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Advancing Economic Development in Bangladesh through Innovation-Driven Governance

Md. Mamunur Rashid^{1*}, Md. Abdullah-Al-Mamun²

¹Senior Management Counsellor and Head of Production Management Division, Bangladesh Institute of Management (BIM).

²Department of Finance and Banking (FIB), Faculty of Business Studies, Hajee Mohammad Danesh Science & Technology University, Dinajpur.

ARTICLE INFO	ABSTRACT
<p>Received date: Nov. 28, 2023 Accepted date: Dec. 12, 2023</p>	<p>This research paper aims to explore the correlation between innovation and economic development in Bangladesh. Various indicators such as financial innovation, trade openness, human development capital, gross capital formation, and domestic credit to the private sector are used as measures of innovation, while GDP represents the country's economic development. Data was collected through a survey questionnaire, while secondary data was obtained from reputable sources such as the World Bank, World Bank Development Indicators, Bangladesh Bank, and Bangladesh Bureau of Statistics. Descriptive statistics in Excel were employed to analyze and summarize the data, while several tests including unit root test, Johansen co-integrating test, vector error correction model, impulse response function, autoregressive distributed lag (ARDL) model, and bound test were conducted for data analysis. The unit root test confirmed that all variables were non-stationary at the level but stationary at the first difference, indicating they were integrated of order one. The Johansen co-integrating test revealed a significant long-term relationship between the dependent variable (GDP) and independent variables. Additionally, the vector error correction model (VECM) and impulse response function were used to calculate the speed of adjustment and short-term shocks associated with GDP. The ARDL model examined the correlation between the dependent variable and independent variables, while the bound test determined long-run co-integration between the regressed and regressor. All analyses consistently demonstrated a significant long-term relationship between innovation and economic development. Therefore, it is crucial for the government to prioritize policies and initiatives that foster innovation in order to promote sustainable economic development.</p>

Keywords: Economic development, Financial innovation, Trade openness, Human development capital, Gross capital formation

*CORRESPONDENCE

mamun.fin@hstu.ac.bd

Department of Finance and Banking, Faculty of Business Studies, Hajee Mohammad Danesh Science & Technology University, Dinajpur

1. INTRODUCTION

Innovation-led governance has emerged as a crucial factor for economic development in nations worldwide. Recognizing its significance, Bangladesh, a lower-middle-

income country, has recently embraced innovation-led governance initiatives since 2018 (Bulman et al., 2017). However, despite these efforts, the country's global ranking in terms of innovation and creativity, as indicated by the Global Innovation Index, remains modest, with an overall

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rank of 116 in 2020 and 2021. This raises questions about the effectiveness and impact of innovation-led governance on the well-being of the people in Bangladesh. To address the challenges of economic development, it is essential to emphasize continuous improvement and innovation (Mazzucato, 2018). Bessant et al. (2001) highlight the significance of continuous improvement in achieving economic development goals. However, the success of government-sponsored programs aimed at fostering innovation and technological advancement in Bangladesh has been limited. This raises questions about the potential of innovation-led governance initiatives to make substantial progress in economic development. Bangladesh still faces significant hurdles in terms of technological adoption, particularly in rural areas where traditional methods prevail (Islam & Uchiyama, 2009). The per capita Gross Domestic Product (GDP) in 2021 was estimated at just \$2138, reflecting the need for substantial improvements. The country also grapples with income inequality, wage disparities between the formal and informal sectors, rising living costs, inadequate calorie intake for a significant portion of the population, unemployment, and internal migration.

Moreover, Bangladesh's international ranking on the United Nations Human Development Index remains low, at 133 out of 189 countries in the 2020 report. Access to innovation-led governance facilities is limited in Bangladesh due to inadequate knowledge and limited technology penetration. One of the primary benefits of innovation is its contribution to economic growth through increased productivity, where the same inputs yield greater outputs. To overcome the middle-income trap, Bangladesh, as a developing nation, must urgently address the challenges of creating a favorable business climate, promoting exports, attracting foreign direct investment (FDI) for human capital development, supporting knowledge acquisition, and embracing digital transformation (Cai, 2012). This research aims to examine the effectiveness of innovation-led governance in Bangladesh and its role in driving economic growth. The study will also identify the challenges faced by innovation-led governance initiatives in Bangladesh and explore potential areas where innovation-driven governance can be applied to foster economic development.

By analyzing various parameters such as the Theory of Inventive Problem Solving (TRIZ), creating an enabling business environment, promoting exports, sustainable innovation, and productivity growth, this research will provide insights into the advancement of economic development through innovation-led governance in Bangladesh (Chai et al., 2005; Ullah et al., 2016). Innovation-led governance has become a critical focus for economic development in Bangladesh. Despite its lower-middle-income status, Bangladesh has embraced innovation-led governance initiatives since 2018 (Woo, 2012). However, the country's performance in terms of innovation and creativity, as indicated by global rankings, remains modest. For this purpose, the literature review has been covers various aspects of innovation in different sectors,

including the public sector. Here is a summary of the key points: Definition of innovation: Innovation is the implementation of new or significantly improved products, processes, marketing methods, or organizational methods (Kuwashima & Fujimoto, 2013). It involves both new ideas and their practical application.

Types of innovation: The review mentions four types of innovation - breakthrough innovation (radical and revolutionary), disruptive innovation (overturning established industries), basic research (preceding major discoveries), and sustaining innovation (incremental improvements). Innovation in the public sector (Hudson, 2003): The public sector has embraced innovation through initiatives such as New Public Management (NPM) in the 1990s, which introduced private sector values and practices. Examples of innovation in the public sector include Taiwan's focus on building wealth through innovation and Bangladesh's goal of efficient, service-oriented activities. Barriers to innovation: Barriers to innovation in the public sector include resource limitations, legal frameworks, lack of top-management support, resistance to change, and inadequate funding and time. Innovation management: Innovation requires a culture that encourages and rewards new ideas, a strategic approach that promotes systemic change, and investment in human capital through recruitment, training, and development (Dejoy, 2005; Brown, 1996).

Innovation in the private sector vs. public sector: While the private sector is often seen as more innovative, the public sector can also innovate in areas such as service delivery, process improvement, organizational changes, and communication methods. Global innovation index: The Global Innovation Index (GII) measures the innovation performance of economies worldwide (Eichengreen et al., 2012). Bangladesh's position in the GII 2021 was 116th. Middle-income trap: The middle-income trap refers to the challenges faced by countries that have achieved middle-income status but struggle to progress to high-income economies (Glawe & Wagner 2016). The duration and criteria for escaping the middle-income trap vary in different studies.

Overall, the literature review highlights the importance of innovation in various sectors, including the public sector, and discusses factors influencing innovation, barriers to overcome, and different types of innovation. This raises questions about the effectiveness of innovation-led governance in driving economic development and improving the well-being of the people. Bangladesh faces significant challenges, including limited technological adoption, rural-urban disparities, income inequality, and inadequate access to innovation-led governance facilities (Im & Rosenblatt, 2015). To break free from the middle-income trap, Bangladesh needs to address these challenges and create a favorable business climate, promote exports, attract foreign direct investment, invest in human capital development, and embrace digital transformation. The concept of innovation-led governance has gained significant attention as a means to promote economic growth and development in nations

worldwide. Bangladesh, being a developing country, is actively seeking ways to enhance its economic growth and improve the well-being of its people. Innovation-led governance offers a promising approach to address these challenges and foster sustainable development. Innovation-led governance encompasses various principles and strategies aimed at driving economic growth through innovation. It involves leveraging tools such as the theory of inventive problem-solving (TRIZ), customer needs analysis, and logical inferences, such as deduction, induction, and abduction (Mann, 2002).

By incorporating these elements into the innovation process, countries like Bangladesh can enhance quality, productivity, and gain a competitive advantage. Bangladesh finds itself in the middle-income trap, characterized by stagnation in economic growth despite reaching a certain income level (Kharas & Kohli, 2011). The World Bank defines this trap as the middle-income range, where countries' gross national product per capita remains between \$1,000 to \$12,000 constant prices. To break free from this trap, Bangladesh must overcome various challenges, including creating an enabling business environment, promoting exports, attracting foreign direct investment (FDI) for human capital development, fostering knowledge acquisition, and embracing digital transformation. Measuring the effectiveness of innovation-led governance and its impact on economic growth is essential to guide policymaking and decision-making processes. By understanding the factors that contribute to successful innovation-led governance, Bangladesh can identify areas where it can be applied to drive economic development effectively. This study aims to explore these aspects and provide insights into advancing economic development in Bangladesh through innovation-driven governance.

To achieve this objective, a survey will be conducted, consisting of 19 questionnaires focusing on innovation, economic development, financial indicators (such as broad money, narrow money, balance of trade, balance of payments), exports, gross domestic product (GDP), trade openness, investment in human development, project completion within budget, physical investment, private investment, domestic credit, and patent registration. These variables have been selected from the Global Innovation Index 2021, considering their relevance to the analysis. Secondary data from reputable sources such as the World Bank, Bangladesh Bank, Bangladesh Bureau of Statistics, and World Bank Development Indicators will be utilized for regression analysis. However, certain variables, such as expenditure on research and development, number of patent applications, technological advancement investments, labor productivity, trade diversification, and online creativity, have been excluded due to data unavailability and time limitations. While the key variables are presented as follows: GDP (Dependent Variable) - Gross Domestic Product (GDP), FI - Financial Innovation, TO - Trade Openness, HD - Human Capital Development, and GCF - Gross Capital Formation. These variables play a crucial role in analyzing and understanding the relationship between

innovation-led governance and economic development. They provide valuable insights into economic output, financial sector innovation, trade integration, human capital investment, and capital formation. By examining these variables, researchers can assess the impact of innovation-led governance initiatives on various aspects of economic growth and development. These key variables are fundamental measures used in analyzing and understanding the relationship between innovation-led governance and economic development in Bangladesh. They provide insights into various aspects of economic performance, financial sector development, trade integration, human capital investment, capital formation, and credit availability to the private sector. By examining these variables, researchers can assess the impact of innovation-led governance initiatives on economic growth, financial innovation, trade dynamics, human capital development, investment patterns, and access to credit for private sector activities in Bangladesh. By examining the relationship between innovation-led governance and economic development in Bangladesh, this research aims to contribute to the existing knowledge on effective strategies for driving economic growth. The findings will inform policymakers, government agencies, and stakeholders on the areas that require attention and provide insights into shaping policies and programs to achieve sustainable economic development in Bangladesh. Therefore, the present work carryout to evaluate the effectiveness of innovation-led governance, measure the contribution of innovation-led governance to economic growth, identify the challenges faced by innovation-led governance initiatives, explore potential areas for the application of innovation-led governance to foster economic development in Bangladesh.

2. MATERIALS AND METHODS

The research focuses on several key variables that are relevant to the analysis. These variables include GDP (Gross Domestic Product), FI (Financial Innovation), TO (Trade Openness), HD (Human Capital Development), and GCF (Gross Capital Formation). They serve as measures to assess the impact of innovation-led governance on economic growth and development.

2.1 Secondary Data Analysis

The research utilizes secondary data from reputable sources such as the World Bank, Bangladesh Bank, Bangladesh Bureau of Statistics, and World Bank Development Indicators. These sources provide reliable and relevant data for the regression analysis. The collected data will be subjected to regression analysis to examine the relationships between the variables. The methodology has been developed to do the research as per following steps. The methodology for the research involves several steps to investigate the relationship between innovation-led governance and economic development in Bangladesh. At a glance, the methodology consists of the following key tasks.

Secondary data analysis has been used following models.

Regression Model

$$\ln Y_t = \alpha_0 + \beta_1 \ln FIt + \beta_2 \ln HDt + \beta_3 \ln TOt + \beta_4 \ln GCFt + \beta_5 \ln DCPt + \epsilon_t \dots \dots \dots [1]$$

Here α & β are the coefficient of variables

Y_t represents the GDP per capita

$\ln Y_t$ = Natural Logarithm of GDP per capita

$\ln FIt$ = Natural Logarithm of Financial Innovation

$\ln HDt$ = Natural Logarithm of Human Capital Development

$\ln TOt$ = Natural Logarithm of Trade Openness

$\ln GCFt$ = Natural Logarithm of Gross Capital Formation

$\ln DCPt$ = Natural Logarithm of Domestic Capital to Private Sector

ϵ_t = Error term.

In the above equation GDP is the dependent variables & financial innovation, Human Capital Development, Trade openness, Gross Capital Formation and Domestic Credit to private sectors are independent variables.

Unit root test:

This test measures the stationary. The most used unit root test is the Augmented Dicky Fuller test (ADF).

Augmented Dicky-Fuller test (ADF) test:

ADF test equation can be written as following:

$$\Delta y_t = \alpha_0 + \beta t + \gamma y_{t-1} + \delta_1 \Delta y_{t-1} + \dots + \delta_{p-1} \Delta y_{t-p-1} + \epsilon_t \dots \dots \dots [2]$$

In the above equation null hypothesis is the data series being tested has a unit root i.e. stationary exists & alternative hypothesis is no unit root exists.

Co-integration test:

To examine the long run equilibrium relation Johansen co-integration test is employed.

Null Hypothesis; H_0 =No co-integration exists among the variables

Alternative Hypothesis; H_1 = H_0 is not correct

Vector Error Correction Model

$$\Delta \ln Y_t = \alpha_0 + \beta_1 \Delta \ln FIt + \beta_2 \Delta \ln HDt + \beta_3 \Delta \ln TOt + \beta_4 \Delta \ln GCFt + \beta_5 \Delta \ln DCPt + \beta_6 ECT_{t-1} + \epsilon_t \dots \dots \dots [3]$$

Innovation Accounting: For capturing the short run shocks impulse response function will be employed in this study.

The Autoregressive Distributed Lag (ARDL) Method:

The study will be applied a well-known approach by Pesaran et al. (2001) called the autoregressive distributed lag (ARDL) approach. The ARDL method is considered as the best econometric model compared to others in a case when the variables are stationary at I (0) or integrated of order I (1). Based on the study objectives, it is a better model than others to catch the short-run and long-run impact of independent variables on economic development. While, ARDL co-integration technique does not require pretests for unit roots unlike other techniques. Consequently, ARDL co-integration technique is preferable when dealing with variables that are integrated of different order, I (0), I (1) or combination of the both and, robust when there is a single

long run relationship between the underlying variables in a small sample size.

2.2 Primary data analysis

The research involves collecting data from 110 respondents through questionnaires. These questionnaires are designed to gather information relevant to the research objectives. The data collected from the respondents will provide insights into the perceptions and experiences related to innovation-led governance and its impact on economic development.

In addition to the primary data collected through questionnaires, the research also utilizes secondary data. This includes data obtained from reputable sources such as the World Bank, Bangladesh Bank, Bangladesh Bureau of Statistics, and World Bank Development Indicators. The secondary data analysis helps to provide a broader context for the research objectives and contributes to the overall analysis.

The research considers the specific objectives of the study, which are to explore the role of innovation-led governance in promoting economic development in Bangladesh. The context of these objectives is considered throughout the research process to ensure that the findings and analysis are aligned with the research goals.

Obtaining Innovation-led Governance for Economic Development of Bangladesh: This step focuses on understanding how innovation-led governance can be achieved in the context of Bangladesh's economic development. It involves examining existing initiatives, policies, and strategies implemented in the country to foster innovation and promote economic growth.

To attaining innovation for economic development, this task involves analyzing the relationship between innovation and economic development. It explores how innovation can contribute to economic growth, productivity, and competitiveness (Lee & Peterson, 2000). The research investigates various factors that influence the adoption and implementation of innovative practices and technologies in Bangladesh.

This step involves identifying the target objects or sectors where innovation-led governance can be applied to foster economic development. It examines specific areas or industries that can benefit from innovation-driven approaches and identifies potential strategies and interventions to promote innovation in these areas.

Regression models are used to assess the relationship between innovation-led governance and economic development. The research employs statistical techniques to analyze the collected data and determine the impact of innovation-led governance initiatives on economic indicators such as GDP, financial innovation, trade openness, human capital development, and gross capital formation.

2.3 Data Management and Analysis Plan

In this study Secondary monthly data will be used from January 2010 to December 2021. In step 1 of data analysis stationary will be checked using Unit root test & if the order

of integration will be I (0) or I (1) then the data analysis will be conduct but if the order of integration is I (2) then the data cannot be analyzed. If the variables are stationary then normal ordinary least square (OLS) test will be run & if non-stationary then Co-integration test will be employed to capture the long run relationship. But if the variables are

mixed (some stationary & some non-stationary) then Autoregressive Distribution Lag (ARDL). Qamruzzaman & Jianguo (2018, 2020) test will be performed for data analysis & further Vector error Correction test (VECM) & Ganger Causality test will be employed as well.

Table 1: Descriptive statistic

Terminology	LNGDP	LNFI	LNT0	LNHD	LNGCF	LNDCP
Mean	10.88316	1.46222	1.55249	1.08983	1.38769	1.45667
Median	10.84161	1.47697	1.54777	1.11396	1.41456	1.46667
Maimum	11.23777	1.55145	1.68223	1.21484	1.50543	1.67780
Minimum	10.49080	1.30963	1.37680	0.90309	1.20453	1.16136
Std. Dev	0.268557	0.06555	0.08934	0.08431	0.08421	0.17338
Skewness	0.064871	-0.6635	-0.06271	-0.6454	-0.68765	-0.2235
Kurtosis	1.596942	2.30671	1.93816	2.47678	2.43986	1.63125
Jarque-Bera	2.564482	2.89674	1.47669	2.51457	2.80317	2.67805
Probability	0.277415	0.23498	0.47790	0.28463	0.24652	0.26210
Sum	337.3778	45.3289	48.1278	33.7849	42.9340	45.1563
Sum Sq. Dev.	2.163680	0.12890	0.23896	0.20812	0.21646	0.90190
Observations	31	31	31	31	31	31

3. RESULTS

Based on the provided information, here is a summary of the results and discussion for the primary data collected: Age: The majority of respondents (55 out of 110) fell in the age range of 26-34, followed by 45 respondents in the age range of 34-45. There were fewer respondents in the age ranges of 18-22 (0), 22-26 (5), and 45+ (5). Gender: Most of the respondents (91 out of 110) identified as male, while 19 identified as female. There were no respondents who identified as others. Profession: The highest number of respondents (99) identified as service holders, followed by 8 respondents in the "Others" category. There were 2 students, 1 businessman, and no security investors among the respondents. Innovation as an indicator of economic development: The descriptive analysis of the data showed that respondents agreed (mean: 4.13) that innovation is strongly correlated with economic development. All the components of descriptive analysis supported the correlation between innovation and economic development. Lack of broad money for capital projects: Respondents agreed (mean: 3.54) that Bangladesh lacks broad money for investment in capital projects. This finding aligns with the difficulties faced by innovation-led governance in Bangladesh. Narrow money as an indicator of financial innovation: Respondents had a below-neutral opinion (mean: 2.84) regarding narrow money as the main indicator of financial innovation. This suggests that narrow money alone may not be sufficient for financial innovation. Negative balance of trade and balance of payments: Respondents agreed (mean: 3.35) that Bangladesh suffers from negative balance of trade and balance of payments. This aligns with the challenges faced by innovation-led governance in Bangladesh. Increasing export positively correlated with GDP: The majority of respondents (102 out of 110) agreed

that increasing exports are positively correlated with GDP, supporting the effectiveness of innovation-led governance in Bangladesh. Increasing trade openness as a goal of commerce ministry: A majority of respondents (90 out of 110) agreed that increasing trade openness is a main goal for economic development, supporting the effectiveness of innovation-led governance. Government's lower investment in education technological advancement: Respondents agreed (mean: 3.43) that the government invests a lower percentage of its budget in education technological advancement compared to other sectors, highlighting a challenge for innovation-led governance. Completing mega projects within stipulated time periods: Respondents had a positive opinion (mean: 3.39) regarding the government's ability to complete mega projects within the stipulated time period, which aligns with the objective of innovation-led governance. Capital accumulation in physical investment and GDP growth: Respondents agreed (mean: 3.82) that capital accumulation through physical investment would enhance GDP growth, indicating the potential of innovation-led governance in this area. Transferring domestic savings to private investment and per capita GDP: Respondents agreed (mean: 3.72) that transferring domestic savings to private investment would step up per capita GDP, supporting the potential of innovation-led governance in this aspect. Domestic credit to private sector and innovation: Respondents agreed (mean: 3.69) that domestic credit to the private sector would amplify innovation, indicating the potential for innovation-led governance.

Increasing the number of patent applications and economic growth: Respondents agreed (mean: 3.85) that increasing the number of patent applications by residents is a positive sign of economic growth, highlighting the importance of innovation-led governance. Human capital development and innovation: Respondents strongly agreed

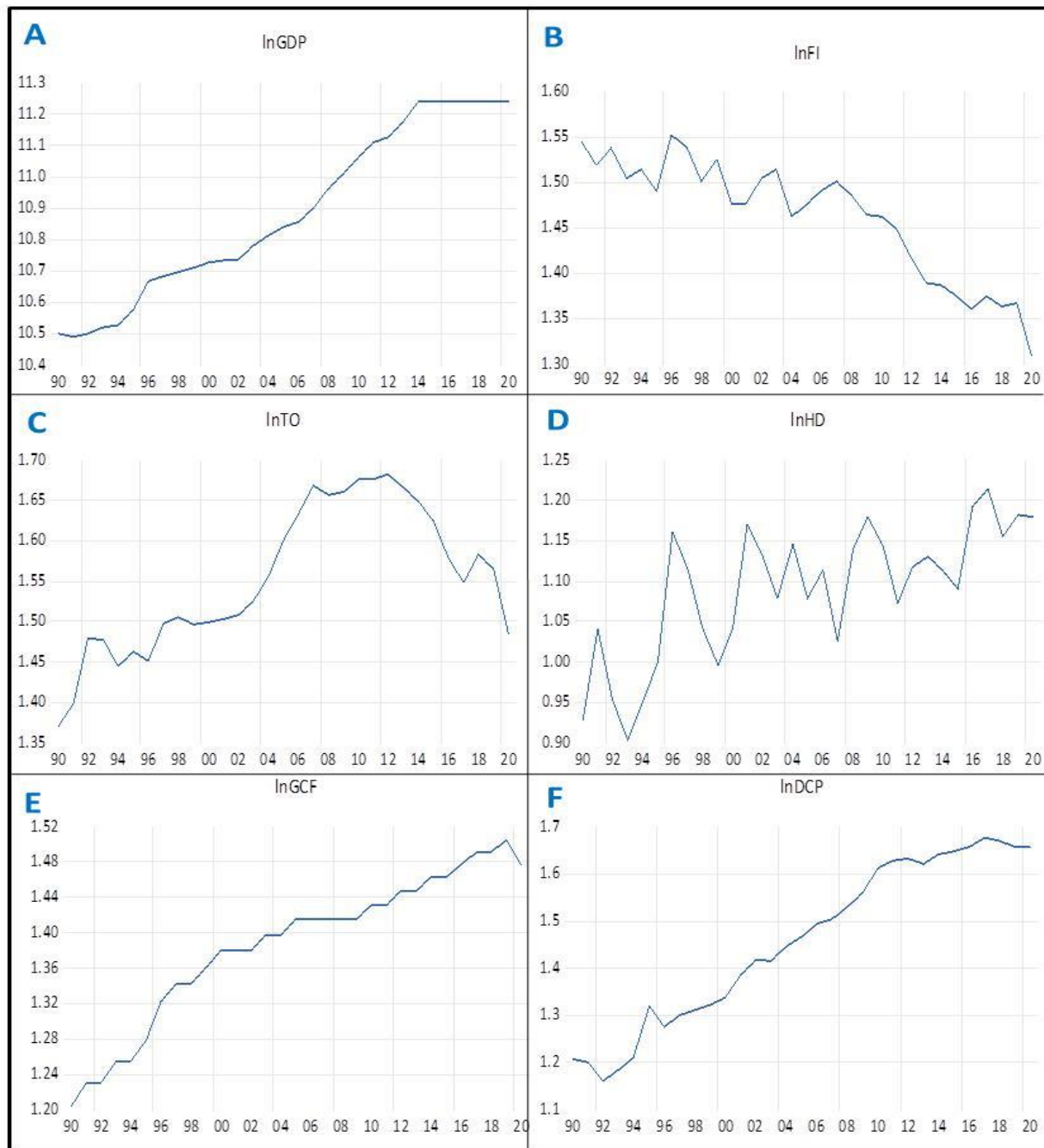


Fig.1: Data-set graph for six variables, i.e. GDP, FI, TO, HD, GCF and DCP.

(mean: 4.09) that human capital development would push up innovation, supporting the potential. In this chapter, the measurement of economic growth is conducted using innovation-led governance with five independent variables: financial innovation, human capital development, trade openness, gross capital formation, and domestic credit to the private sector. These variables were selected from the Global Innovation Index 2021 as they were found to be relevant for the analysis. Certain variables such as expenditure on research and development, number of patent applications,

investment for technological advancement, labor productivity, trade diversification, and online creativity were excluded due to time limitations and data unavailability. Secondary data from various sources including the World Bank, Bangladesh Bank, Bangladesh Bureau of Statistics, and World Bank Development Indicators were utilized for the regression analysis. Descriptive statistics were computed for the six variables: GDP, financial innovation, trade openness, human capital development, gross capital formation, and domestic credit to the private sector (Table

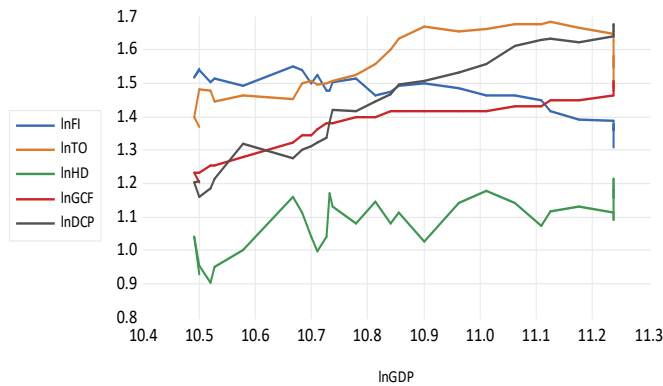


Fig. 2 Data-set Graph for Comparison five variables, i.e. FI, TO, HD, GCF and DCP with respect to GDP.

1). The values of skewness and kurtosis were examined to assess the distributional characteristics of the variables. Skewness measures the lack of symmetry in the distribution, with financial innovation, trade openness, human capital development, gross capital formation, and domestic credit to the private sector exhibiting negative skewness and a long-left tail. On the other hand, GDP displayed positive skewness and a long right tail. Kurtosis, which measures the tails of the distribution, indicated that all variables had platykurtic distributions.

A value of zero skewness and kurtosis of 3 would indicate a normally distributed data series. Additionally, the standard deviation values suggested that GDP and domestic credit to the private sector were more volatile compared to financial innovation, trade openness, human capital development, and gross capital formation.

Table 2: Unit root test

Variables	ADF test result	P value	Comments	Order of integration
LnGDP	-1.182335	0.6682	Failed to reject the null hypothesis (h0)	
D(LnGDP)	-3.318675	0.0232	Rejected null hypothesis(h0)	I (1)
LnFI	-.168563	0.9323	Failed to reject the null hypothesis (h0)	
D(LNFI)	-7.101920	0.0000	Rejected null hypothesis(h0)	I (1)
LnTO	-1.682614	0.4292	Failed to reject the null hypothesis (h0)	
D(LnTO)	-3.089989	0.0385	Rejected null hypothesis(h0)	I (1)
LnHD	-2.856966	0.0625	Failed to reject the null hypothesis (h0)	
D(LnHD)	-5.949011	0.000	Rejected null hypothesis(h0)	I (1)
LnGCF	-2.700883	0.0860	Failed to reject the null hypothesis (h0)	
D(LnGCF)	-5.179516	0.0002	Rejected null hypothesis(h0)	I (1)
LnDCP	-.884627	0.7791	Failed to reject the null hypothesis (h0)	
D(LnDCP)	-5.803172	0.000	Rejected null hypothesis(h0)	I (1)

Table 3: Lag length criterion

Endogenous variables: LNGDP LNFI LNTD LNHD LNGCF LNDGP						
Lag	LogL	LR	FPE	AIC	SC	HQ
0	294.9590	NA	8.92e-17	-19.92828	-19.19022	-19.27806
1	447.0877*	231.0647	3.08e-17*	-28.80702*	-25.92651*	-27.45351*
2	485.6155	41.5567	3.73e-17	-27.79550	-24.18124	-26.14740

*Indicates lag order selected by the criterion

LR: sequential modified LR test statistic (each test at 5 % level); FPE: Final prediction error; AIC: Akaike information criterion; SC: Schwarz information criterion; HQ: Hannan-Quinn information criterion.

Table 4 Johansen Co-integration test

Series: LNGDP LNFI LNTD LNHD LNGCF LNDGP						
Null Hypothesis	Trace statistic	Critical Value (5%)	Comment (According to trace statistic)	Max-Eigen Statistic	Critical value (5%)	Comment (According to Max-Eigen Statistic)
$r \leq 0$	137.7119*	107.81889	Rejected h0	53.74828*	43.87687	Rejected h0
$r \leq 1$	81.59531*	79.85613	Rejected h0	33.02720	37.58434	Failed to reject h0
$r \leq 2$	51.56811	55.79707	Failed to reject h0	24.00993	30.13162	Failed to reject h0
$r \leq 3$	25.558184	35.49471	Failed to reject h0	18.29879	24.26460	Failed to reject h0
$r \leq 4$	6.328305	18.841465	Failed to reject h0	6.328305	17.84146	Failed to reject h0

Note: * denotes the rejection of null hypothesis. Trace test indicates 2 co-integrating equations at the 0.05 level.

Table 5 Co-integration Equation

Normalized co-integrating coefficients (Standard error in parentheses)					
LNGDP	LNFI	LNT0	LNHD	LNGCF	LNDGP
1.0000	6.0649	-5.42	.08886	-41.318	6.709
	(1.10)	(0.60)	(0.48)	(0.935)	(0.85633)

The first & simplest method for checking whether the variables are stationary or not is the graphical representation which observes mean, variance, autocorrelation & seasonality shown in Fig. 1. The pattern of the data set indicates that all of the variables are non-stationary as their mean is different in different point in time Fig. 2. Non-constant mean of the variables proves the non-stationary

nature of the variables. The evidence is further investigating by employing ADF test which is the formal procedure for checking stationary.

Unit root test: The following table reveals that all the variables are non-stationary in levels with intercept. The variables are non-stationary because they accept the null hypothesis i.e., presence of unit root in level. In the first difference all the variables are stationary at 1, 5, 10 percent level of significance. This type of data series is called I (1) as they are integrated of the order I (1). Next Johansen co-integration test is employed for investigating the long-term relation between dependent & independent variables (Table 2).

Table 6: ARDL Test

Dependent Variable: LNGDP				
Method: ARDL				
Dependent lags: 1 (Fixed)				
Dynamic regressors (1 lag, fixed): LNFI LNT0 LNHD LNGCF LNDGP				
Fixed Regressors: C				
Variable	Coefficient	Std. Error	t-statistics	Probability*
LNGDP (-1)	.644701	.1192345	5.412914	.00000
LNFI	-.289042	.238052	-1.214199	.24211
LNFI (-1)	-.023705	.177789	-.133414	.89538
LNT0	.146543	.075671	-.882651	.02318
LNT0 (-1)	.476781	.098764	2.730925	.12945
LNHD	.057089	.078901	.730253	.04567
LNHD (-1)	.134210	.088180	1.504765	.06732
LNGCF	-.678901	.345670	1.928742	.09876
LNGCF (-1)	-.810122	.315679	-2.55678	.87650
LNDGP	-.023456	.158292	-.177890	.09876
LNDGP (-1)	-.324567	.172295	1.909875	.05219
C	3.377253	1.352733	2.498765	.02346
R squared	.997172			
Adjusted R-squared	.995443			
S.E. of regression	.017779			
Log likelihood	85.98604			
F-statistics	576.9305			
Prob (F-statistics)	.000000			
Mean Dependent variance	10.89594			
S.D. dependent var	.263382			
Akaike info criterion	-4.934568			
Schwarz criterion	-4.37653			
Hannan-Quinn criterion	-4.57689			
Durbin-Watson stat	1.795832			

*Note: p-values & any subsequent tests do not account for model selection.

Lag length Criteria: As the regression model is sensitive to lag length chosen, so the appropriate lag length has to ascertain before run the co-integration test (Table 3).

The study determines the optimal lag based on minimum LR, FPE, AIC, Schwarz information criterion (SC) & HQ. All the statistics suggested one lag length. Table 3 proved that. All of the statistics confirmed that except LR

(in Table 3). Therefore, the study selects lag length of one for further analysis.

Johansen Co-integration Test: The result of Johansen Trace statistics & Max-Eigen statistics are shown in Table 4 using 5% significance level. The table shows that in trace test there is 2 co-integrating equation but 1 co-integration in Max-Eigen test. The guideline for rejection is the *p* value.

Max-Eigen test indicates 1 co-integrating equation at the 0.05 level is lower than 0.05 than rejected the null hypothesis. Now the study concerns about which of the two tests (trace test, Max-Eigen) is superior. According to many scholar's trace test is superior to Max-Eigen. Therefore, there exists long term relation between dependent variables (GDP) & independent variables (FI, TO, HD, GCF, DCP).

Interpretation of Co-integration Equation: From the co-integration equation it can be concluded that there is a long-term relationship among dependent & independent variables. Financial Innovation & Trade openness have a positive relationship with GDP. On the other hand, Human development capital, Gross capital Formation & Domestic Credit to private sectors are negatively correlated with GDP in the long run which is showed in the following Table 5.

Table 7: Bound test

ARDL Long run form & Bounds Test				
Dependent Variable: D (LNGDP)				
Method: ARDL (1, 0, 1, 1, 1, 1)				
Included Observation: 30				
Conditional Error Correction Regression				
Variable	Coefficient	Std. Error	t-statistics	Probability*
C	3.32902	1.2694	2.622516	
LNGDP (-1)	-0.352949	0.1147345	-3.076885	0.0168
LNFI**	-0.293523	0.228052	-1.274199	0.00621
LNT0 (-1)	0.318502	0.177789	-1.83414	0.34538
LNHD (-1)	0.186543	0.085671	1.882651	0.04318
LNGCF (-1)	-0.376781	0.118764	-0.830925	0.13945
LNDGP (-1)	-0.157089	0.168901	1.870253	0.04567
D(LNT0)	0.164210	0.158180	-0.984765	0.17732
D(LNHD)	0.058901	0.075670	0.738742	0.11876
D(LNGCF)	-0.770122	0.135679	2.05678	0.06650
D(LNDGP)	-0.027456	0.154092	-0.177890	0.08876
	-0.324567	0.172295	1.909875	0.05219
	3.377253	1.352733	2.498765	0.02346

**Variable interpreted as $Z = Z(-1) + D(Z)$

Table 8: Levels equation

Levels Equation, Case 2: Restricted Constant & No Trend				
Variable	Coefficient	Std. Error	t-statistics	Probability*
LNFI	0.831628	0.505364	1.642516	0.1163
LNT0	0.902400	0.395700	2.286885	0.03431
LNHD	0.531980	0.337046	1.574199	0.00421
LNGCF	0.387451	0.496285	0.788414	0.4446
LNDGP	0.869857	0.378537	2.29651	0.03311
C	9.432023	0.822103	11.47305	0.000

Target Equation: $EC = LNGDP - (-831628 * LNFI + 0.902400 * LNT0 + 0.531980 * LNHD - 0.387451 * LNGCF - 0.869857 * LNDGP + 9.432023)$

ARDL Test: According to ARDL test & bound test, there is a long run relationship among dependent variable (GDP) & Independent Variables (FI, TO, HD, GCF, DCP). In Table 6 and 7, Trade openness (TO), Human Development Capital (HD) & Gross capital Formation (GCF) is positively correlated with GDP & negatively correlated with Financial Innovation & Domestic Credit to Private Sector in the long run. Here, R squared is 99.71% & p value is 0.0000. So, there is no autocorrelation & the statistics is significant.

Innovation is recognized as a critical driver for the economic development of Bangladesh and other developing countries (Nagasato et al., 2018; Ongori & Agolla, 2008;

Pagell, et al., 2014; Sanusi et al., 2021; Rashid et al., 2010) Ullah et al., 2012; Wada, 2018). It has the potential to transform institutions, foster a culture of creativity, attract foreign investment, and contribute to the democratization of processes. However, Bangladesh currently faces numerous challenges in terms of innovation, as indicated by its low rankings in the Global Innovation Index. To unlock the country's innovative potential, it is essential for Bangladesh to establish a National Innovation and Intellectual Property policy. This policy would encourage fair competition, foster development in social, cultural, and economic spheres, and enhance the knowledge economy. Collaboration between academia and the private sector is crucial, particularly in

areas like agro innovation, to build trust among customers. In terms of government innovation, both internal and external factors play a role. Factors such as resistance to change, limited access to information, and resource constraints hinder innovation. To overcome these barriers, the government should focus on developing an innovation strategy that introduces creative plans, policies, and strategies to drive change in the administrative sector, accelerate the market economy, and stabilize politics and society (Fukuzawa, 2015; Fukuzawa & Inamizu, 2017; Fukuzawa, 2019a; 2019b; Kawai, 2020). Measuring economic growth through innovation-led governance requires considering various indicators such as financial innovation, trade openness, human capital development, gross capital formation, and domestic credit to the private sector. While trade openness and human capital development positively correlate with GDP, other factors like gross capital formation and domestic credit to the private sector may have a negative impact. Bangladesh needs to address political, administrative, economic, and social barriers to foster a culture of innovation and achieve its goals of becoming a welfare state (Hudson, 2007). Accountability, effectiveness, efficiency, participatory decision-making, and responsiveness to public needs are key criteria to evaluate governance. Reforms in the government bureaucracy are necessary, including tackling corruption, adopting modern technology, removing bureaucratic hurdles, and fostering commitment among public servants. Applying lean system principles from manufacturing to government processes can help streamline operations, reduce waste, and improve efficiency (Jorgensen, 2007). Public service innovation is vital and can be achieved by simplifying bureaucratic procedures, implementing citizen charters, enhancing service quality, and embracing digitalization. Case studies from Bangladesh and successful international models like Singapore highlight the transformative power of innovation in sectors such as land administration, dairy industry, and overall ease of doing business. In conclusion, Bangladesh's economic development relies on innovation-driven governance. By addressing governance challenges, promoting public service innovation, investing in education and research, and fostering collaboration between the government and the private sector, the country can create a favorable environment for growth and prosperity. Prioritizing innovation, supporting entrepreneurship, and aligning projects with the Sustainable Development Goals will contribute to sustainable development and help Bangladesh achieve its vision for the future.

5. CONCLUSION

This study underscores the significant long-term relationship between GDP and various factors such as Financial Innovation (FI), Trade Openness (TO), Human Development capital (HD), Gross Capital Formation (GCF), and Domestic Credit to Private Sector (DCP). The statistical analysis reveals a strong relationship, with an R-squared value of

99.71% and a p-value of .00000. The findings indicate that an increase in trade openness and investment in human capital positively impact GDP growth. Conversely, financial innovation, gross capital formation, and domestic credit to the private sector show a negative association with GDP, suggesting that excessive reliance on broad money and loans can hinder economic development.

The scope of this study focuses on innovation-led governance in Bangladesh and its impact on economic development. A survey will be conducted using 19 questionnaires to gather data and cross-examine the current status of innovation-led governance initiatives in relation to economic development. The questionnaire covers various aspects, including innovation, economic development, financial indicators, trade, human capital development, and the role of the Government of Bangladesh (GoB) in promoting innovation for economic development. The study specifically considers five independent variables: financial innovation, human capital development, trade openness, gross capital formation, and domestic credit to the private sector. These variables have been selected from the global innovation index 2021. However, certain variables such as research and development expenditure, patent applications, technological advancement investments, labor productivity, trade diversification, and online creativity have been excluded due to data unavailability and time limitations. Secondary data from reputable sources such as the World Bank, Bangladesh Bank, Bangladesh Bureau of Statistics, and World Bank Development Indicators will be used for regression analysis.

The purpose of this study is to examine the relationship between innovation-led governance and economic development in Bangladesh. It aims to explore the potential positive impact of innovation-led governance initiatives on the country's economic growth and the well-being of its people. By analyzing the performance, effectiveness, and challenges of innovation-led governance in Bangladesh, this study seeks to provide insights into how such initiatives can contribute to advancing economic development. Innovation-led governance plays a crucial role in promoting self-employment and ensuring income stability among the population. By fostering innovation and promoting a favorable business environment, innovation-led governance programs aim to stimulate economic growth and improve the livelihoods of the people in Bangladesh. This study aims to assess the contribution of these programs to the income growth of the population and their potential for sustainable economic development. Over the past fifteen years, Bangladesh has made significant progress in several social indicators, which can be attributed to a combination of public and private service provision, including innovative approaches to governance. This study recognizes the importance of innovation in governance and aims to investigate how innovation-led governance can be applied to further enhance economic development in Bangladesh.

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