

An Investigation into the feasibility of wheat versus wood fibre paper for UBC

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THE UNIVERSITY OF BRITISH COLUMBIA
Department of Applied Science

SUSTAINABILITY PROJECT REPORT



**AN INVESTIGATION INTO THE FEASIBILITY OF
WHEAT VERSUS WOOD FIBRE PAPER FOR UBC**

prepared by

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Abstract

The University of British Columbia (UBC) is a leader on sustainability and is currently investigating the feasibility of using wheat fibre paper in lieu of the current 30% post consumer waste wood fibre paper. To examine this matter, a triple bottom line assessment for has been conducted. The triple bottom line assessment includes the investigation of social, environmental, as well as economic aspects of the use of both types of paper through various indicators for each category such as labour conditions, carbon emissions, and cost differences. Through extensive research from sources such as journal articles, online materials and other published reports, surveying users for an evaluation of the performance of both types of paper, as well as interviewing experts in the production of the wheat fibre paper, a significant amount of information and useful data has been gathered. From the investigation, the following observations can be made. First, the overall social aspects such as labour conditions, social awareness, and local resource distribution of the wheat fibre paper meet all the requirements from UBC's Supplier Code of Conduct. Second, the ecological footprint of the wheat fibre paper during its entire lifecycle is significantly less than that of the 30% PCW wood fibre paper. Third, replacing wood fibre paper with wheat fibre paper at UBC has minimal economic impact on the local scale. Based on the findings from the investigation, it is determined that the utilization of wheat fibre paper at UBC is viable and that the replacement of 30% PCW wood fibre paper with wheat fibre paper is recommended.

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Glossary

Carbon sink	A natural reservoir that accumulates and stores carbon containing compounds.
Deforestation	Removal of a forest or stand of trees.
Eucalyptus trees	Can be replenished every 7 years; unlike forest trees, which takes over 50 years.

List of Abbreviations

BTU	British thermal unit
CO ₂	Carbon dioxide
FSC	Forest Stewardship Council
GHG	Greenhouse gasses
IRR	Internal rate of return
PCW	Post consumer waste
UBC	University of British Columbia

1.0 INTRODUCTION

With the rising concerns for sustainability, the University of British Columbia (UBC) is looking to improve its contribution towards the social, environmental, and economic aspects of sustainability. Currently, the UBC Sustainability Program is turning its attention to the usage of paper on campus. In order to satisfy UBC's demand for paper, several hundred tonnes of trees needs to be harvested and processed every year. In order to seek an alternative, the use of wheat fibre paper is investigated for its feasibility compared to the 30% PCW wood fibre paper. Wheat fibre paper is manufactured without the need for deforestation. However, further research must be conducted in order to justify its viability not only environmentally, but socially and economically as well. In order to compare these two options, several groups of students in APSC 262 course have been given an opportunity to analyze the feasibilities for both types of paper.

This report is divided into the following sections:

In section 2, the possible social impacts due to importing wheat paper from India to replace the local wood fibre paper is explored.

In section 3, the environmental impacts for both the wheat fibre paper and the 30% PCW wood fibre paper in a lifecycle analysis is compared.

In section 4, the economic impacts due to the change in the business for paper industry in the long run is examined.

Finally, we draw conclusions and offer recommendations.

2.0 SOCIAL IMPACTS OF WHEAT FIBRE PAPER

The social impacts wheat fibre paper may bring include the labour conditions throughout production, the social awareness raised on sustainability issues, and the local resource distribution and demand.

2.1 LABOUR CONDITIONS

The labour condition through the production of the wheat fibre paper is strictly protected by the laws in India. According to Minto, since India has been manufacturing goods for such a long time, their labour laws have developed thoroughly and a well-established, organized and strict system have resulted. UBC's Supplier Code of Conduct states that children under the age of 15, or 14 where the International Labour Organization exemption for developing countries allows, and forced labour could not be hired. In 1954, India has amended its Factories Act (Bruce, 1970) to abolish the beggar system and bonded labour, as well as to divert children from the field of labour to schools, and to ensure a healthy environment for their all-round development. The Indian government also ensures that workers have a good and healthy working environment. Based on the above, Royal Printers has demonstrated that they meet the requirements of UBC's Supplier Code of Conduct.

2.2 SOCIAL AWARENESS

If the wheat fibre paper is adapted in UBC, social awareness on sustainability issues will be raised. Since UBC is a large and influential institution, UBC can establish a positive public image by demonstrating to the public the sustainability projects UBC participates in as one of the leading organizations on sustainability among North America. Hopefully as a result from this, others will begin positively contributing to the society in order to make our society more sustainable. In fact, as an example, the Canadian Geographic Magazine (Edwards, 2008) has already begun printing their magazine on wheat fibre paper, not only to cut down their ecological footprint but also to improve their public image as well. According to Minto, employees from their company can feel the pride for having such jobs. They can proudly go home after work and

tell their families and friends that they are working not just to make money, but also to contribute to the environment and to help build a greener and more sustainable society.

2.3 LOCAL RESOURCE DISTRIBUTION AND DEMAND

The adaptation of the wheat fibre paper in UBC will incur a large demand in the paper industry while the demand for 30% PCW wood fibre paper will decrease. In addition, the chance for causing unemployment in local wood fibre pulp mills will be made up by employment opportunities from wheat paper production. Although no local pulp mills have invested in wheat paper production currently, the wheat fibre paper must be shipped from India and thus does not quite meet the requirement on Metro Vancouver's "Sustainability Purchasing Guide". However, if the demand for wheat fibre paper increases, then the local wood fibre pulp mills will start investing in wheat paper production and the requirement from the guidelines will be met.

2.4 FEEDBACK FROM CONSUMERS

To see whether wheat fibre paper performs differently from the 30% PCW wood fibre paper, surveys and analysis have been conducted for both types of paper. Our group printed materials onto the wheat fibre paper with both inkjet and laser printers to conduct a performance test. Faults such as paper jams did not occur and the print qualities are determined to be comparable for both types of paper. In addition, both types of paper were handed out to a sample group of 20 participants who do not know the two types of paper are different. Their feedbacks on the two types of paper are then recorded. The consensus of the wheat fibre paper is that it is a bit brownish and slightly thinner compared to the 30% PCW wood fibre paper. Although wheat fibre paper and 30% PCW wood fibre paper are differentiable, from usage on a daily basis, the differences are negligible. Thus adapting the wheat fibre paper would not affect the users.

3.0 ENVIRONMENTAL ASSESSMENT OF WHEAT FIBRE PAPER

To investigate the environmental aspects of the triple bottom line assessment for 30% PCW wood fibre paper versus wheat fibre paper, the sourcing of raw materials, the ecological footprints, as well as the methods of disposal for both types of paper are examined.

3.1 SOURCING OF MATERIALS

Each year, UBC consumes approximately 53 million sheets of letter sized paper. Since each sheet has a mass of approximately 5 grams, 53 million sheets of paper would translate to a mass of 265 tonnes! Currently, UBC is committed to using paper with a minimum of 30% post consumer waste (PCW) material. According to the Paper Calculator, in order to produce 265 tonnes of this type of paper, 693 tonnes, or approximately 4800 trees, are needed. After a forest tree has been harvested, it takes over 50 years for the tree to grow back to its original size. As a result, harvesting 4800 trees each year for paper production has a significant impact on the environment.

Royal Social Print utilizes the residue waste of wheat stock, along with a small portion of Forest Stewardship Council (FSC) certified eucalyptus tree fibres to produce wheat paper. The portion of the wheat stock used to produce wheat fibre paper would otherwise go to waste and thus does not affect the human and animal food chain, as well as biofuel production. In order to produce one tonne of unbleached pulp on a bone dry basis, 2.8 tonnes of wheat straw are needed (Fix, J., Rees, W.E., 2007). There is an abundant amount of wheat straw available from the Prairie provinces in Canada each year, approximating 13-20 million tonnes (Inform, 2009). This means that 4.6 to 7.4 million tonnes of wheat fibre paper, dramatically greater than what UBC consumes annually, can be yielded every year.

For structural rigidity, Royal Social Print currently employs a design with a specification of 80% wheat straw, and 20% eucalyptus tree fibres. Eucalyptus trees, unlike forest trees, are re-

grown and replenished on farms every 7 years. With UBC’s annual paper consumption of 265 tonnes, 20% wood fibre content translates to 198 tonnes of raw wood use. Compared to the 693 tonnes wood use for 30% PCW wood fibre paper and the 50 years re-grow rate of forest trees, sourcing materials to produce wheat fibre paper significantly lowers the environmental impact.

3.2 ECOLOGICAL FOOTPRINT

Many environmental impacts due to the production cycle needs to be taken into consideration when evaluating the ecological footprint. To effectively compare the 30% PCW wood fibre paper with the wheat fibre paper, the following environmental indicators have been chosen: net energy, purchased energy, greenhouse gases (GHG), wastewater, and solid waste.

The table below (see Table 1) shows several environmental indicators associated with paper production. In order to produce UBC’s annual paper consumption of 265 tonnes of 30% PCW wood fibre paper, 7720 million BTU’s of energy are needed. Of the 7720 million BTU’s, approximately 76%, or 5904 million BTU’s of energy has to be purchased. Conversely, since the wheat fibre paper plant in India generates 80% of the required power from steam turbines, only 20% of the net energy has to be purchased.

	<u>30% PCW Wood Fibre Paper</u>	<u>Wheat Fibre Paper</u>
Volume of Paper	265 tones	265 tonnes
Net Energy	7720 million BTU's	N/A
Purchased Energy	5904 million BTU's	N/A
Percentage of Energy Purchased	76.48%	20%
Greenhouse Gases	1.39 million lbs of CO ₂ equivalent	Comparable
Wastewater	4.95 million gallons	Minimal
Solid Waste	0.45 million pounds	Minimal
Carbon Emission from Shipping	N/A	0.14 million lbs of CO ₂ equivalent
Carbon Release from Logging	4.34 million lbs of CO ₂ equivalent	N/A

Table 1. Comparison of 30% PCW Wood Fibre Paper and Wheat Fibre Paper

Trees act as a carbon sink since they store carbon dioxide (CO₂) removed from air. However, when the trees are harvested, all the stored carbon is released into the atmosphere again. According to American Forests, approximately 1 million pounds of CO₂ equivalent is

released for every hectare of forest harvested, approximating 1112 mature trees. In order to produce 265 tonnes of 30% PCW wood fibre paper, approximately 4.3 hectares of forest needs to be harvested. This translates to 4.34 million pounds of CO₂ equivalent released into the atmosphere due to logging. During the production of 265 tonnes of 30% PCW wood fibre paper, greenhouse gases equivalent to 1.39 million pounds of CO₂ are generated. Although no exact figures for greenhouse emissions can be found as a result of the production of wheat fibre paper, Minto believes that the emissions from the paper plant in India is comparable, if not less, to the emissions from the plants which produce 30% PCW wood fibre paper. This is due to the fact that systems involved in production in the wheat fibre paper mill in India such as the recovery boilers and power boilers are designed for low emissions. However, since the wheat fibre paper has to be shipped from India to Vancouver, additional carbon emissions from shipping needs to be accounted for. According to BSR/Clean Cargo, the CO₂ emission for an average deep-sea container vessel is 8.4g/tonne-km. With an approximate shipping distance of 15,719 nautical miles, or 29,112 kilometers from India to Vancouver, purchasing the wheat fibre paper from India would incur an additional 0.14 million pounds of CO₂ emissions. In the end, carbon emissions during the lifecycle of wheat fibre paper are significantly less than that of the 30% PCW wood fibre paper.

Results from the Paper Calculator shows that the production of 265 tonnes of 30% PCW wood fibre paper generates 4.95 million gallons of wastewater and 0.45 million pounds of solid waste (Environmental Paper Network, 2011). However, these effects are minimal for the production of wheat fibre paper. This is true because the whitening process for wheat fibre paper through a sodium salt and oxygenation process contains no harmful chemicals and the water used for cleaning the paper is recycled and re-used many times, until it naturally evaporates and thus needs replacement. Waste materials from the production cycle are recycled and are made into cardboard boxes to hold the wheat fibre paper. As a result, solid waste from wheat fibre paper production has a minimal effect on the environment.

3.3 DISPOSAL

The wheat fibre paper utilizes the current paper recycling methods and thus does not require additional attention during disposal. Since the proportion of the wheat fibre paper is significantly lower than the conventional wood fibre paper, the wheat fibre paper can be recycled into post consumer waste materials such as recycled paper, napkins, cup sleeves, etc. without any modifications to the current recycling methods. However, as the proportion of wheat fibre paper compared to conventional wood fibre paper increases due to increased popularity and usage, modifications or new methods for recycling wheat fibre paper are necessary.

4.0 ECONOMIC ANALYSIS OF WHEAT FIBRE PAPER

For any sustainable feasibility research, the economic aspect may be the final deciding factor. No matter how beneficial the social and the environmental effects an alternative may bring, it may be impossible to realize it if the stakeholders were to lose money as a result. In order to make the most accurate report possible, individuals representing Royal Printers and UBC Supply Management department were interviewed for the different costs for the wheat fibre paper and the 30% PCW wood fibre paper.

4.1 IMPORTING METHOD

The current option UBC is assessing is to import the wheat fibre paper from India, where billions of dollars have already been invested to manufacture wheat fibre paper (Roy, 2012). This method allows access to the product without having to worry about the heavy capital costs such as retrofitting cost for a pulp mill, and thus have relatively small risk from failing the market. However, this option will face drawbacks such as the expenses for shipping and perhaps the reduction in the gross domestic products due to the decreased consumption of local paper products.

According to Minto Roy, the Royal Printers representative, the cost of importing wheat paper from India will be comparable to the manufacturing method to produce conventional wood fibre paper locally. Currently, UBC spends approximately \$1,057,639 annually on paper (Goldspink, Duff, 2012).

4.2 MANUFACTURING METHOD

Perhaps the best long term solution to source wheat fibre paper may be by manufacturing them locally. As mentioned previously, this method will involve relatively large capital costs, because the existing pulp and paper mills must be retrofitted with new machineries in order to manufacture wheat fibre paper (Roy, 2012). Minto mentions that this part remains as a great challenge to be overcome unless the demand for wheat paper significantly rises.

Assuming the demands are met to make this method possible, locally sourced wheat fibre paper will be approximately 10% cheaper than importing them from India (Roy, 2012). This financial advantage will add up to a tremendous sum of money since UBC currently spends about \$1,057,639 on papers annually already.

The table below (see Table 2) is an estimate of an economic overview of a wheat fibre paper plant, where the first year was taken for retrofitting the plant and it was in operation for 10 years with steady depreciation (Dreisinger, 2011).

Cost to Retrofit	550	M
Operating Cost	15	M
Annual Revenue	160	M

Year	Revenue	Operating Costs	Investment	Gross Profit	Depreciation	Taxable Income	Tax	Return	Net Profit
1			550					-550	-550
2	160	15		145	55	90	45	100	-450
3	160	15		145	55	90	45	100	-350
4	160	15		145	55	90	45	100	-250
5	160	15		145	55	90	45	100	-150
6	160	15		145	55	90	45	100	-50
7	160	15		145	55	90	45	100	50
8	160	15		145	55	90	45	100	150
9	160	15		145	55	90	45	100	250
10	160	15		145	55	90	45	100	350
11	160	15		145	55	90	45	100	450

IRR	13%
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Table 2. Economic Analysis of Retrofitting a Plant

With the above assumptions, the wheat fibre paper plant will take 6.5 years to breakeven, and then have an internal rate of return (IRR) of 13% at the end of its life cycle. Given that the business grows into a large scale, this method may return greater net profit than expected as well.

5.0 CONCLUSIONS AND RECOMMENDATIONS

By inspecting the wheat fibre paper and wood fibre paper following the triple bottom line assessment, our group concludes that, from social aspect, the labour conditions of the wheat fibre paper mills meet or exceed the requirements for UBC. The overall social impacts for UBC to adapting the wheat fibre paper are positive. For environmental impact, our group finds that by using wheat fibre paper, 4800 trees could be saved annually. The wheat fibre paper is found to be more environment friendly from sourcing the raw material, to the production process, and to the end product compared to the 30% PCW wood fibre paper. Furthermore, according to the data our group has collected, it is determined that importing wheat fibre paper has minimal economic impact on the local scale. In summary, we find that replacing the 30% PCW wood fibre paper with wheat fibre paper is a feasible and sensible option for UBC to promote sustainability in both the short run and the long run.

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