

**MODELLING THE CAUSAL RELATIONSHIPS BETWEEN SERVICE QUALITY, OPERATIONAL EFFICIENCY, AND SATISFACTION OF PATIENTS IN PUBLIC HEALTHCARE SYSTEMS**

**<sup>1</sup>Y Venkat Santosh Ramana, <sup>2</sup>Dr. Pinakapani Peri**

<sup>1</sup>Research Scholar,

GITAM School of Business Hyderabad

GITAM Deemed to be University, Hyderabad, Telangana

E-Mail ID: vyerrava@gitam.in

<sup>2</sup>Professor, GITAM School of Business Hyderabad,

GITAM Deemed to be University, Hyderabad, Telangana

e Mail ID: pperi@gitam.edu

**Abstract**

The research studies conducted in this study also involve causal studies because it involves proving the relationship between the following and the following; Satisfaction of Patient, the operational efficiency of an operational unit of a healthcare system, and the quality of service offered in a healthcare system as a form of a public healthcare system. The planned sample of the selected medical institutions is 350 patients whose information was calculated via a posterior distribution tool (PLSSEM) implemented thereon and analyzed in the form of the SmartPLS 4.0 format. Construct and structural model reliability were determined by the established measurement model, and since positive validity of construct and structural model was substantial, it identified that the quality of service offered has positive significant opportunities to influence the operational efficiency ( $= 0.52$ ,  $p = 0.001$ ) and satisfaction of patient ( $= 0.61$ ,  $p = 0.001$ ). They also found that its impact on Satisfaction of Patient is mediated in part by the efficiency of operation that is further mediated by quality of service ( $b = 0.18$ ,  $p < 0.01$ ). These results evidenced the bi-modality of the service quality in enhancing the processes and patient outcomes within the hospital. The paper can be applied by health professionals, administrative, and policymakers to deliver evidence based knowledge on how to maximize the value of delivery of services promoted in the sector, how to develop the processes effectively and how to enhance Satisfaction of Patient in government health systems.

**Keywords:** Service Quality, Operational Efficiency, Satisfaction of Patient, Public Healthcare, PLS-SEM, Structural Equation Modeling, SmartPLS

**Introduction**

The health care systems in the world are stretched in such a manner that they offer quality services in addition to being effective and meeting expectations of the patients. The quality of

services offered, operations level, and Satisfaction of Patient are the essential performance dimensions of healthcare that have not been clarified appropriately as the causes and its impact where the shortage of resources, administrative pressure, and fairness within a community-based healthcare system complicate the matter. This is important as understanding how patients perceive themselves in terms of the quality services of Service Quality perceptions and internal efficiency of operations in relation to satisfaction is pertinent to administrators, practitioners as well as policy-makers who will need more efficient mechanisms in terms of providing better health care and allocation of scarce resources.

The quality of the service was traditionally understood as a multidimensional concept that implies the physical services, timeliness or waiting time, interpersonal communication, responsiveness, assurers, empathy and process constituents (e.g. interaction quality, process quality, environment) (Zarei, Daneshkohan, Pouragha, Marzban, & Arab, 2014; Mutlu and Baykara, 2025). Based on the experience of numerous studies, regardless of the location, private, or state, perceived quality of services correlates with higher levels of Satisfaction of Patient (Zarei et al., 2014; Milicevic et al., 2024). In an illustration, Zarei et al., (2014) determined that close to 45 percent of overall satisfaction among patients in private hospitals in Tehran was mediate by the dimensions of service quality (e.g., cost, process, and discussed quality of interaction) (Zarei, Daneshkohan, pouragha, marzban, and Arab, 2014).

Productivity within healthcare can be seen as the capacity of health care institutions to provide services by placing the most appropriate inputs (personnel, equipment, beds) and using the least amount of time without affecting the quality of the services. Efficiency may involve the throughput, waiting, cost per unit of service and eliminating waste. Previous studies have reported conflicting evidence on efficiency and Satisfaction of Patient that in certain large hospital systems an increased efficiency leads to increased Satisfaction of Patient (increased satisfaction being absent in other studies), and that in other studies increasing efficiency through staffing reductions or pressure to move patients through the hospital faster can lead to reduced perceived quality and increased satisfaction (Hospital efficiency and Satisfaction of Patient studies; 2013).

Evidence also exists to support or indicate that efficiency attenuates or constrains the correlation between quality and satisfaction: e.g. in Turkish public hospitals structural quality was differently related to Satisfaction of Patient by the level and size of the hospital (i.e. small, medium, large) (Analyzing the ambiguous relationship..., 2013). Similarly, Canadian studies revealed that reverse relationships where increased efficiency was associated with reduced Satisfaction of Patient indicated some trade-off, though the magnitude of the relationships is also low where efficiency gains are achieved at the cost of other attributes of care that are most important to a patient ( Hospital efficiency and Satisfaction of Patient, Ontario, 2002).

However, gaps exist in perception of these insights. First of all, there is scarcity of research works which empirically modeled the cause and effect relationships between quality perceptions of services, the operating performance and Satisfaction of Patient in healthcare services where the government is the operator. Second, the majority of the available literature

addresses one or two of the links (e.g., service quality - satisfaction), but not explicit or adequate on how efficiency mediates/moderates to the equation, not as an outcome, but as a mediator. Third, most of the literature focuses on a privately based hospital or mixed hospital; less commonly a public based healthcare system (which might have varying constraints and incentives) is a central focus, particularly in low and mid-income countries.

Given these gaps, this study will aim to: (1) study how patients in the publicly-provided health facilities feel about quality of the services; (2) establish a cause-effect relationship between the perceptions about the quality of services provided by healthcare and the efficiency of service delivery and resource allocation to healthcare companies; (3) make evidence-based predictions to health delivery providers, administrators, and policymakers on how to increase efficiency of service delivery and resource allocation; and (4) forecast the relationship between quality of service perceptions with the degree of satisfaction among the patients. Introducing these relations in the context of a scenario of publicly managed healthcare, one will reasonably anticipate that this paper will be able to make some contribution to theory and policy by answering the question of what are the best leverages to increase satisfaction without reducing efficiency.

### **Literature Review:**

Increases in past research related to the healthcare performance have not only given high priorities to three areas that have proved to be intertwined but also, include service quality, operational efficiency and Satisfaction of Patient. Simple constructs, the schemata well embodied by the structure-process- outcome triad, provided by Donabedian, have afforded a continuous organization logic of connecting patient level system inputs and processes to patient level outputs and satisfaction (Donabedian, 1988). The model developed by Donabedian is actively used to identify concepts of quality that can be presumably quantified and developed within national healthcare settings and serves as the foundation of many of its empirical research projects that attempted to explain by what mechanisms an organizational climate can be translated into patient perceptions and satisfaction.

The methods used in quality service measurement in relation to health service would cause modification in multi involved dimensional measurements tools used in services research. The most well exploited is owned, e.g., SERVQUAL or healthcare derivations; who have been operationalized quality of service to greater extents of tangibles, reliability, responsiveness, assurance and empathy that have been demonstrated to exist in several hospitals as well are free of experimentation in the different countries they have been adapted and studies of measurement (servqual adaptations and measurement studies). They can also be facilitated in a comparative work teaching of the everywhere-applicability, hint to questions of contextual-fit: and hint to other gathering of qualities instead of propagated into privately off-the-sheet for compilation of scales specifically in vendor such as on a access-and-equity values-as-public and resources-as-public system.

Through typical empirical findings, the interpretation of servqual as perceived through the satisfaction of the patient may be found, though it change significantly according to the context due to the fact that not all dimensions of service quality are equally significant. SEM

studies have been able to test these relationships through the strong tests in the path modelling of the relationship between latent constructs through the estimation of direct and indirect path. Examples include, SEM helped Woo et al. (2021) demonstrate that perceived medical servqual is also an important predictor of Satisfaction of Patient and behavioral intentions (e.g., intent to revisit) among regional public hospitals, and furthermore, the authors determined that the relationship between medical servqual and these two variables are mediated by other factors (e.g. interaction quality and process efficiency). These SEM studies are also particularly useful in separating the issues of whether the quality of service correlates with satisfaction or has no impact on the quality of other outputs like trust and wanted safety.

Indicators that include operational efficiency (throughput, waiting times, bed turnover and technical productivity) have been evaluated using techniques that involve the Data Envelopment Analysis (DEA), time motion and queueing analysis. However, recent research utilizing DEA - Malmquist indexes has helped to estimate change in efficiency across an interval in government hospitals and to compare organizational productivity via area and type of proprietorship (public hospital and private). These business indicators are not strictly accounting measures, but impact patient experiences (waiting time, accessibility to care), etc. and, therefore, are likely to be correlated with measures regarding perceived quality and satisfaction with the service. Empirical studies are currently beginning to know, indicate about the efficiency being the product of the management practices and change prediction or moderator of Satisfaction of Patient.

Efficiency is a topic that finds expanding academic literature in association with perceived quality. Others are suggesting that trade-offs in favor of interpersonal aspects of care could also be being involved - throughput increase or length of stay reduction initiatives may also trade off interpersonal aspects of care and as a consequence, decrease the perceived quality and satisfaction whereas others have found that efficiency gains (to simplify operations) may benefit both perceived quality and perceived satisfaction. As have been researched and reviewed, the relationship is complex and context-dependent at the same time, as the efficiency gains have no consequence on the important properties of the clinical care and communication process, but efficiency obtained through cost cutting mechanisms, such as staff number decreasing or responsiveness diminishment, should be lessening perceived quality.

Several more recent studies eventually find more integrated forms of analysis including quality measures and efficiency measures or SEM/mediation analysis itself. In line with this, SES application linked patient trust in safety control (a quality indicator) to satisfaction through essential indicators like trust and perceived organizational responsiveness during the pandemic of 2019 (Gomez-Carmona et al., 2021). Only a few days ago research into organizational performance in the government hospitals shows non-financial determinants (governance, staff engagement, process organization) of the organizational performance and quality - establishing the presence of multiple possible mediational lines on which management practices could favorably alter patient perceptions and downstream satisfactions.

This has been carried out but with three gaps. Firstly, literature deficit exists particularly in the literature devoted to the topic of the comparison of resources available in the low-income group and the middle-income group of the countries where the resources are distorted on the basis of incentive schemes as a result of the unavailability of resources and equity provision. Second, the work is largely cross-sectional (as it excludes the aspect of causal inference, longitudinal studies with quality and satisfaction measures in causal inversion would be preferable) observation of productivity indicator (i.e., by DEA-Malmquist) and repeated quality (and satisfaction) indicators. Third, intrinsic to patients parameters (heterogeneity on the basis of socioeconomic status, health literacy) have not been examined as mediators in the list of moderating factors; these parameters could proceed to require prescribing on the kind of beyond complementary (or conflictual) interrelationships among efficiency and quality change intimate intervention.

Overall, the conceptual framework can be saturated with the literature because the model actually advocates the service quality perceptions that affect Satisfaction of Patient either directly or indirectly through operational processes that dictate efficiency and patient experience. However, the pathways of these directions can be different in every situation and when basing a strategy on them. This is why the current study is aimed at simulating causal relationships between servqual, operational efficiency, and Satisfaction of Patient in a public healthcare organization with the help of a powerful analytic module (e.g., SEM function jointly with the measurement of operational efficiency) to specify which levers can have synergistic effects on patients and inspired systems.

**Hypothesis:**

The research aims to test the following hypotheses:

**H1:** There is a significant relationship between patients' perception of service quality and operational efficiency in public healthcare facilities.

**H2:** There is a significant relationship between patients' perception of service quality and their overall satisfaction.

**Methodology:**

This study employed quantitative study research design because it empirically determined cause-effect relationship between the quality of services provided, level of operational efficiency, and Satisfaction of Patient in public healthcare system. The data linked to patients utilising services in selected single healthcare facilities was obtained through a structured questionnaire, the questions of which were pegged on validated service quality and Satisfaction of Patient scales. In order to ascertain that the respondents covered representative demographic groupings and that 350 respondents were interrogated which was considered adequate in both relation to the research, previously undertaken on the same topic and also in view of the power analysis, the stratified random sampling technique was adopted. The perceptions of the patients data were examined through the descriptive statistics and subsequently were examined through the analysis as per the inferential statistical techniques where correlation analysis test and structural equation model (SEM) were adopted to test the

hypotheses on the impact of the quality of the service on the operational efficiency (H1) and the Satisfaction of Patient (H2). A T-test of reliability and validity of the constructs was done using alpha value of Cronbach value and the confirmatory factor analysis (CFA) on the other hand direct and indirect effects of the model were done through mediation and path analysis.

### **Results and Discussions:**

Without restriction on number, three hundred and fifty valid responses were gathered through sampling of patients of the sampled health institutions. The proportion of the demographics is in Table 1. There were 54.3 percent male and 45.7 percent female sample. Most of the respondents were young (26-40 years) and their number of 42.9% made the majority, three-quarter of those who answered. 30.0% fell in category of 41- 55 years with 18.3% being below 25 years. The highest education level was higher education (48.0%), followed by secondary (36.6%), and the lowest educational levels were primary (15.4%).

**Table 1 Demographic Information**

| <b>Variable</b>  | <b>Categories</b> | <b>Frequency</b> | <b>Percentage (%)</b> |
|------------------|-------------------|------------------|-----------------------|
| <b>Gender</b>    | Male              | 190              | 54.3                  |
|                  | Female            | 160              | 45.7                  |
| <b>Age</b>       | Below 25 years    | 64               | 18.3                  |
|                  | 26–40 years       | 150              | 42.9                  |
|                  | 41–55 years       | 105              | 30.0                  |
|                  | Above 55 years    | 31               | 8.9                   |
| <b>Education</b> | Primary           | 54               | 15.4                  |
|                  | Secondary         | 128              | 36.6                  |
|                  | Higher Education  | 168              | 48.0                  |

Construct reliability should be measured by use of the Cronbach alpha. All scales with greater than 0.70 which is the required threshold were reliable. Concerning the service quality construct (operated at dimension of tangibility, reliability, responsiveness, assurance and empathy), the alpha was 0.87, the operational efficiency was 0.81 and at the level of Satisfaction of Patient was 0.89. Confirmatory Factor Analysis (CFA) was conducted to ensure convergent validity: all constructs had a factor loading of higher than 0.60 as well as Average Variance Extracted (AVE) of higher than 0.50.

**Table 2 Reliability and Validity**

| Construct              | Cronbach's Alpha | Composite Reliability | AVE  |
|------------------------|------------------|-----------------------|------|
| Service Quality        | 0.87             | 0.90                  | 0.62 |
| Operational Efficiency | 0.81             | 0.85                  | 0.58 |
| Patient Satisfaction   | 0.89             | 0.91                  | 0.64 |

The proposed causal occurrence relationship was proved via application of Structural Equation Modeling (SEM) and was supported by SmartPLUS 4.0 partial least squares (PLS-SEM) aided by partial least squares (PLS-SEM) variance basis method to establish a mathematical relationship between the proposed causal connections and the outcomes of service quality, operational effectiveness and Satisfaction of Patient. SmartPLS was chosen over covariance means of SEM because of the peculiarity to be both predictive and exploratory, crunching of not only simpler, but also complex model of a number of latent constructs/ indexes and the average sample threshold. The model included three service quality, service operation efficiency and Satisfaction of Patient pass or fail items (latent) that were rated via set of reflective measures, required to be completed by suitability parameter. PLS-SEM provided the chance to examine the model of measurement and structure model together. It was an all embrace approach and method of where a justification of a direct as well as indirect means can be constituted such that the formulated hypotheses can be critically reviewed.

The following was revealed by path analysis:

H1: Service Quality: Operational Efficiency -  $b = 0.52$ ,  $p = 0.001$  (significant).

H2: Service Quality - Satisfaction of Patients:  $b = 0.61$ ,  $p < 0.001$  (significant).

Furthermore, to observe the importance of the mediating value of operational efficiency, a secondary model was used to illustrate the partiality of the service quality and Satisfaction of Patient connection working through operational efficiency ( $b = 0.18$ ,  $p < 0.01$ ).

**Table 3 Path Co-efficient**

| Hypothesis | Path                                                           | Standardized $\beta$ | p-value | Result               |
|------------|----------------------------------------------------------------|----------------------|---------|----------------------|
| H1         | Service Quality $\rightarrow$ Efficiency                       | 0.52                 | <0.001  | Supported            |
| H2         | Service Quality $\rightarrow$ Satisfaction                     | 0.61                 | <0.001  | Supported            |
| Indirect   | Service Quality $\rightarrow$ Satisfaction<br>(via Efficiency) | 0.18                 | 0.01    | Partial<br>Mediation |

As indicated in Table 3, the two proposed relations are well acceptable. The relationship between quality of service and operational efficiency ( $b = 0.52$ ,  $p < 0.001$ ) demonstrates that operational efficiency of healthcare services depends conclusively upon the stronger the

perception of services to be responsive, polite and reliable, the better the impression of how operations take place in a hospital it creates. Similarly, the degree of relationality between quality of service and customer satisfaction ( $b = 0.61$ ,  $p < 0.001$ ) also confirms that quality of service is a decisive factor of customer satisfaction, as how patients perceive care processes and interrelations determines their customer satisfaction. The indirect relationship ( $b = 0.18$ ,  $p < 0.01$ ) shows a partial mediation relationship that shows that it is true that not only can there be a direct impact on satisfaction by service its quality, it also leads to an indirect impact, i.e. increases in operational efficiency. All things considered, the above findings suggest that the significance of the quality of the service is two-fold, that on one hand, it has the direct effect on the level of the satisfaction and on the other, raises its efficiency, which subsequently strengthens the level of the satisfaction.

These findings suggest that the perception of service quality by the patient plays an important role in determining the operational efficiencies as well as patient experience and satisfaction in a government hospital, thus justifying H1 and H2. More efficient hospital operations were linked to higher quality of service provided in areas like responsiveness, empathy and assurance, which led to less waiting time and efficient processes. Also, service quality was also found to be an excellent predictor of patient overall satisfaction indicating that patients associate the concept style with caring quality alongside the provision of clinical outcomes, interpersonal communication, and institutional trustworthiness. The partial mediation effect of service quality stresses on the notion, too, that efficiency increases the effect of service quality on satisfaction, nevertheless, service quality is a direct force as well as a primary one.

Herein, the crucial issue is the necessity to address the aspects of service quality improvement as the strategic tool to improve not only the process within the healthcare sector but also customer satisfaction. In order to mind patient-centered outcomes, policymakers and administrations have to work on interventions to make channels, process flow, and communication as responsive as possible.

**Measurement Model:** It was able to estimate construct reliability, convergent, and discriminant validity of measurement model. LIM reliability analysis using Cronbach alpha indicated that the mean of service quality, operational efficiency, and Satisfaction of Patient had Cronbach of 0.87, 0.81, and 0.89 respectively with all values greater than 0.70. The convergent validity level was high in condition of the composite reliabilities (0.85-0.91), as well as the (AVE ( $>0.50$ )) values. The Fornell-Larcker and the HTMT ratios ( $<0.85$ ), assisted in supporting the existence of discriminant validity, therefore, and all the constructs were unique to empiricism.

**Table 4 Measurement Model**

| Construct                  | Item<br>(Indicator) | Factor<br>Loading | Cronbach's<br>Alpha | Composite<br>Reliability (CR) | AVE  |
|----------------------------|---------------------|-------------------|---------------------|-------------------------------|------|
| <b>Service<br/>Quality</b> | Tangibility 1       | 0.78              | 0.87                | 0.90                          | 0.62 |
|                            | Tangibility 2       | 0.81              |                     |                               |      |
|                            | Reliability 1       | 0.83              |                     |                               |      |
|                            | Reliability 2       | 0.79              |                     |                               |      |
|                            | Responsiveness<br>1 | 0.80              |                     |                               |      |
|                            | Responsiveness<br>2 | 0.77              |                     |                               |      |
|                            | Assurance 1         | 0.82              |                     |                               |      |
|                            | Empathy 1           | 0.76              |                     |                               |      |

|                                |                |      |      |      |      |
|--------------------------------|----------------|------|------|------|------|
| <b>Operational Efficiency</b>  | Efficiency 1   | 0.74 | 0.81 | 0.85 | 0.58 |
|                                | Efficiency 2   | 0.78 |      |      |      |
|                                | Efficiency 3   | 0.79 |      |      |      |
| <b>Satisfaction of Patient</b> | Satisfaction 1 | 0.81 | 0.89 | 0.91 | 0.64 |
|                                | Satisfaction 2 | 0.84 |      |      |      |
|                                | Satisfaction 3 | 0.80 |      |      |      |
|                                | Satisfaction 4 | 0.79 |      |      |      |

**Structural Model:** The structural model was used to determine the predictive relevance and effect sizes of the relationship hypotheses. R<sup>2</sup> values were high:

Operational Efficiency (R<sup>2</sup> = 0.27): 27% of variance expounded by service quality.

Service Quality (R<sup>2</sup> = 0.45): 45% of the length of Satisfaction of Patient is explained by service quality and running efficiency.

The operational efficiency and Satisfaction of Patient predictive relevance, assessed with the aid of a Blindfold, were 0.21 and 0.38, respectively, which proves that the model has a reasonable predictive power. Also, the effect size (f<sup>2</sup>) analysis showed it had a medium to large effect on operation efficiency (f<sup>2</sup> = 0.37) and on Satisfaction of Patient (f<sup>2</sup> = 0.51) whereas the indirect effect of operational efficiency on Satisfaction of Patient had a small-to-medium effect (f<sup>2</sup> = 0.05).

**Table 5 Structural Model**

| Path | Standardized | t- | p- | f <sup>2</sup> Effect | R <sup>2</sup> | Q <sup>2</sup> | Result |
|------|--------------|----|----|-----------------------|----------------|----------------|--------|
|------|--------------|----|----|-----------------------|----------------|----------------|--------|

|                                                           | $\beta$ | value | value  | Size                       | (Endogenous) | (Predictive Relevance) |                      |
|-----------------------------------------------------------|---------|-------|--------|----------------------------|--------------|------------------------|----------------------|
| Service Quality<br>→ Operational<br>Efficiency            | 0.52    | 6.12  | <0.001 | 0.37<br>(medium)           | 0.27         | 0.21                   | Supported            |
| Service Quality<br>→ Satisfaction<br>of Patient           | 0.61    | 7.89  | <0.001 | 0.51<br>(large)            | 0.45         | 0.38                   | Supported            |
| Operational<br>Efficiency →<br>Satisfaction of<br>Patient | 0.18    | 2.58  | 0.01   | 0.05<br>(small-<br>medium) | -            | -                      | Partial<br>Mediation |

The results obtained demonstrate that the measurement model is effective, the construction of the constructs is practically measured, and structural model just shows that Satisfaction of Patient is a determinant of the quality of the services and the efficiency of the work of the system working in the field of healthcare provided by the government.

The findings show that quality of service has effects at both direct and indirect levels on patients since it directly and indirectly affects Satisfaction of Patient by increasing the effectiveness of operations. There were also certain linkages between some of the quality of service delivery, short waiting times, and positive patient experiences and good running of the hospitals. The measured outcomes correlate with the strategic significance of the changes in service quality-related dimensions of the service provision responding to the problems with a positive impact on operations and patient outcomes including responsiveness, empathy, assurance, and consequently - patient-centered outcomes. These could be then used by providing the administrators and policy makers with a capability to come up with interventions aimed at improving access to process flow, communication and responsiveness and then improve satisfaction in the public health sectors.

### **Conclusions:**

As demonstrated in this paper, quality of service is an essential element of not only effectiveness of operations, but Satisfaction of Patient based on health care system. The image above confirms the assertion, with greater perceptions towards responsiveness, empathy, reliability, and assurance showed to positively affect Satisfaction of Patient directly and indirectly since it enhances the efficiency of the operations. The concept of partial mediation the effect by which the operations efficiency positively relates to operational efficiency processes and factors in the hospital elucidate the impact that the operations of the hospital have the operational efficiency mechanisms and factors in on the extent of an increased Satisfaction of Patient concomitant of quality of such services. The general result shows a double meaning concerning the quality service delivery and smooth business operations in terms of guaranteeing improvement of patient centred outcomes. Policymakers

and administrative staff need to keep in mind that the quality of service connotes not only clinical efficacy, but also contact with patients, communicational and innovative and interpersonal reliability.

### **Recommendations:**

According to the study findings the main challenge that such issues as managers and policymakers of the healthcare sector should focus on is strategic intervention conducted on the way of enhancing the quality of services provided in the public hospitals. This will include increasing the responsiveness of staff and personnel, reducing waiting time, patient capable care, and ensuring process efficiency to streamline the processes. Regular training of medical personnel, receiving of feedback, and key performance indicators may help in maintaining the quality of the services. In addition, additional effectiveness and satisfaction of the patient can be achieved by managing the technological processes and integrating the communication. Sustainability in care and improvement enhancement methods could be achieved within the public healthcare system through patient-centered care path, both in terms of initiating high-quality service delivery and realistic Greater operational excellence.

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