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Procedia CIRP 61 (2017) 727 – 731

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The 24th CIRP Conference on Life Cycle Engineering

International survey of the costs of assessment for environmental product declarations

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Abstract

Environmental Product Declarations (EPDs) are used to communicate product's environmental performances to relevant stakeholders, whereas Product Category Rules (PCRs) provide guidelines for making EPDs in different product categories. Little is known regarding the cost for developing EPDs and PCRs. We therefore conducted an international survey, and 15 responses from EPD certification operators were collected. The total cost for creating a PCR and an EPD, was in the range USD 13,000–41,000 and the workload was 22–44 person-days. Our survey revealed eight breakdown costs as well. Multiple regression analysis showed several statistical relationships between cost/workload and characteristics of EPD programs.

Peer-review under responsibility of the scientific committee of the 24th CIRP Conference on Life Cycle Engineering

Keywords: environmental product performance; life cycle assessment (LCA); assessment cost; product category rule (PCR); type III eco-label

1. Introduction

Presentation of the environmental performances of products and services plays an important role in environmental product policy. It helps to increase public awareness for the environment and motivates producers to develop, and retailers to sell, products with better environmental performances. To present this type of information, life-cycle assessment (LCA) has been used in the past two decades. Standardized procedures for the presentation were discussed and developed worldwide, and an international standard on environmental labels and declarations (ISO 14025) [1] was established in 2006. Since then, many Product Category Rules (PCRs) were developed, and based on these standards many individual Environmental Product Declarations (EPDs) were publicized.

One major area of research with regard to EPDs is comparability and harmonization. Ingwersen and Stevenson [2] discussed the comparability of environmental performances of different products in order to prevent falsification, and del Borghi [3] argued that harmonization of EPD programs is crucial in order to assure comparability and transparency of product declarations and to avoid duplication of relevant rules. Another research area concerns how to streamline the process of EPD in order to spread and mainstream its use. Zackrisson et al. [4] presented a streamlined method, Stepwise EPD, and Fet et al. [5] examined the use of data-assistant tools. These methods can support small and medium-sized enterprises (SMEs) with limited expertise and resources. In the wider context of LCA use, the work of SETAC Europe [6], Wenzel [7], and Tasaki et al. [8] discussed the types and applications of simplified or streamlined approaches, which can be used for EPDs.

These two topics, comparability/harmonization and streamlining (efficiency) of EPDs, are intertwined. For instance, harmonization may lead to streamlined methods and decrease the cost of assessing and certifying product performances but a pursuit for high comparability may increase the cost. In addition, the recent emergence of social LCA [9] and life-cycle sustainability assessment (LCSA) [10] may result in the increasing number of impact categories to be assessed in future

Peer-review under responsibility of the scientific committee of the 24th CIRP Conference on Life Cycle Engineering
doi:10.1016/j.procir.2016.11.158

EPDs, and thus the cost the cost may increase. Balancing coverage/level of details in EPDs and the cost for conducting them is therefore one of the key issues for the future use of EPDs. We therefore set out to research the costs associated with conducting LCAs and creating PCRs and EPDs, an issue that is largely unexplored in research; while Weidema et al. [11] have discussed how to reduce the cost of the critical review in the EPD process, but the cost itself is not shown. Initially, we tried to get this data from EPD program operators' websites; however, such information and studies on the cost were very limited.

Therefore, we surveyed the costs associated with PCRs and EPDs to figure out the current cost of assessing the environmental performances of products and services.

2. Method

2.1. Cost survey

Manufacturers of products often use third-party EPD certification programs to assure the credibility of their products' EPDs (hereafter, such third parties are referred to as "program operators"). We asked these program operators about the costs and workloads of creating PCRs and EPDs.

Fig. 1 outlines the procedure used in our survey. First, we surveyed the websites of 35 program operators globally and obtained information about assessment costs. We then determined cost items (tasks) to be investigated. There were three cost items for PCRs: scoping, research and drafting, and review. For EPDs, there were five: LCA and EPD preparation, verification, registration, initial fees other than registration, and annual running (operating) fees. We then developed a questionnaire inquiring about the costs and workloads required for these tasks and sent it to the 35 program operators by email. We asked each operator to estimate the costs listed above in an average case. Respondents also had the option to list up to three additional expenses not listed for each PCR and EPD. In addition, we included general questions about the programs, such as the age of the program, the number of PCRs created, and the number of EPDs registered. The survey was conducted in April and May 2014. Operators were promised that no data from the individual programs would be disclosed in such a way that any individual program would be identifiable and also that we would provide a summary of the results to the program operators. We received 15 effective responses (Europe, 6; North America, 5; Asia, 4; All EPD programs were ISO 14025 compliant. The total number of EPDs and PCRs created by these program operators were 518 and 3,318, respectively). In cases where a program operator wanted to respond on more than one average case, we asked about the rate of occurrence of each case and used a weighted average for that operator. In cases where a program operator answered with a range of the cost or workload, we used the median of the range as the representative value. Finally, the costs surveyed, C_0, were converted from local currencies to U.S. dollars (USD, hereafter $) and adjusted with the country's purchasing power parity (PPP) by using Eq. (1).

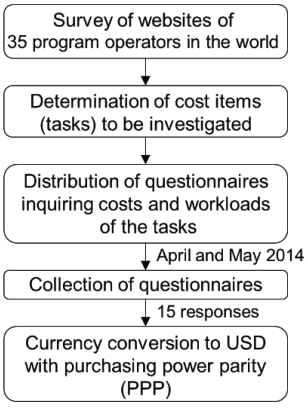


Fig. 1. Outline of the survey procedure.

$$C_a = C_0 \times r \times (P_{US}/P_0) \quad (1)$$

Here, C_a is adjusted cost ($), r is the rate of exchange from the local currency of the surveyed country to USD, P_{US} is the PPP of the U.S. in USD, and P_0 is PPP of the country in the local currency.

2.2. Statistical analysis

Finally, a multiple regression analysis was applied to the total cost and total workload of PCR or EPD to investigate factors affecting them. Eq (2) is the regression equation used for the total cost.

$$TC_a = a_0 + a_1 \times PA + a_2 \times N_{PCR} + a_3 \times N_{EPD} + a_4 \times R_{NA} + a_5 \times R_{As} + a_6 \times I \quad (2)$$

Here, TC_a is the PPP-adjusted total cost of PCRs or EPDs provided by each individual program operator, PA is program age which might represent program operator's experience for cost reduction, N_{PCR} and N_{EPD} are the number of PCRs or EPDs Created by the operator which are relating to economies of scale for the cost, R_{NA} and R_{As} are dummy variables for regions compared with Europe (Subscripts NA and As represents North America and Asia, respectively), I is a dummy variable for programs for single environmental issue such as carbon footprint, and a_i are regression coefficients. In other words, we speculated that program operator's experience, economies of scale, geographical difference, and the number of environmental impacts to be assessed might affect the cost. In the analysis, the variables were selected by using the backward elimination method with the criteria of the probability of F-to-remove was equal to or larger than 0.1. Logarithms of N_{PCR} and N_{EPD} were also used as explanatory variables. In the same way, factors for workload were analyzed. IBM® SPSS® statistics version 23 was used for the analysis.

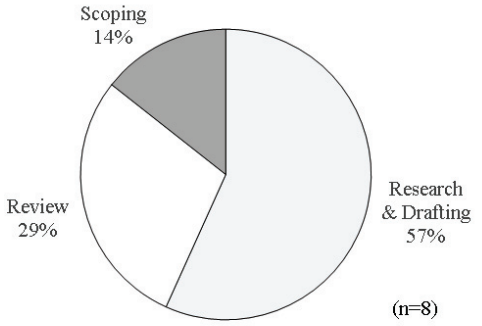
3. Results and discussion

3.1. Cost

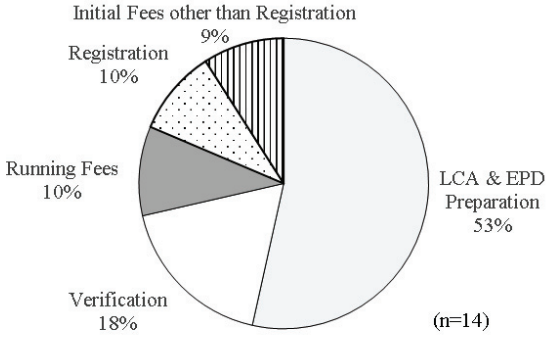
The adjusted costs obtained are shown in Table 1 and Fig. 2. The number of total PCR cost, total EPD cost and there

Table 1. Results of the cost survey

Task		Quartile ($)			N	Width of interquartile range
		Lower	Median	Upper		
PCR	Scoping	485	1,693	3,375	6	2,890
	Research and drafting	2,114	5,928	17,563	8	15,449
	Review	1,013	5,072	8,587	7	7,574
	Total	2,738	15,000	25,625	9	22,887
EPD	LCA and EPD preparation	8,365	15,250	22,745	12	14,380
	Verification	2,108	2,447	3,413	12	1,305
	Registration	663	1,312	2,629	9	1,966
	Initial fees other than registration	528	750	947	6	419
	Annual running fee	587	973	1,531	10	944
	Total	10,309	12,826	30,001	15	19,692
Total of PCR and EPD		12,509	18,761	41,238	15	28,729



(a) PCR



(b) EPD

Fig. 2. Average cost composition of (a) PCR and (b) EPD.

breakdown costs obtained from each operator varied from 6 to 15. The median of the overall surveyed cost (PCR and EPD) was $18,761. The quartile range was from $12,509 to $41,238; these values were approximately half and twice the median, respectively.

The median total PCR cost was $15,000. As shown in Fig. 2 (a), research and drafting accounted for 57% on average, and review accounted for 29%. The width of the interquartile range of the cost of research and drafting was particularly large. A program operator mentioned that PCR costs were affected by the number of stakeholders involved in the creation process. As the research and drafting and the review require a lot of personnel, it is plausible that these interquartile ranges are large.

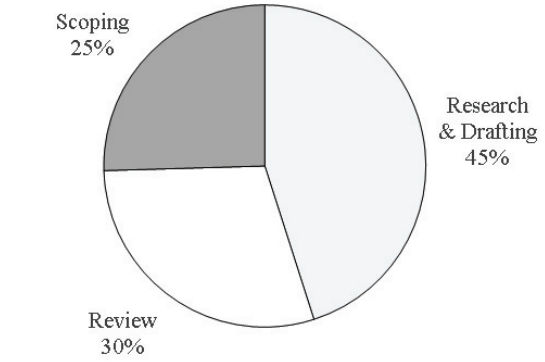
The median of the total surveyed EPD cost was $12,826. The cost of LCA and EPD preparation (hereinafter referred to as "LCA cost") was the largest, accounting for 53% of the EPD costs on average as shown in Fig.2 (b). The width of the interquartile range of the LCA cost was also very wide. We believe that, the cost of the LCAs varied because various products were assessed under various situations.

Note that the costs surveyed are only rough estimates made by program operators. The LCA cost for a single product can vary largely depending on a series of factors such as, the target product group, the number of similar product items assessed per LCA, the difficulty to fulfill the requirements of a PCR, how experienced the practitioner is and how the process is streamlined. A PCR can be reused by other individual products belonging to the same product group. Hence, further research on the costs needs to be undertaken on e.g. what makes differences in each individual cost item of PCRs/EPDs and how those costs can be reduced.

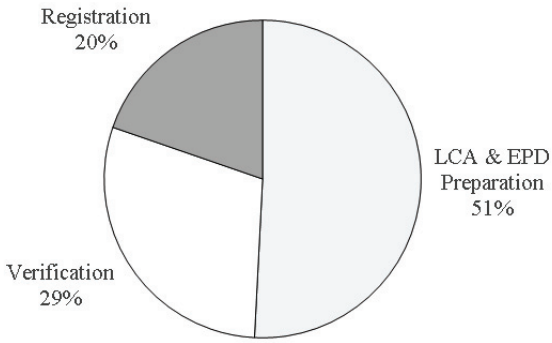
The benefit of this research thus far is that we obtained a rough estimate of the costs of creating PCRs and EPDs. Let us suppose the minimum cost of assessment for environmental product declaration as the median LCA cost because the cost of PCR can be shared many products in a certain product group and become very small and LCA is at least necessary in the EPD tasks.

Table 2. Results of the workload survey.

Task		Quartile *(person-day)*			*n*	Interquartile range
		Lower	Median	Upper		
PCR	Scoping	2.9	3.1	4.2	12	1.3
	Research and drafting	4.6	8.0	9.4	13	4.8
	Review	2.9	4.0	6.0	13	3.1
	Total	12.2	15.6	21.0	13	8.8
EPD	LCA and EPD preparation	5.4	15.0	20.0	9	14.6
	Verification	2.4	3.8	6.0	11	3.6
	Registration	0.8	1.0	3.0	11	2.3
	Total	3.0	19.4	24.8	12	21.8
Total of PCR and EPD		21.9	25.5	43.9	12	22.0



(a) PCR



(b) EPD

Fig. 3. Average workload composition of creating (a) PCR and (b) EPD.

3.2. Workload

The workload results are shown in Table 2 and Fig. 3. The median of person-days for total PCR and EPD was 25.5. The proportions for the individual tasks were similar to those of cost: PCR review and LCA and EPD preparation were the largest in their respective categories. As shown in Fig. 3, deviations of workloads were smaller than those of cost. This result suggests that workloads may be a better benchmark than costs.

3.3. Relationships between total cost/workload and program characteristics

The results of the multiple regression analysis are shown in Table 3. The total PCR cost was explained by the number of PCRs created and the dummy variable of Asia. No variables remained in the analysis for the EPD cost. But there were two outliers in the EPD data. If these data are removed, the total EPD costs are explained by program age and the numbers of PCRs and EPDs. Since regional dummy variables had correlations with the other variables, we conducted a regression analysis without using regional variables as well. The results showed that program age was an explanatory variable for the EPD cost. The older a program is, the less the cost is. We assumed that the program operators will reduce costs as they become more experienced, and the analysis provides some support for this. No regional differences between Europe and North America, and differences between programs with single environmental impact and those with multiple impacts, were observed statistically in any of the analyses. Looking at the signs of the coefficients, we can find that programs in Asia tend to have lower costs and use less workforce compared to Europe and the US, and that the more EPDs that are created within a program, the less workload is spent for conducting EPDs.

4. Conclusions

Roughly speaking, the results of our cost survey showed that the costs of assessment for environmental product declaration (PCRs and EPDs) to be between $13,000 and $41,000, and the workload to be between 22 and 44 person-days. This basic information helps us to consider the balance between different orientations of improving the use of LCA and EPD—e.g., cost and comparability as well as cost and coverage—on an evidence base. Our survey is the first of its kind, and revealed eight breakdown costs as well. Multiple regression analysis showed several statistical relationships between cost/workload and characteristics of EPD programs. In-depth research on how to reduce the costs while retaining credibility of product declaration is expected to be undertaken with a wider range of EPDs in the market.

Table 3. Results of the multiple regression analysis for total cost and workload of PCRs and EPDs surveyed.

		Regression coefficient		Standardized coefficient	p	r^2	Adjusted r^2
		β	S.E.				
With regional dummy variables							
PCR Cost	Constant	-16,560	9,055		.117	.885	.847
	Log(N_{PCR})	55,787	10,786	1.631	.002		
	Region_Asia	-87,284	13,262	-2.076	.001		
EPD cost*	Constant	37,219	2,379		.000	.929	.905
	Program age	-858	280	-0.295	.013		
	Log(N_{PCR})	18,699	3,718	1.354	.001		
	Log(N_{EPD})	-22,801	3,214	-1.938	.000		
PCR workload	Constant	19.3	1.4		.000	.661	.630
	Region_Asia	-11.7	2.5	-.813	.001		
EPD workload	Constant	26.4	6.8		.006	.731	.616
	Log(N_{PCR})	54.0	14.7	3.274	.008		
	Log(N_{EPD})	-31.5	8.3	-2.347	.007		
	Region_Asia	-34.9	16.0	-1.346	.066		
Without regional dummy variables							
EPD cost*	Constant	33,192	4,148		.000	.730	.676
	Program age	-1,350	485	-0.464	.019		
	Log(N_{EPD})	-7,544	1,963	-0.641	.003		
PCR workload	Constant	23.2	2.2		.000	.617	.582
	Log(N_{PCR})	-7.4	1.8	-.785	.001		
EPD workload	Constant	35.1	6.7		.001	.549	.436
	Log(N_{PCR})	31.0	12.3	1.882	.036		
	Log(N_{EPD})	-29.9	10.1	-2.224	.018		

S.E.: standard error, p: probability of statistical significance, N_{PCR} and N_{EPD} are the number of PCRs and EPDs created, respectively. * Two outliers removed.

Acknowledgements

Many program operators kindly participated in our survey. We sincerely thank them for their cooperation.

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