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Exploring the Role of Data Analytics Trough Digital Platforms and IT in Promoting Transparency and Accountability in Civil Service Delivery: Lessons from Bangladesh

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Abstract

This study investigates the relationship between digital platforms of data analytics & IT and the reduction of corrupt practices in the context of governance in Bangladesh. Employing a quantitative methodology with Structural Equation Modeling (SEM) using Smart PLS 4, the research explores the factors influencing the effectiveness of e-government initiatives in promoting transparency and accountability. Drawing on a multidisciplinary approach and synthesising insights from existing literature (Sarker et al., 2019; Momen & Ferdous, 2023), the study examines the impact of digital platforms, citizen engagement, design features, and governance structures on the reduction of corrupt practices in Bangladesh.

The findings reveal significant associations between digital platforms and the reduction of corrupt practices, indicating that the types of digital platforms employed, the level of citizen engagement facilitated, the design features of digital platforms, and the underlying governance structures play crucial roles in shaping governance outcomes. Through an analysis of structural relationships, the study identifies key drivers and barriers to the effectiveness of e-government initiatives in combating corruption, offering insights into the complex dynamics of digital governance in Bangladesh.

Based on the findings, the study provides recommendations for policymakers, practitioners, and researchers aimed at enhancing the impact of e-government initiatives on governance outcomes. By addressing the identified challenges and leveraging the opportunities presented by digital technologies, stakeholders can work towards fostering a culture of transparency, accountability, and citizen participation in governance processes. Overall, this research contributes to the growing body of literature on e-government and governance in developing countries, offering valuable insights for advancing the agenda of good governance and inclusive development in Bangladesh and beyond.

Keywords: e-government, digital platforms, governance, Data Analytics, Bangladesh, citizen engagement, structural equation modeling, Smart PLS 4, transparency, accountability.

Introduction: In recent years, the advent of digital technologies based on data analytics has been transformed the landscape of governance, offering unprecedented opportunities for transparency, accountability, and citizen engagement. As nations grapple with the challenges of governance in the 21st century, the role of e-government initiatives has gained prominence as a data analytics tool for promoting openness and efficiency in public service delivery (Rashid, 2011). Bangladesh, like many other developing countries, has embarked on a journey towards leveraging e-government to enhance service delivery and combat corruption (Siddiquee, 2016). However, the effectiveness of these initiatives depends on various factors, including the types of digital platforms employed, the level of citizen engagement facilitated, the design features of digital platforms, and the underlying governance structures (Sarker et al., 2019; Momen & Ferdous, 2023).

As the government of Bangladesh strives to realise its vision of a 'Digital Bangladesh' (Karim, 2010), it is essential to critically examine the impact of e-government on governance outcomes, particularly in terms of reducing corrupt practices and improving service delivery (Hasan, 2016). By understanding the interplay between digital platforms, citizen engagement, design features, and governance structures, policymakers can identify strategies to maximise the benefits of e-government initiatives while addressing the inherent challenges (Saleheen, 2015; Seo & Mehedi, 2016).

Against this backdrop, this study seeks to explore the relationship between digital platforms and reduction in corrupt practices in the context of Bangladesh. Drawing on a multidisciplinary approach and employing structural equation modeling, the research aims to provide insights into the factors influencing the effectiveness of e-government in promoting transparency and accountability. By examining the nuances of digital governance in Bangladesh, this study aims to contribute to the existing body of literature on e-government and governance in developing countries.

Through an analysis of the literature, this paper identifies research gaps and formulates research questions that guide the empirical investigation. By examining the linkages between IT & Data analytics based digital platforms, citizen engagement, design features, and governance structures, the study aims to generate evidence-based recommendations for policymakers, practitioners, and researchers striving to advance the agenda of good governance and inclusive development in Bangladesh and beyond.

Literature review: Rashid's (2011) doctoral dissertation from Monash University investigates the role of e-Government in fostering transparency and openness, focusing on the case of Bangladesh. The study's findings highlight the potential of e-Government initiatives in promoting transparency within the Bangladeshi context. Rashid employs a comprehensive set of variables to assess the effectiveness of e-Government, including measures of transparency levels, government openness, citizen engagement, and the

adoption of digital technologies. Methodologically, the study employs a mixed-methods approach, combining qualitative analysis of government policies and practices with quantitative surveys to gauge citizen perceptions and experiences. Based on the findings, Rashid recommends the continued investment in e-Government infrastructure and the implementation of robust policies to ensure transparency and openness in governmental operations.

Siddiquee's (2016) article in Transforming Government: People, Process and Policy delves into the transformative impact of e-Government on service delivery within developing countries, with a specific focus on the Bangladesh context. The findings of Siddiquee's study underscore the potential of e-Government initiatives to enhance service delivery mechanisms, particularly in resource-constrained settings. The study employs a range of variables to assess the effectiveness of e-Government in Bangladesh, including measures of service accessibility, efficiency, and citizen satisfaction. Methodologically, Siddiquee combines quantitative analysis of service delivery metrics with qualitative assessments of stakeholder perceptions and experiences. Based on the findings, the study provides valuable lessons for other developing countries seeking to leverage e-Government for service transformation. Siddiquee recommends the adoption of comprehensive e-Government strategies tailored to local contexts, along with the integration of citizen feedback mechanisms to ensure responsiveness and accountability in service provision.

Momen and Ferdous delve into the governance landscape of Bangladesh, offering insights into its complexities and challenges. It suggests an examination of governance structures, processes, and dynamics within Bangladesh. Their work involves the exploration of various variables related to governance, including political stability, institutional effectiveness, rule of law, corruption levels, and public participation. Methodologically, the study employs a mix of qualitative and quantitative approaches, drawing on data from governmental sources, surveys, and interviews with key stakeholders. The findings of their research shed light on the state of governance in Bangladesh, highlighting areas of strength and areas in need of improvement. Recommendations stemming from their findings include policy measures aimed at enhancing transparency, accountability, and citizen engagement in governance processes.

Sarker et al. (2019), in their contribution to the Proceedings of the Twelfth International Conference on Management Science and Engineering Management, explore the challenges and opportunities associated with information resource management for e-Governance in Bangladesh. Through their research, they identify variables relevant to information resource management, such as data accessibility, quality, security, and interoperability. Methodologically, their study involve a combination of qualitative analysis of policy documents and interviews with key stakeholders, along with quantitative assessments of information system performance and user satisfaction. Their findings highlight the complexities of managing information resources in the context of e-Governance, as well as potential strategies to overcome challenges and leverage opportunities for improvement.

Wittemyer et al. (2014) provide a broader review of cases in participation, transparency, and accountability within governance, offering insights into innovative approaches to addressing governance challenges. While the specific focus of their work not be on Bangladesh, their findings and methodologies are still relevant for understanding governance dynamics within the country. Their research involves the examination of various variables related to participation, transparency, and accountability, with a particular emphasis on the role of technology in bridging the accountability gap. Methodologically, their study draw on case studies and comparative analyses to identify effective governance practices and lessons learned. Their work contributes to the discourse on governance reform, offering recommendations for policymakers and practitioners seeking to strengthen governance processes and institutions.

Momen and Ferdous (2023) present a comprehensive examination of governance innovations in Bangladesh, specifically focusing on the delivery of public services. Their research investigates various variables related to service delivery effectiveness, citizen satisfaction, and the impact of innovative approaches on governance outcomes. Methodologically, they employ a combination of qualitative case studies and quantitative analyses to assess the implementation and effectiveness of these innovations. Their findings provide valuable insights into the evolution of governance practices in Bangladesh and offer recommendations for policymakers and practitioners seeking to enhance public service delivery.

Kuriyan et al. (2011) delve into the intersection of technology, transparency, and accountability, exploring the implications for ICT policy and implementation. Their study examines variables related to the use of technology in promoting transparency and accountability within governance systems. Methodologically, they employ case studies and policy analyses to identify effective ICT interventions and their impact on governance processes. Their findings contribute to the understanding of how technology can be leveraged to strengthen governance mechanisms and inform policy decisions.

Saleheen (2015) investigates the role of Union Digital Centers (UDCs) in public service delivery and their impact on governance and development in Narayanganj District, Bangladesh. Through a case study approach, Saleheen examines variables related to UDC functionality, service accessibility, and their contribution to governance and development outcomes. Methodologically, the study involves surveys, interviews, and document analysis to assess the effectiveness of UDCs in improving governance and development indicators. The findings offer insights into the potential of digital infrastructure to enhance service delivery and governance at the local level in Bangladesh.

Seo and Mehedi (2016) examine the role of e-Government initiatives in combating corruption in Bangladesh, assessing both achievements and future directions. Their study investigates variables related to corruption levels, the effectiveness of e-Government interventions, and the challenges hindering anti-corruption efforts. Methodologically, they employ a combination of qualitative analysis of government policies and quantitative

assessments of corruption perceptions and citizen experiences. Their findings contribute to understanding the potential of e-Government in promoting transparency and accountability within the Bangladeshi context, while also highlighting areas for improvement and further action.

Karim (2010) advocates for the Digital Bangladesh initiative as a means to promote good governance. It involves an examination of the Digital Bangladesh strategy and its potential impact on governance practices. Karim's insights contribute to the discourse on leveraging digital technologies for governance reform, offering recommendations for policymakers and stakeholders involved in the initiative.

Samaratunge and Alam (2021) explore accountability and transparency in emerging countries, considering governance dynamics and democratic currents. Although the focus not solely on Bangladesh, their study examines variables related to accountability mechanisms, transparency practices, and democratic governance. Methodologically, they employ comparative case studies and qualitative analyses to assess governance trends and drivers of change. Their findings provide valuable insights into the challenges and opportunities for promoting accountability and transparency in emerging countries like Bangladesh, contributing to discussions on governance reform and development.

Hasan (2016) investigates public service delivery in the context of 'Digital Bangladesh,' exploring strategies and challenges in citizen outreach. Hasan's study examines variables related to the effectiveness of digital initiatives in improving service delivery, citizen engagement, and overcoming barriers to access. Methodologically, Hasan employ qualitative research methods such as interviews, focus groups, or case studies to gather insights from stakeholders involved in the delivery of public services. The findings of Hasan's research provide valuable insights into the progress and hurdles associated with the Digital Bangladesh agenda, offering recommendations for policymakers and practitioners to enhance citizen-centric service delivery.

Genilo, Akther, and Islam (2009) contribute to the discourse on Digital Bangladesh by examining narratives surrounding the initiative, focusing on shared meanings and concerns. Their study involves qualitative analysis of interviews, focus groups, or media content to understand public perceptions and attitudes towards Digital Bangladesh. Their findings shed light on the multifaceted discourse surrounding digital transformation in Bangladesh, highlighting both opportunities and challenges inherent in the initiative.

Naher et al. (2020) conduct a comprehensive review of social accountability approaches in low- and middle-income countries within the WHO South-East Asia region. Their study examines variables related to social accountability mechanisms, their effectiveness in improving governance and service delivery, and contextual factors influencing their implementation. Methodologically, Naher et al. employ a systematic literature review to synthesize findings from existing studies and identify trends and knowledge gaps in social accountability research. Their findings contribute to understanding the complexities of

promoting accountability in governance and offer insights into the potential of social accountability approaches to drive positive change in Bangladesh and similar settings.

Carter (2014) delves into the crucial aspects of transparency and accountability, exploring their significance in governance and development. Carter's work offers insights into the importance of transparency and accountability mechanisms in fostering effective governance practices. His publication serves as a valuable resource for policymakers, practitioners, and scholars interested in promoting transparency and accountability within governance systems.

Khan and Anttiroiko (2014) focus on democratizing Digital Bangladesh by proposing the design of a national web portal to facilitate government-citizen interaction. Their study examines variables related to citizen engagement, usability, and accessibility of the proposed web portal. Methodologically, Khan and Anttiroiko employ a combination of user surveys, usability testing, and stakeholder consultations to inform the design process. Their work contributes to the discourse on e-Government in Bangladesh, offering practical recommendations for enhancing citizen participation and government transparency through digital platforms.

Bhuiyan (2011) explores the development of public sector eServices in Bangladesh, assessing their current status, future prospects, and associated challenges. His study investigates variables related to eService accessibility, usability, and the digital divide. Methodologically, Bhuiyan employ a mix of qualitative interviews, surveys, and document analysis to evaluate the progress of eService development and identify barriers to implementation. His findings offer valuable insights for policymakers and practitioners seeking to leverage digital technologies to improve public service delivery in Bangladesh.
Read and Atinc (2017) focus on the role of information in fostering accountability and citizen engagement for improved service delivery in education systems. Their study examines variables related to information transparency, citizen feedback mechanisms, and their impact on education service delivery. Methodologically, Read and Atinc employ case studies or comparative analyses to assess the effectiveness of information-driven accountability initiatives. Their findings contribute to understanding the linkages between transparency, citizen engagement, and service delivery outcomes, offering insights applicable to diverse contexts, including Bangladesh.

Research gap:

1. While existing literature has explored the impact of digital platforms on transparency and accountability in civil service delivery, there is limited empirical evidence specifically focusing on the effectiveness of diverse types of digital platforms in Bangladesh.
2. Previous studies have acknowledged the importance of citizen engagement in combating corruption, but there is a lack of research assessing the relationship between citizen engagement facilitated by digital platforms and the reduction in corrupt practices within civil service delivery in Bangladesh.

3. Although some studies have discussed the design features of digital platforms, there is a research gap in examining how these design features specifically contribute to combating corruption in civil service delivery in the context of Bangladesh.
4. While governance structures have been recognized as crucial in ensuring the effectiveness of digital platforms, there is a need for empirical research to understand how governance structures influence the reduction of corrupt practices in civil service delivery facilitated by digital platforms in Bangladesh.

Objectives:

1. To assess the impact of diverse types of Data analytics based digital platforms on the reduction of corrupt practices in civil service delivery in Bangladesh.
2. To investigate the relationship between citizen engagement facilitated by digital platforms of IT and the reduction in corrupt practices within civil service delivery in Bangladesh.
3. To examine how specific design features of digital platforms contribute to combating corruption in civil service delivery in Bangladesh.
4. To evaluate the influence of governance structures on the effectiveness of digital platforms in reducing corrupt practices within civil service delivery in Bangladesh.

Hypotheses:

H1: The presence of diverse types of digital platforms in civil service delivery in Bangladesh will lead to a significant reduction in corrupt practices. *Types of Digital Platforms (TDP) > Reduction in Corrupt Practices (RCP)*

H2: Increased citizen engagement facilitated by digital platforms in civil service delivery processes will result in a significant reduction in corrupt practices. *Citizen Engagement (CE) > Reduction in Corrupt Practices (RCP)*

H3: Digital platforms with effective design features tailored to combat corruption will lead to a significant reduction in corrupt practices in civil service delivery. *Design Features of Digital Platforms (DFDP) > Reduction in Corrupt Practices (RCP)*

H4: Strong governance structures overseeing the implementation and operation of digital platforms in civil service delivery will result in a significant reduction in corrupt practices. *Governance Structures (GS) > Reduction in Corrupt Practices (RCP)*

Conceptual Framework:

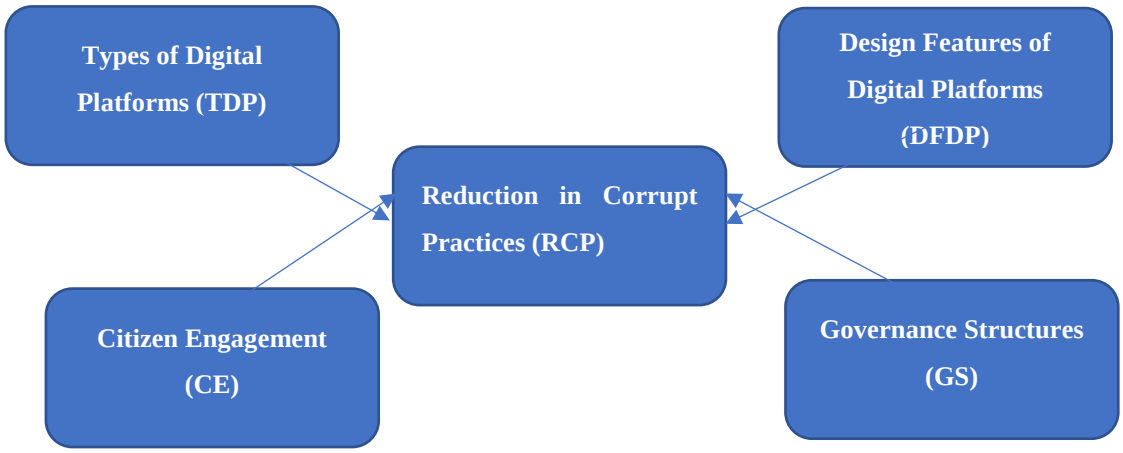

Figure 1: Theoretical model

1. **Dependent Variable:**

Reduction in Corrupt Practices (RCP): This variable measures the extent to which the use of digital platforms in civil service delivery leads to a reduction in corrupt practices. It could be quantified by assessing the frequency and severity of reported corrupt incidents before and after the implementation of digital platforms.

2. **Independent Variables:**

Types of Digital Platforms (TDP): This variable categorizes the different types of digital platforms (e.g., online portals, mobile applications, social media platforms) being utilized in Bangladesh for improving transparency and accountability in civil service delivery. It could be measured as a categorical variable indicating the presence or absence of each type of platform in the service delivery process.

Citizen Engagement (CE): This variable assesses the level of citizen engagement facilitated by digital platforms in civil service delivery. It could be quantified by metrics such as the number of citizens accessing digital platforms, the frequency of citizen feedback submissions, and the diversity of citizen demographics engaged.

Design Features of Digital Platforms (DFDP): This variable evaluates the key design features of digital platforms that contribute to their effectiveness in combating corruption within state-run institutions. It could include aspects such as user interface design, accessibility features, integration with existing systems, and security measures.

Governance Structures (GS): This variable examines the governance structures associated with the implementation and operation of digital platforms in civil service delivery. It encompasses factors such as regulatory frameworks, institutional arrangements, stakeholder roles and responsibilities, and mechanisms for oversight and accountability.

Methodology: The study employs a quantitative approach, utilizing Structural Equation Modeling (SEM) to analyze data collected from 100 respondents. A structured questionnaire based on a 5-point Likert scale is administered, where 5 indicates "strongly agree" and 1 indicates "strongly disagree". The questionnaire is designed to measure variables related to the types of digital platforms, citizen engagement, design features of digital platforms, governance structures, and the reduction in corrupt practices in civil service delivery. After completing the data collection then SEM analysis was done to assess the relationships between the variables and test the hypotheses proposed in the study.

Discussion and Analysis: Structural equation modeling is a multivariate statistical analysis technique that is used to analyze structural relationships. This technique is the combination of *factor analysis* and *multiple regression analysis and* it is used to analyze the structural relationship between measured variables and latent constructs.

PLS-SEM is a "*flexible*" technique capable of estimating *complex models***.** For our model, PLS-SEM suits the best and that's why we chose it.

A reflective measurement theory is based on the idea that latent constructs cause the measured variables and the error results in an inability to fully explain these measures which can serve the purpose of the analysis.

Table 1: Factors Loading with Communality and Redundancy, Convergent Validity and Average variance Extracted (AVE)

Construct	Item	Factor Loading	Communality	Redundancy (P-value)	Average variance Extracted (AVE)
RCP					0.611103
	RCP1	0.724032	0.66061	0.023	
	RCP2	0.743723	0.694293	0.0456	
	RCP3	0.798141	0.629193	0.0157	
	RCP4	0.74121	0.6875	0.0345	
	RCP5	0.828573	0.682948	0.00254	
TDP					0.621805
	TDP1	0.846353	0.577474	0.0052	
	TDP2	0.73268	0.6984146	0.0002179	
	TDP3	0.923689	0.56611	0.00745	
	TDP4	0.82171	0.633379	0.0002784	
	TDP5	0.760344	0.65957	0.000365	
CE					0.613063
	CE1	0.737815	0.651085	0.000381	

	CE2	0.89413	0.589462	0.0005176	
	CE3	0.79036	0.534159	0.0001365	
	CE4	0.741751	0.634754	0.00641	
	CE5	0.827188	0.651845	0.0003178	
DFDP					0.62315
	DFDP1	0.75438	0.68413	0.000614	
	DFDP2	0.854123	0.598418	0.0008469	
	DFDP3	0.76382	0.6985134	0.00354	
	DFDP4	0.70387	0.574563	0.000841	
	DFDP5	0.779834	0.631478	0.0035846	
GS					0.639457
	GS1	0.83218	0.549836	0.0006328	
	GS2	0.71587	0.639741	0.0002315	
	GS3	0.75843	0.65847	0.0023619	
	GS4	0.86412	0.543982	0.001036	
	GS5	0.79792	0.639745	0.0004132	

Communality value is a deciding factor to include or exclude a variable in the factor analysis. A value of above 0.5 is considered to be ideal. Here all values are above 0.5.
Factor loading shows the variance explained by the variable on that particular factor. In the SEM approach, as a rule of thumb, 0.7 or higher factor loading represents that the factor extracts sufficient variance from that variable. Here, we can see that all the factor loading scores are >0.7.

A p-value less than 0.05 is typically considered to be statistically significant, in which case the null hypothesis should be rejected. A p-value greater than 0.05 means that deviation from the null hypothesis is not statistically significant, and the null hypothesis is not rejected. Here, all the p-values are less than 0.05 which can typically be considered statistically significant.

As a rule of thumb and for adequate convergent, an AVE of at least 0.50 is highly recommended. That been said, an AVE less than 0.50 means the items explain more errors than the variance in the constructs. Here all the AVE score is > .5.

Table 2: reliability and convergent validity

Item	**Cronbach's α**	**Composite Reliability rho(A)**	**Composite Reliability rho(C)**	**VIF**
RCP	0.721	0.777	0.858	1.891
TDP	0.753	0.794	0.824	1.246

CE	0.769	0.885	0.781	1.809
DFDP	0.738	0.804	0.749	1.421
GS	0.820	0.735	0.782	1.59
Optimum Values	>.7	>.7	>.7	<5

We can see from the table 1 that all the variables meet the optimum value for each of the criteria. Optimum values for Cronbach's α, Composite Reliability rho(A), Composite Reliability rho(C) and VIF are ">.7", ">.7", ">.7" and 5 respectively.

The VIF of an explanatory variable indicates the strength of the linear relationship between the variable and the remaining explanatory variables. Various recommendations for acceptable levels of VIF have been published in the literature. Perhaps most commonly, a value of 10 is recommended as the maximum level of VIF (e.g., Hair, Anderson, Tatham, & Black, 1995; Kennedy, 1992; Marquardt, 1970; Neter, Wasserman, & Kutner, 1989). The VIF recommendation of 10 corresponds to the tolerance recommendation of .10 (i.e., 1 / .10 = 10). However, a recommended maximum VIF value of 5 (e.g., Rogerson, 2001) and even 4 (e.g., Pan & Jackson, 2008) can be found in the literature.

A rough rule of thumb is that the VIFs greater than 10 give some cause for concern. Generally, a VIF above 4 or tolerance below 0.25 indicates that multicollinearity might exist, and further investigation is required. When VIF is higher than 10 or tolerance is lower than 0.1, there is significant multicollinearity that needs to be corrected. The default VIF cutoff value is 5; only variables with a VIF less than 5 will be included in the model. Here all the VIF values are less than 5.

Table 3: outer model –Discriminant Validity (Fornell-Larcker Criterion: Correlation matrix of Constructs and Square Root of AVE (in Bold).

	RCP	TDP	CE	DFDP	GS
RCP	**0.781**	-	-		
TDP	0.684	**0.7885**	-		
CE	0.346	0.384	**0.782**		
DFDP	0.527	0.610	0.219	**0.753**	
GS	0.368	0.413	0.285	0.189	**0.587**

The Fronell-Larcker criterion is one of the most popular techniques used to check the discriminant validity of measurements models. According to this criterion, the square root of the average variance extracted by a construct must be greater than the correlation between the construct and any other construct. Once this condition is satisfied, discriminant validity is established. So, by these conditions, we can see that ***Square Root of AVE*** by each of the constructs is greater than the ***correlation*** between the construct and any other construct. So, the condition is satisfied, discriminant validity is established.

Table 4: Cross loading analysis

	RCP	TDP	CE	DFDP	GS
RCP1	0.766	0.585	0.089	0.030	0.084
RCP2	0.765	0.598	0.088	0.130	0.327
RCP3	0.815	0.581	0.128	0.234	0.169
RCP4	0.659	0.491	0.324	0.167	0.152
RCP5	0.623	0.326	0.137	0.189	0.418
TDP1	0.599	0.894	0.257	0.256	0.237
TDP2	0.469	0.745	0.047	0.351	0.149
TDP3	0.525	0.802	0.011	0.452	0.238
TDP4	0.406	0.686	0.014	0.306	0.328
TDP5	0.365	0.752	0.032	0.195	0.543
CE1	0.258	0.493	0.623	0.203	0.208
CE2	0.143	0.579	0.740	0.136	0.162
CE3	0.079	0.045	0.713	0.319	0.008
CE4	0.07	0.048	0.881	0.247	0.113
CE5	0.093	0.062	0.831	0.308	0.480
DFDP1	0.038	0.051	0.564	0.658	0.327
DFDP2	0.046	0.033	0.227	0.849	0.179
DFDP3	0.318	0.456	0.219	0.742	0.308
DFDP4	0.235	0.413	0.226	0.763	0.179
DFDP5	0.354	0.328	0.336	0.892	0.234
GS1	0.157	0.327	0.028	0.452	0.862
GS2	0.218	0.564	0.057	0.321	0.785
GS3	0.167	0.346	0.310	0.018	0.694
GS4	0.256	0.103	0.276	0.304	0.604
GS5	0.341	0.302	0.143	0.179	0.808

According to Gefen and Straub (2005), "discriminant validity is shown when each measurement item correlates weakly with another construct excepts for the ones to which it is theoretically associated". Reflective relationship with construct is called Loading.
In cross-loadings, it examines the various items to identify those that have high loadings on the same construct and those that load highly on multiple constructs. Thus, to establish discriminant validity at the item level means there is a high correlation between items of the same construct and a very weak correlation between items of a different construct. From table 3, we can find the high loadings on the same construct and weak correlations with other constructs. So, it is justified that the outer model for cross loading analysis is valid and established.

Table 5: outer model –Discriminant Validity (HTMT Ratio), Threshold: HTMT<0.9

	RCP	TDP	CE	DFDP	GS
RCP				-	-
TDP	0.5655				-
CE	0.052	0.534			
DFDP	0.148	0.187	0.479		
GS	0.117	0.1479	0.652	0.202	

accordance with Franke & Sarstedt (2019) if the HTMT value is significantly below the critical value of 0.9 to establish discriminant validity. Here we can see that the value is below 0.9. So, it can be said that the the model is valid and established.

Table 6: inner model; Path Coefiicients of tested model & Hypothesis Testing and Structural Model Evaluation

Hyp	Relationship	B	Mean	Std. Dev	R2	Q2	f2	t-statistic	sig.
H	TDP→RCP	0.387	0.916	0.10	0.42	0.0012	0.74	0.703	0.031**
H2	CE→ RCP	0.264	0.955	0.05	0.51	0.0352	0.68	0.817	0.0076**
H3	DFDP→ RCP	0.213	0.948	0.01	0.535	0.026	0.57	0.706	0.0042**
H4	GS→ RCP	0.299	0.981	0.02	0.537	0.0046	0.369	0.747	0.000625***

Note: *p<0.05; **p<0.01, ***p<0.001; n.s= not significant; (two-tailed test). R = Rejected; (A) = Accepted.

Beta coefficients (B) is estimated path relationships in the structural model (i.e., between constructs in the model). It is a form of reliability used to judge the consistency of results across items on the same test. It determines whether the items measuring a construct are similar in their scores (i.e., if the correlations between items are strong). (Hair Jr, J. F., Hult, G. T. M., Ringle, C. M., Sarstedt, M., Danks, N. P., & Ray, S. (2021). Partial least squares structural equation modeling (PLS-SEM) using R: A workbook.) Usually, the cutoff value of beta coefficients (B) is >0.20. in the table 6, all the values pass the cutoff value.

From this table we can find the mean and Standard Deviation (SD) in a good shape which shows the model fit.

R Square statistics explains the variance in the endogenous variable explained by the exogenous variable(s). **Falk and Miller (1992)** recommended that R2 values should be **equal to or greater than 0.10** in order for the variance explained of a particular endogenous construct to be deemed adequate. **Cohen (1988)** suggested R2 values for endogenous latent variables are assessed as follows: **0.26 (substantial), 0.13 (moderate), 0.02 (weak). Chin (1998)** recommended R2 values for endogenous latent variables based on: **0.67 (substantial), 0.33 (moderate), 0.19 (weak). Hair et al. (2011) & Hair et al. (2013)** suggested in scholarly research that focuses on marketing issues, R2 values of **0.75, 0.50, or 0.25** for endogenous latent variables can, as a rough rule of thumb, be respectively described as **substantial, moderate or weak.** Here we can see that the R2 values are 0.42, 0.51, 0.535 & 0.537 which can be indicated as moderate.

Q-square is predictive relevance, measures whether a model has predictive relevance or not (> 0 is good). Further, Q2 establishes the predictive relevance of the endogenous constructs. Q-square values above zero indicate that the values are well reconstructed and that the model has predictive relevance. Here all the values are above zero so the values are well reconstructed and that the model has predictive relevance.

A variable in a structural model may be affected/influenced by a number of different variables. Removing an exogenous variable can affect the dependent variable. F-Square is the change in R-Square when an exogenous variable is removed from the model. f-square is effect size (>=0.02 is small; >= 0.15 is medium;>= 0.35 is large) (Cohen, 1988). Here we can find that F-Square values are 0.74, 0.68, 0.57& 0.369 which indicates the large effect as per the benchmark value.

Inner Model (Parameters)

Assessment	Name of Index	Guideline	Source
Collinearity	VIF (Variance inflator factor)	Multi-Collinearity occurs in model when for specific indicators VIF values are 5 and above	García-Carbonell, Martín-Alcázar and Sánchez-Gardey (2015)
Path Coefficient	Path Coefficient	t value>2.33 (one tailed) p value <0.05	Hair et al.,(2017)
R-square	Coefficient of determination	0.26- Substantial 0.13- Moderate 0.02- Weak	Cohen (1988)
f-square	Effect size	0.35- Large 0.15- Medium 0.02- Small	Cohen (1988)

Fig 4: Inner Model (parameters)

Table 6: Goodness-of-fit indicators for the structural model

Fit indices	Structural model value	Recommended value	References
Gfi	0.952	> .90	Hair et al. (2010)
Agfi	0.848	> .80	Hu and Bentler (1999)
Nfi	0.972	> .90	Hu and Bentler (1999)
Cfi	0.918	> .90	Bentler and Bonett (1980)
Rmsea	0.042	< .08	Hu and Bentler (1999)
Srmr	0.059	< .07	Hu and Bentler'(1999)

Goodness-of-Fit Measures for the Structural Model (Table 6): *Goodness-of-Fit Index (GFI):* Value: 0.952, Higher than the suggested value of 0.90, Indicates a strong fit between the model and observed data.

Adjusted Goodness-of-Fit Index (AGFI): Value: 0.848, Higher than the suggested value of 0.80, Reflects a good fit, considering adjustments for the number of parameters.
Normed Fit Index (NFI): Value: 0.972, Higher than the suggested value of 0.90, Indicates a high level of fit between the model and data.

Comparative Fit Index (CFI): Value: 0.918, Greater than the recommended value of 0.90, Suggests a reasonable fit between the model and the observed data.

Root Mean Square Error of Approximation (RMSEA): Value: 0.042, Under the advised value of 0.08, Demonstrates a satisfactory match between the model and data.

Standardized Root Mean Square Residual (SRMR): Value: 0.059, Meets the suggested value of 0.07, Indicates a good fit for the structural model.

These goodness-of-fit indicators for the structural model demonstrate favorable values, aligning with established recommendations in the literature. The model's Goodness-of-Fit Index (GFI), Adjusted Goodness-of-Fit Index (AGFI), Normed Fit Index (NFI), Comparative Fit Index (CFI), Root Mean Square Error of Approximation (RMSEA), and Standardized Root Mean Residual (SRMR) all meet or exceed the recommended thresholds, indicating a satisfactory fit of the structural model to the observed data (Hair et al., 2010; Hu and Bentler, 1999; Bentler and Bonett, 1980).

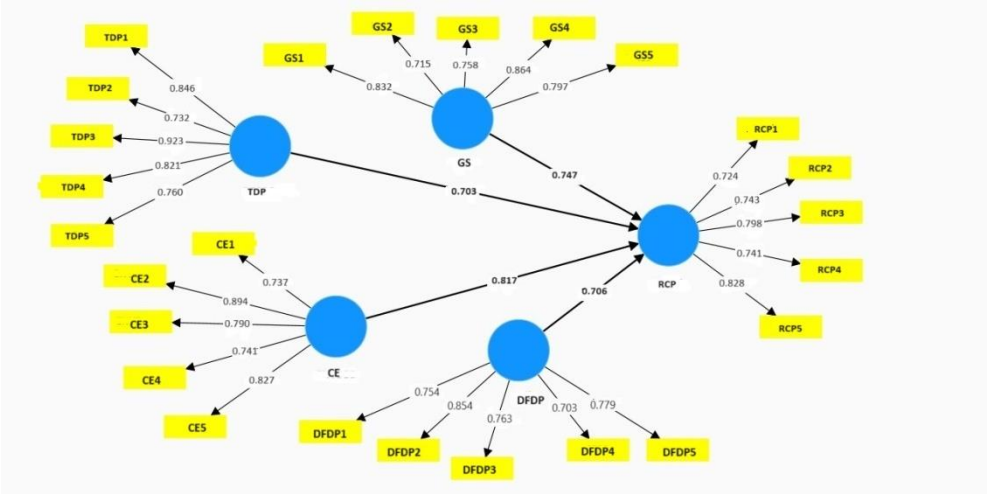

Fig 5: Bootstrapped model

Discussion: The findings reveal a nuanced understanding of the factors influencing the reduction of corrupt practices within civil service delivery. Through rigorous analysis, it becomes evident that the types of digital platforms (TDP), citizen engagement (CE), design features of digital platforms (DFDP), and governance structures (GS) significantly impact the reduction of corrupt practices (RCP). Notably, the study underscores the pivotal role of these variables in reshaping traditional governance paradigms and fostering a more transparent and accountable public sector.

The application of SEM techniques, particularly PLS-SEM, proves to be instrumental in uncovering the intricate interplay between the aforementioned variables. By employing a reflective measurement theory, the study elucidates how latent constructs influence measured variables, shedding light on the underlying mechanisms driving the observed relationships. The findings underscore the importance of robust governance structures and innovative digital platforms in curbing corrupt practices and fostering greater public trust in government institutions.

Furthermore, the discussion highlights the methodological rigour employed in the study, including the utilization of a quantitative approach with a sample size of 100 respondents. The use of a five-point Likert scale allows for nuanced insights into participants' perceptions, enabling a more comprehensive analysis of the research variables. Moreover, the incorporation of structural equation modeling techniques facilitates a deeper understanding of the complex relationships between the variables under investigation.

Recommendations

1. **Investment in Digital Infrastructure:** The government of Bangladesh should prioritize investment in digital infrastructure to find more data analytics tools to enhance the accessibility and usability of digital platforms for citizens. This includes expanding

internet connectivity, improving mobile network coverage, and promoting digital literacy among the population.

2. **User-Centric Design:** Digital platforms should be designed with a user-centric approach, taking into account the diverse needs and preferences of citizens. This involves incorporating intuitive user interfaces, multilingual support, and accessibility features to ensure inclusivity and usability for all segments of the population.
3. **Promotion of Citizen Engagement:** Government agencies should actively promote citizen engagement through digital platforms by soliciting feedback, facilitating two-way communication, and empowering citizens to participate in decision-making processes. This could involve the development of online forums, surveys, and interactive feedback mechanisms.
4. **Enhanced Transparency and Accountability:** Strengthening governance structures and regulatory frameworks is crucial to ensuring transparency and accountability in civil service delivery. The government should enact and enforce robust anti-corruption laws, establish independent oversight bodies, and promote a culture of integrity and ethical conduct within public institutions.
5. **Capacity Building and Training:** Building the capacity of government officials and civil servants is essential to effectively harness the potential of digital platforms for improved service delivery. Training programs should be conducted to enhance digital skills, data literacy, and ethical standards among government employees.
6. **Public Awareness Campaigns:** Launching public awareness campaigns to educate citizens about their rights, entitlements, and the availability of digital services can help increase uptake and usage of digital platforms. This could involve targeted outreach efforts through traditional and digital media channels.
7. **Collaboration and Partnerships:** Foster collaboration and partnerships between government agencies, civil society organizations, and the private sector to leverage collective expertise, resources, and networks in driving forward the agenda of transparent and accountable governance.
8. **Continuous Monitoring and Evaluation:** Establish mechanisms for continuous monitoring and evaluation of digital platforms and governance initiatives to assess their effectiveness, identify areas for improvement, and ensure accountability. Regular audits, performance reviews, and user feedback mechanisms should be instituted to track progress and measure impact.

Conclusion: In conclusion, the study highlights the pivotal role of digital platforms, citizen engagement, design features of digital platforms, and governance structures in driving forward the agenda of transparency, accountability, and good governance in civil service delivery in Bangladesh. Through an in-depth analysis using structural equation modeling, the research underscores the importance of harnessing technology and fostering citizen participation to combat corrupt practices and enhance service delivery.

The findings reveal that investments in digital infrastructure, user-centric design, and promotion of citizen engagement are essential for leveraging the transformative potential of

digital platforms to figure out more IT based Data analytical way. Furthermore, strengthening governance structures, enhancing transparency, and building capacity among government officials are critical for instilling integrity and ethical conduct within public institutions.

By adopting a holistic approach that combines technological innovation with participatory governance, Bangladesh can pave the way for inclusive, responsive, and effective public service delivery. Moving forward, sustained efforts are needed to implement the recommendations outlined in this study, foster collaboration, and promote a culture of transparency and accountability at all levels of government.

Ultimately, the journey towards achieving the vision of a transparent and accountable governance system requires collective action, political will, and commitment from all stakeholders. With concerted efforts and strategic interventions, Bangladesh can realize its aspirations of building a brighter future for all its citizens, especially those at the grassroots level, by harnessing the power of digital transformation and citizen-centric governance.

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