

Exploring Existing Measures of the Environmental Impacts of Print: A Survey of Existing Practices

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Abstract

Environmental pressures have been a growing issue for the printing industry, which has responded aggressively to these challenges. While many companies are trying to measure sustainability, there is much uncertainty as to how this should be done. The RIT Sustainable Print Systems Laboratory recently conducted a survey of companies to begin to characterize the state of sustainability practices and to better understand the specific needs and challenges of measuring the sustainability of print. The survey focused on self-reported measures of sustainability and the factors that might influence this measurement. From the analysis of the survey data, it is clear that there is a large amount of activity within the printing industry in regards to sustainable practices. However, it is also equally clear that much work remains to be done. Some of the findings include the need for a more consistent use and interpretation of the term “sustainability” within the industry; the discovery of a somewhat insular approach to sustainability metric development and use, with a high potential for inconsistency, which suggests that consumers are being given information from competing firms that is most likely being developed in an inconsistent manner; the need for a more detailed look at the processes and standards used to develop sustainability and environmental metrics in the printing industry.

Introduction

The application of sustainability to business strategy is an actively debated topic in the research literature [1-4]. As environmental concerns in society continue to evolve, the sustainable performance of firms is likely to become an increasingly important driver of both competitiveness and profitability. This is clearly true for the printing industry, where environmental pressures have been a growing issue for equipment manufacturers, printers, and print users. The overall environmental performance of firms in the print industry can collectively have a high aggregate impact and is likely to come under increased scrutiny from external interest groups [5].

The print industry has responded aggressively to these challenges over the years with an increase in more sustainable print activities. Accompanying this increase has been new technological innovations such as ink chemistries, printing process efficiencies, and new business models. However, many challenges still remain on the path to “being green.” While many companies are trying to measure sustainability, there is much uncertainty as to how this should be done and what represents the actual state of the art within the industry.

The RIT Sustainable Print System Laboratory recently conducted a survey of companies in the broader printing industry to begin to characterize the state of practice and to better understand the specific needs and challenges of measuring the “sustainability” of print. The survey focused on self-reported measures of sustainability and the factors that might influence this measurement.

More specifically, the goals of this survey were:

- To establish a baseline of the current state of adoption and implementation of sustainability practices within the print industry. This includes:
 - Participation in certification programs and
 - Development and use of sustainability metrics
- To identify organizations that are at the forefront in the areas referenced above for additional in-depth research.

Methodology

Objectives

In order to fulfill the aforementioned goals, the survey will be analyzed for evidence of environmental sustainability practices within the printing industry and evidence of the integration of metrics into individual firm’s decision making. Five major practices were examined:

1. The development of an official sustainability policy,
2. The development and use of sustainability metrics,
3. The development and use of Life Cycle Assessment and Carbon Footprinting metrics,
4. Participation in industry-wide environmental certification programs, and
5. The impact of environmental metrics on corporate decision making.

This work examines three types of metrics: sustainability, Life Cycle Assessment (LCA), and carbon footprinting. The first step toward product stewardship is to define and measure a product’s impact. Life Cycle Assessment is a valuable tool and methodology that can be applied both to operational and marketing processes [6-8]. Another important tool to help identify life-cycle environmental costs is carbon footprinting. This methodology helps to communicate a product’s “global warming potential” and is particularly useful if a firm is interested in communication with customers who consider this an important impact. This analysis also takes a specific look at the following tools and methodologies: Economic Input-Output LCA, Stream-Lined LCA; Sima-Pro; Eco-Indicator; Cambridge Engineering Selector [CES] Material

Selector; Embodied Energy Analysis; Material Input per Unit of Service; Ecological Footprints; and Thermodynamic and Flow Analysis.

This work also examines certification programs. Best practices are often disseminated through industry and trade associations [9]. In the printing industry many associations exist which have developed certification programs dealing both comprehensively or specifically with sustainability. Some of these certification programs include the Sustainable Green Printing Partnership (SGPP), Forest Stewardship Council (FSC), Sustainable Forestry Initiatives (SFI), and the Programme for the Endorsement of Forest Certification (PEFC).

Another important certification program is ISO 14000, which is a more general inter-industry certification closely tied to the ISO 9000 quality standard. ISO 14000 is quickly becoming a “global passport for international trade” [10]. Of course, the choices available to companies in the print industry are not limited to the above, and many companies have developed their own internal or customer-defined certifications related to sustainability.

Lastly, this analysis attempts to define systemic inter-organizational integration of sustainability along four main levels: alignment of sustainability with the “marketing organization” of a firm; alignment with the “executive/corporate organization”; alignment with the “business or functional unit organization” (for example, supply chain, R&D, HR); and alignment of sustainability with the “day-to-day operational organization” of a firm (for example, design decisions, manufacturing).

Survey Design

Respondents

The participants in this study were derived from two sources. Firms that were members of RIT’s Printing Industry Center and individual members from the Society for Imaging Science and Technology (IS&T, 2010) were contacted. The exact number of individuals contacted is not known because the IS&T mailing list was not made visible to the researchers of this study, and there were no restrictions placed on to whom the survey could be forwarded. These organizations were selected because of their extensive and worldwide pool of companies and their cross-sectional representation of companies at all stages of the print value chain.

Survey Questions

In order to collect the data to support the objectives of this study, a survey was developed that was sent out to the firms and individuals discussed above. This survey consisted of 31 questions that focused on the following areas consistent with the objectives of the research:

- Type and state of sustainability policies that the firms have instituted,
- Sustainability programs in which the firms participate,
- Sustainability measurement practices, and
- Sustainability measurement tools and methods awareness.

Before it was released to the population described above, the survey was pre-tested on two sample respondents from North America and Europe for a critique of the questions and the survey design. After some minor modifications, the survey was released

with instructions to forward along to anyone within the industry who could be interested in taking the survey. The survey was distributed online through SurveyMonkey.com and was available from August 19, 2009 to October 12, 2009.

Survey Results

Survey Demographics

A total of 120 individuals started the survey, and approximately 87% completed all or some of the questions—resulting in a sample of 105 total respondents. The demographic information of these respondents is summarized as follows:

Approximately 77% of surveyed companies have headquarters located in the United States, followed by 14% in Europe, and 7% in Asia. A smaller number of companies have headquarters located in Canada or South America. Although the majority of the survey respondents’ companies were headquartered in the US, their business operations were globally distributed with 36% of surveyed companies having operations in North America, followed by 22% in Europe, 18% in Asia/Pacific, 13% in South or Central America, and 11% in the Middle East or Africa.

A disproportionate fraction of respondents were from large enterprises with 41% of the respondents having 1000 or more employees. The remainder of the respondents came from small-to-medium enterprises with 16% of the responses between 250 and 999 employees, 8% between 100 to 249 employees, 19% between 20 and 99 employees, and 16% with under 20 employees.

Most respondents (67%) indicated that their functional position within their organizations was in management, followed by smaller percentages indicating that they were involved in manufacturing (4%), IT (4%), support (2%), sales (2%), and creative (1%) functions. Interestingly, 20% of the respondents reported that their job function was not adequately described by the provided categories. With regard to tenure in the organization, 30% of respondents indicated that they had worked for 21 or more years in their organizations. Twenty-eight percent (28%) indicated they had worked between 10 and 20 years in their organizations; 15% indicated between 5 and 10 years; 22% indicated between 2 and 5 years, and 5% indicated they had worked for 1 year in their organizations.

Survey respondents were asked to provide a general impression of the percentage of customers their organizations have in various markets, as well as the percentage of revenue that is derived from the different segments of the print value chain. The market segments provided in the survey included consumers, office, commercial, packaging, government and “other” sectors. It is interesting to note that more than 70% of the respondents derive less than 25% of their customers from the consumers, office, packaging, government and “other” segments, which suggests a more uniform distribution among these markets. The notable exception is the commercial market segment, in which close to 45% of the respondents derive at least 50% of their customers.

These findings seem to be consistent with the breakdown of the respondents’ report of percent revenue in different segments of the print value chain. A significant fraction of the respondents’ revenues are more uniformly distributed among “content creation”, “workflow and data management”, “print equipment manufacturing”, “print production”, “printer services consulting

and management”, “end-of-life services”, and “other,” while for over 50% of the respondents, at least 50% of revenues come from “print production”. Thus, these survey data may be more representative of companies that provide print production services to commercial customers.

Policies and Practices

Practice of Sustainability Policy

Survey respondents were asked to provide a general overview of their company’s practice of sustainability policies. Respondents were given the options of indicating the degree of implementation of any sustainability policy in which their company may be engaged. No specific policy was pre-indicated to respondents. The results are shown in Figure 1.

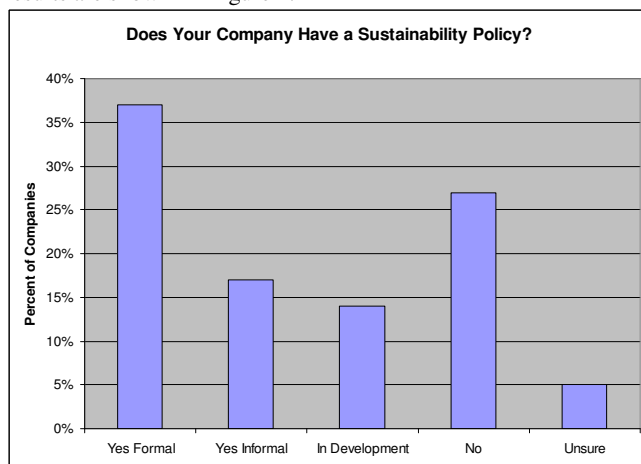


Figure 1: Practice of sustainability policy

For those companies that had a formal or informal sustainability policy, 99% of respondents indicated that this policy included environmental areas; 63% indicated that it included economic areas; 75% indicated that it included social areas; and 4% indicated “other.”

Sustainability Measures and Metrics

Use of Sustainability Measures

Surveyed companies were asked to indicate whether or not they used sustainability measures for one or more of the products they offer. Approximately half (54%) of the respondents already had sustainability metrics or they were under development. Most of the companies (68%) developed these metrics internally. A smaller percentage used a consulting company (18%), university (12%), or “other” (4%) for development.

Only 35% of the firms reported conducting LCAs of any kind. For these companies, 64% of respondents indicated that their LCA development efforts were internal; 19% indicated that it was accomplished with an outside consulting company; 12% indicated they collaborated with a academic university; and 5% indicated “other.”

Interestingly, an average of 63% of respondents indicated that they had not heard of any of the quantifying methods provided in the survey (Economic Input-Output LCA, Streamlined LCA, Sima-Pro, Eco-Indicator, Cambridge Engineering Selector (CES)

Material Selector, Embodied Energy Analysis, Ecological Footprint, Thermodynamics and Flow Analysis, as well as an “other” option), while only an average of 9% of companies indicated that they were currently using at least one of the methods provided (the most popular method being Economic Input-Output LCA, with 18% of respondents).

Almost half of the respondents (47%) reported they had conducted a carbon footprint or were in the process of doing so. Of these companies, 68% of respondents indicated that this was an internal effort; 19% indicated that it was in collaboration with an outside consulting company; 8% indicated that they worked with an academic university; and 6% indicated “other.”

Participation in Environmental Certification Programs or Standards

Survey respondents were asked to indicate the degree to which their companies were involved in various environmental certification programs and standards. Respondents were provided with a wide range of certification and standards options, including external certification programs, self-certification programs, and customer-required certification programs. Results of this question are provided in Table 1.

Table 1: Involvement in Print-related Certification Programs

	Have not heard of it	Not planning to implement	Considering	Planning to implement	Implemented in part	Implemented in full
SGP	35%	16%	28%	9%	11%	2%
FSC	23%	20%	12%	8%	15%	22%
SFI	23%	34%	19%	4%	8%	13%
ISO 14000	19%	35%	15%	4%	12%	16%
LEED	50%	30%	15%	0%	2%	3%
Self/Customer Certified	41%	26%	13%	7%	9%	4%
PEFC	47%	29%	11%	2%	5%	7%
The Natural Step	72%	18%	5%	1%	1%	3%
Self	47%	26%	13%	4%	4%	6%
Other	44%	22%	8%	6%	8%	13%

The results of this question indicate that participation in various environmental certifications and standards in the print industry is wide ranging depending on the certification type. On average, about 40% of respondents had not heard of one or more of the certification programs presented in this survey. A smaller fraction of companies had heard of the various certification programs and standards presented in the survey but were not planning to implement them. On average, 26% of companies were not planning to implement any certification or standard. Companies considering or planning to implement any of the certification programs listed in the survey averaged around 18% of respondents. A relatively small percentage of respondents

indicated that they had implemented any of the certification or standards named in the survey either in part or in full.

In addition to the above choices of certification programs and standards, respondents were given the option to indicate if they participated in a self-certification program or a customer-required certification program. Thirty-seven percent (37%) indicated that they were considering or planning to implement these certifications, and 23% indicated that they partially or fully participated in a self-certification or customer-required certification program.

We also left space for respondents to fill in an “other” program. Fourteen percent (14%) indicated that they were considering or planning to implement, and 21% indicated that they participated either partially or fully in a certification program other than the ones listed in the survey. Of the “other” programs in which respondents participated, responses included ISO 12647, Blue Angel, Nordic Swan, Eco Label, Carbon Disclosure Project, Green Tier, Global Environmental Management Initiative, EPA National Partnership of Environmental Priorities, World Resource Initiative, Forest Landscape Initiative, EPA’s SmartWay Transport Partnership, SoySeal Ink Certification, and Green Marketing Coalition.

Influence of Sustainability on Decision Making Within Organizations

Influence on Measuring Sustainability

Survey respondents were asked to indicate the degree to which various factors have influenced the approach toward measuring sustainability within their organizations. Responses for this question are provided in Table 2.

Table 2: Factors Influencing the Measuring of Sustainability

	1 - Not at all	2	3	4	5	6 - To a great extent
Supplier pressure	38%	13%	20%	13%	9%	7%
Customer pressure	4%	6%	23%	17%	23%	26%
Regulatory standards	6%	11%	26%	17%	23%	17%
Company image	0%	2%	9%	19%	36%	34%
Our competitor’s behavior	17%	6%	28%	30%	15%	4%
Strategic positioning	2%	4%	15%	15%	42%	23%
Leadership’s personal interest in sustainability	6%	4%	13%	17%	33%	27%

Company image is indicated by the respondents’ answers as having a heavy influence on sustainability, with 70% of surveyed companies indicating a 5-6 as an influence factor, and 0% of companies indicating that company image was “Not at all” an influencing factor in sustainability. Strategic positioning and leadership’s interest in sustainability also represent very significant influencing factors on sustainability, with 65% and 60% of

respondents attributing a weighting of 5-6, respectively. Only 6% and 10% of respondents attributed a weighting of 1-2, respectively. Customer pressure and regulatory standards round out the factors that provide a heavy influence on the measurement of sustainability. Each received 49% and 40% of respondents’ answers in the 5-6 range, while 11% and 17%, respectively, were in the 1-2 range.

Factors that provide a lower influence on the measurement of sustainability include competitor’s behavior and supplier pressure. Each received 19% and 16%, respectively, in the ranges of 5-6, while receiving 23% and 51% of responses in the 1-2 weight range. Supplier pressure, it seems, plays little role in influencing sustainability measures upstream in the supply chain.

Influence of Sustainability, LCA, and Carbon Footprint Measures on the Decision-Making Process

Survey respondents were asked to indicate the degree to which their use of sustainability, LCA, or carbon footprint measurements influenced the decision-making process within their organizations. The purpose of this question was to gauge the depth of use of measures and metrics on sustainability within the decision-making process of an organization. Respondents were given the options to chose the degree of influence within several segments of the decision-making process, ranging from marketing or company image decision making, corporate or executive decision making, business unit decision making (such as supply chain, R&D, HR), or decision making in day-to-day activities (such as design decisions and supplier selection). The weighting range of influence within each segment of the decision-making process ranged from “1 - We do not measure these items” to “6 - To a great extent.”

The influence of sustainability measures on the various segments of decision making provided in the survey seems to be relatively uniform. However, several decision-making segments do exhibit a heavier influence and use of sustainability metrics than others. Marketing and executive-level decision-making seems to make the heaviest use of sustainability measures and metrics. On average, 34% of respondents using sustainability measures or metrics indicated a 5-6 weighting for marketing/image, while only 19% indicated a low weighting of 2-3 (1 indicating no use of measures or metrics at all). Likewise, for the influence of sustainability on the executive-level decision-making, 31% of respondents indicated a high weighting of 5-6, and 23% indicated a low weighting of 2-3. These responses indicate that in the higher levels of decision making, sustainability measures, LCA, or carbon footprint measures find an increasing influence and use.

In the lower levels of the decision-making process, however, this relationship isn’t as pronounced. In the business unit level of decision making, 28% of respondents indicated a high weight of 5-6 for the influence of sustainability measures, while 21% indicated a low weighting of 2-3. Likewise, in the day-to-day activities level, 28% of respondents indicated a high level of influence between 5-6, while 23% reported a low level of influence between 2-3. While the results indicate a level of increasing influence within these decision-making segments of sustainability measures, this influence is relatively lower than the executive and company image levels of decision making. Furthermore, a higher percentage

of companies indicated a low level of influence of sustainability measures at the business unit and day-to-day activities levels.

Obstacles

We also asked a more open-ended question at the end of the survey: What are the biggest difficulties in measuring and implementing sustainable practices? There seemed to be three major themes: data acquisition, resources, and lack of a standard process. As one respondent succinctly said, "Cost, measurement, lack of standards." Table 3 6 illustrates some of the representative comments.

Table 3: Open-Ended Comments

Resources	Data Issues	Standardization
Resources for such non-value added activities	Getting data from suppliers	Applying standardized methods of measuring
Cost and complexity	Gathering all the information	Lots of programs and confusion
Bandwidth of business to take on new projects and budget	Getting the right tools and information	Changing standards and non-uniform standard
Time to set up the program	No clear best method and lack of credible data	Awareness of standards applicable to sites and global coordination and implementation
Time and money	Lack of knowledge [regarding] carbon footprint of raw materials (inks, substrates, etc.) and end-of-life analysis (Are products recycled or landfilled, etc?)	No standards. Competitors use whatever messaging that promotes their products

Conclusions

This survey explored the state of practice in the printing industry to better understand the specific needs and challenges to be addressed to standardize the assessment of the environmental impacts of print. The main stated goal of this survey was to establish a baseline of the current state of adoption and implementation of sustainability practices within the print industry.

The results of this survey should be interpreted with the limitations of the study in mind. These include a relatively large representation of:

- US headquartered companies, though a significant number of respondents have operations outside the US,
- Companies with over 1000 employees,
- Companies with commercial customers, and
- Companies that generate revenues from print production.

Lastly, it should be reiterated that these represent self-reported perspectives, and the largest function representation came from management. However, with these caveats in mind, there are still some interesting observations that warrant further investigation.

Current State of Adoption of Sustainability Practices

From the analysis of the survey data, it is clear that there is a large amount of activity within the printing industry with regard to sustainable practices. However, it is also equally clear that much work remains to be done in the industry. An unexpectedly large fraction of respondents did not have a sustainability policy in place (27%). Of the companies that did implement a policy, almost all addressed environmental areas, and the majority addressed economic and social areas, but the degree to which each of these areas was individually documented did vary widely. This suggests that there is a need for a more consistent use and interpretation of the term "sustainability" within industry.

With respect to metrics, a relatively large fraction of respondents (46%) were not even in the process of developing sustainability related metrics, and only 35% and 47% had reported activity on LCA and carbon footprinting, respectively. More surprising was the lack of familiarity with some of the more well-known methods for quantifying environmental impacts and some of the more well-known certifications programs (average response fraction of 63% and 40%, respectively). If you combine this with the fact that a majority of the metrics were being developed in house, it creates a picture of a somewhat insular approach to sustainability metric development and use, with a high potential inconsistency.

This issue becomes even more pressing when you look at how the metrics are being used. While 34% of respondents did not report any influence on decision making, for the remaining fraction of respondents, there was a relatively large influence on marketing/image-related decisions. This suggests that consumers are being given information from competing firms that is most likely being developed in an inconsistent manner, with varying processes and assumptions.

These results call for a more detailed look at the processes and standards used to develop sustainability and environmental metrics in the printing industry. We have conducted follow-up interviews with many of the survey respondents, and these interview results will be reported in a future working paper. In addition, our other working paper, entitled "Life Cycle Analysis in the Print Industry – A Review" takes an in-depth look at a range of publicly available assessment studies. However, one thing that was clear from the comments from the survey respondents, as well as the interviews and studies, was the need for non-biased, more standardized metrics, methods, and processes. This will also be a focus of our future work.

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