

# PUBLIC SERVICE DELIVERY FACADES: MEASURING EFFECTIVENESS THROUGH GREY RELATION THEORY

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## ABSTRACT

*Although the application of grey relation system theory has been prosperous in the engineering field, there are very few applications in the management field. We argue that this theory is worthy of promotion to the management field. Therefore, the main purpose of this study is to demonstrate the application of grey relation analysis, one part of the grey system theory, by analyzing the topic of public service delivery and people satisfaction. We have tried to investigate whether public service delivery and public satisfaction are two different constructs. Finally, tries to verify the relative importance of effective service delivery constructs and the constructs of overall service satisfaction by the service recipients i.e. citizens. The following is an enumeration of the important conclusions: effective service delivery constructs have a different effect on officers' work performance and overall service satisfaction has a different effect on service recipients.*

**Keywords:** Service Delivery, Grey Relation Theory, Public Service, Public Satisfaction, Service Recipient.

## INTRODUCTION

Public service has always been essential and important to the public that has been a catalyst in the economic growth of a nation. Due to the entry of private player/ franchise centres it has become competitive; both the officers involved in service delivery and the recipients the common man. In the present, economic and political order governments are both the service providers and service recipients therefore every stakeholder is closely affected by the service delivery mechanism Tiwari (2022). The image and performance of the government are now gauged upon the potential capacity of service provisions and service delivery. The industry-related services are not only important but every organization must provide services as it is meant to either be managed by the government of government franchise Oliver et al. (1997). Increasing importance is paid to evaluating public service quality and diagnostic procedures in the areas of public service and delivery to the citizens Akinboade et al. (2012).

Public services can be grouped into three broad categories: (i) essential utility or infrastructural services, such as the provision of electricity, gas, water, sanitation, telecommunication and maintenance of roads; (ii) social services such as health care, schooling, public housing and social welfare programs (for example, social security and poverty alleviation); and (iii) regulatory services, such as land registry systems for formalizing property rights and land titles, issuance of licenses and permits, the establishment of safety and environmental standards and codification and enforcement of the law Batley (2004).

Public services are particularly important for the poor and for reducing inequality. Unlike

the better-off, the poor often cannot afford to replace deficient public goods with the costlier alternatives the private sector provides Besley & Ghatak (2006). A public distribution system aimed at fulfilling the needs of poor sections of society through the provision of such essential services as food, health and medical attention can bring livelihood essentials within easy reach of people whose lives may remain otherwise largely untouched by economic growth Blau (1970).

In methodology, research in the management of service delivery uses a multivariate method, but some limitations should be followed, such as, samples are large enough and residuals are normally distributed. Hair et al. (2019) indicated that, for multiple-regression, small samples, usually characterized as having fewer than 20 observations, are appropriate for analysis only by simple regression with a single independent variable. Even in these situations, only very strong relationships can be detected with any degree of certainty. They also indicated that the most fundamental assumption in multivariate analysis is normality, referring to the shape of the data distribution for an individual metric variable and its correspondence to the normal distribution, the benchmark for statistical methods. Although a number of data transformations are available to accommodate non-normal distribution, it is still an arduous job. However, if the sample size is small or the distribution of residuals is unknown, the grey system theory still can be used (Feng and Wang et al. (2022).

Therefore, the grey system theory is worthy of promotion to the management field, at least when the sample size is small and the distribution of samples is unknown. Grey system theory has been universally applied in engineering research, but until now this method still stays in the initial stage of management research Cronbach (1951). Recently, the methodology based on the grey system theory is used in the international management literature such as performance evaluation for airlines Wang et al. (2022), product design and process planning (Chang et al., 2001). The grey system theory is good at dealing with uncertain data, is able to make full use of known information to find the regular pattern of a system, and is strong in solving the problems of incomplete information systems (Datong and Lei, 1986). Specifically, the grey system theory has a very important feature, the feature of least data, which requires only three pieces of data for the grey relation analysis. This research focuses on how to use the grey system theory to explore the topic of service quality and customer satisfaction.

This research is divided into two parts. The first is to review past studies on effective public service delivery (EPSD), second, the satisfaction measures of the service recipients. This study focuses on the grey relation analysis of the grey system theory and describes it in detail because researchers in the management field are very unfamiliar with this method, especially, in Western society. Finally, it provides management implications and gives suggestions for follow-up research.

## **Review of Literature and Factor Identification for Effective Service Delivery**

We have reviewed most of the relevant literature related to public service delivery and public satisfaction and become familiar with existing published work in the last five years. It allowed us to ensure that the present piece of research work has not been previously published by using the Grey Relation Analysis approach of Grey Relation Theory. We come across different levels of research papers in the service delivery domain but a majority of literature focused on corporate service delivery, there is scant research on performance/evaluation/assessment/diagnostic approaches to public service (services as offered by Government departments). We generated a series of relevant nine criterion constructs and one predictor as effective service delivery (ESD).

## **Organizational Structure of Department of Public Service**

Organizational Structure (COS) may be considered the anatomy of the organization, providing a foundation on which the organization functions. Organizational structure is believed to affect the behaviour of organization members. All organizations have an administrative structure. In well designed organizational structure the efforts are to minimize or at least regulate the influence of variations on the organizational performance. Several researchers highlighted the importance of organizational structure both at the organization level and subunit levels for the performance (efficiency, and effectiveness) of organizations. Organizational performance or effectiveness is a variable dependent on the clarity of organization structure that has been envisioned and measured in various ways across the various process of service delivery.

### **Service Specialization**

The service recipients derive the social benefits from long-term relationships with service-providing departments of the government, including professional services like education and medical etc. The social benefits have been presumed to include feelings of familiarity, personal recognition, friendship, rapport, and social support because of the service specialization of the people engaged in service delivery as they are promptly handling the matters and grievances of the public and offer the desired service in minimum cost of time and efforts spending Churchill (1979).

### **Management by Objectives**

The effectiveness of MBO systems is a means for leading self-managing teams. Researchers are of opinion that the proposition that MBO systems can be an effective tool to improve group effectiveness with respect to both group productivity and job satisfaction. As a practical implication, it shows that if group members are committed to their service delivery objectives the service delivery can be improved and the members will be satisfied with their teamwork.

### **Service Reliability**

Reliability is an inter-disciplinary subject area applicable to power supply, transportation, education, public service distribution, banking, health care, etc. The effectiveness of these organizations cannot be appreciated without the concept of reliability. The reliability concepts to service providers are a particular example of the well-canvassed general problem solving by applying quantitative methods where the desired outcomes are intangible. Service reliability judgments depend on the recipients' experiences and information on the specifications, service realization and service receipt.

### **Sense of Responsibility and Authority**

Authority should be accompanied by an equal amount of responsibility. Delegating the authority to someone else doesn't imply escaping from given responsibility. The responsibility, therefore, is the duty of the person to complete the task assigned to him. A person who is given the responsibility should ensure that he accomplishes the tasks smoothly, happily and as per the objectives assigned to him. If the tasks for which he was responsible are not completed, then he should make excuses but should be held accountable. Responsibility without adequate authority leads to discontent and dissatisfaction among the service delivery officials as we understand that responsibility flows from bottom to top together with the authority Kampen et al. (2006).

### **Empathy as Relaxing and Confidence**

Empathic communication is a fundamental way in which we realize with the service-seeking citizens from the organization/ department. How well we make rapid and accurate inferences about the feelings, goals, attitudes, motivations, beliefs, intentions, and behaviours of such service-seeking public, determines to a large extent what we contribute in a specific service as well as our perceived value to be human beings. Empathetic understanding is therefore both an important determinant of how well we communicate with each other as well as a personal characteristic that facilitates our ability to convince other service-seeking people. Empathy and communication is a tools we use every day to understand others and to share our thoughts, feelings, and personal experience.

### **Organizational Strategy Towards Service Delivery**

Effective public service delivery needs effective organizational strategy, particularly capping the gaps created delivery process. Officers make efforts to bridge the gap through institutionalized public service delivery strategies like- (a) The listening gap (b) The service design and standards gap (c) The performance gap and (d) The communication gap. The organizational service delivery strategies must be made and planned in such a way that they should fulfil the expectation of service recipients from the government for various services of government departments Chen & Ting (2002).

### **Responsiveness in Services Delivery**

The service responsiveness also focuses on the degree to which the department offers an excellent service information system to receive, analyze, record and track public needs. Service responsiveness includes organizational cultural support that reflects the ability of a department to provide public representatives with a clear service vision and has the support of service responsiveness in the internal environment and teamwork Chen & Chen (2008).

### **Service Strategy and Performance**

When analyzing this relationship between strategy and performance, the traditional barriers measures lack relevance in the service delivery, as the officials do not react to the public focus service delivery Robinson (2007). Performance measures cover the range of service operations practices and the relevant literature that has addressed service functional strategy to the development of the service delivery system in order to match the peoples' expectations with their perceptions Singh et al. (2010). Service organizations effectively measure the service performance and design strategies required for the proper and effective delivery of services Rice (2007).

### **Effective Service Delivery**

Effective service delivery systems require, an optimal combination of inputs like Clarity of Organizational Structure, Service Specialization, Service Reliability, Service Management by Objectives, Authority and Responsibility, Service Empathy and Communication, Organizational Strategy, Service Responsiveness, Strategy and Performance Ismail & Yusof (2009).

The performance of public service providers is judged by multiple communities (consumers, taxpayers, staff, and politicians). Furthermore, each of these communities may use different criteria to judge the standard of public Liu et al. (2016) services and may apply different weights to the same criterion Rainey (2009). It follows that there is no fixed and universally applicable set of criteria for evaluating whether performance is high or low. Nevertheless, public services have tangible elements (quantity, speed of delivery, effectiveness) that are likely to be valued by all

populations Verma & Prasad (2017).

Issues and motivation for improving public service delivery are one of the biggest challenges worldwide. Public services are a key determinant of quality of life that is not measured like per capita income or on any other measurement scale. Organizing public service provision is deemed to be a core function of government. The imperative needs of the poor and marginalized class of people make it more challenging. The most demanded services are either peripheral (preventive care in the case of epidemics) or other internal services (health, education and welfare) Davis (2004) Hall & Norburn (1987).

## RESEARCH METHODOLOGY

On a predesigned Likert's based questionnaire for six public service department were decided to collect the samples. 150 questionnaires were administered (25 officers from each department) that included revenue, panchayats, health, municipality, police and the department of district administration in Lucknow division of Uttar Pradesh Walker & Boyne (2006). The collected data has been tabulated as per coding and process through SPSS-24. The relevant test were run that resulted adequate in its measurement and thus passed the essential values that could generate factual meaning to the authors to understand the interpretation and drawing the conclusions respectively. Table shows the reliability status of each independent factor including effective service delivery as dependent factors Russell & Bvuma (2001) Table 1.

<b>S. No.</b>	<b>Construct/ Factors</b>	<b>No. of Items</b>	<b>Alpha Values</b>
1.	Clarity of Organizational Structure (COS)	7	0.907
2.	Service Specialization (SS)	6	0.857
3.	Management by Objectives (MBO)	12	0.947
4.	Service Reliability (SRL)	10	0.929
5.	Authority and Responsibility (AR)	4	0.913
6.	Service Empathy (SE)	6	0.942
7.	Organizational Strategy (OS)	5	0.878
8.	Service Responsiveness (SR)	4	0.735
9.	Service Performance (SP)	5	0.873
10.	Essential Service Delivery (ESD)	7	0.919

Source: Authors' own processed data presentation

## Data Processing and Interpretation

The data further processed as per the requirement of grey relation analysis and grey coefficient. Table presents the mean values of each factor on 5 point Likerts' scale (1 highly disagree to 5 highly agree) of questionnaire as administered in six public service departments in the state of Uttar Pradesh particularly in Lucknow division. As discussed earlier we have made the application of Grey Relation Analysis as a component of Grey Relation Theory. Table 2 shows the relevant data as tabulated and processed, made ready to use in further steps of processing.

**Table 2**  
**EFFECTIVE SERVICE DELIVERY DATA SET**

Departments	X	COS	SS	MBO	SRL	AR	SEC	OS	ESR	SP	ESD
1. Revenue	5	4.12	4.05	3.91	3.91	4.07	4.03	4.12	4.07	3.86	3.92
2. Health	5	4.01	3.98	3.89	3.97	4.02	3.99	4.01	3.98	3.75	3.55
3. Panchayat	5	3.78	3.92	3.97	3.84	3.88	3.97	4.22	4.01	3.86	3.78
4. Municipality	5	4.03	3.76	3.69	3.90	4.20	4.18	4.15	3.96	3.79	3.69
5. Police	5	3.80	3.79	3.56	3.86	3.59	3.78	3.78	3.82	3.89	3.58
6. District Admin	5	3.79	3.98	3.78	3.69	3.80	3.83	3.75	3.65	3.94	3.59

Source: Authors' own processed data presentation

The application of grey relation theory suggests processing the collected data in the following manner Tshiyoyo (2009).

Normalization of the original data using  $\Delta = |x_0(k) - x_i(k)|$   
Using the formula-1 to compute grey relation coefficient of each related factor's behavioral data series with regard to characteristics of data series.

$$\Delta_{min} = \min X_j X_i \min X_k |x_0(k) - x_i(k)|,$$

$$\Delta_{max} = \max X_j X_i \max X_k |x_0(k) - x_i(k)|$$

Computation of grey relation degree for each factors of the data with regard to its characteristics.

$$\xi_i(k) = \frac{\Delta_{min} + \rho \Delta_{max}}{\Delta_{xi}(k) + \rho \Delta_{max}}$$

The result obtained using above equation is applied to measure the degree effective public service delivery by the officers in the identified departments as sampled for the study.

Size comparison to permute the obtained grey relation degree for a grey relation order which will explain the relative influence of each related factor's behavioral data series on the characteristics of behavioral data.

Table 3 explain that  $\Delta_{min} = 0.78$  and  $\Delta_{max} = 1.45$ . The distinguishing coefficient  $\rho$  is set to 0.5. (The usual value of  $\rho$  comes in the range of (0, 1).

**TABLE 3**  
**DIFFERENCE IN DATA SET AS PROCESSED FROM THE BASE OF TABLE 2**

S. No.		COS	SS	MBO	SRL	AR	SEC	OS	ESR	SP	ESD
1.	Revenue	0.88	0.95	1.09	1.09	0.93	0.97	0.88	0.93	1.14	1.08
2.	Health	0.99	1.02	1.11	1.03	0.98	1.01	0.99	1.02	1.25	1.45
3.	Panchayat	1.22	1.08	1.03	1.16	1.12	1.03	0.78	0.99	1.14	1.22
4.	Municipality	0.97	1.24	1.31	1.10	0.80	0.82	0.85	1.04	1.21	1.31
5.	Police	1.20	1.21	1.44	1.14	1.41	1.22	1.22	1.18	1.11	1.42
6.	District Admin	1.21	1.02	1.22	1.31	1.20	1.17	1.25	1.35	1.06	1.41

Source: Authors' own processed data presentation.

Grey relational coefficient and relational degree is calculated with the help of maximum and minimum difference value obtained from Table and distinguishing coefficient  $\rho$ . Table is further

processed and converted to grey relational coefficient value as presented in Table. Relational degree represents the degree of related importance of service attributes on overall service quality. As it can be seen from Table, clarity of organizational structure plays the most important role in public service delivery and service performance is least significant in evaluating effective service delivery in public sector. According to values obtained for relational degree from Table, public service delivery attributes can be arranged as in Table 4.

**Table 4**  
**COEFFICIENT OF GREY RELATION FOR THE CONSTRUCTS**

S. No.		COS	SS	MBO	SRL	AR	SEC	OS	ESR	SP	ESD
1.	Revenue	0.938	0.899	0.829	0.829	0.909	0.888	0.938	0.909	0.807	0.834
2.	Health	0.878	0.862	0.820	0.858	0.883	0.867	0.878	0.862	0.762	0.692
3.	Panchayat	0.774	0.834	0.858	0.798	0.816	0.858	1.000	0.878	0.807	0.774
4.	Municipality	0.888	0.766	0.740	0.825	0.987	0.974	0.956	0.853	0.778	0.740
5.	Police	0.782	0.778	0.695	0.807	0.705	0.774	0.774	0.790	0.820	0.702
6.	District Admin	0.778	0.862	0.774	0.740	0.782	0.794	0.762	0.725	0.843	0.705

Source: Authors’ own processed data presentation

The results provide evidence that each constructs of effective public service delivery has different degree of influence on service recipients’ perception. As evident from results obtained, the public departments should Table 5 strategies redeployment of public resources and emphasize more on experiential factors to achieve adequate and effective service delivery Voorberg et al. (2017).

**Table 5**  
**THE RELATIONAL DEGREE FOR GREY PRIORITIZATION**

	COS	SS	MBO	SRL	AR	SEC	OS	ESR	SP	ESD
Relational Degree	5.037	5.001	4.715	4.856	5.081	5.155	5.307	5.017	4.817	4.446

Source: Authors’ own processed data presentation

And then the relational degree as  $r_i = \sum [w(k)\xi(k)]$  where  $\xi$  is the grey relation coefficient,  $w(k)$  is the proportion of the number  $k$  influence factor to the total influence indicators. The sum of  $w(k)$  is 100 per cent. Table 6 shows the ranking and priority tasks to be tackled by the officers and strategy makers in the public service department of the government in ascending mode.

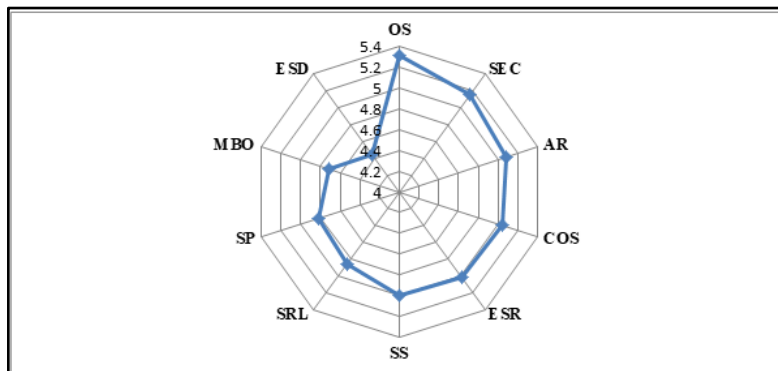
**Table 6**  
**CONSTRUCT PRIORITIZATION ON THE BASIS OF GREY (WEAK) CONSTRUCTS RANK**

S. No.	Construct prioritization on the basis of Grey (weak) constructs Rank		
1.	OS	5.307	First
2.	SEC	5.155	Second
3.	AR	5.081	Third
4.	COS	5.037	Fourth
5.	ESR	5.017	Fifth
6.	SS	5.001	Sixth
7.	SRL	4.856	Seventh
8.	SP	4.817	Eighth
9.	MBO	4.715	Ninth

Effective Service Delivery (ESD) by Officers	4.446	
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Source: Authors' own processed data presentation

Grey relational analysis, clustering evaluation, sequence operator and grey sequence generation, grey cluster modeling theory and some representative methods and techniques such as forecast, decision-making controlling and optimization in the grey system, all established for the sake of simplifications of real system or through the simplifications of the real system, and they conform to the principle of producing effects immediately of scientific methods. ESD is graded with the lowest coefficient value and needs to be focused on by the service delivery department of the government. Grey analysis of the influence factors is: OS> SEC> AR> COS> ESR> SS> SRL> SP> MBO> ESD Figure 1.



**FIGURE 1  
RADAR SHOWING ESD AND OTHER NINE CRITERIONS CONSTRUCTS OF PUBLIC SERVICE**

**CONCLUSION**

The performance evaluation in the service sector is done by its clients/stakeholders. It is the evaluation that acts as a catalyst for a number of important decisions. Service performance management systems integrate the information in their evaluations which become the main driver of managerial/ administrative action and organizational change. The main driver of managerial action is not absolute performance levels but rather discrepancies in the aspiration level in terms of satisfaction. Recent research suggests that public managers also pay attention to aspiration levels of the public/common masses. Our research study focuses solely on the grey relationship between the performances of public servants in delivering services and provides insights into this link by examining whether aspiration levels have massive gaps to bridge by the service delivery policymakers. The present research study contributes in three ways to how officers' efforts of service delivery may be fitted to the theoretical framework (Grey Relation Theory) from the theoretical model to behavioural aspects in the public sector by considering the relevant socio-political environment. Second, the study utilizes the grey relation coefficient approach to gauge service delivery factors' contribution to separate the influence of aspiration levels from absolute performance. Third, the grey relation analysis shows the willingness to make changes in accordance with coefficient values.

**Managerial Implication and limitation**

The present study reveals the use of the grey relation analysis (GRA) of the grey system



theory (GST) developed by Chinese scholar Deng Julong in 1982 for a specific study in the manufacturing and supply chain domain where small data were available. The study provides evidence that each public service delivery factor has a different degree of influence on Effective Public Service Delivery (ESD). The order from greatest to least as has been shown should be enhanced and have a better mechanism like Janhit Guarantee Adhinyam (2013) and should facilitate needy citizens without causing doubts about whether the representatives of the Government are serious and concerned with the public welfare. They should adequately understand the needs and urgency in providing the demanded service. The officers should make efforts to maintain the consistency of performance and dependability and should let the supporting staff possess and apply the related skills and knowledge to perform the service delivery.

Finally, this study discovers the importance of technical expertise and functional tasks in public service delivery and its effectiveness. Up to now, very little research in the field of management science utilizes this helpful methodology, grey system theory. This study advocates the use of the grey system theory in the service sector regarding service satisfaction, service delivery mechanism, different dimensions of service quality and dissonance in services, and service co-creation. The purpose of this study was the explanation and demonstration of the grey system theory, this study has some limitations like we do not compare our results of the grey system theory with the multivariate method. The context sample of this study is limited to six districts of the Lucknow division of Uttar Pradesh, India, therefore cannot be claimed on state or national level. We instigate management researchers with interest in the basic and the applied research of the grey system theory in different functional domain. We also suggest future researchers replicate our research with large samples or other industries to confirm the theoretical validity.

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