Expanding the Impact of Ecolabels: Leveraging Standards to Propose Sustainable Practices for Paper Products Without Certifications

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ABSTRACT

An ecolabel is a voluntary certification that can be put on a product's packaging to indicate that it has fulfilled certain requirements to be more environmentally, socially, and fiscally sustainable. Due to a lack of standardization and trust from stakeholders and consumers, certifying bodies have focused on creating certifications that will sell, covering only a few common products that are used across multiple industries. I investigate whether information from existing certifications and Environmental Preferable Policies (EPP) can be used to expand the range of products covered by ecolabels. Using certified paper products as a test case, I explore the possibility of making practice suggestions for products that are similar in nature but have no certifications available. Out of a total of 79 paper products, only 12 are covered by certifications. I isolated one product at a time and used the other 11 products to make practice predictions. The result showed high levels of precision, with an average of 96% correct suggested practices over total suggested practices. The accuracy levels were lower, with an average of 59% correct suggested practices over the total available practices. The precision levels show that the suggestions were correct, and therefore we can use information across products as long as they are similar in nature. The accuracy level showed that the method can be improved to be more comprehensive of the practices. These results show that there is potential to increase product coverage, therefore improving environmental practices across the market.

KEYWORDS

ecolabel standard, environmental preferable policy, practices, precision, accuracy, impact area

INTRODUCTION

Environmental awareness is defined as the understanding of the fragility of and necessity of the physical environment. Resource depletion, government negligence, and social media have exposed a series of environmental problems that cannot be ignored (Jaca et al. 2018). In the United States, societal environmental awareness has more than doubled since the 1990s (Iosifidi 2016). With this increased awareness on the part of the consumer, industries have been forced to produce and develop more sustainable products as part of developing a greener economy. A green economy is defined as a model that combines growth and development with the improvement of environmental and social well-being (Mirsha 2017). In 2011, a study found that compared to the 1990s, twice as many US consumers (about 30%) have been purchasing products packaged in or made from recycled materials (Iosifidi 2016). Ecolabels and environmental purchase policy (EPP) reports are the primary method of showing consumers which products are being manufactured in a more environmentally friendly way.

An ecolabel is a voluntary certification that can be put on a products' packaging to indicate that it has fulfilled certain requirements to be more environmentally, socially, and fiscally sustainable. Today, over 200 countries use ecolabels that cover more than 25 product categories (Fruntes 2014). There are three different way to obtain an ecolabel. The first way of awarding ecolabels is through an outside independent party, upon voluntary request, and based on multiple criteria (Nadlifatin et al. 2016, Harris and Divakarla 2016). The criteria focus on the pre-production, production, packaging and transport, use, and disposal stages. This type of ecolabel is the most rigorous and hardest to obtain. The second way of awarding ecolabels is through self-declaration, which makes it very hard to quantify its credibility (Nadlifatin et al. 2016, Fruntes 2014). This certification only covers a single parameter of the production chain. The last type of ecolabel is also awarded by an outside independent party. This ecolabel does not ensure compliance with certain criteria, but it is proof that the producer has publicly provided complete data on all their practices, allowing the consumer to judge its sustainability (Fruntes 2014, Harris and Divakarla 2016). Likewise, EPPs serve as guidelines for entities to improve their practices. They are built similarly to ecolabels, but they are not a certification for the product, rather a guideline for the entity to base its practices and show the consumers they intend to improve their

procurement goals (Melamed 2003). Both ecolabels and EPPs have struggled to gain the confidence of the producer and the consumer.

Due to the lack of regulations and standardization around the making of ecolabels and EPPs it is hard to ensure authenticity. The International Standard Organization (ISO) has attempted to homogenize ecolabels through ISO 20400 (Harris and Divakarla 2016). This is a standard that summarizes how to appropriately tackle sustainable procurement in 4 components: fundamentals, policy and strategy, enablers, and process. While ISO 20400 gives a detailed explanation of how to create a standard, it does not force certifiers to follow it. Additionally, there have been critiques that this system is merely symbolic, as numeric transparency does not provide an open discussion and the reports are too complicated for the average consumer or stakeholder to understand (Press and Arnould 2014). Because of this, stakeholders are extremely hesitant in rewarding firms that adopt certifications (Darnall 2017). This distrust in ecolabels and EPPs has shifted the number and distribution of available certifications. Since certifying bodies understand that many firms are hesitant in purchasing their certifications, and need to compensate for this skepticism, they create certifications for the most common and requested products. Additionally, while the majority of the certifying bodies are non-profit, they still need to cover the costs of creating the certification since it is human and capital intensive (WRI 2010). This has shifted the attention to products that sell the most, resulting in poor coverage of all existing products.

In this study, I examine one poorly-covered category: ‘paper products’ as defined by the UNSPSC. In this category there are four subcategories: printing and writing paper, novelty paper, personal paper products, and business use papers. There are 79 products across all four subcategories (see Appendix A for full list). To collect as much data from ecolabels and EPPs as possible, I used Productbio, a database that specializes in collecting this information. Using elaborate algorithms, the tool extracts sustainable practices from multiple ecolabels and EPPs. This allows the user to see what practices should be incorporated in their criteria to improve procurement decisions. Unfortunately, the tool is only as rich as the availability of ecolabels and EPPs. Because of the poor ecolabel and EPP coverage of paper products, the tool can only accumulate information on 12 of the 79 paper products.

In this study, I explore the possibility of using information from existing ecolabels and EPPs for paper products that have been certified to make suggestions for sustainable practices for products that are similar in nature but that have no certifications available. The first goal is to

understand what the opportunity for improvement is across eight environmental impact areas.The next goal is, given that there is space for improvement in every impact area for the 12 products, to figure out what is the precision and accuracy with which this model can suggest practices.

RESEARCH FRAMEWORK

Comparing data points

Breaking down ecolabels and EPPs into data points allows direct comparison between these certifications. This is important because it allows for the accumulation of practices from different sources about the same product. For the purpose of this model, the products are categorized through the United Nation Standard Products and Services Code (UNSPSC). This is a classification system that assigns a number to each product that is bought and sold based on its characteristics and function. For example; single ply, sustainably sourced, with no packaging roll of toilet paper will have a number that can identify all those characteristics. Impact area is an environmental area that might be impacted by a practice within a supply chain of a product. For example; if an ecolabel has a criterion that product *x* has to be produced with 50% post-consumer material, impact areas would be natural resources and waste. By using post-consumer material, less virgin natural resources are used and less material is thrown away. In this study I consider the following impact areas: air, biodiversity, energy consumption, land use, natural resources, soil, waste, and water. Each data point that is extracted from ecolabels and EPPs is also defined as a sustainable practice. These practices, which are accumulated in the ProductBio database, are the ones that I will be using to make my predictions. In order to determine that these practices are scientifically reliable and have appropriate scientific basis, the ProductBio tool uses the assumptions listed below. If they do not fulfill these assumptions, meaning they are outliers, the practices will not show up to the user.

Assumptions

Since the algorithms of the tool that process the data are patented, they cannot be fully described in this study. The two patents are: *Systems and Methods for Inferring Product*

Sustainability from Phylogenetic Methods Patent and *Methods, Systems and Reports for Dynamic Reporting of Product Life Cycle, Sustainability and Human Capital Information*. Instead, I will be discussing the underlying assumptions.

- *Product Quality:* It assumes that products that are compared within the tool serve the same function and are of the same quality.
- *Updates:* It assumes that as long as more data points are added, the tool will continue updating and incorporating the new information to represent the best knowledge available.
- *Information in ecolabels, and EPPs:* It assumes that information across all available ecolabels and EPPs is based off of scientific research that defines which ingredients and processes are detrimental to the environment and/or workers.
- *Sustainable Products:* The tool does not classify practices as sustainable or not. Rather it ranks practices based on which one is less environmentally, socially, and fiscally damaging. The ranking is based off of the repetition assumption.
- *Repetition:* It assumes that if a practice is repeated across multiple reports it is considered more sustainable and relevant than a practice that is not repeated as much. This is because it means there is more of a consensus across different certifiers and entities that the specific practice is important to create a product that is more sustainable. This assumption removes outliers that may be due to bad scientific research, bias in reports, and/or misinformation.

METHODS

Data collection methods

I chose to look at paper products because it is the product category that has the most practices available in the ProductBio database. The database uses the UNSPSC categorization system. This allowed me to know exactly what products are defined as paper products and to make effective comparisons of similar products. I then accessed ProductBio's database and extracted all the available practice data points about as many of these products as possible. I found 196 practice

suggestions for 12 of the 79 products. These suggestions are all related to environmental practices and are divided between eight impact areas listed previously.

Data analysis methods

I used ProductBio's tool to determine if the practices given by ecolabels and EPPs are defined as benefits or liabilities. Benefits are defined as practices that have positive environmental impacts and are sustainable. Liabilities are defined as practices that have negative environmental impacts and are not sustainable. As mentioned in the methodology, the tool defines sustainability based off of the repetition assumption. If the given practices are mainly defined as benefits, then that impact area has less opportunity for improvement than an impact are that had a majority of practices defined as liabilities. The tool defines practices as high liability, medium liability, low liability, low benefit, medium benefit and high benefit. I translated this to an opportunity for improvement scale of one to six, where high benefit is one and high liability is six.

Since there is no reliable information available on the other 69 paper products, I compared the ones that I do have. To come up with suggestions I isolated one product at a time and compiled a list of suggested practices for each impact area for the isolated product. The suggestions were made based off of the practices that were used for the other 11 products in that impact area. I divided the suggestions into two tiers. The first tier was for practices that were mentioned 100% of the times, and the second tier was for those that were mentioned between 70-99% of the time. I did not take into account the practices that were made less than 70% of the time. These suggestions were then compared to the practices that are given by the tool for the isolated product. Based on the comparison I calculated the precision and accuracy of the predictions for each impact area for the isolated product. Precision is defined as what percentage of the suggested practices were correct. Accuracy is defined as what percentage of the total given practices were correctly suggested. I repeated this process 12 times, isolating a different paper product each time.

RESULTS

Table 1 shows the results of opportunity for improvement for each impact area per paper products. I found that on a scale of one to six, where one is low opportunity and six is high

opportunity, there is a variety of results, with five being the most common. Land use, biodiversity, and water have homogenous opportunity for improvement across all the paper products. The rest of the impact areas are more heterogenous in their opportunity for improvement across all the paper products. I also found that there is a lack of suggested practices for three paper products (carbonless, computer printout, and self-adhesive note paper) in the tool, therefore I left those boxes empty on Table 1.

Table 1. Liability and benefit ranking. I ranked each paper product per each impact area based on the opportunity for improvement. (low opportunity = 1, high opportunity = 6)

	Toilet Seat Covers	Calculator or Cash Register Paper	Carbonless Paper	Cardstock Papers	Computer Printout Paper	Printer or Copier Paper	Facial Tissues	Self-adhesive Note Paper	Paper Napkins or Serviettes	Paper Pads or Notebooks	Paper Towels	Toilet Tissue
Air	4	5	4	5	4	5	4	4	4	5	5	4
Biodiversity	5	5	5	5	5	5	5	5	5	5	5	5
Energy Consumption	4	4		4		4	4		4	4	4	4
Land Use	5	5	5	5	5	5	5	5	5	5	5	5
Natural Resources	6	6	6	6	6	6	6	6	6	6	6	6
Soil	4	5	4	5	4	5	4	4	4	5	5	4
Waste	4	6	3	6	4	6	5	4	5	6	6	5
Water	5	5	5	5	5	5	5	4	5	5	5	5

Table 2 and 3 show the accuracy and precision levels from the predictions I made. For most products the precision was between 90-100% but there was no pattern for the accuracy results. There are three empty precision and accuracy results because as mentioned previously, there were no practices available for some paper products.

Table 2. Part 1 of accuracy and precision of the suggestions. I used data from 11 products to make predictions about the 12th product and then crosschecked with the real suggestions of the 12th product and calculated the precision and accuracy.

	Facial tissues		**Self-adhesive note paper**		**Paper napkins or serviettes**		**Paper pads or notebooks**		**Paper towels**		**Toilet tissue**	
	Precision	Accuracy	Precision	Accuracy	Precision	Accuracy	Precision	Accuracy	Precision	Accuracy	Precision	Accuracy
Biodiversity	100%	80%	100%	100%	100%	80%	100%	47%	100%	42%	100%	80%
Land Use	100%	100%	100%	100%	100%	100%	100%	47%	100%	47%	100%	100%
Water	100%	45%	100%	100%	100%	45%	100%	29%	100%	24%	100%	45%
Natural Resources	100%	80%	92%	69%	100%	84%	100%	44%	100%	41%	100%	84%
Waste	100%	71%	100%	40%	100%	50%	100%	17%	100%	14%	100%	44%
Soil	100%	75%	100%	100%	100%	75%	100%	21%	100%	20%	100%	75%
Air	100%	67%	100%	50%	100%	67%	100%	15%	100%	14%	100%	67%
Energy Consumption	100%	100%			100%	100%	100%	100%	100%	100%	100%	100%

Table 2. Part 2 accuracy and precision of the suggestions. I used data from 11 products to make predictions about the 12th product and then crosschecked with the real suggestions of the 12th product and calculated the precision and accuracy.

	Toilet seat covers		**Calculator or cash register paper**		**Carbonless paper**		**Cardstock papers**		**Computer printout paper**		**Printer or copier paper**	
	Precision	Accuracy	Precision	Accuracy	Precision	Accuracy	Precision	Accuracy	Precision	Accuracy	Precision	Accuracy
Biodiversity	100%	70%	100%	47%	100%	100%	100%	47%	100%	100%	100%	47%
Land Use	100%	100%	100%	47%	33%	33%	29%	12%	100%	100%	100%	47%
Water	100%	45%	100%	29%	90%	67%	100%	29%	80%	67%	100%	29%
Natural Resources	100%	79%	100%	44%	92%	100%	100%	44%	88%	93%	100%	43%
Waste	80%	100%	100%	17%	80%	75%	100%	17%	60%	60%	100%	16%
Soil	100%	75%	100%	21%	100%	100%	100%	21%	100%	100%	100%	21%
Air	100%	67%	100%	15%	100%	100%	100%	15%	50%	100%	100%	15%
Energy Consumption	100%	100%	100%	14%			100%	14%			100%	14%

DISCUSSION

The results showed that there is opportunity for improvement across most impact areas for every product. The differences in opportunity for improvement stem from the source of the practices which is the ProductBio database. The practice predictions had high levels of precision but low levels of acracy across products. These results show that with some improvements to the methodology, it is possible to create certifications for new products based on already existing certifications. This would allow better product coverage and reduction in environmental impacts from product procurement.

Opportunity for improvement

The analysis of liabilities and benefits revealed opportunity for improvement in most of the impact areas. Land use, biodiversity, water, and natural resources had homogenous opportunity levels across all the products. Homogeneity shows that there is scientific consensus on the available practices in these impact areas. In the supply chain of paper products studies also show that land use, biodiversity, water, and natural resources should be areas of focus in attempting to mitigate environmental impacts (Ghazali 2015). On the other hand, soil, air, energy consumption, and waste have less homogeneity across the 12 products. This indicates that the data for these impact areas is less consistent across the ecolabels from different products. In some cases, like energy consumption there was even a lack of data in the ProductBio database. This may have less to do with different methods of production, and more to do with less availability of accurate research on the impacts of paper products in those areas (Ghazali 2015). Additionally, because ecolabels target their certifications to the buyers, the information might be skewed towards impact areas that are easier to tackle (Miller 2015). Opportunity for improvement does not indicate areas that are less environmentally friendly, rather it focuses on where there is available technology and desire to improve supply chains.

Precision

The suggestions showed extremely high levels of precision, above 97%, for every product across the impact areas. The only products that had a lower precision level were carbonless paper at 85% and computer printout paper at 82.57%. High precision results indicate that there is consistency in the practices that were mentioned by a variety of ecolabels and EPPs, meaning that the data behind the tool is reliable. In the cases where the precision level was not 100%, I manually searched the practices and found that while the practices were not explicitly mentioned, they were applicable to the product. These results are noteworthy, since it shows that the model can correctly extrapolate practices to other paper products with high level of precision, expanding the impact of single product certifications.

Accuracy

While the suggestions made were very precise, they were not comprehensive of all the available practices for each product. Out of the 12 products, six had accuracy levels from 70-79%, while the rest ranged from 25-40%. This is because I chose to suggest only practices that were mentioned eight or more times, excluding a lot of available practices. Given that the calculation of accuracy is based off of the availability of practices per impact area, I checked to see if there was a correlation between the count of practices and the accuracy values. The results showed no significant correlation. Therefore, the number of practices does not have a definitive impact on level of accuracy. Rather, it is likely that the model itself was the cause of the inaccuracy. The practices were suggested based on how many times they were repeated across 11 products, instead checking if they were applicable to the products production steps. Therefore, it is essential that in future studies the method of choosing practice suggestions be altered. While the accuracy results were not as high as expected, combined with the high level of precision, they still show that with some changes to the method it is possible to make correct predictions.

Limitations & Future Directions

Effective study design is essential to contextualize the importance of my study. First of all, this study was centered around paper products. While the method should work on all categories of products, this study does not necessarily indicate that it does. Additionally, this method could not

be conducted on another product category due to the lack of large numbers of data points in the ProductBio tool. In future studies I would conduct a sensitivity analysis to understand how many times a practice needs to be repeated to be included it in the suggestions. I recommend that future studies focus on creating a tool or model that can determine if the practices are available can be applied to other products. This would even allow suggestions to be made across products that are not similar in nature. Lastly, I encourage future studies to focus on finding solutions to broaden the reach of effective certifications, rather than determining their efficiency. Certifications have the potential to shift procurement decisions to reduce the impact on the environment, but instead of criticizing it, solutions should be proposed.

Conclusion

High levels in precision indicate that it is possible to apply information from existing ecolabels and EPPs to similar products. However, the low levels in accuracy show that the method used in this study might not be the most effective way to do so. The precision results are extremely important because they indicate that it is possible to expand the reach of existing certified products to not certified products. Thus, this research shows that it is possible to tackle the poor coverage of existing products.

The lack of comprehensive product coverage is due to the fact that ecolabels target their certifications to the firms that will buy them (Miller 2015). Since it takes capital and labor to create certifications, if they do not sell, then the ecolabels are not willing to create them. The study shows that the information from certifications can be extrapolated to similar products, drastically cutting down the cost of creating new certifications. Consequently, even without much additional investment, more products could be covered.

The database used in this study brings together certifications and sustainability reports from multiple ecolabels and government bodies. By incorporating practices that stem from multiple sources the quality, and so credibility, of the suggestions in this method would be automatically improved, because the same information is being reinforced. This would help improve the suggestions' transparency, accountability, and impartiality. The ProductBio tool also ignored outliers since it used the repetition assumption. Understating why pooling information together is essential to this model shows that getting certifying bodies to share information could drastically

improve the information available to the consumer and stakeholder. By doing so, the credibility from all parties involved could have a much more significant role in reducing environmental impacts.

Furthermore, the increase in product coverage could also result in a reduction of environmental impacts. By having more certified products, the number of firms that purchase certifications, and therefore improve their practices in their supply chain would also increase. Individuals, industries, and governments can shift their purchasing power towards less environmentally damaging products, driving the world towards greener economy.

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APPENDIX A: Paper Categories

Accounting forms or accounting books
Album papers or tissues
Applicant fingerprint cards
Art or craft paper
Assorted paper kits
Banner paper
Bill of lading forms or bill of lading books
Bills or bill books
Blotter paper
Booking forms or reservation books
Business cards
Business forms or questionnaires
Calculator or cash register paper
Carbonless paper
Cardstock papers
Checks or check books
Computer printout paper
Construction paper
Control forms or control books
Correspondence forms or correspondence books
Cover paper
Delivery forms or delivery books
Deposit verification form
Digital paper
Examination booklets or forms
Facial tissues
Facsimile paper
Foolscap sheets
Game of chance forms or coupons
Gift certificate
Gift wrapping paper or bags or boxes
Graph paper
Greeting or note or post cards
Index cards
Inventory forms or inventory books
Invitation or announcement cards
Label papers
Lining papers
Log books or pads
Magnet paper
Medical monitoring or tracing or recording paper
Mimeograph paper
Multipurpose business book
Multipurpose paper
Music score or manuscript papers
Notebook filler paper
Onion skin paper
Order forms or order books
Paper napkins or serviettes
Paper pads or notebooks
Paper table cloth
Paper towels
Parchment paper
Personnel forms or personnel books
Pharmacy prescription pad
Plotter paper
Poster boards
Poster papers
Printer or copier paper
Receipts or receipt books
Sales forms or sales books
Self adhesive note paper
Stationery
Tax forms or tax books
Telegraph papers
Telephone message pads or books
Telex rolls
Tent cards
Thermal paper
Tickets or ticket rolls
Toilet tissue
Tracing paper
Tractor feed paper
Vellum paper

Leathack paper	Vouchers
Ledger paper	Writing paper
Library book or borrowers cards	

Table A1. List of paper products. This is the complete list of the 79 paper products as defined by the UNSPSC Code