ABC Call Volume Trend Analysis

Project Description

This project investigates call centre operational data to analyze call volume patterns, call handling performance, and propose optimized manpower planning strategies. It involves cleaning and segmenting the data into hourly time buckets to evaluate key metrics such as average handling time, service levels, and abandonment trends. Based on these insights, the project calculates the minimum number of agents needed per hour to maintain a target abandonment rate of 10% or lower. The findings aim to guide workforce scheduling, ensure sufficient staffing during peak periods, reduce customer wait times, and improve overall service efficiency.

Approach

For this project, I followed a structured, step-by-step approach:

- To clean data using Python (Numpy, Pandas) by-
  - Filling missing values using mode values to preserve key trends
  - Removed duplicate records to ensure accurate analysis
  - Replaced **"#N/A"** entries with **"UNKNOWN"** to avoid processing errors.
  - Exporting cleaned data to **.xlsx** format.
- Perform descriptive Analysis using Excel to-
  - Analyzed total call volumes, time-bucket distributions, and average call durations
  - Segmented data into daytime (9 am–9 pm) and nighttime (9 pm–9 am) windows for detailed manpower planning.
- Made strategy for successful Manpower Planning.

Tech-Stack Used

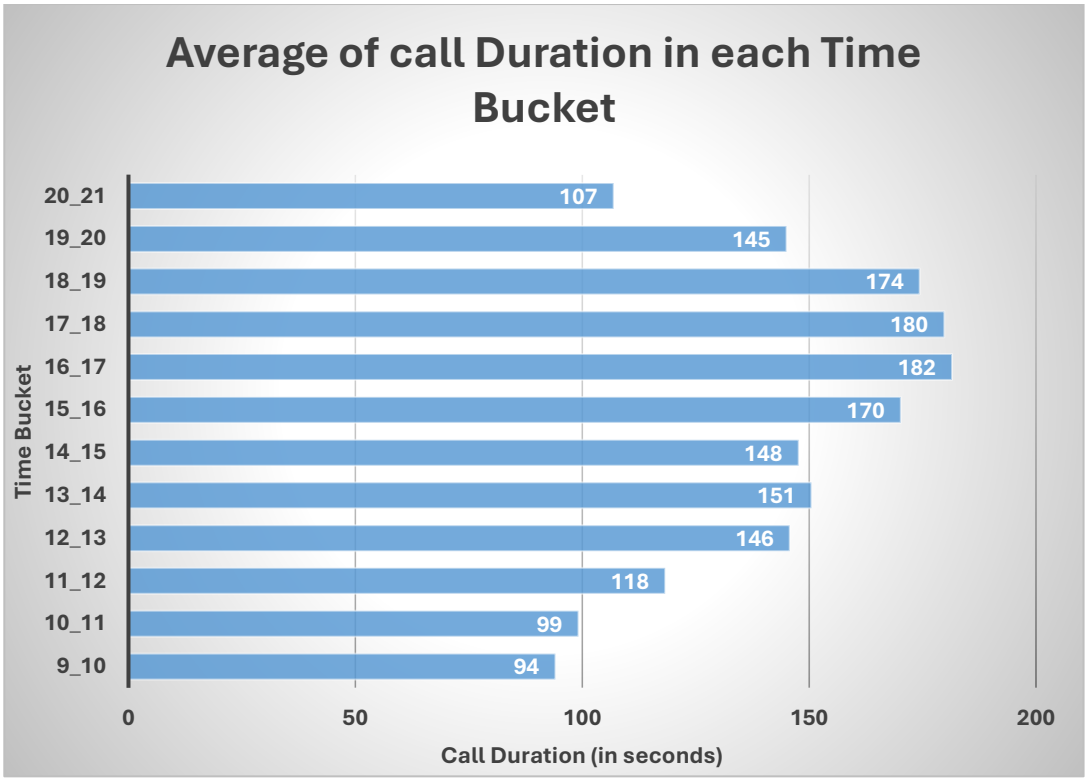
In this project, we have used-

- **Python (Jupyter Notebook, Pandas, NumPy)** – Used for data cleaning and exporting cleaned file.
- **Microsoft Excel 2024** – Used for Calculation, Analysis, and Visualization.
- **Google Drive** – Hosting and sharing reports.

Data Analytics Tasks-

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

Time_bucket	Average of Call Duration (s)
9_10	94
10_11	99
11_12	118
12_13	146
13_14	151
14_15	148
15_16	170
16_17	182
17_18	180
18_19	174
19_20	145
20_21	107
Average of total call Duration	**141**



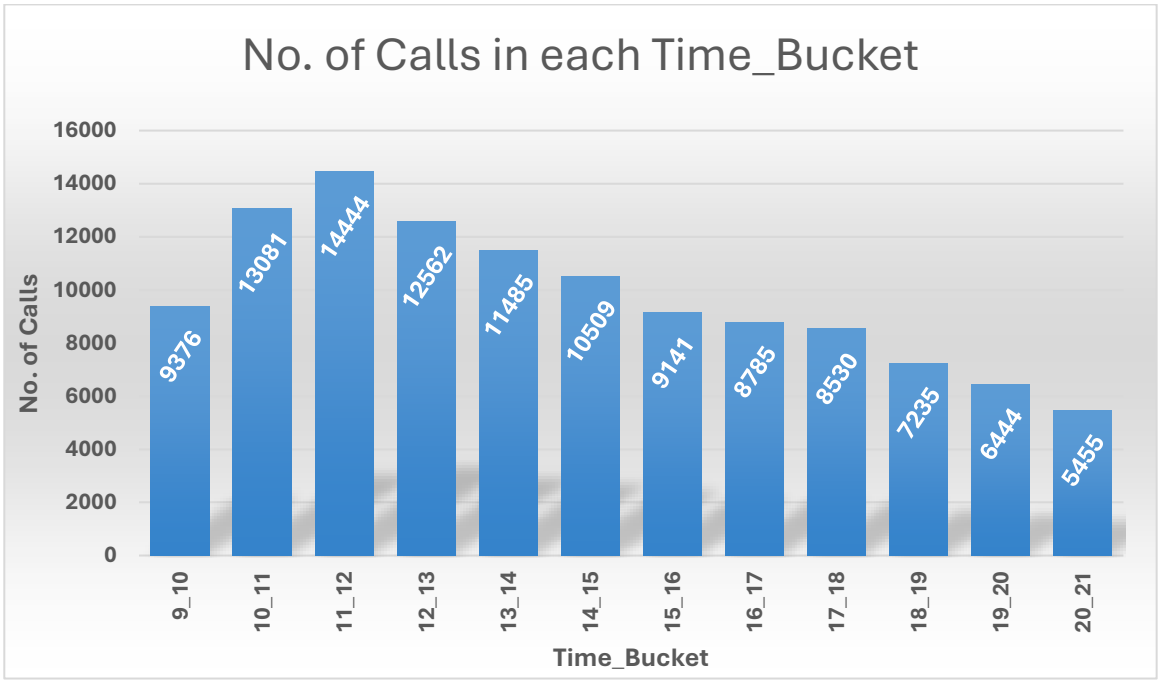
Observations-

- In morning **(9–12 pm),** there are short calls **(94–118 sec),** below the overall average **(141 sec).** Suggests quick inquiries or fast resolutions early in the day.
- From **12–3 pm**, call durations rise sharply **(146–151 sec).** Possibly linked to more complex issues or backlog buildup from the morning.

- From **(3–6 pm)**, we have longest average durations **(170–182 sec)**, these are our most complex or detailed calls. Important window for experienced agents and strong issue resolution.
- In evening **(6–9 pm),** call duration declines to **145–107 sec**, possibly as customer urgency lowers or agents push to clear queues.

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

Time_bucket	No. of Calls
9_10	9376
10_11	13081
11_12	14444
12_13	12562
13_14	11485
14_15	10509
15_16	9141
16_17	8785
17_18	8530
18_19	7235
19_20	6444
20_21	5455
Grand Total	**117047**



Observation-

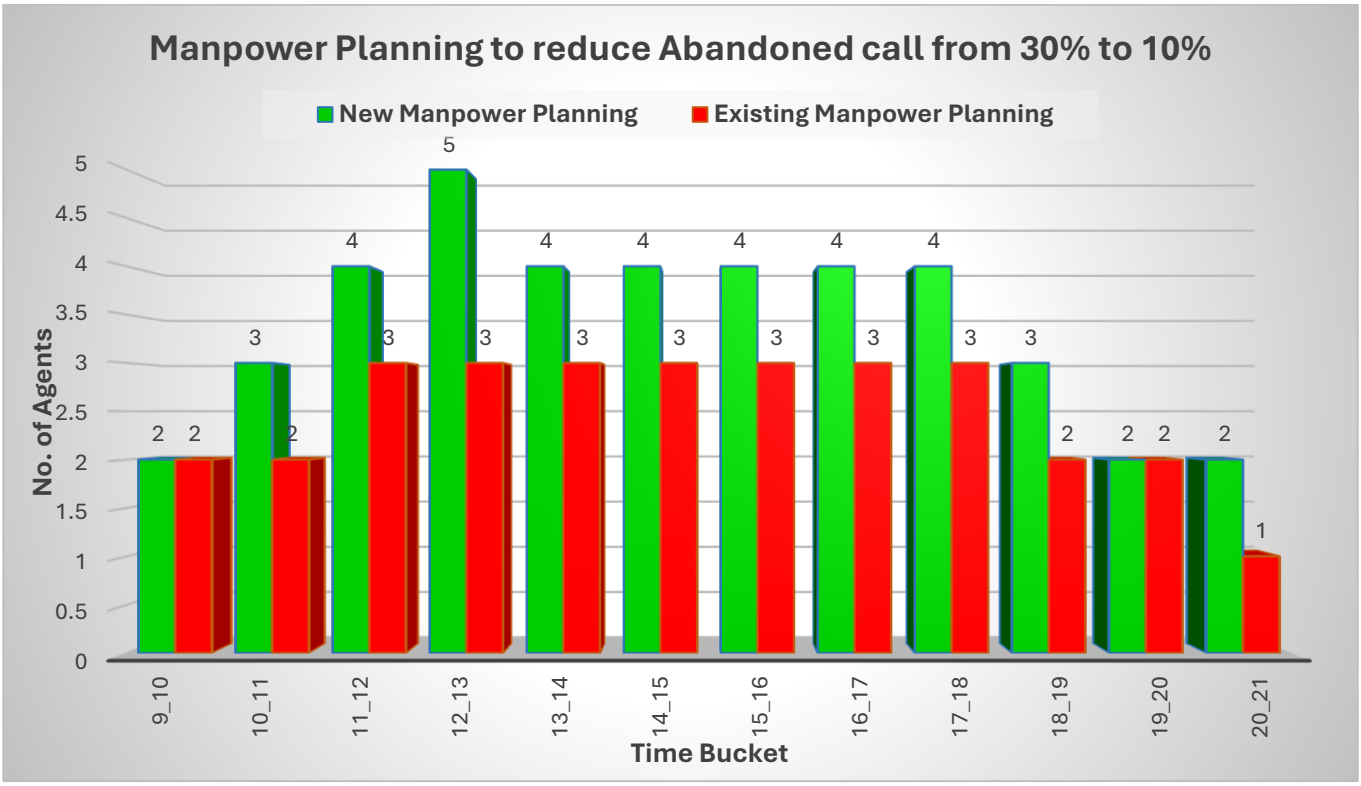
- In **10–11 am (13,081 calls)** and **11–12 pm (14,444 calls) (daily peak).** These are the busiest hours and critical for maximum agent deployment.
- At **Mid-day**, calls slightly decrease but stay high **(~10,500–12,500 calls),** still requiring strong coverage.
- From **3– 6pm**, call drops to **~8,500–9,100**. Staffing can start tapering slightly without hurting performance.
- The lightest periods, with calls steadily falling to **5,455** by **8–9 pm**, less than half the midday peak.
- Over **50%** of total daily calls occur before **2 pm**, emphasizing the need for heavy morning–early afternoon resources.

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

An agent's total working hours	**9 hours**
After **1.5 hours** spent on lunch and snacks in the office, working hours	**7.5 hours**
An agent spends 60% of their total actual working hours (i.e., **60% of 7.5 hours**) on calls with customers/users.	**4.5 hours**
No. of Days for which we have data given	**23 Days**
Answered calls is **70%** of Total no. of call for each time_bucket when abandoned call is 30%	
To reduce abandoned call from **30%** to **10%,** we have to Answer **90%** of Total no. of call in each time bucket	
Tota time duration of Answered call for each time_bucket per day = Average of call Duration for each bucket * No. of Answered call per day	
No. of Agents for each time bucket per day = Total time duration of Answered call for each time_bucket per day / (4.5*3600)	

Calculation when abandoned rate is 30% i.e. 70% of total calls got answered							
Time Bucket (24 hrs format)	Average of Call_Duration(s)	No. of Calls	No. of Answered call	No. of Calls per day	No. of Answered call per day	Total time duration per time_bucket per day	No. of Agents
9_10	94	9376	6563	408	285	26816	2
10_11	99	13081	9157	569	398	39462	2
11_12	118	14444	10111	628	440	52032	3
12_13	146	12562	8793	546	382	55681	3
13_14	151	11485	8040	499	350	52686	3
14_15	148	10509	7356	457	320	47263	3
15_16	170	9141	6399	397	278	47324	3
16_17	182	8785	6150	382	267	48461	3
17_18	180	8530	5971	371	260	46750	3
18_19	174	7235	5065	315	220	38367	2
19_20	145	6444	4511	280	196	28422	2
20_21	107	5455	3819	237	166	17749	1

Calculation when abandoned rate is 10% i.e. 90% of total calls got answered								
Time Bucket (24 hrs format)	Average of Call_Duration(s)	No. of Calls	No. of Answered call	No. of Calls per day	No. of Answered call per day	Total time duration per time_bucket per day	Required No. of Agents	Required No. of Agents for Smooth Fucntion
9_10	94	9376	8438	408	367	34531	2.13	2
10_11	99	13081	11773	569	512	50766	3.13	3
11_12	118	14444	13000	628	565	66814	4.12	4
12_13	146	12562	11306	546	492	71715	4.43	5
13_14	151	11485	10337	499	449	67588	4.17	4
14_15	148	10509	9458	457	411	60703	3.75	4
15_16	170	9141	8227	397	358	60943	3.76	4
16_17	182	8785	7907	382	344	62436	3.85	4
17_18	180	8530	7677	371	334	60056	3.71	4
18_19	174	7235	6512	315	283	49354	3.05	3
19_20	145	6444	5800	280	252	36542	2.26	2
20_21	107	5455	4910	237	213	22774	1.41	2



Observation-

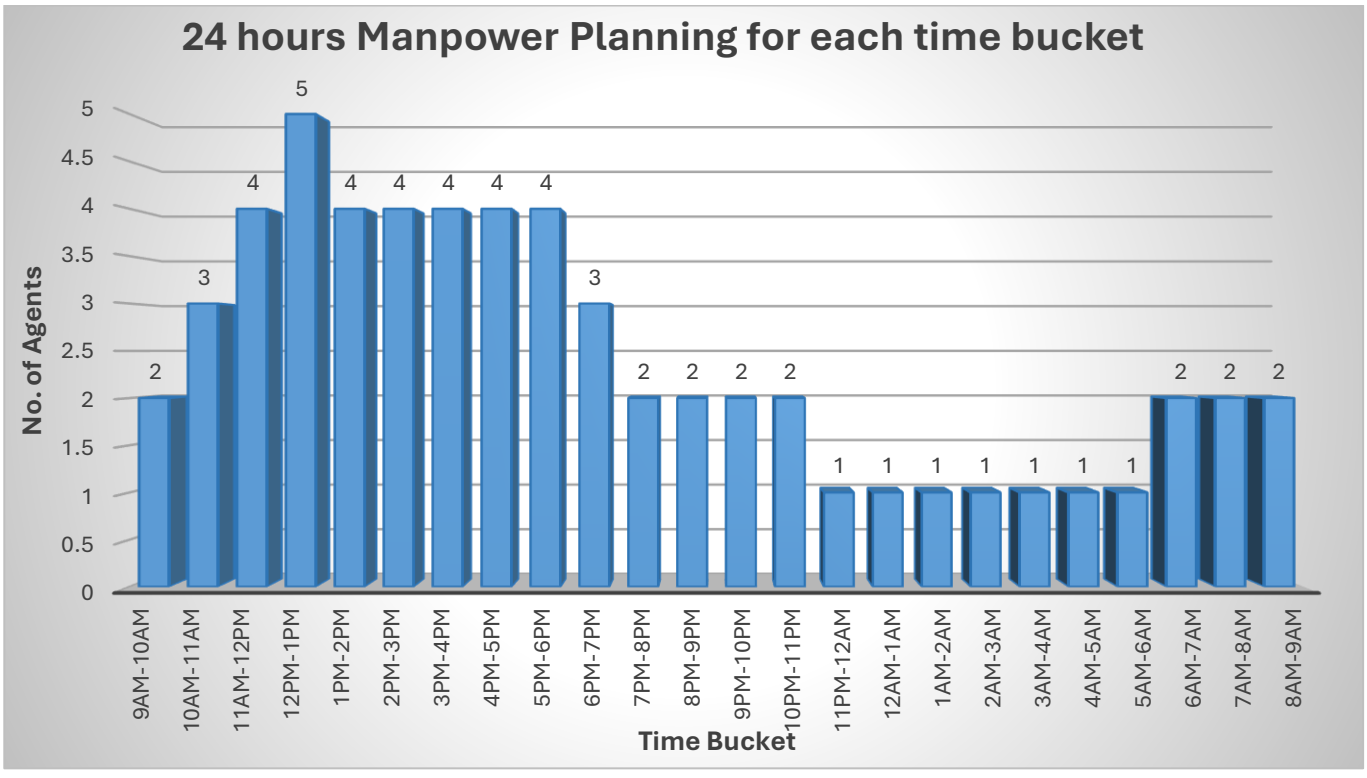
- From **9–11 am** (buckets 9–10, 10–11), needs **~2–3 agents/hour**, supporting rising volume but shorter call durations **(~94–99 sec).**
- From **11am–2pm** (buckets 11–12, 12–13, 13–14), we need highest agent requirements i.e. **4–5 agents/hour**. Due to both high call volume and longest average call durations **(~118–151 sec).**
- From **2–6 pm** (buckets 14–15, 15–16, 16–17, 17–18), there is stable demand for agents **~4 agents/hour**. Sustained, steady call flow needs consistent staffing.
- From **6–9 pm** (buckets 18–19, 19–20, 20–21), calls can be managed by **2 agents/hour**, as both volume and call complexity drop.

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

From **9am to 9pm** total no. of calls are	**117047**
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**.	
Then from **9pm to 9am,** total no. of calls are equal to **30%** of **117988** which is	**35114**
To Maintain maximum abandon rate only **10%** then we have to answers **90%** of total calls in each time bucket	
average call duration **(in seconds)** during day time	**141**
Total time duration per day for each time_bucket = No. of Answered call per day * (average of total call duration i.e. 141)	

Night Shift Manpower Planning

Time bucket	Night Shift distribution for 30 calls	Percentage	Total No. of Calls in night for each time bucket	No. of Answered Call	No. of Calls per day	No. of Answered call per day	Total time duration per time_bucket per day	No. of Agents to answer calls	Minimum No. of Agents required
9pm-10pm	3	10.00%	3511	3160	153	137	19180	1.1840	2
10pm-11pm	3	10.00%	3511	3160	153	137	19180	1.1840	2
11pm-12am	2	6.67%	2341	2107	102	92	12880	0.7951	1
12am-1am	2	6.67%	2341	2107	102	92	12880	0.7951	1
1am-2am	1	3.33%	1170	1053	51	46	6440	0.3975	1
2am-3am	1	3.33%	1170	1053	51	46	6440	0.3975	1
3am-4am	1	3.33%	1170	1053	51	46	6440	0.3975	1
4am-5am	1	3.33%	1170	1053	51	46	6440	0.3975	1
5am-6am	3	10.00%	3511	3160	153	137	19180	1.1840	1
6am-7am	4	13.33%	4682	4214	204	183	25620	1.5815	2
7am-8am	4	13.33%	4682	4214	204	183	25620	1.5815	2
8am-9am	5	16.67%	5852	5267	254	229	32060	1.9790	2



Observations-

- In **evening start (9–11 pm),** we have moderate load **(~137 calls/hour)** which needs **2-3 agents/hour**. This period often overlaps with late-day wrap-ups.
- In **deep night (12–5 am),** we have lightest traffic **(only ~46 answered calls/hour)** which can be managed by **1 agent/hour**. It's Low cost but critical coverage window, any absence hits hard.
- **Early Morning Surge (5–9 am),** noticeable ramp-up:

    - **5–6 am** requires **1 agent/hour**
    - **6–9 am** requires **2 agents/hour**

  as customers start re-engaging, transition to day shift here.
- **Daytime Pattern (9 am–9 pm),** peaks at **12–1 pm (5 agents/hour)** and then gradually decline to **2–3 agents** by evening.
- Full **24-hour plan** needs:
    - **~40–45 agents/day** across all shifts (approx.)
    - Smart overlap and shift rotation to avoid overstaffing.

Insights-

- High call volume and short durations during **9 am–12 pm** is a critical window where fast resolution matters. Prioritize efficiency and speed to clear queues early and avoid midday backlog.
- **12–6 pm** sees rising complexity, with the longest average call durations (**up to 182 sec**). Deploy skilled, experienced agents here to handle complex issues effectively, reducing escalations.
- **6–9 pm** shows a clear drop in both volume and complexity, which is ideal for fewer or junior agents without impacting service.
- **9 pm–5 am** has low volume (often **~46 calls/hour**), but even a small absence hits hard. Maintain at least **1 agent/hour**, with clear backup or on-call support.
- From **5–9 am**, customer activity ramps up again. So, we have to increase agent presence (**1–2 agents/hour**) to ensure a smooth handover into the busy daytime shift.
- A full **24-hour** plan balances **~40–45 agents/day**, with smart rotation and overlap to avoid understaffing or overstaffing.
- Trimming even **10–15 seconds** off peak-period calls (**especially 12–6 pm**) can free up major agent capacity daily, improving cost-efficiency without adding headcount.
- For critical low-staff windows (**night, early morning**), build-in backup coverage or cross-trained multitaskers to handle spikes or absences.

Results-

- Through this project, we developed an effective manpower plan for **ABC Call Centre** to reduce the call abandon rate from **~30% to 10%.**
- We have successfully analyzed call volumes, durations, and time patterns to determine the minimum number of agents needed per hour, balancing customer experience with cost efficiency.
- This project improved my understanding of how data-driven planning connects operations, agent skill matching, and service levels and how even small process improvements can significantly boost performance.

Google Drive Links

Python code used for cleaning dataset -
Data cleaning using Python

Cleaned Dataset (advised to open in excel) -
Cleaned Call Volume Dataset