An Investigation into Waste Station Stream Tracking System in the New Student Union Building (SUB)

Andrew Zang, Mengxue Liu, Meng-Yeng Lee, Seyed Shervin Makkie

University of British Columbia

APSC 261

November 27, 2013

An Investigation into Waste Station Stream Tracking System in the New Student Union Building (SUB)

APSC 261

November 27, 2013

Prepared for Paul Winkelman

Prepared by

Seyed Shervin Makkie

Meng-Yeng Lee

Mengxue Liu

Andrew Zang

ABSTRACT

Recycling has proven to be a necessity in sustaining life on the planet and thus is being explored by organisations in the hopes of coming up with new means of sustainability. It can be as small as one person recycling one single plastic cup per, or as large as a multinational company handling their waste the best way possible. Regardless, these are the steps to clean air, clean water, and longer lifespan for every species on earth. Proper recycling requires the society to know how and what to recycle. As such, it seems like a good idea to provide people with instant feedback on their recycling both of their role in the recycling community, as well as the trends of the community as a whole.

The purpose of this report is to assess not only the economical, environmental and social aspects of two potential hardware or software combinations that serve the purpose of waste tracking and feedback, but also to ascertain whether the project as a whole will be effective at increasing recycling, and what can be done to aid this.

Personal interviews as well as online surveys have shown that most people would be interested in getting an instant feedback on what they have done, in other words: how much they have helped toward a brighter future. The surveys have also shown that taking advantage of social aspects to aid in the effectiveness of this project is also a good idea (detailed later in the report).

Providing instant feedback will not be easy and without costs. Extensive research has provided two of the best hardware and software companies who have worked on tracking waste and giving feedback. Drawing from a series of interviews with previous users of such products, it can be concluded that although the Intelex software will require the additional aspects of a system to install on as well as an attachable scale, it still is the most sustainable and cheapest product currently on the market.

Through assessing the triple bottom line assessment, carefully going over the economical, environmental and social aspects of each product. This report details why Intelex software is the correct choice, and that installing such a system in the SUB at UBC would indeed be an effective method of increasing recycling rates.

TABLE OF CONTENTS

ABSTRACT

LIST OF ILLUSTRATIONS

GLOSSARY

LIST OF ABBREVIATIONS

1.0 Introduction

- **1.1 Normandy Hardware**
- **1.2 Intelex Combination**
  - **1.2.1 Intelex Software**
  - **1.2.2 Floor Scale**

2.0 Economic Assessment

- **2.1 Normandy Waste Management System**
  - **2.1.1 Investment on Hardware**
  - **2.1.2 Energy Cost**
- **2.2 Intelex Waste Management Software**
  - **2.2.1 Investment Costs**
  - **2.2.2 Maintenance & Energy Costs**
- **2.3 Economical Conclusion and Preferences**

3.0 Environmental Assessment

- **3.1 Normandy Waste Management System**
- **3.2 Intelex Waste Management Software**
- **3.3 Environmental Conclusion and Preferences**

4.0 Social Assessment

- **4.1 Personal Survey Result**
- **4.2 Online Survey Result**
- **4.3 Social Conclusion and Preferences**

5.0 Final Conclusion & Recommendation

LIST OF ILLUSTRATIONS

Figure 1: TBL framework - section - 1.0

Figure 2: Normandy Hardware - section - 1.1

Figure 3: Intelex Hardware - section - 1.2

Figure 4: Scale - section - 2.2.1

Figure 5: Coal to electricity - section - 3.1

GLOSSARY

Capital cost - cost of capital: the opportunity cost of the funds employed as the result of an investment decision

Granular - resembling or consisting of small grains or particles

OpenVPN - is an open source software application that implements virtual private network techniques for creating secure point-to-point or siteto-site connections in routed or bridged configurations and remote access facilities.

LIST OF ABBREVIATIONS

AMS--- Alma Mater Society

UBC--- University of British Columbia

SUB--- Student Union Building

HMI --- Human-machine Interface

BC --- British Columbia

CAD--- Canadian Dollar

TBL --- Triple bottom line analysis

VPN --- Virtual Private Network

WMS --- Wireless Management Suite

1.0 Introduction

Since the days of the industrial revolution, man has grew a conscience towards the destruction of the environment. Indeed, entirely new professions have been created for the sole purpose of sustaining our environment. Groups and organizations from around the world are scrambling to implement ideas that they think, will contribute to saving the environment. As one of those scrambling groups, this report was written with the intention of assessing one of those ideas (ie. the effects of instant feedback on the community as a whole in regards to recycling), as well as providing viable options for attaining our particular goal. In particular, the goal of the project is to provide feedback to each individual the moment he or she has recycled, and outline the impact he or she has caused, furthermore, its purpose is also to track the waste to its recycling or disposal destination as well as provide monthly recycling trends to compare to.

This report presents and compares two of the best and most widely used waste tracking products. These are the Normandy hardware and the Intelex software coupled with an ipad and a low profile floor scale. Both options are evaluated for their economical pros and cons, their environmental foot print, and finally the social aspects they can contribute to. In short, we will be performing a TBL (triple bottom line analysis) on both products, detailed in **Figure 1.**

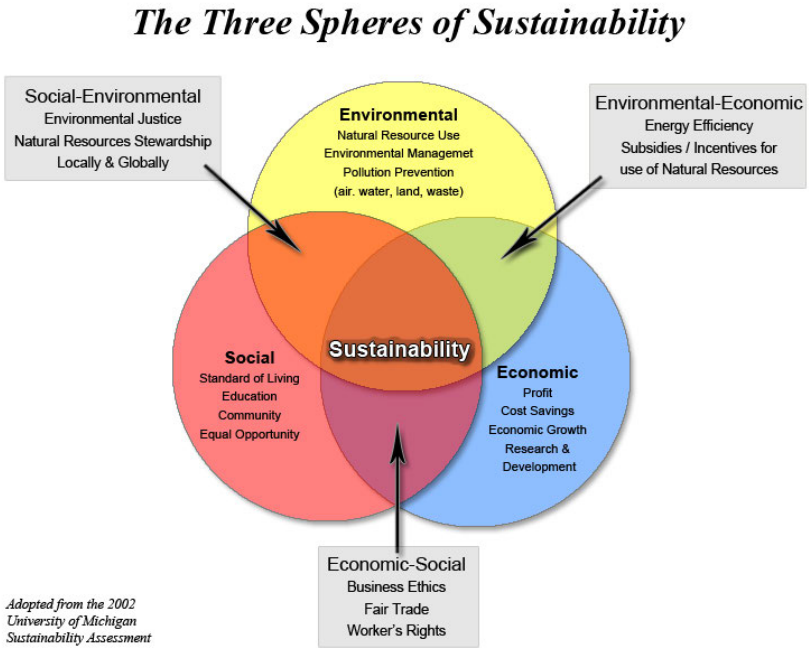

Figure 1. TBL Framework

Vanderbilt's Sustainability and Environmental Management Office (2013). *What is Sustainability?*. [ONLINE] Available at http //www.vanderbilt.edu/sustainvu/who-we-are/what-is-sustainability/. [Last Accessed 27/11/2013]

Descriptions of the design and analyses of prices, operational efficiency and social benefits for each product are described below, followed by an in depth conclusion and recommendations based on the information provided in this report.

1.1 Normandy hardware:

Normandy Waste Management **Figure 2.** system offers a software as well as a hardware for tracking both waste streams and waste trends. It comes with HMI touch screen for ease of use. The management system has a router to connect to regular network, and through the network, it maintains an OpenVPN secure connection to Normandy WMS's network sending real time data to its reporting server.

Figure 2 Normandy hardware
Normandy Waste Management Systems (2012). *Hardware*. [ONLINE] Available at http //www.normandywms.com/our-system/hardware/. [Last Accessed 27/11/2013]

As a pre-programmed hardware, there are two types of packages offered by Normandy waste management system: Management package & Company package.

Management package only covers one garbage bin in the building to track waste streams by types with graphic displays of data. It has trend graphs that allow user to compare waste volumes across selected periods of time with drill down capability to identify data sources at a granular level.

For the Company package, despite management's features, it is an all inclusive package, which can not only cover all garbage bins in the building (meaning the possibility of multiple bins), but also give a real-time instant feedback and automatically updating graphs display. It is able to create "waste goals" and communicate these goals company-wide for a targeted waste reduction effort. With the ability to convert waste volumes into waste costs, students can easily see the real cost of waste and be aware of the importance of waste reduction.

1.2 Intelex Combination:

Intelex **Figure.3** is a waste tracking and feedback software that we are able to couple with both our choice of scale as well as a tablet. It has the capability track a large variety of waste management initiatives including: type, month, quantity shipped etc. It is also able to assess real-time data to see the current status of your scheduled activates by date, hauler, manifest or any other metric being tracked.

Figure 3. Intelex Software

Intelex Technologies Inc. (2013). *Intelex*. [ONLINE] Available at http //www.environmental-expert.com/software/waste-management-69771. [Last Accessed 27/11/2013].

2.0 Economic Assessment

In order to assess the economical aspect of both products, we have considered the cost of the systems in terms of electricity used, maintenance cost as well as the cost of the hardware and software itself.

2.1 Normandy Waste Management System

2.1.1 Investment on hardware

For the Normandy Management package, the investment towards the hardware and software total at $2150/months including maintenance fee. Since two garbage stations are taken into consideration for the sake of this project and the Management package only covers one bin, the total price would come to $4300/month. Much too costly for its intended purpose.

On the other hand, the Company package offers all the same benefits, only it offers several bins (as needed) and as such, total at an all inclusive monthly cost of $3350. This is still much too pricy for its intended purpose despite the drop in price.

2.1.2 Energy cost

The UBC SUB operates from 7a.m to 11:30p.m. daily, which means 16.5 hours of operation of the selected hardware/software systems are required every day. Since Normandy is a computer-like hardware, the energy that it needs is similar to a regular computer---about 250 Watts. So the total energy Normandy uses per year is approximately: *0.25*16.5*365=1505.* ***625kWh***. In BC, electricity rate is 6.9 cents per kWh; therefore, the total cost per year is about **$103.8** for each individual bin.

2.2 Intelex Waste Management Software

2.2.1 Investment costs

The pricing of Intelex waste software was not obtained for this report as pricing was not listed on the official website and attempts to contact the company have been met with silence. However, we have found a similar e-waste recycling software at a cost of $400/month plus maintenance and implement fee.

The 150lb 4'*4' floor scale we have chosen is $220 (according to e-Bay and Amazon). For displaying the software, monitors or tablets are also needed. A very simple 20' monitor and computer systems is about

$500 in market (again according to e-Bay & Amazon price). On the other hand, using a basic Ipad, the initial investment would be $446.88 tax inclusive. Finally, the price of a generic scale **Figure 4** is around 1300 CAD. These hardware and software costs both initial and over time are an immense step down from the both the Normandy packages.

Figure 4. Scale

List of scales (n.d.). *Weighing equipment.* Retrieved November 26, from http://www.scalesgalore.com/pindustry.htm#Check

2.2.2 Maintenance & Energy costs

Moreover, the capital cost of simple computers and Ipads do not differ greatly, however the energy they utilize are dramatically different. For instance, simple computers use around 250 watts the same as the Normandy hardware, which like calculated before, is about $103.8 annually. On the other hand, a basic Ipad will only consume 11.9kWh per year and cost only 0.84 CAD basing on the BC electricity rates. Monthly maintenance fees for monitors and computers is anticipated to be about $50 as well taking into acount potential damage of the hardware.

2.3 Economic Conclusion and Preference

Despite the fact that both hardware and software combinations require monthly fees, it is apparent that the Normandy hardware and software combination is grossly over - priced. As such, in terms of economics, Normandy hardware system is out of the question. So the debate comes down to whether to install the Intelex software on an Ipad or on a simple computer. In the end, it is apparent that an Ipad is both less costly, and holds further benefits (described later in the report).

3.0 Environmental Assessment

In order to assess the environmental aspects of both products, we had to do a little tracking of our own. Firstly, the electricity usage was obtained. Second, we discerned the amount of kWh used, and finally, this number was converted into kilograms of coal. For the purpose of comparison in this report, the environmental footprints of waste extraction and delivery have been excluded as both choices require the same extraction and delivery.

3.1 Normandy Waste Management System

For Normandy Waste Management System, we will assume the system utilizes the same amount of power as a regular computer as detailed before. This is anywhere from 60 to 250 watts per hour. Here the highest possible wattage will be used (250 watts) resulting in up to 6 kWh. This amount then converts to 2.44 kilograms of coal per hour used in total to generate the electricity required for this system. And finally, scales typically use low energy and is described in both choices so it can be omitted. **Figure 5** is provided to give an indication of the process from coal to electricity.

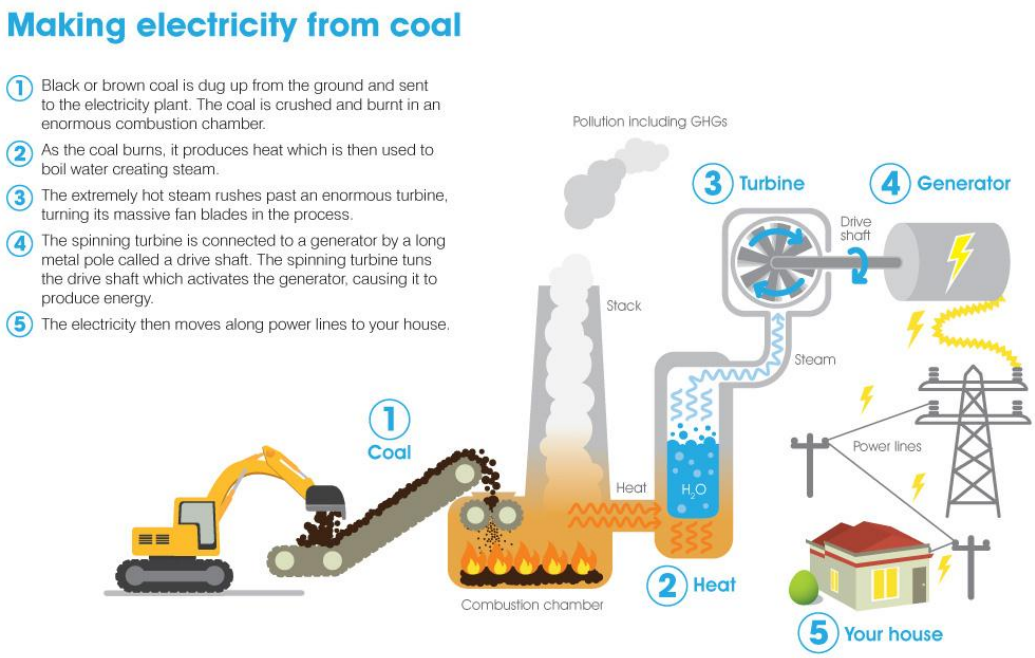

Figure 5. Coal to electricity

(Cannot provide reference as original age was deleted. Image obtained from www.yahoo.com)

3.2 Intelex Waste Management Software

In regards to Intelex, we will assume we apply to a tablet as utilizing a simple computer would again result in the same amount of coal used between Intelex and Normandy. Here, the regular power used for an

Ipad or a standard tablet is 65-75 watts. This finally results in 0.732 kilograms of coal used per hour. Once again we will omit the scales as well as the environmental footprint associated with delivery of waste.

3.3 Environmental Conclusion and Preferences

Despite the similarities in the possibility of hardware used (ie. a simple computer), Intelex has the potential of being installed on a tablet. If this scenario were to be pursued, the energy usage, and thus the coal usage and environmental footprint would be much less. As such, Intelex software coupled with a tablet and a simple scale is highly recommended in regards to the environmental aspect of the TBL.

4.0 Social Assessment

In this we reach the core of the issue. As described by many avid recyclers "Those who will recycle will, and those who do not will not". After all, the entire waste feedback project has the potential to be both completely disregarded by those who don't recycle anyways, and seen as an insult to those who do as it may convey the sense of treating someone who is an avid recycler like a child. As such, an idea was formed to take advantage of the social competitions between the faculties here at UBC. Both this idea as well as general questions about the project were inserted into an online as well as in person survey. Here are our results and recommendations as well as a sample of our online and in person survey.

4.1 Personal Survey Result

Sample:

1.How effective do you think providing feedback on individual recycled impact or overall monthly impact would be?

2.Would it be more effective to construct system as:

-----competition with other faculties

-----a game such as basketball

3.Do you have any suggestions on how to organize the system to increase effectiveness?

According to the result from this survey, 80 percent of the people we interviewed are in favor of the waste feedback and tracking system (in regards to the first question). Surprisingly however, according to the second question, 70 percent of the people we interviewed are in favor of creating a competition out of the systems among the faculties, believing that this will help to promote recycling. Finally, with reference to the last question, those who had suggestions do not seem to care about the instant feedback feature, instead, they believe recycling bins with clear instructions and more recycling bins in the building will increase the effectiveness. It can be noted here that if the bins were to be integrated into a competition between the faculties, we would require at least 3 bins for each of the main faculties, the remaining faculties would be distributed into either: Arts, Science or Engineering (ie. forestry into science etc.). As such, this would create a situation in which there are more bins, coinciding with the suggestion made for more bins.

4.2 Online Survey Result

We have also included an insert of our online survey:

How many times do you recycle a day?

Choices	once	twice	more than twice
Responses	18	3	3
Percentages	75.0%	12.5%	12.5%

How much time are you willing to take to recycle?

Choices	5s	30s	1min
Responses	6	8	10
Percentages	25.0%	33.3%	41.7%

How far are you willing to travel to recycle?

Choices	across the room	different room	different building
Responses	9	12	3
Percentages	37.5%	50.0%	12.5%

How often do you throw recycling items in the garbage bin?

Choices	once a day	once a week	once a month
Responses	9	10	5
Percentages	37.5%	41.7%	20.8%

How interested are you in the impact your recycling can cause?

Choices	not interested	interested
Responses	8	15
Percentages	34.8%	65.2%

Here, we began with general questions about recycling, culminating in the ultimate question of each individuals interest in the impact they can cause. Through this, we were able to discern that 65.2 percent were indeed interested in the impact they could make on the environment and that as a result, our system of instant feedback to provide such (the knowledge of the impact they have caused) would prove to be an asset to the recycling community

2.3 Social Conclusion and Preference

After extensive surveys, we were able to discern that installing a waste feedback and tracking system is generally believed to be a benefit to the recycling community. Even still, many believe that if we were to utilize the social competition between the faculties here at UBC, the system would be even more effective. Although it is apparent that Intelex's benefits far outweigh that of Normandy, there is one more key fact in its favour and that is that it can be installed

on a standard computer or tablet. This means that it is much easier to customize, perhaps by running multiple applications of Intelex to keep track of the different faculties, or other such customizable options, a trait that Normandy with its pre-programming does not offer. Even still, the attractive nature of the tablet will also "draw eyes" in a social aspect and further contribute to the effectiveness of the system. Here, Intelex is clearly the correct choice.

5.0 Final Conclusion & Recommendation

The objective of this paper was to evaluate both the effectiveness of installing a waste feedback and tracking system in the new SUB, as well as compare two products we have identified for this purpose. More specifically, this report was created with the goal of assessing the TBL or economical, environmental and social aspects of the products in question.

Beginning with economical aspects, this report has provided evidence as to why Intelex is the correct choice. After all, Normandy's monthly cost is several times that of Intelex for very similar functions. Furthermore, in regards to environmental aspects, Intelex is still the better choice. After all, Intelex has the capability of being installed on a tablet, which uses much less electricity then its desktop counterpart. Finally, in terms of social, it is apparent that Intelex with its capability of being installed on a standard tablet is far more customizable, allowing the system to take advantage of the competitive nature between the educational faculties at UBC. Intelex is without a doubt the correct choice.

In conclusion, to elaborate on some of the recommendations in this report, it is apparent that the upkeep cost for the Normandy Waste System does not carry enough benefits for its price. In contrast, the Intelex and hardware combination if equipped with the Ipad, is a much more attractive and conservative (cost wise) endeavor that would not only provide a cheap method of achieving our goal, but would also provide social benefits such as sleekness and therefore attractiveness of appearance. Furthermore, through online and in person surveys, we were able to discern the asset our system would be if standalone. Yet if the system were to be converted into a competition between faculties such as Arts, Science and Engineering, we would be able to exploit the competitive social aspects between the faculties to our ends. However, such would require the additional complication of added units, to provide the distinction between individual groups this method requires. We believe however that this is a small price to pay and should be explored.

REFERENCES

Software.(n.d.). *ITED/e-Waste Recycling Software pricing*. Retrieved November 26, from http://recyclingmanager.com/about-mrm/pricing

List of scales.(n.d.). *Weighing equipment.* Retrieved November 26, from http://www.scalesgalore.com/pindustry.htm#Check

Alma Mater Society (). *SUB History*. [ONLINE] Available at: http://www.ams.ubc.ca/at-the-sub/. [Last Accessed 27/11/2013].

Vanderbilt's Sustainability and Environmental Management Office (2013). *What is Sustainability?*. [ONLINE] Available at: http://www.vanderbilt.edu/sustainvu/who-we-are/what-is-sustainability/. [Last Accessed 27/11/2013]

Normandy Waste Management Systems (2012). *Hardware*. [ONLINE] Available at: http://www.normandywms.com/our-system/hardware/. [Last Accessed 27/11/2013]

Intelex Technologies Inc. (2013). *Intelex*. [ONLINE] Available at: http://www.environmental-expert.com/software/waste-management-69771. [Last Accessed 27/11/2013].