Case Study: Sellstra Call-Centre

Mitchell Burton

Introduction

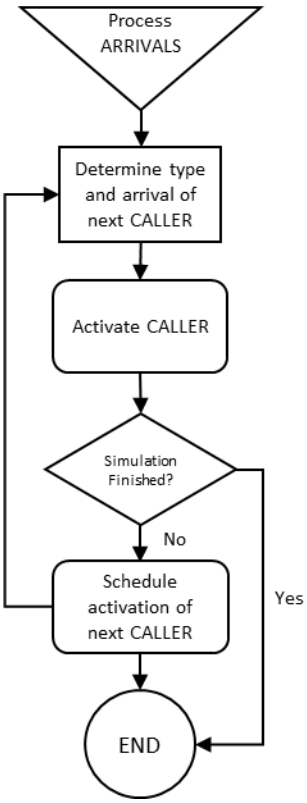
This report contains the results of a simulation designed to determine the number of consultants required to satisfy two separate key performance indicators (KPIs). KPI-1 is the percentage of sales calls completed, with the goal of 85%, and KPI-2 is percentage of service calls completed, with the goal of 50%. The base case is to have 8 consultants answering calls and then to determine what level of service is provided, from here this number is adjusted to find a new case to use to reach the KPIs. This report contains the simulation design chart, simulation manual, model validation, KPI assessment, and comparison of the base case and the adjusted case.

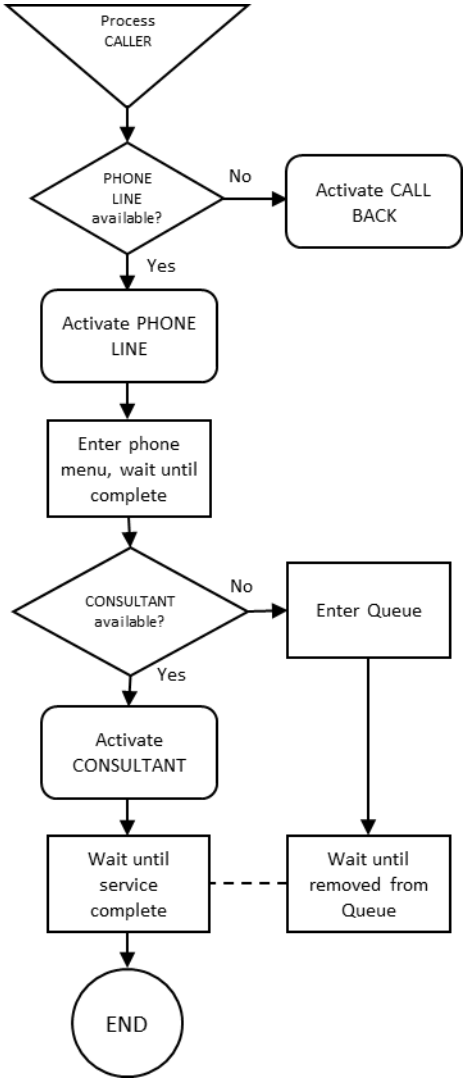
Key Findings

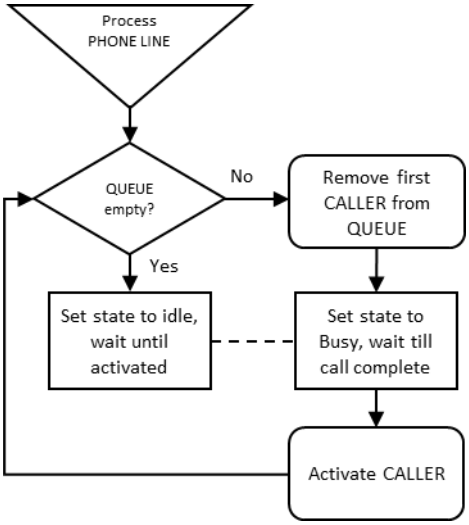
- The base case of 8 consultants delivered 81% for KPI-1 and 64% for KPI-2 with a 95% confidence interval.
    - The base case does not satisfy KPI-1 but does satisfy KPI-2.
- The adjusted case of 9 consultants delivered 99% for KPI-1 and 97% for KPI-2 with a 95% confidence interval.
    - The adjusted case satisfies both KPI-1 and KPI-2.

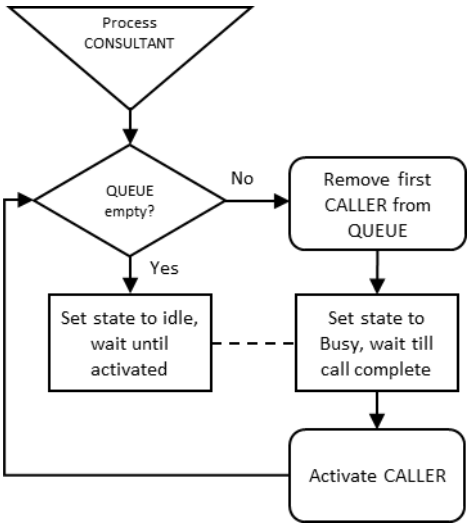
Simulation Design

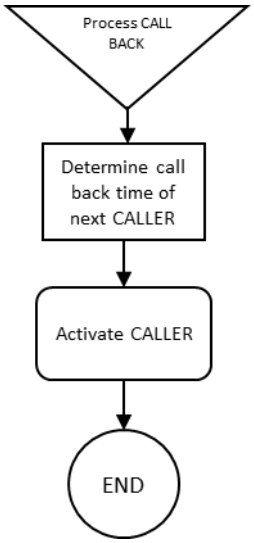
Flow chart of each process in model:











Simulation Manual

Instructions to run code:

1. Open BurtonM334CS.py
2. Choose parameters such as num_phone_lines (Number of phone lines), num_consultants (Number of consultants), sim_end (Simulation run time in minutes), show_full_output (If True: Prints the step by step action of callers)
3. Choose which type of simulation to run by uncommenting desired type: simulation_run (Basic simulation), warmup_experiment (Runs basic simulation for number of replications and prints warmup graph for each KPI), simulation_reps (Runs basic simulation for number of replications and saves KPI data to CSV) and simulation_validate_reps (Runs basic simulation for number of reps and saves KPI data and other data used to validate model).
4. Run the python script

Outputs:

Outputs for every run:

Key Performance Indicator 1 (KPI 1)

Key Performance Indicator 2 (KPI 2)

Phone line average use

Consultant average use

Consultant average queue

Extra outputs for warmup experiment run:

KPI 1 over time graph

KPI 2 over time graph

Extra outputs for simulation repetitions:

Excel file 'kpi1_kpi2_averages_reps.csv'

Columns: KPI 1, KPI 2

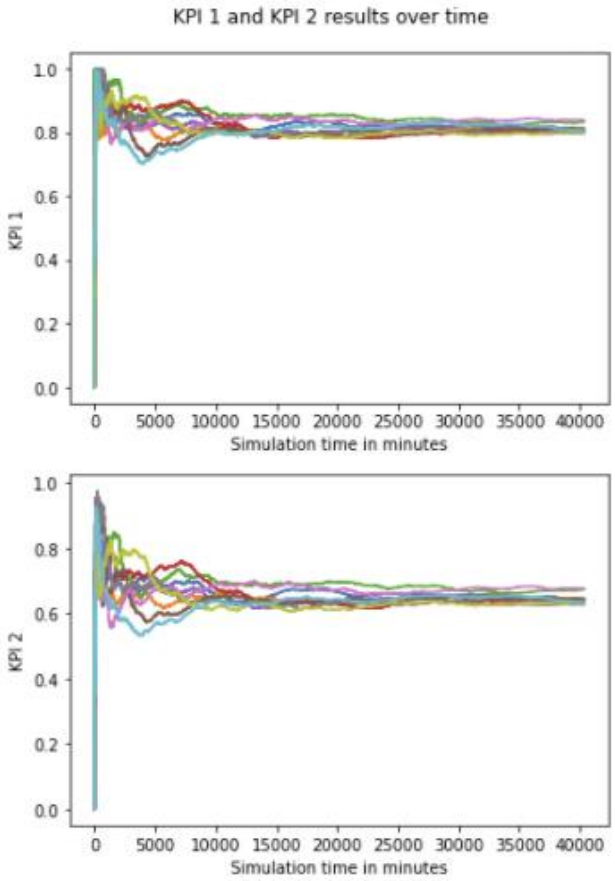
Extra outputs for simulation validation repetitions:

Excel file 'kpi1_kpi2_averages_validate_reps.csv'

Columns: KPI 1, KPI 2, Phone line average use, Consultant average use, Consultant average queue

Model Validation

To choose a simulation run length the warmup period was visually assessed to be approximately 10000 minutes, thus a simulation run of 28 days (28*1440 = 40320 minutes) has been used:



To validate the simulation outputs, key statistics were collated from the validation data set and compared against the simulated outputs. 25 simulations were run for 28 days each to collect the data for validation.

These statistics were gathered from the simulation and analysed in excel and are as follows:

	Validation Data	**Simulation Output**
KPI 1	78.428%	81.202%
KPI 2	61.432%	64.287%
Average phone line use	88.525%	83.271%
Average consultant use	99.886%	99.848%
Average consultant queue	12.627	11.330

The simulated outputs appear sufficiently close to the validation data set and thus this simulation is appropriate to use for further analysis.

Simulation Analyses Base Case

95% Confidence Interval of KPI 1 and KPI 2 in Base Case

The summary statistics here were calculated by applying statistical methods to 1000 separate simulation replications which each ran for 28 days.

The line graphs below show the convergence of KPI 1 and KPI 2 over the 1000 replications. The Box and Whisker plots shows the mean, quartiles, range and some outliers.

KPI 1:

The average KPI 1 for Sellstra is 81.111% with a standard deviation of 1.637%.

The 95% confidence interval is 80.917% < u < 81.304%.

KPI 2:

The average KPI 2 for Sellstra is 64.252% with a standard deviation of 1.799%

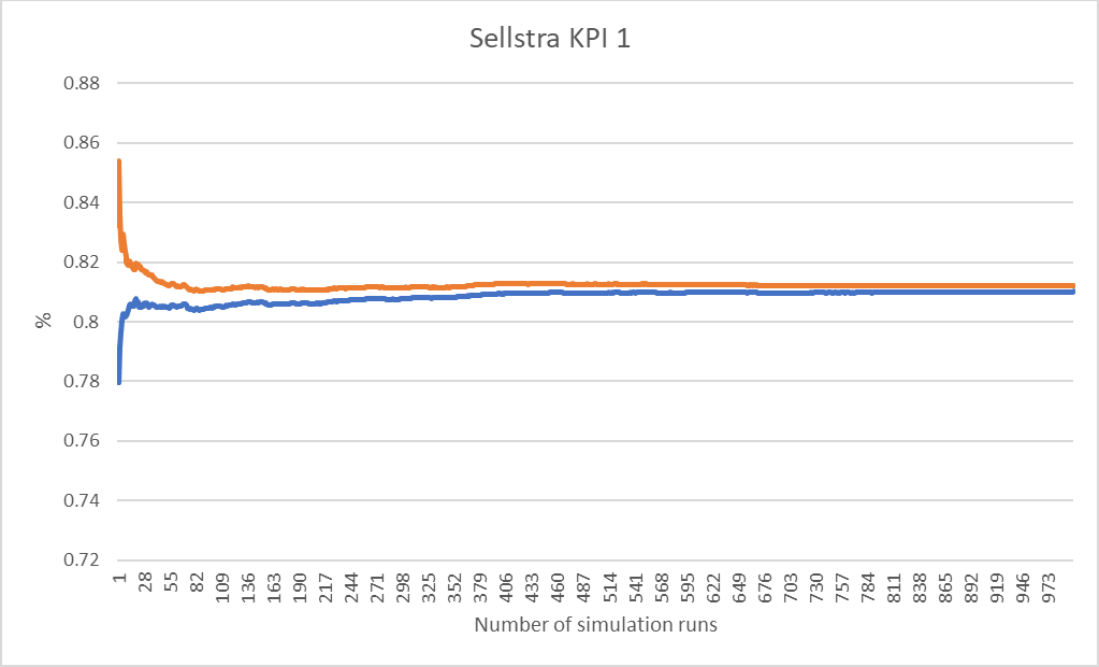
The 95% confidence interval is 64.043% < u < 64.461%

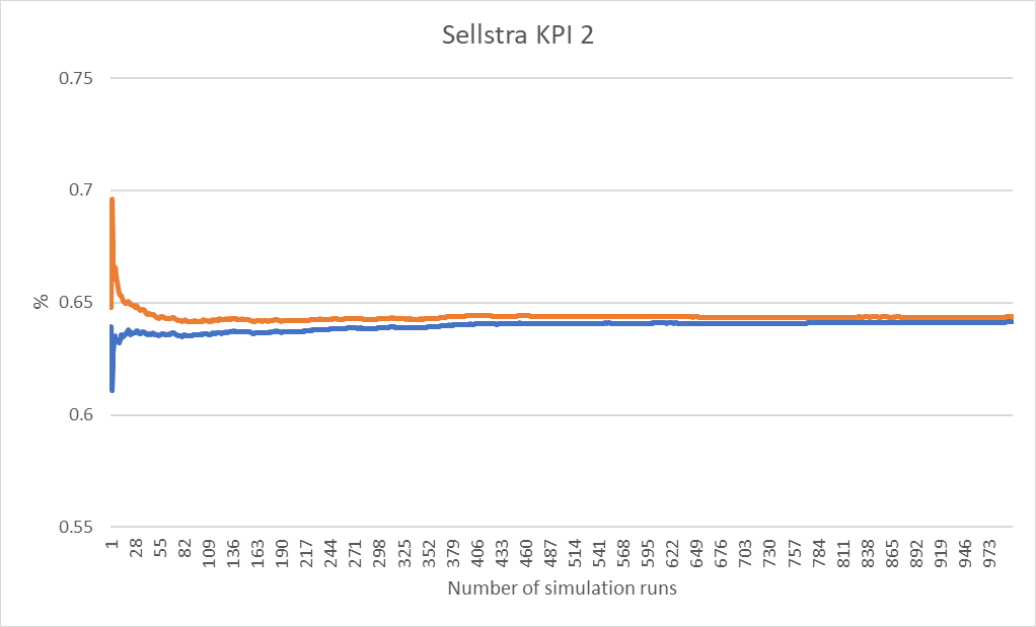
Comments on Base Case with 8 Consultants and 25 phone lines:

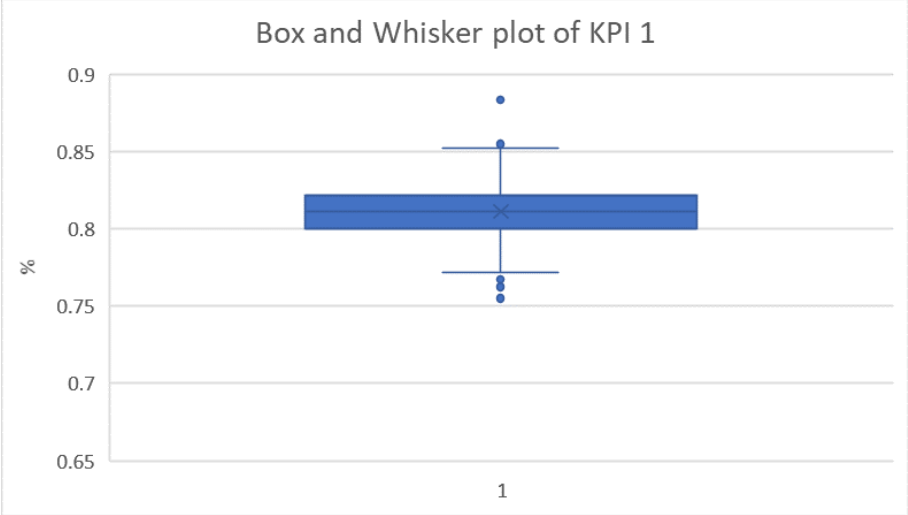
The requirements are KPI 1 >= 85% and KPI 2 >= 50%.

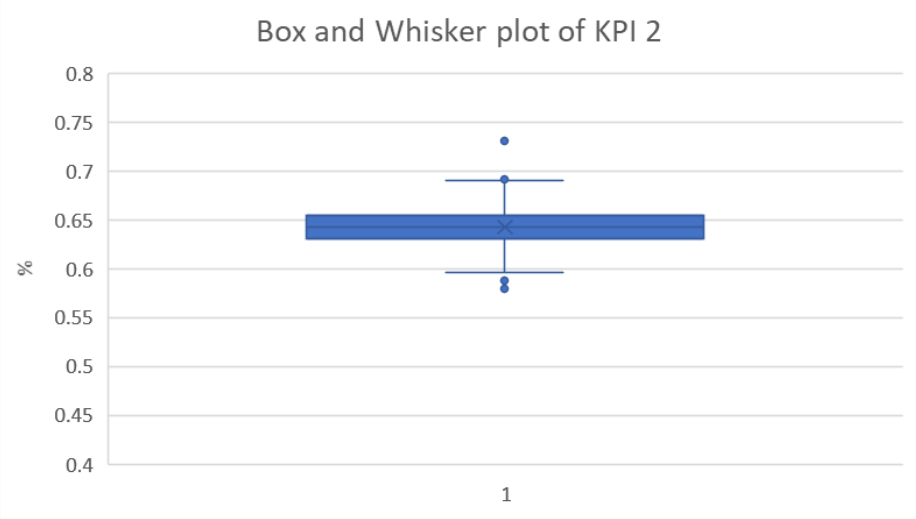
Currently the simulated KPI 1 is insufficient with a 95% confidence interval of 80.917% < u < 81.304%. Sellstra will need to increase KPI 1 by approximately 4.1% at least.

Currently the simulated KPI 2 is already satisfied with a 95% confidence interval of 64.043% < u < 64.461%. Sellstra will need to make sure this does not drop below 50% after adjustments.




Sellstra KPI 2
0.75
0.7
0.65
0.6
0.55
%
1
28
55
82
109
136
163
190
217
244
271
298
325
352
379
406
433
460
487
514
541
568
595
622
649
676
703
730
757
784
811
838
865
892
919
946
973
Number of simulation runs


Box and Whisker plot of KPI 1
0.9
0.85
0.8
0.75
0.7
0.65
%
1


Box and Whisker plot of KPI 2
0.8
0.75
0.7
0.65
0.6
0.55
0.5
0.45
0.4
%
1

Simulation Analysis Adjusted Case

95% Confidence Interval of KPI 1 and KPI 2 in Adjusted Case

The summary statistics here were calculated by applying statistical methods to 1000 separate simulation replications which each ran for 28 days.

The line graphs below show the convergence of KPI 1 and KPI 2 over the 1000 replications. The Box and Whisker plots shows the mean, quartiles, range, some outliers and a comparison of the scenarios.

KPI 1:

The average KPI 1 for Sellstra is 99.398% with a standard deviation of 0.217%.

The 95% confidence interval is 99.370% < u < 99.428%.

KPI 2:

The average KPI 2 for Sellstra is 97.728% with a standard deviation of 0.502%.

The 95% confidence interval is 97.659% < u < 97.798%.

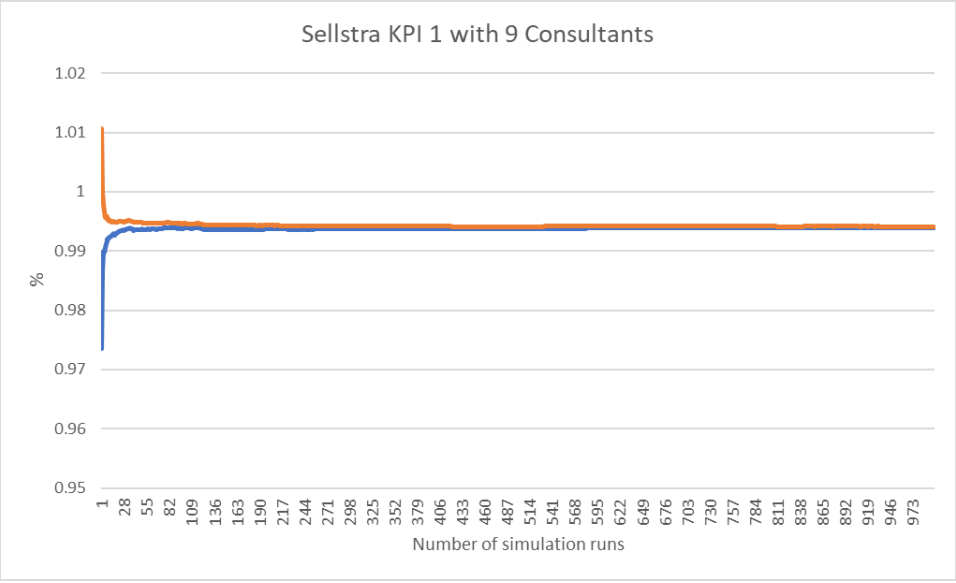
Analysis

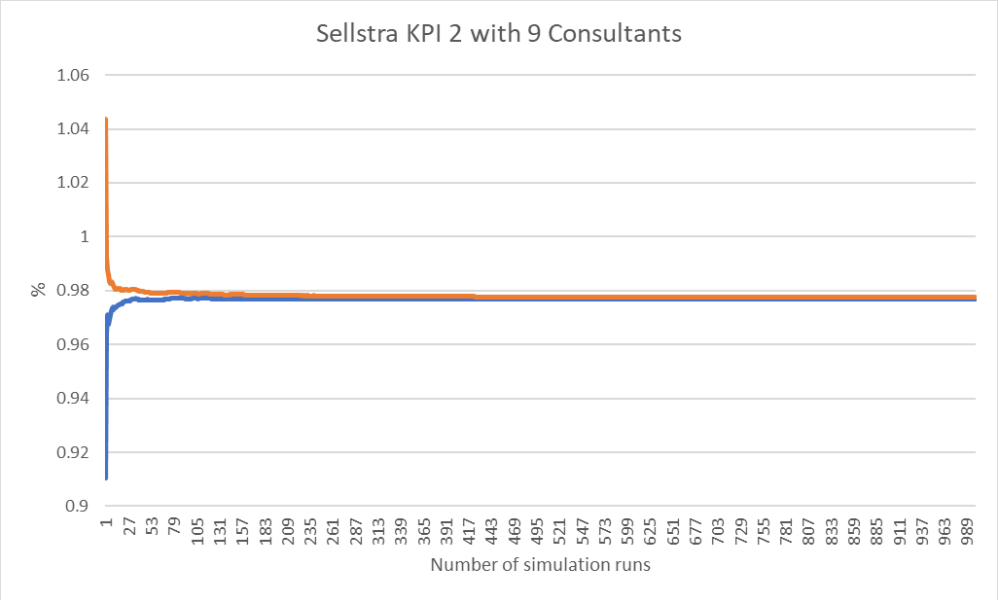
An analysis was undertaken to determine how many consultants and/or phone lines are required to reach Sellstra's KPIs.

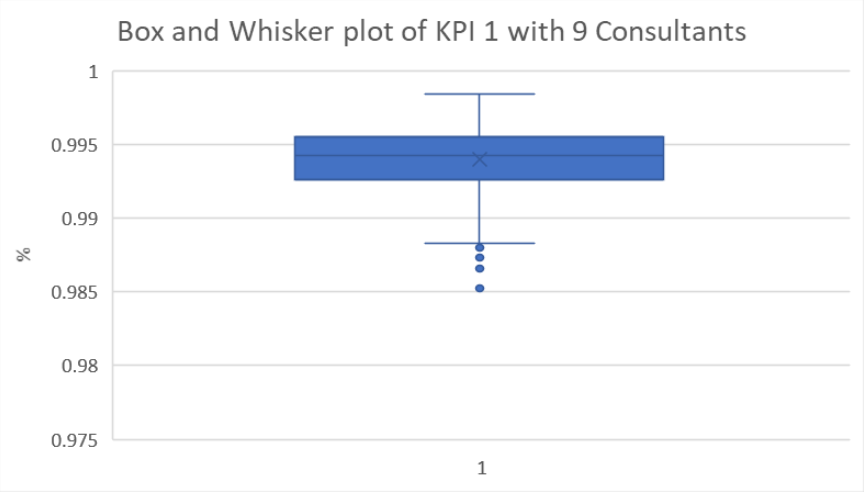
For KPI 1, Sellstra needed to increase its rate from an average of approximately 81% to greater than 85% within a 95% confidence interval. Adding just one consultant, bringing the total to 9, brought the average KPI 1 up to greater than 99% within a 95% confidence interval. Further statistical analysis suggests that this additional consultant is statistically significant enough to reach KPI 1.

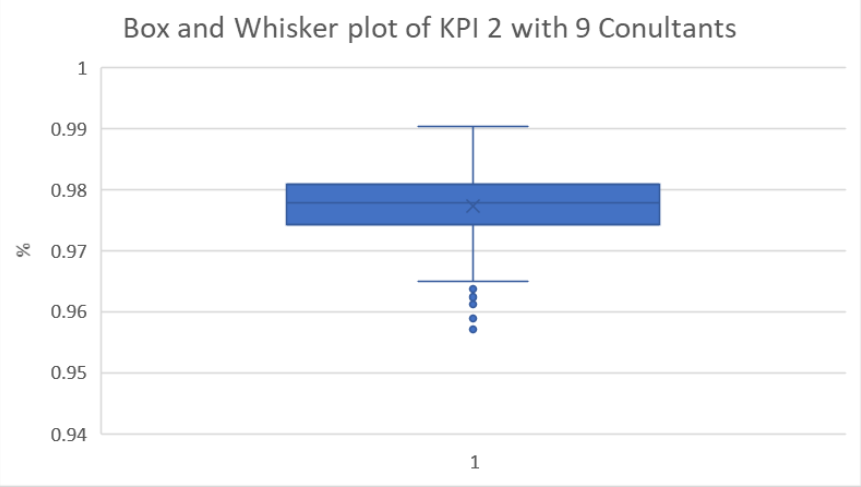
KPI 2 required a greater than 50% rate within a 95% confidence interval. The base case system has already satisfied KPI 2 providing an average of approximately 64% within a 95% confidence interval, thus no analysis for KPI 2 was performed. Adding the 9th consultant brought the average for KPI 2 up to approximately 97%.

In conclusion, adding one additional consultant will ensure KPIs are highly likely to be reached.




Sellstra KPI 2 with 9 Consultants
1.06
1.04
1.02
1
0.98
0.96
0.94
0.92
0.9
%
1 27 53 79 105 131 157 183 209 235 261 287 313 339 365 391 417 443 469 495 521 547 573 599 625 651 677 703 729 755 781 807 833 859 885 911 937 963 989
Number of simulation runs


Box and Whisker plot of KPI 1 with 9 Consultants
1
0.995
0.99
0.985
0.98
0.975
%
1


Box and Whisker plot of KPI 2 with 9 Conultants
1
0.99
0.98
0.97
0.96
0.95
0.94
%
1

Base Case = B, Adjusted Case = X