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Financial Impact of changing a recycling company's collection process

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Financial Impact of changing a recycling company's collection process

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Summary:

This thesis deals with the review of the potential financial benefits of changing a recycling company's collection process to a real time response system as well as researching into technologies that could enable its implementation. We conduct a detailed financial analysis to support this and we provide strong recommendations on how to proceed.



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KEY INSIGHTS

1. There are strong financial indications that we can achieve significant savings by tailoring the implementation of a real time response system to a selected number of customers
2. When performing NPV analysis we need to understand at what level the investment is made, in this case is at the container level and therefore we can conduct individual NPV analysis for each container

Introduction

As a result of the growing concerns about environmental issues, more stringent government regulations and the need for companies to reduce cost by minimizing waste, there is increased focus on recycling and its economic and environmental implications (Kumar Pati, Vrat, Pradeep Kumar et al. 2006)

Recycling is a reverse material flow which is part of a closed loop supply chain, consisting of a forward

supply chain and a reverse supply chain (Kumar Pati, Vrat, Pradeep Kumar et al. 2006).

This thesis was conducted in collaboration with a recycling Company that operates in Europe, focusing specifically on its Spanish operations. The company covers the recycling of a number of materials but we deal specifically with the collection of cardboard/paperboard.

The cardboard to be recycled can be collected directly from households, public containers or from businesses. We focus only on the company's customer onsite cardboard/paperboard storage, collection and transport to central recovering centers.

The reverse supply chain in the recycling process starts with onsite storage (at customer site) followed by material collection and transportation to the recovery center. At this stage of the process there are important costs that are added, mainly the cost associated with transporting the container containing the cardboard from the customer site to a recovery center which tends to represent a significant percentage of the total recycling cost (Chandrashekar, Dougless et al.1996)

The company's customers are located all over the country and get allocated a particular organization region of the Company which then services the customers via their recovery centers.

Each of the recovery centers has its own fleet of trucks as well as having the capability of using subcontractor vehicles if its own fleet is not able to cover the daily collection requirements. In terms of the collection services, customers are offered:

- Collection of loaded containers and replacement with empty ones or the collection and return (empty) of the same container
- Schedule pick up collection (reviewed monthly) or collection based on a 24 hour advice notification.

As is the case with any type of transportation process, it is important that the trucks are used as efficiently as possible since every collection trip results in extra costs. The efficiency in this case translates into ideally collecting the containers only when they are full so that fewer overall trips are made.

The thesis determines the potential financial benefits of moving from the current truck scheduling system to a full real time response system which is able to retrieve fully filled containers. It also provides an understanding of which potential technologies can be used to enable the identification of the moment when a container is full and some of the key business processes required to implement this type of solution.

Analysis Approach

The main opportunity identified today by the Company is the underutilization of the containers' storage capability. This is because of how the containers are scheduled to be collected as well as the strict customer requirements that mean that the customer should not have a fully loaded container waiting to be collected.

There are different containers/compactor options, and these are:

| Container Type | Description |
|-----------------------------------|--|
| Open Container | Usually used when customer doesn't compact. Larger volume but weight ratio tends to be the lowest of all types |
| Container with auto compactor box | Container that has a separate compactor which is linked via a door/plank |
| Autocompactor | This is a container with its own installed compactor |

All the historical and current data collected by the company is done based on weight and therefore we use this as the main unit of measure. We use utilization and underutilization to measure the performance of the system. We defined these equations as follow:

- Utilization = Collected weight/ (Max available storage weight for container)
- Underutilization = 1 - Utilization

We have selected a specific area of Spain to conduct and validate our financial model since not all the different recovery centers work exactly the same, but the basis of the data is common.

To conduct the analysis we had to define the **baseline** for which we can calculate the % of the container that is been underutilized. First we isolated the weight collection variability between different locations, container types and materials by conducting the analysis based on an individual: Customer/location, Container type and Material collected

Then we develop an approach to calculate the observed max weights rather than the theoretical max. This was done by reviewing all the collection data for each customer / location/ material type and container type, and calculating the maximum collected weight from the data after a pre-defined % of the highest collected weights are excluded. This is to ensure we exclude outliers as well as having a conservative approach on max weight estimations.

We decided to include different % exclusion values and keep this as part of the parameters that we would want to include in the financial analysis sensitivity part. We then calculated the trip savings for each of the max % exclusion factors. The process of calculating the trip savings was as follows:

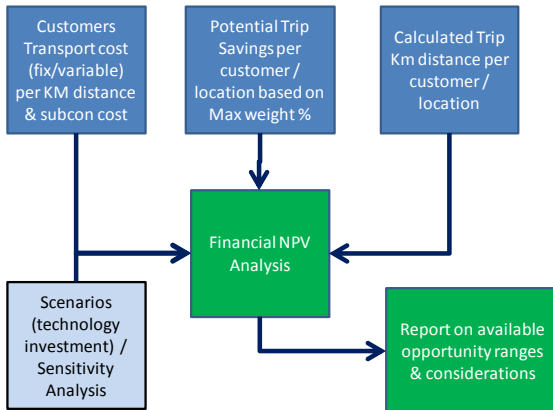
1. For each "customer/location/container type/material collected" combination we calculate the max observed weight. This is done by excluding the top Y % of the collected weights (the values of Y are the different factors that we use) and then finding the maximum collected weight value of the remaining data
2. The excluded data is then included back
3. The total weight collected for each "customer/location/container type/material collected" is calculated
4. We calculate the trip saving for each "customer/location/container type/material collected" by the following formula:

$$(original\ number\ of\ collections) - \frac{(Total\ Weight\ Collected)}{(Max\ Observed\ Weight)}$$

5. Finally we add up all the trip savings

Financial Analysis

We first establish the relationship between the different factors that support our final report. The following figure shows those key relationships:



The approach used on the financial NPV calculation was the following:

- NPV was calculated per each customer/location/container
- 3 years of operations have been taken into account to calculate NPV.
- Steady state volumes have been assumed during the three year period.
- Discount rate as per provided by the Company
- Subcontract transport operations were the first to be considered in the trips savings cost, companies' variable costs were only considered if all the subcontractor costs had been removed.

For the distance and time we then applied a multiplication factor to each type of customer to reflect the total distance travel to complete the emptying/replacement of the container.

For the technology investment options we used costs ranging from €0 to €7,000 and for the operational cost we calculated a total yearly operational cost. This cost was calculated by taking the number of trips we would be doing and multiplying it by the number of times we would be sending information before a pick up (we use a value of 25) and multiplied it by the information sending cost (we used €0.10 per text).

Financial Summary

We will now summarize and highlight the main points of the financial analysis for the different categories reviewed:

1. **Closed Containers with only customer location / container types with positive NPV:**
 - Shows that significant savings can be achieved under the different scenarios and that those levels are still significant and positive even under less favorable scenarios (e.g.: €32,000 under €7,000 of investment requirements per container and using 25 % of max weight cut off)
 - Only needs to be implemented across a small number of customer locations to realize the savings
 - There is a clear case to be made to strongly consider developing and implementing this solution
2. **Open Containers with only customer location / container types with positive NPV:**
 - Shows less overall levels of savings compared to above and savings are greatly diminished (below €10,000) for higher levels of investment such as €4,000 and above.
 - Only needs to be implemented across a small number of customer locations to realize the savings
 - Main focus is the development of a cost effective technology that is able to provide bigger; savings, there is the risk that this may not be possible
3. **Closed Containers All location / container types (positive or negative NPV):**
 - Shows less overall savings than closed containers/only positive NPV and saving are only significant (over €35,000) for investment per container lower or equal to €2,000
 - Added advantage of enabling single operating systems for this type of containers
 - There is not such a strong case compared to the only positive NPV, but we should consider it if the technology solution is below the stated value
4. **Closed Containers All location / container types (positive or negative NPV):**
 - Doesn't show any significant levels of savings under favorable scenarios and we have negative total NPV for low level of investment requirements per container (e.g.: above €300)
 - There is a strong argument to drop this option from consideration

Technology and real time process review

The first step taken on the **technology review** was to understand the key solution requirements. The list below shows the summary of these requirements which must be:

- Reliable and have the right level of reading accuracy

- Robust with little or no maintenance required
- Able to record the filled volume in the container or another measure that can be related back to the volume
- Able to automatically record and communicate real time information back to central center
- Able to communicate regularly and give different updates before the container is actually full
- Able to cost as little as possible and must ideally be easily retrofitted to current containers or compression equipment

We reviewed current technologies and how they could be considered in the measurement step of the process as well as some of the pros, cons and actual feasibility. From the analysis we believe that one of the options in particular was worth exploring in more detail, this related to the **measurement of the force used by compactors**. We believe that this solution could be retrofitted to existing equipment and adding a reader and memory storage device to record the power used as well as a mobile device that is able to send that information via text. A compactor supplier was approached to quote for this and they stated a figure of €150 for fitting such as device.

From a **process review** point of view, we identified some of the main requirements for operating a real time response system, this would require us to:

- Forecast the collection requirements so we can ensure that trucks are available to support real time call offs
- Review segregating the customer/location by demand behaviour and/or importance so that tailored policies can be applied
- Capture and processing of “event” driven data and update the systems parameters
- Definition of a time horizon for response
- Continued review and update of the expected filled container max point
- Analysis of performance and correlation of “measurement” used versus weights collected and/or % of filled container

Conclusions

The main conclusion of this thesis is that there is strong financial evidence that the company should seriously consider investing in developing the appropriate technology and processes that enables the implementation of a real time response system.

As a result we have three main recommendations. The first is that the company should consider the technology review that is provided with this thesis

and as a result concentrate its technology development efforts on the solution that records and transmits the force used by the compactors at the moment of compression. This solution provides both a measurement that can be correlated to the volume and shows evidence of it being feasible and economically viable.

The second is that the company should limit this implementation to the closed containers and only for those customer/locations/container types that have a positive NPV. The implementation of closed containers should be launched by doing a pilot program with the customer/location that provides the highest projected benefit allowing validation of the technology, processes and projected benefits. There are added complexities to the company’s operations by having to run the real time system for the defined customer/locations on top of the current systems but we believe the benefits outweigh this extra administrative effort/cost.

The third is that the company should make sure that it protects the potential competitive advantage that it would gain as a result of implementing this. This means either working alone or closely with the container/compactor manufacturer to develop the power reader for the autocompactor and compactor box. In the case that the work is done with the manufacturer then there needs to be assurance/ agreements in place that stops the manufacturer selling the solution to other recycling companies.

Finally, there is potential for further research once the technology element has been proven. This further research should include a review on how the real time response system requirements are responded to (e.g.: truck scheduling and time window response) and specifically how the expected collection time/date is determined and how the power reading data is correlated to the % of fill.

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