MSc. Business Analytics MS5103 Major

Project: Final Report

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Declaration of Originality

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I/We hereby declare that this project is my/our own original work. I/We have read the University *Code of Practice for Dealing with Plagiarism*[*] and am/are aware that the possible penalties for plagiarism include expulsion from the University.

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Executive Summary

An analysis of Supply and Demand in Irish Tourism

The Irish Tourism and Hospitality industry is one of the biggest homegrown industries providing means of living to one in every ten in the workforce. It employs twice the agricultural industry and employs more than the construction and the IT industry in Ireland. With such a deep reach, its effects are conspicuous in the standard of living of the people in cities as well as the rural areas (Irish Tourism Industry Confederation, 2018).

Considering the involvement and importance of this sector in the Irish economy, it is crucial to seek out and analyze the internal as well as external factors influencing this industry. Our research is focused in the areas of segmentation of the inbound tourist market based on geographical demographics, accommodation demand, hotel revenue and domestic travel. Our aim consists of catering the targeted audience with patterns, trends and features and the influential factors in order to maximize the development of this sector**.** We have carried out the analysis using business analytics tools like Excel, Python, R, &Tableau.

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List of terms/abbreviations:

Term/abbreviation	Meaning
Alternative accommodation	Tourist accommodation comprised of rental apartments/houses, guesthouses/B&Bs or other accommodation not including hotel stays or stays at friends/relatives residences
CRS	Country of Residence Survey
CSO	Central Statistics Office
Domestic trips	A trip refers to the travel that is undertaken from departure of residence to return – thus referring to a round trip. Domestic trips in this report do not require an overnight stay.
EM	Euro Million
EO	Estimated occupancy
ETE	Estimated tourism expenditure
HTS	Household Travel Survey
ITIC	Irish Tourism Industry and Confederation
PCI	Passenger Card Inquiry
GDP	Gross Domestic Product
GNP	Gross National Product
ADR	Average Daily Rate
RevPAR	Revenue per available room
ESRI	Environmental Systems Research Institute

1. Introduction

Ireland's tourism sector is one of the most important elements of the Irish economy as it has extensions into every city, town and even villages employing over approx. 230,000 people – about 11% of the total working population in Ireland – contributing approx. 4% to the Gross National Product (GNP) (Failte Ireland, 2016). It provides over €9.2 billion to the Irish economy as measured in the year 2018 by ITIC (Irish Tourism Industry and Confederation, 2019). Also, by the end of 2025 these numbers are predicted to reach as high as €5 billion just from the foreign earnings and employment of more than 250,000 people in this sector (Failte Ireland, 2016). After the advent of Brexit, Great Britain, which has a major hand in Irish tourism with a revenue worth €1.45 billion, threatened an imminent downfall due to the declining value of sterling (Pope, 2019). The visitors from UK have been reduced by 4% overall, compared with the year 2017, and it is forecasted to reduce to 5% in the next few months (Crowe, 2019).

ITIC in their tourism report says that the competitiveness amongst the businesses has started to diminish as the cost to run a business precisely has been rising sharply. As a result of the same, these circumstances prove to be challenging for the approximated 20,000 tourism related businesses in Ireland (Irish Tourism Industry and Confederation, 2019). Also, due to the COVID-19 outbreak the Irish tourism has suffered a further depreciation. (Irish Tourism Industry and Confederation, 2020). The tourism industry supports a lot of areas like aviation, B&B's, hotels, pubs, festivals, exhibitions, sports, business conferences and so on. ITIC has made an estimate of €3.52 billion of loss to the Irish economy by means of the tourism and hospitality department (Irish Tourism Industry and Confederation, 2020)

We assessed the past data in order in the form of a descriptive analysis regarding the different segments of inbound based upon their country of origin. Our descriptive analysis also tells us that the consumer accommodation preferences moved from renting a hotel to renting a B&B. It gives us rough idea that even if the demand and supply relationship of the hotel room to rent is a positive one, chances exist that they might be coinciding. Last but not the least it defines a relationship between domestic travel, tourism demand, hotel occupancy and the revenue generated by the hotels. It aims to give predictions about the future revenue generated from the hotels posing to be a better helping hand in upscaling the GDP/GNP. Our analysis can be brought to use by a widespread target audience which includes Failte Ireland, Tourism Ireland, Hotel and accommodation businesses which would help Ireland grow on the economic as well as the social front.

2. Background

With the onset of digital transformation, penetration of emerging technologies has been a greatest trend of all. Due to this, visitors have started making use of smartphones, IoT enables technologies to express and contain their travel experiences. Even if the success in the tourism industry depends upon managerial and political areas, the increasing understanding of ever-changing customer needs is the key to prepare this sector for changes (Xiang & Fesenmaier, 2016). Location based services and web applications contain the driving value to imply a more sophisticated system which would influence the manner of tourism carried out in any country (Gretzel, 2011). The use of the social media to pin in information, ratings, likes and dislikes about the destination is the new word of mouth. The customer reviews regarding a particular destination on a particular website has been gaining new capacity. The main objective of an industry development is to increase the standard of living of the people in it. One such model of destination competitiveness describes how it is efficient in maintaining and up scaling the income of the citizens.

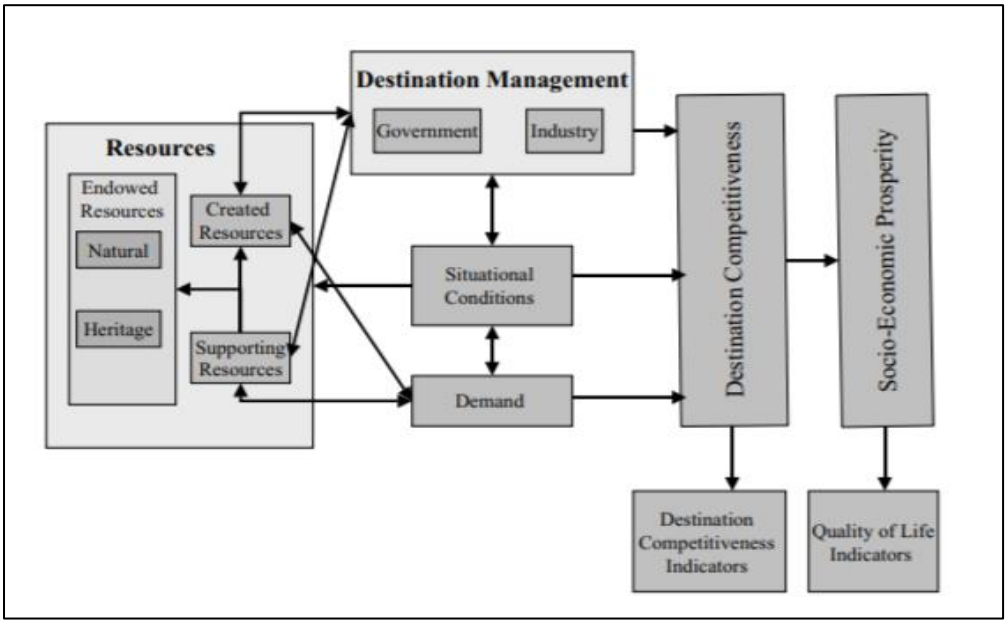

Figure 1: The destination competitiveness model (Dwyer et al., 2004)

The given model can be used to identify a comparative performance of the destinations that suit our interest. A performance rating scale can be developed by the help of this model and it can also detect the changes that take place in a destination's competitiveness. It allows assessments, characteristics or motivations by travelers regarding a destination, which might be a threat to the competitiveness of a destination as they come influenced due to external factors like environmental instances or pressures. A long-term outlook of this model is to recognize the elements in a particular destination which needs special attention. This model sets up an understanding of the competitiveness indicators which can be helpful in a knowledgeable policy making for an enhanced social and

economic quality of life of the residents (Dwyer et al., 2004)

Most of the times it is source and the flow of the information that derives the economic power in development of tourism. Nonetheless we can say that, the real business value appears from access to shared data, ownership and other resources (Xiang & Fesenmaier, 2016).

2.1. Predicting tourism demand using analytics

There is a consensus that predictions can be improved through data-driven decision-making and that forecasts can be improved given proper analysis to find hidden patterns in large sets of data (Shi, 2014). The search engines like Google Trends, etc. have been a proven as an effective data supplement for predicting the forecast of tourism parameters. For example, there is various research made in these areas using the analytic prediction models.

Predicted Variable	Data Provider	Keywords used	Data Pre-processing by	Forecasting model used
Tourists arrival to Spain	Google Trends	Travel terms used related to Spain	Correlation Analysis	ARX Model
Visits to UK	Google Trends	Top searches in vacation destinations	Correlation analysis	ARX Model
Tourist arrivals to Vienna	Google Analytics	10 website traffic Indicators	Unit root tests	FAVAR model

Table 1: Some examples of how analytics have been used to predict tourism trends (Li & Law, 2020).

There has been a proven example of how Brazil carried out analysis to manage tourism efforts and activities which would be provided to the policy makers there. The study involved a shift-share technique which was developed by Esteban-Marquillas. This includes decomposing the growth of the tourists in numbers into various section which can explain its behavior which would enable them a in depth analysis of the ambulation's (Sobral, Peci &Souza, 2007). The Booking.com makes use of predictive analytics taking in consideration the principles like:

- Consistency- Matching the online and offline predictions.
- Observability- For example if there is a FIFA world cup scheduled it might be a reason for more travelers in the respective area.
- Reusability- If one of the model gives us results for a family- friendly accommodation, the same result can be used in diverse product features too. Model reusability is what booking.com focuses on (Bernardi, 2019)

2.2. Creating value proposition using analytics

Creating value from data means transformation of data to create informative assets which will generate knowledge about hidden business acumen and patterns about the customer experiences that will improve the performance, customize offerings, and predict the market and much more (Vecchio, et al., 2018). A sense of reliability is created when the authenticity of the data is ensured because it happens to be coming straight from the user actions. The use of analytics enables a flow of new information through the industry as continuous upgradations in the insights keep on taking place. It also offers a check to see if the supply of the services and products of the industry are in tune with the tourists demands are presented by the analytics (Xiang & Fesenmaier, 2016). Values proposed from the tourism data can be used for development of new products, newer business models to run, and customization of supply and invents better decision making.

3. Analytical methodology

3.1. Data Analytics Lifecycle

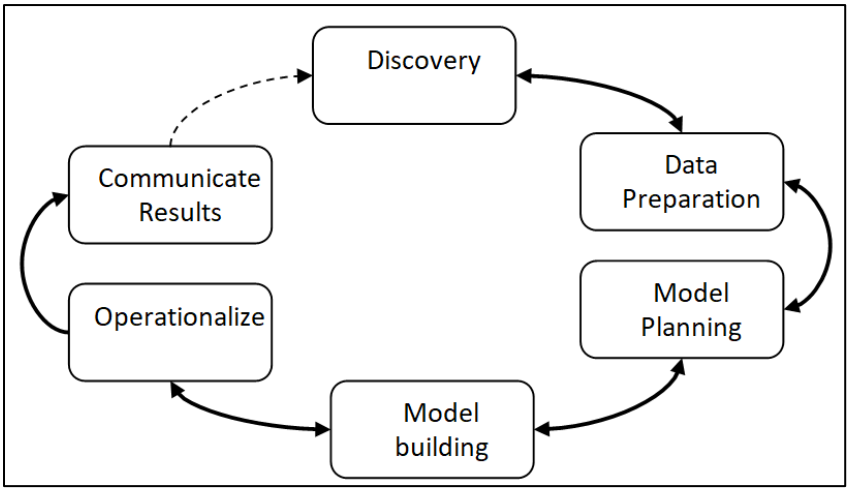

Figure 2: Data Analytics Lifecycle *(Bonthu, 2017)*

For better management of data and activities through every phase, we decided to apply the Data Analytics Lifecycle framework to our project. This framework accurately defines best practices for data science projects which comprises of 6 stages with iterative movement between them for simplicity of use. Main advantage of using this model is the ability to move freely between two stages as per requirement. We commonly learn new

things in every stage and thus can go back to previous stage to make appropriate changes and improve our work. We have described below how our project aligns with this framework.

3.1.1. Discovery

Formulate the business problem and project scope and obtaining data from various sources. This was the project initiation phase where we chose to direct our research towards the Irish tourism and hotel trends. During this stage, we have gathered quarterly hotel industry data from STR and CSO. During the later phases after considering other factors, we also collected data of trip advisor hotel reviews from Kaggle and Airbnb listings and reviews data from insideairbnb.com. All of our data was obtained in Excel or csv worksheets and was structured. These datasets and their parameters are described in detail in data description section.

Data Sources

Source	Type of data	Format	Type
CSO	Details on accommodation and expenditure of inbound tourists to Ireland, information on domestic and outbound travel by Irish residents, details on GDP and currency, information on airport passenger movement	Excel CSV Spreadsheet Files. Quarterly time series data	Structured
STR	Hotel data by measure	Excel Spreadsheet Files. Monthly time series data	Structured
Kaggle	Restaurant reviews of European cities	Excel CSV Spreadsheet Files.	Structured
InsideAirbnb.com	Irish Airbnb listings and reviews	Excel CSV Spreadsheet Files.	Structured

Table 2: Structure: The data from CSO and STR is time series data and is available from Q1, 2012 to Q4, 2018.

Validation

The CSO conduct three sample surveys of passengers at sea and airports – the Country of Residence Survey (CRS), Household Travel Survey (HTS) and the Passenger Card Inquiry (PCI). In addition to passenger movement figures supplied by the air and sea transport companies, data from these surveys are used to provide the estimates for overseas and well as in-bound tourism and travel.

The CRS is a continuous sample survey of overseas passengers (both inward and outward) which provides an estimated country of residence breakdown for passengers entering and leaving Ireland.

The PCI is a continuous sample survey of incoming and departing passengers. This survey provides information on the reason for journey, length of stay, type of accommodation, expenditure and fare costs, in addition to residency (Central Statistics Office, 2019). These results are used in conjunction with the overall residency estimates from the CRS to provide the overseas tourism and travel details.

The HTS is a continuous sample survey of domestic and overseas travel of Irish residents which includes number of trips made, length of stay and expenditure. It includes travel to Northern Ireland while the Tourism and Travel Survey (TTS) only includes overseas travel. (Central Statistics Office, 2019).

Total expenditure refers to the amount paid for the acquisition or consumption of goods and services for one's own use or for use by others, for and during trips. It includes expenditure by travelers themselves, as well as expenses that are paid for or reimbursed by others (Central Statistics Office, 2019).

3.1.2. Data Preparation

Exploring the data and preprocessing it to transform variables as needed. This was the phase where we got to understand the data and transform it as per our requirement. During this stage we combined all the time series quarterly data from CSO and STR into single excel file. This made all the quarterly data available in one file and made it easier to perform further analysis. We also made basic visualizations form this to understand the available data and how value generating it is. The dataset for hotel reviews contained text data which had some control characters that needed cleansing. Overall, since all our data was structured and in proper format, high level cleansing and transformation wasn't required.

3.1.3. Model Planning

Discussing the methods which will be used for analyzing and finalizing tools and techniques for implementing them. During this stage, we created multiple visualization using Tableau and Excel from the available time series data as well as the reviews and listings to understand which type of predictions can be made and what analysis can be achieved. We have applied the concept of data storytelling to explain the concept of our visualizations in more understandable easier way. For our predictive analysis, we had planned to use R programming to show correlation between variables and build regression models which help predicting the outcome.

Tools and Technologies used

During initial phase, we had proposed of using XL Miner and SPSS as well for our analysis. However, the operations performed using XL miner (creating regression models, data mining, creating visualization, etc.) were later performed using Excel, Tableau and R. Similarly we had planned to use SPSS for performing regression analysis which was later carried out using R.

Tool/Technology	Value in the project	Strengths	Weaknesses
Tableau	For creating various visualizations which also helps obtaining trends and pattern in existing data.	• Low cost • Multiple customer resources • Easy to use and upgrade • Mobile support available	• No automatic refreshing of reports • No version control • Needs SQL knowledge
MS Excel	For viewing datasets and arranging or filtering data as required. For combining and pre-processing of data. Also used for creating graphs/charts.	• Excellent data viewing and organization • Availability of formulas and calculation • Can be integrated with MS Office tools	• Cost of licence • High time required for processing huge data • Difficult to perform complex analysis
R	Used for building multiple and linear regression models for analysing correlations between various parameters/variables and that affect revenue of hotels. Also used for creating visualizations/graphs to display results of analysis.	• Open source • Vast number of packages available • Platform independent • High quality plotting of graphs • Constant growth • Availability of Statistical tools	• High memory consumption • Low data security • Low processing speed • Complex to learn
Python	Used for performing sentiment analysis of hotel reviews. Also used for creating visualizations/graphs to display results of analysis.	• Easy to read and learn • Offers object-oriented approach • Highly interactive • Is extensible in C and C++ • Strong process integration • Extensive libraries	• Low speed • Higher testing time • Underdeveloped database access
SWOT Analysis	To explain the strengths, weaknesses, opportunities, and threats to the Irish Tourism Industry based on our research, and to adjust the SWOT based on the findings of our other analysis to demonstrate the value of our findings	• Simple to understand • Easy to create • Commonly used for the tourism sector	• Because this is an exercise based off of research and opinion, results might not be conclusive
MS Teams	Used for managing project conversations and inventory, sharing documents/data and conference calls.	• High transparency • Easy to operate • Mobile-friendly interface	• Difficulty in transition from outlook • Permission setting for files not available

Table 3: Tools and Technologies used

3.1.4. Model Building

Creating the actual prediction and regression models using the existing data. Being in-line with the trends observed in visualizations, we initially created linear and multiple regression models to check the effect of factors like occupancy and ADR on hotel revenue. Later on we also performed sentiment analysis on reviews of hotels to find out what travelers prefer and how this data can be used to improve customer service and attract more tourists. We have also analyzed how the popularity of Airbnb has increased over

the years and how it will affect the hotel industry. Outcome of all this is described in the findings of analysis section

Descriptive analysis

To describe what the data shows, descriptive statistics will be used to tell the story of what has happened in the period of time when data was captured. We have majorly used Tableau and MS Excel for creating visual representation of past trends in the Irish tourism Industry. We have discovered trends as below:

- Where tourists are coming from?
- Is the supply of hotel accommodation meeting demands?
- Has the type of accommodation used by tourists changed over time (and how)?
- How air travel rates and ADR have changed over year?
- How much UK currently contributes to tourism in Ireland and how will Brexit affect it?
- Have changes in foreign exchange rates concur with a change in levels of tourism?
- Does the average daily rate change the traveler's choice of accommodation?
- How current drop in travel due to Recent events has affected overall stock market of airlines

STRENGTHS	WEAKNESSES
• People, Landscapes and Heritage • EU member • English speaking • Historical attractions • Music and cultural festivals	• Lack of online exposure • Weather • Cultural changes
OPPORTUNITIES	**THREATS**
• Development as a business/conference destination • Development of new markets (Asia, Eastern Europe) • Improved airport facilities	• BREXIT • Continued growth in shorter stays

Figure 3: Initial SWOT Analysis based on Irish Tourism facts.

Predictive analysis

Based on the historical data, we are currently trying to predict as to what effect air travel numbers and domestic travel within Ireland will have on the hotel revenue. We have built a Generalized Linear Model performing Logistic Regression for this using R. We are in progress of discovering answers for below:

- How changes in volume of tourist will affect the hotel revenue and in-turn GDP of Ireland or vice-versa?

- If the strength Pound Sterling changes, will this alter the levels of British tourists traveling to Ireland?
- How will changes in strengths of US and Canadian dollar affect the tourism revenue?

3.1.5. Communicate Results

Observe and compare all the results obtained from analysis. Formulate a brief summary describing the findings of analysis which will be conveyed to target audience. During this stage we gathered all the results from all our analysis and formulated all the questions our research answers. It is said that "*Zero out the interface, and it becomes more beautiful. The reader is there for the data, not the interface (Auerbach, 2016)*". While creating the visualizations and graphs, we made sure of following constant pattern so as to not overwhelm the viewer. As quoted "*Insist on simple designs to maximize the rich data at hand (Auerbach, 2016)*", we focused on minimum usage of colors and simple patterns in graphs to give a subtle approach while conveying all required information. As quoted by Edward Tufte in his famous book 'The Visual Display of Quantitative Information', *"Graphical excellence is that which gives to the viewer the greatest number of ideas in the shortest time with the least ink in the smallest space."*, and we have tried to adopt it to the fullest. We then created a discussion of our findings which shows the outcome and what value our analysis has generated.

3.1.6. Operationalize

Monitor the performance of the project and deploying for industrial use. After compiling all our analysis, we were able to come to few conclusion like how the tourists from USA, Canada and UK highly contribute to Irish tourism revenue and it is necessary to implement personalized marketing strategy. There are many such observations and the discussion section of this report explains what we have achieved from it and how it can be helpful to our target audience. Also, we faced some limitations in performing prescriptive analysis due to less amount of data which is mentioned in the Limitations section of the report.

4. Findings of analysis

4.1. Tourism expenditure

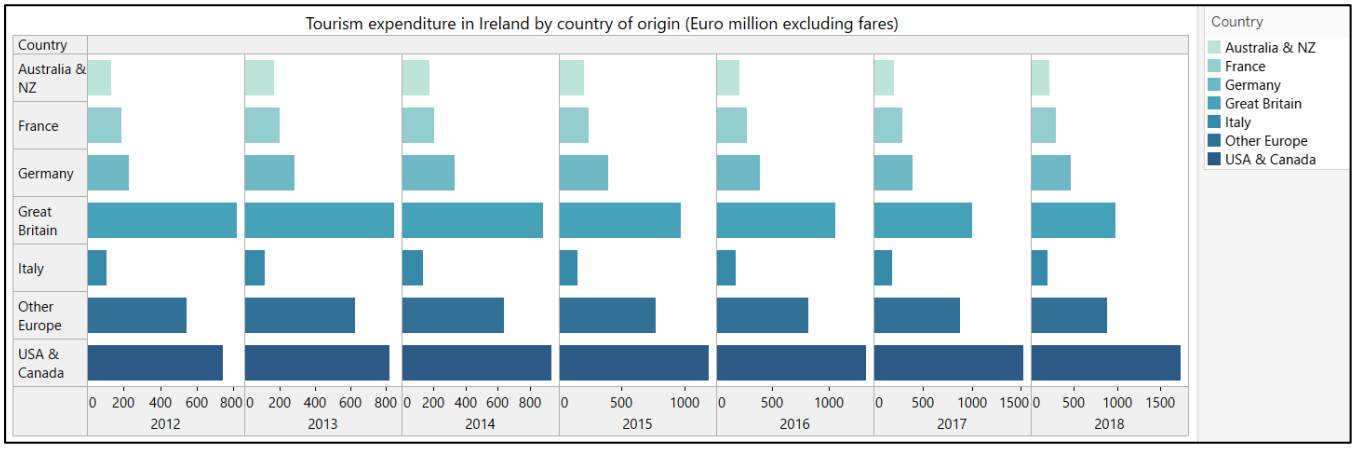

Figure 4: Estimated expenditure by tourists to Ireland by country per year (Euro million excluding fares) Data source – CSO, 2020

Using data gathered from CSO, we decided to create a visual using Tableau which would illustrate the ETE of foreign tourists in Ireland each year. The ETE data is a result of the information taken from PCI, where tourists who participate in the PCI estimate their expenditure (excluding fares), while they were in Ireland. We felt that this descriptive analysis was important to identify the quantitative spending trends of inbound tourists to better understand which market contributes the highest expenditure to the tourism industry in Ireland. Figure 4 shows that the top three contributors to ETE in the years 2012-2018 were Great Britain, USA & Canada, and European countries (excluding France, Germany, and Italy). Great Britain contributed the most to Ireland in ETE in 2012 at 818 EM, excluding fares. Notably, USA & Canada surpasses Great Britain in ETE in Ireland from 2015 onwards and in 2018, remained the highest contributor to Irish tourism expenditure, contributing an estimated 1,735 EM, excluding fares. As the top two contributors to ETE, we then took the ETE data for Great Britain and USA & Canada and calculated the expected overall ETE without contribution from the UK (Table 4) and the expected overall ETE without contribution from USA & Canada (Table 5), by subtracting the contribution of each country from the overall ETE. Additionally, we calculated each countries contribution as a percentage of overall ETE in order to demonstrate the value of each market to ETE. Great Britain contributes between 818 and 1,061 EM each year, and accounts for an average of 24.82% of ETE, based on the data. USA & Canada contributes between 742 and 1,735 EM each year, accounting for on average 27.44% of ETE. This calculated data was then visualized using Tableau to better illustrate the value of each market to Irish tourism (Figure 5 & 6). The blue line in the top half of the visualization shows how overall ETE would be reduced without the contribution of each of these markets.

ETE Contribution from Great Britain				
Date	Overall ETE (EM excluding fares)	UK Contribution to ETE (EM excluding fares)	Calculated Expected Overall ETE without UK Contribution (EM excluding fares)	Calculated % Contribution to ETE by UK
March-12	483	168	315	34.78
June-12	816	218	598	26.72
September-12	994	246	748	24.75
December-12	622	186	436	29.90
March-13	541	176	365	32.53
June-13	870	194	676	22.30
September-13	1186	281	905	23.69
December-13	665	196	469	29.47
March-14	534	171	363	32.02
June-14	1001	223	778	22.28
September-14	1303	280	1023	21.49
December-14	711	212	499	29.82
March-15	590	181	409	30.68
June-15	1194	246	948	20.60
September-15	1551	309	1242	19.92
December-15	873	236	637	27.03
March-16	693	214	479	30.88
June-16	1261	269	992	21.33
September-16	1693	337	1356	19.91
December-16	930	241	689	25.91
March-17	684	198	486	28.95
June-17	1408	267	1141	18.96
September-17	1736	303	1433	17.45
December-17	1046	239	807	22.85
March-18	795	206	589	25.91
June-18	1475	262	1213	17.76
September-18	1832	292	1540	15.94
December-18	1047	221	826	21.11

Table 4: ETE Contribution from tourists arriving from the UK, with additional calculated data on overall ETE without UK contribution and percentage contribution to ETE by the UK market. Data source - CSO

ETE Contribution from USA & Canada				
Date	Overall ETE (EM excluding fares)	USA & Canada Contribution to ETE (EM excluding fares)	Calculated Expected Overall ETE without USA & Canada Contribution (EM excluding fares)	Calculated % Contribution to ETE by USA & Canada
March-12	483	97	386	20.08282
June-12	816	210	606	25.73529
September-12	994	287	707	28.87324
December-12	622	148	474	23.79421
March-13	541	101	440	18.66913
June-13	870	239	631	27.47126
September-13	1186	329	857	27.7403
December-13	665	153	512	23.00752
March-14	534	107	427	20.03745
June-14	1001	267	734	26.67333
September-14	1303	389	914	29.85418
December-14	711	172	539	24.19128
March-15	590	125	465	21.18644
June-15	1194	375	819	31.40704
September-15	1551	470	1081	30.30303
December-15	873	226	647	25.88774
March-16	693	144	549	20.77922
June-16	1261	394	867	31.24504
September-16	1693	494	1199	29.17897
December-16	930	303	627	32.58065
March-17	684	152	532	22.22222
June-17	1408	476	932	33.80682
September-17	1736	580	1156	33.41014
December-17	1046	315	731	30.11472
March-18	795	194	601	24.40252
June-18	1475	493	982	33.42373
September-18	1832	681	1151	37.17249
December-18	1047	367	680	35.05253

*T*able 5: ETE Contribution from tourists arriving from the USA & Canada, with additional calculated data on overall ETE without USA & Canada contribution and percentage contribution to ETE by the USA & Canada market. Data source – CSO

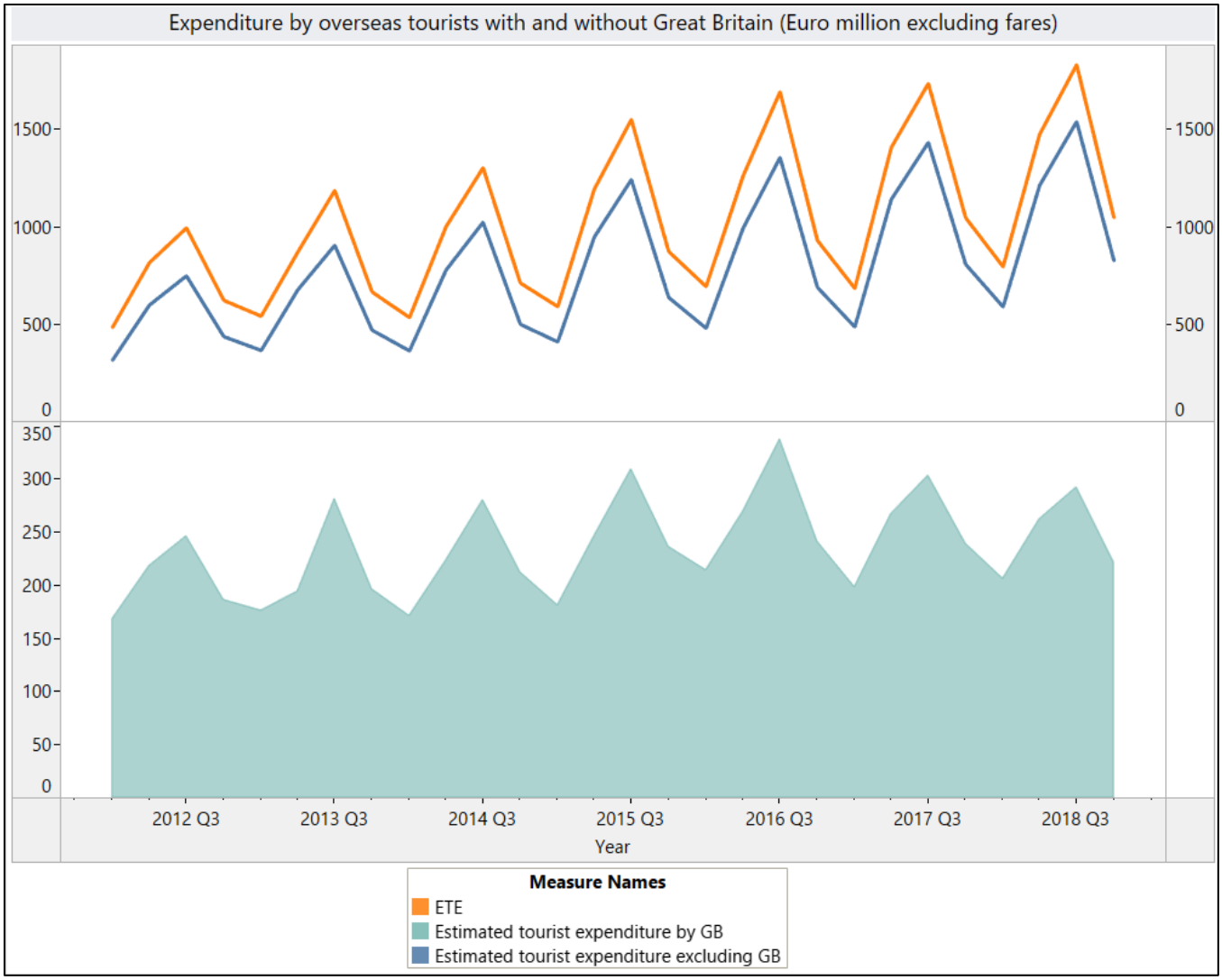

Figure 5: Contribution to Irish tourism expenditure, excluding fares, by Great Britain using historical data and derived data from Table 3.Data source - CSO

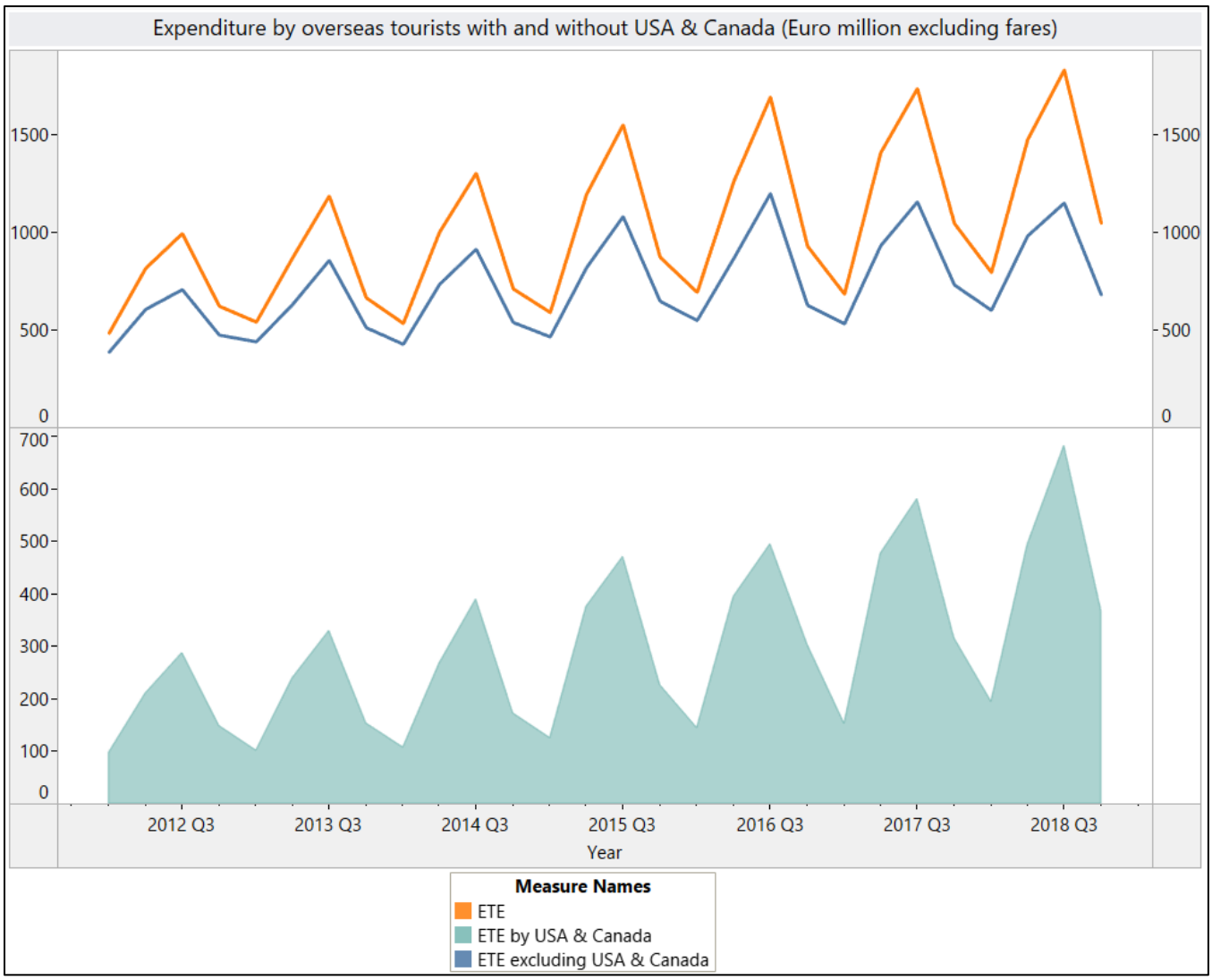

Figure 6: Contribution to Irish tourism expenditure, excluding fares, by USA & Canada using historical data and derived data from table 4. Data source – CSO

In summary:

- A descriptive visual analysis was carried out based on historical ETE data from CSO to examine the largest demographic contributors of ETE to Irish tourism. The USA & Canada and Great Britain were found to be the largest contributors of ETE to the sector. At the beginning of the time period examined, Great Britain was the largest contributor of ETE before being replaced by USA & Canada.
- By understanding which tourists contribute the most to ETE, targeted marketing efforts can be made to bring in tourists that not only spend time, but money, in Ireland.
- We did further descriptive visual analysis on Great Britain and USA & Canada ETE contribution, as the two largest contributors. We created calculated fields using the ETE data to find what the overall ETE would be without contribution of each of these markets. We also created a calculated field to show what

percentage of ETE is contributed by Great Britain, and USA & Canada. They represent on average 24.82% and 27.44% of ETE, respectively, based on historical data from CSO from 2012-2018.

4.2. Accommodation demand

In order to describe the excess capacity of hotel rooms in Ireland, we took the historical data that we had from STR and subtracted the demand figures from the supply figures to create a calculated field which showcases the surplus of hotel rooms in Ireland from 2012-2018 (Table 6). The Table shows that there is significant excess capacity in the hotel market with respect to rooms available. We felt that this information would assist us in evaluating the competitiveness of the hotel market in Ireland.

Date	Hotel room supply	Hotel room demand	Hotel room surplus
March-12	6,166,039	3,422,844	2,743,195
June-12	6,314,032	4,677,445	1,636,587
September-12	6,376,797	5,279,022	1,097,775
December-12	6,318,481	4,059,561	2,258,920
March-13	6,074,847	3,530,192	2,544,655
June-13	6,233,003	4,768,323	1,464,680
September-13	6,291,837	5,331,827	960,010
December-13	6,241,276	4,214,412	2,026,864
March-14	6,000,856	3,565,136	2,435,720
June-14	6,145,732	4,862,982	1,282,750
September-14	6,226,394	5,366,046	860,348
December-14	6,184,619	4,269,401	1,915,218
March-15	5,935,679	3,761,100	2,174,579
June-15	6,050,127	5,030,830	1,019,297
September-15	6,124,251	5,466,207	658,044
December-15	6,090,069	4,398,952	1,691,117
March-16	5,825,105	3,790,399	2,034,706
June-16	5,970,601	4,955,399	1,015,202
September-16	6,046,931	5,389,253	657,678
December-16	6,025,478	4,221,052	1,804,426
March-17	5,827,759	3,785,804	2,041,955
June-17	5,945,143	5,015,499	929,644
September-17	6,023,703	5,415,419	608,284
December-17	5,999,268	4,304,169	1,695,099
March-18	5,858,951	3,893,786	1,965,165
June-18	6,002,748	5,082,840	919,908
September-18	6,120,581	5,442,928	677,653
December-18	6,090,744	4,420,305	1,670,439

Table 6: Irish hotel rooms supply versus demand, data source - STR

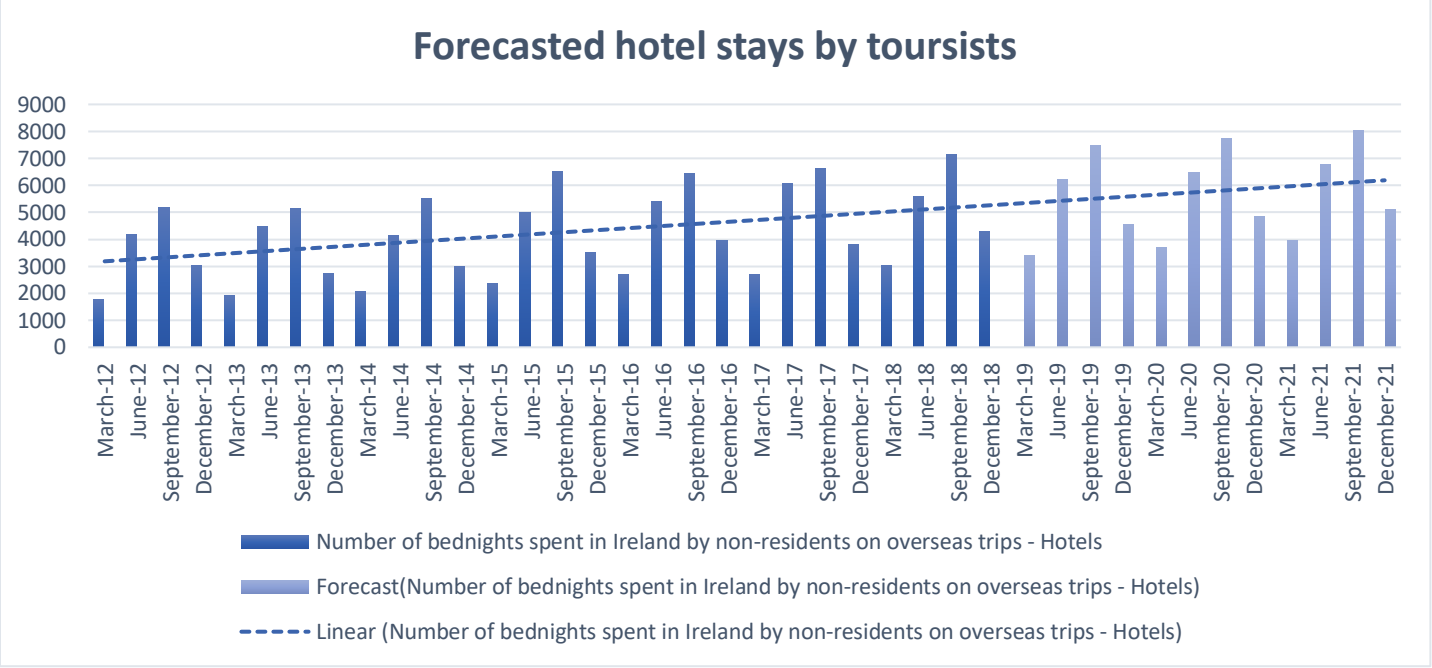

Figure 7: Forecasted hotel bed night demand by inbound tourists, based 2012-2018, data source – CSO

We decided to use the historical data from CSO on accommodation nights, gathered from the information given on the PCI, to forecast the future demand for hotel rooms (Figure 7). This forecast can help to indicate whether the gap between supply and demand may continue to lessen in the future and is an indicator of general tourism demand. The forecast was built using an Exponential Smoothing Technique in MS Excel, where an algorithm carries out smoothing by detecting confidence intervals and seasonal patterns. The trend line in Figure 7 is based on the historical data from CSO and shows that hotel room demand by inbound tourists is trending up. The forecast shows that this demand is predicted to increase into the end of 2021.

Table 7 below contains the forecasted data from Figure 7 above in addition to the confidence intervals for each prediction. Newer data from CSO was used in order to compare the 2019 predictions with the actual figures from 2019. On average, the predictions from the Exponential Smoothing technique overestimated the 2019 figures by 186.77 thousand bed nights.

Date	Forecast (Number of bed nights spent in Ireland by non-residents on overseas trips - Hotels)	Confidence Interval (Number of bed nights spent in Ireland by non-residents on overseas trips - Hotels)	Actual (Number of bed nights spent in Ireland by non-residents on overseas trips - Hotels)	Calculated Difference Between Forecasted and Actual (Number of bed nights spent in Ireland by non-residents on overseas trips - Hotels)
March-19	3407.440723	608.5002739	3313	-94.440723
June-19	6206.391513	680.5963356	6246	39.608487
September-19	7470.256229	746.0037158	7214	-256.256229
December-19	4551.702508	806.3521812	4116	-435.702508
March-20	3686.203572	1011.286998		
June-20	6485.154363	1056.943781		
September-20	7749.019079	1100.878407		
December-20	4830.465357	1143.289756		
March-21	3964.966422	1287.14533		
June-21	6763.917213	1333.610363		
September-21	8027.781929	1369.242308		
December-21	5109.228207	1404.104856		

Table 7: Forecasted data for hotel bed night demand by overseas tourists, created based on historical data from 2012-2018, in addition to actual 2019 figures for the same and a calculated field of the differences in the figures. Data source – CSO

In order to further analyse the competitiveness of the hotel industry, we decided to use historical data obtained from CSO to see if there had been an increase in the number of inbound tourists using alternative accommodations during their stay in Ireland, and to build a forecast based on the same data to see whether there would be an increase in the future in the number of tourists choosing alternative accommodations. Again, this data was gathered from information given by tourists who had filled out the PCI. Figure 8 displays the forecast, again built using an Exponential Smoothing Technique in MS Excel. The trend line is based on the historical data and shows an increase in the number of tourists choosing to stay in alternative accommodations during their visit to Ireland.

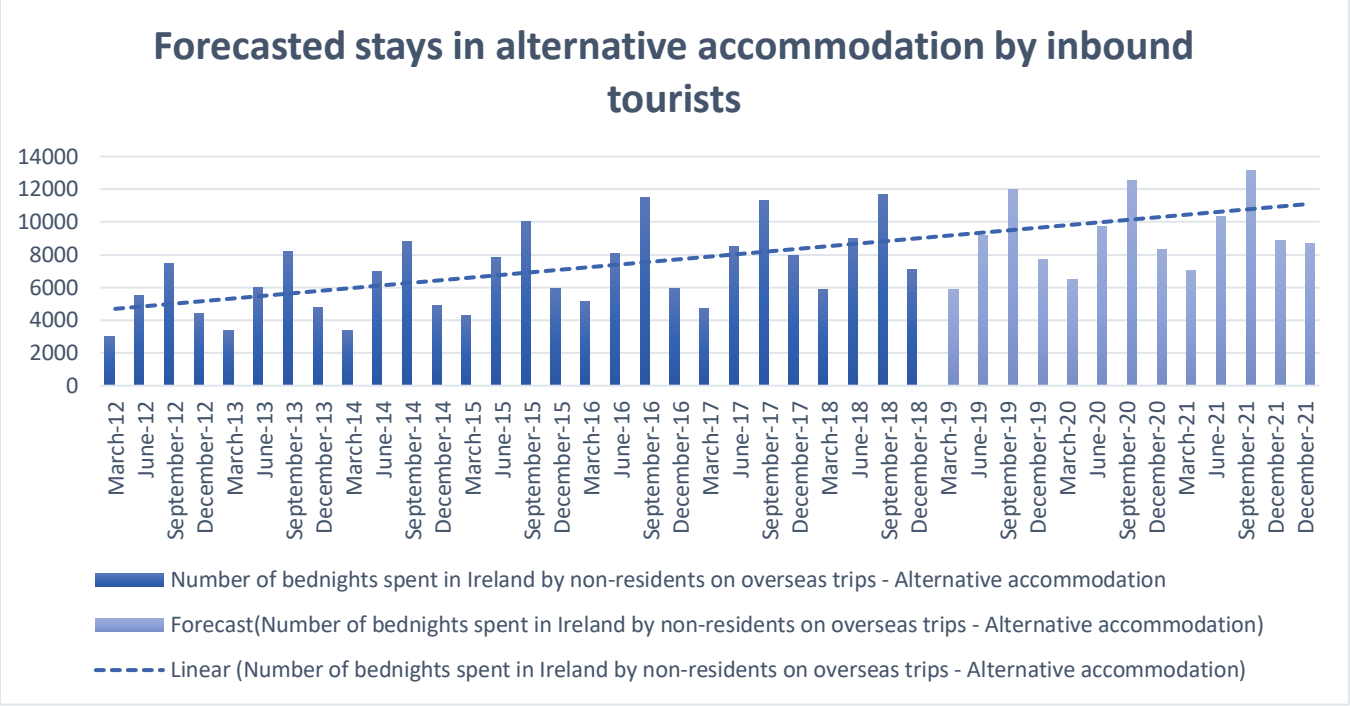

Figure 8: Forecasted alternative accommodation bed night demand by inbound tourists, based 2012-2018, data source - CSO

Figure 8:

To further explore this trend, we took data from InsideAirbnb.com, and explored the popularity of Airbnb use by examining how the number of Airbnb reviews has changed over time. Figure 9 below shows that the number of reviews of Irish Airbnbs has grown exponentially in recent years, which may indicate that more people have been using Airbnb accommodations and that it is growing in popularity in Ireland.

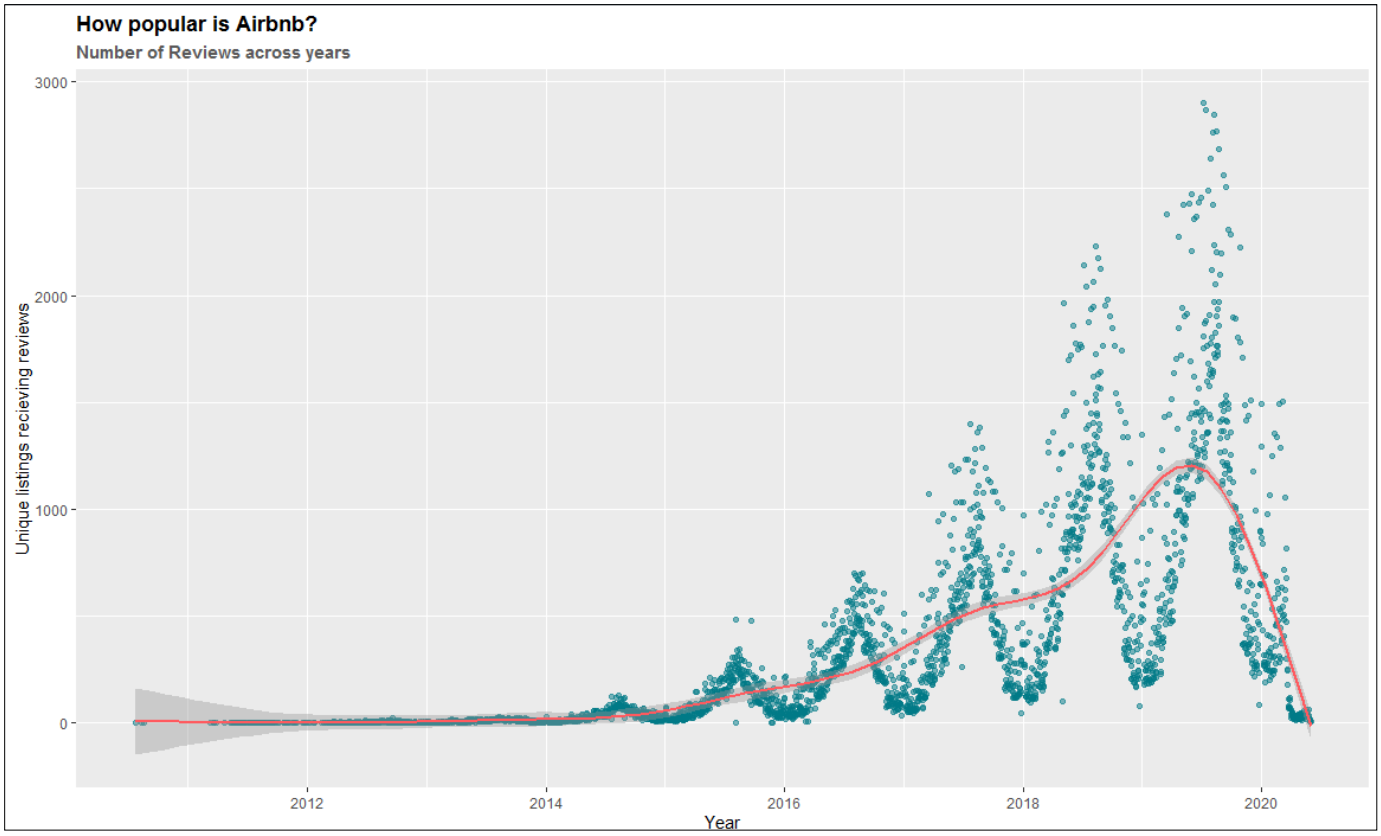

Figure 9: A plot depicting the increase in the number of reviews of Irish Airbnbs over the past number of years using data gathered from InsideAirbnb.com. Data source – InsideAirbnb.com

Below Table 8, the forecasted bednight stays in alternative accommodations and the confidence intervals are displayed. We took newer data from CSO for 2019 and compared the forecasted bed nights with the actual bedights to understand the accuracy of the Exponential Smoothing forecasting Technique. In addition, we made a calculated field subtracting the forecasted figures from the actual figures to further indicate the accuracy of the predictions. On average, there were 557.02 less alternative accommodation bed nights demanded than was predicted by the model in 2019. This is a much larger difference than recorded for hotels, which would indicate that this forecast may not be as accurate.

Date	Forecast (Number of bed nights spent in Ireland by non-residents on overseas trips - Alternative accommodation)	Confidence Interval (Number of bed nights spent in Ireland by non-residents on overseas trips - Alternative accommodation)	Actual (Number of bed nights spent in Ireland by non-residents on overseas trips - Alternative accommodation)	Difference Between Forecasted and Actual (Number of bed nights spent in Ireland by non-residents on overseas trips - Alternative accommodation)
March-19	5878.424182	1192.010957	5017	-861.424182
June-19	9152.226536	1228.98642	9552	399.773464
September-19	11958.1893	1265.163952	10608	-1350.1893
December-19	7706.231421	1300.611234	7290	-416.231421
March-20	6464.429136	1766.640267		
June-20	9738.27149	1792.59901		
September-20	12544.19426	1818.386831		
December-20	8292.236375	1844.01167		
March-21	7050.43409	2200.279811		
June-21	10324.27644	2221.833922		
September-21	13130.19921	2243.345303		
December-21	8878.24139	2264.815799		

Figure 10: Forecasted data for alternative accommodations bed night demand by overseas tourists, created based on historical data from 2012-2018, in addition to actual 2019 figures for the same and a calculated field of the differences in the figures. Data Source-CSO

We then wanted to examine the relationship between the tourist demand for alternative accommodation and hotel demand and revenue. To understand this relationship, we carried found the correlations between these variables using R. We believed that this would be of relevance, as a negative relationship between demand for alternative accommodation and hotel variables may indicate that the demand for alternative accommodations might indicate that such demand might have had a negative impact on hotel business. As displayed in table 9 however, a strongly positive correlation was found between demand for alternative accommodation and demand for hotel rooms (0.96), and between demand for alternative accommodation and hotel revenue (0.95). This would imply that to date, demand for alternative accommodation has had little or no impact on hotel business.

Correlations of alternative accommodations with the hotel industry		
	Bed nights in hotels	**Hotel revenue**
Bed nights in alternative accommodation	0.9595056	0.9495633

Table 8: Correlations between bed nights spent in alternative accommodations and the hotel industry based on historical data. Data source – CSO and STR

In summary:

- There is significant excess capacity of hotel rooms in Ireland based on CSO data from 2012-2018. A calculated field was created and visualized using Tableau to demonstrate the surplus supply of hotel rooms. This is one reason why the hotel market in Ireland is so competitive.
- Forecasts built using an Exponential Smoothing Technique predict that tourist demand for hotel rooms and alternative accommodations is due to increase until the end of 2021. When comparing the predictions for 2019 with actual 2019 data taken from CSO, it was found that the predictions overestimated the demand for both types of accommodation.
- Correlations between tourism demand for alternative accommodation, hotel bednights, and hotel revenue show a strongly positive relationship between alternative accommodation and hotel business, which might indicate that tourism demand for alternative accommodations has so far had little or no impact on hotel business.

4.3. Hotel occupancy

While one would naturally assume higher occupancy rates in hotels would result in higher revenues, research by Enz et al. (2004) suggests that basing a pricing strategy targeted on increasing occupancy rates may actually result in lower RevPAR and overall revenue. This may be due to high overheads. For example, a busier hotel will result in more staff being required on a daily basis – more rooms needing to be cleaned, extra staff needed to accommodate guest needs, and more electricity being used. For this reason, we decided to explore the relationship between hotel revenue and occupancy rates more fully in order to determine how hotels should base their pricing strategy. In R, a correlation analysis was carried out to establish this relationship. Figure 10 shows a scatterplot which explains this relationship. Figure 10 indicates that there is a positive relationship between hotel occupancy % and hotel revenue, further explained by a strong positive correlation of 0.899, with statistical significance (p value 8.33E-11). This means that yes, the higher % of rooms that are filled per night in a hotel, the higher the resulting revenue is.

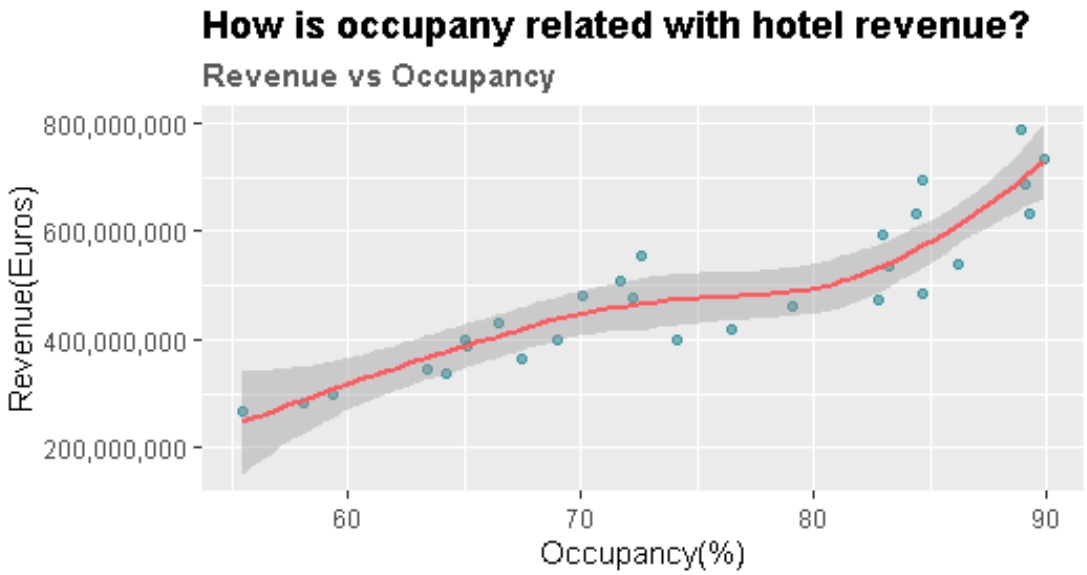

Figure 11: Scatterplot indicating a positive relationship between occupancy % in Irish hotels and hotel revenue using quarterly figures from 2012-2018. Data source – STR.

Once we had established a strongly positive relationship between occupancy rates and hotel revenue, we decided to explore the occupancy % contribution of tourists from Great Britain and the USA & Canada, as two of the largest contributors to ETE. In order to examine this contribution, we took the CSO data on the number of bednights spent in hotels by overseas guests (non-residents) and the number of hotel bednights spent by domestic tourists and added them together to find the total number of bednights spent in hotels each quarter. We then calculated the percentage contribution to overall hotel bednights by each demographic segment, and calculated this as the contribution to actual occupancy levels, as gathered by STR. This information is displayed in table 9 (Great Britain) and table 10 (USA & Canada). On average in the given time frame, tourists from Great Britain accounted for 17.17% of hotel occupancy, whereas tourists form the USA & Canada accounted for 47.65%. On average, hotel occupancy levels would have been reduced to 62.28% from 74.86% without tourists from Great Britain. Tourists from the USA & Canada accounted for 47.65% of hotel occupancy on average, and hotel occupancy levels would have been reduced by 36.19% to 38.67% without tourists from the USA and Canada.

Date	Number of hotel bednights spent in Ireland by non-residents on overseas trips	Number of hotel bednights spent in Ireland by residents on domestic trips	Number of hotel bednights spent in Ireland	GB - Number of hotel bednights spent in Ireland by non-residents on overseas trips	GB - % of hotel bednights spent in Ireland	Hotel occupancy %	Contribution to % occupancy by GB guests	Occupancy % without GB guests
March-12	1781	1332	3113	689	22.13	55.5	12.28	43.22
June-12	4175	1491	5666	939	16.57	74.1	12.28	61.82
September-12	5195	2646	7841	1094	13.95	82.8	11.55	71.25
December-12	3029	1508	4537	742	16.35	64.2	10.50	53.70
March-13	1906	1239	3145	623	19.81	58.1	11.51	46.59
June-13	4489	1513	6002	970	16.16	76.5	12.36	64.14
September-13	5126	2583	7709	1062	13.78	84.7	11.67	73.03
December-13	2751	1445	4196	836	19.92	67.5	13.45	54.05
March-14	2071	1395	3466	725	20.92	59.4	12.42	46.98
June-14	4141	1813	5954	948	15.92	79.1	12.59	66.51
September-14	5497	2505	8002	1108	13.85	86.2	11.94	74.26
December-14	2998	1494	4492	867	19.30	69	13.32	55.68
March-15	2354	1399	3753	796	21.21	63.4	13.45	49.95
June-15	4997	1551	6548	1129	17.24	83.2	14.35	68.85
September-15	6522	2601	9123	1411	15.47	89.3	13.81	75.49
December-15	3501	1582	5083	1009	19.85	72.2	14.33	57.87
March-16	2708	1681	4389	948	21.60	65.1	14.06	51.04
June-16	5391	1492	6883	1271	18.47	83	15.33	67.67
September-16	6452	2340	8792	1278	14.54	89.1	12.95	76.15
December-16	3971	1630	5601	1058	18.89	70.1	13.24	56.86
March-17	2700	1488	4188	889	21.23	65	13.80	51.20
June-17	6058	1636	7694	1117	14.52	84.4	12.25	72.15
September-17	6610	2378	8988	1066	11.86	89.9	10.66	79.24
December-17	3814	1727	5541	956	17.25	71.7	12.37	59.33
March-18	3036	1557	4593	875	19.05	66.5	12.67	53.83
June-18	5589	1776	7365	1019	13.84	84.7	11.72	72.98
September-18	7162	2767	9929	1116	11.24	88.9	9.99	78.91
December-18	4273	1737	6010	959	15.96	72.6	11.58	61.02

Table 9: Hotel occupancy % dependency on Great Britain, monthly per year.

Date	Number of hotel bednights spent in Ireland by non-residents on overseas trips	Number of hotel bednights spent in Ireland by residents on domestic trips	Number of hotel bednights spent in Ireland	USA & Canada - Number of hotel bednights spent in Ireland by non-residents on overseas trips	USA & Canada - % of hotel bednights spent in Ireland	Hotel occupancy %	Contribution to % occupancy by USA & Canada guests	Occupancy % without USA & Canada guests
March-12	1781	1332	3113	1161	37.30	55.5	20.70	34.80
June-12	4175	1491	5666	2618	46.21	74.1	34.24	39.86
September-12	5195	2646	7841	3069	39.14	82.8	32.41	50.39
December-12	3029	1508	4537	1840	40.56	64.2	26.04	38.16
March-13	1906	1239	3145	1239	39.40	58.1	22.89	35.21
June-13	4489	1513	6002	2788	46.45	76.5	35.54	40.96
September-13	5126	2583	7709	3445	44.69	84.7	37.85	46.85
December-13	2751	1445	4196	1972	47.00	67.5	31.72	35.78
March-14	2071	1395	3466	1315	37.94	59.4	22.54	36.86
June-14	4141	1813	5954	2752	46.22	79.1	36.56	42.54
September-14	5497	2505	8002	3849	48.10	86.2	41.46	44.74
December-14	2998	1494	4492	1918	42.70	69	29.46	39.54
March-15	2354	1399	3753	1339	35.68	63.4	22.62	40.78
June-15	4997	1551	6548	3612	55.16	83.2	45.89	37.31
September-15	6522	2601	9123	4266	46.76	89.3	41.76	47.54
December-15	3501	1582	5083	2441	48.02	72.2	34.67	37.53
March-16	2708	1681	4389	1651	37.62	65.1	24.49	40.61
June-16	5391	1492	6883	3462	50.30	83	41.75	41.25
September-16	6452	2340	8792	4708	53.55	89.1	47.71	41.39
December-16	3971	1630	5601	3192	56.99	70.1	39.95	30.15
March-17	2700	1488	4188	1750	41.79	65	27.16	37.84
June-17	6058	1636	7694	4387	57.02	84.4	48.12	36.28
September-17	6610	2378	8988	5342	59.43	89.9	53.43	36.47
December-17	3814	1727	5541	3047	54.99	71.7	39.43	32.27
March-18	3036	1557	4593	2045	44.52	66.5	29.61	36.89
June-18	5589	1776	7365	4428	60.12	84.7	50.92	33.78
September-18	7162	2767	9929	5989	60.32	88.9	53.62	35.28
December-18	4273	1737	6010	3386	56.34	72.6	40.90	31.70

Table 10: Hotel occupancy % dependency on USA & Canada quarterly.

Because guests from the USA and Canada account for a higher % of occupancy rates in hotels, we decided to create a forecast of the demand for hotel bednights for these tourists up until the end of 2021. This, again, was done using an Exponential Smoothing Technique based on historical data from CSO. The forecast (Figure 11) shows that the demand is due to increase. However, when we took CSO data from 2019 to compare actual results with the forecasted results, it was found that on average, the forecast had overestimated the number of bednights demanded by tourists from the USA & Canada by 2581.39 thousand rooms per quarter. Additionally, on average, 2529.68 thousand more bednights were spent in alternative accommodations by tourists from the USA & Canada than were spent in hotels. This may account for the discrepancy in the forecasting model. This information is displayed in table 11.

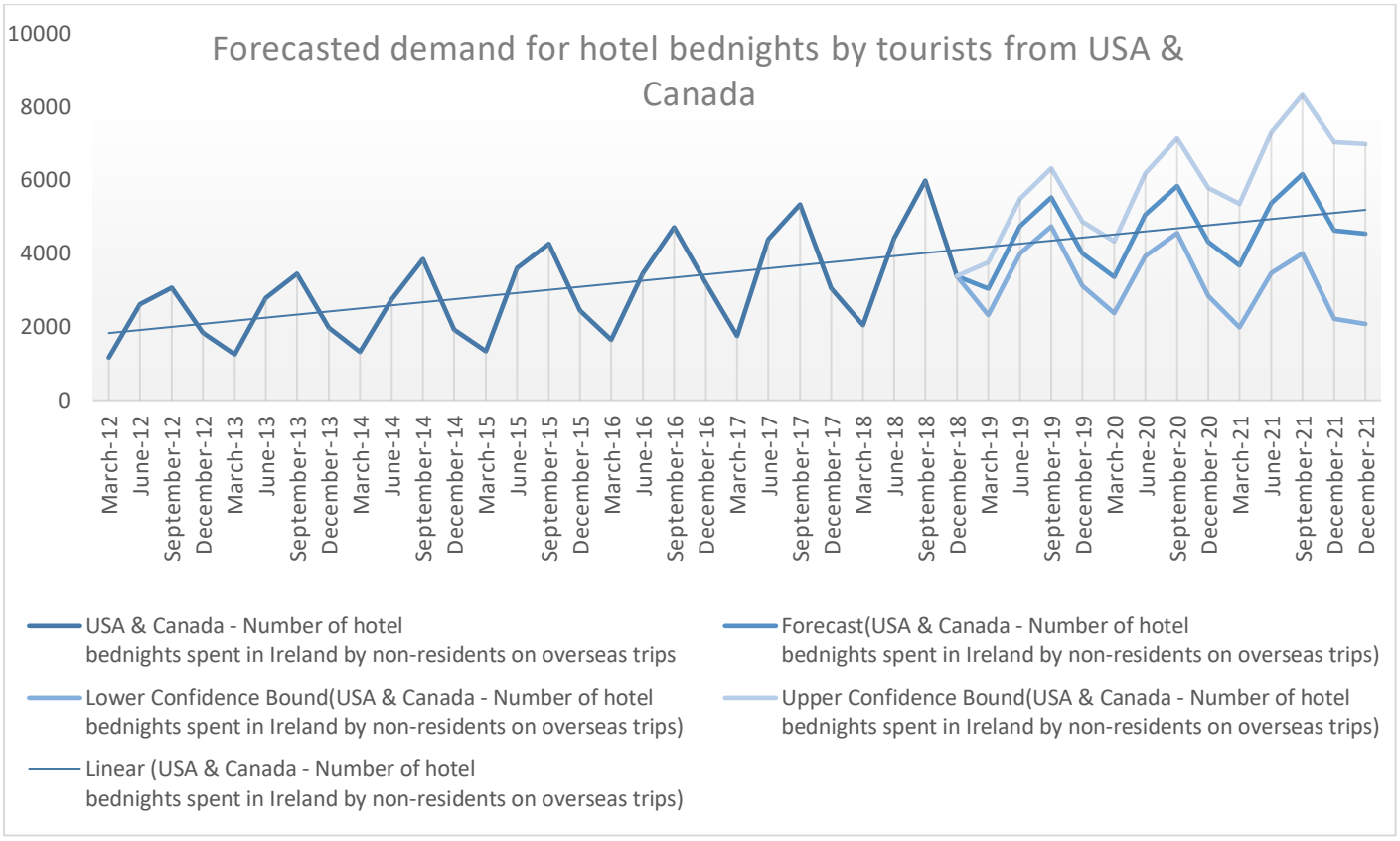

Figure 12: Line graph indicating forecast till December 2021 for hotel room demand by international travellers from USA and Canada on foreign trips. Data source – CSO.

Date	Forecast (USA & Canada - Number of hotel bednights spent in Ireland by non-residents on overseas trips)	Lower Confidence Bound (USA & Canada - Number of hotel bednights spent in Ireland by non-residents on overseas trips)	Upper Confidence Bound (USA & Canada - Number of hotel bednights spent in Ireland by non-residents on overseas trips)	Actual number of hotel bednights required by tourists from USA & Canada	Difference between actual and forecasted	USA & Canada stays in Alternative accommodation	Difference between the number of stays in Alternative Accommodation and hotel stays
March-19	3041.81	2318.91	3764.72	921.00	-2120.81	2564.91	1643.91
June-19	4741.37	3996.03	5486.70	2267.00	-2474.37	5279.33	3012.33
September-19	5532.19	4738.84	6325.54	2630.00	-2902.19	6053.35	3423.35
December-19	3995.17	3123.06	4867.28	1167.00	-2828.17	3206.11	2039.11
March-20	3358.71	2375.85	4341.58				
June-20	5058.27	3935.43	6181.11				
September-20	5849.09	4559.98	7138.20				
December-20	4312.07	2833.75	5790.40				
March-21	3675.61	1987.65	5363.57				
June-21	5375.16	3460.20	7290.13				
September-21	6165.99	4008.08	8323.89				
December-21	4628.97	2213.61	7044.33				
December-21	4537.04	2080.66	6993.41				

Table 11: Forecast Hotel occupancy of travellers from USA & Canada quarterly.

After having examined the contribution to hotel occupancy by inbound tourists, we decided to examine the contribution of the domestic market in order further understand any dependencies of the industry on the foreign market. Table 12 shows the calculated percentage of hotel bednights that were consumed by Irish residents on domestic trips each quarter in the given time frame. On average, the Irish market contributed 31.05% of all bednights spent in Ireland in the given time frame. Without Irish contribution, hotel occupancy levels would have been reduced, on average, by 22.80% from 74.86% to 52.06% in this period.

Date	Number of hotel bednights spent in Ireland by non-residents on overseas trips	Number of hotel bednights spent in Ireland by residents on domestic trips	Number of hotel bednights spent in Ireland	Irish domestic trips - % of hotel bednights spent in Ireland	Hotel occupancy %	Contribution to % occupancy by Irish guests	Occupancy % without Irish guests
March-12	1781	1332	3113	42.79	55.50	23.75	31.75
June-12	4175	1491	5666	26.31	74.10	19.50	54.60
September-12	5195	2646	7841	33.75	82.80	27.94	54.86
December-12	3029	1508	4537	33.24	64.20	21.34	42.86
March-13	1906	1239	3145	39.40	58.10	22.89	35.21
June-13	4489	1513	6002	25.21	76.50	19.28	57.22
September-13	5126	2583	7709	33.51	84.70	28.38	56.32
December-13	2751	1445	4196	34.44	67.50	23.25	44.25
March-14	2071	1395	3466	40.25	59.40	23.91	35.49
June-14	4141	1813	5954	30.45	79.10	24.09	55.01
September-14	5497	2505	8002	31.30	86.20	26.98	59.22
December-14	2998	1494	4492	33.26	69.00	22.95	46.05
March-15	2354	1399	3753	37.28	63.40	23.63	39.77
June-15	4997	1551	6548	23.69	83.20	19.71	63.49
September-15	6522	2601	9123	28.51	89.30	25.46	63.84
December-15	3501	1582	5083	31.12	72.20	22.47	49.73
March-16	2708	1681	4389	38.30	65.10	24.93	40.17
June-16	5391	1492	6883	21.68	83.00	17.99	65.01
September-16	6452	2340	8792	26.62	89.10	23.71	65.39
December-16	3971	1630	5601	29.10	70.10	20.40	49.70
March-17	2700	1488	4188	35.53	65.00	23.09	41.91
June-17	6058	1636	7694	21.26	84.40	17.95	66.45
September-17	6610	2378	8988	26.46	89.90	23.79	66.11
December-17	3814	1727	5541	31.17	71.70	22.35	49.35
March-18	3036	1557	4593	33.90	66.50	22.54	43.96
June-18	5589	1776	7365	24.11	84.70	20.42	64.28
September-18	7162	2767	9929	27.87	88.90	24.77	64.13
December-18	4273	1737	6010	28.90	72.60	20.98	51.62

Table 12: Contribution to hotel occupancy due to domestic trips made by Irish residents.

Finally, having established that the Irish market is an important contributor to occupancy levels in the hotel sector – more so than inbound tourists from Great Britain, we used the Exponential Smoothing Technique to forecast the future demand of Irish travellers for hotel bednights (Figure 12). This forecast shows that the demand is due to remain steady in the coming quarters.

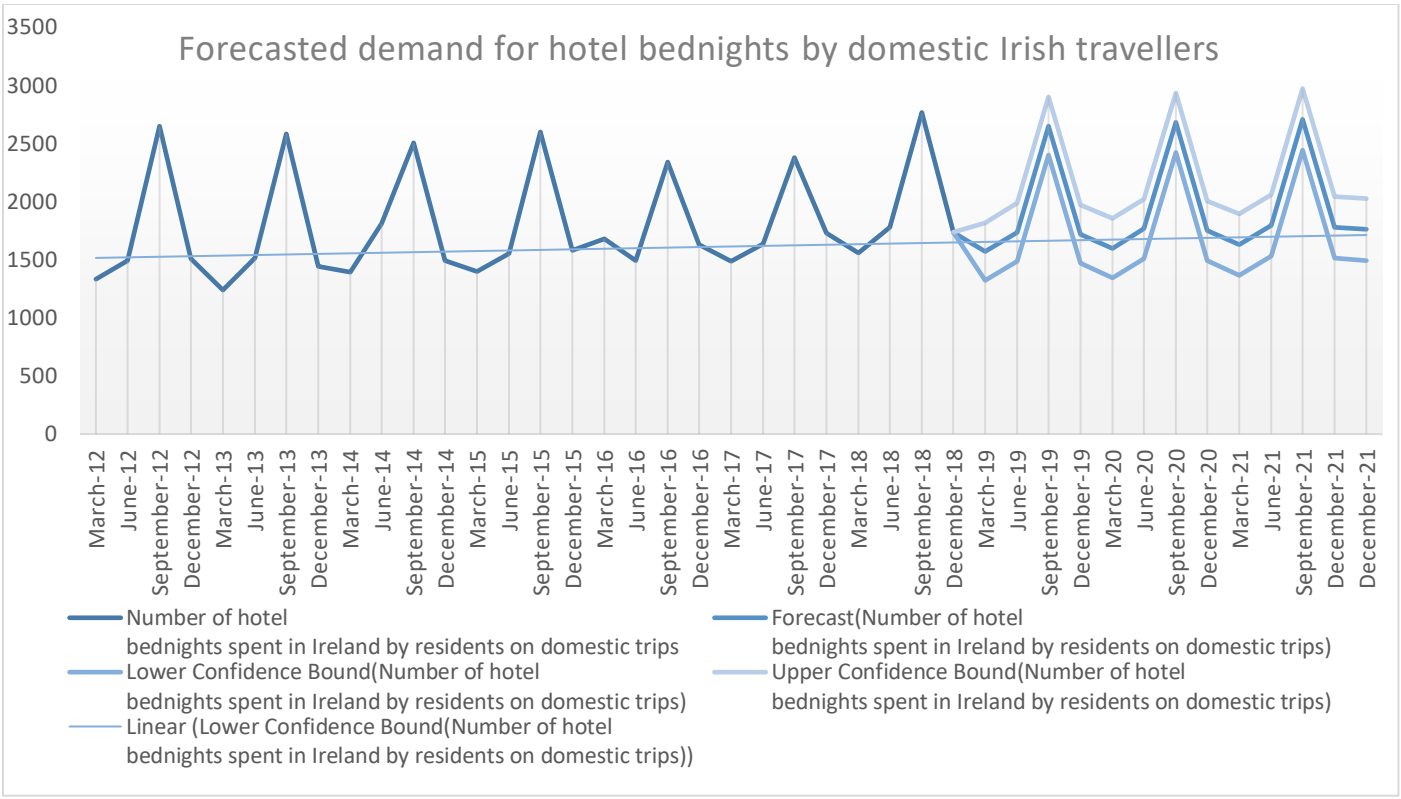

Figure 13: Line graph indicating forecast till December 2021 for hotel room demand by Irish travellers on their domestic trips. Data source – CSO.

In summary:

- There are conflicting opinions on whether hotel room rates should be based on occupancy levels, as lower rates to fill rooms can result in lower RevPAR and higher overheads. However, our analysis shows that occupancy rates and hotel revenue has a strong positive relationship.
- In the given time frame, tourists from Great Britain accounted for 17.17% of hotel occupancy, whereas tourists form the USA & Canada accounted for 47.65% on average. Occupancy levels in hotels would have been reduced to 62.28% from 74.86% without tourists from Great Britain and by 36.19% to 38.67% without tourists from the USA and Canada.
- A forecast made using an Exponential Smoothing Technique showed that demand for hotel bednights by tourists hailing from USA & Canada is due to increase, however actual figures from 2019 show that this model overestimated the demand on average by 2581.39 thousand rooms per quarter. Additionally, on average, 2529.68 thousand more bednights were spent in alternative accommodations than in hotels by these tourists per quarter in this time frame, which may help account for the discrepancy in the forecast.
- Upon examining the contribution of the Irish market to hotel occupancy levels, it was found that they contribute a higher proportion of occupancy levels than tourists from Great Britain. A forecasting model made using Exponential Smoothing forecasted that the demand for hotel bednights by the Irish market is due to remain steady up until the end of 2021, based on previous data from CSO.

4.4. Inbound versus outbound travel

As we have seen, inbound tourists contribute high expenditures to the Irish tourism industry and comprise and a large proportion of hotel guests. Therefore, it would ring true that higher levels of inbound tourists result in higher hotel revenues. This relationship is explained in figure 14, which shows that there is a positive relationship between Irish airport traffic and hotel revenue, where data was taken from CSO and STR. The correlation between these two factors is 0.98, further confirming this strongly positive relationship.

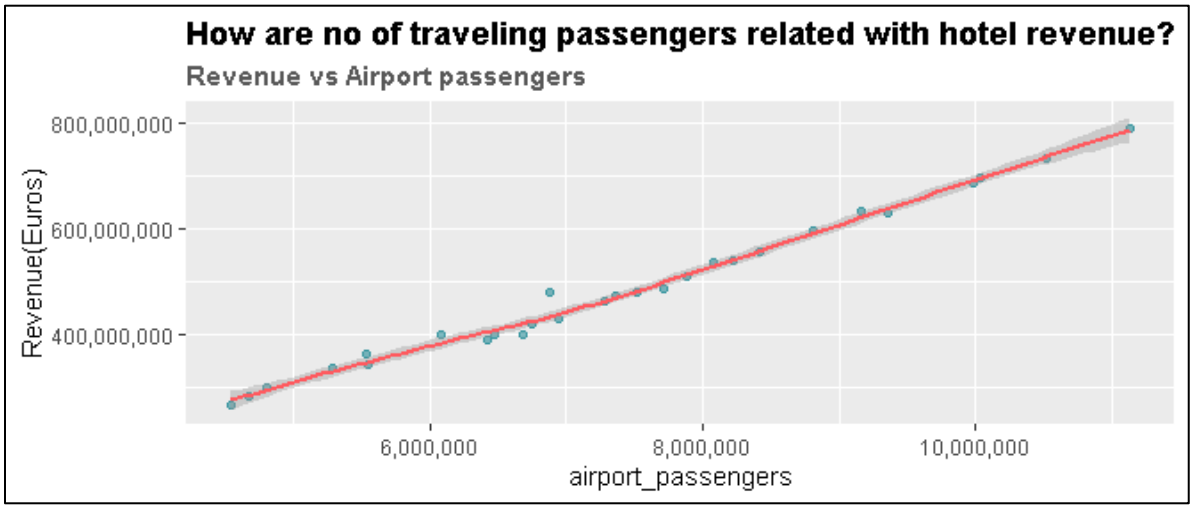

Figure 14: The relationship between hotel revenue and Irish airport traffic

We have also seen that domestic travellers contribute a large proportion of occupancy levels to Irish hotels. Therefore, we examined the relationship between domestic trips and hotel revenue based on data from CSO and STR. We found a strong positive correlation of 0.81 between these two factors, and the relationship is demonstrated below in figure 14. Because the Irish market only comprises on average 31.05% of hotel guests, this might be why the positive relationship between these factors is slightly weaker than that between airport traffic and hotel revenue. However, it is still a highly positive relationship and demonstrates that domestic travel is extremely important to the hotel sector.

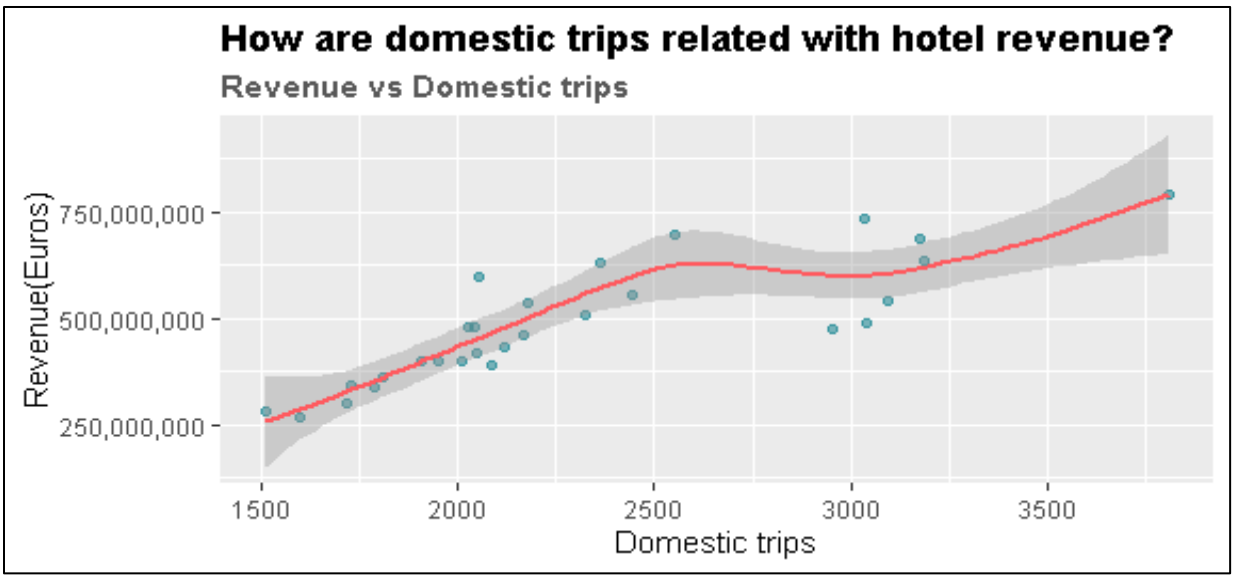

Figure 15: The relationship between hotel revenue and domestic trips by Irish residents.

Because there was an established relationship found between domestic travel and hotel revenue, we decided to explore the gaps in expenditure between domestic and outbound travel by Irish residents in the given time frame using data from CSO. These calculations are displayed in Table 13 below. On average, there was 1108.58 EM more spent on outbound travel, per quarter, by Irish residents, than on domestic travel. This gap is visualized below in table 13.

Date	Domestic travel Estimated expenditure by Irish residents (EM)	Outbound travel Estimated expenditure by Irish residents (EM)	Estimated Expenditure Outbound minus Domestic (EM)
March-12	243.8	995.1	751.3
June-12	352.2	1301.1	948.9
September-12	632.1	1950.1	1318
December-12	286.1	1096.2	810.1
March-13	239.5	1012.2	772.7
June-13	334.8	1346.1	1011.3
September-13	658.5	1939.7	1281.2
December-13	300.2	1086.1	785.9
March-14	244	937.7	693.7
June-14	402.5	1468.5	1066
September-14	693.9	1980.4	1286.5
December-14	373	1203.5	830.5
March-15	269.1	1040.7	771.6
June-15	393.6	1510.1	1116.5
September-15	701.9	2146.7	1444.8
December-15	360.6	1324.6	964
March-16	331.1	1224.1	893
June-16	370	1582.1	1212.1
September-16	699.4	2273.3	1573.9
December-16	397.2	1459.5	1062.3
March-17	352.9	1240.2	887.3
June-17	456	1730.2	1274.2
September-17	664.4	2438.5	1774.1
December-17	405.7	1481.8	1076.1
March-18	336.2	1395.5	1059.3
June-18	495.5	1908.9	1413.4
September-18	728.3	2517.2	1788.9
December-18	446	1613	1167

Table 13: Estimated travel expenditures due to inbound and outbound travels.

In summary:

- Airport traffic in Irish airports shows a strong positive relationship with hotel revenue.
- The number of domestic trips undertaken by Irish residents also displays a strong positive relationship with hotel revenue.
- There is a huge expenditure gap, however, between expenditure on outbound travel and domestic travel by Irish residents in the given time frame.

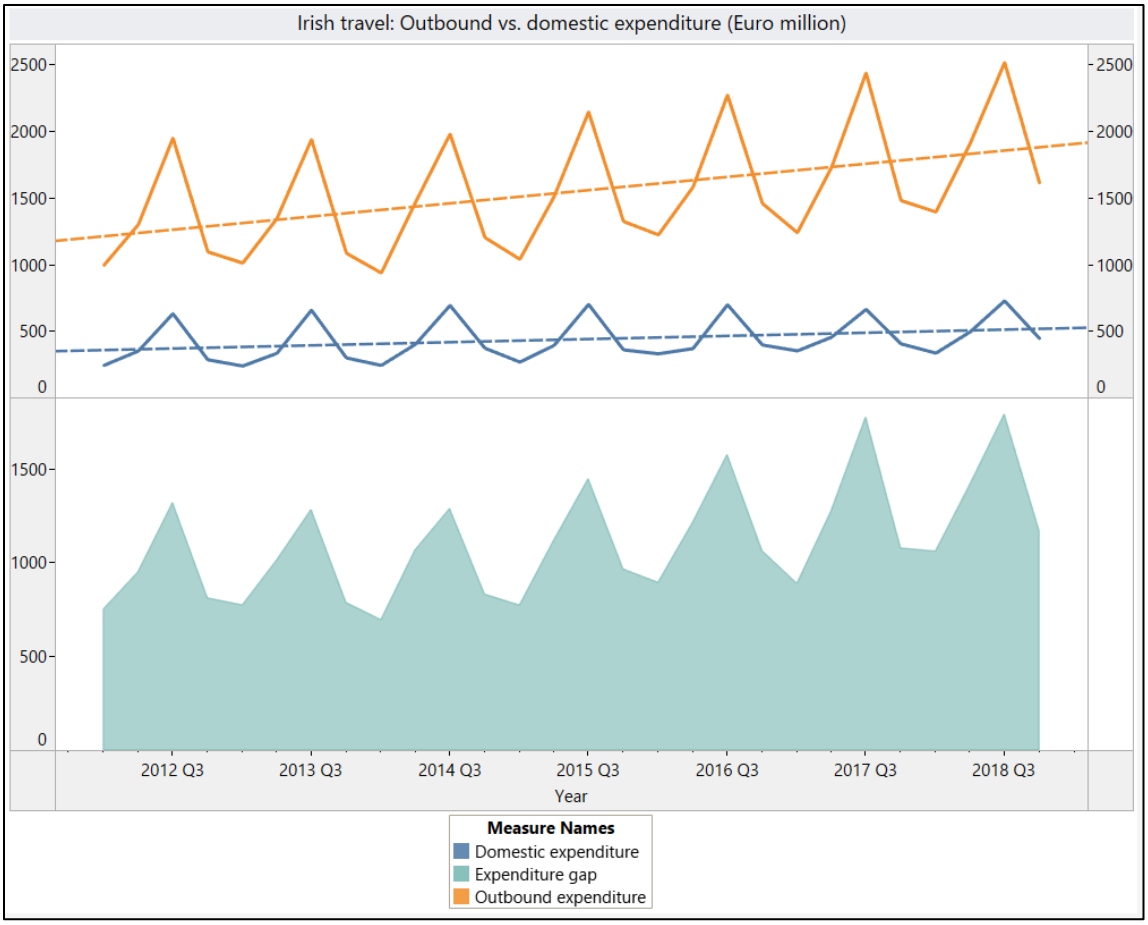

Figure 16: The expenditure gap between domestic and outbound travel of Irish tourists.

4.5. Prediction of the Hotel Revenue (in Euros)

We have used a linear multiple regression model for the prediction of hotel revenue using some of fields or factors available in our dataset. Here we have used Hotel Revenue (in Euros) as the dependent variable with Hotel ADR (Average Daily Rate), Hotel revPAR(Revenue per available room), Hotel Occupancy (in %) and Hotel Demand as the independent variables. We have used these independent variables due to its high correlation with the dependent variable.

```
> cor(my_data$HotelrevenueinEuro,my_data$HotelADRinEuro)
[1] 0.9128368
> cor(my_data$HotelrevenueinEuro,my_data$`Hoteloccupancyin%`)
[1] 0.8898589
> cor(my_data$HotelrevenueinEuro,my_data$HotelRevPARinEuro)
[1] 0.9971898
> cor(my_data$HotelrevenueinEuro,my_data$`Hoteldemand(rooms)`)
[1] 0.8301762
```

Figure 17: Correlations

The data is partitioned into training and test data. The train data contains 80% of the dataset and the rest of it is put into the test row.

```
Coefficients:
                      Estimate Std. Error t value Pr(>|t|)
(Intercept)         -9.230e+05  1.524e+07  -0.061    0.952
HotelADRinEuro       6.008e+03  1.766e+05   0.034    0.973
HotelRevPARinEuro    6.080e+06  1.912e+05  31.799  < 2e-16 ***
`Hoteloccupancyin%` -5.966e+06  2.780e+05 -21.458 9.45e-14 ***
`Hoteldemand(rooms)` 9.796e+01  4.555e+00  21.506 9.11e-14 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 1262000 on 17 degrees of freedom
Multiple R-squared:  0.9999,    Adjusted R-squared:  0.9999
F-statistic: 6.606e+04 on 4 and 17 DF,  p-value: < 2.2e-16
```

Figure 18: Output of the Linear multiple regression model.

In the above figure 17 we can see that all of the considered independent variables except Hotel ADR show a p value less than 0.05 which states that they have a statistically significant correlation with the dependent variable. Hence these variables can be used to predict the future trend of the hotel revenue. Along with this model to due enhance the accuracy of these predictions, cross validation has been used. In a k- fold cross validation the available dataset gets divided into k number of subsets which are of the similar size. For each of the testing iteration one of the parts is considered to be a test subset and the rest of them are considered to be the training data.(Couronné, Probst & Boulesteix, 2018) Here we have considered to undertake a 10 fold cross validation with 25 resampling. This ensures that we receive more stable estimates. We have applied random regression forests in order to keep in check with the accuracy of the prediction for the available dataset. We receive an output as follows-

```
Models: lm, rf
Number of resamples: 25

MAE
         Min.  1st Qu.   Median     Mean  3rd Qu.     Max. NA's
lm   869715.1  1052083  1210144  1251015  1325588  2070586    0
rf 10538686.0 18757018 21266125 22094297 26127980 32354556    0

RMSE
       Min.  1st Qu.   Median     Mean  3rd Qu.     Max. NA's
lm  1080617  1260634  1441781  1495097  1628957  2406121    0
rf 13362896 22213846 28241007 28245164 35465351 41845376    0

Rsquared
        Min.   1st Qu.    Median      Mean   3rd Qu.      Max. NA's
lm 0.9995929 0.9998730 0.9999349 0.9998942 0.9999496 0.9999713    0
rf 0.9200350 0.9647712 0.9780482 0.9706242 0.9804788 0.9941483    0
```

Figure 19: Linear multiple regression and Random regression forest accuracy.

As in the figure 18 we can see the linear multiple regression the R squared of linear multiple regression has been 0.99 and the random forests give us an accuracy of 0.92 .The linear multiple regression works better because we work on a limited dataset. As the dataset increase the random forest gives us a better accuracy.

5. Discussion

5.1. Demographic segmentation of inbound tourists

Market segmentation is an effective marketing strategy whereby heterogenous markets are divided into homogenous sub-markets based on a variable which helps to describe their specific desires and requirements (Mok & Iverson, 2000). Significant differences have been found between demographics where tourism expenditure is used as the segmentation variable (Pizam & Reichel, 1979), and can be considered a more useful approach to tourist segmentation that segmentation based on travel activities (Mok & Iverson, 2000). Marketers specialising in progressive tourism attempt to increase their market share through targeting travellers who will not only spend time, but money, on touristic products. Tourism expenditure is largely considered discretionary in nature, and so understanding the consumers that we rely on for their contribution is key to understanding consumer behaviour patterns and maximising their contribution (Mok & Iverson, 2000). The top three overseas contributors to Irish tourism expenditure are Great Britain, USA & Canada, and Europe (excluding France, Italy and Germany). USA & Canada overtook Great Britain as the highest contributor in 2015 and has remained in this position. Both segments contribute significantly to Irish tourism expenditure each year (27.44% and 24.82%, on average, per quarter, respectively) and could pose a major loss to the Irish economy if their markets were reduced/lost. The practice of market segmentation has long been used across multiple sectors including tourism

to gain a more competitive position within the market. The reasons for this are clear: Awareness of your target market allows you to cater to them specifically and target their individual needs (Dolnicar, 2002). While all international markets examined in this study significantly contribute to Irish tourism, it is important to not use one single marketing strategy to target all customers, as personalisation becomes increasingly important to consumers and travellers. With the advent of Brexit and now the Covid-19 outbreak, it is likely that travel will greatly reduce in 2020 and perhaps even in 2021, and so it is becoming more important than ever to target tourists effectively in order to reduce the impact of current events on the market. Mok & Iverson (2000) describe 4 marketing goals that can be pursued by tourist destinations improve their market share, namely they can (1) attempt to increase tourism numbers, (2) increase the length of stay of the tourists, (3) increase tourist expenditure or (4) increase visitation frequency. Having an understanding of consumer behaviour through segmentation can help to guide marketers towards which strategy to use. For example, American and Canadian tourists are unlikely to become frequent visitors to Ireland due to the geographical distance and fare costs, whereas British tourists may easily be persuaded to travel to Ireland more often due to the short flight times.

5.2. Tourist accommodation requirements

In the years following 2003, hotel room availability rose more rapidly in Ireland than in overseas markets. Growth of the domestic market kept occupancy rates high at this time, however a slow-down following the economic downfall in 2008 revealed extensive surplus capacity (Bacon, 2009). In the years prior, investments in hotels more commonly were as a result of incentives driven by allowances without regard to the potential impact the sector would suffer as a result of excess capacity (Bacon, 2009). This in addition to the high cost bases experienced in Ireland make the market increasingly difficult to compete in. While the gap between supply and demand seems to have lessened in recent years, the Irish Times has predicted that hotel rooms are expected to fall short by 1,100 rooms by the end of 2020 (Gleeson, 2018). While it is forecasted that demand for hotel room nights will increase, the turbulent nature of the tourism industry indicates that hoteliers need to be proactive in increasing demand for rooms, and that in absence of action the supply will have to be reduced in order for the sector to remain viable.

Hotels remain to be the preferred accommodation by overseas travellers, but demand for alternative accommodations is also forecasted to increase. Interestingly, our correlation analysis would indicate that since there is a strongly positive correlation between alternative accommodation stays and hotel stays, as well as between alternative accommodation stays and hotel revenue, that the increased demand for alternative tourist accommodations has yet had little or no effect on hotel business. However, as disruptive innovators such as Airbnb continue to emerge and establish themselves as valid alternatives to hotel accommodation, it will become increasingly important for hotels to stand out in an already saturated market (Guttentag, 2015). Several studies

have cited economic benefits and more space as important motivators for tourists who chose Airbnb (Tussyadiah, 2015). While there is little room for hotels in a saturated market to improve their offerings based on these factors, authenticity has also been cited as one of the key motivators to tourists who use Airbnb (Lamb, 2011), in addition to sustainability. By identifying some of the important motivators for Airbnb users, hotels might be able to get out in front of any threats in the future by adopting strategies to suit the needs of these customers.

5.3. Hotel occupancy rates

Hotel occupancy % is strongly positively related to hotel revenue, and so any threat to hotel demand could result in reduced revenues long-term. Great Britain accounts for approx. 17.17% of hotel guests and USA & Canada accounts for approx. 47.65% of hotel guests, meaning that they are significantly important markets for not only tourism boards, but hotels, to target. Where both markets are relatively close in their percentage contribution to ETE, however, there is a large gap in the percentage contribution of each market to hotel stays. This may be because visitors from Great Britain spend more than visitors from the USA & Canada, or it could be that visitors from Britain stay in alternative accommodations such as Airbnbs and guest houses. Additionally, due to the shorter geographical difference, it is possible that many visitors from Great Britain have friends and family living in Ireland, or even have their own holiday homes here in the country. Because visitors from the UK comprise a large portion of ETE, it might be a good strategy for hotels to increase their marketing targeted at these tourists in order to increase their contribution towards occupancy rates. However, research has shown that hotels tend to succeed against their competitors when they maintain price levels at a lower occupancy rate rather than offering discounted prices to fill rooms (Enz, et al., 2004). The temptation to reduce rates in order to fill beds becomes most prominent in times of economic uncertainty, but hotels which trend at lower ADRs, while having higher occupancy rates, have a lower RevPAR. This suggests that a dynamic pricing model should be used when dictating room prices, but that prices should not be dictated by trying to increase occupancy levels alone.

Often, consumers have very little knowledge about products or services that they have not experienced before or are purchasing at a distance. As a result, they often rely on external sources of information for decision-making (Viglia, et al., 2016). Strategies to improve the type and quality of information available online, such as on booking and review platforms such as Booking.com and Tripadvisor, may therefore increase the likelihood of consumers purchasing a hotel stay. For example, research by Viglia et al. (2016) shows that a one-point increase on an average review score for a hotel results in a 7.5% increase in hotel occupancy percentage scores. There are many external factors which have an influence on hotel occupancy rates (Abdullah & Hamdan, 2012) such as the economy and environment. However, hotels can achieve a competitive position within the market by improving their occupancy rate through identifying and improving their internal factors. Our results further show how

marketing strategies need to utilise market segmentation and offer personalized experiences for guests to improve their market position and increase revenues.

5.4. The effect of inbound and domestic travel on hotel revenues

Tourist destinations compete with each other on an international scale to attract inbound tourists. We've previously spoken about the importance of segmenting the international market in order to target specific tourists in a personalized manner in order to increase the chances of them visiting. However, figures compiled by AIB show that domestic travel is the single largest source of spending when it comes to the Irish tourism sector (Hamilton, 2019), particularly in the food and beverage sector. With external threats to the industry such as Brexit and Covid-19 looming, inbound tourism is set to take a hit in the coming months, and domestic tourism may become more important than even in 2020 and even 2021. Because tourism is largely considered a luxury of discretionary expenditure, it is usually one of those to be effected first in times of economic uncertainty, regardless of travel restrictions. We have shown that there is a strong positive relationship between airport traffic and hotel revenue in Ireland. With travel restrictions in place and general fear of the effects of the current pandemic, airport traffic figures will no doubt be massively decreased into the future. In order to replace the gap left by the lack of inbound tourists in the coming months, the tourism industry will have to lean harder than ever on the domestic market. Where the market already is the largest contributor to the industry, our analysis found that there is still a huge gap in expenditure among Irish residents between domestic and outbound travel. This means that each quarter Irish people are spending far more travelling abroad than at home. If this expenditure could be redirected into the country where there is a reduction in inbound tourism, it is highly possible that the effects of the pandemic could be minimized on this sector. Incentives are being put in place in several countries across the world to help revive the tourism industry. For example, areas of Italy and Japan are offering to subsidize costs to tourists by offering a free night in a hotel for every third night paid, or through vouchers which can be redeemed in restaraunts, bars and stores around the country (Jones, 2020).

Additionally, promoting an increase in domestic tourism might have the potential to create a more environmentally sustainable tourism sector long-term. Tourism has been found to account for 60% of air travel (Sunlu, 2003) and so is responsible for a significant level of air emissions. For example, almost half the CO_2 emissions that are produced by a single person in a year through lighting, heating and daily business is produced by one return flight across the Atlantic (Sunlu, 2003).

6. Conclusion and Recommendations

STRENGTHS	WEAKNESSES
• People, Landscapes and Heritage • EU member - easier travel access for EU citizens • English as major first language • Historical attractions • Music and cultural events • Strong domestic market	• Lack of online exposure • Weather • Cultural changes • Dependency on inbound tourism • Excess accommodation supply
OPPORTUNITIES	**THREATS**
• Development as a conference/business destination • Development of new markets (Asia, Eastern Europe) • Improved airport facilities • Develop accommodations in-line with consumers changing needs – why is Airbnb so popular? • Develop domestic tourism demand further • Develop the markets with the highest ETE such as GB and USA & Canada • Develop pricing strategies and promotions – put incentives in place to encourage inbound tourism and domestic tourism	• BREXIT (Loss of the British market) • Continued growth in shorter stays • Covid-19 • Changes in consumer behaviour - changes in accommodation requirements • Expenditure gap from the Irish market between domestic and outbound tourism • Economic uncertainty – lack of discretionary expenditure

Figure 20: Adjusted SWOT analysis based on the findings of our analysis.

In conclusion, inbound tourists come to Ireland from a wide variety of backgrounds. The initial SWOT analysis that identified Asia and Eastern European countries as weaker markets that need to be targeted is correct. However, it can be said that it is easier to keep a customer than to create a new one. And so, based on our descriptive analysis we have identified the USA and Canada and Great Britain as the most important inbound tourists to target personalized campaigns at, since these are the markets who contribute the most to ETE. These inbound tourists contribute highly to hotel occupancy, which is strongly positively correlated with hotel revenue. The loss of these inbound tourists, then, could prove detrimental to this sector. This again emphasizes the need for targeted marketing campaigns to British guests, in particular, as we wait for the other shoe to fall with Brexit. Demand for hotel rooms is due to increase based on 2012-2018 data – however, demand for alternative accommodations is also due to increase. Our analysis shows that tourists arriving from the USA & Canada, in particular, seem to be inclined towards using alternative accommodations in 2019. We would recommend that further analysis be carried out on the effect of Airbnb and other alternative accommodations on the hotel sector,

with access to occupancy and revenue rates for both. There is a significant relationship between airport traffic and hotel revenue, which would be logical considering a large portion of occupancy rates are contributed by inbound tourists. However. With the event of Covid-19 the industry will have to prepare to recover without an influx of inbound tourism. And so we would recommend based on our analysis that the domestic market is developed. Analysis shows that there has been a significant expenditure gap between outbound and domestic expenditure and we feel that by redirecting that expenditure into the country in the coming months that the impact of Covid-19 on the industry will be reduced. Our adjusted SWOT analysis above reveals the differences that our analysis makes to the industry outlook given historical data.

7. Appendices:

7.1. Detailed Sources List:

1. Source: Central Statistics Office

a) Type: Trips made to Ireland by non-residents along with expenses

- Number of bed nights spent in Ireland by non-residents on overseas trips
- Number of bed nights spent in Ireland by non-residents on overseas trips by area of residence (UK, USA and Canada, Remaining Europe, Remaining World)
- Number of bed nights spent in Ireland by non-residents on overseas trips by type of accommodation (Hotels, Friends/Relatives, Rented House/Apartment, Guest house/B&B, Other)
- Estimated expenditure by overseas travelers to Ireland
- Number of trips to Ireland by non-residents- Total and by area of residence (UK, USA and Canada, Germany, Italy, Australia and NZ, Remaining Europe, Remaining World)
- Average length of stay by overseas travelers to Ireland- Total and by area of residence (UK, USA and Canada, Germany, Italy, Australia and NZ, Remaining Europe, Remaining World)
- Expenditure by overseas travelers in Ireland (excluding fares)- Total and by area of residence (UK, USA and Canada, Germany, Italy, Australia and NZ, Remaining Europe, Remaining World)

b) Type: Trips made by Irish residents:

- Domestic travel –
    - Number of trips by Irish residents
    - Number of nights by Irish residents
    - Average length of stay by Irish residents (Nights per trip)
    - Estimated expenditure by Irish residents (€ million)
- Outbound travel –
    - Number of trips by Irish residents (Thousand)
    - Number of nights by Irish residents (thousand)
    - Average length of stay by Irish residents (Nights per trip)
    - Estimated expenditure by Irish residents (€ million)

c) Type: GDP and currency

- Sterling to euro
- Dollar to euro
- Canadian dollar to euro
- GDP at Constant (chain linked annually ref to 2017) Market Prices (Euro Million)
- GDP at Current Market Prices (Euro Million)
- GDP at Current Market Prices (Seasonally Adjusted) (Euro Million)

d) Type: Passenger movement

- Passengers by airports in Ireland (inbound & outbound) Total
- Passengers by airports in Ireland (inbound & outbound) airport wise (Cork, Dublin, Knock, Kerry, Shannon)
- Fare receipts of Irish carriers from overseas travellers to Ireland (€ million)

2. Source: STR

- Hotel data by measure:
  - Occupancy (%)
  - Average daily rate (ADR)
  - Revenue per available room (RevPAR)
  - Supply
  - Demand
  - Revenue

3. Source: Kaggle (TripAdvisor Restaurants Info for 31 Euro-Cities)

a) Type: Restaurant details with ratings and reviews

- Name
- City
- Cuisine Style
- Ranking
- Rating
- Price Range
- Number of Reviews
- Reviews
- URL_TA
- ID_TA

4. Source: insideairbnb.com (Airbnb data for Ireland)

a) Type: Listings of all Airbnb across Ireland with details

- id
- name
- host id
- host name
- neighborhood group
- neighborhood
- latitude
- longitude
- room type

- price
- minimum nights
- number of reviews
- number of reviews
- last review
- calculated host listings count
- availability (out of 365 days)

b) Type: Reviews on listed Airbnb as per their id

- listing id
- id
- date
- reviewer id
- reviewer name
- comments

7.2. Target Audience:

Fáilte Ireland:

It is the National Tourism Development Authority of Ireland which was established in 2003 under National Tourism Development Authority Act. They majorly aim for improvising tourism activities in Ireland by applying smart planning and development strategies. They also collaborate with other businesses and agencies in various sectors related to travel to help them implement practical and profitable solutions for betterment of Irish tourism and economy.

They also perform research on topics like the current tourism performance in Ireland, impacts of exchange rates and Brexit, current and future supply of accommodation for tourists, trends on tourists from European countries and Northern America, Ireland's performance in the hotel sector, and many such.

Their international tourism trends research helps in gaining insights on what attracts foreign tourists and implement strategies likewise. Their 'Best Face Forward' trend for sharing more travel related posts and photos was driven by idea of technological advancement and how young generation nowadays is enthusiastic about sharing their life on social media platforms.

They have recently carried out a survey of how covid-19 travel restriction has impacted tourism and how it has led to high un-employment rates. They have also listed future challenges which will come with social distancing and limitations to number of people allowed at time.

Tourism Ireland:

It was established under Good Friday Agreement of 1998. They operate under the North South Ministerial Council and target towards development and promotion of marketing strategies for overseas tourism in Ireland. They also work with travel trade companies and air and sea services to gather current trends which helps them in boosting their marketing campaigns. This influences travelers to visit Ireland. They perform their research based on demographics of tourists visiting Ireland, travel patterns, market study and analysis, etc. and accordingly work on their promotions.

Their research on market reviews and strategies proves to be of high importance. Market reviews of countries like Great Britain, USA, Germany, Spain and Italy have research insights and strategies to increase tourists from these countries in the coming years. These are the major countries contributing to tourism in Ireland. Also they have generated segmented market profiles for each of these countries along with few others separately to further classify their trends.

Tourism Northern Ireland:

Tourism Northern Ireland or Northern Ireland Tourist Board as previously known, work towards the advancement of travel and tourist activities in Northern Ireland region. They also provide monitorial support to organization involved in tourism development projects and help in building influential marketing strategies for attracting tourists. Their research mainly is about how the festivals and events affect the tourism. They contribute more to generate additional revenue during these times and help spreading more awareness of Irish culture and tradition

Our research contribution:

All the above mentioned organizations collectively work towards enhancing travel opportunities in Ireland and promoting tourism in Ireland on international level. We know that tourism accounts for major revenue in Ireland and is one of the highly developed sector.

Our project also aims at analyzing historical trends of tourism activities in Ireland and building a forecasting model. This will help in making sustainable and astute development decisions for future considering current global scenarios. Our research discussions provide below suggestions considering current situations:

- Current travel restrictions will reduce the number of international travelers and thus it is important to encourage inbound domestic travel to stabilize the revenue.
- Implement market segmentation based on travel activities of travelers from different countries to create personalized strategies.
- Maintain cultural authenticity so as to avoid the threats of competition against alternative accommodation sources.

- Current supply of resources exceeds demand but it is forecasted that demands will increase in near future and hotels should be prepared for this rise.

7.3. Scope Management Plan

1. Plan scope management

Project definition: Descriptive analysis of the Irish Tourism sector to determine patterns and dependencies between various internal and external factors relating to the industry. Aim of making targeted recommendations to relevant audiences which could safeguard Irish tourism in an increasingly competitive market, where global events such as Brexit and Covid-19 could possibly have a negative effect on the industry.

Project validation: Where 11% of the Irish population is employed in the tourism sector, which provides several billion euro to the Irish economy annually, an understanding of the critical success factors for the industry is important in order to facilitate a proactive approach to ensure the continued success of the industry. Recent events such as Brexit and the Covid-19 global pandemic have raised concerns regarding tourism in the future, where tourism may be permanently altered. With rumours of a looming recession, it is imperative that industry players are able to find innovative ways to reduce the impact to their businesses and survive in the current climate.

Project control: Irelands tourism sector has thrived in the past, ranked as the second “most excellent” country to visit in 2018 by TripAdvisor, and is highly rated with regard to tourism marketing and branding by the World Economic Forum. However, where tourism and hospitality are considered discretionary expenditure, during periods of economic downturn the sector is one of the first and largest casualties. Additionally, where the market is becoming increasingly competitive, the sector must manage risk effectively and find innovative ways to maintain a competitive position.

Identified areas of focus include incoming tourism demographics, expenditure, airport traffic figures, hotel revenue and domestic travel. Where patterns, relationships and dependencies between different factors can be identified, the goal will be to understand which segments are most important to the sector, and improvements can be made to increase visits and expenditure by adopting more targeting marketing approaches. Additionally, we will examine the gap between domestic and outbound tourism expenditure, where we might find that domestic tourism might have potential to increase as outbound travel patterns change in the face of a global pandemic such as Covid-19, or in a period of recession.

2. Collect requirements

Requirements:

Research resources	STR CSO Journal articles Web documents
Time management	WBS Timeline
Project execution resources	Microsoft word Microsoft Excel Tableau R studio
Team management	Microsoft team's communication Skills matrix RACI chart

3. Define scope

1. Introduce the tourism sector in Ireland, discussing its importance to the Irish economy with research to back up each of these points, providing an explanation surrounding the circumstances which theoretically could derail the success of the sector.
2. Discuss research already carried out in relation to how analytics have been used to predict tourism trends and improve offerings around the world in various cases.
3. Describe the planned analytical methodology for the project in the pattern of the data analytics lifecycle, describing sources of data and its validity.
4. Present the findings of the analysis with the use of various figures and graphs, accompanied by a description.
5. Discuss in detail the potential impact of the findings of the analysis, ensuring to compare and contrast the results with any similar studies.
6. Outline some recommendations for the target audience based on the findings of the analysis.
7. Outline the limitations of the analysis, recommending what further work can be done in the future and explaining how the limitations effect the recommendations.
8. Lay out a conclusion of the study, reiterating the key findings and recommendations moving forward.
9.

4. Creating the Work Breakdown Structure (WBS)

1. Identify tasks
2. Create skills matrix

3. Allocate tasks
4. Identify project timeline

5. Validate scope

1. Evaluation criteria
   1.1 Is the chosen topic of interest to the group members?
   1.2 Is there enough valid, available data and resources to undertake this project?
   1.2 Does the chosen topic fit in line with the project requirements?
   1.3 Who is the target audience?
   1.4 Has this research been done before? If so, how will our research differ?
   1.5 What impact could any findings have?
   1.6 What limitations should be considered in undertaking this project?

2. Project deliverables
   2.1 Research: Brainstorming ideas
   2.2 Research: Research on chosen topic
   2.3 Project proposal
   2.4 Interim progress report
   2.5 Preliminary report
   2.6 Final report

6. Controlling scope

Changes to initial scope baseline:

Responsible: Helena Hoedt (**Team Leader**)

Scope baseline:

The tourism sector in Ireland is one of the key contributing industries to the Irish economy. Ireland is famous for its hospitality and tourism. The sector, however, can be slow to change and we believed that by applying analytics to the industry that business offerings could be improved. Based off of research on smart tourism destination we focused our attention on the Capital of Culture festival arriving in Galway in 2020 with the

hopes that our findings could be applied to use here. Additionally we believed that using systems such as block chain could be the way forward in the industry and by turning Ireland into a smart tourist destination that any potential impacts of Brexit could be lessened. For the initial scope our main focus was on Galway city itself as a tourist destination and to explore datasets pertaining to Irish tourism and Hospitality.

(February 2020)

Adjustment 1:

Further research was undertaken in the uses of analytics in the tourism industry throughout the world. Big data has been used globally to identify trends and patterns within the industry and IoT technologies are being used more and more in order for tourism destinations to find a competitive position within the market. At this stage we have gathered open source data from CSO and are reaching out to tourism companies and statistics offices such as ESRI to find additional data which we can hopefully compile to find some new information. While the inclusion of block chain technologies as a tourism solution has been used in some parts of the world, we find it difficult to understand how to create a prescriptive analysis with these solutions with limited data available. At this stage we have performed basic descriptive visual analysis in Tableau in order to familiarise ourselves with the data that we have.

(March 2020)

Adjustment 2:

Having acquired data on Irish hotels including revenue, occupancy and RevPAR, we seek to understand the relationship between currency exchange rates and inbound tourism in Ireland. Such data is available at the same time scale as our existing data from CSO. We are particularly interested in the effect of the pound sterling on the influx of British tourists. Additionally, we hope to look at the effect of tourism on GDP and GNP.

(March 2020)

Adjustment 3:

With the arrival of Covid-19 we have the realization that the tourism industry will be one of the first effected industries and we wonder what analysis we can do to tie this in to our project. We consider looking at stock prices for airlines, due to the fact that some have already gone under and trying to understand the relationship

between passenger movement and stock prices. This notion, however, is discarded on the basis that there are many factors influencing the stock price of an airline and that day-to-day passenger movement over short periods of time would not be one of the defining factors of the project. Descriptive analysis, additionally, has not shown any significant relationships between changing currency exchange rates and tourism number, we may not include this in our final analysis. We have built a linear regression model in R which can predict hotel revenue based on occupancy rates, airport travel rates or domestic travel.

(March 2020)

Adjustment 4:

We have the realization that there is not enough trustworthy data on Covid-19 to undertake an analysis which includes this as a factor. We agree, however, that the descriptive and predictive analysis that we have can help us to make recommendations and have discussions around how the tourism industry will survive Covid-19. To date the tools that we have used include Tableau, MS Excel and R. Initially we had considered using SPSS statistics and XL miner but once we had gathered the data we understood these to be the best tools for our specific data set. We consider discussing in the report the effect of alternative accommodations such as Airbnb and decide to try to find data on Irish Airbnbs.

(March 2020)

Final Version 1:

Working from the preliminary report we decide to update visualizations based on the work of Edward Tufte. Visualizations are to be overseen by a ONTG with this in mind. Additionally, we decide to frame the analytical methodology around the data analytics lifecycle in order to give it a bit of structure and clarity. We have been unsuccessful in finding a way to apply prescriptive analytics to our data set. Data for Airbnb was found opensource online on InsideAirbnb.com but unfortunately this information was mainly listings and reviews. Another company named AirDNA, a competitor company to STR, has Airbnb information, with the same metrics that we have for hotels such as occupancy etc., however access to this data is far over budget for this project.

(May 2020)

Final Version 2:

We have appointed an ONTG for all referencing in the final report to ensure that they are compliant. Visualizations are continually being updated and we have decided to add tables in which give actual figures for 2019 beside predicted figures from our model to compare predicted and actual.

(June 2020)

Final Version 3:

Reports that have been used throughout the semester are consolidated and formatted in order to go into the appendices of the final report. We are above the wordcount requested and must comb carefully through all of the content to be selective about what we choose to use in the report.

(June 2020)

Final Version:

The final report is consolidated and being edited so that styles are consistent and headings are relevant. We are checking to ensure that the project has good flow and makes logical sense. Each analysis is explained – the reasoning why it was carried out and what impact it may have, in the discussions. We believe the report has asked and answered the following questions:

- What countries do most inbound tourists arrive from?
- Highest tourism expenditures are derived from tourists arriving from which countries?
- How could hotel occupancy rates be altered with the loss of inbound tourists?
- With respect to inbound tourism, what is the forecasted demand for Irish hotel rooms in the future?
- Has there been a change in the number of inbound tourists using alternative accommodation?
- Has the use of alternative accommodation by inbound tourists effected the number of inbound tourists staying in hotels?
- With respect to inbound tourism, what is the forecasted demand for alternative Irish accommodations in the future?
- What is the relationship between hotel occupancy % and hotel revenue?
- What is the relationship between airport traffic and hotel revenue?
- How might a change in inbound tourism effect hotel occupancy %?
- Is there an expenditure gap between outbound and domestic tourism in Ireland?
- Is there a relationship between domestic travel and hotel revenue?

7.4. Skills Matrix

FYP Group 26
Skills Matrix

Skill	Helena	Rishi	Namrata	Apurva
MS Excel	Average	Confident	Confident	Average
Coding - C#, R and Python	Poor - experience only in C#	Confident	Confident	Confident
XLMiner	Confident	Confident	Average	Average
SPSS	Interpretation issues	Confident	Confident	Confident
Data Visualisation - Tableau etc.	Confident	Confident	Confident	Confident
Presentation Skills	Confident	Average	Confident	Confident
Editing - referencing etc.	Confident	Confident	Average	Average
Creative - design skills etc.	Confident - infographics, posters, presentations etc.	Confident	Confident	Confident
PPT skills	Confident	Confident	Confident	Confident
Sourcing - data sourcing, contacts, communication etc.	Confident	Confident	Average	Average
Time management skills	Average	Average	Confident	Confident
Power BI	n/a	Average	Poor	Poor
MS Visio	n/a	Average	Average	Average
What areas/tool appeal to you?	I enjoy Tableau and XLMiner, don't mind SPSS, dislike coding but would like to learn, am happy to do editing of docs.	Enjoy creating dashboards in Tableau and Visualizations in R like coding and like learning new tools and techologies	good in coding and creating visualisation or presentation	good in coding and creating visualisation or presentation

Table 14: Skills Matrix

7.5. RACI Chart

Project Name: Group 26 RACI Chart

Task	Helena Hoedt	Namrata Desai	Apurva Bhilare	Rishi Mukherjee
Phase 1: Research and initiation				
Brainstorming on ideas	R/A	R	R	R
Research previous studies	R/A	R	R	R
Research previous projects	I	R/A	C	I
Define project objectives	C	C	R/A	R
Create scope management plan	R/A	R	C	C
Create skills matrix	R/A	I	I	I
Create work breakdown structure	R/A	I	I	I
Project proposal	R/A	R	R	R
Create timeline	C	I	I	R/A
Phase 2: Data Gathering / initial analysis				
Collect possible data from online sources	C/A	R	R	R
Contact tourism companies in Ireland	R	C	R/A	I
Acquire possible data from tourism compar	R/A	I	I	I
Further research	R/A	R	R	R
Adjustments to project scope	R/A	I	I	I
Data pre-processing	R/A	R	R	I
Basic analysis	C	R/A	R	C
Interim progress report	R/A	R	R	R
Phase 3: Further analysis and adjustments to project scope				
Analyisis of feedback from supervisor	C	R	A	R
Adjustments to project scope	R/A	I	I	I
Background research	C	A/R	I	I
Analytical methodologies	C	A/R	I	I
Visualisations	C	R	A/R	I
Further analysis	R	R	R	A/R
Findings of analysis	R	I	I	A/R
Discussion of results	R/A	C	C	R
Conclusions	R/A	I	I	I
Preliminary report	R/A	R	R	R
Phase 4: Final delivery				
Analysis of feedback from supervisor	A	R	R	R
Adjust project scope	R/A	I	I	I
Define final title and relevant terms	R/A	C	C	C
Introduction and background research	C	I	R/A	I
Analytical methodologies	C	R/A	I	I
Findings of analysis	C	I	I	R/A
Visualisations	R	C/A	R	I
Discussion of results	R/A	C	C	R
Conclusions and limitations	R/A	I	I	I
Appendices	R/A	R	R	R
Final report	R/A	R	R	R

Table 15: RACI chart

7.6. Further Analysis

Content Based Recommendation Engine

Booking a hotel online can be an overwhelming task with thousands of hotels to choose from, for every destination. Motivated by the importance of these situations, we decided to work on the task of recommending hotels to users.

A recommendation system is class of information filtering system that is used to recommend most relevant items here, Hotel/Restaurants to the user. So, if a visitor has a previous experience of a hotel/restaurant we have made a recommendation engine in which the user input the hotel of which he knows of and we recommend the user hotels which have similar cuisines styles and rating. This recommendation engine could help companies like Booking.com to better advice users where to stay in their country of visit. We have used a dataset from Kaggle which has been extracted from Trip Advisor website (famous American online tourism website used for travel booking and hotel reservations). The dataset contain restaurants information for 31 cities in Europe: Amsterdam (NL), Athens (GR) , Barcelona (ES) , Berlin (DE), Bratislava (SK), Bruxelles (BE), Budapest (HU), Copenhagen (DK), Dublin (IE), Edinburgh (UK), Geneva (CH), Helsinki (FI), Hamburg (DE), Krakow (PL), Lisbon (PT), Ljubljana (SI), London (UK), Luxembourg (LU), Madrid (ES), Lyon (FR), Milan (IT), Munich (DE), Oporto (PT), Oslo (NO), Paris (FR), Prague (CZ), Rome (IT), Stockholm (SE), Vienna (AT), Warsaw (PL), Zurich (CH). The data is a comma-separated file that contains 125 433 entries (restaurants/hotels).In our initial analysis of our dataset we have prepared some basic visualization of our data.

The below plot shows the number of hotels/restaurants in each of the 31 cities that have been scraped into the dataset.

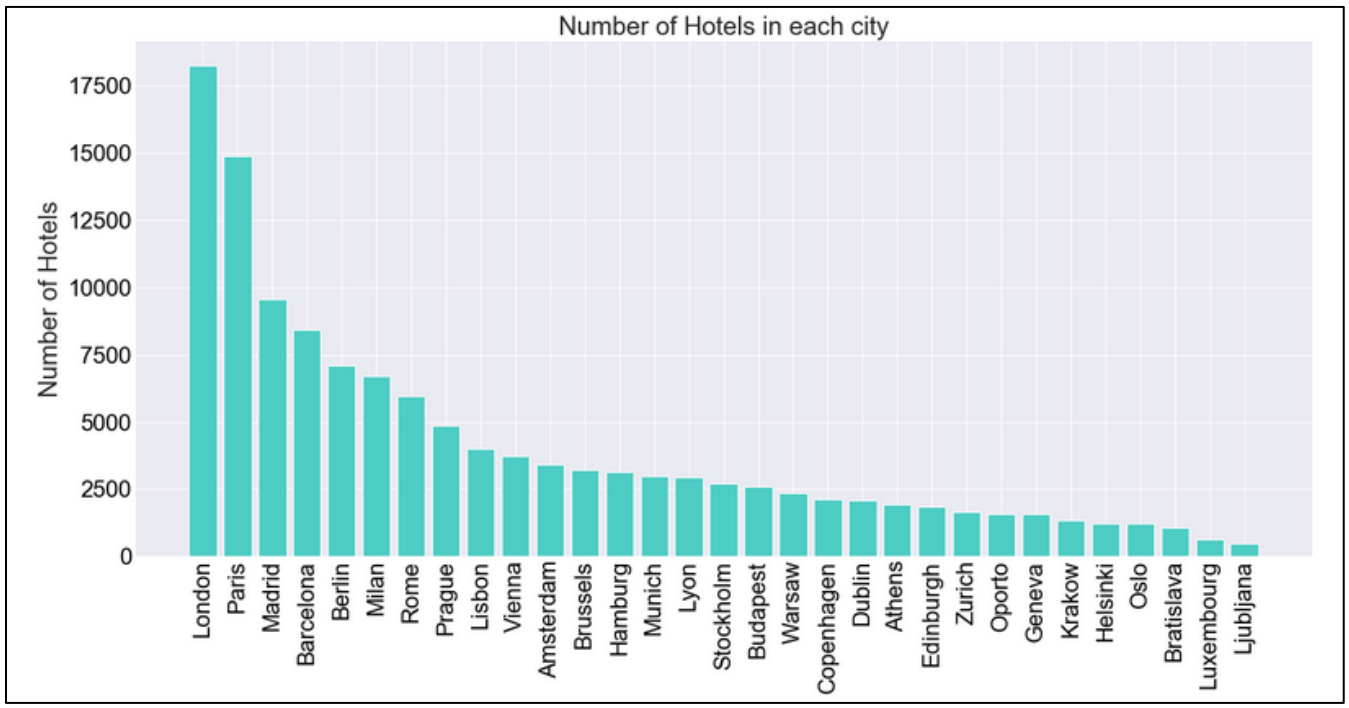

Figure 21: Bar Chart of the number of Hotels vs Cities

The below plot shows the number of reviews in millions for each city from the dataset. Here, we can see Dublin has around 250k thousands.

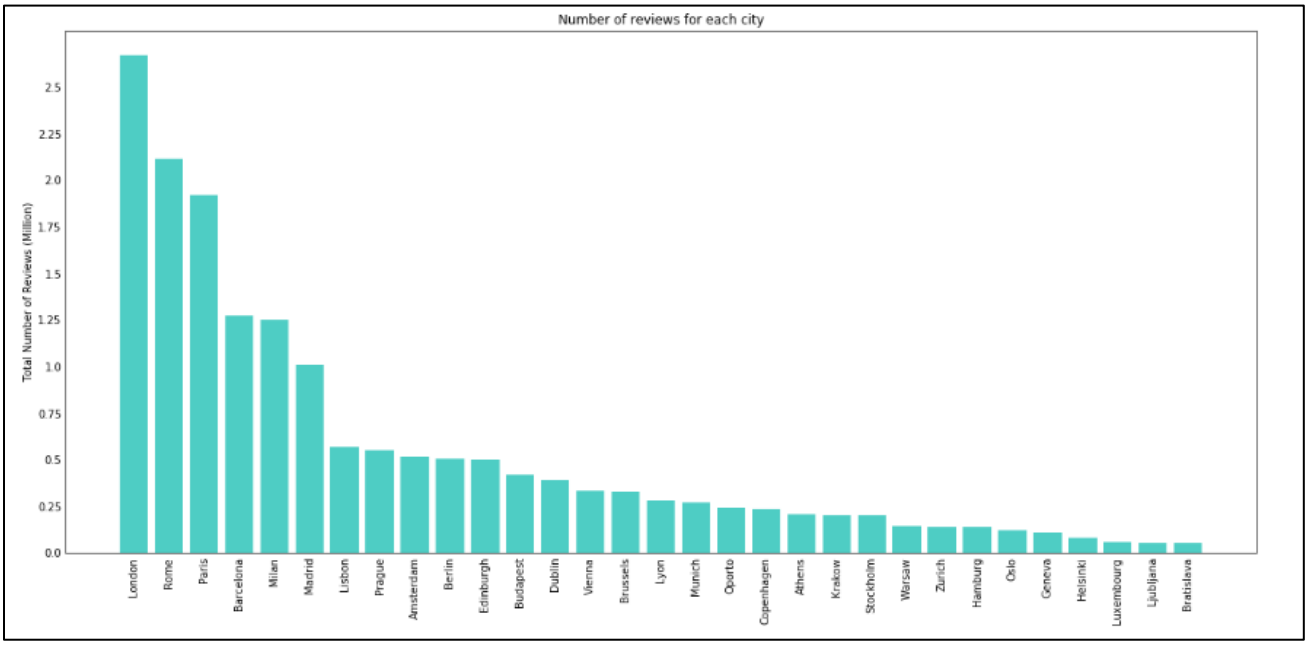

Figure 22: Bar Chart of the number of reviews vs Cities

The below plot shows the average number of reviews for each city in Europe.

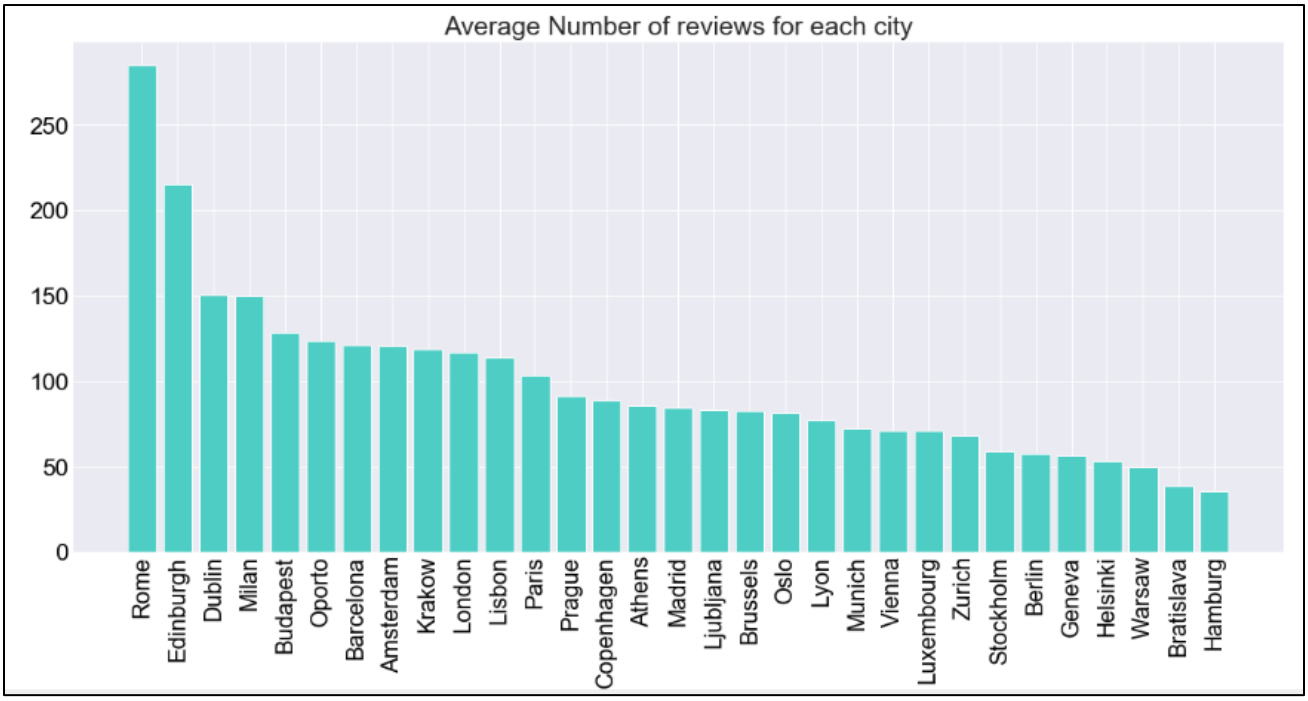

Figure 23: Bar chart of the Average number of reviews vs cities

For building a simple recommender system we have followed the below steps:

- Firstly we choose a metric to rate the hotels/restaurants. Here, we choose the rating as the metric.
- Determine the prerequisites for a hotel/restaurant to be included in the level of cheap/medium/expensive range.
- Calculate the weighted rating of each hotel/restaurant using the formula

Weighted rating (WR) = (v/ (v+m) * R) + (m/(m+v) * C)

Where, **v** is the number of reviews of a particular restaurant.

m is the minimum number of review a restaurant needs to have.

r is the average rating.

C is the mean rating of the reveiws.

We have calculated the m value by the formula

```
# To calulate m
# The minimum number of review a restaurant needs to have
m = tripadivsor_clone_reviews_df['reviews_number'].quantile(0.50)
print('The minimum number of reviews required',m)
```

```
The minimum number of reviews required 22.0
```

Figure 24: Calculate the value of minimum number of reviews required to be added for the recommendation

We can see that the minimum number of reviews required to come in the recommendation criteria. I have used the number of reviews garnered by the 50th percentile reviews for our recommender as the value for m. Our value for m is 22.

```
# To calculate C
C = tripadivsor_clone_reviews_df['rating'].mean()
print('The mean review across all restaurants is ', str(C)[0:5])
```

```
The mean review across all restaurants is  3.909
```

Figure 25: Calculate the value of the mean reviews for the whole dataset

We can see that the average rating is 3.91 out of 5. Our value for C is 3.91.

```
# get restaurants that have at crossed m  number of reviews
TA_data = tripadivsor_clone_reviews_df.copy().loc[tripadivsor_clone_reviews_df['reviews_number'] >= m]
print(str(TA_data.shape[0]) + ' restaurants can be included in the chart')
```

```
63146 restaurants can be included in the chart
```

Figure 26: Calculate the number of hotels/restaurants to be added into the recommender system

We can see from our analysis that 63146 hotels and restaurants have crossed the 22reviews benchmark and will be considered in our analysis.

```
# create a function that calculate the weighted review for each restaurant
def weighted_review(x, m=m, C=C):
    # v is the number of reviews of a particular restaurant
    v = x['reviews_number']
    # R is the average rating
    R = x['rating']
    # weighted rating
    WR = (v/(v+m) * R) + (m/(m+v) * C)
    # return weighted rating
    return WR
```

Figure 27: Function to calculate the weighted average of the ratings and score the data.

We have all data for our weighted rating model. We have prepared a function to calculate the weighted average rating scoring model. The below screenshot shows the data from the score column which is the new column to store the value of the model.

```
TA_data['score']

0         4.848125
1         4.484417
2         4.477935
3         4.959051
4         4.461550
             ...
125407    3.204631
125411    2.887547
125423    2.913384
125434    3.571459
125435    2.244208
Name: score, Length: 63146, dtype: float64
```

Figure 28: Shows the new column score after applying the weighted average formula on the model parameters

In the below screenshot the user can input a hotel/restaurant that they have stayed in any country and our recommendation engine recommends users based on the rating and the cuisine styles of a hotel/restaurant in the country of visit. La Rive is a restaurant in Amsterdam and the user wants to get recommendation of restaurants in Dublin, Ireland which the user might be visiting in the upcoming days. The engine provides the best restaurants based on the ranking and cuisine style similarity of the restaurant.

```
Insert the name of the Restaurant/Hotel: la rive
Insert the city in lower case : dublin
If you liked  la rive then, in  dublin  you could also try out similar Hotels/Restaurants:
```

	Name	City	description
1318	restaurant patrick guilbaud	dublin	'French', 'European', 'Vegetarian Friendly', '...
1408	l'ecrivain	dublin	'French', 'European', 'Vegetarian Friendly', '...
1400	peploe's st stephens green	dublin	'Irish', 'European', 'International', 'Vegetar...
1382	bang restaurant & bar	dublin	'Irish', 'European', 'International', 'Vegetar...
1360	hugo's	dublin	'French', 'European', 'Vegetarian Friendly', '...
1305	pearl brasserie	dublin	'French', 'Irish', 'European', 'Vegetarian Fri...
1404	the greenhouse	dublin	'European', 'Vegetarian Friendly', 'Gluten Fre...
1433	chez max	dublin	'French', 'European', 'Vegetarian Friendly', '...
1442	l'gueuleton	dublin	'French', 'European', 'Vegetarian Friendly', '...
1373	brasserie sixty6	dublin	'Irish', 'European', 'International', 'Vegetar...

Figure 29: The Content based filtering model to filter the cheap hotels/restaurants in a city based on the dataset

Recommender systems help to provide users with the right information at the right time. They do this by profiling a user's interests and preferences over time and use profiles to select and/or rank items for presentation by preferring those that are similar to those the user has liked in the past. Here in our analysis we have focused on a personalized hotel/restaurant recommendation which is given to a user on the basis of the user input of the location of the hotel/restaurant and the category of price which the user would like to board in or have some food.

The below screenshot shows the user input of the city as Dublin and the price range as cheap and the user is shown all the hotels which are cheap with the highest rating.

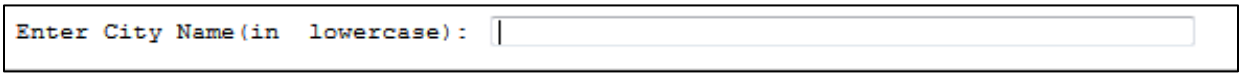

Figure 30: User input for the city name

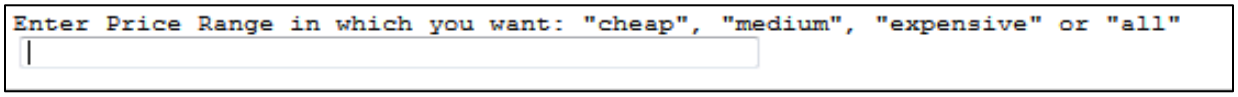

Figure 31: User input for the price range

```
Enter City Name(in  lowercase): dublin
Enter Price Range in which you want: "cheap", "medium", "expensive" or "all" cheap
```

	Name	cuisine_style	rating	price_range
30111	el grito	['Mexican', 'Latin', 'Fast Food', 'Central Ame...	5.0	cheap
30069	tang cafe	['Cafe', 'Healthy', 'Middle Eastern', 'Vegetar...	5.0	cheap
30338	ernesto's	['Cafe', 'Irish', 'European', 'Vegetarian Frie...	5.0	cheap
30473	le petit cafe	['Cafe', 'European', 'Irish', 'Soups', 'Vegan ...	5.0	cheap
30447	the strawberry hall	['Irish', 'Pub']	5.0	cheap
30490	dall'italia pasta bar	['Italian', 'European', 'Mediterranean', 'Soup...	5.0	cheap
30436	catherine's cafe	['Irish', 'Cafe', 'Fusion', 'European', 'Veget...	5.0	cheap
30582	delisuz	['European', 'Irish', 'Healthy', 'Cafe', 'Fast...	5.0	cheap
29898	bunsen	['American', 'Fast Food', 'Gluten Free Options']	4.5	cheap
29887	uml falafel	['Lebanese', 'Fast Food', 'Mediterranean', 'Mi...	4.5	cheap
29870	beanhive	['Irish', 'Cafe', 'European', 'Vegetarian Frie...	4.5	cheap
29924	john kavanagh - the gravediggers	['Irish', 'Bar', 'Pub', 'Vegetarian Friendly',...	4.5	cheap
29928	bunsen	['American', 'Fast Food', 'Gluten Free Options']	4.5	cheap
29886	boojum - millenium walkway	['Mexican', 'Fast Food', 'Vegetarian Friendly'...	4.5	cheap
30072	pablo picante	['Mexican', 'Latin', 'Fast Food', 'Central Ame...	4.5	cheap
29937	pho viet	['Asian', 'Vietnamese', 'Soups', 'Vegetarian F...	4.5	cheap
29878	the stage door cafe	['Irish', 'Cafe', 'European', 'Vegetarian Frie...	4.5	cheap
29883	mochaland cafe	['Mediterranean', 'Irish', 'Cafe', 'European',...	4.5	cheap
30004	neon	['Chinese', 'Fast Food', 'Asian', 'Thai', 'Veg...	4.5	cheap
30041	o'donoghue's	['Irish', 'Bar', 'Pub']	4.5	cheap

Figure 32: The Content based filtering model to filter the cheap hotels/restaurants in a city based on the dataset

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7.7. Performance Reports:

Performance Report Version 1

Date (25/01/2020)

Project Name: Group 26

Reporting Period: 20 December 2020 – 15 January 2020

Work completed this reporting period:

-Brainstorming ideas.

-Ideation for project execution.

-Outlets to obtain data from.

-Formation of first formal document (The Project Proposal).

Work to complete next reporting period:

-Obtaining the data from organizations.

- Data familiarization.

-Working on the Project interim Report.

-Seminar from STR.

What's going well and why:

-Request emails sent to STR for Data and reports.

- Every week meets.

What's not going well and why:

-Confusions in discussion regarding methodology to adopt for the project.

Suggestions/Issues:

- Differences regarding the considerable scope of the project.

Project changes:

- Null

Performance Report Version 2

Date (18/02/2020)

Project Name: Group 26

Reporting Period: 16 January 2020 – 17 Feb 2020

Work completed this reporting period:

-Gathering data from STR.

-Understood the data and classified the fields to work upon.

- Initial step of descriptive analysis explaining the tourist nationality traffic performed.

-Formation of second formal document (The Project Interim Report).

-Found the objective and direction for the analysis and its outcome.

Work to complete next reporting period:

-Performing predictive and prescriptive analysis.

- Discussion about the outcome of our analysis.

-Working on the preliminary team report.

-Seminar from STR.

What's going well and why:

- Every week meets.

- Team spirit.

What's not going well and why:

-Confusions in defining the project scope.

Suggestions/Issues:

-Null

Project changes:

-Change of the scope from tourism in Galway to tourism overall Ireland.

Performance Report Version 3

Date (26/03/2020)

Project Name: Group 26

Reporting Period: 18 Feb 2020 – 26 March 2020

Work completed this reporting period:

-Formulating the Data description from STR and sent emails to Hotel Federation and ESRI regarding data requirements.

- Researches for Data validations.

- Conceptualize potential possible predictive analysis.

-Formation & editing of second formal document (The Project Interim Report).

- A descriptive visualization-based study on the number of overseas trips to Ireland by non-residents, by quarter.

Work to complete next reporting period:

- Finding parameters for and performing predictive analysis.

- Discussion about the outcome of our analysis.

-Working on the team report remotely.

- A descriptive analysis regarding the demands and supply of the hotel rooms occupany.

- Correlations between factors like occupancy, domestic travels and the hotel revenue examined.

What's going well and why:

- Descriptive Analysis and discussion.

- Team work & spirit.

What's not going well and why:

-Confusions in a predictive analysis regarding the project scope.

Suggestions/Issues:

-Null

Project changes:

-Null

Performance Report Version 4

Date (25/03/2020)

Project Name: Group 26

Reporting Period: 28 March 2020 – 19 May 2020

Work completed this reporting period:

- Completion and editing of Preliminary report.

- A descriptive visualization based on the share of nations worldwide in Irish tourism.

- A descriptive visualization on demand of B & B accommodations exceeding the hotel ones.

Work to complete next reporting period:.

- Discussion about the outcome of our analysis.

-Working on the modifications of report remotely.

-Modifications of RACI chart and project scope reports.

- Appointment of ONTG for tasks.

To perform predictions on the revenue with the help of factors like occupancy, Hotel RevPAR and more.

What's going well and why:

- Team work.

What's not going well and why:

- Social media analytics to help in Irish tourism(Unavailability of sensible & free of cost data for analysis)

Suggestions/Issues:

-Null

Project changes:

-Null

7.8. Minutes of Meeting (all):

Meeting/Project Name:	Group 26		
Date of Meeting:	19/02/2020	**Start time:**	10:00 AM
Location:	Online	**End time:**	11:00 AM
Chair:		**Minute taker:**	Team

1. Meeting Objective(s)

- Introduction to topic and discuss on data sources
- Discuss project scope and timeline
- Update from each individual group member on their own task/areas of responsibility
- Discussion of key dates, what is expected from the next deliverable
- Questions/concerns

2. Attendance

Present			**Apologies**
Apurva Bhilare	19232284		
Helena Hoedt	12356366		
Namrata Desai	19230216		
Rishi Mukherjee	19230172		

3. Agenda, Decisions, Issues

Topic/ Discussion notes	**Discussion led by**
• How is data from UK segmented and from which part the travellers come? • How Brexit will affect tourism • How currency exchange rate will impact umber or travellers • Research on Irelands GDP and GNP trends and how the tourism industry in affected by it or vice versa • How prices of accommodation change over season and how these changes affect bookings • Validity of the data obtained from CSO	Team

4. Action Items

Action	**Responsible**	
Obtain additional data from below sources: a. ESRI b. Airlines data c. Hotel Federation d. Tourism data prior to 2012	Team	
Submit the skills matrix	Helena	
Get more categorized data related to non-resident travelers visits	Team	
Make sure to include terms and definition of data in the final report	Team	

Meeting/Project Name:	Group 26		
Date of Meeting:	20/03/2020	**Start time:**	10:00 AM
Location:	Online	**End time:**	10:35 AM
Chair:		**Minute taker:**	Helena

1. Meeting Objective(s)

- Feedback on interim progress report
- Discussion on referencing and plagiarism
- How things have changed – advice on how to operate remotely
- Updates to project scope – should we maybe consider the impact the current situation will have on the tourism industry?
- Discussion of key dates, what is expected from the next deliverable
- ·Questions/concerns

2. Attendance

Present			**Apologies**
Apurva Bhilare	19232284		
Helena Hoedt	12356366		
Namrata Desai	19230216		
Rishi Mukherjee	19230172		Mic was not working.

3. Agenda, Decisions, Issues

Topic/ Discussion notes	**Discussion led by**
• Inventory of Datasets. • Classify importance of the fields and choose from what we have amongst the datasets. • Define terms , measures we used in the report. • Discussed on tools to facilitate and make most of the online meetings • Discussed expected recommendation in terms of current situation. • Discussed on modified and more focused project plan	Team

4. Action Items

Action	**Responsible**	**Due Date**
Decide on what tools to use going forward and timeline	Team	20/03/2020
Allocate work due for next deliverable	Helena	23/03/2020
Examine dataset and decide on key aspects for analysis	Helena	30/03/2020
Explore dataset further using tableau to see any trends through visualisation	Namrata	30/03/2020

Meeting/Project Name:	Group 26		
Date of Meeting:	19/05/2020	**Start time:**	11:00 AM
Location:	Online	**End time:**	12:30 AM
Chair:		**Minute taker:**	Namrata

1. Meeting Objective(s)

- Walk through of the preliminary report/Feedback on preliminary report
- Review items discussed during last call/Progress made since the last call
- Update from each individual group member on their own task/areas of responsibility
- Discussion of key dates, what is expected from the next deliverable
- Questions/concerns

2. Attendance

Present			**Apologies**
Apurva Bhilare	19232284		
Helena Hoedt	12356366		
Namrata Desai	19230216		
Rishi Mukherjee	19230172		Mic was not working.

3. Agenda, Decisions, Issues

Topic/ Discussion notes	**Discussion led by**
• Current scope of the project and if we will be changing/updating it as per new inputs. • How airlines stock prices and currency exchange rates will affect tourism • Making predictions which will be of historical time • Consider impact of Airbnb on hotel revenue • Using data analytics lifecycle model for our project • Research on incorporation of sentiment analysis of social media and its impact on tourism in the project • More focus of the value and USP of data rather than its quantity Feedback of Preliminary report: • Provide proper references to images and any other data claims • Provide necessary descriptions of any models used and their relevance to our project • Provide data sources for visualizations • Only use dated reference sources • Include task performed by every team member in a matrix in the appendix of report	Team

4. Action Items

Action	**Responsible**	
Reforming RACI chart. Appoint ONTG for each section	Namrata	
Identifying critical success factors for project	Team	
Focus on the minimum criteria of the value delivered by data	Team	
Construct a tentative timeline	Team	
Improve the description of methodology of the project and further describe which tools and techniques are used and why (possibly in a matrix)	Namrata	
Keep a tab on how we are updating our preliminary report through stages of project	Helena	

Meeting/Project Name:	Group 26		
Date of Meeting:	26/06/2020	**Start time:**	10:00 AM
Location:	Online	**End time:**	11:27 AM
Chair:		**Minute taker:**	Namrata

1. Meeting Objective(s)

- Discussion on relationship between initial project proposal and draft report
- Discuss the consolidated meeting minutes and progress through each task
- Feedback on draft of the final report
- Discuss what is missing from the draft
- Discussion on how group members feel the project progressed and what we learned

2. Attendance

Present			**Apologies**
Apurva Bhilare	19232284		
Helena Hoedt	12356366		
Namrata Desai	19230216		
Rishi Mukherjee	19230172		Mic was not working.

3. Agenda, Decisions, Issues

Topic/ Discussion notes	**Discussion led by**
• Supporting documents and sections of report missing • Clarify terms used in text, explain certain aspects in more detail • Describe why certain tools were used and their advatages/disadvantages, in addittion to why not all described in proposal were used • Discuss limitations to the analysis and recommend further study to be done • Review all visualisations and graphics and make a selective choice based on value offered to the project • Incorporate tables to show predictions – describe the model in detail • Explain why certain types of analysis were carried out and discuss the value they bring • Discuss the effects of each variable examined • Review all referencing throughout in order not to give marks away	Team

4. Action Items

Action	**Responsible**	
Include all supporting documents in appendix	Helena	
Discuss limitations	Rishi	
Review visualizations and graphics	Namrata	
Describe model	Apurva	
Review references	Apurva	
Define the value of the analysis	Helena	

7.9. Project Timeline:

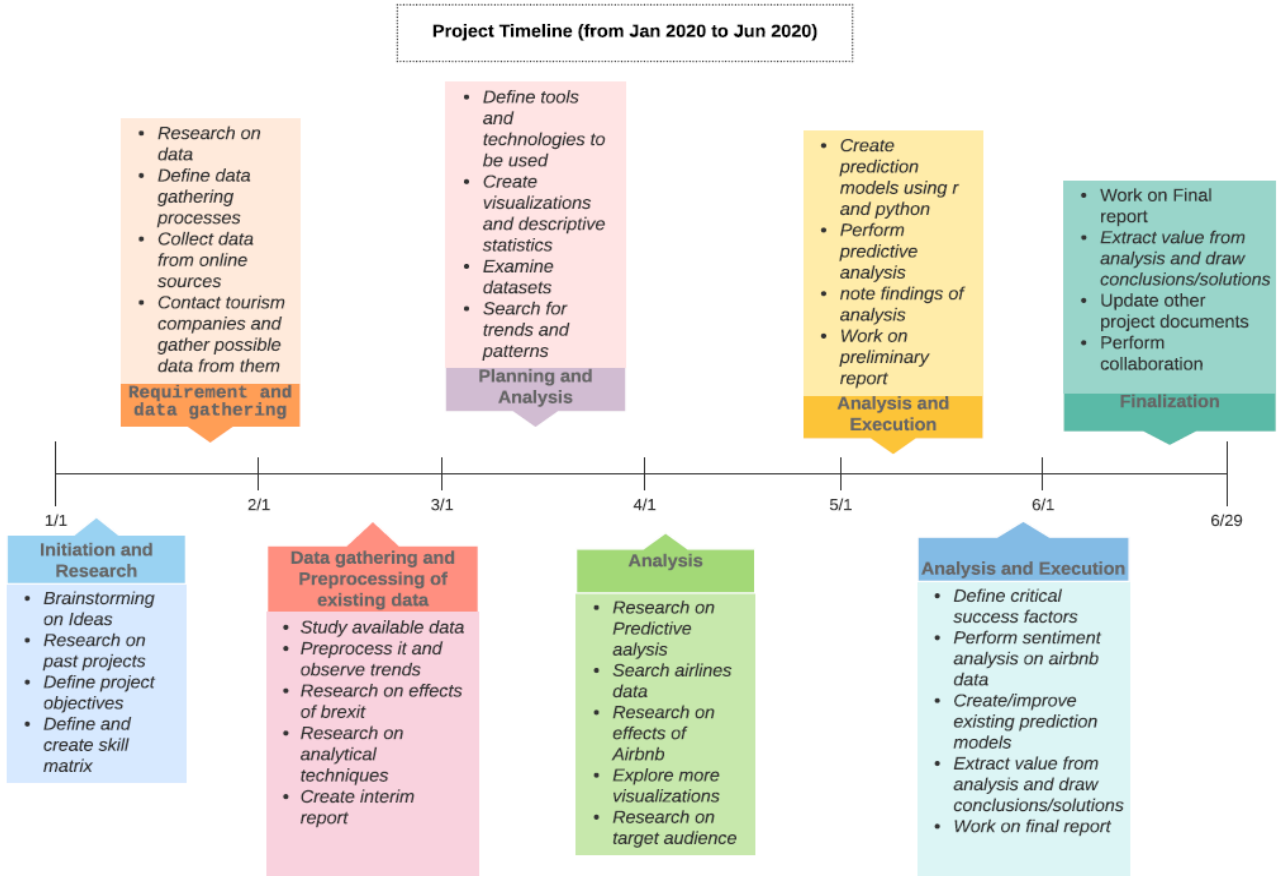

Figure 32: Timeline

7.10.WBS:

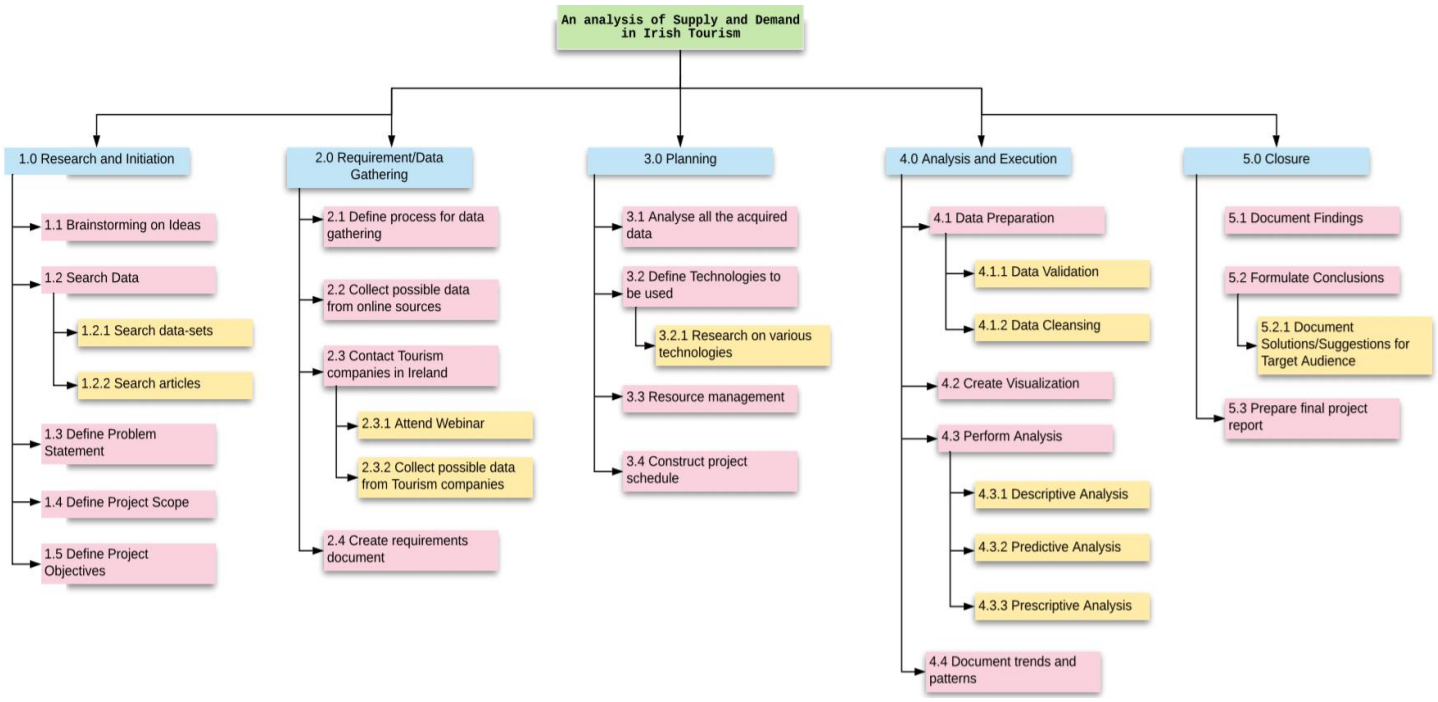

Figure 33: WBS

7.11. Lessons Learned:

1. Working remotely

   Due to the incident of Covid-19 in Ireland and the resulting lockdown, large adjustments had to be made in the manner in which we worked as a group. Instead of the regular face-to-face meetings, we had to learn to communicate and work remotely. This did prove difficult initially as although only one ONTG could be appointed per task, we found that working in pairs on tasks worked to our advantage previously, as generally two heads are better than one. Reviewing this challenge, however, we feel that learning to work in this manner will stand to us in the coming years in our careers, as it is common to be asked to work remotely, if only partly. It also immensely improved our communication skills as reviews of tasks completed needed to be very clear as to not cause remote confusion.

2. Data gathering

   The project topic, due to its importance in the Irish economy, has been examined carefully and thoroughly for trends and patterns previously by several different bodies such as CSO. Our task was to gather a variety of data from different resources and consolidate and analyze it in a way that it would provide new and meaningful analysis to the industry. The trouble that we faced was finding data to consolidate along a consistent timeline that could be logically measured against each other.

   We obtained data mainly from STR and CSO in a given time frame from 2012-2018. While any predictions we were able to make were also for 2019, which is in the past. We found that being able to compare predicted and actual helped us in a meaningful way to see how accurate the predictions were. We did have concerns over the amount of data gathered compared to previous projects where big data sets were analyzed. However we were able to find highly valid data that was specific to our project and so this concern was eradicated. In reviewing the project changes that could have been made to this stage would be to contact private companies at an earlier stage to find industry data that was not publicly available and had not been previously analyzed. Finding meaningful information from previously analyzed data proved a challenge but we believed that we were successful in doing so.

3. Understanding limitations

   Initially we believed that we would be able to carry out descriptive, predictive and prescriptive analysis on the Irish tourism industry in a way that could incentivize the industry to adopt new technologies such as blockchain in order to improve the industry. However, it became clear throughout the project that not enough data was available on these technologies in order to carry out a meaningful prescriptive analysis.

In reviewing the project objectives initially maybe we could have been more realistic in our overall objectives based on the data that was available to us.

4. Scope development

   When developing your own project, it is difficult to predict what changes will occur to the scope based on limitations of the data available. As can be seen in our scope management plan, there were any adjustment to the scope of the project due to data being unavailable, out of budget, or insufficient to finding meaningful analysis. However, upon review of the project this has allowed us to make recommendations for future research given a larger budget and more resources.

5. Last mile steps

   While gathering report requirements and performing the actual analysis were key parts of the project, the last mile steps where you must explain the relevance of your findings became prominent as we carried on the analysis. Being able to connect facts and figures to real-world scenarios is a key area of business analytics that we feel that we developed and that will stand to us in our future careers.

6. Onboarding feedback

   As stated previously, two heads are generally better than one. In this same way, a set of fresh eyes can help move a project forward immensely, as long as the feedback is taken aboard. Our supervisor offered us points to consider that we had not, and it did take time to adjust to noticing these areas. However, we do feel that we benefitted immensely from his view on the work and improvements that needed to be made, and we thank him immensely for his input at each stage.

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