Ontology Driven Model for Environmental Legislation Knowledge Based System : UK Context

LUT Lappeenranta University of Technology

PERCCOM Erasmus Mundus

Introduction

- Environmental awareness has been increasing rapidly over the past couple of decades. However, only in last 10 years or so the construction industry in UK has really started to consider its environmental impacts
- Around **47%** of total UK carbon emission comes through both construction and the operation of buildings. (Fig. 1)
- Government and Construction Industry meet join strategy for sustainable construction following Environmental Legislations
- It's a challenge for Stakeholders to comply with wide range of UK Environmental Legislations (more than 100 with sub categories) as there's no existing **knowledge base**
- Development of such a knowledge base would increase compliance and put significant impact on environment and sustainability

CO2 Emissions from construction industry in the United Kingdom (UK) from 1990 to 2015
(in 1,000 metric tons)

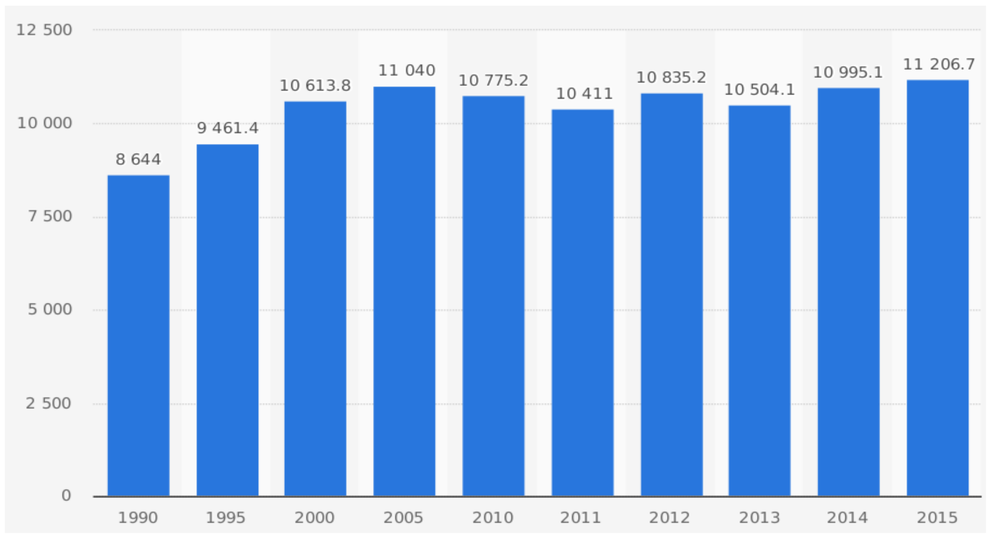


Fig 1: (Source- Office for National Statistics UK, Ricardo-AEA; 1990 to 2015)

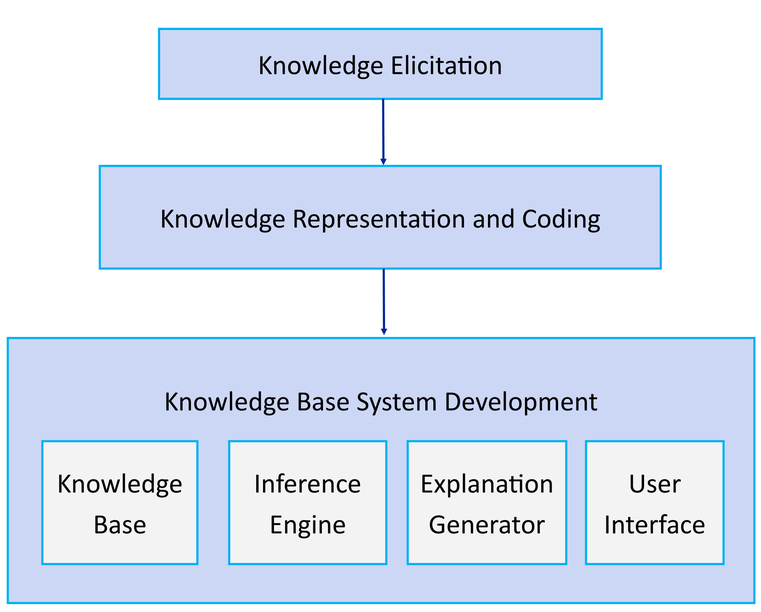
Objectives

- Conduct user requirement analysis and survey of all relevant environmental legislations
- Develop an ontology-driven environmental legislations knowledge-based system for building design and constructions.
- Integrate inference engine, explanation generator and UI with the knowledge-based system.

Research Questions

- What type of ontology will be appropriate for this research?
- What type of inference mechanisms will be suitable for the knowledge-based system?
- How to effectively manage the ontological representations in the knowledge base?
- What are the metrics to evaluate the quality of the ontological representations?

Methodology



Proposed Architecture

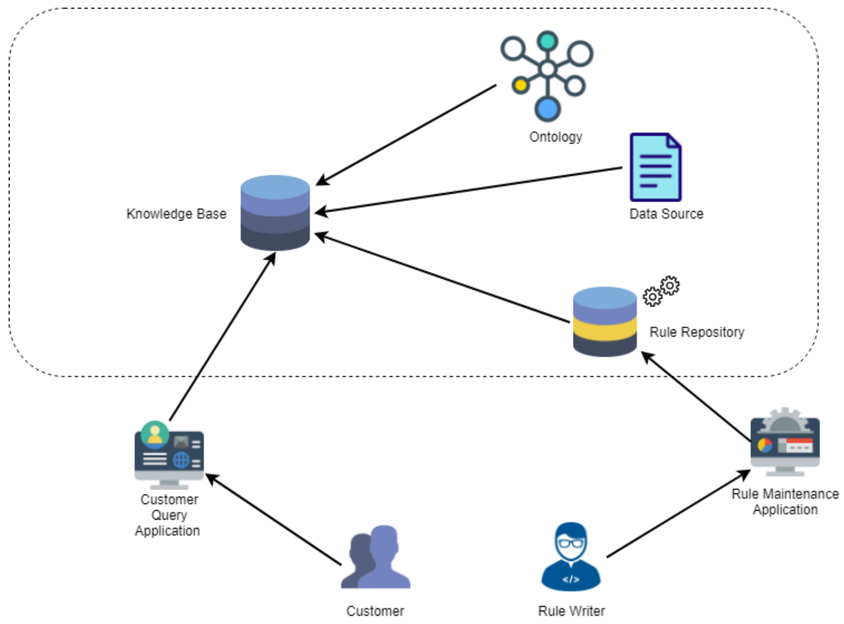


Fig 2: Proposed architecture of the system

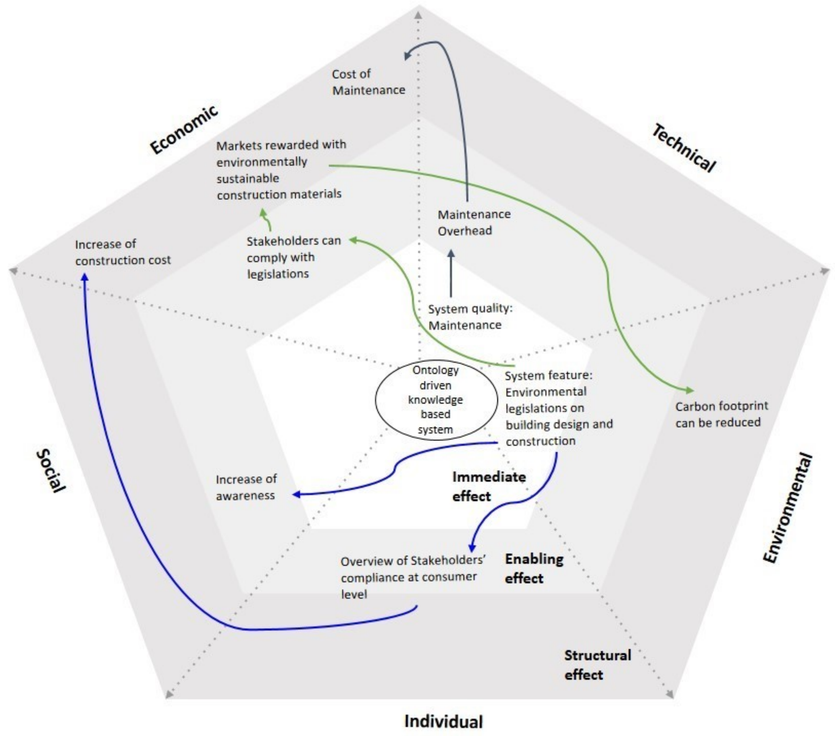
Findings in Current Literature

- To work with heterogeneous data sources Ontology is more efficient comparing to RDB [5]
- Till date, less work has been done building Knowledge base of environmental legislations
- Modern information systems are moving from 'data processing' to 'concept processing' [1]
- Evaluation of an ontology is a challenge [3]

Related work that have been done so far -

- An Environment Ontology for Global City Indicators (Dahlia et al. 2013)
- Ontology-Based Representation and Reasoning in Building Construction Cost Estimation in China (Xin et al. 2016)
- Using ontologies for comparing and harmonizing legislation (Alexander et al. 2003)

Sustainability Analysis



Future Work

- Developing Ontology
- Scoping developed ontology
- Knowledge base development
- Inference engine development
- Interface design and implementation

References

[1] K. Munir and M. Sheraz Anjum, "The use of ontologies for effective knowledge modelling and information retrieval," *Appl. Comput. Informatics*, Aug. 2017

[2] H. Hlomani and D. Stacey, "Approaches, methods, metrics, measures, and subjectivity in ontology evaluation: A survey," *Semant. Web J.*, vol. 1, pp. 1–5, 2014

[3] J. Brank, M. Grobelnik, and D. Mladenić, "A survey of ontology evaluation techniques", 2018

[4] C. Becker *et al.*, "Requirements: The Key to Sustainability," *IEEE Softw.*, vol. 33, no. 1, pp. 56–65, Jan. 2016

[5] C. Martinez-Cruz, I. J. Blanco, and M. A. Vila, "Ontologies versus relational databases: are they so different? A comparison," *Artif. Intell. Rev.*, vol. 38, no. 4, pp. 271–290, Dec. 2012.

CONTACT

Md Anisul Islam
Lappeenranta University of Technology
anisul.iut@gmail.com

SUPERVISORS

Prof. Colin Pattinson
Leeds Beckett University, UK

Dr. Ah-Lian Kor
Leeds Beckett University, UK

Prof. Chris Gorse
Leeds Beckett University, UK

Leeds Beckett University · Université de Lorraine · ITMO University · Luleå University of Technology · Erasmus+