**WGU D210 TASK 1 REV 12 - MATTINSON**

Dashboard and Storytelling of Telecom Churn Data

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Task 1: Data Dashboard and Storytelling

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Abstract

Wgu.edu Data Analytics coursework. Create interactive dashboards using Tableau. Combine churn data provided by Wgu.edu with external US state population and region data. Use data from both data sets to create data visualizations and engaging stories. Allow viewer to use filters and parameters to customize the dashboards and visualizations. Lead viewer towards actionable insights.

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# Interactive Data Dashboard

## Interactive dashboard

Provide a copy of your interactive Tableau dashboard to support executive decision-making. Your dashboard must be accessible to users with colorblindness, and must include the components in each of the following areas:

* A1. The Interactive Dashboard
* A2. Key Performance Indicators computed from both data sets
* A3. Data integrated from two (2) data sets
* A4. Instructions to install dashboard
* A5. Instructions to navigate dashboard

### The Dashboard

Dashboard. For this task, I created multiple interactive dashboards using Tableau Public 2021.4.

* Link to my profile <https://public.tableau.com/app/profile/mike.mattinson>
* Link to the Density Dashboard <https://public.tableau.com/app/profile/mike.mattinson/viz/D210_Task1_Density_11/Density>
* Link to the Lost Revenue Dashboard <https://public.tableau.com/app/profile/mike.mattinson/viz/D210_Task1_Lost_Revenue_45/LostRevenue>
* Link to the Age Histogram Dashboard <https://public.tableau.com/app/profile/mike.mattinson/viz/d210_task1_Age_6/AgeHistogram>
* Link to the Lost Customer Dashboard <https://public.tableau.com/app/profile/mike.mattinson/viz/D210_Task1_Lost_Customers_1/LostCustomers>

The figure below shows an example from the Lost Revenue dashboard (Mattinson, 2022) :

Map

Description automatically generated

Figure Example from dashboard

interactive dashboard showing number of LOST customers from NORTHWEST REGION. dashboard components are automatically recalculated when different options are selected by user.

Four (4) Representations. My dashboard includes the following data representations to summarize the data or display trends:

|  |  |  |
| --- | --- | --- |
| **Dashboard** | **Primary Viz** | **Secondary Viz** |
| Lost Revenue | Heatmap | Barchart |
| Density | Heatmap | Barchart |
| Age | Histogram |  |
| Lost Customer | Hexmap |  |

Two (2) Interactive Controls. My dashboard contains the following interactive controls:

|  |  |  |  |
| --- | --- | --- | --- |
| **Dashboard** | **Calculated** | **Parameter** | **Filter** |
| Lost Revenue | Revenue |  | Churn=Yes |
| Density | Density |  | Churn=No |
| Age | Age (bins) | Bin Size |  |
| Lost Customers |  |  |  |
|  |  |  |  |

In addition to the primary controls, Tableau has other built -in controls such as:

* All visualizations have tooltips that have appropriate data displayed when user mouses into or over the data elements of the visualization
* When looking at a map, the user can zoom in and out with mouse wheel or by using the map tools at top left of map.
* On the map, the user can select one or more states or regions by selecting the item in the sub-totals, or by Ctrl-clicking on an area of the map.

### Key Performance Indicators

Key Performance Indicators (KPI). My dashboard includes the following key performance indicators:

Lost Revenue: Total aggregation of annual revenue lost because of lost customers.

[Monthly Charge]\*12

Revenue: Total aggregation annual revenue based on the loyal customer’s monthly charge.

count([Customer])/sum([Population])\*1000

Lost Customers: Total number of lost customers.

%Lost Customers: # of lost customers / total customers

### The Data

Provide both data sets that serve as the data source for the dashboard.

Data. This task uses one (1) primary internal dataset and two (2) external datasets.

Data set 1: churn\_clean.csv. This is the primary data provided by the telecom organization. It consists of 10,000 customer records. The data is broken down into the following attributes:

1. Customer\_id is categorical (CATEGORICAL): ['K409198' 'S120509' 'K191035' ... 'I243405' 'I641617' 'T38070'].

2. State is categorical (CATEGORICAL): ['AK' 'MI' 'OR' 'CA' 'TX' 'GA' 'TN' 'OK' 'FL' 'OH' 'PA' 'PR' 'IA' 'ME'

'IL' 'WI' 'NC' 'AL' 'NM' 'VT' 'MD' 'NY' 'WA' 'CT' 'NJ' 'DC' 'ND' 'LA'

'NE' 'WV' 'AZ' 'MO' 'WY' 'MT' 'VA' 'KY' 'MN' 'KS' 'MA' 'IN' 'SC' 'NH'

'DE' 'MS' 'ID' 'AR' 'SD' 'CO' 'HI' 'UT' 'RI' 'NV'].

3. Area is categorical (CATEGORICAL): ['Urban' 'Suburban' 'Rural'].

4. TimeZone is categorical (CATEGORICAL): ['America/Sitka' 'America/Detroit' 'America/Los\_Angeles' 'America/Chicago'

'America/New\_York' 'America/Puerto\_Rico' 'America/Denver'

'America/Menominee' 'America/Phoenix' 'America/Indiana/Indianapolis'

'America/Boise' 'America/Kentucky/Louisville' 'Pacific/Honolulu'

'America/Indiana/Petersburg' 'America/Nome' 'America/Anchorage'

'America/Indiana/Knox' 'America/Juneau' 'America/Toronto'

'America/Indiana/Winamac' 'America/Indiana/Vincennes'

'America/North\_Dakota/New\_Salem' 'America/Indiana/Tell\_City'

'America/Indiana/Marengo' 'America/Ojinaga'].

5. Children is numerical (CONTINUOUS) - type: int64.

Unique: [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10]

6. Age is numerical (CONTINUOUS) - type: int64.

Unique: [18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89]

7. Income is numerical (CONTINUOUS) - type: float64.

Min: 348.670 Max: 258900.700 Std: 28199.917

8. Marital is categorical (CATEGORICAL): ['Widowed' 'Married' 'Separated' 'Never Married' 'Divorced'].

9. Gender is categorical (CATEGORICAL): ['Male' 'Female' 'Nonbinary'].

10. Churn is categorical (CATEGORICAL): ['No' 'Yes'].

11. Outage\_sec\_perweek is numerical (CONTINUOUS) - type: float64.

Min: 0.100 Max: 21.207 Std: 2.976

12. Email is numerical (CONTINUOUS) - type: int64.

Unique: [1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23]

13. Contacts is numerical (CONTINUOUS) - type: int64.

Unique: [0, 1, 2, 3, 4, 5, 6, 7]

14. Yearly\_equip\_failure is numerical (CONTINUOUS) - type: int64.

Unique: [0, 1, 2, 3, 4, 6]

15. Techie is categorical (CATEGORICAL): ['No' 'Yes'].

16. Contract is categorical (CATEGORICAL): ['One year' 'Month-to-month' 'Two Year'].

17. Port\_modem is categorical (CATEGORICAL): ['Yes' 'No'].

18. Tablet is categorical (CATEGORICAL): ['Yes' 'No'].

19. InternetService is categorical (CATEGORICAL): ['Fiber Optic' 'DSL' 'None'].

20. Phone is categorical (CATEGORICAL): ['Yes' 'No'].

21. Multiple is categorical (CATEGORICAL): ['No' 'Yes'].

22. OnlineSecurity is categorical (CATEGORICAL): ['Yes' 'No'].

23. OnlineBackup is categorical (CATEGORICAL): ['Yes' 'No'].

24. DeviceProtection is categorical (CATEGORICAL): ['No' 'Yes'].

25. TechSupport is categorical (CATEGORICAL): ['No' 'Yes'].

26. StreamingTV is categorical (CATEGORICAL): ['No' 'Yes'].

27. StreamingMovies is categorical (CATEGORICAL): ['Yes' 'No'].

28. PaperlessBilling is categorical (CATEGORICAL): ['Yes' 'No'].

29. PaymentMethod is categorical (CATEGORICAL): ['Credit Card (automatic)' 'Bank Transfer(automatic)' 'Mailed Check'

'Electronic Check'].

30. Tenure is numerical (CONTINUOUS) - type: float64.

Min: 1.000 Max: 71.999 Std: 26.443

31. MonthlyCharge is numerical (CONTINUOUS) - type: float64.

Min: 79.979 Max: 290.160 Std: 42.943

32. Bandwidth\_GB\_Year is numerical (CONTINUOUS) - type: float64.

Min: 155.507 Max: 7158.982 Std: 2185.295

33. Item1 is numerical (CONTINUOUS) - type: int64.

Unique: [1, 2, 3, 4, 5, 6, 7]

34. Item2 is numerical (CONTINUOUS) - type: int64.

Unique: [1, 2, 3, 4, 5, 6, 7]

35. Item3 is numerical (CONTINUOUS) - type: int64.

Unique: [1, 2, 3, 4, 5, 6, 7, 8]

36. Item4 is numerical (CONTINUOUS) - type: int64.

Unique: [1, 2, 3, 4, 5, 6, 7]

37. Item5 is numerical (CONTINUOUS) - type: int64.

Unique: [1, 2, 3, 4, 5, 6, 7]

38. Item6 is numerical (CONTINUOUS) - type: int64.

Unique: [1, 2, 3, 4, 5, 6, 7, 8]

39. Item7 is numerical (CONTINUOUS) - type: int64.

Unique: [1, 2, 3, 4, 5, 6, 7]

40. Item8 is numerical (CONTINUOUS) - type: int64.

Unique: [1, 2, 3, 4, 5, 6, 7, 8]

Data set 2: population.csv. The original data had a population attribute, but I wanted to include population calculations based on each state’s total population. This is an external dataset from United States Census Bureau showing population data for the US states for years 2020 and 2021. The external population data is broken down as follows:

1. NAME is categorical (CATEGORICAL): ['United States' 'Northeast Region' 'Midwest Region' 'South Region'

'West Region' 'Oklahoma' 'Nebraska' 'Hawaii' 'South Dakota' 'Tennessee'

'Nevada' 'New Mexico' 'Iowa' 'Kansas' 'District of Columbia' 'Texas'

'Missouri' 'Arkansas' 'Michigan' 'New Hampshire' 'North Carolina' 'Ohio'

'South Carolina' 'Wyoming' 'California' 'North Dakota' 'Louisiana'

'Maryland' 'Delaware' 'Pennsylvania' 'Georgia' 'Oregon' 'Minnesota'

'Colorado' 'New Jersey' 'Kentucky' 'Washington' 'Maine' 'Vermont' 'Idaho'

'Indiana' 'Montana' 'New York' 'Puerto Rico' 'Connecticut' 'Florida'

'Virginia' 'Massachusetts' 'Illinois' 'Mississippi' 'Arizona' 'Utah'

'Wisconsin' 'Alabama' 'West Virginia' 'Rhode Island' 'Alaska'].

2. POP\_2021 is numerical (CONTINUOUS) - type: int64.

Unique: [732673, 29527941, 5039877, 21781128, 6165129, 19835913, 4246155, 1104271, 895376, 1441553, 6984723, 7276316, 57159838, 774948, 2115877, 5707390, 1963692, 4624047, 1782959, 11780017, 5190705, 2934582, 3143991, 9267130, 1095610, 1388992, 645570, 7738692, 3337975, 39237836, 2949965, 10799566, 3986639, 4509394, 1372247, 12964056, 6168187, 3605597, 3263584, 6805985, 670050, 3025891, 68841444, 5812069, 8642274, 5895908, 12671469, 331893745, 127225329, 6975218, 578803, 1900923, 3193079, 1003384, 10551162, 10050811, 78667134]

Source: NST\_EST2021\_POP Annual Estimates of the Resident Population for the United States, Regions, States, District of Columbia, and Puerto Rico: April 1, 2020 to July 1, 2021 (US Census Bureau, 2022)

Data set 3: states.csv. To link between churn data and the population data, I needed another indexing table. Churn data uses two (2) letter state code and the population data uses the full state name. The index table has both fields and can be used to link between tables. The external states data is broken down as follows:

1. State is categorical (CATEGORICAL): ['Alabama' 'Alaska' 'Arizona' 'Arkansas' 'California' 'Colorado'

'Connecticut' 'Delaware' 'District of Columbia' 'Florida' 'Georgia'

'Hawaii' 'Idaho' 'Illinois' 'Indiana' 'Iowa' 'Kansas' 'Kentucky'

'Louisiana' 'Maine' 'Maryland' 'Massachusetts' 'Michigan' 'Minnesota'

'Mississippi' 'Missouri' 'Montana' 'Nebraska' 'Nevada' 'New Hampshire'

'New Jersey' 'New Mexico' 'New York' 'North Carolina' 'North Dakota'

'Ohio' 'Oklahoma' 'Oregon' 'Pennsylvania' 'Rhode Island' 'South Carolina'

'South Dakota' 'Tennessee' 'Texas' 'Utah' 'Vermont' 'Virginia'

'Washington' 'West Virginia' 'Wisconsin' 'Wyoming'].

2. Code is categorical (CATEGORICAL): ['AL' 'AK' 'AZ' 'AR' 'CA' 'CO' 'CT' 'DE' 'DC' 'FL' 'GA' 'HI' 'ID' 'IL'

'IN' 'IA' 'KS' 'KY' 'LA' 'ME' 'MD' 'MA' 'MI' 'MN' 'MS' 'MO' 'MT' 'NE'

'NV' 'NH' 'NJ' 'NM' 'NY' 'NC' 'ND' 'OH' 'OK' 'OR' 'PA' 'RI' 'SC' 'SD'

'TN' 'TX' 'UT' 'VT' 'VA' 'WA' 'WV' 'WI' 'WY'].

Source: US States Names and Abbreviations data. (World Population Review, 2022)

The tables will be linked as follows:

Diagram

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1 : ꝏ

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Figure Data Relationships

Churn: State has 1:Many relationship with States:Code. Population: Name has 1:Many relationship with States:State

### Install (Create) Dashboard using Tableau Desktop

Provide step-by-step instructions to guide users through the dashboard installation.

I have created a separate document titled, “Creating the Density Dashboard” which explains the details of creating the sheets and dashboards.

### Navigate Dashboard using Tableau Public

Provide instructions to help users navigate the dashboard. There are numerous ways to navigate the dashboard, the fact that it is an interactive dashboard means the user can change the look and results of each data representation, and thereby, the user can create any number of navigational sequences.

For the purpose of this paper, I will demonstrate a typical navigational sequence by answering the following question:

#### Step 1. What are the top three (3) states contributing to the highest lost revenue? That is, aggregate revenue by state, sort by aggregated revenue descending and only consider lost customers. The results should show a list of states in sorted order, and we want to consider the top 3 states in that list.

#### Step 2. Open the latest version of the Lost Revenue dashboard

#### Step 3. Make sure that you are seeing all of the domestic US states, if there were a selection filter applied, you may only be seeing a portion of the total data. Clear any of the selection filters by clicking on the blue heading to un-select it.

#### Step 4. While looking at all states, update the Top N parameter to 3, then click enter key. This will refresh the table and the heading will show “Top 3 States”

#### Step 5. Now click on the lower table where it says “Top 3 States”, the map will refresh and the upper key measures tables will refresh data based on the selection, it should look like this:

Map

Description automatically generated

Figure Top 3 States Lost Revenue

the figure shows total number of lost customers, 447. The average monthly charge for those lost customers, $201.32. The total amount of lost revenue, $1.1M. The map refreshes to show only those states, tx, pa and ny. the bottom table shows the three states ranked by highest lost revenue.

# Storytelling with Data

## Presentation Video

Text

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Link to Panopto video <https://wgu.hosted.panopto.com/Panopto/Pages/Viewer.aspx?id=ccac072d-f6cf-493a-b9e0-ae5a00eb5758>

### Introduction/Background

A picture containing text, person, person, screenshot

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### Summarize Data

Text

Description automatically generated

Text

Description automatically generated

Text

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Text

Description automatically generated

Text

Description automatically generated

### Key Results

Timeline

Description automatically generated

Figure 4 Key Results - Top 3 Density States

Graphical user interface, application

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Figure 5 Key Results - Top 3 Lost Revenue/Customers

### Data Representations

Diagram

Description automatically generated with medium confidence

Chart

Description automatically generated

# Reflection Paper

## Reflection Paper

Text

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### Explain Dashboard Purpose and Function

The Telecom organization data contains 10,000 customer records “in all regions of the United Sates”. The organization breaks down the United States into four (4) regions and has a management team dedicated to each region.

The purpose of the Lost Revenue dashboard is to break down trends for lost revenue by region. The information will be made available to the company’s regional managers and enable them to focus on states with high number of lost customers.

The purpose of the Density dashboard is to break down trends for customer density by region. The information will be made available to the company’s regional managers and enable them to focus on states with high or low customer density.

The purpose of the Age dashboard is to show distribution of lost and loyal customers by age. The Age Bins is a parameter that will allow the dashboard to be changed to show different age groups.

### Explain How External Data Enhances Insights

The external data for United States regions and population are included with the organization’s customer data. Each customer record has location data (City, State, County, Zip, Lat, Lng) and population data. The customer data will be linked to the United States data using the State attribute. The organization’s data shows the state as a two-letter abbreviation, the external data uses the state’s full name. Instead of using the organization’s Population attribute, showing population within a mile radius of the customer’s residence, the dashboard will include external data from US Census on the population for the entire state.

By incorporating the external data, the dashboard will be able to aggregate customer data by Region, and, in the case of the Density data, will be calculated using the entire state’s population.

### Explain Data Representations

The Density and the Lost Revenue dashboard both use a similar layout which include both a map and a barchart representation. In addition, there are two (2) areas where totals are show for the current selected situation. All of these components are linked together and refreshed as selections are made by the dashboard user.

The map representation shows the domestic United States, AK, HI, PR and DC were intentionally excluded from the data so that the map would be scaled to show just the contiguous United States. Because density is associated with loyal customers, the total number of customers on the density dashboard are the total number of loyal customers. Also, the revenue on the density dashboard is the actual aggregated revenue for those loyal customers. In contrast, the customers and revenue on the lost revenue dashboard are lost customers and lost revenue. Individual states can be selected and de-selected by using the CTRL key with the mouse. When multiple states are selected using this method, click on any state twice will clear the selection and go back to all states being shown.

The barchart representation is a list of all the states ranked by either density (for the density dashboard) or by lost revenue (for the lost revenue dashboard). When the user changes the Top N parameter to another value, the barchart is recalculated and changes the display to show the “Top N States”. Once that happens, the user can click on the “Top N States” and the map and totals will refresh to show just those top N states. To remove the selection, click again on the “Top N States”, which is shown in blue highlight, and the map and total will go back to showing all the states.

The totals above the map can also be selected, for example, by clicking on “Midwest”, the map and barchart will refresh to show only those states in the Midwest region. Clicking on “Midwest” or the blue highlighted area again will unselect that region and all the states will be shown again.

Regional managers can use both dashboards to interactively change and focus on specific regions or states needing specific action. These dashboards should allow managers and the organization to find regions with high customer churn to find ways to reduce or eliminate that churn and realize the lost revenue attributed to those lost customers as well as highlighting regional areas with high or low density or revenue to increase density and thereby, increasing the overall revenue. Region managers of areas with high density and high revenue can share best practices with the other regions where more focus is required to increase customer and revenue base or curtail the rate at which the organization is losing customers.

### Explain Interactive Controls

The primary controls for both dashboards are the “Top N” parameter and the built-in Tableau selection filters.

The Top N parameter allows the dashboard user to change the number of states highlighted at the top of the barchart. When the value is changed, the following chain of events takes place:

* The State Set is updated which basically divides all the states into two (2) groups, states in the top N ranked by either Density or Lost Revenue, and states that are not in the Top N states
* The Subset Density (or Subset Revenue) is a calculated field that will be either “Top N States” if the state is in the State Set, or “Others” if not.

The Built-in Selection filters are the way Tableau connects the different parts of the dashboard. By selecting “Use as Filter” option, any change to that component will cascade to the other components. In the back

ground, action filters are created. You can get crazy with how these action filters are created and apply to other components. But, for these dashboards, the basic action filter is used. The result is that when selections are made to the barchart, the map is refreshed, and, when you click on a region in the total area, both the map and barchart refresh, etc.

On the Age dashboard, the Age Bins parameter is used to re-distribute the histogram into varying sized age bins.

### Describe Accessibility to Users with Colorblindness

Colorblindness. To make the dashboard more accessible to users with colorblindness, I have chosen to use color-blindness friendly palette of blue and orange. According to Shaffer (Shaffer, 2022), “one color used together in combination with another color is generally fine when one of them is not usually associated with CVD.” Common CVD color combinations are Red/Green or Blue/Yellow, with Red/Green accounting for over 90% being the most common. (Turgut & Karanfil, 2022)

### Explain How Data Representations Support Story

The Story. You have lost something valuable, and you might want to find it. If you don’t find it, you could be sad for the rest of your life. If possible, not losing the thing in the first place is much better.

The Lost Revenue dashboard identifies lost customers and lost revenue.

The Density dashboard identifies regions with highest customer density.

### Explain Audience Analysis

Audience Analysis. Regional managers responsible for customers throughout the United States. These managers are familiar with the company’s customer data but may not know exactly where or how many customers they are losing in each region.

### Describe Universal Access

The dashboard was designed to facilitate universal access. One element that facilitates access is the Tooltip. Each component of the dashboard has a Tooltip that is configured to show simple table in text format that is similar to the map or chart data being displayed.

### Explain Elements of Storytelling

Plot. Rags to Riches. If the company can find and keep customers it will be riches, but, if it losses customers and can’t find or retain them, it will surely be rags for the lot of them.

Characters.

* The lost package – metaphor meaning the lost customer
* The company – literal
* The loadmaster – metaphor meaning the regional manager

Anecdote. Imagine in your own life, you have lost something that has great meaning to you, think about what you did to find it, think about the anguish you felt knowing that you might never find the thing again, what actions did you take to try and find the thing? I really like playing aerobie frisbee with my kids on the beach, one time, well actually, many times, we have missed the catch and watched the aerobie fly out into the deep water, we run, but it is just out of reach, it hits the water and begins to sink, aerobie frisbees don’t float, it is lost, and we are sad.

Anecdote/Humor. I was Christmas shopping in the mall some years back with my wife and small children. Very stressful environment, always worried about the children. We had just left a store and were talking in the busy open mall when I panicked, I couldn’t see my young daughter, “Where is Lindsey?” I screamed. Everyone was looking at me, “Where is she?” If you have children, you can sympathize with my concern. To this day I can still feel the pangs of missing and loss. “Daddy, I am right here", the tiny voice rang out. My little princess was right where I had put her minutes earlier, she was on my shoulders, and I was holding her feet while I was frantically searching for my baby.

Anecdote. Occasionally as a cargo pilot, when I am moving Amazon packages between China and the United States, the loadmaster will notify me that he has lost a box or misplaced a container, he will then work with the ground crew to find the lost package, sometimes it is found, other times, the package is lost and cannot be found.

Context. Can you imagine how you would feel about the company responsible for shipping your package, to find out your package has been lost. That might make you mad, you might even stop using that company. Can you then imagine how the company would feel when they find out one of its customers has been lost, the company’s bottom lineis negatively impacted by the loss of a customer.

Conflict. If organization takes no action to find lost customers, they will lose revenue and in the extreme, could lose the entire company.

Actions. Can you find something that is lost? Can you find someone that is lost? In our organization, do you know when and where and the impact of lost customers? By using the Lost Revenue dashboard, managers will have a tool to help them find lost customers.

Insight. There is great joy when you find the thing that was lost, but it is obviously better to never lose the thing in the first place.

Metaphors:

* company’s bottom line
* just out of reach
* the lost package

Future Work. The dashboards are just a start, they can be enhanced by the data analysis team to model and predict customer churn. Manager could then have indicators to help identify customers at higher risk of churn, and act before losing them.

References

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