



Final Project-4

PROJECT 8

ABC Call Volume Trend Analysis



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Project Description: This Project “**ABC Call Volume Trend Analysis**” is about the world of Customer Experience (CX) analytics, specifically focusing on the inbound calling team of a company.

Inbound calling team/customer support, which is the focus of this project, involves handling incoming calls from existing or prospective customers. The goal is to attract, engage, and delight customers, turning them into loyal advocates for the business.

Business Problem: Advertising is a crucial aspect of any business. It helps increase sales and makes the audience aware of the company's products or services. The first impressions of a business are often formed through its advertising efforts.

The advertising business is highly competitive, with many players bidding large amounts of money to target the same audience segment. This is where the company's analytical skills come into play. The goal is to identify those media platforms that can convert audiences into customers at a low cost.

Tech Stack Used:

- **Microsoft Excel Version 2407, 2019** – Excel is a spreadsheet editor developed by Microsoft. It features calculation or computation capabilities, graphing tools, pivot tables etc.

Dataset Overview: The dataset contains information about the inbound calls received by a company named ABC, which operates in the insurance sector. Below is the link of the dataset provided

<https://docs.google.com/spreadsheets/d/1aE90aHBpkW0oO1qE-wqKVfa2pDGWovWq/edit?usp=sharing&oid=104821401726051422014&rtpof=true&sd=true>

The dataset after analysis with answers, insights and visualization is,

https://docs.google.com/spreadsheets/d/1mbB-h4G9_agHrHbUMEaP2n7yCHSKjns/edit?usp=sharing&oid=108154584635151678812&rtpof=true&sd=true

The dataset contains,

- **Total data points/observations: 1,17,989**
- **Attributes/Columns: 13**

Column names:

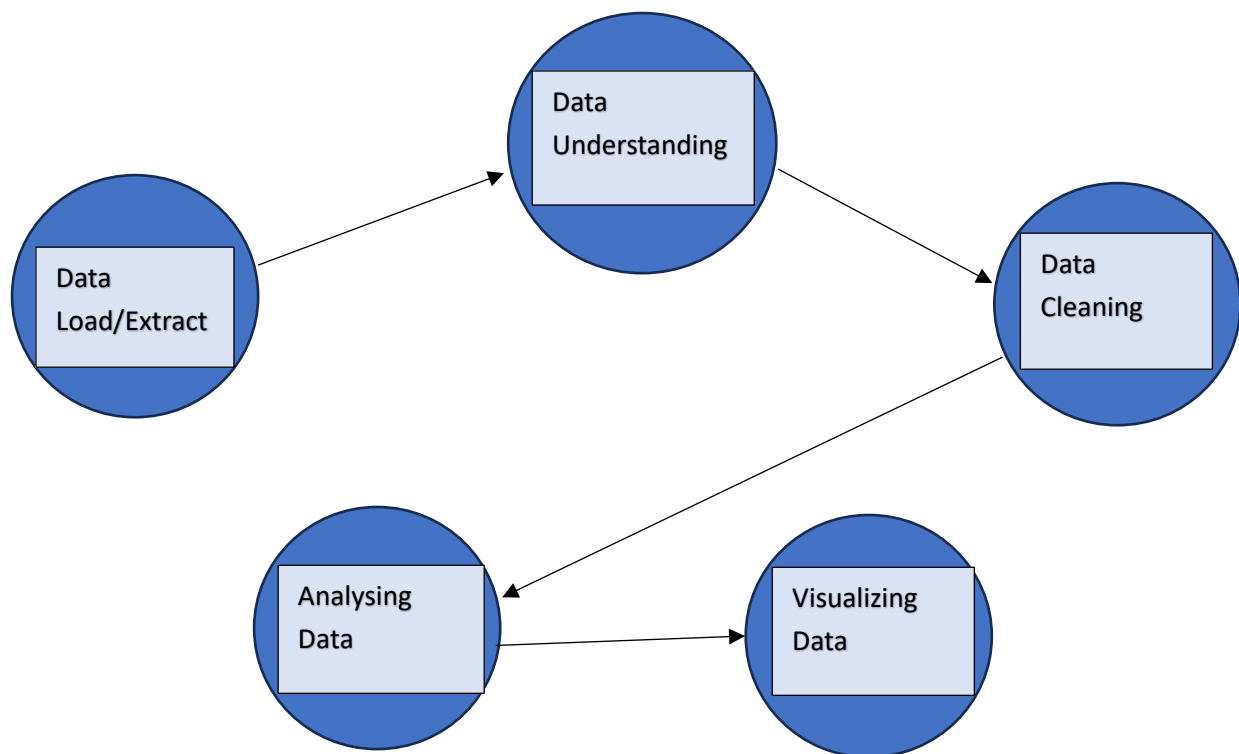
1. **Agent_Name:** Name of the Agent receiving the call.
2. **Agent_ID:** ID number of the Agent receiving the call.
3. **Customer_Phone_No:** Phone number of the customer (encrypted for security reasons).
4. **Queue_Time(Secs):** Waiting time before receiving the call.
5. **Date_&_Time:** Date on which the call was made.
6. **Time:** Hour of the day in which the call was made (24-hour format)
7. **Time_Bucket:** The hourly time bucket in which the call was made.
8. **Duration(hh:mm:ss):** Duration of the call in time format.
9. **Call_Seconds (s):** Duration of the call in seconds.
10. **Call_Status:** Whether the call was answered or transferred or abandoned.
11. **Wrapped_By:** Whether the call was disconnected by the agent or it was automatically disconnected.
12. **Ringin:** Whether the system gave a ring when the call was made.
13. **IVR_Duration:** Duration of Interactive Voice Response in hh:mm:ss format.

NOTE: The dataset consists data that spans 23 days.

Assumptions: An agent works for 6 days a week; On average, each agent takes 4 unplanned leaves per month; An agent's total working hours are 9 hours, out of which 1.5 hours are spent on lunch and snacks in the office. On average, an agent spends 60% of their total actual working hours (i.e., 60% of 7.5 hours) on calls with customers/users. The total number of days in a month is 30

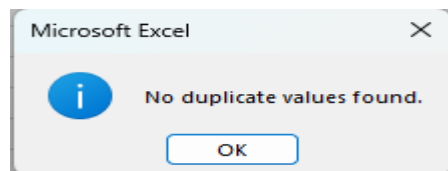
Approach:

- **Data Loading/Extraction:** Loading Datasets needed for the analysis
- **Data Understanding:** Comprehending the structure, context and content
- **Data Cleaning:** Identifying and rectifying errors, inconsistencies and missing values
- **Analysing:** Perform various analysis to derive insights
- **Visualization:** Representing data through graphs, charts and plots.



After downloading the data set, we need to pre-process and clean (Data Clean) it, this is one of the most important steps to perform before performing analysis.

1. **Handling Duplicate Values:** I have used '**DATA**' tabs, *Remove Duplicates* option on entire column range to look for a duplicate. **No duplicates are found.**



2. **Handling Missing Data and Abnormal Data:** We need to check if there are any missing values/blanks in the dataset along with Abnormal data. Let's list down the count of blanks and abnormal data if any for each column.

1. Duplicate Rows - None
2. Handling missing data and abnormal data

Column Name	Abnormal Value	Count of Abnormal Value
Agent_Name	#N/A	34198
Agent_ID	#N/A	34198
Customer_Phone_No	If > or < 10 digits	1

We see that we have N/A in the Agent Name and Agent ID Columns. These N/A's values are for the calls which were Abandon. Since the calls were abandon & had no call duration, hence they were not transferred to any agent and hence they do not have any Agent ID or Agent Name.

Column Name	Count of NULL values
Queue_Time(Secs)	0
Date_&_Time	0
Time	0
Time_Bucket	0
Duration(hh:mm:ss)	0
Call_Seconds (s)	0
IVR_Duration	0
Call_Status	0
Wrapped_By	47877
Ringing	0
Agent_Name	0
Agent_ID	0
Customer_Phone_No	0

Wrapped_By column has 47,877 blanks

- Most of the null values were for “abandon” Call_Status with #N/A value for Agent_Name and Agent_ID – So let’s fill null values with “Not Available” and replace #N/A in Agent_Name and Agent_ID with “Not Available”.
- If Wrapped_By column has “answered” and “transfer” Call_Status and valid Agent_Name and Agent_ID, let’s fill the blanks with “Agent”, which is the mode.

Customer_Phone_No with less than 10 numbers is filled with Xs to make it 10.

117989	Not Available	Not Available	XXXXX	120	20-01-2022	10:00:10_11	00:00:00	0.00	abandon	Not Available	YES	00:00:15
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3. **Outlier Detection:** Let's plot a box and whisker plot for each numerical variable to spot outliers.

Numerical Variable

1. Queue_Time(Secs) – No Outlier Present
2. Date_&_Time – No Outlier Present
3. Time – No Outlier Present
4. Duration(hh:mm:ss) – Outlier Present – Retaining them as they might be genuine and doesn’t seem like a mistake as it completely depends on the nature of issue and customer satisfaction.
5. Call_Seconds (s) – Outlier Present - Retaining them as they might be genuine and doesn’t seem like a mistake.
6. IVR_Duration – Outlier Present - Retaining them as the outlier values are possible in case customer doesn’t hangs up.

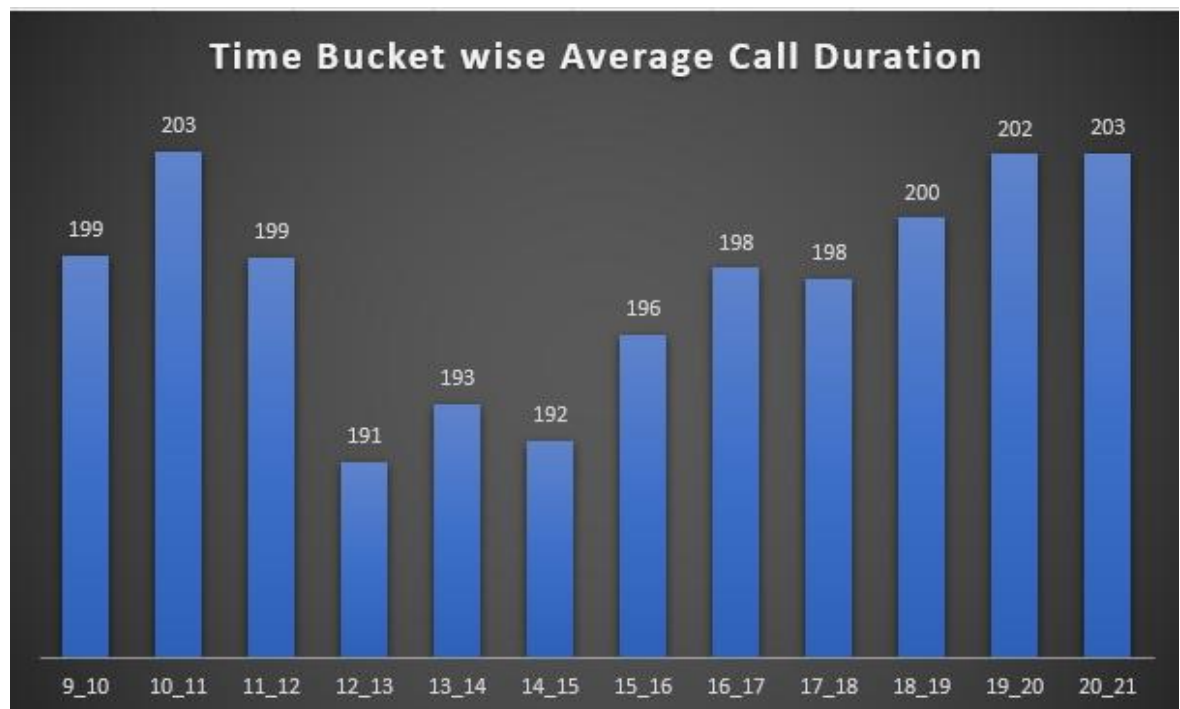
Data Analytics Tasks:

1. **Average Call Duration:** Determine the average duration of all incoming calls received by agents. This should be calculated for each time bucket.
Your Task: What is the average duration of calls for each time bucket?

Output:

Call_Status (Multiple Items)	
Row Labels	Average of Call_Seconds (s)
9_10	199
10_11	203
11_12	199
12_13	191
13_14	193
14_15	192
15_16	196
16_17	198
17_18	198
18_19	200
19_20	202
20_21	203
Grand Total	197

Visual Representation:



Insight: From above pivot table and column chart, which is filtered based on “answered” and “transferred” Call_Status as the task is asking to, Determine the average duration of all incoming calls received by agents. Few of the insights derived are as below,

- The average call duration is highest during the time bucket of 10 am to 11 am and 8 pm to 9 pm.
- The average call duration is lowest during the time bucket of 12 pm to 1 pm.
- **Total average call duration of entire day, i.e., 9 am to 9 pm is 197 seconds.**
- 12 pm to 3 pm (Afternoon) have least amount of average call duration.
- These above insights can help us to allocated man power rightfully.

TASK 1	Average Call Duration	Highest	Lowest
		203 seconds	191 seconds
	Time Bucket	10 am to 11 am & 8 pm to 9 pm	12 pm to 1 pm

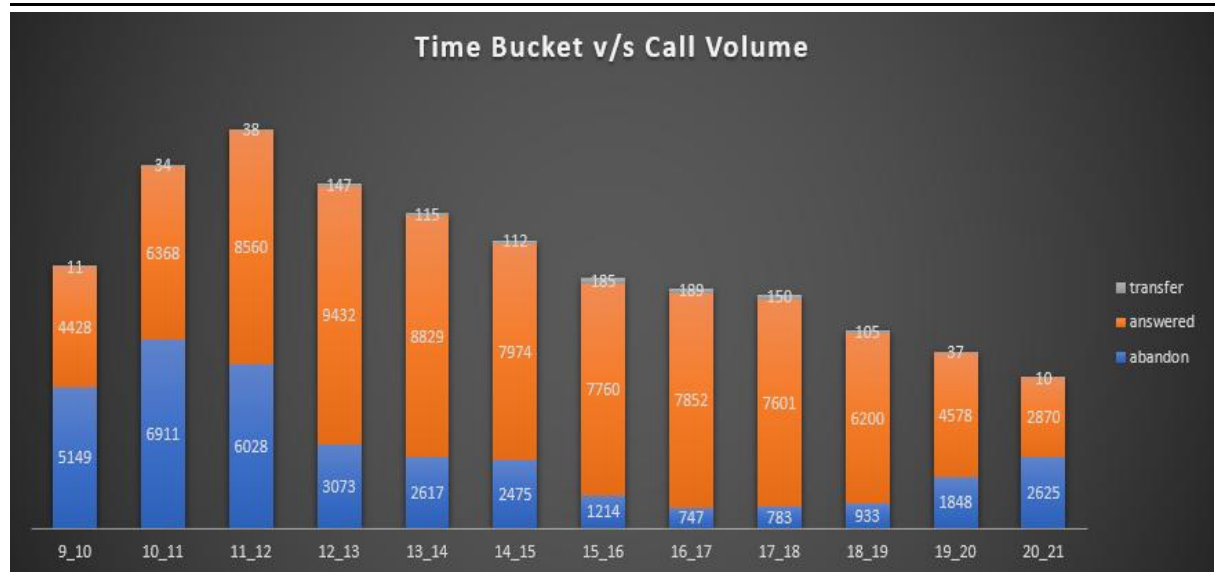
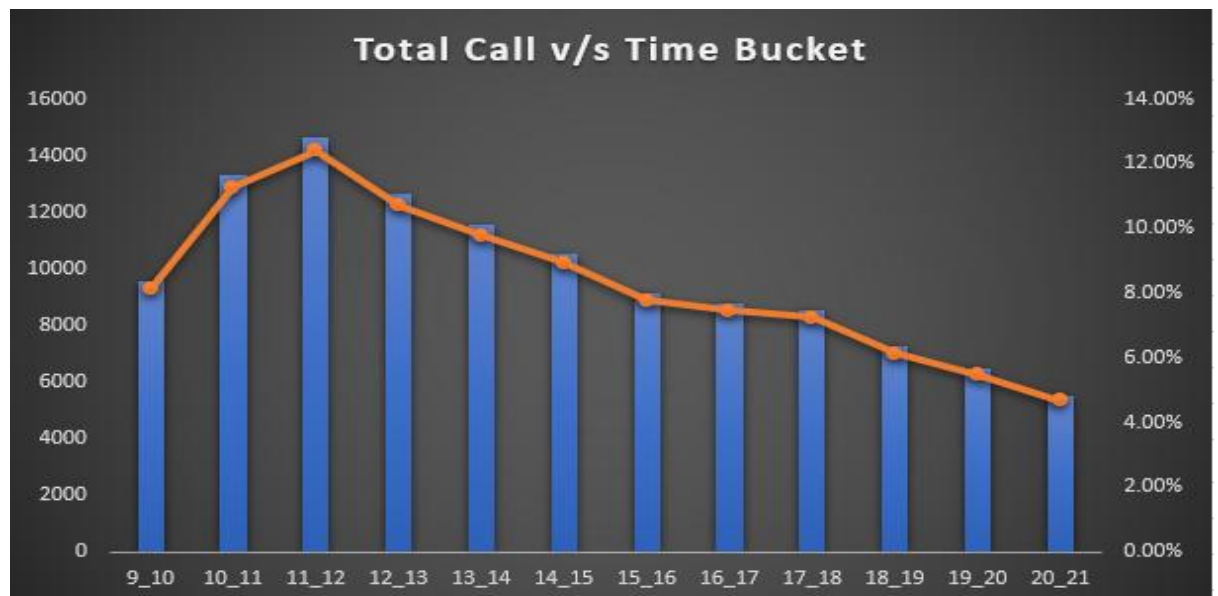
2. **Call Volume Analysis:** Visualize the total number of calls received. This should be represented as a graph or chart showing the number of calls against time. Time should be represented in buckets (e.g., 1-2, 2-3, etc.).
Your Task: Can you create a chart or graph that shows the number of calls received in each time bucket?

Output:

Row Labels	Count of Call_Status	Percentage of Total Call_Status
9_10	9588	8.13%
10_11	13313	11.28%
11_12	14626	12.40%
12_13	12652	10.72%
13_14	11561	9.80%
14_15	10561	8.95%
15_16	9159	7.76%
16_17	8788	7.45%
17_18	8534	7.23%
18_19	7238	6.13%
19_20	6463	5.48%
20_21	5505	4.67%
Grand Total	117988	100.00%

Count of Call_Status	Column Labels			
Row Labels	abandon	answered	transfer	Grand Total
9_10	5149	4428	11	9588
10_11	6911	6368	34	13313
11_12	6028	8560	38	14626
12_13	3073	9432	147	12652
13_14	2617	8829	115	11561
14_15	2475	7974	112	10561
15_16	1214	7760	185	9159
16_17	747	7852	189	8788
17_18	783	7601	150	8534
18_19	933	6200	105	7238
19_20	1848	4578	37	6463
20_21	2625	2870	10	5505
Grand Total	34403	82452	1133	117988

Visual Representation:



Insight: Calls received can either be answered, transferred or abandoned. The above pivot table and stacked chart shows distribution of various call status for each time bucket. Few of the insights derived are as below,

- The **highest number of calls are answered** during the time bucket of 12 pm to 1 pm.
- The **lowest number of calls are answered** during the time bucket of 8 pm to 9 pm.
- The **highest number of calls are abandoned** during the time bucket of 10 am to 11 am.
- The **lowest number of calls are abandoned** during the time bucket of 4 pm to 7 pm.
- The **highest number of calls are transferred** during the time bucket of 3 pm to 5 pm.
- The **lowest number of calls are transferred** during the time bucket of 9-10 am (beginning of the shift/day) am and 8-9 pm (end of the shift/day).
- The **overall incoming calls is highest** during time bucket of 11 am to 12 pm and **least during** the time bucket of 8 pm to 9 pm.
- Morning hours show highest number of abandoned calls, which needs to be taken care of.

TASK 2	Call Volume Analysis	Highest Call Numbers	Lowest Calls Numbers
		14626	5505
	Time Bucket	11 am to 12 am	8 pm to 9 pm
	Calls Abandoned Time Bucket	10 am to 11 am	4 pm to 5 pm
	Calls Aswered Time Bucket	12 pm to 1 pm	8 pm to 9 pm
	Calls Transfer Time Bucket	4 pm to 5 pm	8 pm to 9 pm

3. **Manpower Planning:** The current rate of abandoned calls is approximately 30%. Propose a plan for manpower allocation during each time bucket (from 9 am to 9 pm) to reduce the abandon rate to 10%. In other words, you need to calculate the minimum number of agents required in each time bucket to ensure that at least 90 out of 100 calls are answered.
Your Task: What is the minimum number of agents required in each time bucket to reduce the abandon rate to 10%?

Output:

Assumptions:				
Work Hours :	9			
Break :	1.5			
Actual Working Hours :	7.5			
Time Spent on call with Customers :	60% of 7.5 hrs	4.5	60%*7.5	
Total Working Seconds :	16200		60%*7.5*60*60	
Days in a month :	30			
Working Days in a week :	6			
Unplanned Leaves:	4			
Average Call Duration by Agent :	197			Refer Task 1 Pivot Table
Calls attended by agent in a day :	82			Total Working Seconds (16200)/197
Calls attended by agent in an hour :	18			82/4.5
We have data of:	23 days			

23 Days Call Status:

The data provided is of 23 days(from 1st Jan 2022 to 23rd Jan 2022)				
Count of Call_Status	Column Labels			
Row Labels	abandon	answered	transfer	Grand Total
9_10	5149	4428	11	9588
10_11	6911	6368	34	13313
11_12	6028	8560	38	14626
12_13	3073	9432	147	12652
13_14	2617	8829	115	11561
14_15	2475	7974	112	10561
15_16	1214	7760	185	9159
16_17	747	7852	189	8788
17_18	783	7601	150	8534
18_19	933	6200	105	7238
19_20	1848	4578	37	6463
20_21	2625	2870	10	5505
Grand Total	34403	82452	1133	117988
% of Call Status	29.16%	69.88%	0.96%	100.00%

Per Day Call Status:

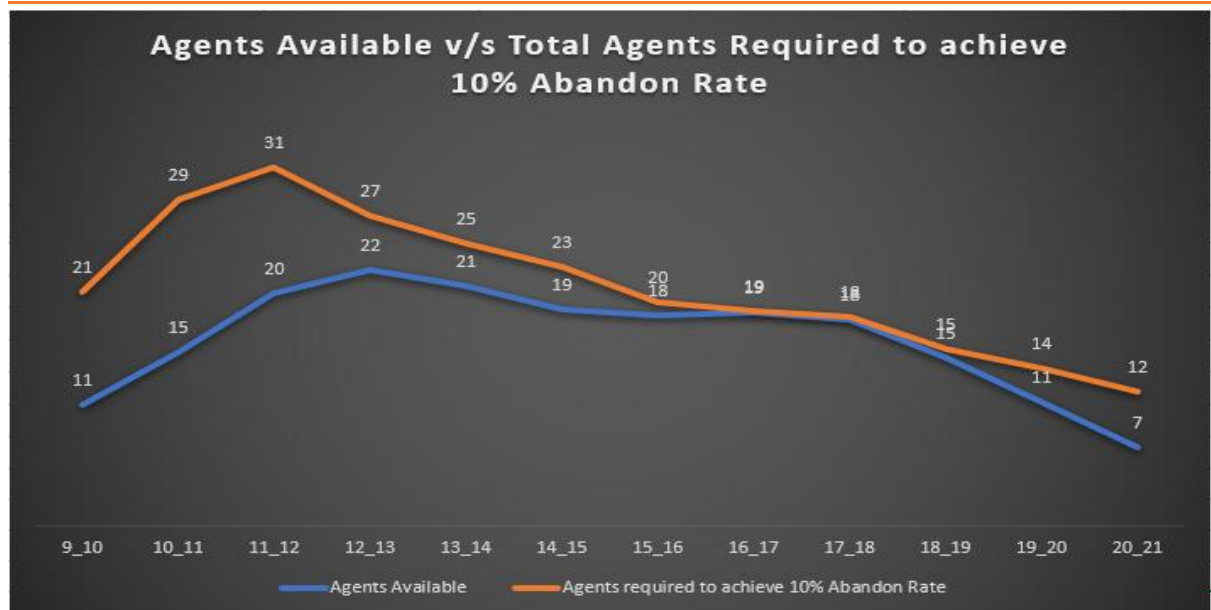
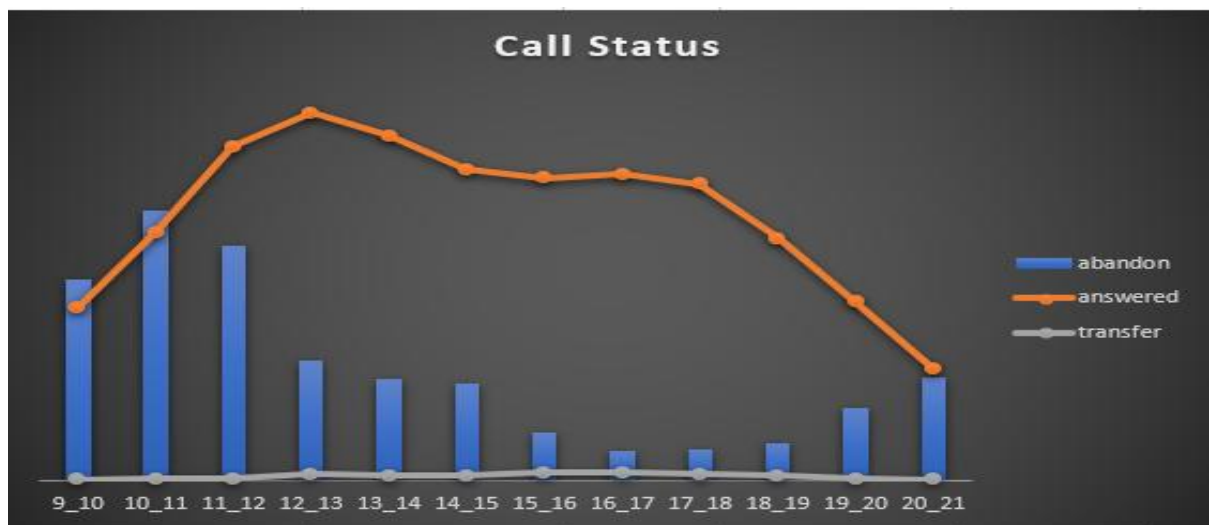
Time Bucket	Call Status for 1 day			Grand Total
	calls abandon per day	calls answered per day	calls transfer per day	
9_10	224	193	0	417
10_11	300	277	1	579
11_12	262	372	2	636
12_13	134	410	6	550
13_14	114	384	5	503
14_15	108	347	5	459
15_16	53	337	8	398
16_17	32	341	8	382
17_18	34	330	7	371
18_19	41	270	5	315
19_20	80	199	2	281
20_21	114	125	0	239
	1496	3585	49	5130

Call Status % for 1 day		
% of calls abandon per day	% of calls answered per day	% of calls transfer per day
54%	46%	0%
52%	48%	0%
41%	59%	0%
24%	75%	1%
23%	76%	1%
23%	76%	1%
13%	85%	2%
9%	89%	2%
9%	89%	2%
13%	86%	1%
29%	71%	1%
48%	52%	0%
29%	70%	1%

Our Task of finding minimum number of agents required in each time bucket to reduce the abandon rate to 10%

OUR TASK		Agents Required		Minimum Agents required
abandon to 10%	answered to 90%	Agents Available	to achieve 90%	to reduce the abandon rate to 10%
42	375	11	21	10
58	521	15	29	13
64	572	20	31	11
55	495	22	27	5
50	452	21	25	4
46	413	19	23	4
40	358	18	20	1
38	344	19	19	0
37	334	18	18	0
31	283	15	15	1
28	253	11	14	3
24	215	7	12	5
513	4617	196	253	56

Visual Representation:



Insight: Calls received can either be answered, transferred or abandoned. The above pivot table and charts shows distribution of various call status and their percentages for each time bucket. Our goal is to minimum number of agents required in each time bucket to reduce the abandon rate to 10% or increase answered rate to 90%. Few of the insights derived are as below,

- The **highest number of agents/manpower to answer the calls are required** during the time bucket of 9 am to 12 pm due to high call volume and high abandon rate.
- 4 pm to 6 pm time bucket doesn't require any extra agent allocation as the **lowest number of calls are abandoned** during this time period.
- **56 extra agents** are required to reduce the abandon rate to 10%.

Day Manpower Planning		Initial	Our Goal
	Initial Abandon Rate	30%	10%
	Initial Answered Rate	70%	90%
		Available	Additional Requirement
	Man Power/Agents	196	56
	Additional Agents Required	Highest Additional Agents	Least/No additional Agents
	Time Bucket	9 am to 12 pm	4 pm to 6 pm

4. **Night Shift Manpower Planning:** Customers also call ABC Insurance Company at night but don't get an answer because there are no agents available. This creates a poor customer experience. Assume that for every 100 calls that customers make between 9 am and 9 pm, they also make 30 calls at night between 9 pm and 9 am. The distribution of these 30 calls is as follows:
Your Task: Propose a manpower plan for each time bucket throughout the day, keeping the maximum abandon rate at 10%.

Distribution of 30 calls coming in night for every 100 calls coming in between 9am - 9pm (i.e. 12 hrs slot)											
9pm-10pm	10pm-11pm	11pm-12am	12am-1am	1am-2am	2am-3am	3am-4am	4am-5am	5am-6am	6am-7am	7am-8am	8am-9am
3	3	2	2	1	1	1	1	3	4	4	5

Output:

The data provided is of 23 days(from 1st Jan 2022 to 23rd Jan 2022)			
NIGHT SHIFT MANPOWER			
Assumptions:			
Work Hours :	9		
Break :	1.5		
Actual Working Hours :	7.5		
Time Spent on call with Customers :	60% of 7.5 hrs	4.5	
Total Working Seconds :	16200		
Days in a month :	30		
Working Days in a week :	6		
Unplanned Leaves :	4		
Average Call Duration by Agent :	197		
Calls attended by agent in a day :	82		
Calls attended by agent in an hour :	18		
We have data of:	23 days		
Total agents required per day to achieve answered rate of 90%	56		
Call volume daily from 9 am to 9 pm at 10% abandon rate	4617		
Night call volume is 30% of day volume	1385		
Call duration for 1385 calls in hours	76	total night calls * (avg call duration/3600)	
Additional Agents Required for Night Shift	17	Call duration for 1385 calls in hours/4.5	
Total additional agents for day shift and night shift	73	day shift agents+ night shift agents	

Call_Status	(Multiple Items)
Row Labels	Average of Call_Seconds (s)
9_10	199
10_11	203
11_12	199
12_13	191
13_14	193
14_15	192
15_16	196
16_17	198
17_18	198
18_19	200
19_20	202
20_21	203
Grand Total	197

Night Time Bucket	30 Night Call Distribution	Total Night Call Distribution	Night Call Duration
9pm_10pm	3	139	8
10pm_11pm	3	139	8
11pm_12am	2	92	5
12am_1am	2	92	5
1am_2am	1	46	3
2am_3am	1	46	3
3am_4am	1	46	3
4am_5am	1	46	3
5am_6am	3	139	8
6am_7am	4	185	10
7am_8am	4	185	10
8am_9am	5	231	13
	30	1385	76

To achieve 10% abandon rate		
Additional Agents Required for Night	Additional Agents Required for Day	Day Time Bucket
2	10	9_10
2	13	10_11
1	11	11_12
1	5	12_13
1	4	13_14
1	4	14_15
1	1	15_16
1	0	16_17
2	0	17_18
2	0	18_19
2	3	19_20
3	5	20_21
17	56	
Total Additional Agents :		73

Visual Representation:



Insight: From above pivot tables, calculations and charts few of the insights derived are as below,

- Total 4617 calls are answered in day shift. Therefore, 30% of it, 1385 calls are answered in night shift.
- The **highest number of agents/manpower to answer the calls during night are required** during the time bucket of 8 am to 9 am.
- 1 am to 5 am time bucket has the **lowest number of calls and gradually starts increasing after that.**
- **17 extra agents** are required to reduce the abandon rate to 10% in Night Shift and 56 in day shift. Total being 73.

Night Shift Manpower Planning		Initial	Our Goal
	Initial Abandon Rate	30%	10%
	Initial Answered Rate	70%	90%
		Day Shift	Night Shift
	Relationship	100 calls	30 calls
	Additional Agents Required	56	17
	Additional Agents Required for Night Shift	Highest Additional Agents	Least/No additional Agents
	Time Bucket	8 am to 9 am	1 am to 5 am
	Total Additional Agents	73	

Insights:

a) Key Insights:

TASK 1	Average Call Duration	Highest	Lowest
		203 seconds	191 seconds
	Time Bucket	10 am to 11 am & 8 pm to 9 pm	12 pm to 1 pm
TASK 2	Call Volume Analysis	Highest Call Numbers	Lowest Calls Numbers
		14626	5505
	Time Bucket	11 am to 12 am	8 pm to 9 pm
	Calls Abandoned Time Bucket	10 am to 11 am	4 pm to 5 pm
	Calls Answered Time Bucket	12 pm to 1 pm	8 pm to 9 pm
	Calls Transfer Time Bucket	4 pm to 5 pm	8 pm to 9 pm
Day Shift Manpower Planning		Initial	Our Goal
	Initial Abandon Rate	30%	10%
	Initial Answered Rate	70%	90%
		Available	Additional Requirement
	Man Power/Agents	196	56
	Additional Agents Required	Highest Additional Agents	Least/No additional Agents
	Time Bucket	9 am to 12 pm	4 pm to 6 pm
Night Shift Manpower Planning		Initial	Our Goal
	Initial Abandon Rate	30%	10%
	Initial Answered Rate	70%	90%
		Day Shift	Night Shift
	Relationship	100 calls	30 calls
	Additional Agents Required	56	17
	Additional Agents Required for Night Shift	Highest Additional Agents	Least/No additional Agents
	Time Bucket	8 am to 9 am	1 am to 5 am
	Total Additional Agents	73	

b) Relevance to Business Problem:

These insights directly address the business problem by providing actionable information on the trends in the call volume of the CX

- c) Recommendations:** The **call Abandon rate by the agents at the start and towards the end of the shift is very high**. The management must have a strong look if the reason for such high number of calls being abandoned is because of the agents not being monitored properly towards the start and end of the shift or reasons such as team meetings towards the start and end of the day.

If the reason is team meeting, then meetings should be conducted during afternoon hours between 4 pm to 6 pm where in the call abandon rate is below 10%.

Count of Call_Status	Column Labels
Row Labels	abandon
9_10	5149
10_11	6911
11_12	6028
12_13	3073
13_14	2617
14_15	2475
15_16	1214
16_17	747
17_18	783
18_19	933
19_20	1848
20_21	2625
Grand Total	34403

Result:

- The call volume analysis reveals the trends and pattern across the various time buckets. Notable peaks were observed in specific time, indicating periods of **higher customer engagement or service demand**
- There is a clear timing pattern, with call volumes peaking during 11 am to 12 pm. This suggests a need for increased agents or resource allocation during these periods.
- By analysis we can see that abandon rate is high during beginning and end of the shifts. So, we have to motivate the agents to answer more calls.
- Based on the analysis, it is recommended to increase the manpower during peak hours, implement more efficient call handling processes and techniques.
- This project aims to utilize and allocate the resources wisely.

- a) **Visualization:** We used visualizations such as pivot tables, line charts, and bar charts to display the results obtained from the analysis. These visualizations will help stakeholders to understand the findings more effectively and facilitate decision making.
- b) **Discussion:** The insights obtained from the analysis have significant implications in understanding the trends in the call volume of the CX (**Customer Experience**) team.
- c) **Limitations or uncertainties regarding the results:** The insights obtained is based on the dataset that spans 23 days.
- d) **Future Directions:**
- The organization should consider creating 3 shifts in a day to provide 24/7 service to its customer as that enhances customer experience and can help to solve many of the problems.
 - Some morning shift support agents can start work as early as 5 am instead of 9 am.
 - The calls received during the evening are less, Therefore, the company can shift some agents to peak hours like morning and afternoon.
- e) **Conclusion:** This project, helped me in understanding the importance of **Data Analytics** in **Customer Experience Analysis** as it provided valuable insights which helps in making **Data-Driven Decisions**.

In this project I was able to get insights like distribution of call duration, number of calls, call abandon rates, how to create a manpower plan so as to decrease abandon calls or increase call answering rate during day and night etc.

Links: My excel worksheet link with different sheets for each task,

https://docs.google.com/spreadsheets/d/1mbB-h4G9_agHrHbUMEaP2n7yCHSKjns/edit?usp=sharing&oid=108154584635151678812&rtpof=true&sd=true

You can connect with me on LinkedIn account,

<https://www.linkedin.com/in/raksha-nayak-41578738/>

Video Link,

<https://go.screenpal.com/watch/cZXtQOnV7Wi>