

A proposal for a LCA community knowledge management system

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ABSTRACT

Practitioners conducting life cycle assessments are uniquely dependent on data collected or published by their colleagues. To meet the LCA community's strong need for transparent, quality, regionally-relevant data, this paper proposes the development of an online LCA-community knowledge management system (KMS). An online LCA-community KMS could provide the means for the global LCA community to collaboratively create, store, review and compare LCI data. In conjunction with the LCI data store the KMS could provide for an online publication knowledgebase with the ability for authors to provide further clarification of the data collection and analysis methods used in their publications. Finally, an LCA-community KMS could adapt features of various social software applications to provide even more avenues for members to collaborate, to share and to learn from one another.

Keywords: online community, knowledgebase, LCA, LCI, knowledge management system

1. Introduction

It no longer takes an organisation to have an organized effort. With today's Internet technologies, anyone with an Internet connection can easily publish knowledge and collaboratively create and share data (Shirky, 2008). The free open source software (FOSS) movement introduced this way of working together. Open source programs are developed by teams of volunteers. The source code for these programs is made available to the general public. Linux, Apache and Firefox are just three of many open source products created by the FOSS community which successfully compete against their commercial equivalents. The open source development model is based on the simple formula that many developers working in concert can achieve more than the same number of developers can achieve by working alone.

Today's prevalence of social web applications have now made this open collaboration and sharing of knowledge available to the general public. Blogs, forums and wikis are available for almost any topic of interest. Users from anywhere on the globe can share ideas and knowledge. Sites like Flickr, Picasa and Panoramio allow their members to share photos. Digg allows its members to share and rate content found anywhere on the web. Serving as a collaborative news website, all of the content on Digg - from news to videos to images - is submitted by its community members.

The power to collaboratively create and share knowledge should also be available to the global LCA community. Each member's individual contributions could be collected into an online knowledge management system (KMS) incorporating areas for LCI data and a publication knowledgebase. Each individual member's contribution added to the collective

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knowledge creates a richer knowledgebase of ideas and data than would be available to any one member working alone (Bell, 2009).

2. Purpose of the research and research questions

2.1. Background

Practitioners conducting life cycle assessments are uniquely dependent on data collected or published by their colleagues. A Life Cycle Assessment (LCA) of even a modest product supply chain can easily require data for hundreds or even thousands of unit processes. This amount of data collection is beyond the budget and time scope of almost all individual LCA projects.

Consequently practitioners source data from wherever they can find it. Commercial databases with regionally based data will most likely have to be modified. Journal or conference publications have paper length restrictions that lead to insufficient descriptions of methodological choices. Sometimes processes are deemed to be insignificant, or at least unavailable, and their data are simply omitted (Gnansounou, Dauriat, Villegas, & Panichelli, 2009; Suh *et al.*, 2004).

The LCA community has a strong need for transparent, quality, regionally relevant data. LCA practitioners need to be able to objectively review and compare data based on data collection and analysis methods. Several commercial and government sponsored projects are underway to address this data shortfall. However, most efforts are still regionally focused and data availability is still limited.

This paper proposes a parallel and complementary approach to meet the needs of the LCA community - the development of an online LCA-community KMS. The objectives of the online community KMS include

- to supply the means and online tools for the LCA community as a whole to objectively create, review and compare data;
- provide the means for an online publication knowledgebase to be created where authors can provide further clarification of the data collection and analysis methods used in their publications;
- provide the means and online tools for members of the LCA community to share unit process data, to register interest in specific types of data and to form data interest groups whose objective is to create and share data which follows a consistent protocol.

2.2. Research questions and strategy

The proposed LCA-community KMS is at its core an information system. Its development will therefore follow a typical Systems Development Life Cycle (SDLC): initiation and planning, requirements gathering and analysis, systems design, development, testing, implementation, and maintenance. This paper discusses the first two phases of the SDLC.

The first phase in the SDLC is initiation and planning. This phase defines a need and identifies the scope of the system to be developed to meet this need. The LCA communities need for transparent, quality, regionally relevant data and the scope of the proposed system were discussed above.

The second phase, requirements gathering and analysis, involves communicating with key stakeholders to establish a group consensus on the system's requirements. To fulfil this phase, input will be sought from the LCA community to assist in identifying a list of system requirements based on the following research questions:

- RQ1:** What features must the KMS possess to motivate members to identify with and become active participants of their online community?
- RQ2:** What types of capabilities must the KMS provide to meet the LCA community's need for transparent, quality regionally relevant data?
- RQ3:** What types of activities must the KMS facilitate to enable members to collaborate with, to share and to learn from one another?

A requirement gathering typically uses an iterative feedback technique to obtain the most reliable group consensus. The process usually starts with a brainstorming/open-ended solicitation of ideas and ends with as close to a group consensus as is feasible.

In the interest of starting the brainstorming of ideas, the rest of this paper discusses the authors' personal opinions of some of the features, capabilities and activities that could be incorporated into the LCA-community KMS.

3. A LCA-Community KMS

A knowledge management system refers to a system for managing knowledge in organizations. A KMS provides support for the creation, capture, storage and dissemination of information.

Business and government policy makers increasingly base their decisions on published LCA reports. LCA practitioners themselves frequently use the published results of other papers for comparisons to their results or even as sources for missing data.

For LCA results to be transparent and comparable the reader needs all relevant information concerning the inventory data selected, the assumptions made to complement unavailable data and modelling choices about system definition and boundaries, functional units, reference systems and allocation methods. Unfortunately, whether due to lack of data or insufficient space to fully report all of the methodological choices made, many LCA publications provide insufficient information to make such quantitative comparisons with any confidence.

3.1. Publication Knowledgebase

An online LCA-community KMS can provide a place for LCA practitioners to provide detailed information on the methodological choices made for their own publications and ask questions regarding other member's publications. All supplemental information provided for a publication could be linked to, and accessible with, that publication. This method of providing the means for further clarification in an online forum makes the knowledge available to all members. Members could make more informed decisions on which publications to use for comparison or as data sources. Business and government policy makers could have more confidence in their analysis of the publication's results.

Beyond this basic dissemination of information, an online KMS could allow LCA community members around the globe to collaboratively create and share their knowledge. A publications area of a KMS can serve as a repository for the community's general LCA references.

For example, each community member could upload their own EndNote reference libraries to the publication knowledgebase. The references uploaded would be available to the community as a whole. Community members could add their own reviews, citations and keywords for each publication in the knowledgebase. Also, each member could create and manage their own personal library based on selections from the entire publications know-

ledgebase. Member libraries could be downloaded, in whole or in part, as new EndNote reference library files. Where electronic versions are available and copyright permits, publications could be uploaded to and downloaded from the repository; otherwise links to online versions could be provided.

As more and more publications and their associated metadata are added to the knowledgebase, its value grows. The community's collective contributions create a richer knowledgebase available to the community as a whole than would have ever been available to any member through their own individual efforts.

A publication knowledgebase is one component of a LCA community KMS. Another essential component for the LCA community is a repository for life cycle inventory data.

3.2. LCI Data Store

Life cycle inventory (LCI) is the accounting method used to track the input and output material and energy flows associated with each step in a process or in the production of a product. During the goal and scope step of a LCA, practitioners select functional units, define system boundaries and make decisions concerning handling of unavailable data, appropriate allocation methods to be employed and which impact categories to include.

The methodological choices made while defining the goal and scope step of a LCA greatly influence the gathering and selection of its LCI data. Since a LCA of even a modest supply chain can involve collecting data for hundreds of individual supply chain steps, i.e. unit processes, practitioners are uniquely dependent on data collected by their colleagues.

Given this dependency, the LCA community has a corresponding requirement for transparent, quality, regionally relevant data.

The publications knowledgebase can provide the means for clarifications on methodological choices made for a LCA publication. A LCI data store, in conjunction with a publications knowledgebase, would provide the means to make direct linkages between a publication's LCA results and the LCI data on which the results were based; thus increasing both the transparency of and the confidence in the publications results and in the usability of the LCI data for other life cycle assessments.

The LCI data store could consist of both complete unit process data files and unit process reference files. Unit process data files would provide complete data for a specific step in a supply chain, for example the input and output material and energy flows required to produce one tonne of sorghum on a farm in South East Queensland. Where copyright permits unit process data files could be uploaded to the LCI data store and made available to the community as a whole.

Unit process reference files would be used where copyright restrictions prohibit the data from being made publicly available. Just like a data file, a unit process reference file could provide detailed information about its functional unit, impact categories included, missing data, allocation choices, regional relevance, etc. However, instead of a downloadable data file, a reference file could provide a link to where the unit process data could be acquired.

The LCI data store could provide the means for the LCA community as a whole to objectively review and compare data. In conjunction with the KMS, it could also allow the means for LCA community members to collaboratively create and share LCI data.

The KMS could provide the means for members to register their interest in specific types of data. Members with similar data requirements could form data interest groups who could collaboratively create and share data which follows a consistent protocol. Online tools to facilitate the data creation and collaboration could also be provided.

Community-created data could be made available in the LCI data store as either unit process data files or as reference files if the community members chose to retain copyright for themselves.

The KMS has the potential to allow LCA community members to gain access to valuable information they need to do their jobs and have their contributions open for peer review. LCA community members could therefore gain recognition for their areas of expertise and become more visible to the global LCA community.

3.3. Collaboration and More

Beyond the publications and data store sections of the KMS, other Internet technologies may provide ways for members to easily collaborate and share knowledge. Some of the standard online tools for people collaborating on ideas and information are blogs, forums, wikis and videos. Blogs, wikis and videos could be used to provide tutorials for conducting some of the more complicated LCA processes. Some potential examples could be creating Input/Output data tables or the proper use of co-product allocation methods. Forums could be employed for community discussions on topics such as the adoption and appropriate use of a new impact category.

Some or all of these standard online tools could be incorporated into the LCA-community KMS. Popular features of current social software applications could also be adapted.

One potential adaptation that could add value to the KMS is Amazon-style reviews for the publications. Amazon taps into the expertise and opinions of its customers by encouraging them to post reviews of their products. Undecided customers gain the advantage of the opinions of reviewers familiar with the product. The review system also allows customers to rank the usefulness of a reviewer's posting. Reviewers whose postings are consistently ranked as 'useful' have this higher level of confidence delineated next to their postings; providing an additional dimension of confidence in the reviewer's opinion.

This style of review system could be a very valuable addition to the publication knowledgebase. Publication authors get feedback, the reviewer gets feedback, good reviewers can establish a reputation for providing useful advice, and community members gain the advantage of other member's viewpoints regarding the value of a publication.

Another popular social software feature that could be adapted is iTunes Playlists. iTunes is a software application that allows users to organize their music. iTunes Playlists allow users to create song 'collections' based on artist, genre or use, i.e. 'Treadmill Run'. Songs can be individually added to a Playlist or the user can define a Smart Playlist. A Smart Playlist continuously searches the user's music library and adds any new tracks meeting the criteria set for the Playlist. iTunes Playlists can also be shared with others by publishing them on the iTunes Store.

An iTunes-style Playlist for publications would allow members to create and share topical lists of publications. Unlike keywords which generally refer to the content of a publication, a Publist would provide a means to organize publications based on how they are used. A Publist for 'Australian Pork' could include publications on Australian grain production, regional farm processes, references to percentages of fertiliser imports, etc (Wiedemann, McGahan, Grist, & Grant, 2010). Publists would provide a means of associating a publication with its relevant reference material, i.e. LCI data, allocation methods, etc. Creating such a project specific Publist would provide a way for experienced members to organize a project's reference material for easier documentation and retrieval. Sharing this type of Publist with the community would allow other members to gain insight into the standards and practices followed for the life cycle assessment. Transparency in methodological choices and data sources could increase the perceived value of and confidence in a publications result.

4. Conclusion and outlook

An online LCA-community KMS provides the means for the global LCA community to collaboratively create, store, review and compare LCI data. In addition, a LCA-community KMS could provide the means for experienced LCA practitioners to share their knowledge and have their expertise recognised by the larger community. For newer members, a community based KMS could provide access to a collective knowledgebase of expertise and the opportunity to learn from and adopt the community's standards of practice.

With an online LCA-community KMS, opportunities to collaborate, to learn, to share and to be recognized could all be viable and offer enormous potential. This paper proposes the development of an LCA-community KMS, designed by and developed for the LCA community. Construction of the KMS will occur over the next few years. Its creation will require community input. Its success will require community participation, one member at a time.

5. References

- Bell, G. (2009). *Building Social Web Applications*. Sebastopol: O'Reilly Media, Inc.
- Gnansounou, E., Dauriat, A., Villegas, J., & Panichelli, L. (2009). Life cycle assessment of biofuels: Energy and greenhouse gas balances. *Bioresource Technology*, 100, 4919-4930.
- Shirky, C. (2008). *Here comes everybody: The power of organizing without organizations*. Camberwell, Vic: Penguin Group (Australia).
- Suh, S., Lenzen, M., Treloar, G. J., Hondo, H., Horvath, A., Huppes, G., Joliet, O., Klann, U., Krewitt, W., Moriguchi, Y., Munksgaard, J., & Norris, G. (2004). System boundary selection in life-cycle inventories using hybrid approaches. *Environmental Science & Technology*, 38(3), 657-664.
- Wiedemann, S., McGahan, E., Grist, S., & Grant, T. (2010). *Environmental assessment of two pork supply chains using life cycle assessment*. Barton, ACT, Australia: Rural Industries Research and Development.