# Advanced Data Acquisition Performance Assessment

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D211: Advanced Data Acquisition

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# Exploratory Data Analysis Performance Assessment

## A1: Both Data Sets

The final Tableau dashboard has been included for evaluation via the WGU submission portal along with this document. The analysis performed for this performance assessment is a truncated version of my own analysis performed in D210. This truncation is due to the fact that the InternetService column has been dropped from the Churn database included in the default Labs on Demand configuration. The component tables of the D211 version of the Churn dataset have been exported to .csv files and included in my submission to comply with this rubric item. The external dataset used was “Types of Computers and Internet Subscriptions,” sourced from the 2020 United States Census (American Community Survey, 2021), hereafter referred to as the Census dataset. I have included both the source Census dataset as available for download at <https://data.census.gov/table?q=broadband&tid=ACSST1Y2021.S2801>, as well as a copy of the processed table used in my Tableau dashboard.

## A2: Dashboard Installation

The completed dashboard has been submitted via the WGU submission portal as “Tabletmetrics.twbx”, which can be explored using Tableau Reader. However, in order to access the dashboard via a default instance of the provided Labs on Demand virtual machines for this performance assessment, the following steps can be performed.

* Open a Labs On Demand instance for the performance assessment
* Open Microsoft Edge and click on the address bar
* In this document, select and copy the following link: <https://drive.google.com/drive/folders/10KkF9EbvdztQ37UzLOakC2f52aGhNwZK?usp=sharing>
* Click the lightning bolt icon at the top left of the VM instance window
* Select Type Text > Type Clipboard Text
* If the following window appears, paste the above link and click OK
* Wait for the vm to type the link, then press Enter
* In the google drive link, check the files.zip file and select Download
  + NOTE: The files.zip file has also been included in the PA submission. This zip file contains all of the files included in the Google Drive link. If the evaluator so chooses, they can transfer the submitted .zip file via email and download it on the VM by logging into the email account on Microsoft Edge instead of the files via the Google Drive link
* Navigate to the Downloads folder by clicking the folder icon that appears in the Downloads popup
* Right click the files.zip icon in the Explorer window and select Extract All
* Change the destination folder to C:\Users\Public\Downloads
* Click Extract
* Open PGAdmin4
* Double click Servers to expand it in the Browsers pane
* Right click Databases > Churn and select Query Tool
* In the query window, click the file icon at the top of the window
* In the popup, change Format to All Files and navigate to C:\Users\Public\Downloads
* Click SQLNEW.txt and click Select
* Right click in the SQL query window and select Select All
* Click the play button at the top of the SQL Query window to execute the script
* Minimize PGAdmin4
* Open Tableau 2021.4 and close any update popups
* Click File > Open and select Tabletmetrics.twbx in C:\Users\Public\Downloads
* Enter “Passw0rd!” in the password field of the login window and click Sign In
* The Dashboard and all associated sheets can now be explored in Tableau

## A3: Dashboard Navigation

The dashboard I designed is contained in a single tab, and displays 2 visualizations at a time with the functionality to switch either one or both visualizations for alternative visualizations via interactive controls. Regardless of control settings, The left half of the dashboard is devoted to representations of customer data sourced exclusively from the Churn Dataset, and the right half relates to data sourced from the Census dataset, or comparisons between the two datasets.

The dashboard’s interactive controls include two dropdown parameter selection objects that enable users to switch between visualizations in the Customer and Census half of the dashboard respectively. On the left half of the dashboard, the Customer Data Parameter allows the user to display either a pie chart of customer tablet ownership percentage by selecting the “Charts” value, or a state map of relative customer tablet ownership percentages by selecting the “Maps” value. This map can be navigated in multiple ways, allowing the user to zoom in and out, shift-click and drag to pan the frame around the map, and even type specific state names into the embedded search bar to automatically focus on that geographical region.

On the right half of the dashboard, the Census Data Parameter allows the user to display either a pie chart of national tablet ownership percentage by selecting the “Charts” value, or a single-celled table displaying the relative percentage of internal customer tablet ownership percentages versus national tablet ownership percentages by selecting the “Difference Tables” value. These interactive controls were developed using instructions sourced from the following tutorial: <https://www.postgresqltutorial.com/postgresql-tutorial/postgresql-identity-column/>.

## A4: SQL Code

The following encompasses the entirety of the SQL code used to preprocess and arrange the data used in this analysis.

-- Create a table to load our source Census data into

CREATE TABLE CensusData (

column1 VARCHAR(255),

column2 VARCHAR(255),

    column3 VARCHAR(255),

    column4 VARCHAR(255),

    column5 VARCHAR(255)

);

-- Copy the data from the CSV

COPY CensusData(column1, column2, column3, column4, column5) from 'C:\Users\Public\Downloads\ACSST1Y2021.S2801-2023-05-14T010706.csv' DELIMITER ',' CSV HEADER;

-- Return tablet ownership percentage

SELECT

CAST(REPLACE(REPLACE(REPLACE("column4", ' ', ''), '%', ''), '\n', '') AS FLOAT) AS tablet\_percentage

INTO tablet\_percentage\_table

FROM CensusData

WHERE "column1" = '            Tablet or other portable wireless computer'

LIMIT 1;

-- Make a new table for the dummy data

CREATE TABLE IF NOT EXISTS tablet\_series\_table (

tablet TEXT

);

-- Generate the dummy data

DO $$

DECLARE

tablet\_percent NUMERIC;

BEGIN

tablet\_percent := (SELECT tablet\_percentage FROM tablet\_percentage\_table);

WITH tablet\_series\_y AS (

     SELECT 'Yes' AS tablet\_y

     FROM generate\_series(1, ROUND(tablet\_percent \* 100))

    )

INSERT INTO tablet\_series\_table (tablet)

SELECT tablet\_y

FROM tablet\_series\_y;

WITH tablet\_series\_n AS (

     SELECT 'No' AS tablet\_n

     FROM generate\_series(1, (10000 - ROUND(tablet\_percent \* 100)))

    )

INSERT INTO tablet\_series\_table (tablet)

SELECT tablet\_n

FROM tablet\_series\_n;

END $$;

-- Add CaseOrder columns so that the customer and census data can relate

ALTER TABLE tablet\_series\_table

ADD COLUMN "CaseOrder" int

     GENERATED BY DEFAULT AS IDENTITY;

ALTER TABLE customer

ADD COLUMN "CaseOrder" int

     GENERATED BY DEFAULT AS IDENTITY;

-- Change our column name to more easily differentiate in Tableau

ALTER TABLE tablet\_series\_table

RENAME COLUMN tablet TO "CensusTablet";

-- Drop our intermediary tables

DROP TABLE IF EXISTS CensusData;

DROP TABLE IF EXISTS tablet\_percentage\_table;

-- Copy all tables to csv files for submission

COPY tablet\_series\_table("CaseOrder", "CensusTablet") to 'C:\Users\Public\Downloads\Census.csv' DELIMITER ',' CSV HEADER;

COPY contract(contract\_id, duration) to 'C:\Users\Public\Downloads\contract.csv' DELIMITER ',' CSV HEADER;

COPY customer("CaseOrder",

      customer\_id,

      lat,

      lng,

      population,

      children,

      age,

      income,

      marital,

      churn,

      gender,

      tenure,

      monthly\_charge,

      bandwidth\_gp\_year,

      outage\_sec\_week,

      email,

      contacts,

      yearly\_equip\_faiure,

      techie,

      port\_modem,

      tablet,

      job\_id,

      payment\_id,

      contract\_id,

      location\_id) to 'C:\Users\Public\Downloads\customer.csv' DELIMITER ',' CSV HEADER;

COPY job(job\_id, job\_title) to 'C:\Users\Public\Downloads\job.csv' DELIMITER ',' CSV HEADER;

COPY location(location\_id, zip, city, state, county) to 'C:\Users\Public\Downloads\location.csv' DELIMITER ',' CSV HEADER;

COPY payment(payment\_id, payment\_type) to 'C:\Users\Public\Downloads\payment.csv' DELIMITER ',' CSV HEADER;

## B: Panopto Presentation

The Panopto presentation for this analysis has been included for evaluation via link the WGU submission portal. This presentation will address rubric items B1-B7. In addition, the video presentation can be viewed via the following link: https://wgu.hosted.panopto.com/Panopto/Pages/Viewer.aspx?id=e89f89fd-150d-429c-8c3a-b01401871fe0

## C: Written Report

## C1: Dashboard Alignment

The research question that I sought to address in this analysis was the following: “How do the percentages of customer tablet ownership in the Churn database compare to national percentages of table ownership?” I chose this question because it aligns with the provided data dictionary’s underlying business need of churn mitigation in several interesting ways.

Tablet devices act as an all-in-one solution for access to many different telecommunications services. They can utilize a SIM card to communicate as a cellular device, access the internet via wifi, and function as a portable hotspot for other devices to connect to the internet. They effectively bridge the gap between a smartphone and a laptop computer, allowing users to stream media, play games, conduct research, answer emails, and even perform advanced administrative tasks through the use of peripheral devices such as wireless or attached keyboards and mice.

Because these devices enable such easy access to a multitude of services, they are an appetizing target for telecommunications organizations, because they enable providers to upsell and bundle services to existing customers. This allows telecom organizations to more effectively incentivize customers to sign service contracts for extended periods of time, thereby extending customer tenure, building lasting brand impressions of convenience and simplicity, and ultimately deterring customers from churning.

## C2: Business Intelligence Tool

## The business intelligence tool that I have chosen to utilize for this analysis is Tableau Desktop. The Tableau ecosystem is an industry-standard suite of data visualization tools and services that enable an extremely robust feature set of data visualization techniques to be applied dynamically to a wide variety of databases, both relational and nonrelational. This allows users to rapidly derive, present, and share salient business metrics from dissimilar data sources and quickly adapt to structural changes in existing data analysis pipelines.

## C3: Data Cleaning

The data cleaning steps performed in this analysis were fairly minimal, as the only columns used in the Churn dataset were Tablet (located in the “customer” table in our PostgreSQL database), and State (from the “location” table). These two columns were already mostly formatted appropriately for the purposes of our analysis and free of any null values. The customer table utilizes a foreign key, “location\_id,” that corresponds to the primary key of the location table, enabling us to relate the Tablet and State columns in our visualizations. However, unlike in previous classes, CaseOrder is not a column included in the customer table or in any other existing table of the database. Because we need a way to relate our Census data to our customer data for easy comparison in Tableau, we have re-added the CaseOrder column, which is effectively an index column, to our customer table using the following SQL query:

ALTER TABLE customer

    ADD COLUMN "CaseOrder" int

        GENERATED BY DEFAULT AS IDENTITY;

(This code was adapted from instructions sourced from the following tutorial: <https://www.postgresqltutorial.com/postgresql-tutorial/postgresql-identity-column/>)

The Census dataset, on the other hand, required some processing in PostgreSQL in order to be employed alongside the Churn dataset in Tableau.

* First, the Census source file (“ACSST1Y2021.S2801-2023-05-14T010706.csv”) was copied in its entirely into a table in the Churn database
* Next, the column containing the percentage figures was filtered by searching an identifier column for a string indicating that the row corresponded to ownership of  “Tablet or other portable wireless computer.” The returned value reflects the ownership percentage.
* This percentage value was then used to calculate the number of records (rows) that would appear as “Yes” out of a sample size of 10,000, in order to match the number of records in our Churn database
* A new table (“tablet\_series\_table”) with a single column (“Census Tablet”) of 10,000 records, with the values “Yes” and “No” was then created to the proper proportions using this percentage value.
* Just as we did with our customer table, we then added an index column called CaseOrder to tablet\_series\_table so that it can be linked to our customer table easily in Tableau.
* The intermediary tables used to create our final tables were then dropped from the database.
* All remaining tables, including those from the Churn dataset and tablet\_series\_table, were then exported to .csv files for inclusion in our PA submission to comply with rubric section A1.

## C4: Dashboard Creation

In order to create the Tableau dashboard featured in my analysis from scratch, the following steps can be referenced.

DATA SOURCE

* After opening Tableau, click To a Server > PostGreSQL on the left pane of the window
* Configure the popup as follows, and enter “Passw0rd!” in the Password field
* A screenshot of a login box

  Description automatically generated with medium confidence
* Click Sign In
* Drag the customer table from the Table pane to the main window
* Drag the tablet\_series\_table from the Table pane to the main window so that a curved line connects the two tables
  + Click the line connecting the two tables, and click Performance Options in the bottom left section of the main window. Under Cardinality, change both fields to “One.”
  + Change both fields under “Referential Integrity” to “All records match.”
* Drag the location table from the Table pane to the main window so that a curved line connects it to the customer Table

CUSTOMER TABLET

* Click the “Sheet 1” button at the bottom of the window.
* Drag Tablet from the Tables menu under customer to the Columns shelf
  + Right click Tablet in the Columns shelf and select Measure > Count
* Drag Tablet from the Tables menu under customer to the Rows shelf
* Click the Show Me button at the top right of the screen and select the pie chart
* Double click in the Rows shelf, enter “1” in the pill, and press enter
* Right click the 1 to the left of the pie chart and deselect Show Header
* Drag the CNT(Tablet) pill with the size icon next to it in the Marks pane to the Label box
  + Right click Tablet and select Quick Table Calculation > Percent Of Total
* Right Click the Tablet pill with the Angle Icon and select Quick Table Calculation > Percent Of Total
* Drag Tablet from the Tables menu to the Label icon in the Marks pane
* Reorder the pills in the Marks pane as follows:
  + A screenshot of a computer

    Description automatically generated with medium confidence
* Right Click the title under the Rows shelf and select Edit Title
  + Title the sheet “Customer Tablet”
  + Click OK
* Double click the Sheet tab at the bottom of the window and rename it to match the slide title
* Right Click in the Tables frame and select Create > Parameter
  + Populate the fields of the popup window in the following way:

A screenshot of a computer

Description automatically generated with medium confidence

* Click OK
* Right Click in the Tables frame and select Create > Calculated Field
  + Format the popup window as follows
  + A screenshot of a computer program

    Description automatically generated with medium confidence
  + Click OK
* Drag the Customer Selection Filter to the Filters pane above Marks
  + In the popup window, click the Condition tab and format the fields as follows:
  + A screenshot of a computer

    Description automatically generated with medium confidence
  + Click OK
* Right click Customer Data Parameter on the left pane and select Show Parameter
* Change “Standard” in the dropdown at the top of the window to Entire View
* Right click the Legend in the top right of the main window and select Edit Colors
  + Click the Select Color Palette dropdown and select Gray
  + Click the Assign Palette button and then click OK

CUSTOMER TABLET TITLE

* Click the “New Worksheet” button at the bottom of the window.
* Right click the Columns shelf and select New Calculation
  + Enter the following: “1”
  + Press Enter
* Right click in the Marks pane and select New Calculation
  + Enter the following: "Customer Tablet Ownership Percentage"
  + Press Enter
  + Drag the new field to the Text box to change it to text
* Right click the title of the sheet and select Hide Title
* Right click the “1” label and select “Hide Field Labels for Columns”
* Right click 1 and deselect Show Header
* Right click “Custom..” and select Format
  + Click the Alignment Icon and select the Sheet Tab
  + In the Default > Pane dropdown, under Horizontal, center the text
* Change “Standard” in the dropdown at the top of the window to Entire View
* Drag Customer Selection Filter to the Filters pane and format it as follows:
  + A screenshot of a computer

    Description automatically generated with medium confidence
  + Click OK
* Right click Customer Data Parameter on the left pane and select Show Parameter
* Double click the Sheet tab at the bottom of the window and rename it to “Customer Tablet Title”

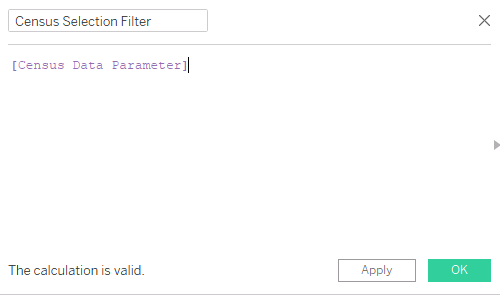
CENSUS TABLET

* Click the “New Worksheet” button at the bottom of the window.
* Drag Census Tablet from the Tables menu under tablet\_series\_table to the Columns shelf
  + Right click Census Tablet in the Columns shelf and select Measure > Count
* Drag Census Tablet from the Tables menu to the Rows shelf
* Click the Show Me button at the top right of the screen and select the pie chart
* Double click the rows shelf
  + Enter “1” in the pill and press enter
* Right click the 1 to the left of the pie chart and deselect Show Header
* Drag the CNT(Census Tablet) pill with the size icon next to it in the Marks pane to the Label box
  + Right click Census Tablet and select Quick Table Calculation > Percent Of Total
* Right Click the Census Tablet pill with the Angle Icon and select Quick Table Calculation > Percent Of Total
* Drag Census Tablet from the Tables menu to the Label icon in the Marks pane
* Reorder the pills in the Marks pane as follows:
  + A screenshot of a computer

    Description automatically generated with medium confidence
* Right Click the title under the Rows shelf and select Edit Title
  + Title the sheet “Census Tablet”
  + Click OK
* Right Click in the Tables frame and select Create > Parameter
  + Populate the fields of the popup window in the following way:

A screenshot of a computer

Description automatically generated

* Click OK
* Right Click the Tables frame and select Create > Calculated Field
  + Format the popup window as follows
  + 
  + Click OK
* Drag the Census Selection Filter to the Filters pane above Marks
  + In the popup window, click the Condition tab and format the fields as follows:
  + A screenshot of a computer

    Description automatically generated
  + Click OK
* Right click Census Data Parameter on the left pane and select Show Parameter
* Change “Standard” in the dropdown at the top of the window to Entire View
* Right click the Legend in the top right of the main window and select Edit Colors
  + Click the Select Color Palette dropdown and select Gray
  + Click the Assign Palette button and then click OK
* Double click the Sheet tab at the bottom of the window and rename it to “Census Tablet”

CENSUS TABLET TITLE

* Click the “New Worksheet” button at the bottom of the window.
* Right click the Columns shelf and select New Calculation
  + Enter the following: “1”
  + Press Enter
* Right click in the Marks pane and select New Calculation
  + Enter the following: "National Tablet Ownership Percentage"
  + Press Enter
  + Drag the new field to the Text box to change it to text
* Right click the title of the sheet and select Hide Title
* Right click the “1” label and select “Hide Field Labels for Columns”
* Right click 1 and deselect Show Header
* Right click “Nationa..” and select Format
  + Click the Alignment Icon and select the Sheet Tab
  + In the Default > Pane dropdown, under Horizontal, center the text
* Drag Census Selection Filter to the Filters pane and format it as follows:
  + A screenshot of a computer

    Description automatically generated
  + Click OK
* Right click Census Data Parameter on the left pane and select Show Parameter
* Change “Standard” in the dropdown at the top of the window to Entire View
* Double click the Sheet tab at the bottom of the window and rename it to “Census Tablet Title”

STATE TABLET

* Click the “New Worksheet” button at the bottom of the window.
* Drag State from the Tables pane to the Marks pane. A national map should appear automatically.
* Right click in the Tables pane and select Create > Calculated Field.
  + Name the calculated Field “Tablet %” and enter the following in the calculation field:

SUM(IIF(CONTAINS([Tablet], 'Yes'), 1, 0))/ COUNT([Tablet])

* Click OK
* Right click Tablet % in the Tables pane
  + Select Default Properties > Number Format
  + Select Percentage and click OK
* Drag Tablet % from the Tables pane into the Color boc of the Marks pane
* Drag Tablet % from the Tables pane into the Label box of the Marks pane
* Right Click the title under the Rows shelf and select Edit Title
  + Title the sheet “State Tablet”
  + Click OK
* Drag the Customer Selection Filter to the Filters pane above Marks
  + In the popup window, click the Condition tab and format the fields as follows:
  + A screenshot of a computer

    Description automatically generated with medium confidence
  + Click OK
* Right click Customer Data Parameter on the left pane and select Show Parameter
* Right click the Legend in the top right of the main window and select Edit Colors
  + Click the Palette dropdown and select Gray
  + Click OK
* Double click the sheet tab at the bottom of the window and rename it to “State Tablet”

STATE TABLET TITLE

* Click the “New Worksheet” button at the bottom of the window.
* Right click the Columns shelf and select New Calculation
  + Enter the following: “1”
  + Press Enter
* Right click in the Marks pane and select New Calculation
  + Enter the following: "Customer Tablet Ownership Percentage by State"
  + Press Enter
  + Drag the new field to the Text box to change it to text
* Right click the title of the sheet and select Hide Title
* Right click the “1” label and select “Hide Field Labels for Columns”
* Right click 1 and deselect Show Header
* Right click “Custom....” and select Format
  + Click the Alignment Icon and select the Sheet Tab
  + In the Default > Pane dropdown, under Horizontal, center the text
* Change “Standard” in the dropdown at the top of the window to Entire View
* Drag Customer Selection Filter to the Filters pane and format it as follows:
  + A screenshot of a computer

    Description automatically generated with medium confidence
  + Click OK
* Right click Customer Data Parameter on the left pane and select Show Parameter
* Double click the sheet tab at the bottom of the screen and rename it to “State Tablet Title”

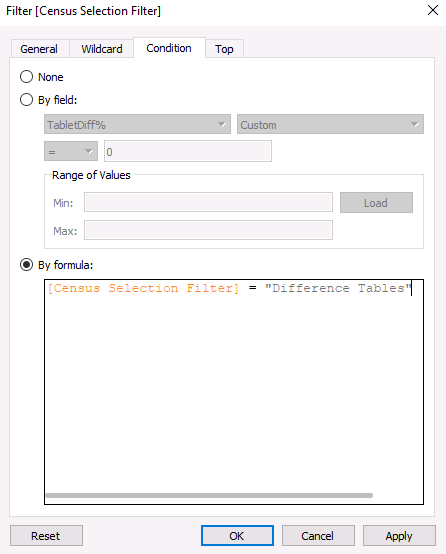
TABLET COMPARISON

* Click the “New Worksheet” button at the bottom of the window
* Right click in the Tables pane and select Create > Calculated Field.
  + Name the calculated Field “TabletDiff%” and enter the following in the calculation field:

SUM(IIF(CONTAINS([Tablet], 'Yes'), 1, 0))

/

SUM(IIF(CONTAINS([Census Tablet], 'Yes'), 1, 0))

* Click OK
* Drag TabletDiff% to the Text box in the Marks pane
* Right click TabletDiff% in the Tables pane
  + Select Default Properties > Number Format
  + Select Percentage and click OK
* Right Click the title under the Rows shelf and select Edit Title
  + Title the sheet “Tablet Comparison” and Center the text
  + Click OK
* Click the “Standard” dropdown at the top of the window and select “Entire View”
* Right click the table value and select Format
  + Select Default>Worksheet, change the font size to 20, and click Bold
  + Click the Alignment button, then select Default > Pane > Horizontal and center the text
* Drag Census Selection Filter to the Filters pane and format it as follows:
  + 
  + Click OK
* Right click Census Data Parameter on the left pane and select Show Parameter
* Double click the sheet tab at the bottom of the screen and rename it “Tablet Comparison”

TABLET COMPARISON TITLE

* Click the “New Worksheet” button at the bottom of the window.
* Right click the Columns shelf and select New Calculation
  + Enter the following: “1”
  + Press Enter
* Right click in the Marks pane and select New Calculation
  + Enter the following: "Relative Percentage of Customer Tablet Ownership vs. National Averages"
  + Press Enter
  + Drag the new field to the Text box to change it to text
* Right click the title of the sheet and select Hide Title
* Right click the “1” label and select “Hide Field Labels for Columns”
* Right click 1 and deselect Show Header
* Right click “Relativ..” and select Format
  + Click the Alignment Icon and select the Sheet Tab
  + In the Default > Pane dropdown, under Horizontal, center the text
* Click the “Standard” dropdown at the top of the window and select “Entire View”
* Drag Census Selection Filter to the Filters pane and format it as follows:
  + A screenshot of a computer

    Description automatically generated
  + Click OK
* Right click Census Data Parameter on the left pane and select Show Parameter
* Double click the sheet tab at the bottom of the screen and rename it “Tablet Comparison Title”

DASHBOARD

* Click the New Dashboard Button at the bottom of the window
* Check the Show dashboard title box at the bottom left of the window
* Edit the Dashboard title to read “Tablet Ownership Metrics” and center the text
* Double click the dashboard tab at the bottom of the screen and rename it “Tablet Ownership Metrics”
* Click the Floating Button at the bottom left of the window

* From the Sheets pane, drag the Customer Tablet sheet to the left of the Dashboard above the parameter dropdown
* Resize the chart so that it fills the left half of the dashboard with a gap at the top and bottom
* Drag the Customer Data Parameter dropdown to the bottom left of the dashboard below the chart
  + Right click the title of the chart and select Hide Title
  + Select the chart legend that appears and click the X in the top right to remove it from the dashboard
  + Drag the chart’s title sheet from the sheets pane onto the dashboard
    - Right click the sheet title above the text of the title sheet and select Hide Title
    - Resize the title sheet vertically so it is small enough to fit between the chart and the dashboard title
    - Position the title sheet above the chart on the dashboard
* Change the Customer Data Parameter dropdown from Charts to Maps. The chart and title on the left half of the dashboard should disappear
* From the Sheets pane, drag the State Tablet sheet to the left side of the Dashboard
* Resize the chart so that it fills the left half of the dashboard with a gap at the top and bottom
  + Right click the title of the chart and select Hide Title
  + Select the chart legend that appears and click the X in the top right to remove it from the dashboard
  + Drag the chart’s title sheet from the sheets pane onto the dashboard
    - Right click the sheet title above the text of the title sheet and select Hide Title
    - Resize the title sheet vertically so it is small enough to fit between the chart and the dashboard title
    - Position the title sheet above the chart on the dashboard
  + From the Sheets pane, drag the State Tablet sheet to the bottom left of the Dashboard above the parameter dropdown
    - Right click the title of the chart and select Hide Title
    - Select the chart legend that appears and click the X in the top right to remove it from the dashboard
    - Drag the chart’s title sheet from the sheets pane onto the dashboard
      * Right click the sheet title above the text of the title sheet and select Hide Title
      * Resize the title sheet vertically so it is small enough to fit between the charts
      * Position the title sheet above the chart on the dashboard

* From the Sheets pane, drag the Census Tablet sheet to the right half of the Dashboard above the parameter dropdown
  + Resize the sheet so that it takes up the right half of the dashboard with a gap at the top and bottom
  + Drag the Census Data Parameter dropdown to the bottom left of the dashboard below the chart
  + Right click the title of the chart and select Hide Title
  + Select the chart legend that appears and click the X in the top right to remove it from the dashboard
  + Drag the chart’s title sheet from the sheets pane onto the dashboard
    - Right click the sheet title above the text of the title sheet and select Hide Title
    - Resize the title sheet vertically so it is small enough to fit between the charts
    - Position the title sheet above the chart on the dashboard
* Change the Census Data Parameter dropdown from Charts to Difference Tables. The chart and title on the right half of the dashboard should disappear

* From the Sheets pane, drag the Tablet Comparison sheet to the right of the Dashboard above the parameter dropdown
  + Resize the chart so that it fills the right half of the dashboard with a gap at the top and bottom
  + Right click the title of the chart and select Hide Title
  + **Select the Tablet Comparison sheet in the dashboard, then right click it and select Floating Order > Send to Back**
  + Drag the chart’s title sheet from the sheets pane onto the dashboard
    - Right click the sheet title above the text of the title sheet and select Hide Title
    - Resize the title sheet vertically so it is small enough to fit between the charts
    - Position the title sheet above the chart on the dashboard

## C5: Data Analysis Results

My dashboard was designed to operate as a launch point for exploring the device and usage habits between the organization’s existing customer base and national averages. By comparing customer data with existing benchmarks and further dividing that data regionally through the use of interactive maps, executive leadership can begin to make operational and marketing decisions tailored to the regions that most significantly deviate from national tablet ownership metrics, thereby maximizing the effectiveness of any campaigns undertaken to rectify these deviations.

The results of the analysis were fairly clear: The percentage of customers who own a tablet is 29.91%, while the national average for tablet ownership is 63.80%. When comparing the two percentages against one another, the organization’s metric is 46.88% of the national average. This demonstrates that the organization either are not effectively marketing to tablet owners, or that the services that they provide fail in some way to be functional or satisfactory when accessed on tablet devices.

The results of this analysis indicate a number of follow-ups that should be explored. First, surveying should be conducted on current and former customers regarding their device usage habits, and whether or not the organization provides satisfactory telecom services when those services are accessed via tablet devices. Furthermore, surveying should include questions about customer interest in tablet devices in order to see if this market lack of customer tablet ownership can be leveraged to incentivize contract agreements, either through discounted or financed tablet devices. Tying this strategic initiative to customer contracts would thereby create a result of increased customer tenure, and by extension, mitigate customer churn. As a secondary objective, market research should also be conducted on prospective customers to determine how current marketing and promotional efforts are failing to attract tablet owners.

Once the underlying causes of the main tablet ownership discrepancies are identified, executive leadership should then partner with regional leadership to focus their efforts on strategic initiatives tailored to the states with the lowest relative percentages of tablet ownership, as identified in the map included in the dashboard.

## C6: Analysis Limitations

There are several limitations of this analysis. The first limitation is that while the datasets are comparable, and we can derive metrics of comparison through them in order to understand how the organization’s customer base differs from the larger population of the United States in terms of tablet ownership, our Census data is not further broken down by state, meaning that our understanding of regional averages for this metric is incomplete. If possible, we should endeavor to include a census dataset that does include percentages by state, so that our regional breakdown could reflect the relative differences between customer and national averages using the same basic formula employed in our comparison table. This would give executive and regional leadership more accurate baselines to compare against when determining their own metrics for success in any strategic initiatives undertaken on the merits of this analysis.

Another limitation is that while our analysis effectively shows that a difference exists between customer averages and national averages, we have no real understanding of why these discrepancies exist. As mentioned previously, the underlying cause could be a failure to market to tablet owners, some qualitative shortcomings of services provided via tablet device that drives that customer demographic to churn, or some other as yet unidentified factor. We can only declare that a significant difference exists, and any potential action taken to rectify or capitalize on that difference requires additional justification through further analysis.

The last significant limitation of this analysis is that the Census dataset used as a point of comparison is multiple years old at the time of this writing. It is worth understanding that consumer device habits and popularity can change significantly over time, and that at least some degree of the deviation observed in our analysis may actually reflect a broader decline in consumer tablet usage. However, due to the large size gap between the customer average and national average and the relative recency of the last US Census, it is unlikely that such a discrepancy can be explained solely by changes in consumer device trends.

## D: Web Sources

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