

An Investigation Into Printer Toner Cartridges
A Triple Bottom Line analysis of remanufactured, OEM and compatible cartridges

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University of British Columbia

APSC 261

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An Investigation Into Printer Toner Cartridges

A Triple Bottom Line analysis of remanufactured, OEM and compatible cartridges

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APSC 261: Technology and Society
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ABSTRACT

The following report outlines our triple-bottom line (TBL) analysis of printer toner cartridges as it applies to procurement at the University of British Columbia. The request for an investigation was brought forward by Faiza Wilson and Paula Goldspink of the UBC Payment and Procurement Strategic Sourcing group.

In contrast to typical bottom-line accounting, which only considers net economic profit or loss for decision making, triple-bottom-line analysis also takes environmental and social factors into account.

Three alternatives of toner cartridges are included in this investigation. Original equipment manufacturer (OEM) cartridges are purchased new from “brand-name” companies such as Hewlett-Packard or Brother. “Remanufactured” cartridges are produced by a dedicated remanufacturing company, such as Digitech, which collects used OEM cartridges and replaces worn out components and toner. Finally, “compatible” cartridges are manufactured new by a third party to work with OEM printers.

In terms of up-front cost, “compatible” cartridges are by far the cheapest option. However, the 3rd party manufacturers are always based overseas and violate patent and copyright laws; producing products that appear to be OEM but exhibit poor reliability and quality. A failed cartridge can seriously damage a printer and that risk is a major disadvantage of “compatible” cartridges. Remanufactured cartridges were found to be 10-30% cheaper, and exhibit equal or higher quality, than OEM products.

The environmental benefit of a remanufactured cartridge is that it reuses most of the components of an OEM cartridge, whereas a “compatible” cartridge is too low of quality for reuse. This reuse spreads the grams of CO₂ and kilograms of material used over an average of 3.5 cycles. Because of the wide range of processes labelled as “remanufacturing”, it is difficult to draw conclusions on the entire industry with regards to recycling. However, Hewlett-Packard (OEM) and Digitech (Remanufactured) were specifically considered and found to have admirable recycling practices, with Digitech using relatively local facilities.

Social aspects were found to be the biggest barrier to more sustainable practice at UBC. Despite Digitech having an existing relationship with UBC BuySmart, none of the survey respondents were aware of the company. Digitech’s local facility and recycling partnerships align well with UBC Sustainability strategies, and free drop-offs and pickups are extremely convenient. The HP “Closed-loop” program requires a local drop-off.

As a result of this investigation, it is recommended that Digitech, or a similar quality remanufacturing company, be promoted to departments for toner purchases. Furthermore, well placed disposal collection points will ensure more cartridges are reused or properly recycled.

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GLOSSARY

Compatible Toner Cartridge – A compatible toner cartridge is made by a third party manufacturer and is made up of all new compatible parts. It has a similar quality to an OEM cartridge (often cannot be remanufactured).

OEM Cartridge – An OEM Cartridge is one made by the Original Equipment Manufacturer. If you own a Hewlett-Packard LaserJet printer for instance, then the Hewlett-Packard brand is the OEM cartridge for your printer.

Remanufactured Toner Cartridge – A remanufactured toner cartridge is one in which a manufacturer takes an original OEM cartridge, disassembles it, tests and replaces any worn parts, fills it with toner and re-assembles.

1.0 INTRODUCTION

This investigation is a collaboration between our team of APSC 261 students, the UBC Campus Sustainability SEEDS (Social Ecological Economic Development Studies) Program and the UBC Payment and Procurement Strategic Sourcing group.

The goal is to perform a Triple-Bottom-Line (TBL) analysis of alternatives for printer toner cartridges, by considering the economic, environmental and social implications of each option.

Three alternatives of cartridges are included. Original equipment manufacturer (OEM) cartridges are purchased new from major brands such as Hewlett-Packard or Brother. "Compatible" cartridges are manufactured new by a third party to work with OEM printers, typically at significantly reduced cost and quality. Finally, "remanufactured" cartridges are produced by a dedicated remanufacturing company, such as UBC BuySmart partner Digitech, which collects used OEM cartridges and replaces only worn out components and toner.

First considered are the short-term and long-term economics of the various cartridges, including a brief discussion of legal action against "compatible" manufacturers. The environmental analysis compares the major options by three metrics: grams of CO₂ produced in manufacturing, kilograms of material used on an annual basis, and recycling opportunities. Finally, the social aspects of purchasing and disposing of printer toner are discussed. This section has particular relevance to future implementation of any new purchase programs.

2.0 ANALYSIS

2.1 ECONOMIC

This section of the report will discuss the findings on the economic aspects of OEM, remanufactured and compatible toner cartridges. It is important to note that the economics of these cartridge types will be analyzed as three separate items.

Understanding the differences in customer prices between OEM, remanufactured and compatible toner cartridges is an important aspect in the decision making process of the final consumer. Table 1 provides a comparison of prices of HP toner cartridges from the OEM, Digitech and toneronline.ca. These prices are used as an example to represent the price range of the three types of toner cartridges. From this comparison it can be seen that the prices increase from compatible to remanufactured to OEM toner cartridges. Prices may fluctuate between a given toner cartridge for different OEM and remanufactured distributors.

Table 1: Price Comparison of HP OEM, Remanufactured and Compatible Toner Cartridges
*Toner on Sale

Toner Cartridge Type	OEM (HP)	Remanufactured (Digitech)	Compatible (toneronline.ca)
	CAD	CAD	CAD
CE505A	102.99	84.95	32.50
CE505X	187.99*	139.95	42.50
Q1339A	225.99	159.95	57.25
CC364X	316.99	279.95	63.60

An economic analysis cannot solely be based on purchase price but also on the quality of the varying types of toner cartridges. This is quantified by a reliability test involving the printing of pages and deeming them acceptable for external use (all uses including distribution outside of a company). Digitech provides a 96% reliability on their remanufactured products and also provides a year warranty on toner cartridges that have not been depleted. Testing on HP and compatible monochrome cartridges reliability concluded that HP and compatible cartridge reliabilities were 94.7% and 57% respectively (SpencerLab, 2013).

Another aspect of the economic impact of these toner cartridges is which economy is being stimulated by the purchase of each toner cartridge. OEM companies are generally world wide companies having their service and support based in large North American and European cities

while their production is outsourced to Mexico and Asian countries. Digitech is a local company that remanufactures and distributes out of Burnaby. Compatible toner companies have national distribution offices with production overseas in Asia, primarily in China and Taiwan. Compatible toner is mainly purchased online and shipped to consumers from the national distribution offices. It should be noted that it is difficult to research the whereabouts of compatible production sites.

The Imaging Supply Coalition (ISC) is a nonprofit organization aimed at attacking third party toner cartridges that are either counterfeit or infringe on patents. Counterfeit toner cartridges are sold under an OEM brand but are produced by a third party. This does not include toner cartridges that are label as either compatible or remanufactured. As it is too difficult to analyze these counterfeit toner cartridges as they are unlawfully labeled as OEM brands they will not be included in this analysis. The ISC has also targeted compatible toner cartridges that aren't counterfeit but do infringe on the intellectual property of the OEM. Due to these patent violations, many OEM has begun to take legal action against compatible toner cartridge companies. This legal issue converts into an ethical issue for the end consumer when purchasing.

The overall economic analysis has determined that remanufactured (Digitech) and OEM toner cartridges (HP) provide a reliable product with remanufactured edging out OEM with price and local markets. Compatible toner cartridges generally provide a 'cheap' product that is inexpensive but also unreliable and potentially damaging to printers. This type of cartridge may also infringe on OEM patents. This unreliable toner cartridge is not desirable for UBC departments as they produce a large amount of printed pages for external use and cannot afford unusable pages.

2.2 ENVIRONMENTAL

The environmental section of the triple bottom line analysis will use a number of different metrics to compare and evaluate the three different toner options (OEM, compatible and remanufactured). In particular, these metrics include:

- Grams of CO₂ produced throughout life cycle
- Material Usage by mass
- Recycling possibilities

It should be noted that for the first two metrics it is reasonable to group OEM and compatible cartridges together, since they are both new cartridges that have never been used before, and require similar manufacturing processes and materials. Therefore, the analysis of CO₂ emissions and material usage will compare new toner cartridges (OEM or compatible) versus remanufactured toner cartridges. The final metric, recycling possibilities, will analyze each of the three different toner options individually.

Table 2 below shows the carbon emissions of a new toner cartridge versus a remanufactured toner cartridge over its entire life cycle. The life cycle analysis of a new cartridge is

straightforward and easily interpreted. It involves looking at the production of each individual component from raw material, the packaging of the toner cartridge, the shipping of the toner cartridge, the distribution of the toner cartridge and the carbon emissions from energy use. However, the analysis of the remanufactured cartridge is slightly more complex.

A remanufactured toner cartridge originally starts as a new toner cartridge. Specifically, an OEM cartridge since compatible cartridges are too low of quality for remanufacturing. After the OEM cartridge has been used, the consumer has the option of having this toner cartridge remanufactured. If they choose to do so, the toner cartridge will be sent to a remanufacturing company and they will refill it with toner before sending it back to the consumer. This process can be repeated on average 3.5 times before the toner cartridge becomes incapable of further remanufacture. At this point, the consumer must purchase a new OEM toner cartridge and repeat the process.

Therefore, when analyzing the carbon emissions of a remanufactured toner cartridge, the emissions during remanufacture must be considered in addition to the emissions of the original OEM cartridge, which are amortized over its extended remanufacture lifetime. Essentially, the more times a toner cartridge is remanufactured the less significant the manufacture of the original OEM cartridge becomes. The results show in Table 2 below take this into account.

Table 2: A comparison of the carbon dioxide (CO₂) generated during the life cycle of a OEM or compatible toner cartridge versus the life cycle of a remanufactured toner cartridge. (Based on data reported by Best Foot Forward Sustainability Consultants for the Centre of Remanufacturing and Reuse, 2008)

Life Cycle Stage	Emissions of OEM or Compatible Cartridge (gCO ₂)	Emissions of Remanufactured Cartridge (gCO ₂)
Component Production	2,136	650
Components Packaging	286	110
Cartridge Packaging	980	510
Components Shipping	203	60
Distribution	33	360
Energy Use	761	680
TOTAL	4,399	2,370

Table 2 above illustrates that using remanufactured toner cartridges produces significantly less carbon emissions compared to using new toner cartridges. In particular, one of the largest carbon emissions advantages for remanufactured toner cartridges over new cartridges results from component production. This is due to the fact that the remanufacture process reuses as many of the original toner cartridge components as possible. In some cases components are replaced, but this only occurs when they are damaged.

Table 3 below shows the number of new components used to produce 1,955 new toner cartridges versus the number of new components used to remanufacture 1,955 toner cartridges.

As expected, it requires 1,955 of each part to produce 1,955 new toner cartridges. On the other hand, remanufacturing requires significantly less of each part to remanufacture the toner cartridge.

Table 3: A comparison of the number of new components required to produce 1,955 new toner cartridges versus the number of new components required to remanufacture 1,955 toner cartridges. (Based on data reported by Best Foot Forward Sustainability Consultants for the Centre of Remanufacturing and Reuse, 2008)

Component Type:	OEM or Compatible		Remanufactured	
	Components Required	Total Weight (kg)	Components Required	Total Weight (kg)
Drums	1,955	160.2	708	63.0
Wiper Blades	1,955	172.3	116	9.8
Primary Charge Rollers	1,955	78.6	196	12.9
Mag Rollers	1,955	52.2	92	2.6
DR Blades	1,955	104.6	36	2.9
TOTAL	9,775.00	567.90	1,148.00	91.20

Since the remanufacture process requires significantly fewer components to produce a certain number of toner cartridges when compared to the production of new toner cartridges, a large amount of raw material is saved. In particular, Figure 1 below shows the material usage in a new toner cartridge compared to the material used in remanufacturing a toner cartridge.

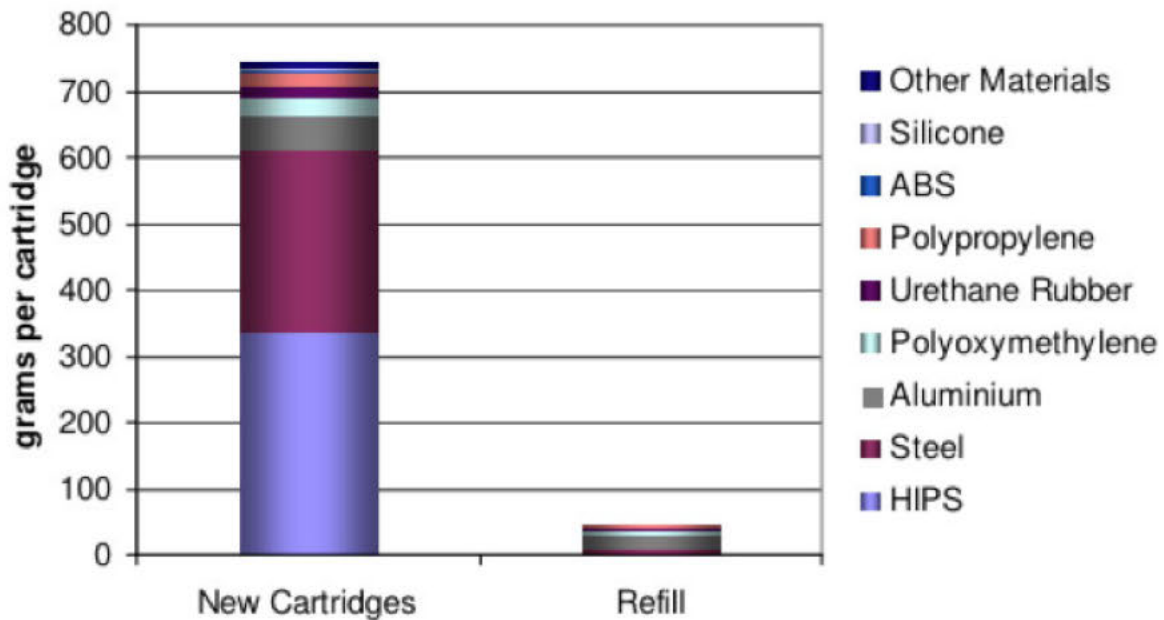


Figure 1: Comparison of materials (by weight) used in new toner cartridge manufacture versus toner cartridge remanufacture (Prepared by Best Foot Forward Sustainability Consultants for the Centre of Remanufacturing and Reuse, 2008)

The last metric to consider is the recycling possibilities available for the three different types of toner cartridges. As mentioned above, it is useful to analyze OEM, compatible and remanufactured cartridges separately for this particular metric. Many of the different suppliers and remanufacture companies have their own recycling programs in place to dispose of their toner cartridges in a responsible manner. It is not feasible to examine the recycling process of each individual supplier and remanufacture company. As a result, the recycling process of a single OEM company, Hewlett Packard (HP), will be examined. HP is the dominant brand of printer on campus, and they are one of the dominant companies in the industry. This recycling process will be compared to the recycling process of Digitech, a lower mainland based remanufacture company whom UBC already does business with. And finally, these two processes will be compared to the scarce recycling options available for compatible toner cartridges.

Figure 2 below shows a simplified schematic of HP's closed loop recycling process. This diagram illustrates the process used in recycling any type of plastic they may collect, including the plastic contained in toner cartridges.

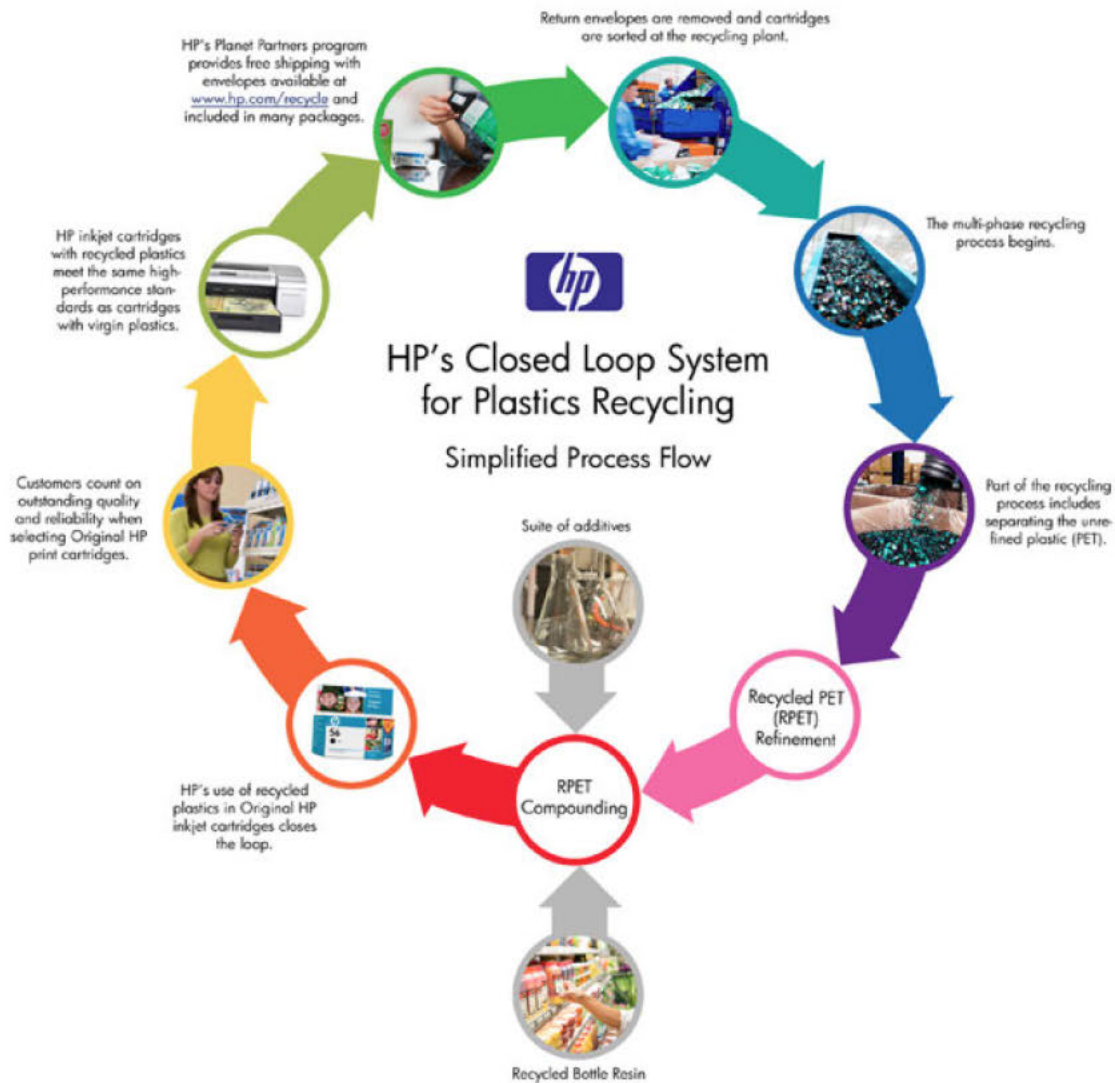


Figure 2: HP's closed loop recycling process for plastics (Prepared by Hewlett-Packard, 2008)

HP's closed loop recycling process is very innovative for a large diversified company. It is clear that HP is leading the way in OEM recycling programs, and as a result has received a wealth of positive media coverage. However, there are still some additional aspects to consider. The closed loop title means that the recycled material goes right back into the production of new HP products. This process can have big benefits; although, as with any recycling program, the success of the program relies on the consumer. In the HP process, consumers can return their cartridges to specific collection locations or mail them using prepaid packaging. It is not feasible for a company like HP to pick up toner cartridges from each individual consumer; and as a result, the success of the program requires some consumer initiative. In addition, HP only

accepts toner cartridges that they have produced. They do not accept any compatible cartridges or OEM cartridges produced by other companies.

HP operates a number of different recycling facilities in a number of different countries. Currently, HP offers its recycling programs in Canada, US, most of Europe, and certain countries in Asia and South America. They do not operate recycling facilities in each of these countries; instead, they rely on both national and international shipping of waste material to their recycling facilities. Although the energy use and carbon emissions associated with this transportation cannot be estimated, it should be noted that they are likely high due to the volume of waste being transported and the distance the waste is being transported.

Digitech was contacted to determine the specific details of their recycling process. These details are outlined in Table 4 below.

Table 4: Digitech’s Recycling Process

Materials/ Components	Company Used	Company Location
Metals	Regional Recycling	Lower Mainland (Multiple Locations)
Plastics	Urban Impact	Lower Mainland (Multiple Locations)
Casings	Clover Technologies	United States (Multiple Locations)

One of the main benefits of Digitech’s recycling processes is the use of local third party recycling companies. From an environmental standpoint, this means minimal energy usage and carbon emissions resulting from transportation of waste material. Digitech’s process requires minimal consumer initiative since they pick up all waste cartridges from the consumer, and do so in a hybrid Toyota Prius.

However, due to the number of different third party companies used, it is difficult to analyze Digitech’s process any further. In particular, it is not feasible to analyze the effectiveness of the recycling methods used by each one of the third party companies, or determine how each company utilizes the recycled materials.

Compatible toner cartridges have the least number of available recycling options. Most compatibles toner cartridges are sold by large internet based companies who do not offer any recycling programs. In particular, the only publicized option is recycling compatible toner cartridges using certain retail store recycling programs. One issue that arises with this method is that many retail stores have limits on how many toner cartridges a particular consumer can

return per time period.

The overall environmental analysis shows that the use of remanufactured toner cartridges results in a significant reduction of CO₂ emissions and raw material usage when compared to the use of OEM and compatible toner cartridges. It is also noted that a particular OEM toner cartridge can only be remanufactured an average of 3.5 times before it loses its necessary functionality. As a result, it was important to examine the recycling option available for each type of toner cartridge. Although, viable recycling options are available for both OEM and remanufactured toner cartridges, recycling options are scarce for compatible toner cartridges.

2.3 SOCIAL

The social impacts of the companies involved in the recycling is an important part of the overall process. HP and Digitech cartridges will be the main focus with a small component on compatible. Additionally, the impact on the UBC departments and individuals who are involved in the use and recycling play a role in the final recycling plan.

As shown in Figure 2: HP's Closed Loop System, the location of the processes are not defined. They mention local drop-off locations and in Canada they have partnered with Staples and London Drugs but they do not place emphasis on the recycling locations. Working with local companies is a factor that Digitech takes into consideration and places great emphasis on as can be seen in the locations mentioned in Table 4; Digitech Recycling Process. In an email exchange with President of Digitech, Dave McConachie, mentioned that "preference is given to the local supplier whenever possible." It is extremely difficult to find examples of local community support from Compatible cartridge companies.

The level of responsiveness and technical support have a big impact on the performance and ease of use of each system. Getting in touch with HP and Digitech was relatively easy. Digitech was extremely responsive both by email and telephone. However, in trying to get in touch with a local Compatible company, Laservalley Technologies, they were not as willing to disclose information nor provide support for our research.

Additionally, the current practices and views of users and purchasers in the UBC faculties and departments are extremely varying. Displayed in Table 5 are some of the current practices by departments at UBC. Surprisingly, no one that was interviewed or surveyed used Digitech. The exact reasoning for this is unknown. Potential reasoning includes lack of awareness about remanufacturing and the benefits, current long-standing partnerships, and preferences in quality. Additionally, one of the major factors that was identified was that all three of the recommended department contacts did not utilize the UBC BuySmart Program and were unaware of the preferred suppliers (Goldspink, 2013) (Moncayo, 2013) (Trouchenko, 2013).

Table 5: Current Practices

Type	Company	Departments Using	Reasoning
OEM	Xerox	Electrical and Computer Engineering Mechanical Engineering	Special Xerox chip prevents alternative recycling methods (Chu Chon, 2013) (Yabuno, 2013)
Compatible	Laservalley Technologies	Electrical and Computer Engineering Mechanical Engineering Payment and Procurement Services	Convenient & long-standing partnership (Chu Chon, 2013) (Yabuno, 2013) (Goldspink, 2013)
Remanufactured	Digitech	N/A	N/A

Overall, Digitech places the most emphasis on utilizing and supporting local companies and communities. Laservalley Technologies is also local and has the potential to be supporting local companies. However, supplemental information would be need to be gathered from them. Additionally, departments like convenient methods of toner disposal in addition to upholding their partnerships. As all of the department contacts were aware and in favor of the UBC Sustainability Initiative but not utilizing UBC BuySmart program, further promotion and education on the benefits and use of this program should be communicated to the departments in order to provide knowledge on the benefits of using the program and the preferred suppliers.

3.0 CONCLUSION AND RECOMMENDATIONS

By evaluating the three major options of toner cartridges in terms of social, environmental, and economic, remanufactured cartridges are found to be preferable on a Triple-Bottom-Line basis.

While compatible cartridges are considerably cheaper, their low reliability and questionable legality make them a poor option for academic use. For the same quality as an OEM product, remanufactured cartridges offered a 10-30% discount.

The reuse of OEM parts in a remanufactured cartridge translates to lower per-use environmental impact in all the metrics considered. The low quality of compatible cartridges makes them non-reusable. Both OEM and remanufactured companies considered, HP and Digitech, offered good recycling programs. Digitech's recycling program stood out in particular for its use of local and Californian facilities.

For a more sustainable program of toner purchasing and disposal to be successful, the ease of use must be considered. The free campus drop-off and collection offered by Digitech and other remanufacturing companies is a considerable advantage. These companies also focus on responsible recycling and the local economy, which aligns with the UBC Sustainability Strategies. However, creating awareness of new programs and user buy-in will be a considerable social challenge.

In conclusion, it is recommended that Digitech be promoted to departments for purchasing toner cartridges. This option has the least barriers since the company is already a supplier in the UBC BuySmart system.

There may be opportunities to have toner replacement and recycling done by an OEM as part of a large machine's service. The Hewlett-Packard "Closed-loop" program is a well organized system and could exist in parallel to remanufactured products for smaller printers.

Finally, in light of the questionable legality of the compatible cartridge industry and the reportedly poor quality of its products, compatible cartridges are not recommended for use at UBC.

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APPENDIX A: Project Option Description

Triple Bottom Line Analysis of Remanufactured Toner Cartridges vs. OEM Cartridges

Stakeholders:

- Paula Goldspink, Category Management & Sustainability Program
- Faiza Wilson, Category Analyst Payment & Procurement Services | Strategic Sourcing

Project Background: Toner cartridges are purchased and used all across campus and since they are used by over 16,000 staff and faculty in over 400 departments, they have high visibility and high impact. The purchase of toner cartridges by individual UBC departments is currently decentralized (anyone can purchase items that are <\$3,500) and difficult to track (purchased from many different suppliers – often outlets that sell office supplies). A major issue is the waste generated when the cartridges are empty. They are often thrown in the garbage, or returned to the original supplier for recycling. Although UBC has a Supplier Arrangement in place with Digitech Renewable Printer Cartridges with whom we spend about \$30,000 annually (UBC BuySmart <http://www.supplymanagement.ubc.ca/news/ubcbuysmart>), we know the overall toner spend is much higher.

Project Objective: to perform a TBL analysis showing the overall benefit to purchasing a remanufactured vs. OEM/compatible cartridges. We will use the analysis to promote the purchase/reusing of remanufactured toner cartridges on UBC BuySmart. This will also help us when formalizing a UBC campus wide toner recycling program.

Connection with UBC Policies and Plans:

- Supplier Code of Conduct: UBC must align with Supply Management's Supplier Code of Conduct <http://supplymanagement.ubc.ca/sites/supplymanagement.ubc.ca/files/uploads/documents/Supplier%20Code%20of%20Conduct.pdf> when making purchases and take into account the full life cycle for products.
- Zero Waste Action Plan: One of the goals for the upcoming Zero Waste Action Plan is to update the Sustainability Guide. Payment & Procurement Services (PPS) will be looking to include toner cartridges and APSC 261 recommendations will be used as reference.

General Task:

Using a triple bottom line analysis, we would like you to compare remanufactured toner cartridges to OEM/compatible cartridges

Specific Tasks:

In the assessment, include an evaluation of the economic aspects (total cost of products), the environmental aspects (energy & material resources used, waste generated, recycling opportunities), and social aspects (local/global sourcing of materials and manufacturing, current

consumer practices, performance for consumer, impact on awareness of sustainability).

Anticipated Outcomes:

Report findings and recommendations will contribute to the decision making of PPS procurement practices and support the PPS Sustainability Framework. The findings will be published on UBC BuySmart and in the Sustainable Purchasing Guide v3.

Resources:

Mike Karamanian, Vice President, Digitech Renewable Printer Cartridges Tel: 604-322-5433
mike@digitechlaser.com

Toner Round up data (November 29th, 2012)

- Picked up 950 cartridges (800 toner cartridges; 150 ink cartridges)
- Declined 100 (deemed unusable)
- Picked up from approx. 70 departments campus wide
- Noted that many departments are using compatible toner cartridges (cartridges that Digitech can't reuse in their remanufacturing process). These are often very cheap and widely available.

Helpful definitions:

- Remanufactured Toner Cartridge – A remanufactured toner cartridge is one in which a manufacturer takes an original OEM cartridge, disassembles it, tests and replaces any worn parts, fills it with toner and re-assembles.
- OEM Cartridge – An OEM Cartridge is one made by the Original Equipment Manufacturer. If you own a Hewlett-Packard LaserJet printer for instance, then the Hewlett-Packard brand is the OEM cartridge for your printer.
- Compatible Toner Cartridge – A compatible toner cartridge is made by a third party manufacturer and is made up of all new compatible parts. It has a similar quality to an OEM cartridge (often cannot be remanufactured).

APPENDIX B - Email Correspondence with D. McConachie

Note: email from our team is in purple and responses are in red.

From: Amy Leson [mailto:amy.leson@gmail.com]
Sent: November-12-13 2:42 PM
To: Dave McConachie
Cc: Jordan Eichorn
Subject: Apsc 261 Project Questions

Hi Dave,

Thank you for taking the time to help us out with this project. We have come across a couple questions that we have about **Digitech** and some of the processes.

- In the event you don't have a component to refurbish a cartridge, how do you find the additional materials/ component you need? Is it a local supplier?

We have suppliers that we can purchase the individual components from – 1 is local, 2 are located in northern California. Preference is given to the local supplier when-ever possible.

- Are you ever in short supply of toner cartridges? or do you commonly get more cartridges returned that purchased?

Usually when we start rebuilding a new cartridge empty cartridges can be hard to find. We do have arrangements with some organizations where we simply pick up their empty cartridges, as well we work with our clients to ensure that they are starting with an empty cartridge that we can rebuild. In some cases we may require the client to buy a brand new cartridge so that we can get them on a recycling program.

- Also, we are trying to assess the recycling process of toner cartridges. In particular how each component/ or similar material is recycled. Are there any materials/components that cannot be recycled? Also, for the materials/components that can be recycled, what recycling companies are used?

The only part of a cartridge that can't be re-used is the waste toner. The metal components are recycled locally through regional recycling, some plastic parts are recycled through Urban Impact and the casings are handled by Clover Technologies out of the US.

APPENDIX C - Survey Results from Trevor Yu

- What department do you represent?
 - Pharmaceutical Sciences
 - Faculty of Medicine
 - Payment and Procurement Services
- What brand of photocopier cartridge(s) is your department currently using?
 - HP
 - HP
 - Other
- What type of photocopier cartridge(is) is your department currently using?
 - Toner
 - Toner
 - Toner
- On average, how long does a toner cartridge last before you have to refill/replace it?
 - 9 months- 1 year
 - 5- 8 months
 - 1-4 months
- Where do you go to buy your cartridges?
 - SNS Data
 - TLD
 - Xerox UBC Global Services
- When you cartridges run out of ink, what do you do with the cartridges?
 - buy a new one and recycle the old
 - recycle the old
 - recycle the old
- If you buy new cartridges, what type do you buy?
 - Compatible
 - Remanufactured
 - OEM

APPENDIX D - Meeting Minutes (Sustainability Project Workshop)

- Also in attendance, Dave from Digitech
- It is up to us to find specific purchasing info for the many campus faculties
- Toner cartridges are considered “smaller purchases”
- UBC buy smart is an online portal that contains UBC purchasing contracts/sustainable purchasing information
- Project is limited to photocopy toner
- Finding statistic on remanufactured toner performance is very difficult
- People at UBC generally don't know how to dispose of cartridges
- We are not limited to Digitech when it comes to remanufactured toner companies
- 80% are HP brand printers
- Remanufacturing cartridges is a non regulated process – no standards exist
- There are 7 parts to be inspected/replaced when remanufacturing a toner cartridge
- Compatible cartridges are illegal, they don't comply with North American copy right laws
- Digitech has a 96% success rate on remanufactured toner cartridges
- HP reports a 5% failure rate on their new OEM cartridges
- Only one other company in BC that remanufactures cartridges
- Digitech sought ISO designation for quality manufacturing as a method of validating their process/ performance
- Everything can be recycled from old cartridges. Digitech pays to recycle the parts; however, they make money on the recycling of aluminum.
- They use reusable boxes/ bags to decrease environmental impact – some boxes have been in circulation for a decade
- The most difficult thing to recycle is the residue toner. Digitech currently sends this to a company that grinds it up to make speed bumps
- In the past Digitech has dealt with 50-200 UBC departments
- A drum can be used 2-4 times on average
- Lifetime is dependent on visual inspection
- Remanufactured toner cartridges are 10-30% cheaper than OEM
- We are welcome to tour Digitech's facility
- Shipping for lower mainland is free