Role of Online Survey Tools in Creating Temporally Accurate Environmental Product Declarations within the Context of the US Wood Products Industry*

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Abstract

An environmental product declaration (EPD) presents quantified environmental information on a product or process in a simplified form. EPDs are based on the life-cycle assessment (LCA) of products conducted in accordance with standards of the International Organization for Standardization. An LCA analysis ensures that the environmental impacts associated with *all processes* undertaken to produce the product, ranging from extraction (cradle) to its final product stage (gate) or postuse disposal (grave), are included. To be able to present temporally accurate EPDs, the corresponding LCA data need to be updated every 5 to 10 years, depending on the nature of the industry. In this article, we present the pros and cons associated with using Web-based data collection tools to conduct and maintain temporally accurate LCA data. We also present the lessons learned in using Web-based survey tools, with reference to the wood-based industry, and propose a methodology to maintain temporally accurate LCA data with minimal intervention, facilitating periodic update of the EPDs.

One of the greatest benefits of using renewable bio-based materials is their lower impact on the environment relative to their nonrenewable counterparts. This is especially true for wood products, which not only store carbon but also substitute for high-energy intensive materials, such as steel, plastic, and concrete (Lippke et al. 2011). To convey the environmentally beneficial role associated with wood products, it is of key importance that these benefits are communicated to consumers in a simplified and standardized manner. Environmental product declarations (EPDs) fulfill the need for presenting the necessary quantitative environmental information to consumers and businesses (Bergman et al. 2014). The transparency and consistency of EPDs are ensured by an international consensus regarding environmental declarations Type III based on Standard 14025 of the International Organization for Standardization (ISO 2006a). EPDs also meet demands for objectivity, comparability, and credibility in presenting environmental impacts, with necessary explanations and supporting documentation. At the core of these EPDs are life-cycle assessments (LCAs) conducted according to ISO Standards 14040 and 14044 (ISO 2006b, 2006c). An LCA analysis

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ensures that the environmental impacts associated with *all processes* undertaken to produce a product, ranging from extraction (cradle) to its final product stage (gate) or postuse disposal (grave), are included.

Data collection from the wood products industry to develop life-cycle inventory (LCI) data is conducted primarily using a combination of semistructured questionnaires, interviews, and site visits. Multiple LCIs corresponding to the raw materials used, material transportation and handling, and energy inputs are then incorporated in an LCA model to develop the life-cycle impact assessment of the product under consideration. To capture the complexity and variation associated within the production process, the questionnaires used for data collection are typically long and detailed. In almost all cases, an LCA expert needs to interview multiple individuals within the production process in order to collect accurate information. In addition, depending on the nature of the industry, the availability of reliable data is variable. Given the size of the facility and the nature of the operation, the data collection process often requires multiple visits and follow-up questions in order to gather the necessary information or to provide clarification.

Major Hurdles in Developing and Updating the LCAs

Independent of the industry under consideration, the most significant challenge of conducting an LCA of any industrial product is gathering temporally accurate data. This is especially difficult in industries characterized by multiple manufacturers producing the same generic product using a broad range of technologies and raw materials. This is especially true for engineered wood products manufactured in the United States. Similar to most value-added products, engineered wood products have multiple stages in their supply chain, compounding the data collection issues. In the remainder of this article, we discuss some of the major hurdles that were encountered while collecting data for creating LCAs of engineered wood products.

Temporal accuracy

The biggest hurdle in creating a temporally accurate LCA of any product is the need for a coordinated effort in acquiring temporally accurate LCIs for the various components within the supply chain. For the wood products industry, the coordination of the data collection efforts associated with the various supply chain components is a key factor to ensuring the accuracy of the LCA. The accuracy and timeliness of the LCA of an engineered wood product would depend on the accuracy and temporal proximity (within a defined time frame, ideally the same year) of not only the process associated with engineering the wood product under consideration but also the processes involved in the acquisition of raw materials, including lumber, resin, packaging, and others. However, the time frame associated with the temporal proximity for LCIs of intermediary products may be determined by the relative dynamicity of the industry under consideration.

Time-consuming data collection process

Another challenge associated with the data collection process is the time-consuming nature of the survey and interviews required to collect the information used to develop the LCI. Given the nature of the data collected, the LCA expert often needs to talk to multiple individuals within the manufacturing facility, including the individuals responsible for procurement, accounting, manufacturing operations, and environmental compliance, among others. In certain instances, the LCA practitioners need to supplement or complement the primary data with secondary data.

Willingness to share data

The respondents' reluctance to share what is often considered to be sensitive data is a very common problem in developing accurate LCAs. It is also common to encounter trust issues associated with sharing some data associated with proprietary or specialized processes. Within the US forest products industry, willingness to share data often depends on the strength of the existing relationships between the surveyor and the respondents. In some instances, confidentiality concerns may lead to prolonged discussions on the nature of the data that can be made available to the public and ensuring the confidentiality of proprietary information, technology, and/or processes.

Other miscellaneous issues

Data issues can also be associated with the nature of the manufacturing process under consideration or the general environmental orientation of the respondents. Given the fragmented nature of some of the sectors within the wood products industry, absence of proper accounting procedures and accurate data is common. On the other hand, innovative companies with a significant environmental focus are generally especially diligent in maintaining and providing quality data required for developing comprehensive LCAs.

Role of Web-Based Tools for Producing Temporally Accurate LCAs for EPDs

For EPDs to be relevant, it is essential that the data used to create the environmental assessment of any product accurately reflect the existing practices of manufacturing and delivering the product. Hence, temporally accurate EPDs, within the context of the wood products industry, require that the corresponding LCA data be updated every 5 to 10 years (Bergman et al. 2014). This intensive data demand for developing and maintaining updated LCA data requires adopting a streamlined and phased data collection approach. In this section, we propose a Web-based longitudinal data collection protocol and present the advantages of using the proposed protocol.

Web-based longitudinal data collection protocol

Based on the pooled LCA data collection experience within the Consortium for Research on Renewable Industrial Materials network, especially in the forest products industry, it is evident that an online tool will not be able to replace the need for factory visits and interviews. However, a hybrid approach involving a Web-based questionnaire along with factory visits and/or phone interviews can improve the data collection process. The proposed Web-based questionnaire will also serve as a data depository for all industry data, where authorized personnel from individual manufacturing facilities will be able to log in and update any changes in the manufacturing process. All such updates will be assigned a time stamp and stored on the servers.

Fluctuations in industry coverage can be monitored, as production outputs from mills are updated on a yearly basis. Low industry coverage may be addressed by contacting the nonrespondents and by adding new entrants to the survey pool. This will be a significant improvement over the snapshot LCIs that are currently produced and will facilitate the longitudinal analysis of the wood products industry's environmental footprint.

Individually customized surveys.—A Web-based tool will facilitate the utilization of detailed ''skip logic'' within the survey protocol where respondents customize their paths through the survey. For example, Respondent A, who identifies three sources of energy in the manufacturing process—grid electricity, solar power, and hog fuel—would be sent additional sets of detailed questions on each of these sources of power related to the distribution of power use. However, another respondent, Respondent B, who identifies only grid electricity as the source for power in the manufacturing process, would not receive any questions related to the use of solar power or hog fuel. Similarly, if respondents indicated that they kiln dry their lumber and apply a chemical preservative for outdoor use, their survey would automatically be populated with questions related to the kiln drying and lumber treatment processes. Given the range of technologies used for producing the same product in the US engineered wood products industry, auto-customization of surveys would play an especially important role in streamlining the line of questioning.

Incorporating flexibility.—Within the online survey tool, individuals would be provided with the option of creating categories for responses and with clickable category-specific options to populate the response. For example, in categories like chemical use, creating an exhaustive list of chemicals is almost impossible. The survey would include only the most commonly used chemical preservatives in the drop-down list with the option to list other preservatives in the ''other preservatives'' list. Similar flexibility would be provided for machinery usage, where respondents would be given the option of including information such as horsepower, number of cylinders, and other relevant information.

Auto-filled longitudinal data.—Ease of gathering longitudinal data would be an important component of the questionnaire design. This allows a respondent to go to one's previously completed survey and modify or add information based on changes in the manufacturing process. Following the completion and submission of their first survey, respondents would be directed to a URL where they can access information that provides the details on how to update their data in the future. Every time there is a change in their manufacturing process, they would access their online profiles, using a secured ID and password, to update their data. Respondents would be periodically reminded to update their data in order to ensure the relevancy of their LCAs and EPDs. A number of security checks would be used to ensure that only legitimate respondents could access their unique survey URL.

Preliminary lessons learned

Over the past 3 years, a series of online surveys were implemented for collecting data from various stages of the US wood products industry, ranging from logging and trucking operations to the final value-added engineered wood products production. During the data collection exercise, we observed that utilizing online surveys as a tool to acquire data quickly and efficiently comes with certain drawbacks, which are described in this section.

Issues with data reliability.—When trying to survey respondents who work primarily in the field, responses are inherently difficult to obtain. Most respondents do not have the relevant data readily accessible, while many do not compile and keep complete and up-to-date records (mileage for transport, fuel use on site, and machine productivity). Many of these data end up being estimates based on secondary data, which can significantly differ from actual data.

Length of surveys.—Respondents who are involved in multiple stages of the forest harvest and processing supply chain will have numerous questions to answer. Online surveys configure a logic based on the survey responses in order to minimize survey fatigue and provide only relevant questions.

High employee turnover and updating the data.—Employing the same respondent to retake the survey across multiple data cycles would help to minimize respondent fatigue and reduce incomplete surveys. These respondents would be familiar with the data required to complete the survey and with the format of the online survey. Respondents would be able to refer to their previous responses. However, given the high employee turnover rate within the forest products industry, follow-up phone calls would still be required in order to update the LCI data.

Proprietary data and trust issues.—In the case of surveying manufacturers, there are inherent issues with the proprietary data that respondents may not feel comfortable providing to the researcher. Examples of sensitive information include data related to fuel and electricity consumption and other inputs (chemicals, resins, and specialized equipment). These concerns can be addressed by providing documentation on data privacy and sensitive data protection protocols used by the researcher. Often, these data privacy policies are established by the universities or reputable research institutions, and the researchers are required to follow the protocols.

Confusion about the questions.—When questions are generalized for multiple respondents, the wording of the questions may sometimes confuse the respondents. If this occurs, the respondents may believe that they are unable to answer the question, or they may mistakenly believe that the question is not relevant to their process and may skip the question, resulting in missing data. If not properly addressed, the issue of missing data or nonresponse bias could result in inaccurate LCA results.

Concluding Remarks

The need to find an effective strategy for collecting time-series LCI data is critical in ensuring temporally accurate EPDs for forest products. The role of a longitudinal Web-based survey tool for data collection and the periodic update of LCI data present significant advantages over the current practice of creating snapshot LCIs based on printed questionnaires and extended factory visits. However, the Web-based tool cannot completely replace the need for factory visits and interviews with the respondents. Any discrepancy in the data collected using a Web-based survey needs to be validated via phone calls and/or site visits. If incorporated sensibly, the proposed Web-based longitudinal data collection protocol for developing temporally accurate LCAs and EPDs would prove to be an effective and efficient

approach to collecting and updating the LCI data that form the basis of the LCA and accurate EPDs.

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