

# ABC Call Volume Trend Analysis

---



- Samruddhi Pawar

## **Project Description:**

---

A Customer Experience (CX) team plays a crucial role in a company. They analyse customer feedback and data, derive insights from it, and share these insights with the rest of the organization. This team is responsible for a wide range of tasks, including managing customer experience programs, handling internal communications, mapping customer journeys, and managing customer data, among others.

In the current era, several AI-powered tools are being used to enhance customer experience. These include Interactive Voice Response (IVR), Robotic Process Automation (RPA), Predictive Analytics, and Intelligent Routing.

One of the key roles in a CX team is that of the customer service representative, also known as a call centre agent. These agents handle various types of support, including email, inbound, outbound, and social media support.

Inbound 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.

In this project, we will be diving into the world of Customer Experience (CX) analytics, specifically focusing on the inbound calling team of a company. We are provided with a dataset that spans 23 days and includes various details such as the agent's name and ID, the queue time (how long a customer had to wait before connecting with an agent), the time of the call, the duration of the call, and the call status (whether it was abandoned, answered, or transferred). We will be using our analytical skills to understand the trends in the call volume of the CX team and derive valuable insights from it.

## **Approach:**

---

- I have used SQL for the analysis and Tableau for visualization.
- To gain insights and find the answers, the dataset will be loaded into a spreadsheet and subjected to a number of computations.
- The initial stage in the project is to load the dataset into the spreadsheet application.
- Once loaded, the dataset must be cleaned by eliminating duplicates, nulls, and missing values.
- The insights are calculated with the help of SQL.
- Charts and other graphics are later created using specific criteria, computations, and visualizations in Tableau in accordance with the questions posed and the problem statement.
- Every inquiry has an answer, and those responses are kept on distinct spreadsheets.

## Tech-Stack used:

---

- Excel: Data manipulation, cleansing, and sorting is done with the help of Excel.
- MySQL: Interactive platform to write and execute codes to derive desired outputs.
- Tableau: Visualization tool to create graphs, charts, and interactive dashboards.

## Dataset Overview:

---

### *Source of Data:*

The dataset provides details about the calls received by various agents like call duration, date and time of the call, etc.

The Dataset details are:

- Number of Data Points: 1,17,988
- Number of Features: 13
- Column Details:
  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: Mobile number of the customer (encrypted).
  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.
  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 transferred or abandoned.
  11. Wrapped\_By: Whether the call was cut by the agent or it was automatically cut.
  12. Ringing: Whether the system gave a ring when the call was made.
  13. IVR\_Duration: Duration of Interactive Voice Response in seconds.

## Data Pre-Processing:

---

### *Handling Duplicate Values*

- Found duplicate rows on analysis. Except for the first instance, I dropped all other duplicate rows.

### *Handling Null Values*

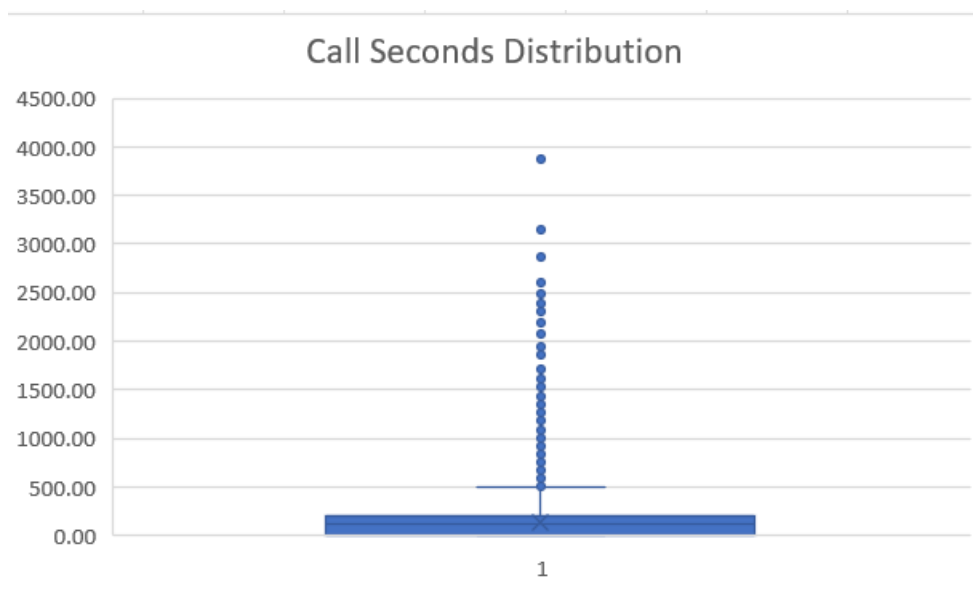
- We found that all the rows where Agent\_Name and Agent\_ID were Null are rows denoting abandoned calls.
- Some calls where Wrapped\_By was Null were answered or transferred calls. So replaced them with the value 'Agent'.
- The rest of the Null values were replaced by the value 'Not Available'.

### **Handling Errors**

- As the below process shows the Customer\_Phone\_No column had a row(s) with a 5-digit number which is an error.
- So, we checked and found one such row and replaced the column value with 'XXXXXXXXXX'.

### **Handling Outliers**

- For Outliers in the Call\_Seconds (s) Column, we plotted a box plot and considered 3000 as the threshold value for being an Outlier.
- Found 4 rows with Call\_Seconds (s) column value greater than 3000. On further investigation, I didn't find anything unusual. So, nothing was changed.



### **Handling Inconsistencies**

- While analysing Agent\_ID column values, we found some inconsistencies.
- There were some rows where Agent\_ID had a proper value but the agent didn't receive any calls. So, I changed these Agent\_ID values and Agent\_Name values to 'Not Available'.

## **Database Generation:**

---

### **A. Create Database:**

```
create database Call_data;
```

### **B. Create Table:**

This SQL code creates a table named calls\_analysis to store information about customer calls received by the company. Here's a breakdown of each part of the code:

```

create table calls_analysis
(
  Agent_Name varchar(50),
  Agent_ID varchar(50),
  Customer_Phone_No varchar(50),
  Queue_Time int,
  Data_and_Time datetime,
  Call_Time time,
  Time_Bucket varchar(50),
  Duration time,
  Call_Seconds int,
  Call_Status varchar(50),
  Wrapped_By varchar(50),
  Ringing varchar(50),
  IVR_Duration time
);

```

	Agent_Name	Agent_ID	Customer_Phone_No	Queue_Time	Data_and_Time	Call_Time
►	Executives 42	1000042	98502XXXXX	2	2022-01-01 09:02:38	09:00:00
	Executives 4	1000004	80595XXXXX	0	2022-01-01 09:02:40	09:00:00
	Executives 65	1000065	70202XXXXX	0	2022-01-01 09:02:49	09:00:00
	Executives 55	1000055	96104XXXXX	1	2022-01-01 09:02:51	09:00:00
	Executives 21	1000021	82001XXXXX	0	2022-01-01 09:02:55	09:00:00
	#N/A	#N/A	96424XXXXX	13	2022-01-01 09:04:19	09:00:00
	Executives 55	1000055	96737XXXXX	79	2022-01-01 09:04:23	09:00:00

Time_Bucket	Duration	Call_Seconds	Call_Status	Wrapped_By	Ringing	IVR_Duration
9_10	00:01:36	96	answered	Agent	YES	00:00:16
9_10	00:02:20	140	answered	Agent	YES	00:00:26
9_10	00:01:25	85	answered	AutoWrapped	YES	00:00:16
9_10	00:01:31	91	answered	Agent	YES	00:00:25
9_10	00:02:45	165	answered	Agent	YES	00:00:23
9_10	00:00:00	0	abandon	Not Available	YES	00:00:16
9_10	00:01:25	85	answered	AutoWrapped	YES	00:00:13

## Insights:

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

**Task:** What is the average duration of calls for each time bucket?

**Result:**

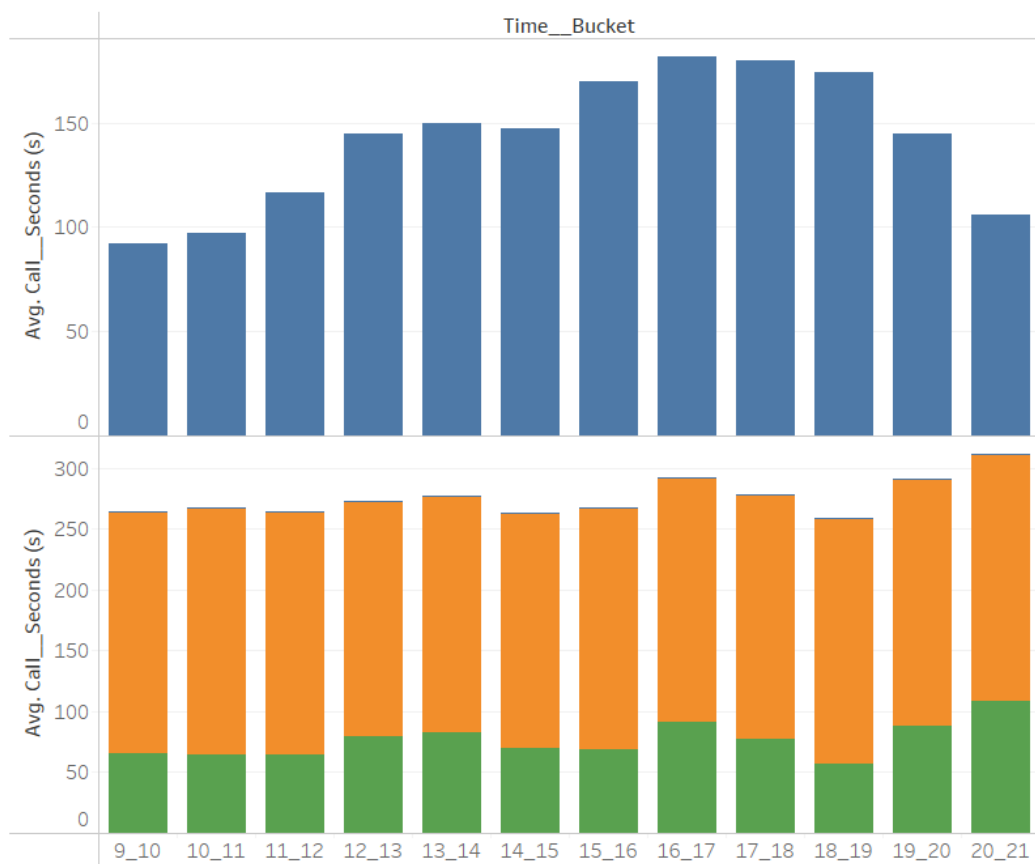
```

# Average Call Duration:
select Time_Bucket, avg(Call_Seconds) as Avg_Total_Call_Duration,
AVG(CASE WHEN call_status = 'answered' THEN Call_Seconds ELSE NULL END) AS answered,
AVG(CASE WHEN call_status = 'transfer' THEN Call_Seconds ELSE NULL END) AS transfer,
AVG(CASE WHEN call_status = 'abandon' THEN Call_Seconds ELSE NULL END) AS abandon
from calls_analysis
group by Time_Bucket
order by Time_Bucket;

```

Time_Bucket	Avg_Total_Call_Duration	answered	transfer	abandon
10_11	97.4240	203.3310	64.5294	0.0000
11_12	116.7837	199.2550	64.6316	0.0000
12_13	144.7250	192.8888	79.8231	0.0000
13_14	149.5410	194.7402	82.4522	0.0000
14_15	146.9693	193.6771	69.3036	0.0000
15_16	169.8968	198.8889	68.6865	0.0000
16_17	181.4393	200.8682	91.3862	0.0000
17_18	179.7245	200.2488	77.8533	0.0000
18_19	174.3247	202.5510	56.6286	0.0000
19_20	144.5825	203.4061	87.6757	0.0000
20_21	105.9491	202.8460	108.2000	0.0000
9_10	92.0103	199.0691	65.1818	0.0000

### Average Call Duration



- Overall Increasing Trend: There is an overall increasing trend in call volume from 9 am to 9 pm. This indicates that more calls are received as the day progresses.
- Lowest Duration: The lowest average call duration is observed during the 9 am to 10 am time slot, followed by the 10 am to 11 am slot. These time periods have relatively shorter call durations compared to other time slots.

- Longest Duration: The longest average call duration is observed during the 4 pm to 5 pm time slot, followed by the 5 pm to 6 pm slot. These time periods have relatively longer call durations compared to other time slots.
- The average length of each call answered by an agent is 139.53 seconds. This indicates that, on average, each call lasts for approximately 139.53 seconds.

**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.).

**Task:** Can you create a chart or graph that shows the number of calls received in each time bucket?

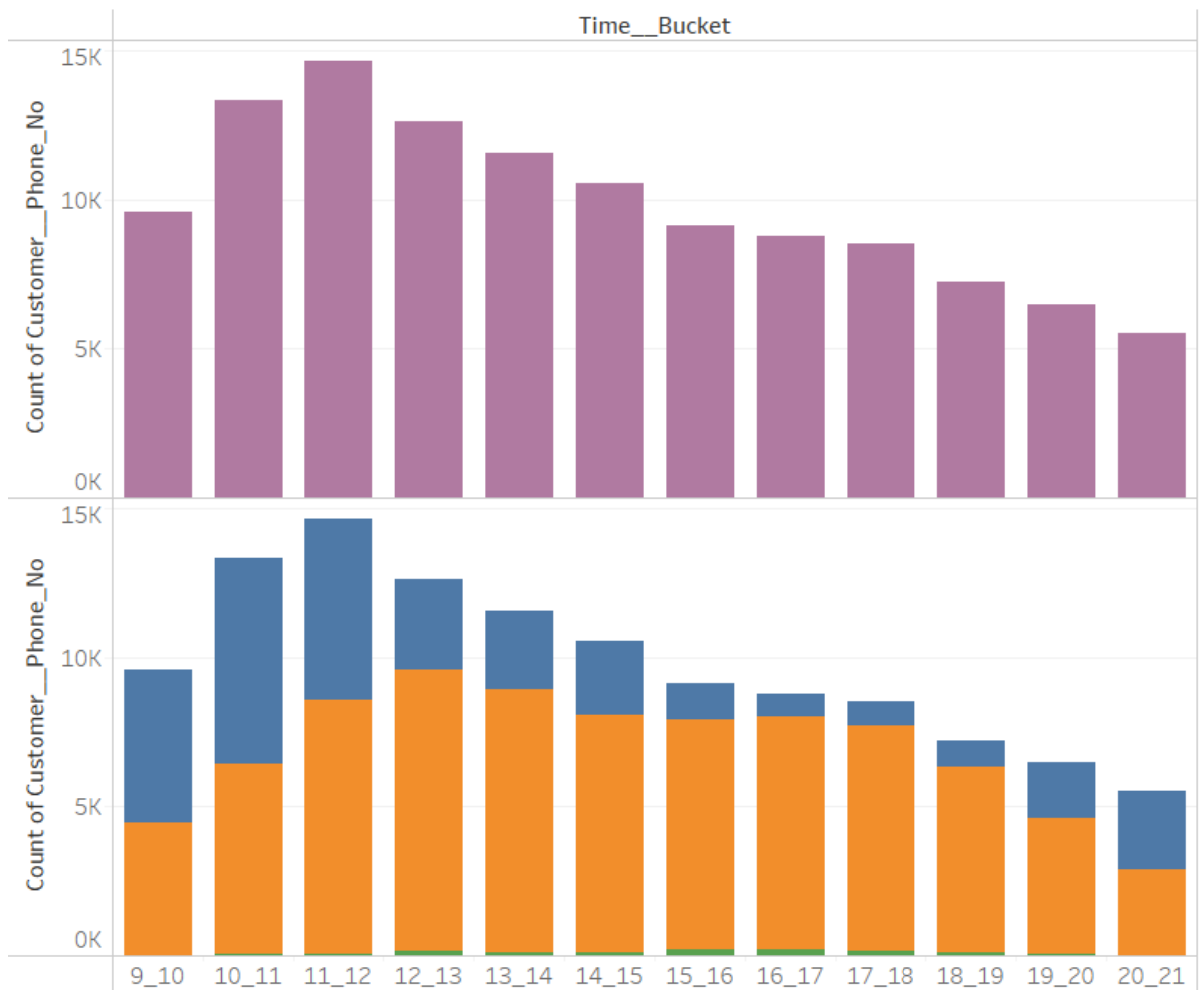
**Result:**

# Call Volume Analysis:

```
select Time_Bucket, count(Customer_Phone_No) as Total_Count_of_Calls,
count(case when call_status = 'answered' then Customer_Phone_No else null end) as answered,
count(case when call_status = 'transfer' then Customer_Phone_No else null end) as transfer,
count(case when call_status = 'abandon' then Customer_Phone_No else null end) as abandon
from calls_analysis
group by Time_Bucket
order by Time_Bucket;
```

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

## Call Volume Analysis



- The peak of the call volume occurs between 11 am to 12 pm, with a total of 14,626 calls during that time period. From there, the number of calls rapidly declines to 5,505 calls between 8 to 9 pm.
- Overall, there is a declining trend in the call volume throughout the day, with fewer calls being received as the day progresses. This trend is evident by the decreasing number of calls during the later hours.
- From 1<sup>st</sup> Jan to 23<sup>rd</sup> Jan, the service handles 1,16,855 calls.

**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.

**Task:** What is the minimum number of agents required in each time bucket to reduce the abandon rate to 10%?

**Result:**



Assumptions:	
Agent total working hrs of a day	9hrs
On-floor working hrs	7.5hrs
Days an agent works in 1 week	5
Total time spend on a call	4.5
[Total time spend on calls = 7.5*60%(occupancy) = 4.5hrs]	

```
select avg(Call_Seconds) as Avg_Call_Duration
from calls_analysis;
```

Avg_Call_Duration
139.5321

```
# Manpower Planning:
WITH Subquery AS (
    SELECT
        Time_Bucket,
        COUNT(CASE WHEN call_status IN ('answered', 'abandon') THEN Customer_Phone_No ELSE NULL END) as Calls_Per_Time_Bucket
    FROM calls_analysis
    GROUP BY Time_Bucket
),
AvgSubquery AS (
    SELECT
        Time_Bucket,
        AVG(Calls_Per_Time_Bucket / 23) as Avg_Calls_Per_Time_Bucket
    FROM Subquery
    GROUP BY Time_Bucket
)
SELECT
    Time_Bucket,
    Avg_Calls_Per_Time_Bucket,
    (Avg_Calls_Per_Time_Bucket * 139.532 * 0.9) / 3600 as Call_Duration_Per_Time_Bucket,
    round(((Avg_Calls_Per_Time_Bucket * 139.532 * 0.9) / 3600) / 4.5) as No_of_Agents_Required
FROM AvgSubquery
ORDER BY Time_Bucket;
```

Count of Calls	Time Bucket													
Date	10_11	11_12	12_13	13_14	14_15	15_16	16_17	17_18	18_19	19_20	20_21	9_10	Grand Total	
01-Jan		550	486	458	365	423	354	317	356	337	233	329	359	4567
02-Jan		438	397	334	341	244	227	273	206	220	201	117	293	3291
03-Jan		457	454	472	488	466	419	431	365	326	288	217	295	4678
04-Jan		407	543	545	530	473	371	410	404	316	324	253	423	4999
05-Jan		465	533	469	449	432	363	370	354	337	251	217	436	4676
06-Jan		547	587	456	449	402	404	421	346	312	307	235	400	4866
07-Jan		562	789	488	467	400	353	377	350	273	237	251	359	4906
08-Jan		588	621	488	414	387	382	354	344	273	223	201	347	4622
09-Jan		532	452	342	305	252	249	256	250	251	215	174	312	3590
10-Jan		472	616	480	468	436	380	322	406	321	352	296	362	4911
11-Jan		427	517	466	455	364	404	390	360	285	301	267	315	4551
12-Jan		455	628	519	425	422	316	314	360	287	283	202	385	4596
13-Jan		343	458	400	419	420	369	363	301	223	186	207	375	4064
14-Jan		255	291	338	304	237	223	298	288	248	238	195	208	3123
15-Jan			397	394	323	343	284	312	312	248	214	134	73	3034
16-Jan		737	511	264	452	358	374	346	394	429	429	645	162	5101
17-Jan		3565	3443	3080	2673	2145	1228	985	860	745	579	375	2664	22342
18-Jan		481	532	522	386	556	650	476	615	426	422	299	397	5762
19-Jan		474	523	493	410	407	452	389	341	317	302	258	325	4691
20-Jan		438	558	448	418	411	374	351	360	279	257	149	275	4318
21-Jan		394	496	357	302	334	282	309	311	245	206	161	273	3670
22-Jan		334	382	345	304	261	280	288	255	231	187	162	255	3284
23-Jan		358	374	347	299	276	236	247	246	204	191	151	284	3213
Grand Total		13279	14588	12505	11446	10449	8974	8599	8384	7133	6426	5495	9577	116855

Time_Bucket	Avg_Calls_Per_Time_Bucket	Call_Duration_Per_Time_Bucket	No_of_Agents_Required
10_11	577.34780000	20.1396233074000000	4
11_12	634.26090000	22.1249229747000000	5
12_13	543.69570000	18.9657371031000000	4
13_14	497.65220000	17.3596016926000000	4
14_15	454.30430000	15.8474968969000000	4
15_16	390.17390000	13.6104361537000000	3
16_17	373.86960000	13.0416932568000000	3
17_18	364.52170000	12.7156104611000000	3
18_19	310.13040000	10.8182787432000000	2
19_20	279.39130000	9.7460067179000000	2
20_21	238.91300000	8.3340021790000000	2
9_10	416.39130000	14.5249777179000000	3



- As calculated above, the average call duration is 139.53 seconds. A query has been passed to calculate the average calls per time bucket, then followed by the call duration per time bucket which is the product of the average calls per time bucket
- To handle 90% of the incoming calls, a total of 39 agents are needed daily. This calculation takes into account the average number of calls made per day (187.96), assuming agents work for five hours each day and only 60% of calls are answered

**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:

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.

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

**Task:** Propose a manpower plan for each time bucket throughout the day, keeping the maximum abandon rate at 10%.

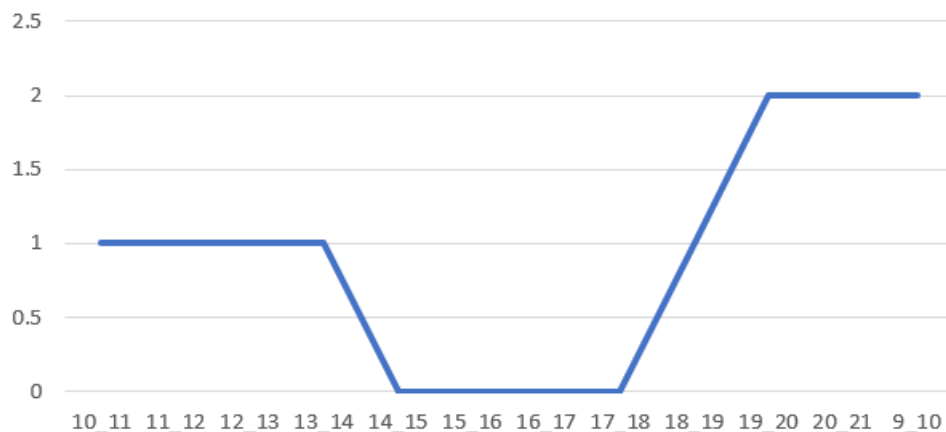
**Result:**

Insights:											
As mentioned, If 100 calls are made from 9am to 9pm, then 30 calls are made from 9pm to 9am											
Also as calculated earlier, total average calls is 5107											
Similarly, total average calls from 9pm to 9am would be $5107 \times 30 / 100$ which is											1532
The average call duration is 139.532 sec											
Total time spent on call is 4.5hrs											

Time_Slot	Distribution of 30 calls	Percentage Distribution	Distribution of calls
9pm-10pm	3	10%	153.2
10pm-11pm	3	10%	153.2
11pm-12am	2	7%	102.1333333
12am-01am	2	7%	102.1333333
01am-02am	1	3%	51.06666667
02am-03am	1	3%	51.06666667
03am-04am	1	3%	51.06666667
04am-05am	1	3%	51.06666667
05-am-06am	3	10%	153.2
06am-07am	4	13%	204.2666667
07am-08am	4	13%	204.2666667
08am-09am	5	17%	255.3333333
<b>Total</b>	<b>30</b>	<b>100%</b>	<b>1532</b>

Time Bucket	Avg Calls per Time Bucket	Total Call Duration	No.of. Agents Required
10_11	153.2	5.3440756	1
11_12	153.2	5.3440756	1
12_13	102.1333333	3.562717067	1
13_14	102.1333333	3.562717067	1
14_15	51.06666667	1.781358533	0
15_16	51.06666667	1.781358533	0
16_17	51.06666667	1.781358533	0
17_18	51.06666667	1.781358533	0
18_19	153.2	5.3440756	1
19_20	204.2666667	7.125434133	2
20_21	204.2666667	7.125434133	2
9_10	255.3333333	8.906792667	2
<b>Total Avg Calls</b>	<b>1532</b>	<b>53.440756</b>	<b>12</b>

### No.of. Agents Required



- We know that the total average number of calls between 9 am to 9 pm is 5107. So, we can say no call between 9 pm to 9 am is  $5107 * 30/100$  i.e., 1532
- The Average of Call\_Seconds (s) 139.532. Time to answer 90% of calls in hrs =  $(\text{total avg calls} * \text{total avg duration} * 90\%) / 3600 (\text{convert sec into hrs}) = (1532 * 139.532 * 90/100) / 3600 = 53.44$
- So number of person required in night =  $\text{total call time} / \text{total time spend on calls} = \text{ROUND}(53.68402655/4.5, 0) = 12$
- So, in total we need 12 agents from 9 pm to 9 am.

### Summary:

---

- The time bucket 16-17 has the highest average call duration of 181 sec
- The time bucket 11-12 has the highest number of calls 14626
- 39 agents are required per day to reduce the abandon call rate from 30% to 10% during the day shift of 9 am to 9 pm
- 12 agents are required per day to reduce the abandon call rate from 30% to 10% during night shift of 9 pm to 9 am
- The company can also divide the employers into three groups to ensure that the agents are available around the clock.
- We discovered that there were few outliers in the data. And the results would have been different if those outliers had been removed.

### Conclusion:

---

- This project, helped me in understanding the importance of Data Analytics in Customer Experience Analysis as it provides valuable insights that help in making Data-Driven Decisions.
- My awareness of the significance of data analytics in customer experience analysis has improved as a result of this project since it offers insightful information that facilitates the making of data-driven decisions.

- In this project I was able to get insights like call abandon rates, distribution of call duration, number of calls, agents, how to create a manpower plan to decrease abandoned calls, etc. I also got experience in Data Preprocessing like Data Cleaning, handling Outliers, Feature Engineering, etc. in this project. I can now communicate the insights to relevant stakeholders as per the requirements.