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RESEARCH ARTICLE

A QUANTITATIVE ASSESSMENT OF THE ROLE OF DIGITAL TRANSFORMATION ON OPERATIONAL EFFICIENCY IN SERVICE-BASED ORGANIZATIONS

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ABSTRACT

This study aims to assess the role of digital transformation in enhancing operational efficiency within service-based organizations in Bangladesh. In an era where digital technologies are rapidly reshaping business processes, understanding the specific factors driving operational improvements is essential for organizations to remain competitive. The research identifies five key factors that influence operational efficiency: Digital Technology Adoption, Employee Digital Skills, Leadership Support for Digital Transformation, Customer-Centric Digital Strategies, and Digital Infrastructure Availability. The study utilized a survey-based approach, collecting data from 218 respondents working in service-based organizations. The analysis revealed that digital infrastructure availability plays a crucial role in driving operational efficiency, with a significant positive correlation between the two variables. Furthermore, while Digital Technology Adoption and Employee Digital Skills showed a moderate relationship with operational efficiency, their impacts were less pronounced compared to the role of infrastructure. Leadership support and customer-centric strategies, though critical in broader organizational performance, were found to have a more indirect effect on operational efficiency in this study. The findings emphasize the importance of investing in robust digital infrastructure and suggest that organizations should focus on continuous skill development and strong leadership to ensure successful digital transformation. The study provides valuable insights for managers and policymakers aiming to optimize digital transformation efforts in the context of service-based organizations in Bangladesh and offers directions for future research in this area.

KEYWORDS

Digital Transformation, Operational Efficiency, Digital Technology Adoption, Employee Digital Skills, Leadership Support, Customer-Centric Strategies, Digital Infrastructure

1. INTRODUCTION

Digital transformation has emerged as a fundamental element of organizational advancement in contemporary times, significantly altering operational structures and redefining performance indicators. The incorporation of digital technologies, including artificial intelligence, machine learning, cloud computing, and big data analytics, has transformed the operational frameworks of service-oriented enterprises worldwide. In Bangladesh, a developing economy increasingly focused on digitalization, service-oriented firms have begun to use these technology innovations to maintain competitiveness and enhance efficiency. This research examines the impact of digital transformation on improving operational efficiency across Bangladeshi service businesses, a sector with significant potential for development and innovation. The paper acknowledges the essential role of digital transformation in addressing deficiencies in efficiency, customer happiness, and organizational productivity, offering a detailed comprehension of its applications and results in a growing economy.

The growing digitalization of service delivery processes has significantly altered the operations and interactions of companies with their stakeholders. Digital transformation includes a wide range of methods, from customer service automation to supply chain optimization, that greatly enhance organizational efficiency (Emon and Khan, 2024). Service-oriented enterprises in Bangladesh, such as banks, healthcare facilities, educational institutions, and e-commerce platforms, have begun to use digital technologies to optimize their operations, save expenses, and enhance client experiences (Emon, 2023). Technological adoptions are often motivated by the need to rectify operational inefficiencies, adjust to changing customer habits, and sustain competitiveness in a digitally advancing marketplace. Recent studies underscore the transformational influence of digital technologies on organizational processes, illustrating their capacity to reduce duplication, improve decision-making, and stimulate creativity (Lu et al., 2023; Thomas, 2024).

In Bangladesh, the service industry plays a crucial role in the nation's gross domestic product (GDP) and employment, rendering it essential for economic development. Nevertheless, inefficiencies in conventional operating methods have impeded development and competitiveness in this industry. Digital transformation provides a solution to these difficulties via the automation of regular procedures, the facilitation of real-time data analysis, and the promotion of collaborative work environments. The implementation of mobile banking services, telemedicine platforms, and e-governance efforts in Bangladesh illustrates the nascent phase of digital transformation and its capacity to enhance efficiency and accessibility. Research indicates that firms using digital transformation strategies often have superior operational results, such as expedited service delivery, decreased operational expenses, and increased

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staff productivity (Zhang and Bhattacharjee, 2024).

Notwithstanding the clear advantages of digital transformation, its execution in service-oriented firms in Bangladesh sometimes encounters obstacles. These include restricted access to sophisticated technology, insufficient digital literacy among workers, and reluctance to change within company cultures. Moreover, infrastructure limitations, such inconsistent internet access and inadequate technological investment, exacerbate the challenges associated with implementing digital transformation methods. The report acknowledges these issues and seeks to provide insights on how service firms in Bangladesh might surmount them to attain operational excellence. Research demonstrates that overcoming these obstacles requires a comprehensive strategy, including investments in technology, staff training, and the promotion of an innovative culture (Iqbal et al., 2024).

As the global business environment grows more digital, the capacity of service-oriented firms in Bangladesh to adapt and succeed in this context relies on their preparedness to adopt digital transformation. The rapid expansion of cellphones, cost-effective internet services, and government-driven digitization efforts have fostered a conducive atmosphere for technology adoption. The government's "Digital Bangladesh" goal has stimulated the development of digital infrastructure and services, prompting enterprises to use creative solutions to improve their operations. This vision has also fostered cooperation between public and commercial sectors to create digital platforms that enhance service delivery and accessibility. Nonetheless, the degree to which these attempts result in operational efficiency needs further examination.

The influence of digital transformation on operational efficiency may be evaluated via several aspects, such as process improvement, resource allocation, and performance assessment. Through the digitization of operational processes, firms may diminish human intervention, decrease mistakes, and attain enhanced uniformity in service delivery. Furthermore, digital technologies provide real-time monitoring and analytics, enabling firms to spot bottlenecks, measure progress, and make data-informed choices. The use of customer relationship management (CRM) systems by Bangladeshi banks has facilitated the optimization of customer contacts, elevated service quality, and bolstered client retention. Likewise, e-commerce platforms have used digital technologies to enhance supply chains, oversee stocks, and guarantee prompt delivery, so improving operational efficiency (Emon et al., 2024). These examples highlight the transformational potential of digital technology in improving organizational skills and attaining strategic goals (Konopik et al., 2022).

Employee involvement and digital literacy are crucial for the effective execution of digital transformation activities. Employees proficient in digital tools and technology are more inclined to adapt to new procedures and advance company objectives. The deficiency of digital skills among the workforce sometimes presents a considerable obstacle for firms in Bangladesh. In response, several firms are allocating resources to staff training initiatives and formulating extensive change management plans to facilitate seamless migrations to digital processes. Research indicates that cultivating a culture of learning and innovation is essential for mitigating resistance to change and optimizing the advantages of digital transformation (Yang et al., 2024).

Customer-centricity is a vital component of digital transformation in service-oriented enterprises. Utilizing digital platforms allows firms to get profound insights into client preferences, habits, and expectations, hence facilitating the customization of their offerings. Predictive analytics and artificial intelligence enable firms to foresee client demands and provide tailored experiences, therefore significantly improving customer happiness and loyalty. The rapid expansion of digital payment systems, online marketplaces, and mobile apps in Bangladesh underscores the rising demand for technology-driven services. Organizations that emphasize customer-centric digital strategies are more inclined to attain competitive advantages and sustained success (Al-Shammari, 2023).

2. LITERATURE REVIEW

Digital transformation has attracted considerable attention in both academic and professional domains, especially for its capacity to improve operational efficiency in many organizational settings. Digital transformation denotes the purposeful use of digital technology to radically change corporate processes, value delivery systems, and customer experiences. It is acknowledged as a vital factor in organizational competitiveness, allowing organizations to adapt to swiftly changing market conditions and customer demands. Literature highlights that digital transformation is not only a technology transition but a comprehensive process necessitating alterations in corporate culture, leadership, and personnel competencies (Bansal et al., 2023). Multiple research have investigated its effect on operational efficiency, offering significant insights into the processes by which technology-driven innovation enhances organizational performance. Operational efficiency is a major result of digital transformation, defined by streamlined procedures, decreased expenses, and improved productivity.

Research indicates that the use of digital technology streamlines the automation of repetitive processes, reducing human error and allowing staff to concentrate on more valuable activities. A group researchers noted that firms using digital solutions including enterprise resource planning (ERP) systems and customer relationship management (CRM) platforms achieved considerable enhancements in workflow efficiency and decision-making capacities (Al-Assaf et al., 2024). In other study, author emphasized the significance of big data analytics in facilitating real-time monitoring and predictive insights, hence enhancing resource allocation and process optimization (Aljohani, 2023). These results highlight the revolutionary capacity of digital technology in optimizing processes and improving overall efficiency. In service-based firms, digital transformation has shown significant influence owing to the sector's dependence on customer contact and satisfaction.

Customer-focused digital tactics, including targeted marketing and automated service delivery, enhance customer experiences and loyalty, thereby increasing operational efficiency. A group researchers said that digital transformation allows firms to use sophisticated analytics and artificial intelligence to get profound insights into consumer behaviors, hence facilitating the anticipation of demands and the customization of services ((Aldoseri et al., 2024). The use of digital technologies across the banking, healthcare, and education sectors in Bangladesh has yielded comparable advantages. Digital payment systems and mobile banking platforms have transformed the financial services sector, improving accessibility and convenience for users while decreasing operating costs for providers (Borges et al., 2020). Notwithstanding these gains, the literature underscores the obstacles linked to digital transformation, especially in emerging countries such as Bangladesh.

Restricted access to sophisticated technology, insufficient digital infrastructure, and a deficiency of competent labor are prevalent obstacles to effective adoption. Research conducted by underscores the need of tackling these difficulties by strategic investments in technology and personnel training initiatives (Jianing et al., 2024). Cultural resistance to change inside businesses sometimes obstructs the implementation of digital processes. Some researchers posited that cultivating a culture of innovation and perpetual learning is crucial for surmounting these obstacles and optimizing the advantages of digital transformation (Voskerichyan and Baiming, 2024). The significance of leadership in facilitating digital transformation is another essential aspect examined in the literature. Effective leadership is crucial for aligning digital projects with corporate objectives, obtaining stakeholder support, and managing the intricacies of change management.

A study, they discovered that firms led by digitally proficient leadership teams were more inclined to successfully execute digital transformation plans (Heubeck, 2023). Leaders who emphasize digital literacy and promote cross-functional cooperation create an atmosphere conducive to innovation and efficiency. This is especially pertinent for Bangladeshi firms, where conventional hierarchical frameworks may obstruct the agility necessary for digital change. Promoting participatory leadership and allowing people to explore new technologies may substantially improve organizational preparedness for digital transformation. Employee involvement and skill development are highlighted in the literature as essential elements of digital transformation. The effective use of digital technologies and procedures necessitates that personnel have the requisite digital competencies and flexibility.

Nevertheless, workers sometimes exhibit a lack of confidence in using new technology, resulting in resistance and inefficient use of digital resources. In other study, authors contended that delivering extensive training and facilitating ongoing learning opportunities are crucial for developing digital competencies within the workforce (Ramsden et al., 2022). Same goes in another study, authors proposed that enterprises take a human-centric approach to digital transformation, guaranteeing employee engagement in the change process and comprehension of its significance for their positions and the firm overall (Fenwick et al., 2024). The COVID-19 pandemic has shown the need of digital transformation in preserving operational efficiency during disruptions. Research performed during and after the pandemic indicates that firms that had already used digital technologies were more adept at adjusting to remote work setups, supply chain interruptions, and changing customer requirements.

A group researchers said that the pandemic expedited the integration of digital technology throughout several sectors, enabling many firms to accomplish years of digital advancement within few months (Khurana et

al., 2022). In Bangladesh, this trend manifested in the rapid expansion of medical services, online education platforms, and e-commerce enterprises, highlighting the resilience fostered by digital transformation (Haque et al., 2024). An additional significant facet of digital transformation addressed in the literature is its influence on sustainability and corporate social responsibility. A group researchers emphasized that digital technologies, including blockchain and the Internet of Things (IoT), provide enhanced transparency and efficiency in organizational processes, hence minimizing waste and augmenting sustainability results (Hrouga et al., 2022). These tools may improve supply chain visibility, allowing firms to detect inefficiencies and make more informed choices. Bangladeshi service firms may enhance value by including sustainability concerns into digital transformation initiatives, therefore tackling environmental and social issues in conjunction with operational objectives.

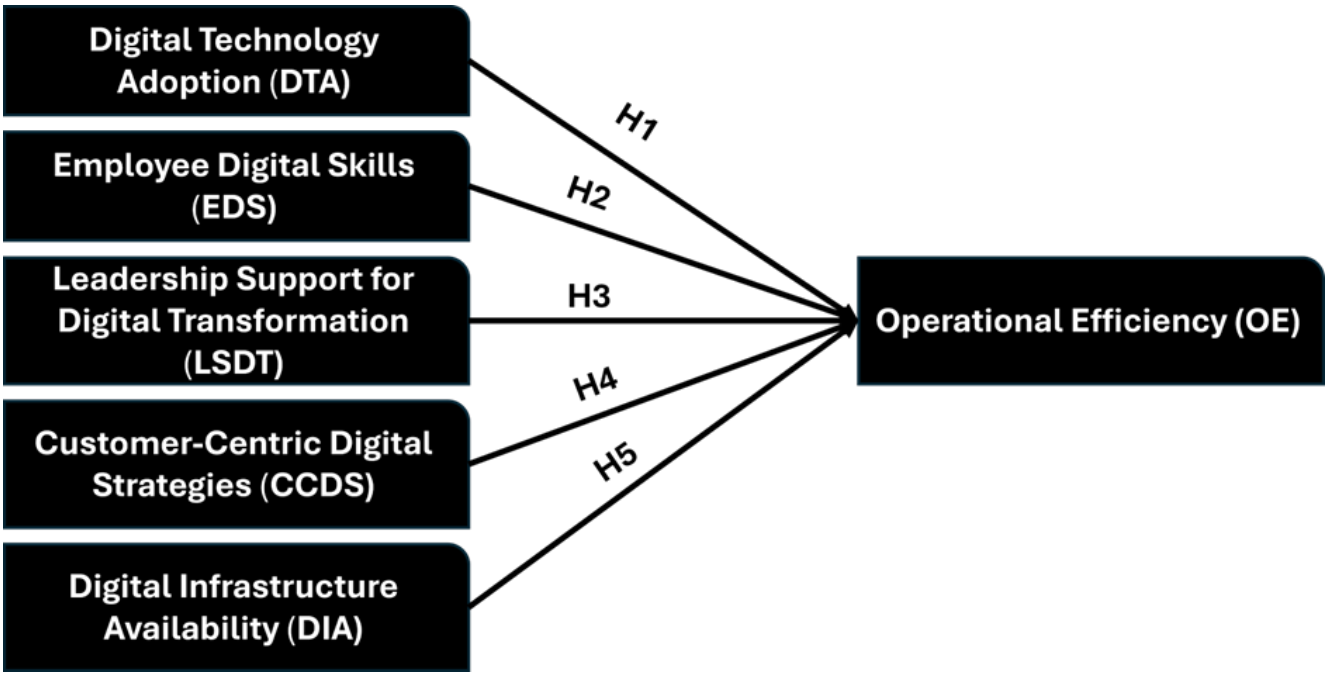

Figure 1: Conceptual Framework

3. Research Methodology

This study used a research technique aimed at evaluating the impact of digital transformation on operational efficiency in service-oriented firms in Bangladesh. A quantitative research methodology was used to collect data from a substantial sample of service-oriented firms across several sectors. The principal technique of data gathering included a standardized questionnaire, sent to workers and managers inside the firms. The questionnaire had a series of statements centered on five principal variables: digital technology adoption, staff digital competencies, leadership endorsement for digital transformation, customer-focused digital initiatives, and the availability of digital infrastructure. The participants were asked to evaluate their level of agreement with each statement on a five-point Likert scale, from strongly disagree to strongly agree. The research sample consisted of 218 respondents picked from several service industries, including banking, healthcare, education, and IT services.

The participants were selected by a convenience sample method, guaranteeing a varied array of workers from various organizational levels and departments contributed to the data. This sample approach was suitable for the study's breadth, facilitating the acquisition of diverse insights into the impact of digital transformation on operational efficiency within the chosen firms. The data collection spanned four weeks, during which the questionnaire was distributed both online and in person. The online survey platform facilitated replies from distant participants, while in-person surveys were done inside businesses to enhance response rates and participant engagement. All participants were guaranteed the secrecy and anonymity of their comments to promote candid and impartial criticism.

Upon collection, the data was coded and evaluated using statistical tools. Descriptive statistics were first used to characterize the sample's demographic characteristics, then followed by inferential analysis to examine the links between the independent factors and the dependent variable, operational efficiency. Correlation analysis was performed to evaluate the strength and direction of correlations among the variables, and regression analysis was used to examine the influence of digital transformation on operational efficiency. The research revealed significant insights into the contributions of digital technology, staff competencies, leadership support, and other aspects to enhanced operational efficiency in service-oriented firms. The research mitigated possible biases by ensuring the sample was diverse and representative of Bangladesh's service industry. The use of a structured questionnaire including clear and succinct questions mitigated response bias and guaranteed the relevance and reliability of the obtained data. The analytical findings were interpreted in relation to the current literature on digital transformation, enhancing the comprehension of how digital strategies affect operational efficiency inside Bangladesh's service-oriented enterprises.

4. Results and Findings

4.1 Reliability Statistics

The reliability statistics in Table 1 demonstrate a good degree of internal consistency for the scale used in this investigation. A Cronbach's Alpha rating of 0.906 indicates outstanding reliability, since a number beyond 0.80 is often seen as indicative of a dependable instrument. The Cronbach's Alpha for standardized items is 0.908, reinforcing the scale's resilience post-standardization. The findings indicate that the questionnaire questions reliably measure the targeted characteristics, confirming the instrument's efficacy in gathering data on digital transformation and operational efficiency. The scale has 20 questions, demonstrating comprehensiveness, and the reliability metrics affirm the data's trustworthiness for further research.

Table 1: Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.906	.908	20

4.2 Descriptive Statistics

Table 2: Descriptive Statistics

Constructs	N	Mean	Std. Deviation
Our organization actively integrates advanced digital tools into its daily operations.	208	4.27	.705
The use of automation software has significantly streamlined our processes.	208	4.23	.668
Digital technologies have enhanced our ability to analyze and utilize data for decision-making.	208	4.19	.891
The adoption of digital systems has improved the overall performance of our organization.	208	4.01	.940
Employees in our organization possess the necessary skills to use digital technologies effectively.	208	3.99	.980
Digital literacy training programs are regularly conducted to improve employee competencies.	208	3.89	.944
Employees adapt quickly to new digital tools and systems introduced in the workplace.	208	4.06	.901
Our workforce feels confident in leveraging digital technologies to perform their tasks.	208	3.98	.948
Leadership in our organization prioritizes investments in digital transformation initiatives.	208	3.98	.903
Our leaders clearly communicate the benefits and goals of digital transformation.	208	4.36	.773
Leadership fosters a culture that encourages innovation through digital technologies.	208	4.09	.864
Leaders actively support employees during the implementation of new digital systems.	208	4.30	.804
Our organization uses data-driven insights to personalize customer experiences.	208	4.04	1.067
Digital platforms have enhanced our communication and engagement with customers.	208	4.00	1.043
Automated service delivery has improved customer satisfaction in our organization.	208	4.11	.979
Digital strategies are aligned with customer needs to ensure optimal service delivery.	208	4.15	.866
Our organization has access to high-quality technological infrastructure.	208	4.22	.687
The digital systems in our organization are reliable and support smooth operations.	208	4.16	.880
Digital transformation initiatives have improved the efficiency of our organization's processes.	208	3.91	.951
The implementation of digital tools has contributed to cost reduction and resource optimization.	208	3.93	1.007
Valid N (listwise)	208		

Table 2 presents descriptive data summarizing the replies of 208 participants about different facets of digital transformation and its influence on operational efficiency. The Mean values represent the average answer for each construct, while the Standard Deviation (Std. Deviation) signifies the diversity of responses. The statement "Our organization actively integrates advanced digital tools into its daily operations" received a mean score of 4.27 and a standard deviation of 0.705, indicating that participants largely concurred, suggesting frequent integration of digital tools in organizational operations. The assertion "The use of automation software has significantly streamlined our processes" had a mean of 4.23 (Std. Dev. = 0.668), indicating a strong consensus that automation has favorably influenced operational processes.

Additional related constructs, including "Digital technologies have augmented our capacity to analyze and leverage data for decision-making" (Mean = 4.19, Std. Dev. = 0.891) and "The implementation of digital systems has elevated the overall performance of our organization" (Mean = 4.01, Std. Dev. = 0.940), also indicate favorable responses, illustrating that digital technologies are perceived as enhancing both decision-making and overall organizational efficacy. The average scores for employee-related constructs indicate that while employees generally possess the requisite skills for effective digital technology use (Mean = 3.99, Std. Dev. = 0.980), there is potential for enhancement in training programs and skill development, as reflected in the statement "Digital literacy training programs are regularly conducted to improve employee competencies" (Mean = 3.89, Std. Dev. = 0.944).

Leadership-related constructs, such as "Leadership in our organization prioritizes investments in digital transformation initiatives" (Mean = 3.98, Std. Dev. = 0.903) and "Our leaders clearly communicate the benefits and goals of digital transformation" (Mean = 4.36, Std. Dev. = 0.773), suggest that although leadership support for digital transformation is predominantly robust, there exists variability in responses, particularly concerning the prioritization of investments and the communication of digital transformation benefits. Customer-centric digital strategies, exemplified by "Our organization employs data-driven insights to tailor customer experiences" (Mean = 4.04, Std. Dev. = 1.067) and "Automated service delivery has enhanced customer satisfaction in our organization" (Mean = 4.11, Std. Dev. = 0.979), indicate favorable results, with respondents concurring that digital transformation initiatives are facilitating improved customer experiences.

Concerning the availability of digital infrastructure, assertions such as "Our organization has access to high-quality technological infrastructure" (Mean = 4.22, Std. Dev. = 0.687) and "The digital systems in our organization are reliable and support smooth operations" (Mean = 4.16, Std. Dev. = 0.880) indicate that organizations typically possess the requisite infrastructure for digital operations, exhibiting a relatively low degree of variability in the responses. The constructs pertaining to operational efficiency, including "Digital transformation initiatives have enhanced the efficiency of our organization's processes" (Mean = 3.91, Std. Dev. = 0.951) and "The implementation of digital tools has facilitated cost reduction and resource optimization" (Mean = 3.93, Std. Dev. = 1.007), reflect moderate agreement that digital transformation has positively influenced efficiency and cost optimization, although some respondents may not entirely recognize the same degree of impact.

4.3 Correlation among the Variables

Table 3: Correlations

		Digital Technology Adoption	Employee Digital Skills	Leadership Support for Digital Transformation	Customer-Centric Digital Strategies	Digital Infrastructure Availability	Operational Efficiency
Digital Technology Adoption	Pearson Correlation	1	.828**	.760**	.561**	.216**	.242**
	Sig. (2-tailed)		.000	.000	.000	.002	.000
	N	208	208	208	208	208	208
Employee Digital Skills	Pearson Correlation	.828**	1	.647**	.625**	.154*	.186**
	Sig. (2-tailed)	.000		.000	.000	.027	.007
	N	208	208	208	208	208	208
Leadership Support for Digital Transformation	Pearson Correlation	.760**	.647**	1	.696**	.141*	.135
	Sig. (2-tailed)	.000	.000		.000	.043	.053
	N	208	208	208	208	208	208
Customer-Centric Digital Strategies	Pearson Correlation	.561**	.625**	.696**	1	.118	.144*
	Sig. (2-tailed)	.000	.000	.000		.091	.038
	N	208	208	208	208	208	208
Digital Infrastructure Availability	Pearson Correlation	.216**	.154*	.141*	.118	1	.478**
	Sig. (2-tailed)	.002	.027	.043	.091		.000
	N	208	208	208	208	208	208
Operational Efficiency	Pearson Correlation	.242**	.186**	.135	.144*	.478**	1
	Sig. (2-tailed)	.000	.007	.053	.038	.000	
	N	208	208	208	208	208	208

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Table 3 presents the correlation matrix illustrating the correlations among several characteristics pertaining to digital transformation and operational efficiency. All correlations use Pearson's correlation coefficient, which quantifies the strength and direction of linear connections between variable pairs. The significance (2-tailed) values indicate the statistical importance of each association, with values below 0.05 regarded as significant. Digital Technology Adoption has a robust positive link with Employee Digital Skills ($r = 0.828$, $p < 0.001$), Leadership Support for Digital Transformation ($r = 0.760$, $p < 0.001$), and Customer-Centric Digital Strategies ($r = 0.561$, $p < 0.001$). This indicates that when firms embrace digital technology, there is a concomitant enhancement in staff competencies, leadership endorsement for digital projects, and the execution of customer-centric strategies.

The positive connection with Digital Infrastructure Availability ($r = 0.216$, $p = 0.002$) suggests that firms with more adoption of digital technologies often possess superior access to digital infrastructure, although with a modest degree of association. Finally, the connection with Operational Efficiency ($r = 0.242$, $p < 0.001$) indicates a substantial albeit modest link, suggesting that increased use of digital technology correlates with enhanced operational efficiency, although the effect may not be instantaneous or uniformly seen. Employee Digital Skills exhibit a robust correlation with Digital Technology Adoption ($r = 0.828$, $p < 0.001$) and Leadership Support for Digital Transformation ($r = 0.647$, $p < 0.001$), indicating that enhancements in employees' digital skills correspond with increased adoption of digital technologies and greater leadership support for digital transformation.

A moderate positive association exists with Customer-Centric Digital Strategies ($r = 0.625$, $p < 0.001$), suggesting that improved digital abilities among workers contribute to the enhancement of customer-focused strategies. The correlation with Digital Infrastructure Availability ($r = 0.154$, $p = 0.027$) is weak but significant, indicating a modest association between workers' digital abilities and infrastructure availability. The connection with Operational Efficiency ($r = 0.186$, $p = 0.007$) is positive and significant, suggesting that higher employee digital abilities are marginally linked to improved operational efficiency. Leadership Support for Digital Transformation has a substantial positive link with Digital Technology Adoption ($r = 0.760$, $p < 0.001$), Employee Digital Skills ($r = 0.647$, $p < 0.001$), and Customer-Centric Digital Strategies ($r = 0.696$, $p < 0.001$). The findings indicate that robust leadership endorsement of digital transformation projects favorably affects technology uptake, augments staff competencies, and refines customer-centric tactics.

The connection with Digital Infrastructure Availability ($r = 0.141$, $p = 0.043$) is weak but significant, suggesting a small association between leadership support and the availability of digital infrastructure. The association with Operational Efficiency ($r = 0.135$, $p = 0.053$) is not statistically significant at the 0.05 level, although it nears significance, indicating that leadership support may have a slight influence in enhancing operational efficiency. Customer-Centric Digital Strategies exhibit substantial positive correlations with Digital Technology Adoption ($r = 0.561$, $p < 0.001$), Employee Digital Skills ($r = 0.625$, $p < 0.001$), and Leadership Support for Digital Transformation ($r = 0.696$, $p < 0.001$), indicating that advancements in technology adoption, employee competencies, and leadership endorsement collectively enhance the formulation of customer-centric strategies.

The modest association with Digital Infrastructure Availability ($r = 0.118$, $p = 0.091$) indicates that, while infrastructure may contribute, it is not a

significant determinant of customer-centric methods. The connection with Operational Efficiency (r = 0.144, p = 0.038) is statistically significant at the 0.05 level, indicating that customer-centric digital initiatives have a little but favorable effect on operational efficiency. The association between Digital Infrastructure Availability and Digital Technology Adoption (r = 0.216, p = 0.002) is significant albeit modest, indicating that enhanced infrastructure correlates with increased adoption of digital technologies. The link with Employee Digital abilities (r = 0.154, p = 0.027) is modest but significant, indicating that access to infrastructure slightly promotes the development of digital abilities among workers.

The association between Leadership Support for Digital Transformation (r = 0.141, p = 0.043) is modest but significant, suggesting that firms with superior infrastructure are more likely to get more leadership support for digital transformation. The association with Operational Efficiency (r = 0.478, p < 0.001) is moderate to high, indicating that the presence of digital infrastructure significantly enhances operational efficiency. Finally, Operational Efficiency exhibits positive correlations with Digital Technology Adoption (r = 0.242, p < 0.001), Employee Digital Skills (r = 0.186, p = 0.007), and Digital Infrastructure Availability (r = 0.478, p < 0.001), suggesting that enhancements in technology adoption, employee competencies, and infrastructure availability collectively enhance operational efficiency. The connection between Leadership Support for Digital Transformation (r = 0.135, p = 0.053) is not significant at the 0.05 level, indicating that while leadership support may impact operational efficiency, its influence is less than that of other components.

4.4 Regression Analysis

Table 4 displays the model summary, including essential data for assessing the regression model's goodness of fit. An R value of 0.505 signifies a moderate positive correlation between the predictor variables (Digital Infrastructure Availability, Customer-Centric Digital Strategies, Digital Technology Adoption, Leadership Support for Digital Transformation, and Employee Digital Skills) and the dependent variable, presumably operational efficiency or a related construct. This indicates that the predictors together account for a moderate share of the variation in the dependent variable. The R Square score of 0.255 indicates that around 25.5% of the variance in the dependent variable is accounted for by the five predictor variables in the model. This modest fraction suggests the existence of other unaccounted components in the model that also affect the dependent variable.

The Adjusted R Square score of 0.236 offers a modified assessment of the model's goodness of fit, considering the number of predictors included. The adjusted R-squared is somewhat lower than the R-squared, which is customary when many predictors are used. This modified value indicates that the model remains somewhat successful in elucidating the variation in the dependent variable, considering the quantity of predictors. The Standard Error of the Estimate is 0.79798, indicating the average deviation between the actual values and the model's projected values. A reduced standard error indicates that the model's predictions are nearer to the actual observed values. Considering the standard error in this instance, the model seems to provide quite accurate predictions, but with a residual margin of error. The model suggests that the chosen predictors (digital infrastructure, customer-centric strategies, technology adoption, leadership support, and personnel skills) help to elucidating operational efficiency; nevertheless, supplementary variables may be required for a more thorough analysis.

Table 4: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.505[a]	.255	.236	.79798

a. Predictors: (Constant), Digital Infrastructure Availability, Customer-Centric Digital Strategies, Digital Technology Adoption, Leadership Support for Digital Transformation, Employee Digital Skills

Table 5 displays the Analysis of Variance (ANOVA) for the regression model, which assesses whether the model substantially predicts the dependent variable, namely Operational Efficiency. The Sum of Squares column indicates the aggregate variance in the dependent variable. The Regression sum of squares (43.984) denotes the variance elucidated by the independent variables: Digital Infrastructure Availability, Customer-Centric Digital Strategies, Digital Technology Adoption, Leadership Support for Digital Transformation, and Employee Digital Skills. The Residual Sum of Squares (128.627) denotes the unexplained variation or model error, whereas the Total Sum of Squares (172.611) signifies the overall variance in the dependent variable. The degrees of freedom (df) for the regression is 5, reflecting the five independent variables, while the df for the residual is 202, representing the total number of observations minus the number of predictors. The Mean Square is calculated by dividing the Sum of Squares by the associated degrees of freedom. The Mean Square for Regression (8.797) and for Residual (0.637) indicate the amount of variance explained per degree of freedom. The F-statistic of 13.815 is used to evaluate the adequacy of the overall regression model for the data. The F-statistic is determined by the ratio of the mean square of the regression to the mean square of the residuals. A high F-statistic indicates that the model offers a substantially improved fit compared to a model devoid of predictors. The significance score of 0.000 demonstrates that the total regression model is very significant at the 0.05 level of significance. Given that the p-value is below 0.05, we may reject the null hypothesis asserting that the model does not account for any variation in the dependent variable. Consequently, the independent factors together have a statistically significant influence on operational efficiency.

Table 5: ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	43.984	5	8.797	13.815	.000[b]
	Residual	128.627	202	.637		
	Total	172.611	207			

a. Dependent Variable: Operational Efficiency

b. Predictors: (Constant), Digital Infrastructure Availability, Customer-Centric Digital Strategies, Digital Technology Adoption, Leadership Support for Digital Transformation, Employee Digital Skills

Table 6 displays the coefficients for each predictor variable in the regression model, together with their corresponding statistical significance, elucidating the influence of each variable on the dependent variable, Operational Efficiency. The Unstandardized Coefficients (B) indicate the variation in the dependent variable resulting from a one-unit alteration in the independent variable, while maintaining all other variables constant. The unstandardized coefficient for Digital Technology Adoption is 0.359, indicating that a one-unit increase in digital technology adoption is anticipated to result in a 0.359 unit gain in operational efficiency, providing all other variables remain constant. The Standardized Coefficients (Beta) indicate the relative significance of each predictor inside the model.

These values facilitate the comparison of variables by standardizing the units of measurement. The Digital Technology Adoption variable has a Beta value of 0.248, indicating a modest positive correlation with operational efficiency. The highest Beta value is attributed to Digital Infrastructure Availability (0.442), indicating that it has the most substantial positive influence on operational efficiency within this model. The t-value assesses whether the coefficient significantly deviates from zero, whereas the corresponding Sig. (p-value) indicates if the variable meaningfully contributes to the model. A p-value below 0.05 indicates statistical significance. Digital Infrastructure Availability is very important, shown by a t-value of 7.082 and a p-value of 0.000, indicating a robust and substantial positive effect on operational efficiency.

The variables Employee Digital Skills, Leadership Support for Digital Transformation, and Customer-Centric Digital Strategies possess p-values over 0.05, indicating that these predictors do not substantially enhance the model. Employee Digital Skills exhibits a t-value of -0.393 and a p-value of 0.695, indicating it lacks a meaningful impact on operational efficiency within this model. Likewise, Leadership Support for Digital Transformation and Customer-Centric Digital Strategies have p-values of 0.196 and 0.380, respectively, indicating no substantial effect on operational efficiency. The constant (intercept) term is 0.520, with a p-value of 0.288, indicating a lack of statistical significance, which implies that the baseline level of operational efficiency is not markedly different from zero in the absence of any predictors.

Table 6: Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.520	.488		1.065	.288
	Digital Technology Adoption	.359	.192	.248	1.876	.062
	Employee Digital Skills	-.054	.136	-.046	-.393	.695
	Leadership Support for Digital Transformation	-.195	.150	-.142	-1.298	.196
	Customer-Centric Digital Strategies	.102	.116	.080	.879	.380
	Digital Infrastructure Availability	.599	.085	.442	7.082	.000
a. Dependent Variable: Operational Efficiency						

5. Discussion

The study's findings provide significant insights into the correlation between several digital transformation elements and operational effectiveness in service-oriented firms in Bangladesh. The investigation, using multiple regression and correlation tests, underscores the intricate interactions among digital technologies, staff competencies, leadership endorsement, and infrastructure accessibility. The results augment the expanding corpus of research on digital transformation and its impact on improving operational efficiency, particularly in developing nations. The research reveals a substantial influence of Digital Infrastructure Availability on Operational Efficiency. The unstandardized coefficient for this variable was 0.599, and it had the highest standardized coefficient (0.442), highlighting its significance. This discovery corresponds with current research indicating that a strong digital infrastructure is essential for the effective deployment of digital technologies inside businesses (Chakraborty and Mallick, 2020; Lee and Shin, 2021).

The presence of dependable and superior digital infrastructure allows for the seamless incorporation of digital technologies into daily operations, enhancing processes and minimizing inefficiencies. As digital transformation advances, firms with superior infrastructure are more likely to achieve substantial efficiency improvements. Notably, Digital Technology Adoption, albeit demonstrating a positive correlation with operational efficiency, did not seem to be the most significant component. The coefficient for this variable was 0.359, with a Beta of 0.248, indicating a considerable effect, but less significant than infrastructure availability. This indicates that the use of digital technologies is crucial for enhancing efficiency, but it requires robust digital infrastructure to achieve optimal effectiveness. This discovery supports previous research highlighting the synergistic relationship between digital technology and infrastructure (Porter and Heppelmann, 2015).

Merely implementing modern technology, such as automation or data analytics tools, without adequate infrastructure may result in subpar performance and an inability to realize the intended operational enhancements. The impact of Employee Digital Skills on improving operational efficiency was ambiguous in this research. The variable had a negative coefficient of -0.054 and a p-value of 0.695, indicating its insignificant contribution to the model. This discovery undermines the presumption that employee digital literacy directly enhances efficiency benefits. A potential reason for this outcome may be the environment of Bangladeshi service-oriented firms, where employee proficiency in digital technologies may not yet match that of other countries or sectors. Digital transformation is nascent in several Bangladeshi firms, leading to workers underutilizing current technology and thus achieving limited operational efficiency.

This outcome may also indicate the need for specialized training programs aimed at skill enhancement for certain digital technologies, potentially boosting operational performance (Choudhury and Bandyopadhyay, 2021). The variable Leadership Support for Digital Transformation did not have a meaningful impact on operational efficiency. The coefficient of -0.195 and a p-value of 0.196 suggest that leadership support in this situation may lack significant influence. This may stem from the observation that, whereas leadership in several Bangladeshi service-oriented firms may emphasize digital transformation, the implementation and backing for these projects may be deficient. Leaders may be failing to provide the essential resources, training, or incentives required for digital transformation to achieve its maximum potential.

Leadership's involvement in cultivating a digital culture and endorsing digital projects may be more indirect, perhaps reflected in areas such as employee motivation or organizational strategy, rather than in direct enhancements to operational efficiency (Avasarala, 2022). Likewise, Customer-Centric Digital Strategies shown no substantial impact on operational efficiency. The variable has a coefficient of 0.102 and a p-value of 0.380, indicating a somewhat modest influence. This indicates that while customer-centric digital initiatives, including customized services and enhanced digital interaction, are crucial for customer satisfaction and corporate expansion, they may not have a clear relationship with operational efficiency in service-oriented firms. Service-based firms in Bangladesh may still be integrating their digital strategies with consumer demands, which directly impacts internal processes and efficiency (Choudhury and Bandyopadhyay, 2021).

A heightened emphasis on refining operational processes in alignment with customer requests may be necessary for customer-centric methods to provide a more quantifiable effect on efficiency. This research reveals inconsistent findings for the Employee Digital Skills variable. This research indicates that, while skills are crucial for optimizing digital technology, a disparity between digital literacy and the actual use of these tools may persist in several service-oriented firms. Employees may have fundamental digital abilities but lack the advanced competencies required to maximize the use of complex technologies, hence limiting their influence on operational efficiency. The skills gap may be ascribed to the sluggish implementation of digital training programs in some firms, particularly in developing economies like as Bangladesh (Azim and Rahman, 2021). Notwithstanding these issues, the prevailing opinion is that Digital Infrastructure Availability is the most significant predictor of operational efficiency in this setting.

The findings underscore the essential need for firms to possess appropriate technology infrastructure to facilitate digital transformation initiatives. In the absence of dependable infrastructure, variables like technology adoption and personnel competencies may fail to provide the anticipated operational enhancements. Organizations aiming to enhance operational efficiency via digital transformation should prioritize investments in resilient digital infrastructure, thereafter focusing on programs that promote skills development and leadership endorsement for digital projects. In summary, although digital transformation possesses considerable potential to enhance operational efficiency in service-oriented organizations in Bangladesh, the research emphasizes the necessity of a comprehensive strategy that includes infrastructure, technology implementation, employee competencies, and leadership endorsement. Future study should investigate the influence of these elements across many sectors and contexts to further our comprehension of how digital transformation might be used for operational improvements. Organizations should implement focused training programs to improve employee digital abilities and ensuring leadership is actively engaged in promoting and supporting digital projects, since these elements may provide greater long-term effects.

6. Conclusion

This research underscores the critical importance of digital transformation in improving operational efficiency within service-oriented enterprises in Bangladesh. The results highlight that the availability of digital infrastructure is the primary element enhancing operational efficiency. The findings indicate that firms possessing dependable and resilient digital infrastructure are more adept at properly integrating digital technologies, resulting in optimized processes and increased production. This reinforces the idea that infrastructure is essential for the effective application of digital technologies, facilitating seamless adoption and operation of digital systems. Although Digital Technology Adoption contributes to operational efficiency, its effect is less significant than that of infrastructure availability. This suggests that just implementing modern technology is insufficient to achieve significant efficiency gains without the backing of appropriate infrastructure.

Likewise, Employee Digital Skills did not have a substantial influence on operational efficiency, indicating that skill development initiatives must be more focused and matched with certain technologies to enhance their effectiveness on performance. The support of leadership for digital transformation and customer-centric digital strategies did not significantly influence operational efficiency in this study's environment. This may indicate the continuing digital transformation process in Bangladeshi service-oriented firms, where leadership endorsement may not be completely established, and customer strategies may not be entirely refined for operational enhancements. The report underscores the need for firms to enhance their digital infrastructure as a fundamental facilitator of operational efficiency. Organizations must invest in infrastructure enhancement, provide specialized training to elevate employee digital competencies, and secure robust leadership commitment to propel digital projects for sustainable change. Future study should investigate these relationships across many sectors to provide better insights into the determinants of digital transformation and operational success. By comprehending and tackling these critical components, firms may optimize the advantages of digital transformation and attain enduring enhancements in efficiency and productivity.

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