To:

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From:

Subject: Choosing between paper towels, cloth toweling rolls and hot air dryers for drying hands in the restrooms.

Date:

Foreword

In opening a new specialty delicatessen, named DeeLights, you are looking to find out what kind of facility should be placed in the restrooms for customers to dry their hands. Currently, there are three options – paper towels, cloth toweling rolls, and hot air dryers. To arrive at a conclusion, you would need to find out how the total monthly cost of the options varies with the number of customers that use the restrooms. You requested us to perform a cost analysis of the options to determine the most cost effective option and recommend which facility should be installed. We have completed this work. This report presents the details cost analysis and our recommendations.

Summary

To calculate the total monthly cost of each option, we took into account both the fixed cost and the variable cost. The result of the cost analysis suggests that the total monthly cost of the hot does not depend on the number of customers as it comprises of only a fixed monthly cost of $120. Meanwhile, the total monthly cost of the paper towels varies directly with the number of customers. Paper towels cost $100 for 2000 customers and $150 for 3000 customers. The total monthly cost of the cloth toweling rolls is $150 if there are less than 2000 customers and $300 otherwise. An economic decision would be between paper towels and hot air dryers. We determined that at less than 2,400 customers a month, paper towels are the least expensive. At more than this, the dryers are the least expensive. However, considering other factors such as health, environmental and energy issues, our preliminary research shows that using paper towels seems to be a more attractive option than using the hot air dryers. Therefore, DeeLights should install paper towels. However, in order to provide a more concrete justification, additional work is necessary. EnginEcon can conduct a thorough analysis and propose a recommendation if funding for additional work is granted.

Discussion

The cost data used in this study are obtained from the suppliers of hot air dryers, paper towels and clothing toweling rolls. The details of the three options are outlined in Table 1 below.

Table 1: Total monthly cost the 3 options as a sum of fixed and variable costs

Options	Number of	Quantity for 2	Lifetime	Cost per	Monthly cost		
					Fixed	Variable	Total

Options	customers	restrooms	Lifetime	unit	Monthly cost			
					Fixed		Variable	Total
					Depreciation	Service		
Hot air dryers	2000	2	4 years	$500	$20	$100		**$120**
	3000							
Paper towels	2000	2000	1 usage	$0.05			$100	**$100**
	3000	3000					$150	**$150**
Cloth toweling rolls	2000	2	2 days	$5			$150	**$150**
	3000		1 day				$300	**$300**

Your market research expects about 2,000 customers for the first 4 months and about 3,000 customers thereafter. Hence 2 restrooms are needed. The total monthly cost of each option for 2,000 and 3,000 customers a month are outlined in Table 1.

The total monthly cost is calculated by

Total monthly cost = Fixed cost + Variable cost (1)

The fixed cost is the sum of both the depreciation and the service cost. The depreciation cost is given by

Depreciation cost = Upfront charge/lifetime in months (2)

The variable cost depends on the number of customers and is calculated by

Variable cost = Variable quantity * Unit cost of variable quantity (3)

Using the cost data in Table 1, we plotted a graph showing the relationship between the total monthly cost of each option and the number of customers as shown in Figure 1 below.

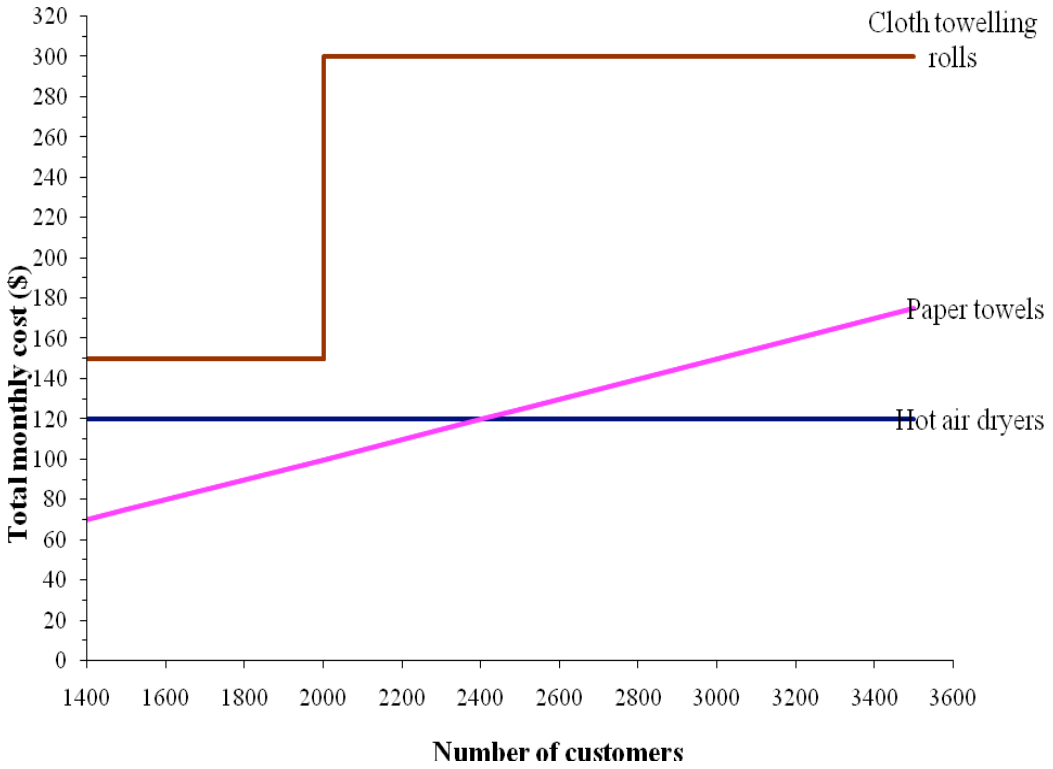

Figure 1: Total monthly cost of 3 options versus the number of customers

Hot Air Dryers

For the 2 hot air dryers, the total monthly cost does not depend on the number of customers, because it comprises of only a fixed monthly cost of $120. The 2 hot air dryers require an upfront charge of $1000 which would depreciate over their lifetimes of 48 months. Plugging these values into Equation 2 gives us a depreciation cost of approximately $20. The sum of this monthly depreciation cost and service cost gives the total monthly cost the dryers. The constant monthly cost can be seen by the straight line of the hot air dryers graph as shown in Figure 1.

Paper Towels

The total monthly cost of the paper towels consists of only variable cost, since you assumed that each customer will use 1 paper towel and throw it after usage. So the total monthly cost varies directly with the number of customers, at a cost of $0.05 per customer. Using Equation 3, we obtained a sloping straight line of the paper towels in Figure 1.

Toweling rolls

For 2 toweling rolls, if there are less than 2,000 customers, they have to be changed every 2 days. In other words, this option costs $10 every 2 days or $150 a month. If there are more than 2,000 customers, this option costs $10 every day or $300 per month. Figure 1 shows that this option is more costly than both the dryer and the paper towels option, and with more than 2,000 customers this option will only look more unfavorable.

Figure 1 shows that at less than 2,400 customers a month, paper towels are the least expensive. At more than this, the dryers are the least expensive. Looking only from the cost perspective, paper towels should be used in the first 4 months since it is the cheapest method. Then for the next 4 months, hot air dryers should be used since after 2400 customers, using hot air dryers is cheaper than using paper towels.

Additional considerations

However, in order to make a more informed decision, we should not only consider the cost, but also other relevant issues. We conducted a preliminary research based on the studies performed by University of Westminster, University of Washington and WorldDryer Corp. Hot air dryers increase the numbers of bacteria and spread them into the air. Paper towels prove to be a more hygienic option since they can remove 58% of the bacteria from people's hands. Looking from the environmental aspect, pressing the button of a dryer once accounts for less than 0.5 ounce of greenhouse gases, while using 1 paper towel accounts for 1 ounce of greenhouse gases. However on average, 114 kWh of electricity is needed to run 2 dryers for a month, whereas none is needed for paper towels. Even though there is a minimal increase in the greenhouse gases emission in paper towels over hot air dryers, the generation of electricity for the hot air dryers will also emit more greenhouse gases and incur extra costs. This may cause hot air dryers to be more expensive than paper towels.

Conclusion

The cost analysis suggests that an economic decision should be between the hot air dryers and the paper towels. For the next 4 months after its opening, even though the hot air dryers are cheaper than the paper towels, the cost savings is merely $30 for 3,000 customers. Using paper towels seems to be a more attractive option because it is more hygienic. Moreover, DeeLights will not have to risk the extra greenhouse gases and the cost of electricity incurred by hot air dryers, which in fact may make them more expensive than the paper towels. Hence, based on our cost analysis, and taking other factors such as health, environmental and energy issues into consideration, DeeLights should use paper towels in the 2 restrooms. In order to quantify the extra greenhouse gases and electricity costs incurred by the hot air dryers, additional work is needed. If funding for additional work is granted, EnginEcon can conduct a thorough analysis and propose a more informed recommendation.