Business Analytics and Decision Science

Project Brief

Part 1 Autonomous Shipment roll-out: autonomous delivery trial

Background information

In this part of the assignment, you are the analytic manager of "AutonomousShipment", a new start-up venture operating out of Leeds that is looking to use autonomous robot drones to conduct last leg logistics to deliver different products to customer doorsteps. The belief is that consumers would benefit from faster delivery through automation and that the company will benefit from optimisation and reduced costs. This new venture is supported by several venture capital investors and backed by the UK government.

To do this, the management team which you directly report to are planning to conduct a trial roll out in the area around Leeds, working with various different stores such as groceries, clothing, sport, and tech stores. The company has developed four prototype robots which they are considering and would like to trial one of these robots. The management would like the trial to run for a month and to ensure that the trial covers as many potential customers across the different store types as possible. The priority, however, is that the trial remains on budget.

Given robots are set to roll-out on the streets of Leeds, this requires management of AutonomousShipment to make two decisions:

1. They must decide on a prototype robot that would participate in this trial based on a set of requirements.
2. They must decide how many robots to allocate across various stores to ensure that the goal and constraints of the trial are satisfied.

The management have tasked you to provide a report to them that addresses both questions. You should use tables and figures as appropriate as well as text to present your findings. The report should be in a format that is suitable for this purpose of communication to the management team.

Your Task

1st Task

Firstly, you must provide a recommendation that is based on maximising utility in accordance with the requirement that is set by the decision-maker on which prototype robot should be used for this trial. Overall, the company has identified four potential prototypes that they have developed:

- Robot A032 - Archer
- Robot B23 - Bowler
- Robot CJKL - Corner
- Robot DSXX – Deviant

There are several concerns that impact such a decision both qualitatively and quantitatively. The decision on which prototype to use should be based on the following criteria:

- Carrying Capacity – The carrying capacity in litres of each autonomous robot. The company prefers to have a larger robot as some products may be large.
- Battery Size – The battery capacity in hours of operation for each autonomous delivery robot. The company prefers to have a robot with a larger battery as this would result in less need to recharge and a greater coverage distance.
- Average Speed – Average speed in km/h for each robot. The company would prefer the robot that has a higher average speed.

- Cost per Unit – Cost per unit of each robot in GBP. The company would prefer the robot that has the lower cost per unit.
- Reliability – Estimate average time between instance of breakdown. The unit is in hours of operation till breakdown. The company would prefer a robot that has a higher reliability and a smaller number of breakdowns.
- the autonomous system is not part of the evaluation, the focus of selection is on hardware, not software.

The information about each robot in relation to these criteria are available in the file 'Robot_Info.csv' and the importance that is put into each of them by the management team is provided in the file 'Management_Priority.xlsx'. The importance of each criterion was derived from latest management team meeting in July 2023.

2nd Task

The trial is for a limited time and for a limited budget. You have a goal that is less focused on the profit but ensures that the test covers key objectives that would improve your understanding for the future implementation of autonomous robot. As such, you must allocate these autonomous robots across various stores so that the store can use them for delivery to a local customer. The options include:

- Grocery Store
- Clothing Store
- Sport Equipment Store

You have a limited budget for the trial and the total cost must not exceed the trial budget of 250,000 GBP in any circumstances. The individual cost of each robot is based on the robot that is selected for the first task plus operating costs.

The following information about each store is provided below:

1. Estimated number of orders that each robot should be able to deliver per day:
    a. Grocery Store: 9 orders per robot per day
    b. Clothing Store: 6 orders per robot per day
    c. Sport Equipment Store: 4 orders per robot per day

2. Operating cost per robot per store (this is in addition to the cost of the robot selected from 1st task.)
    a. Grocery Store: 1600 GBP per robot per month
    b. Clothing Store: 1000 GBP per robot per month
    c. Sport Equipment Store: 600 GBP per robot per month

3. The number of technician staff working hours needed per robot per week to support each store, each store has different procedures for packing the product so this would be different. (there is no additional cost associate with this)
    a. Grocery Store: 10 technician man hours per robot per week
    b. Clothing Store: 7 technician man hours per robot per week
    c. Sport Equipment Store: 5 technician man hours per robot per week

The constraint and goals of the trial is as follows:

1. Each store must have at least 5 robots during the trial.
2. The trial should have robots complete as many orders as possible per day.
3. The total number of technician staff hours available to support this trial is 250 hours per week.
4. The cost of operation and acquisition must not be more than the budget.
   You must provide a solution of how to conduct a trial that adheres to above requirements.

Part 2: Value of customers: what makes a customer valuable?

Background information

'Drinks@home.uk' is an ecommerce website which operate a direct to consumer business. It operates within the area of Great Britain and deal withs both alcoholic and non-alcoholic beverages from all over the world. In this assignment, you work for 'drinks@home.uk' as an analyst. You have been provided with the data on 400 customers. Information that is provided include the revenue from the order that they made, the advertisement medium that brought them to the website, their age, their income, the time that they have spent on the website on average over a week, and if they have been presented with an online voucher pop-up in the past.

Your manager would like to gain a better understanding of your customers so that he can prepare a report to input to the next marketing campaign. Therefore, he has tasked you to write a report for him answering two business questions:

1. Given the demographic and behaviour of past customers on the website, what is the factor that has significantly led to customers spending more or less money on the 'drinks@home' website.
2. There are three choices on the next marketing project and your manager would like to get your recommendation on which one would be the best to go with for increasing profits.

Your Task

1st Task

The first task is for you to determine what is the factor that positively or negatively impacts the spending of each customer on the website. You have been provided with the following information on 400 customers of the website.

- Revenue (GBP) – This is the revenue from the latest order that was made by this customer.
- Advertisement Channel – This is the advertisement medium that brought them to the website which includes: {1: Leaflet,2: Social Media, 3: Search Engine, 4: Influencer}
- Estimated Age – This is an estimated age of the customer according to the website tracking software.
- Estimated Income (GBP) - Customer estimated income according to website tracking software.
- Time on website per week (Seconds) – The estimate average time that the customer spends on the website per week.
- Seen Voucher – If the customer has seen any discount voucher popup.

The information about each customer is available in the file 'Transactions_Customer.csv'. You should provide a report to the analytics manager on which factors have a positive and negative influence on revenue generated on the website. You should provide justification and a detailed explanation of how you logically come to this conclusion in regard to factors that influence each customer.

2nd Task

Given what is learnt in the first task, 'drinks@home.uk' would like you to present them with a recommendation between three options that they are considering to increase profit on the website:

1. Run an advertisement targeting customers who are older than 45 years old as they are likely to spend more money.
2. Provide a voucher for 20 GBP off their next orders.
3. Spend more money on advertising with an influencer.

This recommendation should be based on findings from task 1 and you should provide justification and a detailed explanation of how you logically came to this conclusion in regard to factors that influence each customer.