Broadband Penetration in Ireland

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Introduction:

The main objective of this project is to examine the penetration of domestic broadband networking across counties and electoral divisions in Ireland and create a map representation for the same. A set of data for both have been abstracted from 2016 census CSO website. The data set has the details of number of households using broadband and personal computers and the total number of households.

To find out the **proportion** of usage, I have created two new columns in the **excel** data file to identify percentage of the data among the total population that uses Broadband and PC. The **boundary layer is transformed** into the ITM and CSV data file Text delimited layer is imported in QGIS. Using this, I have created a map in QGIS with usage of Geojson boundary files with different **classification ranges**. The categorization is shown in separate **colors**.

Details of Map Creation

- **Examining the attribute data in the census file of 2016.**

Below are the column names and there meaning in both the data files.

Table 2	T15_2_Y	Yes
Number of households with a personal computer	T15_2_N	No
	T15_2_NS	Not stated
	T15_2_T	Total

Table 3	T15_3_B	Broadband
Number of households with internet	T15_3_OTH	Other
	T15_3_N	No
	T15_3_NS	Not stated
	T15_3_T	Total

- **Refining the data file to calculate proportions.**

Redundant columns are removed and two new columns are created to identify percentage of the data among the total population that uses Broadband and PC's.

Counties: -

GUID	GEOGDESC	Proportion of PC	Proportion of BroadBand
EB9428B8-B443-407E-977B-9393FD73E1D0	Cork City	61.71	69.35

Electoral Divisions: -

GUID	GEOGDESC	Proportion for PC	Proportion for BroadBand
2AE19629185813A3E055000000000001	Carlow Urban	58.105	62.594

- **Studying about the Electoral Divisions and Counties in Ireland.**

The **four provinces** of Ireland are Connacht, Leinster, Munster and Ulster. These provinces are divided into **31 counties** and are consistent Irish land divisions. A district electoral division (second level of local administrative

unit (LAU)) was the identified name for a low-level territorial division in the Republic of Ireland in 90's. In 1994, both DED and Wards were renamed as **Electoral Divisions (3,409)** for studying valuation records and taking of censuses.

- **Studying about Broadband usage in Ireland.**

Broadband technologies have become all pervasive – enabling quick Internet access to residential users, mobile users and small businesses at a budgeted price. Widely used types of BB's: -

- Fixed Broadband Internet Technologies (Wired Options)
- Mobile Broadband Internet Technologies
- Wireless Broadband Internet Technologies

Households with access to the internet

						% of house
2010	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**
72	78	81	82	82	85	87

Note: - We have some data where the owners of the houses have not stated whether they use the PC and Broadband or not, so we can expect slight variability in the actual and predicted results.

- **Maps Creation and Visualization**

QGIS **2.18** is a desktop based **geographic information system (GIS)** open-source application that helps in viewing, updating, and analysis of geospatial data. OpenStreetMap of the world is used as a background layer in this project for better interpretation and association with the geography of Ireland.

Firstly, **boundary layers** Geojson Files for ED's and Counties and CSV data file Text delimited layer is **imported** in QGIS. Joins are then **created** for the data file with the boundary files in QGIS. Then using the columns containing the proportions, we created a Graduated style **map with different modes** available in the software.

- **Equal Interval:** This method creates classes which are of the same size. If our data ranges from 0-50 and we want 5 classes, this method would create a class from 0-10, 10-20, 20-30 etc.
- **Quantile:** This method divides the classes keeping number of parameters in each class the same. If there are 60 values and we want 4 classes, quantile method divides each class having 15 values.
- **Natural Breaks (Jenks):** This algorithm identifies natural groupings of figures to create classes. The resulting classes will have maximum variance between individual classes and least variance within the classes itself.

We have changed the transparency of the boundary layers to see the underneath OSM layer for better visualization.

Broadband usage in Counties:

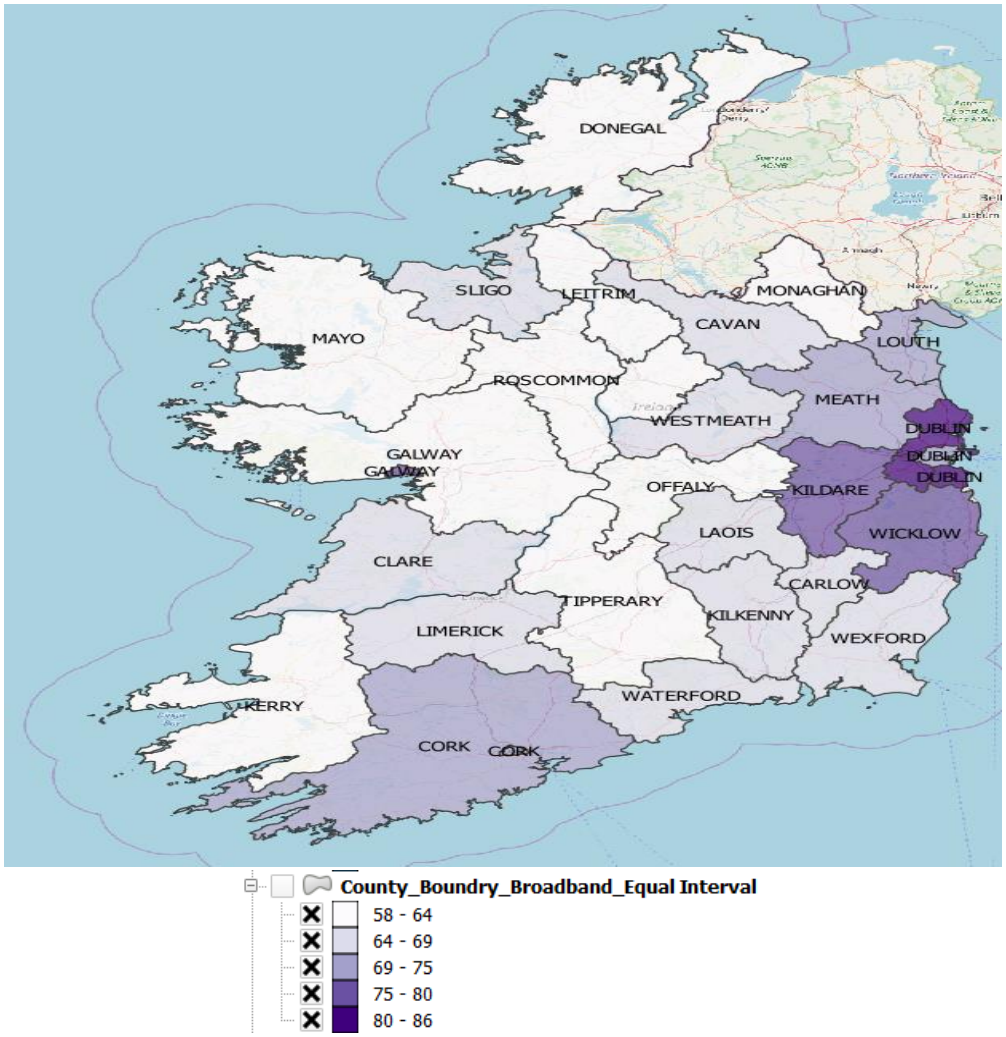

Figure 1

Figure 1 highlights the broadband usage across counties. The mode used is **Equal intervals with 5 classes**. We have used **Labels to represent County** names. From the map, it is indisputable that highest percentage of usage is in eastern part of republic of Ireland. **Dublin has maximum** usage between **80% to 86 %.** This dominance is precisely due to the large population, geographical location and penetration of IT in and around Dublin. About 20% of Ireland's population is concentrated in Dublin as it is developed and caters the most software companies, businesses and has some of the best educational institutions. Majority of folks are either employees working directly or indirectly with tech companies, or students studying schools or colleges where internet is vital for everyone.

Kildare, Wicklow and Galway City county ranks second in the list with range of **75-80 %.** The first two counties were expected in the list as they are in close **proximity to Dublin** and the impact should reflect in these counties. But the presence of Galway City hints the development of the county (despite the vast distance from Dublin) and the measures taken by the local government to setup and provide broadband access to its majority population in conjunction with the infrastructure development and popularity of the Galway Institute among masses.

Cork, Meath & Louth counites together rank third in the usage of Broadband. It is intriguing to see Cork in this category despite of the development, businesses, institutes located in this region. One of the prime reasons could be the population density of Cork is lesser in comparison. The usage is in the range of **69-75 %. Clare, Limerick, Cavan, Sligo and 6 other counties are in the fourth** band with consumption of **64-69 %.** Remaining counties such as **Mayo, Donegal, Kerry, Offaly and 6 others are in the last** category of **58-64 %** where usage is finical because of the locality, development and infrastructure.

The cost of laying broadband fibers in remote areas is one of the major underlying reason of unavailability of BB. As the population is very less in such areas, the expected revenue generation for the internet provider companies to operate profitably in also less thoughtful. The overall picture shows that the **average consumption is above 65 % for the country** with slight indications towards predicting positive trends for upcoming years. This map can be used by the government and private internet provider companies to analyze future business potential and service people not having these facilities.

Proportion of Broadband in Electoral Division:

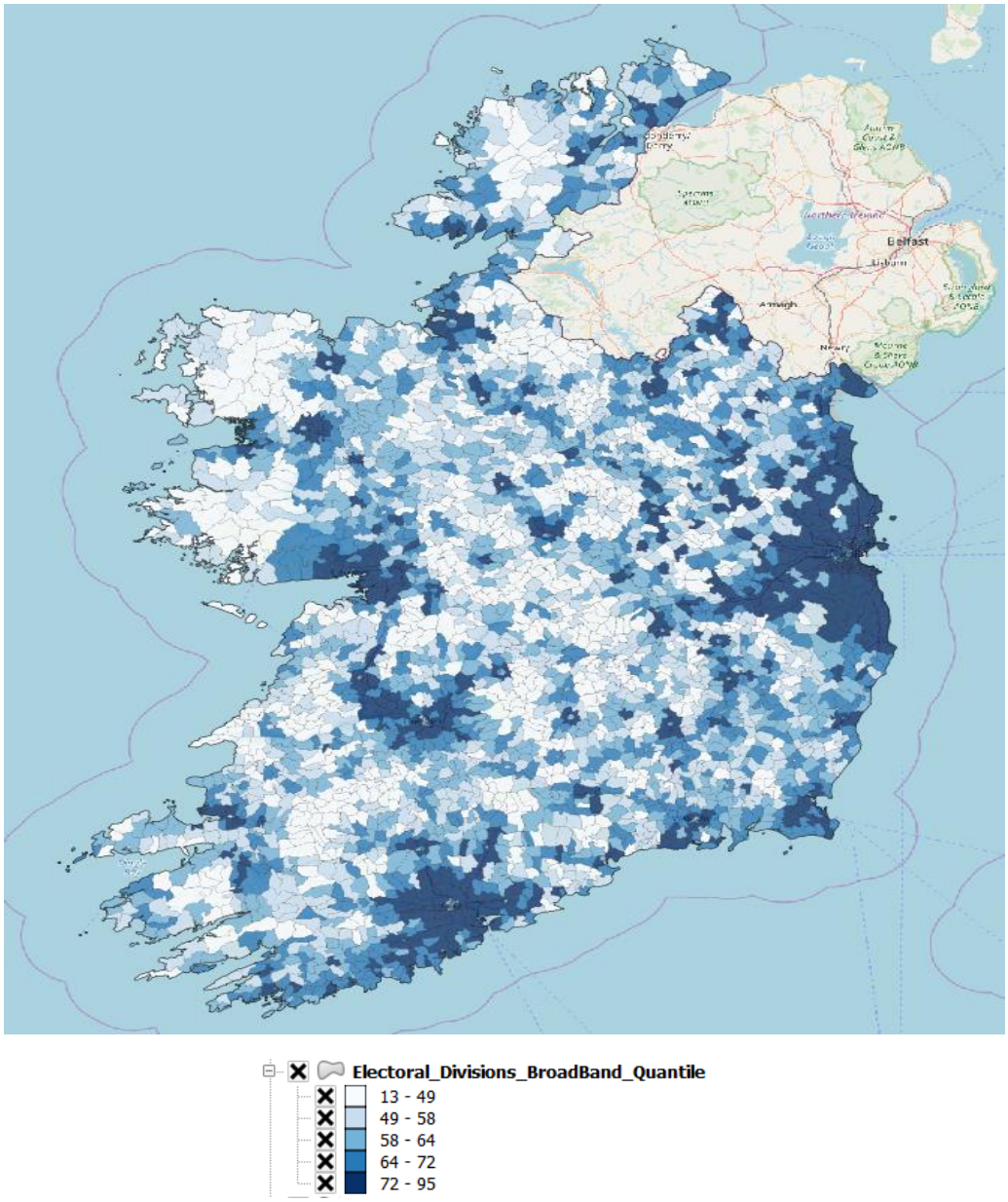

Figure 2

Figure 2 paints the idea of broadband usage across Electoral divisions in Ireland. The mode used for this map is **Quantile intervals with 5 classes**. The total number of ED's represented in this dataset in 3409. As the number of ED's are very large and this method has same number of values in each class which is only fair when the data is huge. Broadband penetration in ED's is very **similar but not same** as compared to counties because here the of usage is analyzed on a microscopic scale.

The first category usage in the range of **72-95 %** is spread across Ireland in smaller chunks dominated by the **ED's in Dublin, Kildare, Wicklow**. In County map we saw that only Dublin had the highest penetration, but if we look at ED distribution there are many more ED's in other counties within highest band: Central Cork (ED: Douglas, Lescleary, Cloyne), Galway (ED: Doora, Oranmore), Limerick (ED: Clarina, Roxborough, Adare South). Some of the ED's in counties which belonged to the last group of BB penetration in county wise analysis, are

included in the first list of ED's wise penetration analysis. This is very well explained by **MAUP** (Modifiable areal unit problem) and **Ecological fallacy** where results obtained from aggregated data such as counties cannot be assumed to apply to individual ED's within counties. This concludes that even though some of the ED's have outperformed others, when we see the bigger picture only in terms of the counties in which they belong, we cannot see the true underlying results.

The **second category in the range of 64-72 % has counties like Lixnaw, Drom, Balla, Tallow** etc. The **third and fourth** set of data follows a range of **58-64 % and 49-58 %** respectively. **Shinrone, Kiltormer, Hinds etc in 3rd category and Oatfield, Graigue, Ettagh etc in 4th category.**

Surprisingly, even in Dublin County (Highest penetrated County in Ireland), there is one ED named Clonmethan which falls in the last category (13-49 %) of least penetrated ED's in which confirms the MAUP.

Difference comparison for Broadband usage and Personal Computers Ownership in Counties:

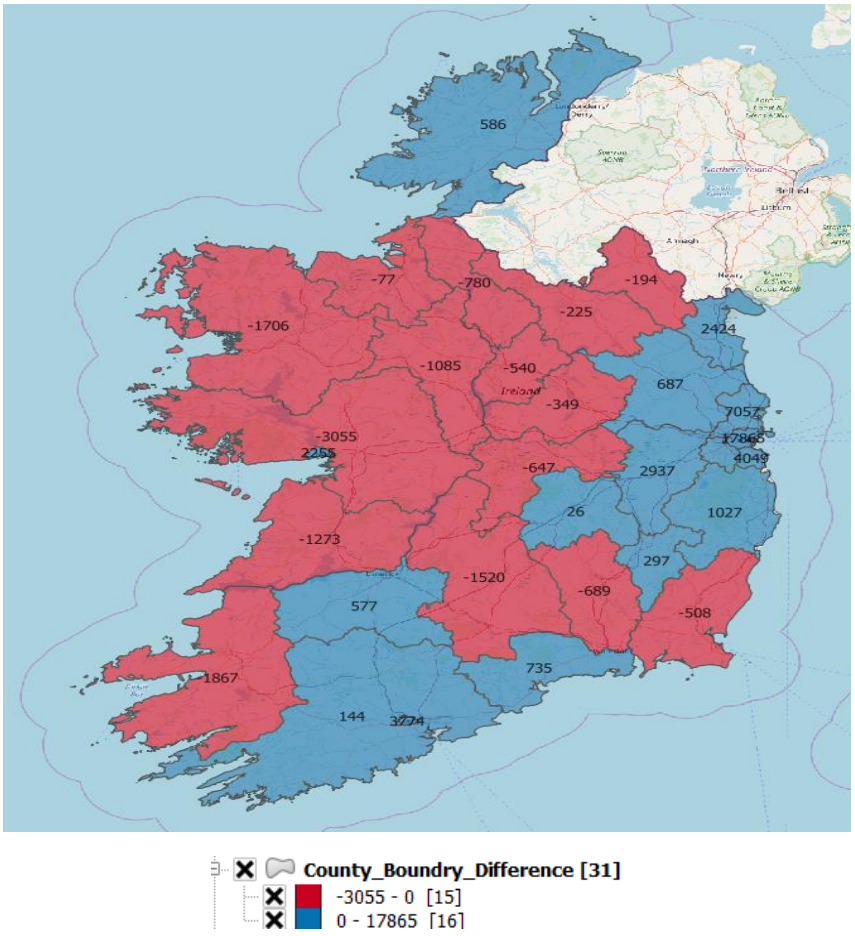

Figure 3

Figure 3 compares the statistics of users with Broadband connection not having Personal Computer (**Representing 16 Blue Counites**) to the users having PC's but no Broadband connection across counites (**Representing 15 Red Counites**). A new column was created in the excel to find the difference between T15_3_B and T15_2_Y.

Sample Calculation for **Cork City County** - > 34240 – 30466 = 3774

The above calculation shows that there are **3774 extra Broadband users in Cork City that do not own personal computer**. This analysis can predict the emerging trends of Broadband users moved away from using PC's to other devices like Laptop's and Mobile phones. **Dublin County is the most significant** in terms of above analysis having a population of **17865 BB users that don't have a PC**. This trend is in line with the factors concluded in figure 1 analysis for Dublin having higher density of overall users.

Sample Calculation for **Clare County** - > 27941– 29214= -1273

There are **1273 more people in Clare that own PC but have no Broadband connection**. One of the reasons can be that they either don't have connectivity availability or they use different means for internet such as dial-up. This analysis can be used to identify the target audience for Broadband market especially for traditional users. **Galway County is the most significant** in terms of above analysis having **3055 extra PC users without BB connection.**

Challenges and Solution:

It was a very interesting project to analyse the census data to map the broadband penetration in Ireland in various counties and electoral divisions. I have highlighted some of the challenges encountered while refining data, creating map and interpretation.

1. **Refining input data and Proportion Calculation:**

The input CSV data file Text delimited layer collected from census website had redundant columns which had to be removed and two new columns had to be created to identify percentage of the data among the total population that uses Broadband and PC in Counties and ED's.

2. **Selectin an appropriate Background layer:**

For better interpretation and association with the geography of Ireland, we had to use a suitable background layer in the map. There are various options available in QGIS, but I found OSM Standard layer was the most suitable layer. This needed to be installed from plugin in QGIS. After adding the layer and changing transparency, visualization was significantly improved.

3. **Study and understand about the ED's and Counties:**

The administrative geography of Ireland is different from my home county "India", so I had to research web for better understanding about the structure of Counties and ED's in Ireland so as to verify the map for interpretation.

Conclusion:

Thousands of people are outflanked by the digital revolution and are unable to access high-speed broadband network in Ireland as per the above analysis and map conclusions. Dublin county has the highest penetration, but on the other hand remaining counties (except one's sharing boundary with Dublin like Kildare, Wicklow and Meath) like Kerry, Mayo, Donegal are still devoid from having full scale Broadband availability for its people.

One of the significant factors is population concentration around Dublin having a rippling effect of technological advancement, popularity of educational institutes and growth of Software industries in the region. Over 67 % of counties in Ireland have less than 69 % of Broadband penetration, especially lower in rural areas. Looking further at atomic levels of Electoral Divisions, we see that spatial distribution of Broadband penetrations is widely scattered across the country and though Ireland is gently moving towards digitization, there is an urgent need for rapid development in rural areas.