Bournemouth University

Faculty of Management

BUSNESS INTELLIGENCE ASSIGNMENT

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Executive summary

This report was commissioned to evaluate how the factors influence on the customer satisfaction throughout the 2 weeks, to assess individual and team-level performance and to recommend ways of improving labour productivity.

The research draws attention to the fact that the call duration has a positive effect on customer satisfaction. On average, the call centre agent spends over 10 minutes on supporting sufficiently our customers. Especially, female staff have better ability of dealing with customers to have higher score of satisfaction. Additionally, the average waiting time is still high with 30-40 seconds, meanwhile the best time for customer to wait for connecting with should be 20 seconds, which affects negatively on the customer satisfaction. About problem categories, the technical issues are frequently encountered problem at a call centre, however, they have the least forwarded cases recorded (only 0.42 percent). After analysing, it can be seen that customers have tendency of interacting for their issues in two main intervals: from 7AM to 9AM and from 3PM to 8PM, which can be considered as the peak time throughout a day.

With respect to individual and team performance, it can be drawn conclusion that gender and tenure have significant effects upon the level of customer's satisfaction, the contrast pattern can be seen in age and qualification factor. In particular, the call centre agent achieves highest score of customer satisfaction when she or he works for our company about 100 working months. As mentioned, although there is not existence of effect on customer's fulfilment by qualification, the staff who graduated colleges usually have relative higher score than the others.

It is recommended:

- Developing a standard table of call duration for each issue
- Reducing customer waiting time to 20-30 seconds by adding personnel at 2AM, 5AM and 10AM. Using an automated self-service queue to reduce on-hold time.
- Focusing on two peak time frames: 7AM - 9AM and 3PM - 8PM. The company should establish specialized groups of employees to solve problems more professionally (especially technical and delivery issues).
- Developing tournament bonus schemes to promote competition among individuals in the organization. Encouraging staff to stick around for at least 100 working months by increasing salary, offering a promotion to motivate their performance.
- Prioritizing college graduates with experience in solving technical issues - the most frequently encountered problem at a call centre.

Introduction

Call centre is a central point of customer service from which all issues are resolved. There are several challenges to the call centre system of the company. Particularly, with respect to service quality, the call duration and waiting time are the cruxes that are difficult to quantify how they directly impact on the level of customers' fulfilment. In relation to human resource aspects, coordinating agents with diversified levels of experience and qualification plays important roles in optimizing performance of the whole company. Therefore, it is actually essential to utilize business intelligence to provide handy recommendations for improving organizational performance.

Within the scope of this report, customer satisfaction is understood as a center factor and thence, illustrates an assessment of how well individual and team productivity of call centre staff fits with the strategic operational metrics of the company. The structure of the paper contains three parts. The first part introduces the variable background. The next part gives more comprehensive analysis about the current pattern of individual and team-level performance. The final part is the recommendation which provides the company with useful strategies of management and recruitment.

Data restrictions and variable definition

1. Customer satisfaction and metrics of call centre agent productivity.

First of all, customer satisfaction is considered as the main factor to determine the service quality of this company. Marketing researchers have defined customer satisfaction in disparate ways. According to Oliver (1997), it is the consumer's response with ordinal levels of fulfillment from unpleasant to pleasant after their service experience. Similarly, this business definition has conceptualized by Zeithaml and Bitner (2000) as customers' assessment of whether that service has met their needs and expectations.

In this paper, customer satisfaction depends on a likert scale involved in the research that costumers have been asked to evaluate their satisfaction with the service after the call. Out of 132.851 observations, there are 81.814 respondents. This limitation with a large number of NA values can significantly influence on the analysis report's result.

Regarding the service quality index, it is important to collect other variables as explanatory factors:

Firstly, length is considered as the time taken to handle per customer per agent. The "length" variable records 228 seconds and 1110 seconds as the minimum and maximum values respectively. On average, an agent spends 624.3 seconds on the duration of the call.

Secondly, waiting time or queue time gives managers insight into the amount of time customers wait before they interact with a call agent. The conventional service level in the contact centre requires 20 seconds to answer 80% of calls (David Preece et al. 2018). Approximately 35.36 seconds is the average deal of waiting period.

Thirdly, "forwarded" variables illustrate whether the agent transfers the call to another staff having a higher level of knowledge or skill. There are 1.137 forwarded cases compared to 131.714 non-forwarded cases.

Managers might be able to have a view of the current performance in the company based on each of these key variables. However, some important operational metrics such as First Call Resolution (Resolving an issue on the first contact) failed to be reported in this dataset which could be seen as a data restriction.

2. Personal factors influencing on call centre agent performance.

Tenure presents the number of months agents working in the company. The data records their working experience ranging from 3 to 376 months. Additionally, qualification variable is key personal information to give managers a critical perspective into the effect of each ability upon the whole company's productivity.

Besides, there are 2 control variables (Gender and Age) which play remarkable roles as confounding variables. According to the HRM data, there is a negligible difference in gender with 57 females and 53 males and the average age of staff is 35.51.

In the paper, two files of data are merged in order to analyze variables in-depth (Appendix 1.1), which helps managers evaluate the company's situation and create an appropriate management scheme.

Methods

Data files were released from the union that had endorsed intending to determine how their agents perceived key responsibilities. From these datasets, the quantitative report uses a linear model and regression to show visual results and analytics providing business intelligence and recommendations for the company to enhance its future performance. Particularly, regression analysis is used as a predictive modelling approach investigating the relationship between satisfaction and other explanatory variables. The RStudio software is the main tool used to analyse.

Analysis

1. The key indicators of the call centre performance

1.1. Customer satisfaction and service quality assessment

In reality, successful centres should have a higher proportion of good evaluation from their customers. In the paper, three levels of score were created to make a clear situation of the company's service quality, respectively good, average, and poor score.

Figure 1: The overview of customer satisfaction

It can be seen clearly that the call centre received more good score than average and poor score when the percentage of the most positive evaluation fluctuates over 35 percent compared with only under 10 percent of poor level and approximately 20 percent of average level. However, the relevant problem is that there is a remarkable number of customers who did not take part in the survey. From the result of

Appendix 2.1, there is no relationship between the number of non-response and length, time and problems related to delivery and return. Only technical issues impact on the fact of customers not responding to the satisfaction survey.

Factors that influence the levels of fulfillment include the length of the call and waiting time. *First,* outcome visualisation shows the call handling time have a positive impact on customer satisfaction (Appendix 2.2):

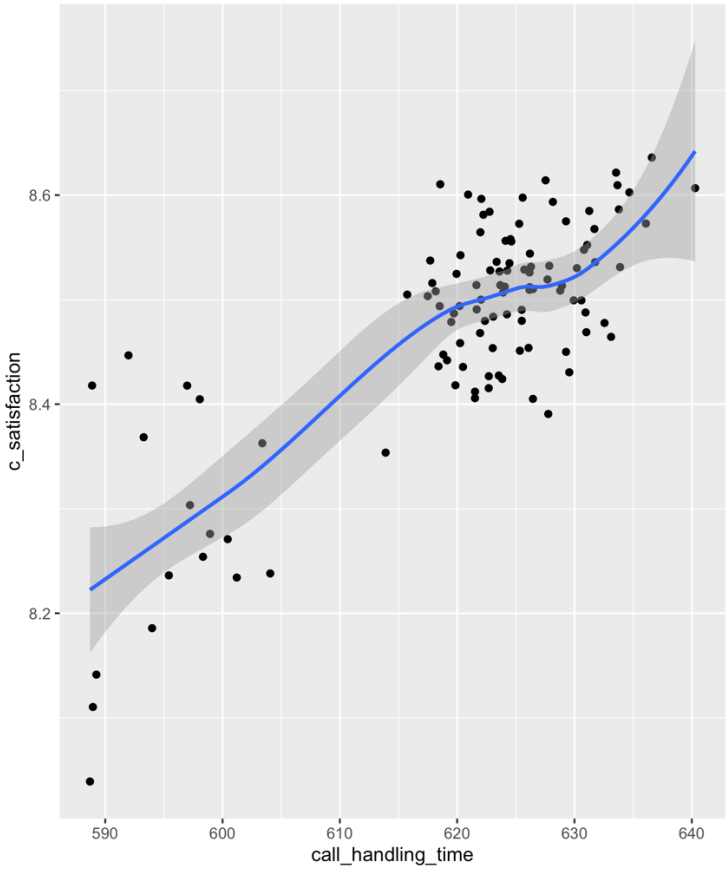


Figure 2: Relationship between the call handling time and customer satisfaction

The average scores of the call centre agent ranged from 8.0 to 8.65 throughout the recorded period. Most plots concentrate on the call handling time between 615 and 635 seconds, corresponding to 8.5 – one good score of satisfaction, the range of time could be long enough for the agent to support customers. It can also be stated that the high level of customers' evaluation would require the similarly reasonable

length of the call. Another question in analytics is whether the score of evaluation has an impact on the length factor. As the outcome of regression shown in Appendix 2.3, the amount of call handling time would reduce when the level of satisfaction customers rate increases. It means the staff have tendency of shortening time of call when they receive high score from customers in their previous call. In the long term, this trend has a negative effect on the call centre agent's attitude and performance.

Second, the level of customer satisfaction was affected negatively by waiting time or queue time (Appendix 2.4), which is shown by the below graph:

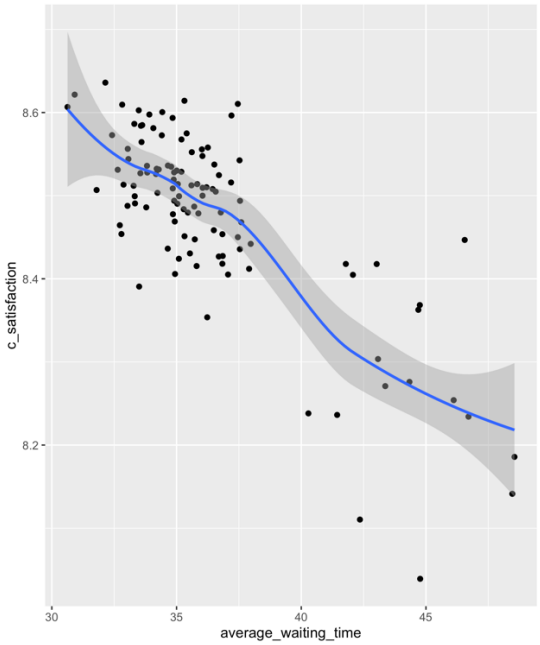


Figure 3: Relation between the average waiting time and customer satisfaction

This line chart illustrates a rapidly decreasing trend toward customer expectations of service if the call is instantaneous. Therefore, it is necessary for the staff to connect with customers as soon as possible. It can be also seen that fluctuation of the time customers wait to interact with an agent is from 30 to 38 seconds, considerably higher than the traditional wait time for the contact centre customers – 20 seconds.

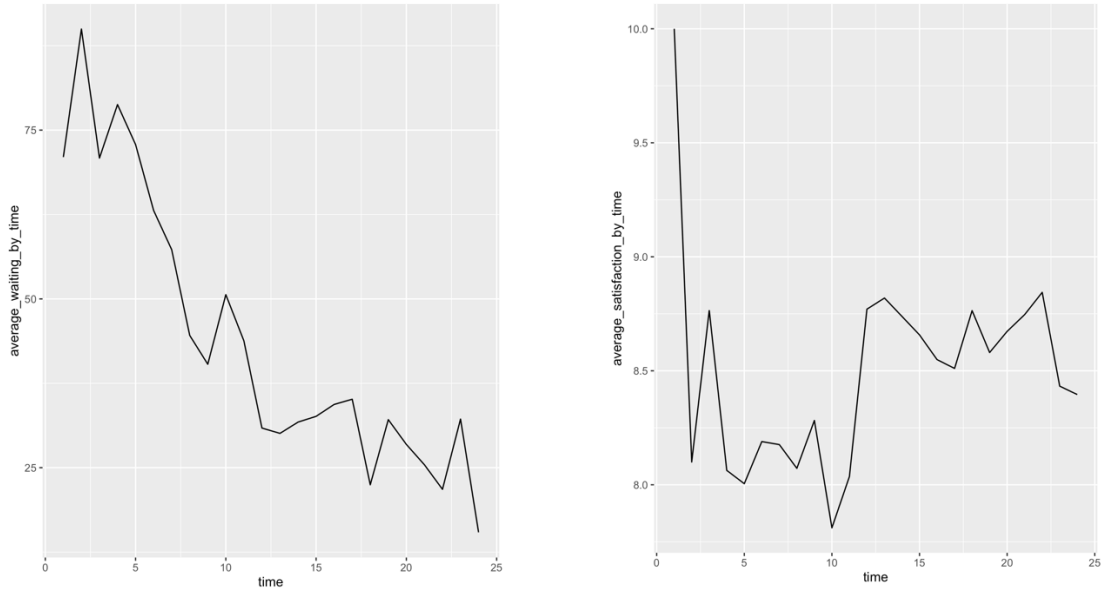


Figure 4: The average wating time and customer satisfaction by time

The charts give more information about the average waiting time and the average satisfaction score per hour, which record the fastest response to the call from 11AM to 11PM and the contrast feature in around 2 AM. As a result, the higher average scores of satisfaction level are reported from 11AM to 11PM. It is important to notice some time frame in which the agent responds instantaneously, including 2AM, 5AM and 10AM.

1.2. Problem solving situation by time

This part analyses the particular situation of resolving problems: distribution of the total number of calls and distribution of length for 4 distinct issues.

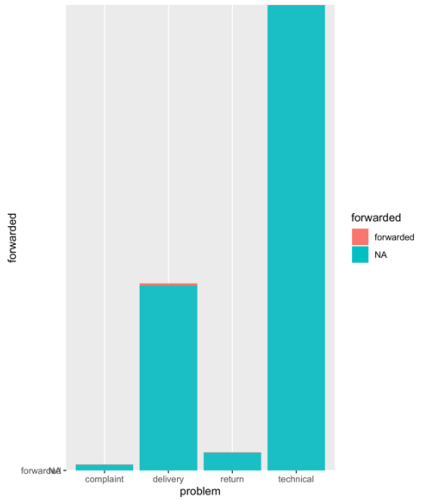


Figure 5: The proportion of forwarded calls in problems

Firstly, technical issue is the most frequent problem with 91124 calls, three times as many as the number of delivery problem. However, the percentage of cases the agents transfer the call to the expert is about 0.24 percent, compared with 2.62 percent of the total forwarded calls for return issues. This means the call centre staff have good experience in resolving technical problems.

	forwarded	NA	total	forwarded percentage
complaint	21	1161	1182	1.78%
delivery	799	36164	36963	2.16%
return	94	3488	3582	2.62%
technical	223	90901	91124	0.24%

Table 1: The overview of forwarding situation

Secondly, in regards to the distribution of total handling time the employees use to resolve issues, the chart presents that customers have tendency of interacting for their issues in two main intervals: from 7AM to 9AM and from 3PM to 8PM. All of problems have a similar pattern, however, technical and delivery issues should be gained with special attention.

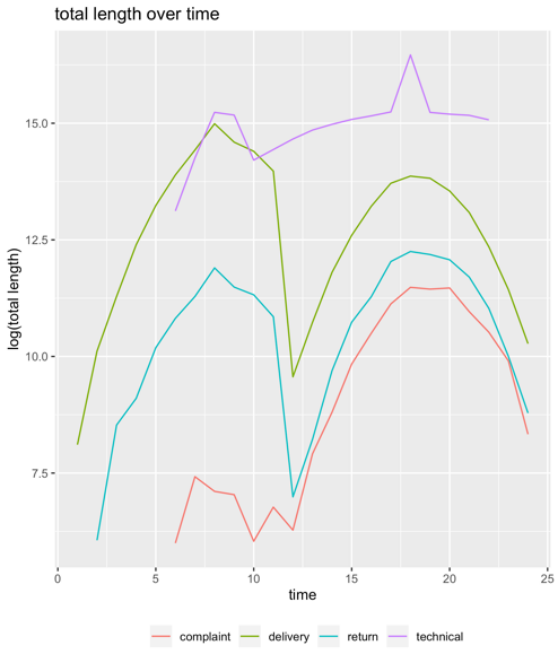


Figure 6: Length over day in problems

2. Assessment of individual and team performance

2.1. The impact of personal information on individual performance.

STT	agent	Average satisfaction
1	46	8.63597299
2	42	8.621536524
3	81	8.614173228
4	14	8.610407876
5	43	8.609500308
6	47	8.606679035
7	44	8.602673147
8	7	8.600522193
9	89	8.597593583
10	66	8.596443228

Table 2: Top 10 best performance

The given table illustrates the list of 10 agents having the best performance. Compared with the average level of customer satisfaction – 8.5046 (Appendix 1.2), these achievements failed to be absolutely outstanding.

As an aspect of individual information, tenure has a considerable effect on the score of fulfilment they gained from customers. By contrast, age of employees has no impact on customer satisfaction (Appendix 2.5).

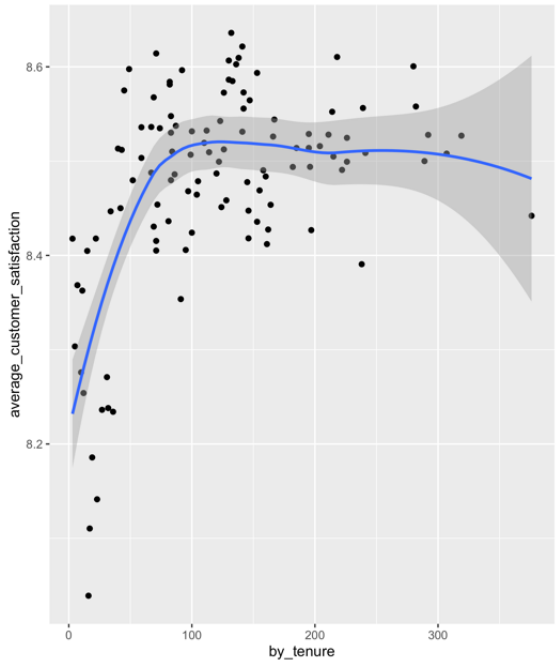


Figure 7: Relationship between customer satisfaction and tenure

The call centre staff usually spend from 50 to 250 months on sticking with the company. It also shows that they gained the highest average score of customer satisfaction at around 100th working month, and decreased gradually the productivity afterwards. As analysed in Appendix 2.6, the working experience influencing the amount of call handling time also impacted really upon the level of customer's fulfilment (The call length plays a role of a mediating factor). In this case, it can be explained that the employees would have better knowledge and skill in controlling call duration when working longer in the organization.

2.2. The impact of personal information on team performance.

2.2.1. Gender composition on team performance.

As analyzed in Appendix 2.7, the effect of call duration on customer satisfaction depends on gender as moderating variable.

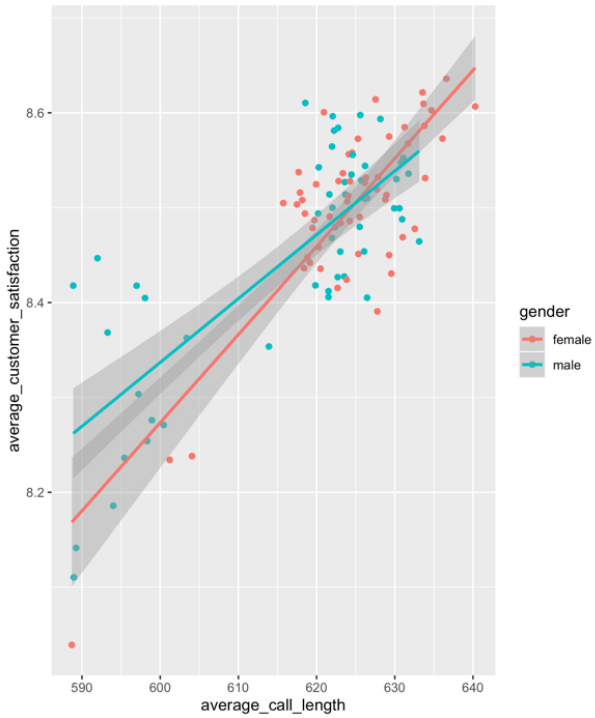


Figure 8: Relationship between call duration and customer satisfaction depends on gender

The score of satisfaction women gained more sensitive to the call handling time than men did, they would achieve the lower levels of fulfilment with shorter length calls but higher levels than men if they interact longer with customers. It can be deduced that it is reasonable to encourage female employees to have long call duration.

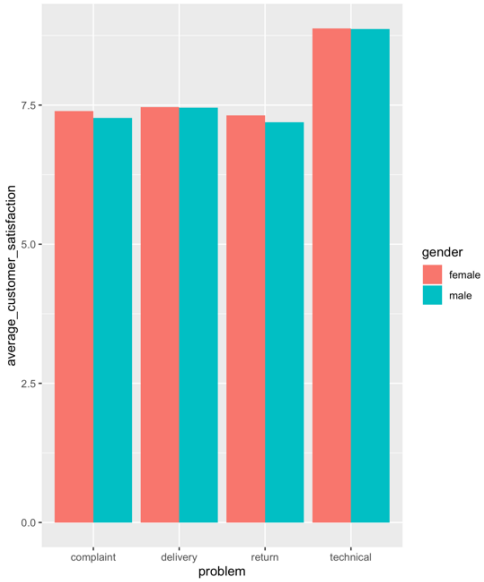


Figure 9: Comparation of average customer satisfaction by gender

Additionally, the working productivity of men is relatively lower than women's in all problems, which represents the call centre job is more suitable for women.

2.2.2. Qualification composition on team performance.

Appendix 2.8 shows there does not exist any effect of qualification level on the score of customer satisfaction.

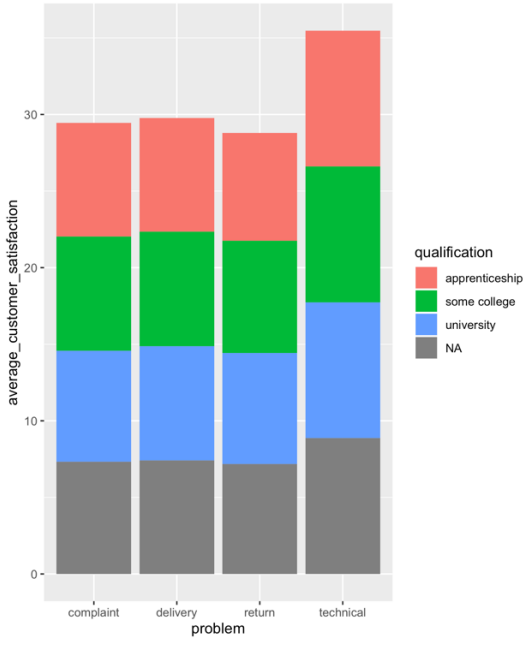


Figure 10: Comparation of average customer satisfaction by gender

The bar chart gives more information about the average score of customer satisfaction in 4 different problems. It can be easily seen that there is no significant difference in the work productivity of staff from 3 distinct levels of qualification. However, it is important to understand which qualification is outstanding than the others.

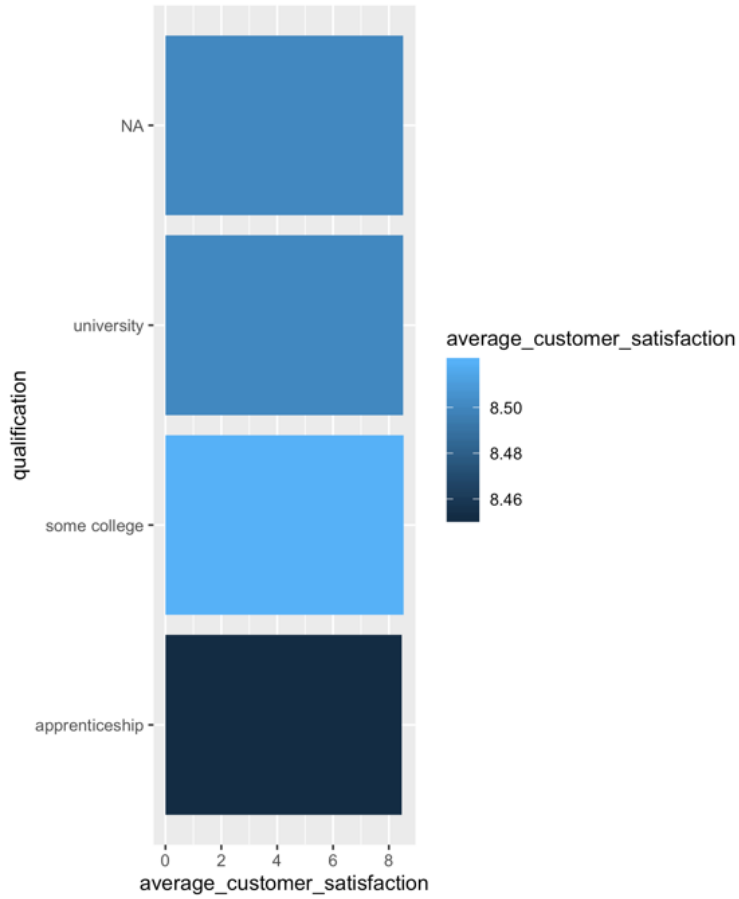


Figure 11:The average customer satisfaction in each qualification

Based on the level of colour tone, we can identify that the call centre agents who graduated in college have the highest average score of customer fulfilment meanwhile there is 50.962 staff in this category. This is an essential clue for recruitment plans of the company in the future.

Recommendation and conclusion

1. Strategies to help improve customer satisfaction

- Regarding the length of calls

Following the 10-minute-call rule to advice and support for customers in all problems, give priority to technical issues. Developing a standard table of call duration for each issue avoids that an agent shortens the call duration due to the high appreciation of the previous call.

- Regarding waiting time

Reducing customer waiting time to 20-30 seconds by adding personnel at 2AM, 5AM and 10AM. Using an automated self-service queue to reduce on-hold time.

- Regarding problem resolving

Providing necessary training for staff on skills and in-depth knowledge in three issues: complaint, delivery and technique to restrict a call transfer to the expert.

Focusing on two peak time frames: 7AM - 9AM and 3PM - 8PM. The company should establish specialized groups of employees to solve problems more professionally (especially technical and delivery issues).

2. Strategies to help enhance individual and team performance

- Regarding tenure

Developing tournament bonus schemes to promote competition among individuals in the organization. Encouraging staff to stick around for at least 100 working months by increasing salary, offering a promotion to improve their performance.

- Regarding future recruitment plan

Providing priority recruitment to women who have an acumen for controlling call duration and assisting customers in resolving issues. Adjusting the qualification

structure, prioritizing college graduates with experience in solving technical issues - the most frequently encountered problem at a call centre.

In conclusion, the report reveals the strong effects on customer satisfaction by other factors such as the call duration, waiting time, gender and experience. Visualizing analysis of performance patterns, it can be valuable basic for making decisions of improving the company's future performance.

List of references

David P., Frank S. and Brent B. (2018), "*What Are the Industry Standards for Call Centre Metrics?",* viewed 24 May 2020, < https://www.callcentrehelper.com/industry-standards-metrics-125584.htm>

Oliver, R. L. (1997), *"Effect of Service Quality and Marketing Stimuli on Customer Satisfaction: The Mediating Role of Purchasing Decisions",* Vol. 4 No. 4, pp. 76-81.

Zeithaml, V.A. and Bitner, M.J. (2000), "*Services Marketing: Integrating Customer Focus across the Firm*", 2nd Edition, McGraw-Hill, Boston.

Appendix

1. R script explanation

1.1. Data preparation

1.1.1. Data cleaning

- Inspect variable length

Because that the duration of the call with the call centre agent has value less than 20 seconds was not considered as a serious call, they are assigned as NA. However, the shortest call lasts 228 seconds.

- Inspect variable customer satisfaction

There are 51037 blanks recorded in customer satisfaction column, which present cases customers not evaluated according to 1-10 scale for service quality. All of the values are also changed into NA.

- Inspect variable qualification

After running is.na () function, it returns 9 suspicious values that exist in qualification column. Particularly, there are 6 values of “NA” under character type and 3 values of “20” under numeric type. Therefore, all of them was removed by R function, which changed them into NA.

1.1.2. Combination of two files.

The command *data <- merge (cc, hrm, by = "agent")* allows to gather two file data (call central file and HRM file) that “agent” variable plays a role of reference.

The new data have 132.851 observations and 17 variables.

1.2. Data Analysis

The avarage number of satisfaction score

The function *mean(data$costumer_satisfaction, na.rm = TRUE)* returns 8.5046 – the mean of score that represents the level of customer's fulfillment.

2. Interpret Regression Analysis Results

2.1. Relationship between nonresponse and length, time and problem.

	term	estimate	std.error	statistic	p.value
1	(Intercept)	0.505841124	0.016307965	31.01804161	0.00000
2	length	0.0000028	1.41E-05	0.197721772	0.84326
3	time	0.0004301	0.000288337	1.491607634	0.13580
4	problemdelivery	-0.0094368	0.014368989	-0.656748557	0.51134
5	problemreturn	0.0103942	0.016156357	0.643351189	0.52000
6	problemtechnical	0.1521841	0.014474438	10.51399241	0.00000

In statistics, the p-value is the probability of obtaining results as extreme as the observed results of a statistical hypothesis test, assuming that the null hypothesis is correct. If a p-value that is less than the significance level (often 0.05), there is evidence against the null hypothesis.

In this results of the regression, only technical problem has positive effect on the number of cases the customers do not respond to Likert-scale survey (with Correlation coefficients – 0.1521841)

2.2. Relationship between the call handling time and customer satisfaction

	term	estimate	std.error	statistic	p.value
1	(Intercept)	7.02577912	0.02571535	273.213448	0.000
2	length	0.00232451	3.96E-05	58.7542792	0.000

Linear regression model:

$$\text{customer satisfaction}_i = 7.02577912 + 0.00232451 * \text{length}_i + e_i$$

With P-value < 0.05, length variable has positive effect on the level of customers' fulfillment. In other words, when the amount of the call handling time increases 1 second, the score of customer satisfaction increases 0.00232451 point.

2.3. Relationship between length and customer satisfaction

	term	estimate	std.error	statistic	p.value
1	(Intercept)	506.754823	23.0233093	22.0105119	0.0000000
2	costumer_satisfaction	-5.9881029	0.6090505	-9.831866	0.0000000
3	problemcomplaint	-282.29013	25.5571977	-11.045426	0.0000000
4	problemdelivery	-189.07346	22.5975472	-8.3669901	0.0000000
5	problemreturn	-244.56531	23.0839778	-10.594591	0.0000000
6	problemtechnical	42.7911877	22.5305404	1.89925261	0.0575560

Because P-value < 0.05, customer satisfaction variable has negative effect on the call handling call (with Correlation coefficients = -5.9881029). It can be understood that when the score of customer satisfaction increases, the call length decreases as a result.

2.4. Relationship between customer satisfaction and waiting time

	term	estimate	std.error	statistic	p.value
1	(Intercept)	8.95382911	0.00618276	1448.19341	0.00000
2	waiting	-0.0135181	0.00011134	-121.41683	0.00000

Linear regression model:

$$\text{customer satisfaction}_i = 8.95382911 - 0.0135181 * \text{waiting}_i + e_i$$

With P-value < 0.05, waiting time variable has negative effect on the level of customers' fulfillment. In other words, when the amount of the waiting time increases 1 second, the score of customer satisfaction decreases 0.0135181 point.

2.5. Relationship customer satisfaction and tenure, age

	term	estimate	std.error	statistic	p.value
1	(Intercept)	8.44963249	0.03594984	235.039494	0.0000
2	tenure	0.00033909	9.26E-05	3.66293227	0.0002
3	age	0.00027447	0.00114982	0.23871103	0.8113

With $\text{P-value}_{\text{tenure}} < 0.05$, the number of working months has positive effect on the level of customers' fulfillment. In other words, when an agent works 1 more month in the call centre, the score of customer satisfaction he or she achieves increases 0.00033909 point.

Additonally, that $\text{P-value}_{\text{age}} > 0.05$ means that this variable does not have any effect on the satisfaction levels

2.6. Relationship between customer satisfaction and tenure with length as a mediating variable

2.6.1. The total effect

	term	estimate	std.error	statistic	p.value
1	(Intercept)	8.45776939	0.01142268	740.436241	0.0000
2	tenure	0.00035181	7.57E-05	4.64606182	0.0000

Linear regression model:

$$\text{customer satisfaction}_i = 8.45776939 + 0.00035181 * \text{tenure}_i + e_i$$

The total effect is the estimated coefficient c (0.00035181). This is a very important outcome to decide if the relationship should be significant or not.

2.6.2. The direct and indirect effect

	term	estimate	std.error	statistic	p.value
1	(Intercept)	620.172379	0.78444637	790.586075	0.0000
2	tenure	0.03035071	0.00520255	5.8338147	0.0000

M ~ aX, with M the mediating variable and the coefficient of X: Length ~ 0.03035071 tenure

	term	estimate	std.error	statistic	p.value
1	(Intercept)	6.98804925	0.02742388	254.816169	0.0000
2	length	0.00232241	3.96E-05	58.7013466	0.0000
3	tenure	0.00029355	7.42E-05	3.95714969	0.0001

Y ~ dX + bM, with d and b as the coefficients:

Customer satisfaction ~ 0.00029355*tenure + 0.00232241*length

The coefficients allow now the following inferences:

a*b = 0.03035071* 0.00232241 is the indirect effect, the part of the total effect that was triggered by the mediator

d = 0.00029355 is the direct effect of X, or the part of the total effect which was not triggered by the mediator.

In linear models hold: c = a*b + d

We have: 0.00035181 < 0.03035071* 0.00232241 + 0.00029355 = 0.000364037

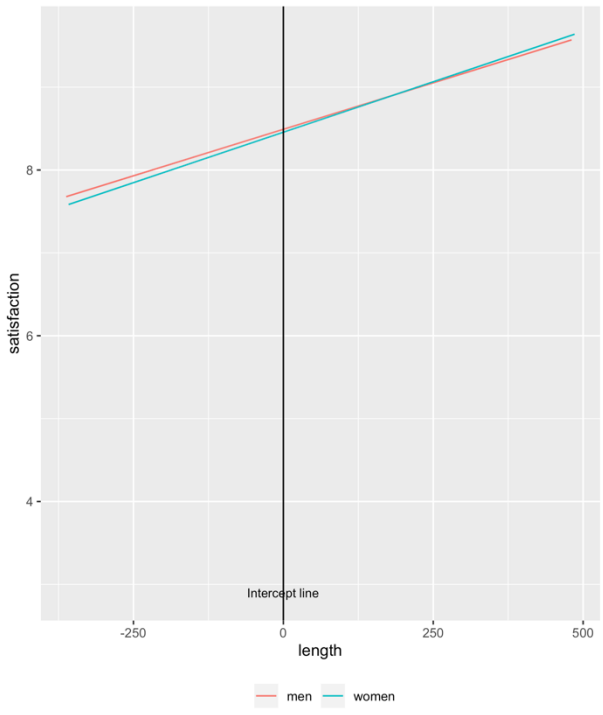
We conclude that length is mediating the relationship between tenure and customer satisfaction.

2.7. Investigate whether the effect of call duration on customer satisfaction depends on gender

	term	estimate	std.error	statistic	p.value
1	(Intercept)	8.49125094	0.00687521	1235.0532	0.0000
2	length_center	0.00224467	5.15E-05	43.5908595	0.0000
3	gender.male	-0.035181	0.01077172	-3.2660508	0.0011
4	length_center:gender.male	0.00019033	8.05E-05	2.36569578	0.0180

*(R function: reg_mod <- lm(costumer_satisfaction ~ length_center * gender.male, data = mod_data))*

Since the regression coefficient (0.00019033) for the interaction term *length_center * gender.male* is significant at the alpha level 0.05 with a p-value=0.0180, there exists a significant moderation effect. In other words, the effect of the call length on customer satisfaction significantly depends on gender.



2.8. Investigate whether the effect of call duration on customer satisfaction depends on qualification.

	term	estimate	std.error	statistic	p.value
1	(Intercept)	8.08044407	0.03074184	262.848425	0.0000
2	length	0.00129653	3.81E-05	34.049908	0.0000
3	waiting	-0.0125656	0.00011403	-110.19276	0.0000
4	dum_quali.1	-0.0126968	0.02571153	-0.4938174	0.6214
5	dum_quali.2	0.02821508	0.01896	1.48813743	0.1367
6	dum_quali.3	0.01478041	0.01865407	0.79234197	0.4282

(R function: quali_reg <- lm(formula = costumer_satisfaction ~ length + waiting + dum_quali.1 +

dum_quali.2 + dum_quali.3 + dum_quali.NA, data = data_with_dummies)

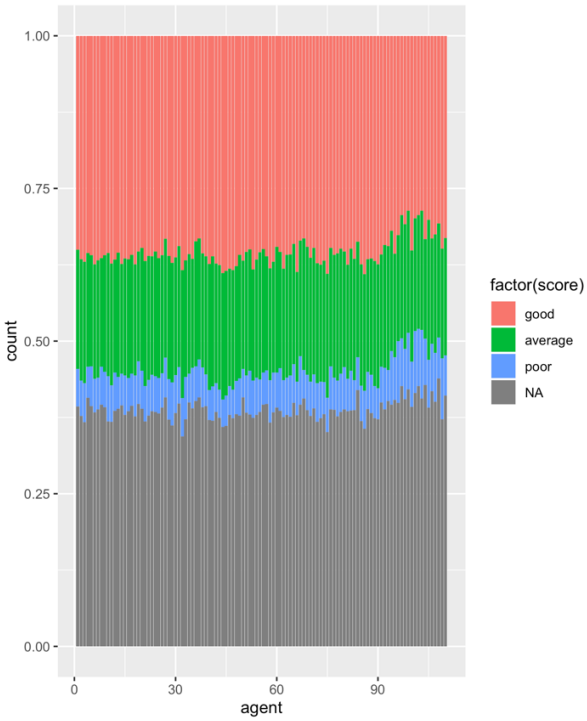
With: dum_quali1: apprenticeship

dum_quali2: some college

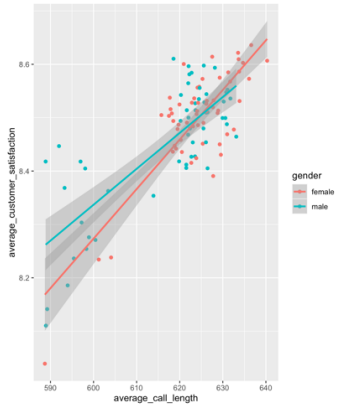
dum_quali3: university)

Since the regression coefficient of three dummies for the qualification term are not significant at the alpha level 0.05 (with p-value = 0.6214, 0.1367, 0.4282 respectively). Therefore, there does not exist any effect of qualification level on the score of customer satisfaction.

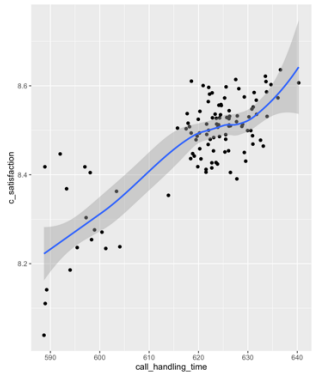
Dashboard performance



The overview of customer satisfaction



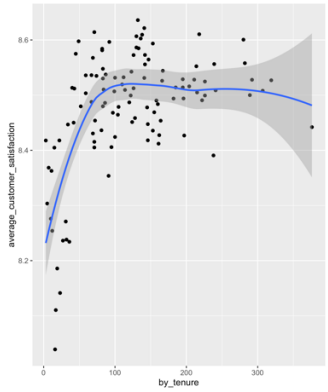
Relationship between call duration and customer satisfaction depends on gender



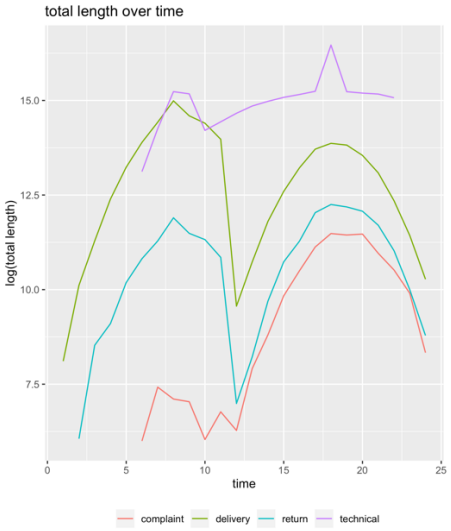
Relationship between the call handling time and customer satisfaction

Order	Agent ID	Average satisfaction
1	46	8.6360
2	42	8.6215
3	81	8.6142
4	14	8.6104
5	43	8.6095
6	47	8.6067
7	44	8.6027
8	7	8.6005
9	89	8.5976
10	66	8.5964
Mean of customer satisfaction		**8.5046**

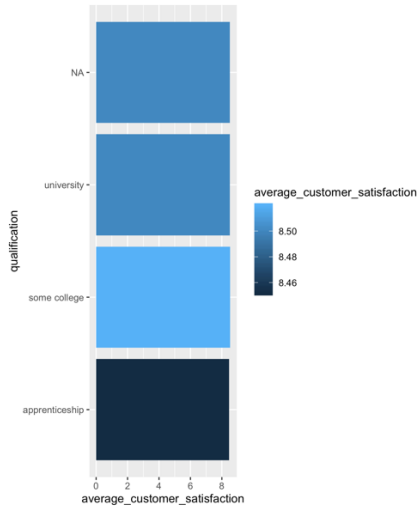
Top 10 best performance



Relationship between customer satisfaction and tenure



Length over day in problems



The average customer satisfaction in each qualification