Common Action

Achieving Sustainability in Industry 5.0 with the Core Ontology for Sustainable Resource Accounting

Problem Statement

Societies globally are increasingly recognizing the need for sustainable resource usage and CO_2 emissions reductions. Responsibility for reducing natural and energy resource consumption as well as waste byproducts falls directly on industry participants; how well our societies progress toward environmental and social sustainability targets will be largely determined by the ability of individual firms to identify and enact needed changes.

This is, however, a tremendous challenge; sustainability is a new context, at odds with prevailing industry norms and incentives. Neither best practices nor opportunities for transformation are well-recognized, and leadership is generally stymied by insufficient expertise within the market.

Additionally, some transformations require collaboration across and between industries, which takes concerted and unprecedented efforts, which are easiest to undertake if directed towards specific goals and outcomes.

Proposed Solution

These barriers can be addressed through AI-supported knowledge technology based on the Semantic Web Layer Stack (Figure 1), specifically targeted towards creation of a knowledge base of collective communications sharing system-wide information. Such a system could support decision-makers, through:

- the identification of resources used within industry
- the sharing of progress and learnings made along change journeys
- ollective setting of priority reduction targets, in context of changing market and socio-environmental conditions

We envision a core ontology featuring terminology for companies to explicitly track the number and type of resources utilized, and manufacturing and distribution steps conducted. The collected data can be used to populate an accounting of resources used across the economic system, which can inform the decisions of a wide range of industry and cross-sector participants, as detailed below.

As an added benefit, the collective nature of our global sustainability challenges presents a unique opportunity for widespread adoption of a single, interoperable core ontology. This ontology could later serve as a foundational semantic framework for companies and industry associations to further develop domain-relevant vocabularies--expanding the usage of semantic technology without fracturing the capacity for communication between domains.

Expected Outcomes

1

Challenge #1: Illuminating total resource usage throughout the economy
The core ontology will represent the resources, materials, and processes that are used and undertaken throughout the economy. Company representatives will be enabled to share data about their processes, producing collective data about what materials are being used, in what quantities, where, and by whom, for what purpose.
This information will illuminate resource consumption along three tiers:

- Throughout an entire company and supply chain, enabling companies to meet new regulations, requiring reporting across their entire production cycle (as in Germany).
- Throughout an entire industry, enabling comparison between industries for ESG investors.
- Throughout the economy, providing an estimate of the entire volume and rate of resource usage throughout the economy, enabling the identification of priority areas for regulators and resilience project developers.

2

Challenge #2: Identifying priority areas for reduction, transformation and innovation targets.
Illuminating a collective view of industry activities will support various actors to converge around shared priorities, enabling:

- Progress towards circular industries, through the identification of existing oaps in looped cycles.
- Flagging of resource-intensive processes for transformation or innovation both within industry and for outside partners, such as startups.
- Identifying participants and items related to very specific initiatives, such as the identification of fossil-fuel-powered machinery that needs to be replaced as part of climate mitigation efforts.

3

Challenge #3: Enabling collaboration between multiple sectors to execute reduction, transformation, and innovation targets.
Swiftly and effectively reaching reduction, transformation and innovation targets will involve communications between multiple parties. We intend to combine the Core Ontology for Sustainable Resource Accounting with a communications platform, similar to LinkedIn, to enable multi-sector partnerships and collaborative activities. Industry participants will be able to:

- Collaborate with competitors and industry associations to develop strategies to increase the sustainability of standard operating practices across the entire industry
- Enable discussion across industry about shared resources--such as communications from natural resource suppliers to manufacturers
- Enable contributions from support roles, such as non-profits, entrepreneurs, and academics, consultants, around company and industry needs and challenges
- Align industry and company investments with governmental classification systems and regulations

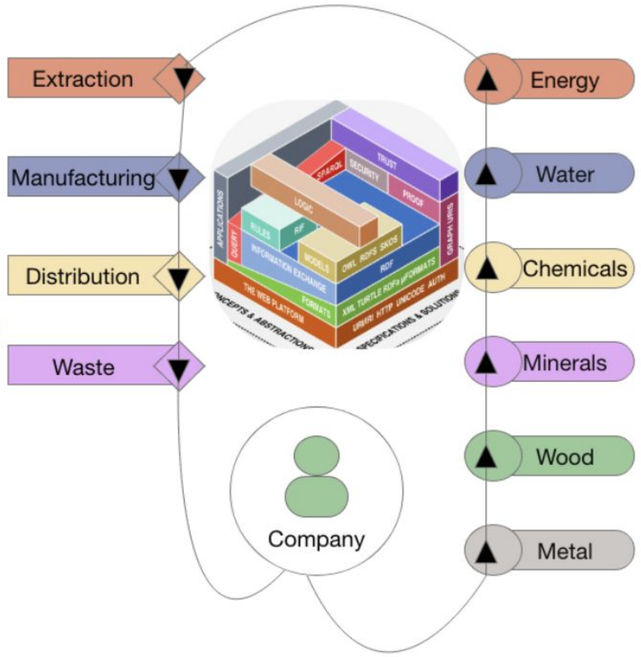

Figure 1: Sustainability based on the Semantic Web Layer Stack (CC, Jim Hendler)

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Methodology

Ontology Scope
The Core Ontology for Sustainable Resource Accounting will serve as a core ontology to semantically and uniformly describe resources (i.e. raw material), their life cycle, their carbon footprint and the overall impact they have in sustainability. The ontology is antagonistic to the domain but flexible to be aligned and linked with other domain specific ontologies and standard ontologies.

Ontology Life Cycle

- Problem analysis through literature review, focus groups, interviews with domain experts, and questionnaires.
- Knowledge extraction in terms of key and in common entities, relations and other insights between these multidisciplinary domains.
- Implementation of a formal model in Web Ontology Language (OWL).
- Continuous ontology evaluation from the domain experts, open community and tools.

After reaching a stable stage the ontology will be continuously enriched and maintained using manual and AI based approaches.

Use Cases
The Core Ontology for Sustainable Resource Accounting can be explored in a wide rage of use cases such as:

- *Circularity Passport* to support the classification of resources and take action on identified non environmental friendly resources.
- Life cycle assessment of product manufacturing (i.e. manufacturing production line).
- Optimisation of supply chain.
- Impact on sustainable products design through early stage design optimisation.
- Prediction of new pathways to waste treatment.

Conclusion

The Sustainable Resource Use Core Ontology supports industry participants to:

- Visualize resource consumption patterns at macro scale
- Facilitate the Industrial Symbiosis process.
- Set priorities to set reduction, transformation, and innovation targets
- Collaborate across industries and sectors to reach reduction, transformation and innovation targets and share best practices
- Power decision-support tools, such as lifecycle assessments, for investors, consumers, and other parties
- Reach clean energy and resource targets more swiftly and cost effectively
- Knowledge discovery of hidden links and insights.

ABOUT US

Common Action is an innovation network facilitating climate and sustainability action with data and technology. Our mission is to build connections between companies, non-profits, academics, entrepreneurs, government, citizens, and more, to produce a coherent, collective force across society for responding to urgent global priorities. We endeavor to surface macro-scale information about sustainability challenges, to enable the setting of collective action targets and 2) to build cross-domain connections to increase the impact, speed, and consistency of the globe's collective action efforts.

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