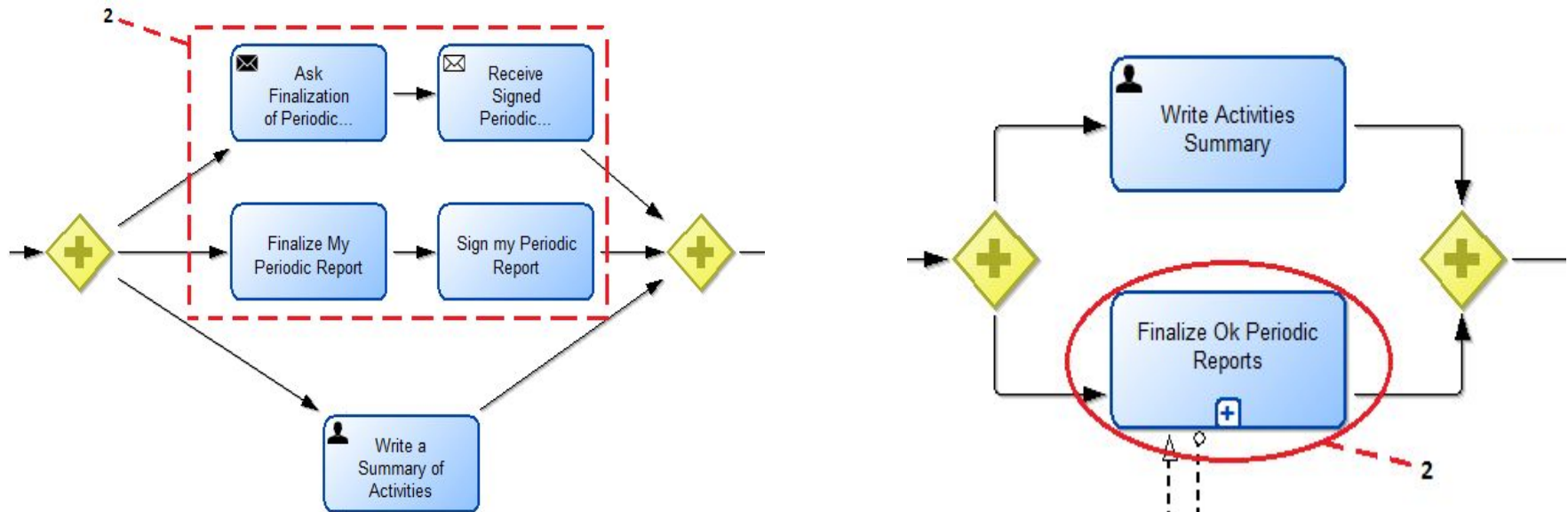
Activity referring to the same topic can be aggregated in a subprocess.
In this way we reduce the model size **(guideline 2).**

*EPBR: European Project Budget Report.

Guidelines Application
EPBR scenario (e.2)
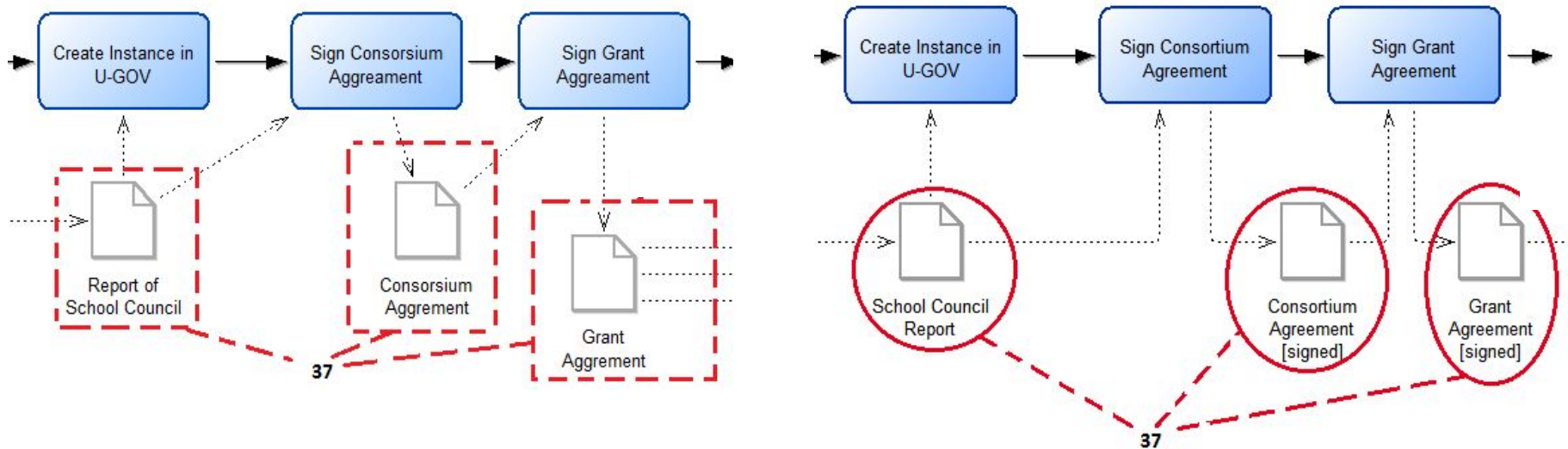
Data object should have a proper label (the data object states goes between square brackets [ ]) (**guideline 37**)

Guidelines Application - EPBR scenario (e.3)

- Before
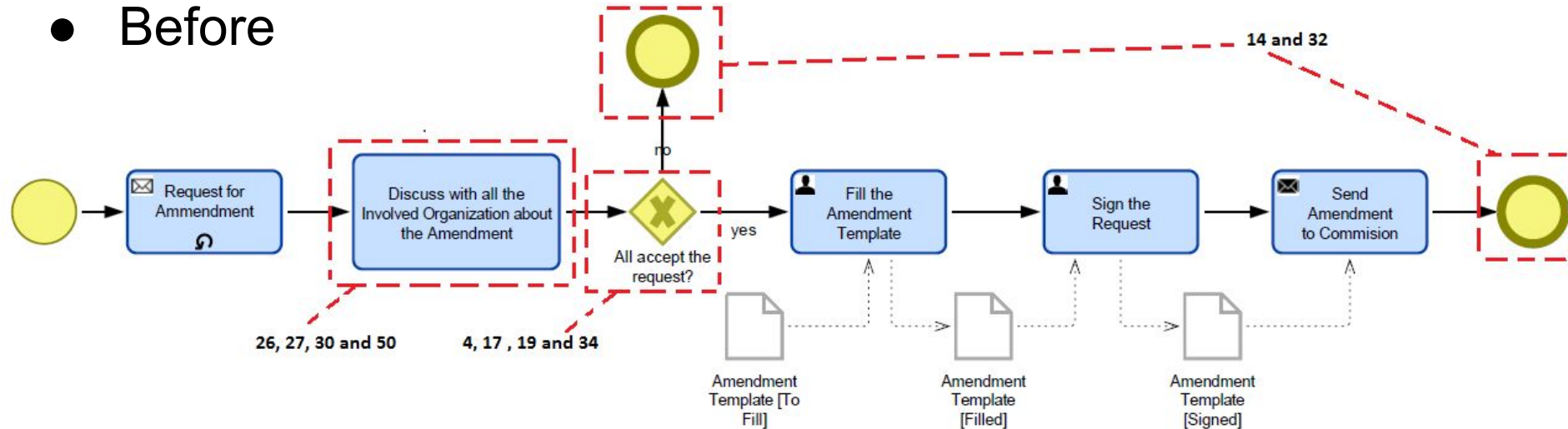
- Activities require proper labels with essential information, details can go into the activity description (**guidelines 26, 27, 30 and 50)**.
- The model should be as structured as possible, gateways should be balanced, Xor gateways should have a marker **(guidelines 4, 17, 19 and 34)**.
- If multiple end states are present they should be labeled, if they represent the same state, they should be merged. **(guidelines 14 and 32).**

Guidelines Application - EPBR scenario (e.3)

● After
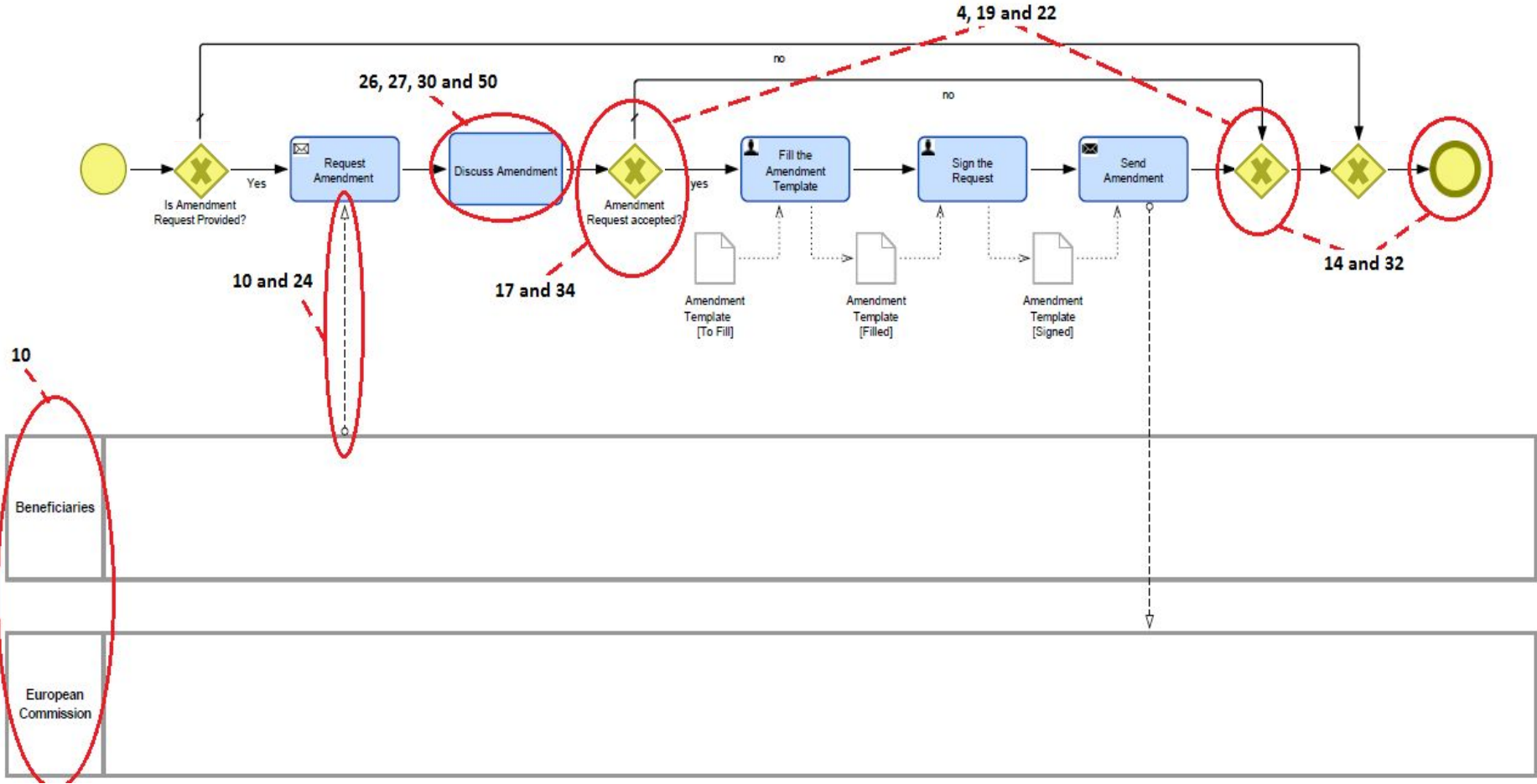
Validation

We defined a questionnaire to investigate the importance of the modelling guidelines for the design of understandable BP models. We had 76 participants including: students, BPMN experts, companies and civil servants.
An example of question and answers is reported below.

16. Observing the following Exclusive Gateway, do you think that the marker improves the understandability of the model?

- No, A - I prefer the Exclusive Gateway without marker
- Yes, B - I prefer the Exclusive Gateway with marker
- I don't know

22.2%

76.4%
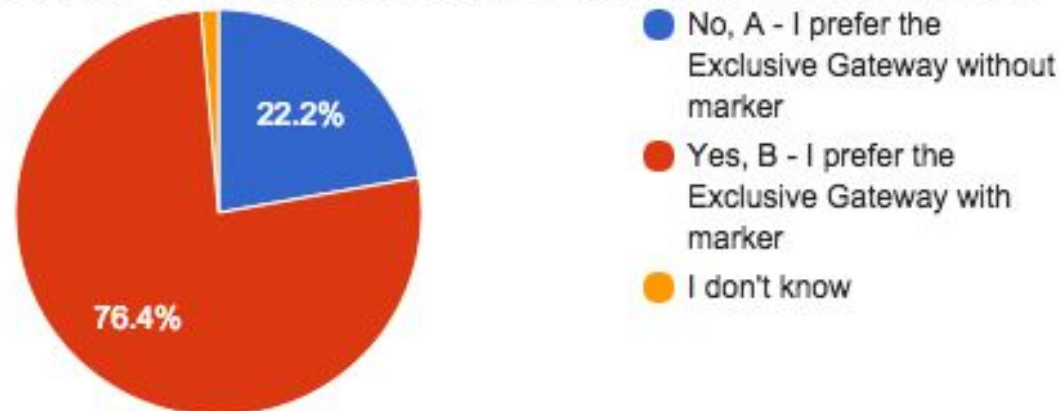
Validation - results

We analysed the overall answers to the questionnaire and we came to the conclusion that the answers by different profiles are quite similar.

The answers to the questionnaire comply with the vision that led us to the definition of the BPMN modelling guidelines.

After this questionnaire we can confirm that the usage of the defined modeling guidelines leads to the design of understandable BPMN models.

Technical Report

Corradini F, Ferrari A, Fornari F, Gnesi S, Polini A, Re B, Spagnolo G (2015) Quality assessment strategy: Applying business process understandability guidelines for learning. Tech. Rep. 4.1, ISTI-CNR, University of Camerino, Italy.

URL

http://puma.isti.cnr.it/linkdoc.php?idauth=1&idcol=1&icode=2015-TR-034&authority=cnr.isti&collection=cnr.isti&langver=it

BEBoP - understandaBility vErifier for Business Process models

Our collaborators from the CNR of Pisa, developed a webservice which enables us to upload a BPMN model, designed with Eclipse or Signavio BPMN modeler, and to test which guidelines the model respects and which not.

BEBoP - Excercises and Testing

To take practice with the Guidelines introduced, you can access the BEBoP webservice.

BEBoP website:

http://understandabilitybpmn.isti.cnr.it:8080/JSPUIUnderstandability/contentform.jsf

The End...

Thank You!

My contact:
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