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MODELING SUSTAINABILITY IN BUSINESS PROCESSES

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Subject : COMPUTING SCIENCE

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INTRODUCTION

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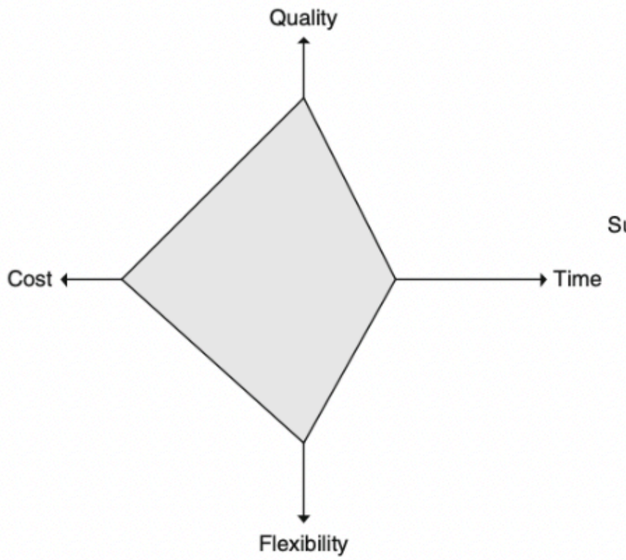
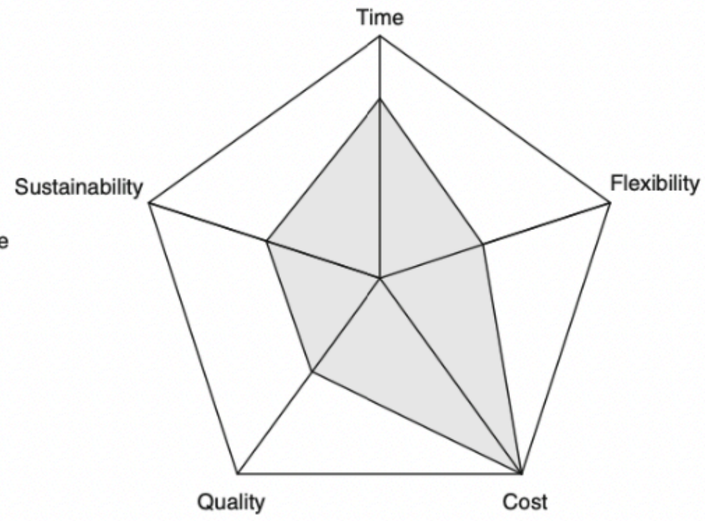
- **Growing environmental awareness and legal requirements push businesses to adopt sustainability.**
- **BPMN (Business Process Model and Notation) lacks built-in capabilities to represent sustainability metrics.**

Problem: BPMN lacks built-in capabilities to represent sustainability metrics.

Solution: Green BPM extends traditional BPM by integrating environmental objectives.

How can BPMN be extended to model environmental sustainability in business processes?



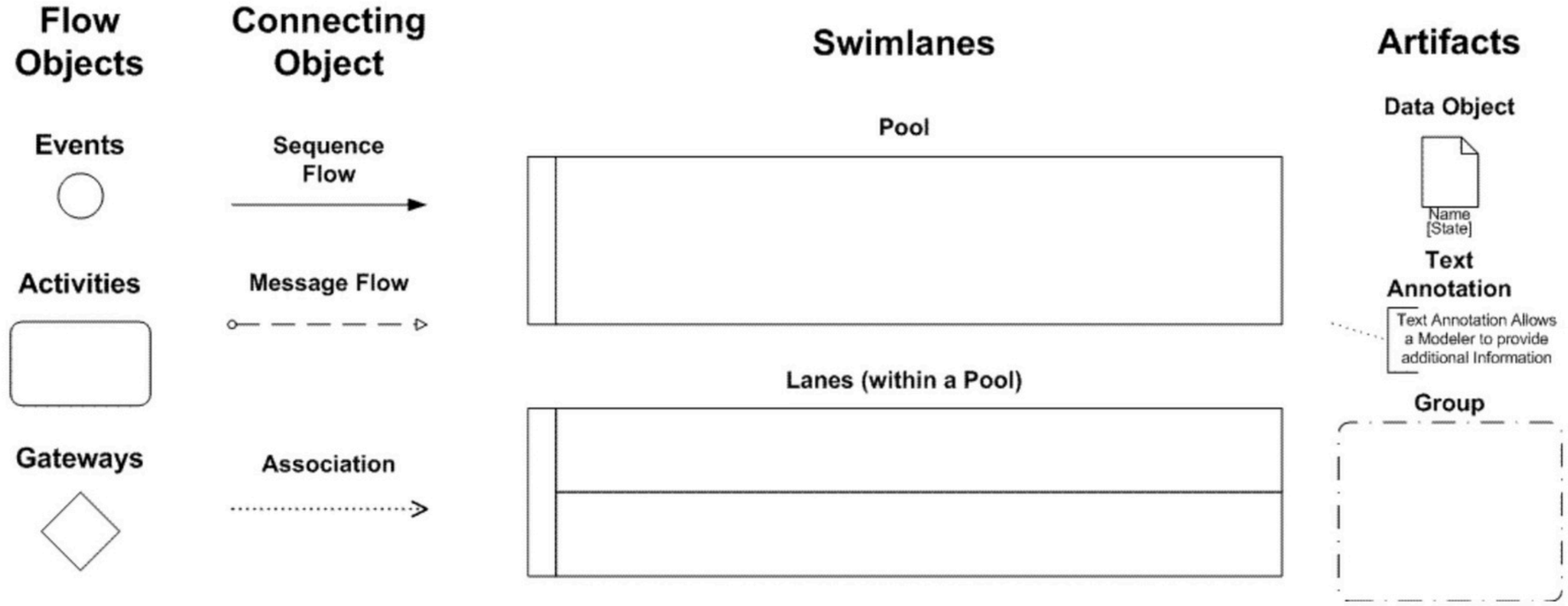


BPM = Business Process Management

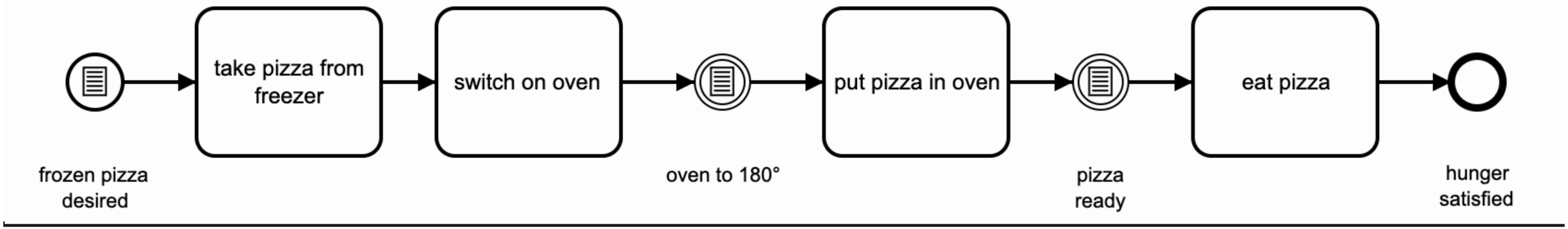
***The devil's pentagon extended**

*Reijers, H. A., & Mansar, S. L. (2005). Best practices in business process redesign: An overview and qualitative evaluation of successful redesign heuristics. Omega, 33(4), 283–306.

BPMN



Key Elements of BPMN. (n.d.). Camunda. https://camunda.com/bpmn/reference/



Example use of BPMN. (n.d.). Camunda. https://camunda.com/bpmn/reference/

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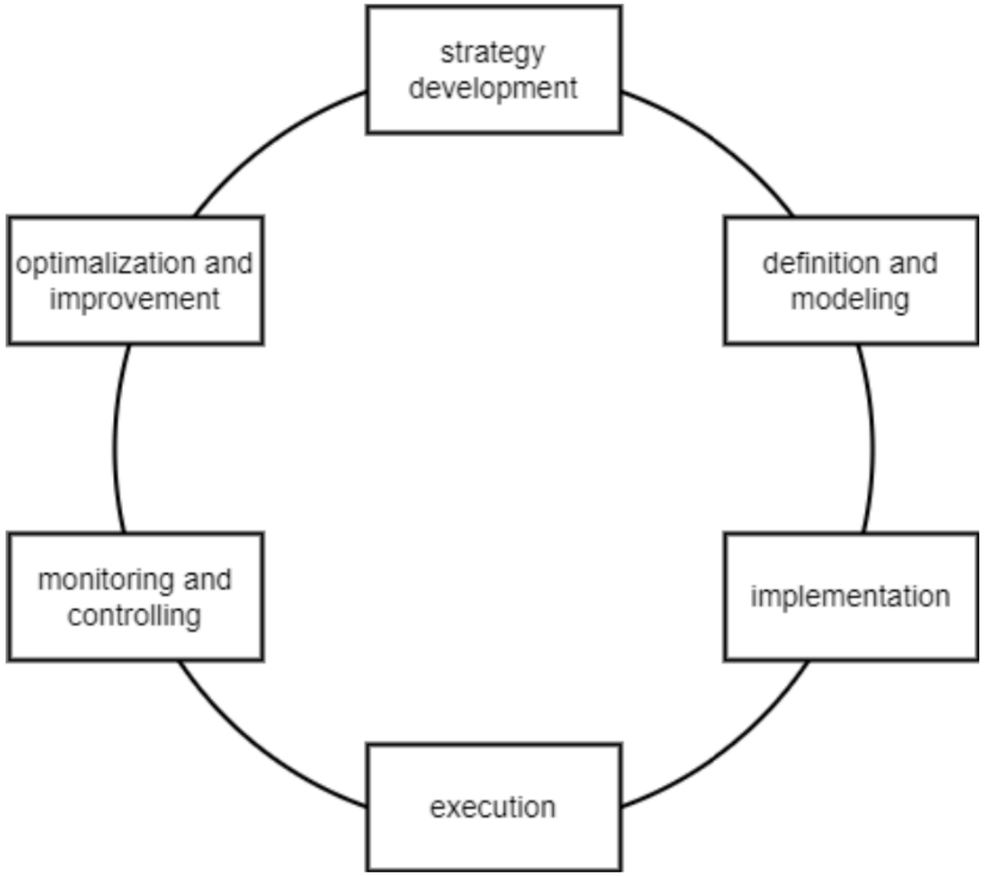
GREEN BPM



BPM life cycle for continuous process improvement *

- Green BPM extends traditional BPM by integrating sustainability metrics into process design and management.
- Focuses on minimizing environmental footprints while maintaining process efficiency.
- Encourages a culture of sustainability within organizations.

*C. Houy, M. Reiter, P. Fettke, P. Loos, K. Hoesch-Klohe, and A. Ghose, Advancing Business Process Technology for Humanity: Opportunities and Challenges of Green BPM for Sustainable Business Activities, pp. 75–92. Berlin, Heidelberg: Springer Berlin Heidelberg, 2012.

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INTEGRATION OF SUSTAINABILITY MODELING INTO BPMN

Category	Indicators	Description
Energy	Total energy	Total energy consumed
	Renewable energy	Wind, Solar, Run-Of-River Hydro, Reservoir Hydro, Wood, Food Products, Biomass from agriculture, Geothermal Energy
	Non-Renewable energy	Fossil (Hard Coal, Lignite, Crude Oil, Natural Gas, Coal Mining Off-Gas, Peat), Nuclear, Primary Forest (Wood and Biomass from primary forests)
	Indoor energy	Energy used for indoor activities
	Transportation energy	Energy used for transportation
	[Single source of energy]	Energy prodided by a source that could be particularly relevant for the business
Waste	Total waste	Total waste produced
	Recyclable waste	Waste rendered recyclable in Annex III of Directive 2008/98/EC
	Non-Recyclable waste	Wast redendered non-recyclable in Annex III of Directive 2008/98/EC
	Hazardous waste	Waste rendered hazardous in Annex III of Directive 2008/98/EC
	[Single waste material]	Single waste material produced in the process
Water	Total water withdrawal	Total water withdrawn
	Water Non-consumptive use	Water physically withdrawn from the environment and returned
	Water Use	Water use that either reduces the quality or quantity of water that is returned
	Water Pollution	Volume of water polluted, namely grey water
Emissions To Air	Total emissions to air	Total emissions to air
	GHGs emissions	Greenhouse gas emissions expresses in g of CO_{2eq} (CO_2, CH_4, N_20, 0_3, CCL_2F_2, CCl_2F_2, SF_6)
	CO_2 emissions	Amount of CO_2 emissions
	NOx and SOx emissions	Total emissions of nitrogen oxigens and oxides of solfur
	[Other single gas]	Amount of specific gas produced by the process relevant for the business

*the categories presented are non-exclusive; depending on the organization's criticalities, a choice can be made between the classifications proposed

Key Environmental Indicators

- **These indicators provide insights into the environmental impact of various business activities.**
- **KEIs are chosen based on their applicability to specific processes and their capacity to provide useful data.**

List of Key Environmental Indicators,

*V. van den Broek. Going greener through bpm: a method for assessing processes environmental footprint and supporting continuous improvement, Aug 2015.

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IMPLEMENTATION

EXTEND THE META-MODEL

EXTEND BPMN-JS

EXTEND THE META-MODEL

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  <xs:element name="transportationEnergy" type="MetricType" minOccurs="0"/>
  <xs:element name="singleSourceOfEnergy" type="MetricType" minOccurs="0"/>
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  </xs:extension>
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EXTEND THE META-MODEL

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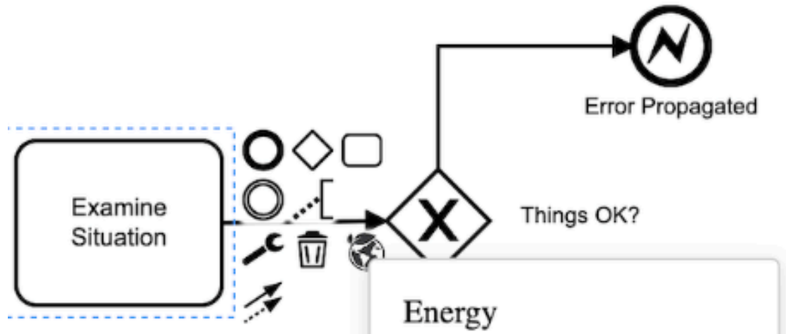
EXTEND THE BPMN-JS

CUSTOM CONTEXT PAD



Energy

- energyConsumption
- renewableEnergy
- nonRenewableEnergy
- indoorEnergy
- transportationEnergy
- [singleSourceOfEnergy]

Waste

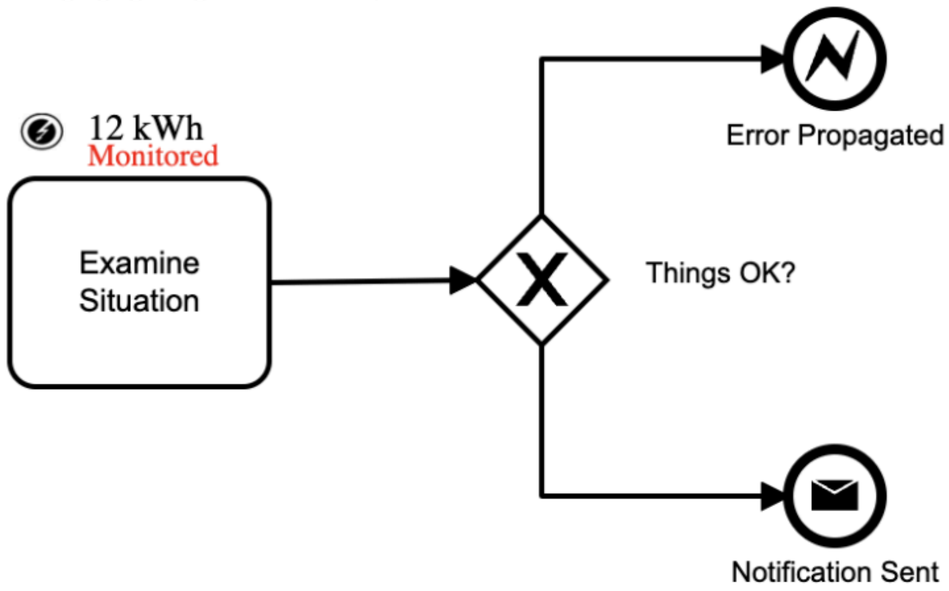
Water

Emissions

SAVE BUTTON

Save Diagram

CUSTOM RENDERER



DEMO

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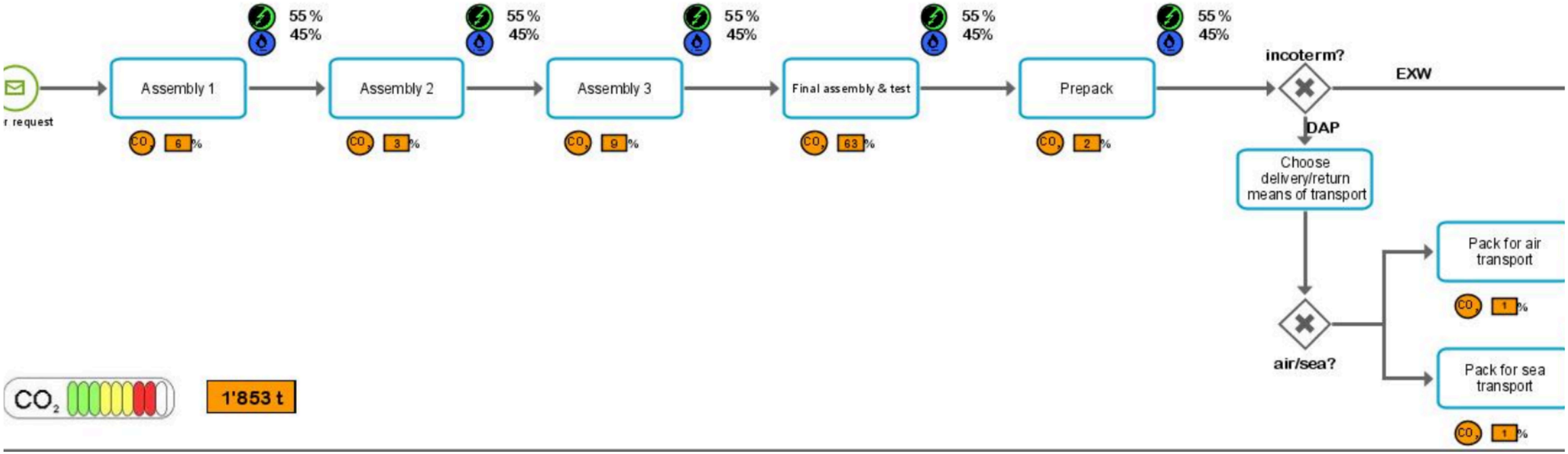

*Snippet of extended workflow

*V. van den Broek. Going greener through bpm: a method for assessing processes environmental footprint and supporting continuous improvement, Aug 2015.

CONCLUSION

- The thesis aimed to develop a custom extension module (smExtension) that integrates KEIs, such as energy consumption and carbon emissions, directly into BPMN diagrams.

- The BPMN 2.0 meta-model was extended by modifying the XML Schema Definition (XSD) to incorporate the most relevant sustainability metrics. Custom renderers and context pads were developed to enable users to assign, edit, and visualize KEI values in real-time within BPMN elements.

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FUTURE WORK

Enabling the assignment of multiple KEIs to a single task would allow for more detailed analysis of complex processes.

Enhancing the user interface for better accessibility across platforms, including mobile devices, could improve usability in various business contexts.

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Finish

THANK YOU

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