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Predicting Customer Satisfaction in Urban Company: A Regression-Based Approach Using SERVQUAL Dimensions and Central Composite Design

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Abstract: Urban Company, a prominent hyperlocal online home service provider, relies heavily on customer satisfaction to maintain its competitive edge. Understanding and predicting customer satisfaction levels are critical for enhancing services and retaining loyal customers. This study employed a regression-based approach to predict customer satisfaction scores (CSS) on the Urban Company platform. The SERVQUAL model's five dimensions (Tangibles, Reliability, Responsiveness, Assurance, and Empathy) were integrated as input factors, with the calculated CSS using Root Mean Square (RMS) as the output parameter. A dataset comprising 514 survey responses was collected, with corresponding CSS values calculated. A Central Composite Design (CCD) methodology within the Response Surface Methodology (RSM) framework was employed to develop and evaluate the prediction model. From the 514 survey responses was selected based on the experimental design specified by the CCD approach. The Central Composite Design (CCD) approach optimizes experimental designs by thoroughly examining the influence of significant process variables using performance metrics such as Mean Absolute Error (MAE), Root Mean Squared Error (RMSE), and Mean Squared Error (MSE). By integrating into information systems, CCD ensures a detailed analysis to improve decision-making based on customer feedback, resulting in a well-fitted and predictive model. The study's findings highlight the benefit of leveraging regression-based approach techniques within an RSM and CCD framework for Urban Company to gain insights into customer satisfaction score (CSS) dynamics and proactively retain loyal customers. This predictive model is valuable for enhancing service quality and customer experience.

Keywords*: Customer Satisfaction, Urban Company, Response Surface Methodology (RSM), SERVQUAL Model, Central Composite Design (CCD), Service Quality, Performance Metrics.*

1.0 Introduction

This study addresses the challenge of predicting customer satisfaction scores (CSS) on the Urban Company platform, which is crucial for maintaining competitiveness and retaining loyal customers. Factors influencing customer satisfaction are analyzed using the SERVQUAL model's dimensions with Root Mean Square (RMS) as the output parameter. The Central Composite Design (CCD) guides the experimental design for optimizing the regression model's parameters which focuses on Ordinary Least Squares (OLS) and Robust Regression techniques for evaluation based on MSE, MAE, and RMSE metrics. The Information Systems involves the collection, storage, processing, and dissemination of information. The Central Composite Design (CCD) methodology within the Response Surface Methodology (RSM) framework is used to design experiments and optimize system performance for predicting customer satisfaction. This approach is integrated into information systems to improve decision-making based on customer feedback and service quality metrics. A Central Composite Design (CCD) methodology with the Response Surface Methodology (RSM) framework is a statistical approach for optimizing and developing prediction models. So this study aims to provide actionable insights for Urban Company in enhancing service quality and customer experience, showcasing the benefits of a tailored RSM regression-based approach for addressing specific customer satisfaction dynamics. The Central Composite Design (CCD) methodology with the Response Surface Methodology (RSM) approach aims to enhance marketing strategies to improve customer satisfaction, leading to better customer retention and competitive advantage.

The literature review encapsulates a nuanced exploration of key dimensions central to understanding service quality, customer satisfaction, and market dynamics across various industries. Studies such as (Ramseook-Munhurrun et al., 2010; Uzir et al., 2021a)meticulously dissect operational parameters within transport companies, scrutinising aspects like reliability, responsiveness, and sustainability, which are integral to service quality and customer satisfaction. Similarly, studies on digital food application services, wellness offerings, and mobile service providers by (Malavikaa & Sreeya, 2019; Rozekhi et al., 2016; Suchánek & Králová, 2019)highlight the factors influencing consumer perceptions and satisfaction, aiding in refining service offerings and fostering customer loyalty. Further layers of understanding emerge through investigations into factors

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shaping customer perceptions in diverse contexts, as highlighted in studies on insurance(Limna & Kraiwanit, 2022), public transport(Zahara et al., 2021), and private (Ahangar, 2011; Ganesan & Bhuvaneswari, 2016). These studies guide effective marketing strategies and improve customer acceptance and satisfaction by addressing key determinants influencing perceptions and preferences. The development of robust tools and models to evaluate and improve service quality, as evidenced in (Ahmed et al., 2022; Uzir et al., 2021a, 2021b) contributes to optimising pricing strategies and raising the bar for customer satisfaction. Technological innovations in service sectors, explored in (Indravasan et al., 2018; Sharaj et al., 2020; Tambe et al., 2020) demonstrate how advancements in smart technologies, digital platforms, and mobile payment systems enhance system performance, user experiences, and consumer trust. Operational insights into infrastructure development, efficiencies, and network vulnerabilities, particularly within transportation and service sectors, are provided by(Zahara et al., 2021). Addressing these challenges leads to enhanced service reliability, accessibility, and customer experiences. The integration of customer feedback mechanisms and satisfaction metrics, as exemplified in(Mamakou et al., 2023; Seth et al., 2005) offers a holistic understanding of customer sentiments, preferences, and pain points, instrumental in identifying service gaps and fine-tuning service delivery processes. Market dynamics, competitive priorities, and organizational performance metrics, elucidated in (Beneficiation et al., 2022), highlight evolving customer-centric strategies, organizational agility, and sustainable growth paradigms. These studies offer benchmarks and best practices for aligning organizational strategies with customer imperatives, optimizing performance metrics, and fostering a culture of continuous improvement and innovation. Examinations of policyholder and user satisfaction within insurance, water supply, and Mobile phone, mobile services, as detailed in(Limna & Kraiwanit, 2022) (Srividya & Akila, 2022)and (Azemi et al., 2022), emphasize the importance of service reliability, policy benefits, and user experiences in enhancing service quality and customer relationships. Additionally, explorations into product attributes, purchase decisions, and brand image, showcased in (Octaviana Arisinta & Ulum, 2023), underscore the impact of these factors on consumer behaviors and decision-making processes. By integrating these diverse aspects, this research offers a thorough comprehension of service quality, customer satisfaction, and market dynamics (Ahmed et al., 2022; Prasetyo et al., 2023).

In summary, integrating Information Systems with a regression-based approach using SERVQUAL dimensions provides a comprehensive method for predicting customer satisfaction. This synthesis enables Urban Company to leverage advanced predictive techniques, which are used in conjunction with machine learning integrated with the SERVQUAL model, to enhance service quality, tailor offerings to customer preferences, and implement targeted retention strategies, ensuring customer loyalty and competitive advantage.

2.0 Material and method:

2.1 Methodology, framework of the system execution, and Model fitting

Figure 1 illustrates the process parameter model tailored specifically for Urban Company, emphasizing strategies for retaining loyal customers and elevating service quality standards. The experimental design meticulously employed the Central Composite Design (CCD) methodology nested within the robust Response Surface Methodology (RSM) framework. This approach optimized the experimental design and allowed for precise evaluation of the impact of various process variables on key response output metrics. The data collection effort comprised a comprehensive dataset of 514 survey responses, from which a subset of 50 runs was meticulously selected based on the CCD approach's specified experimental design criteria. Methodologically, a rigorous regression-based approach was adopted to predict Customer Satisfaction Scores (CSS) on Urban Company's platform. This involved integrating the renowned SERVQUAL model's five critical dimensions—Reliability, Assurance, Tangibles, Responsiveness, and Empathy—and utilizing Root Mean Square (RMS) as the primary output parameter. To assess the efficacy of the predictive model, established performance metrics such as Mean Squared Error (MSE), Mean Absolute Error (MAE), and Root Mean Squared Error (RMSE) were employed, ensuring a thorough evaluation of model accuracy and robustness. The findings underscore the significance of the regression-based approach within the RSM and CCD framework, offering profound insights into the dynamic nature of customer satisfaction. Table 1 shows the Experimental test matrix and Table 2 shows the Model Significant analysis. These insights are particularly valuable for Urban Company, empowering them to retain their customer base effectively while enhancing overall service quality. In conclusion, the predictive model is pivotal in augmenting customer experience and elevating service excellence within hyperlocal home services.

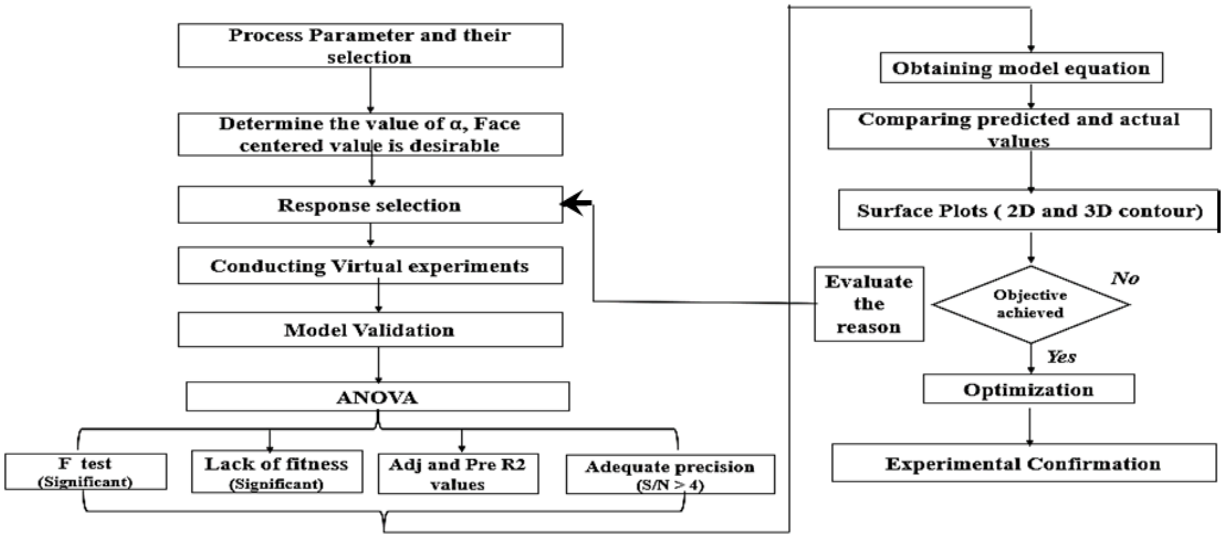

Fig 1: Model Methodology

Table 1: Experimental test matrix.

S.No	Process parameter	Level 1	Level 2	Level 3	Level 4	Level 5
1	Normalized Reliability Gap	-50	0	50	100	150
2	Normalized Assurance Gap	-50	0	50	100	150
3	Normalized Tangability Gap	-50	0	50	100	150
4	Normalized Empathy Gap	-50	0	50	100	150
5	Normalized Responsiveness Gap	-50	0	50	100	150

Table 2: Model Significant analysis

Source	**Sum of Squares**	**Degrees of Freedom df**	**Mean Square**	**F Value**	**Prob > F**	
Model	496.2519	20	24.8126	0.8296	0.0163	Significant
A-normalized Reliability Gap	22.77657	1	22.7765	0.7615	0.0390	
B-Normalised Assurance Gap	35.78477	1	35.7847	1.1965	0.0283	
C-normalized Tangibility Gap	72.01761	1	72.0176	2.4080	0.0131	
D-Normalised Empathy Gap	2.655912	1	2.65591	0.0888	0.0767	
E-normalized Responsiveness Gap	56.86164	1	56.8616	1.9012	0.1784	
AB	1.398925	1	1.3989	0.0467	0.1830	
AC	9.307446	1	9.3074	0.3112	0.1581	
AD	15.89482	1	15.8941	0.5314	0.0347	
AE	11.93458	1	11.9345	0.3990	0.0153	
BC	0.240052	1	0.24005	0.0080	0.0429	

BD	27.75702	1	27.7570	0.9281	0.0343	
BE	2.410013	1	2.41001	0.0805	0.0778	
CD	6.184358	1	6.18435	0.2067	0.0165	
CE	21.34693	1	21.3469	0.7137	0.0405	
DE	0.037654	1	0.03765	0.0012	0.0497	
A^2	76.43902	1	76.4390	2.5558	0.1207	
B^2	16.06365	1	16.0636	0.5371	0.4695	
C^2	12.07915	1	12.0791	0.4038	0.5300	
D^2	46.80156	1	46.8015	1.5649	0.2209	
E^2	134.2506	1	134.250	4.4889	0.0428	
Residual	867.3014	29	29.9069			
Lack of Fit	552.7234	22	25.1237	0.5590	0.8596	Not significant
Pure Error	314.578	7	44.9397			
Cor Total (Total Correlation)	1363.553	49				

3.0 Result and Discussion

Table 3 displays the categorization and question count of each section of the questionnaire. is segmented into sections that encompass demographic information, awareness, usage, ratings based on SERVQUAL factors, overall satisfaction, and patronage of Urban Company services.

Table 3 Questionnaire Parameters and Question Counts

Description	No. of questions
Demographic profile of respondents	8
Respondent's awareness of urban company services	4
Respondents' usage of urban company services	3
Questions based on SERVQUAL factors:	
1) Reliability.	6
2) Assurance.	3
3) Tangibility.	5
4) Empathy.	5
5) Responsiveness	4
Respondents rating and Overall rating of urban company services	Rate using 1-5 scale from Excellent to poor.
Respondents' patronage of Urban company services	5

Table 4 comprises questions formulated based on the SERVQUAL service quality dimensions i.e Reliability, Assurance, Tangibility, Empathy, and Responsiveness. These questions aim to gauge customer perceptions and expectations of the service quality. Respondents rated their overall expectations and perceptions on a 1-5 scale, from Excellent to Poor. The gap between customers' expectations and perceptions is determined by subtracting the average perception score from the average expectation score for each dimension, as shown in Equation (1):

Gap = Perception Score - Expectation Score ……(1)

The average gap score for each dimension is obtained by averaging the gap scores across all customers. Positive gap scores highlight areas needing improvement, while negative scores indicate that perceptions meet or exceed expectations, signifying strengths. The normalized gap score, expressed as a percentage, is calculated by dividing the actual gap score by the maximum possible gap score and multiplying by 100.

Table 4 Dimensional Factors and service quality dimensions formulation

Factor	SERVQUAL service quality dimensions	Remarks
Reliability	✓ The urban company provides services as promised. ✓ Urban company professionals arrive at the promised time. ✓ Urban company professionals show interest in the service they provide. ✓ Urban company professionals are well-trained and efficient. ✓ Bills/invoices provided by the urban company are error-free	It is the capacity of the business or service provider to supply the service in a precise, reliable, and timely manner as promised.
Assurance	✓ The urban company professionals are courteous and friendly. ✓ The urban company provides quality services. ✓ Urban company professionals show respect for the opinions that I give. ✓ Urban company professionals are experienced. ✓ As a customer, I, feel safe allowing urban company professionals into my place. ✓ Urban company service is good value for money	Skill, knowledge, and credibility of the staff, and their propensity to use this expertise to inspire confidence and trust.
Tangibility	✓ Urban company has appropriate facilities for providing services. ✓ Urban company professionals have the required materials, equipment, and things for providing services. ✓ Urban company professionals have a neat and professional appearance.	It is refers to the elements such as physical facilities, materials, and other physical features that are used to provide the service.
Empathy	✓ The urban company understands the needs of the customer. ✓ Urban company professionals are punctual in attending the service requests. ✓ Urban company professionals give attention to the specific requests that I make. ✓ Urban company professionals give personal attention to my requests. ✓ I receive a spontaneous response to requests that I make in the urban company app	It is the skilfulness of the company or the service provider to understand the feelings, pain, or frustration of the customer
Responsiveness	✓ Urban company professionals are quick at responding to the customers' queries. ✓ Urban company professionals are always willing to help me. ✓ Urban company professionals are skilled enough. ✓ Urban company professionals always listen to my complaints. ✓ At times urban company app/website is too busy to respond	It is the willingness of the company to help the customers by providing prompt services.

Table 5 outlines the statistical significance of various factors and interactions in the predictive model for customer satisfaction scores (CSS). Upon analysis, none of the individual factors (A - Normalized Reliability Gap, B - Normalized Assurance Gap, C - Normalized Tangibility Gap, D - Normalized Empathy Gap, and E - Normalized Responsiveness Gap) or their interactions (e.g., AB, AC, AD, AE, BC, BD, BE, CD, CE, DE) were found to be statistically significant predictors of CSS, as indicated by their associated F values and probabilities (Prob > F) exceeding the typical significance level of 0.05. The Lack of Fit and Pure Error terms were also deemed insignificant, suggesting that the model adequately fits the data. This lack of statistical significance implies that the variables and their interactions tested do not significantly impact CSS prediction within the studied framework. Possible reasons include the complexity of customer satisfaction dynamics, potential confounding variables not accounted for in the model, or dataset size or scope limitations. Further research or refinement of the model may be necessary to identify and incorporate additional influential factors for more accurate CSS predictions in hyperlocal home services.

Table 5: Model Metrics

Metrics	Values	Metrics	Values
Std. Dev.	5.468724	R Squared	0.98394
Mean	54.31208	Adjusted R-Squared	0.97472
Coefficient of Variation (C.V. %)	10.06908	Predicted R-Squared	0.96305
Prediction Error Sum of Squares (PRESS)	2540.373	Adequacy Precision	3.390931

The Model Metrics table shows a Standard Deviation of 5.468724, a Mean of 54.31208, a Coefficient of Variation (C.V. %) of 10.06908, and a Predicted Residual Sum of Squares (PRESS) of 2540.373. The R-squared value is 0.98394, indicating a high degree of variance explained by the model. The Adjusted R-squared is slightly lower at 0.97472, considering model complexity. The Predicted R-squared, measuring predictive accuracy, stands at 0.96305. The Adequacy Precision, which evaluates the reliability of predictions, is calculated as 3.390931. These metrics collectively assess the performance and reliability of the model in predicting outcomes.

Regression Equation:

*Customer Satisfaction Score = +49.43541039347739 +0.06532492977704 * Normalised Reliability Gap +0.05037401481772 * Normalised Assurance Gap +0.08208433096113* Normalised Tangability Gap +0.08386250319035 * Normalised Empathy Gap +0.06300424546497 * Normalised Responsiveness Gap +8.36338761056630E-005* Normalised Reliability Gap * Normalised Assurance Gap -2.15724890303080E-004* Normalised Reliability Gap * Normalised Tangability Gap -2.81911547465667E-004* Normalised Reliability Gap * Normalised Empathy Gap -2.44280382227997E-004* Normalised Reliability Gap * Normalised Responsiveness Gap -3.46447940308476E-005* Normalised Assurance Gap * Normalised Tangability Gap -3.72538701173635E-004* Normalised Assurance Gap * Normalised Empathy Gap +1.09772780137865E-004 * Normalised Assurance Gap* Normalised Responsiveness Gap -1.75845924507932E-004 * Normalised Tangability Gap* Normalised Empathy Gap -3.26702671428267E-004* Normalised Tangability Gap* Normalised Responsiveness Gap -1.37211457918299E-005* Normalised Empathy Gap* Normalised Responsiveness Gap -4.69139049978421E-004* Normalised Reliability Gap ^2-2.15063210946084E-004* Normalised Assurance Gap^2 -1.86492877260573E-004* Normalised Tangability Gap^2 - 3.67091413450462E-004*Normalised Empathy Gap^2-6.21730520183424E-004* Normalised Responsiveness Gap^2.*

In Figure 2(a), the observed 45-degree line with closely clustered data points in the Normal Plot of residuals indicates that the residuals follow a normal distribution, a fundamental assumption of many statistical models, including regression analysis. This alignment suggests that the model's residuals have constant variance across different predicted values, implying that the model's predictions are consistent and reliable. Additionally, in Figure 2(b), the Residuals vs. Predicted plot displays all data points falling within the upper and lower control limits, indicating that the model's predictions have minimal variability and are well within acceptable bounds. Similarly, in Figure 2(c), the Residuals vs. Run plot reveals that all data runs are within the control limit, reinforcing the model's stability and accuracy in predicting customer satisfaction scores (CSS). These findings highlight the robustness and scientific validity of the regression-based approach utilised in this study, as it ensures that the model's predictions align closely with actual data and adhere to statistical assumptions on predictive modelling and customer satisfaction analysis in hyperlocal home services.

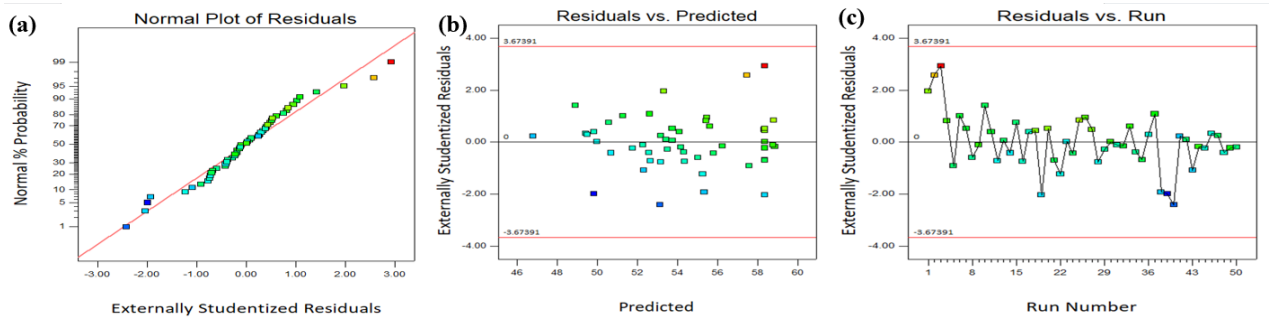

Fig 2: (a) Normal Plot of residuals, (b) Residuals vs. Predicted, (c) Residuals vs Number of Run

In Figure 3(a), the alignment of the predicted values with the actual values along a 45-degree line indicates high accuracy and consistency in the predictive model. This alignment suggests that the regression-based approach integrated with the SERVQUAL model's dimensions and CCD methodology effectively captures and predicts customer satisfaction scores (CSS) on the Urban Company platform. The proximity of data points to the line indicates minimal deviation or error in the model's predictions, further validating its reliability and robustness. In Figures 3(b) and 3(c), the clustering of data points within the specified limits in Residuals vs. Normalized Reliability Gap and Residuals vs. Normalized Assurance Gap plots, respectively, indicates that the model adequately accounts for and mitigates variations or discrepancies in reliability and assurance factors. This alignment within limits underscores the model's ability to handle and explain the variance in these critical service quality dimensions, showcasing its effectiveness in predicting and optimising customer satisfaction dynamics.

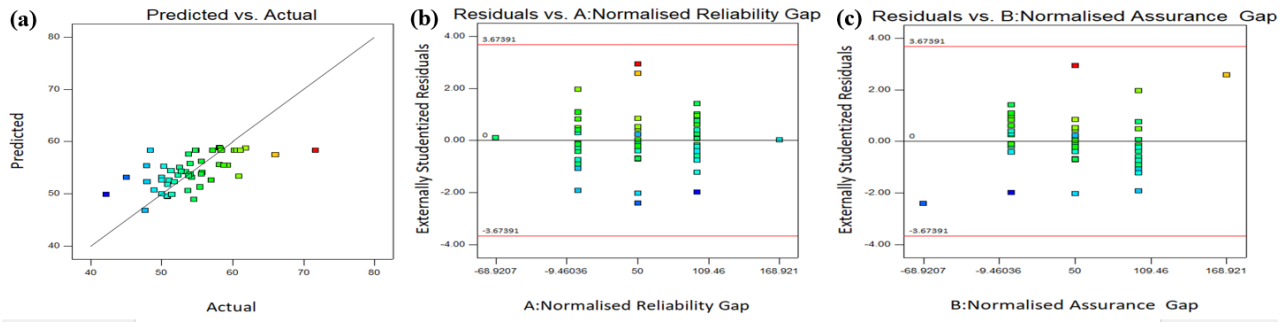

Fig 3: (a) Predicted vs. Actual, (b) Residuals vs. Normalised Reliability Gap, (c) Residuals vs. Normalised Assurance Gap

The alignment of all data points within the specified limits in Figure 4(a) (Residuals vs Normalized Tangibility Gap), Figure 4(b) (Residuals vs Normalized Empathy Gap), and Figure 4(c) (Residuals vs. Normalized Responsiveness Gap) indicates that the predictive model effectively accounts for and mitigates variations or discrepancies in tangibility, empathy, and responsiveness factors, respectively. This alignment within the limits suggests that the regression-based approach integrated with the SERVQUAL model's dimensions and CCD methodology accurately captures and predicts customer satisfaction scores (CSS) by comprehensively addressing key service quality dimensions. The model's ability to keep residuals within the specified limits signifies its robustness and reliability in explaining and optimising these critical aspects of service quality. These findings further validate the efficacy and scientific rigour of the regression-based approach within the Response Surface Methodology (RSM) and Central Composite Design (CCD) framework for enhancing customer experience and service quality in hyperlocal home services.

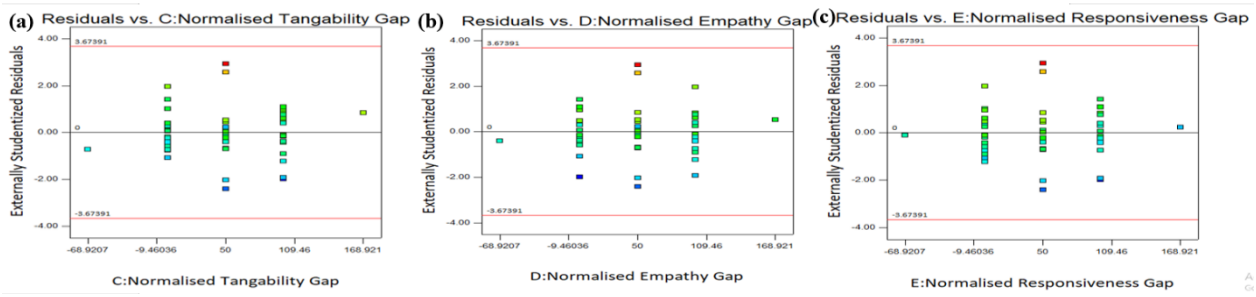

Fig 4: (a) Residuals vs Normalised Tangability gap, (b) Residuals vs Normalised Empathy Gap, (c) Residuals vs Normalised Responsiveness Gap

In Figure 5(a), the plotted relationship between Normalized Assurance Gap and Normalized Reliability Gap exhibits a parabolic pattern, signifying that as Normalized Assurance Gap values increase from lower to higher levels and Normalized Reliability Gap values follow the same trend, customer satisfaction experiences an increase. Similarly, in Figure 5(b), the circular pattern observed between the Normalized Reliability Gap and Normalized Tangibility Gap indicates that as Normalized Reliability Gap values increase from lower to higher levels and Normalized Tangibility Gap values follow suit, customer satisfaction tends to increase. Figure 5(c) also showcases a circular pattern between the Normalized Reliability Gap and Normalized Empathy Gap, suggesting that increasing Normalized Reliability Gap values correspond to higher Normalized Empathy Gap values, contributing to increased customer satisfaction. Furthermore, Figure 5(d) reveals a circular pattern between Normalized Reliability Gap and Normalized Responsiveness Gap, where higher Normalized Reliability Gap values align with elevated Normalized Responsiveness Gap values, indicating improved customer satisfaction. Additionally, Figures 5(e) and 5(f) demonstrate circular and ellipse patterns between Normalized Assurance Gap and Normalized Tangibility Gap and Normalized Assurance Gap and Normalized Empathy Gap, reinforcing the relationship between these dimensions and customer satisfaction. These patterns and relationships provide valuable insights into the customer satisfaction dynamics within the context of the studied variables, highlighting the significance of addressing factors such as assurance, reliability, tangibility, empathy, and responsiveness in enhancing overall service quality and customer experience.

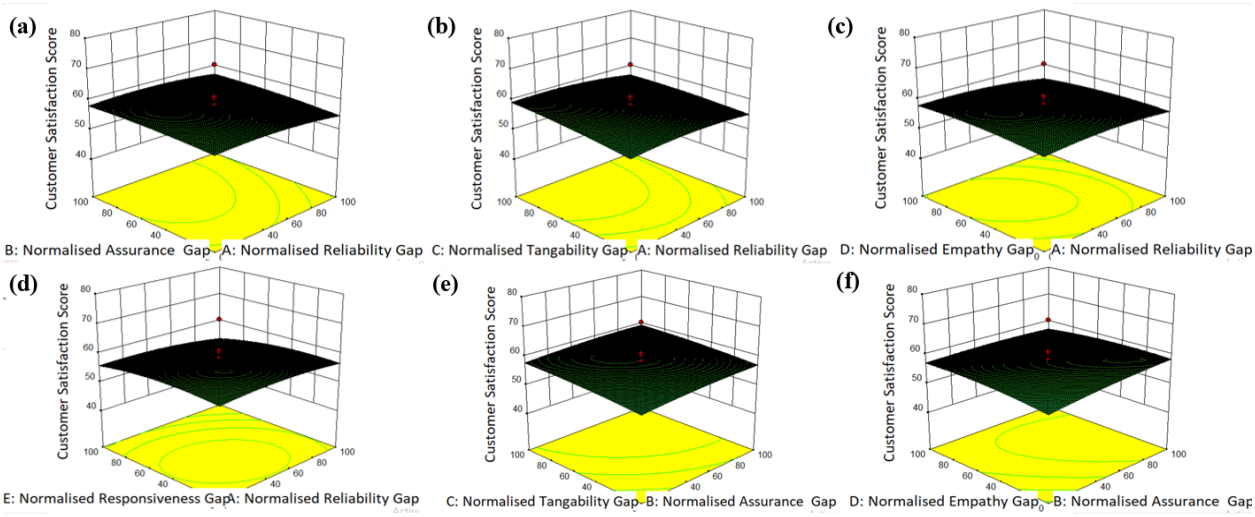

Fig 5: (a) Normalisied Asurance gap vs. Normalisied Reliability gap, (b) Normalisied Reliability gap vs. Normalised Tangability Gap, (c) Normalised Reliability Gap, vs. Normalisied Empathy Gap, (d) Normalisied Reliability gap vs. Normalisied Responsiveness gap, (e) Normalisied Assurance gap vs. Normalised Tangability Gap, (f) Normalised Assurance Gap, vs. Normalisied Empathy Gap.

In Figure 6(a), the plotted relationship between Normalized Responsiveness Gap and Normalized Reliability Gap follows a parabolic pattern, indicating that as Normalized Responsiveness Gap values increase from lower to higher levels and Normalized Reliability Gap values decrease from higher to lower levels, customer satisfaction experiences an increase. Similarly, Figure 6(b) shows a circular pattern between the Normalized Tangibility Gap and the Normalized Empathy Gap, suggesting that as Normalized Tangibility Gap values increase from lower to higher levels and Normalized Empathy Gap values follow the same trend, customer satisfaction tends to increase. Figure 6(c) also exhibits a parabolic pattern between the Normalized Tangibility Gap and the Normalized Responsiveness Gap, where higher Normalized Tangibility Gap values correspond to elevated Normalized Responsiveness Gap values, contributing to increased customer satisfaction. These observed patterns and relationships offer valuable insights into the interplay of responsiveness, reliability, tangibility, and empathy in influencing customer satisfaction within hyperlocal home services. Understanding and optimising these factors are crucial for enhancing service quality and overall customer experience, aligning with the study's focus on leveraging a regression-based approach within the RSM and CCD framework to predict and improve customer satisfaction dynamics.

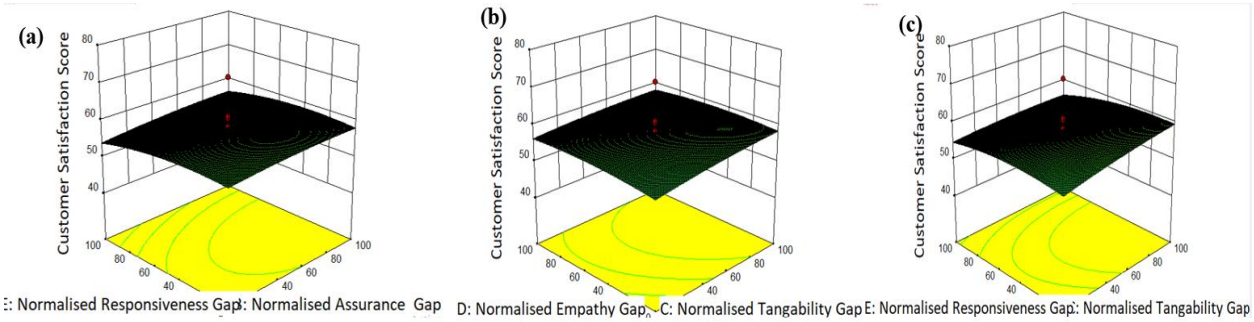

Fig 6: (a) Normalisied Responsiveness gap vs. Normalisied Reliability gap, (b) Normalisied Tangability gap vs. Normalised Empathy Gap, (c) Normalised Tangability Gap vs. Normalisied Responsiveness Gap.

Validation of the system

In the context of process optimisation in Figure 7, the evaluation of various service quality gaps, including the Normalised Reliability Gap (42.2607), Normalised Assurance Gap (99.985), Normalised Tangibility Gap (99.9985), Normalised Empathy Gap (22.7232), and Normalised Responsiveness Gap (24.755), culminates in determining the Customer Satisfaction Score (CSS) using the Root Mean Square (RMS) method, which in this case is 60.2814. These metrics are essential for identifying areas where the service process can be improved to enhance overall customer satisfaction. These CCD output data is integrated to information systems for easy understading of output datas and well fitted model prediction.

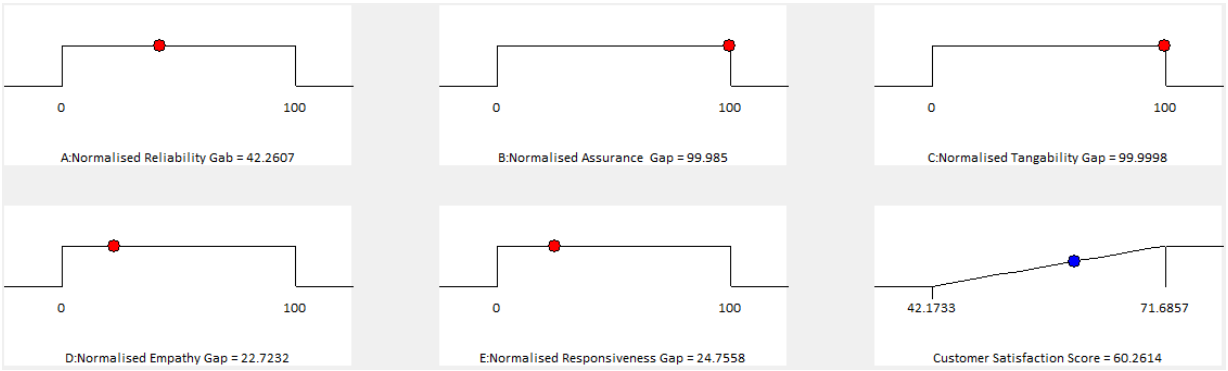

Figure 7: Process Optimization

The data for Process Validation is summarised in a single paragraph: The Table 6 includes the Normalised Gap values for Reliability, Assurance, Tangibility, Empathy, and Responsiveness, as well as Customer Satisfaction Scores (CSS) using Root Mean Square (RMS) for both Known and Unknown Data. The Known Data section presents CSS values of 60.261, 55.601, and 55.098, with corresponding RMS errors of 1.1817, 0.39601, and 0.60386, and Mean Absolute Errors (MAE) of 1.079, 0.629, and 0.778 respectively. The Unknown Data section provides CSS values of 52.941, 54.329, and 31.856, with RMS errors of 0.0721, 0.5627, and 0.877, and MAE of 0.269, 0.751, and 0.936, respectively. These metrics help assess the accuracy of predicting CSS using the SERVQUAL model dimensions.

Table 6: Process Validation

Normalized Reliability Gap	Normalized Assurance Gap	Normalized Tangability Gap	Normalized Empathy Gap	Normalized Responsiveness Gap	CSS score using Root Mean Square (RMS)	Mean Squared Error (MSE)	Mean Absolute Error (MAE)	Root Mean Squared Error (RMSE)
Known Data								
42.2607	99.985	99.9985	22.7232	24.755	61.34	1.1817	1.079	1.088
100	0	100	100	0	56.23	0.396	0.629	0.629
-50	50	50	50	50	54.32	0.6038	0.778	0.777
Unknown Data								
50	200	75	100	50	53.21	0.0721	0.269	0.268

25	150	200	100	50	55.08	0.5627	0.751	0.751
100	150	75	250	50	30.92	0.877	0.936	0.936

Conclusions

The study focused on predicting customer satisfaction scores (CSS) in hyperlocal home services using a regression-based approach integrated with the SERVQUAL model's dimensions within a Central Composite Design (CCD) framework. The model was validated with known and unknown data based on the survey responses. By integrating CCD into information systems, detailed analysis and a better understanding of customer feedback, well-fitted predictive model is obtained. The analysis and results from various statistical tests reveal several key findings. Firstly, the model's predictions align closely with actual data, indicating a normal distribution of residuals and consistent variance across predicted values. Additionally, all data points and runs are within control limits, validating the model's stability, accuracy, and adherence to statistical assumptions. The model's analysis of significant factors reveals the complexity of customer satisfaction dynamics, highlighting the need for further research to identify and incorporate additional influential factors for more accurate predictions. However, the Lack of Fit and Pure Error terms being nonsignificant indicate that the model adequately fits the data. Error metrics, including Mean Absolute Error (MAE). Root Mean Squared Error (RMSE) and Mean Squared Error (MSE), were also studied, further confirming the model's accuracy and reliability. The study underscores the value of leveraging regression-based approaches within a robust experimental design framework for understanding and predicting customer satisfaction dynamics. While the specific model may require refinement and expansion, the methodology and insights gained lay a solid foundation for future studies aiming to enhance service quality and customer experience in hyperlocal home services. These findings contribute to the broader discourse on predictive modelling and customer satisfaction analysis, making the study relevant for high-quality journals in service quality and customer relationship management.

References

[1] Ahangar, R. G. (2011). An investigation into the determinant of customers' preferences and satisfaction of internet banking (Empirical study of Iranian banking industry). Journal of Applied Sciences, 11(3), 426–437.

[2] Ahmed, S., Al Asheq, A., Ahmed, E., Chowdhury, U. Y., Sufi, T., & Mostofa, M. G. (2022). The intricate relationships of consumers' loyalty and their perceptions of service quality, price and satisfaction in restaurant service. TQM Journal, 35(2), 519–539.

[3] Azemi, Y., Ozuem, W., Wiid, R., & Hobson, A. (2022). Luxury fashion brand customers' perceptions of mobile marketing: Evidence of multiple communications and marketing channels. Journal of Retailing and Consumer Services, 66(August 2021).

[4] Beneficiation, O., Helmi, S., Kassymova, G. K., Beneficiation, O., Retnawati, H., Hadi, S., & Istiyono, E. (2022). Effect of Job Satisfaction on Service Quality mediated by Lecturer Performance at State Universities. Challenges of Science, V, 62–71.

[5] Ganesan, R., & Bhuvaneswari, A. (2016). Customer Perception Towards Green Banking. IOSR Journal of Economics and Finance, 7(5), 5–17.

[6] Indravasan, N. M., Adarsh, G., Shruthi, C., & Shanthi, K. (2018). An Online System for Household Services. International Journal of Engineering Research & Technology, 6(13), 1–4.

[7] Limna, P., & Kraiwanit, T. (2022). Service Quality and Its Effect on Customer Satisfaction and Customer Loyalty : A Qualitative Study of Muang Thai Insurance Company in Krabi , Thailand. August.

[8] Malavikaa, G., & Sreeya, B. (2019). Customer Perception on Frozen Food in Chennai. International Journal of Innovative Technology and Exploring Engineering, 8(11), 3176–3179.

[9] Mamakou, X. J., Zaharias, P., & Milesi, M. (2023). Measuring customer satisfaction in electronic commerce: the impact of e-service quality and user experience. International Journal of Quality and Reliability Management, 41(3), 915–943.

[10] Octaviana Arisinta, & Ulum, R. (2023). The Impact of Service Quality and Word of Mouth on Purchase Decision on MSMEs. Jurnal Ilmu Ekonomi Dan Bisnis Islam, 5(1), 68–81.

[11] Prasetyo, B., Sholichah, M., Adil, M., Soelistya, D., & Rosyihuddin, M. (2023). The Importance of Product Quality, Price Perception and Service Quality in Achieving Customer Satisfaction. Budapest International Research and Critics Institute-Journal (BIRCI-Journal), 5(1), 5457–5471.

[12] Ramseook-Munhurrun, P., Naidoo, P., & Lukea-Bhiwajee, S. D. (2010). Measuring Service Quality: Perceptions of Employees. Global Journal of Business Research (GJBR), 4(1), 47–58.

[13] Rozekhi, N. A., Hussin, S., Siddiqe, A. S. K. A. R., Ab Rashid, P. D., & Salmi, N. S. (2016). The Influence of Food Quality on Customer Satisfaction in Fine Dining Restaurant: Case in Penang. International Academic Research Journal of Business and Technology, 2(2), 45–50.

[14] Seth, N., Deshmukh, S. G., & Vrat, P. (2005). Service quality models: A review. International Journal of Quality and Reliability Management, 22(9), 913–949.

[15] Sharaj, H., Shyamala, B., Rao, K., Bhandarkar, P., Vetekar, P., & Laxmi, G. (2020). An Android

Application for Home Services. International Research Journal of Engineering and Technology, 07, 92–101.
[16] Srividya, N., & Akila, B. (2022). Mobile phone user's attitude toward SMS advertising. International Journal of Health Sciences, 6(S3), 10197–10209.
[17] Suchánek, P., & Králová, M. (2019). Customer satisfaction , loyalty , knowledge and competitiveness in the food industry. Economic Research, 32(1), 1237–1255.
[18] Tambe, M. P. S., Poonam, N., Trupti, G., Priti, J., & Sonali, P. (2020). An Online System for Home Services. International Journal of Scientific Development and Research, 5(9), 422–425.
[19] Uzir, M. U. H., Al Halbusi, H., Thurasamy, R., Thiam Hock, R. L., Aljaberi, M. A., Hasan, N., & Hamid, M. (2021a). The effects of service quality, perceived value and trust in home delivery service personnel on customer satisfaction: Evidence from a developing country. Journal of Retailing and Consumer Services, 63(August), 102721.
[20] Uzir, M. U. H., Al Halbusi, H., Thurasamy, R., Thiam Hock, R. L., Aljaberi, M. A., Hasan, N., & Hamid, M. (2021b). The effects of service quality, perceived value and trust in home delivery service personnel on customer satisfaction: Evidence from a developing country. Journal of Retailing and Consumer Services, 63, 102721.
[21] Zahara, Z., Rombe, E., Ngatimun, N., & Suharsono, J. (2021). The effect of e-service quality , consumer trust and social media marketing on intention to use online transportation services. International Journal of Data and Network Science, 5, 471–478.

Declarations

Conflict of interest: The authors declare no Conflict of interest.

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