Enabling automation of BIM-based cost estimation by semantic web technology

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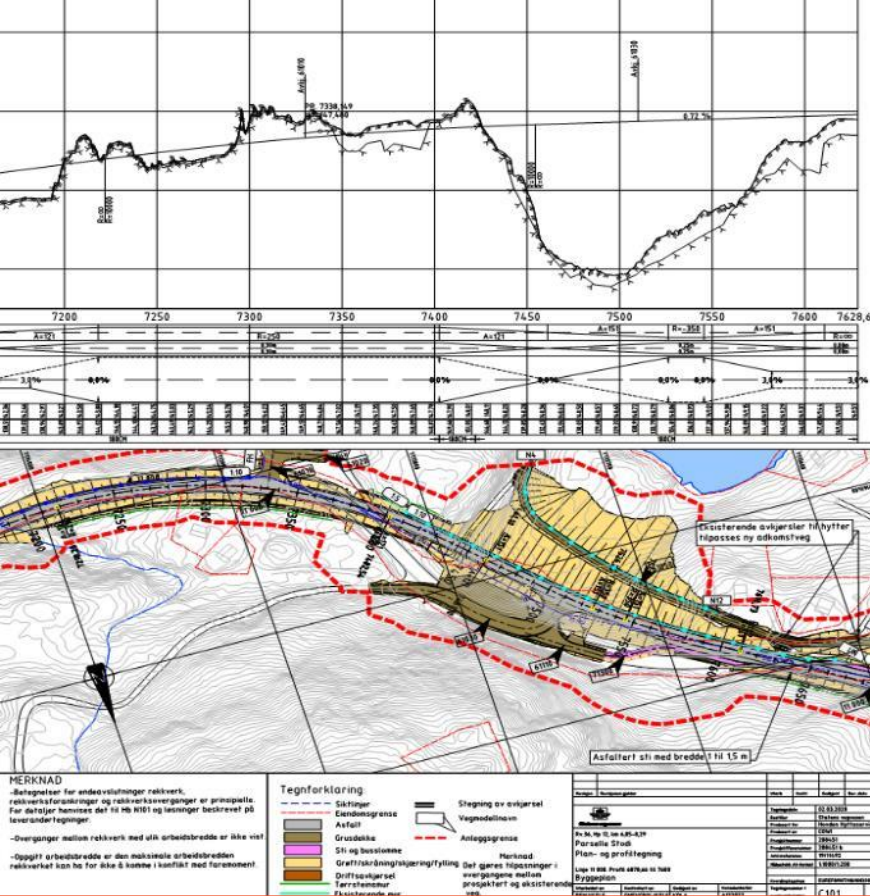**Lars Wikström**
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NTNU

The Research Council of Norway

COWI

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Use case cost estimation

- Labor-intensive

- Manual and repetitive task

- Prone to human error

- Dependent on data from different domains
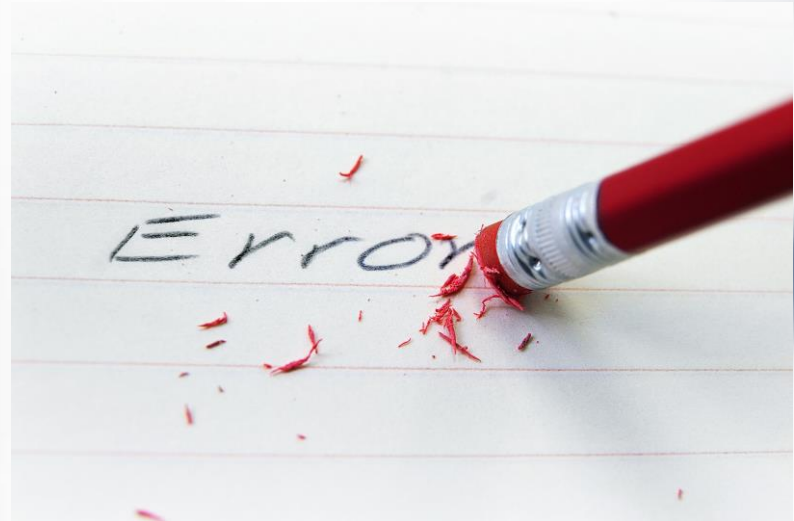
→ Huge potential for automation

Research questions

RQ1: How can semantic web technology support automated cost estimation?

**RQ2:** What are the challenges when using semantic web technology?

Norwegian specification of work

COWI

1. Classifies work processes not objects

2. Consists of 9 main processes divided into 3 parts

3. Contains a code, a title, a unit and requirements

84.411 *Leveling with concrete on soil*
a) Includes delivery and casting of screeds on soil.
b) Concrete quality of at least B30 M60 pursuant to NS-EN 206+NA.
c) The entire foundation contact area and a minimum distance of 150 mm beyond this area shall be levelled with concrete. The thickness shall not be less than 50 mm anywhere.
d) The screeding precision shall be such that the requirements for safe covering of the reinforcing in the foundation are clearly fulfilled.
x) The quantity is measured as the net projected area, including the area up to 150 mm outside the contact surface of the foundation.
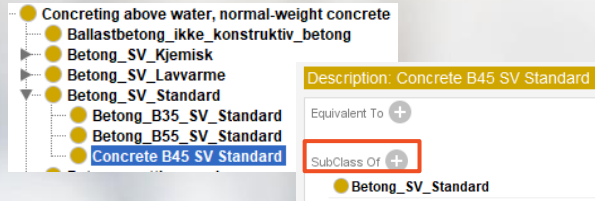**Unit:** m2

PDF (XML)
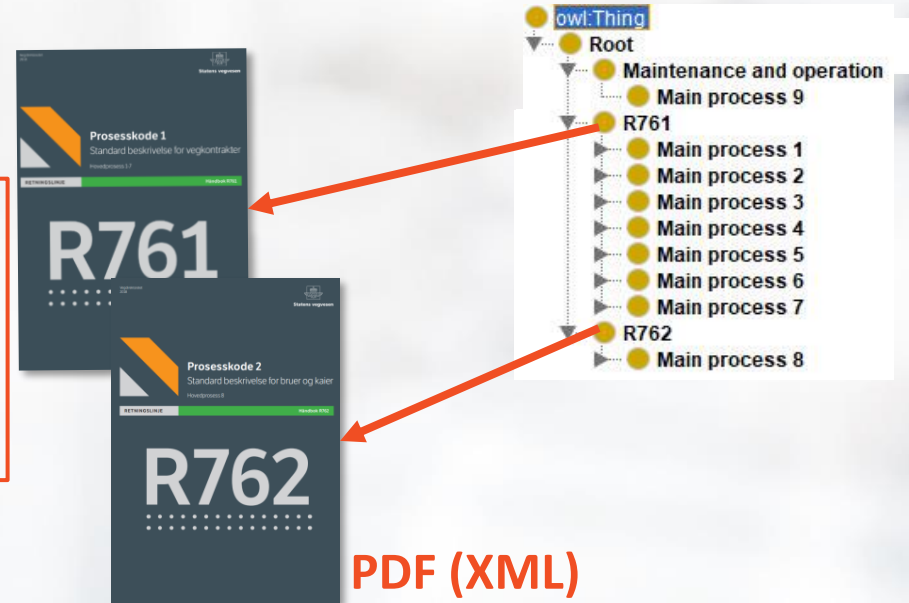
Method

Design Science Research

Ontology serialized in TTL format

➢ Code
➢ Title
➢ Unit
➢ Requirements (letters a-x)

Results RQ1 - How can semantic web technology support automated cost estimation?

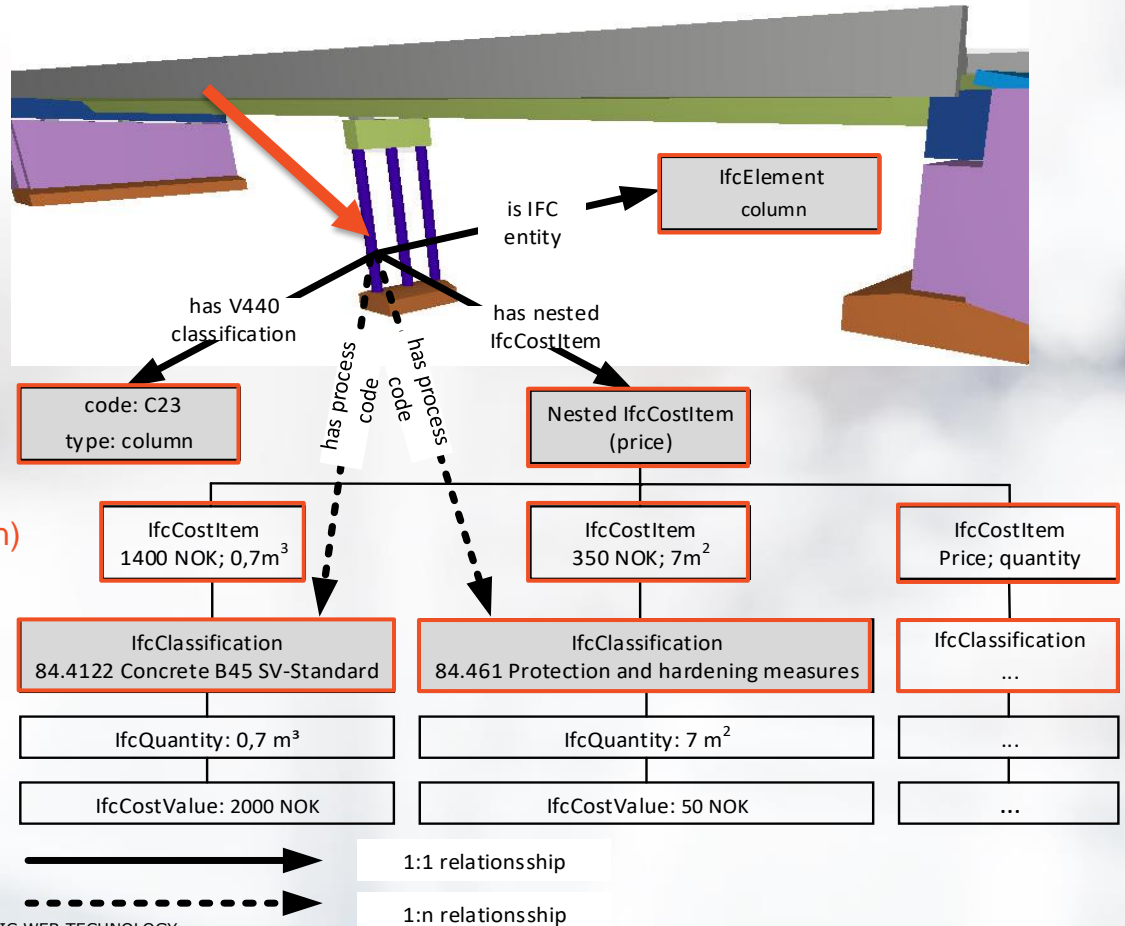- Product- and process-based:
  - IFCowl

- Product-based:
  - V440 (Norw. bridge classification)

- Process-based:
  - R761/R762

Results RQ1 - How can semantic web technology support automated cost estimation?

PDF (XML)

	INFO						
	(M) Column.0.2						
Identification	Location	Quantities	Material	Profile	Relations	Classification
Hyperlinks	BaseQuantities	Pset_ColumnCommon	R761_R762	Tekla Common	Tekla Quantity

Property	Value
000_R761_R762_Code_all	84.4122;84.461
001_R761_R762_Code	84.4122
001_R761_R762_Label	Concrete B45 SV-Standard
001_R761_R762_URI	http://rdf.vegdata.no/test/r761_R762-owl#concrete_B45_SV_Standard
002_R761_R762_Code	84.461
002_R761_R762_Label	Protection and hardening measures for formwork surfaces
002_R761_R762_URI	http://rdf.vegdata.no/test/r761_R762-owl#protection_and_hardening_measures_for_formwork_surfaces

Results RQ2 - What are the challenges when using semantic web technology?

- Conversion of number-based classification system

- No underlying logic in the form of a taxonomy

- Generalization of the ontology is somewhat limited

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Discussion

1. Well-known and logic in the context of road construction in Norway

2. Hinders full interoperability to other domain knowledge

3. **HOWEVER:** linked a national (V440) and international (ifcOWL) ontology via a proxy (nested IfcCostItems)

Conclusion

- Picking low hanging fruits

- Applicable in commercial software

- Complements IFC step files

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Further work

- Publish in a triple store

- Test by software developers (APIs)

- Full taxonomy-based ontology

Thank you for your attention!

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