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I. INTRODUCTION

In the financial system, non-bank financial institutions (NBFIs) play a crucial dual role. In the service of the commercial banks, which have some gaps, they supplement their functions. However, they also put commercial banks in a position of competition, which makes them more responsive to client demands and efficient. Non-Bank financial organizations, finance businesses and consumers, investment banks, and others that deal with pensions and mutual funds exist in relatively mature notions. NBFIs provide advances and loans for a commercial organizations, farming, housing, and real estate. They also underwrite or purchase securities and lease financing, buy and sell securities, invest in shares, stocks, bonds, or debentures, and reinvest in those securities.

There are now 35 NBFI's, the first of which was opened in 1981. Out of the total number of NBFIs, 19 were established by private domestic enterprises, 13 through joint ventures, 2 were entirely under government supervision, and one is a branch of the state-owned commercial bank (SOCB). There were 277 branches of the 24 NBFIs in FY 2021, with assets totaling BDT 914.3 billion. Bangladesh has achieved remarkable progress in financial diversification, asset growth, NBFI numbers, area coverage, and account holder numbers. Despite significant progress, NBFI's face several challenges, including rising lending rates, rising NPL levels, higher interest spreads, credit concentration in trading and business, and reduced investment in the social sector.

The evaluation of NBFI's performance would enable them to carry out their responsibilities while also contributing to improving of NBFI's performance in Bangladesh. Even though several performance studies of the performance of NBFI's have been conducted in advanced industrial, emerging, and developing countries, Bangladesh has seen only a small number of these studies. A non-parametric data envelopment analysis (DEA) method is used in this work to empirically investigate the performance of Bangladeshi NBFI's in terms of technical, pure technical, and scale efficiency from 2016 to 2021.

The article has two goals: first, it examines the efficiency performance of Bangladeshi NBFI's from 2016 to 2021, and second, it offers policy recommendations for improving NBFI performance in Bangladesh. The remainder of the

paper has the following structure: The second section covered a literature review. The third section of this paper focuses on methodology, while the fourth section looks at the results of overall technical, pure technical, and scale efficiency findings. The fifth section illustrates the comparative effectiveness of NBFIs, while the sixth section describes policy options. The seventh section focuses on the conclusions and recommendations.

II. LITERATURE REVIEW

In Bangladesh, conventional financial institutions like banks have been the subject of numerous efficiency studies, but there is a shortage of information on non-banking businesses. There are still gaps in the efficiency study of non-bank institutions in Bangladesh. Due to the importance of studies, we evaluated the efficiency of non-bank institutions in Bangladesh in this study.

The paper "Performance Analysis of non-banking finance companies using two-stage data envelopment analysis" by Dutta, Jain, and Gupta (2020) aims to evaluate the performance of non-banking finance companies (NBFCs) in India using two-stage data envelopment analysis (DEA). The authors have collected financial data on NBFCs from 2011-2019. In the first stage, the study examines the input/output efficiency of the NBFCs using traditional DEA models. In the second stage, the study explores the impact of environmental factors on the efficiency scores of NBFCs using a Tobit regression model. The authors' findings reveal that the average efficiency score of the NBFCs is relatively low, indicating significant inefficiencies in their operations. Further analysis using Tobit regression shows that macroeconomic factors such as inflation, GDP growth, and market concentration significantly affect the efficiency of NBFCs.

A data envelopment analysis" by Sharma, Rastogi, and Gupta (2020) examines the financial efficiency of Non-Banking Financial Companies-Microfinance Institutions (NBFC-MFIs) in India using data envelopment analysis (DEA). The authors collected financial data of NBFC-MFIs from the Indian Microfinance Pulse database for 2014-2018. The study aims to evaluate the technical efficiency, pure technical efficiency, and scale efficiency of the NBFC-MFIs. The authors' findings reveal that the average technical efficiency score of NBFC-MFIs is relatively low, indicating significant inefficiencies in their operations. Further analysis shows that the pure technical efficiency score is lower than the technical efficiency score, meaning that there is scope for improvement in managerial and operational practices. The authors also found that the scale efficiency of NBFC-MFIs is high, suggesting that they are operating at an optimal scale.

In "The efficiency of non-bank financial institutions: empirical evidence from Malaysia" (2006), Sufian investigates the technical efficiency of non-bank financial institutions (NBFIs) in Malaysia using data envelopment analysis (DEA). The study uses panel data covering 1998-2002 and includes 17 NBFIs. The results reveal that the average technical efficiency of NBFIs in Malaysia is low, indicating significant inefficiencies in their operations. The study also finds that small NBFIs are more efficient than larger ones, and the efficiency of NBFIs is positively related to their profitability. Moreover, the study finds that NBFIs that are more specialized in their operations tend to be more efficient than those that are more diversified. The study concludes that the Malaysian NBFIs' overall efficiency can be improved by increasing their scale of operations, adopting specialized functions, and improving their managerial and operational practices.

The profitability of businesses in Bangladesh's non-banking financial institutions (NBFIs) from 2005 to 2014 is examined by Mazumder, M. A. (2015). The findings show that profitability indicators affect net profit, but total assets, total equity, and operating income have a discernible influence on the profitability of Bangladesh's non-banking sector. Total assets are one of the most straightforward metrics for assessing the financial soundness of financial organizations. Almost all independent and dependent variables have strong positive associations, except operating costs. Except for total liabilities, term

deposits, and operating expenses, almost every element has a positive effect.

Debnath, G. C., Rahman, S. N., & Akhter, S. (2011) compares and analyze the liquidity positions of a few chosen non-bank financial organizations in Bangladesh from 2011 to 2015. The analysis considered the five NBFIs' places in terms of liquidity over the short and long terms according to maturity. We concluded from the complete investigation that all the chosen financial institutions have a positive and improving overall liquidity situation. However, the rate of liquidity expansion varies. Based on analysis, a significant portion of the company's short term liquidity is negative.

III. DEA Methodology

Data Envelopment Analysis was introduced in 1978 by Charnes, Cooper, and Rhodes. (DEA). The DEA maintains that returns to scale are constant. DEA is a non-parametric linear programming model that seeks to improve the effectiveness of each decision-making unit by optimizing its weighted output/input ratio (DMU). The efficacy of various input and output orientations was evaluated. According to Banker et al.'s assumptions, Scale efficiency (SE) and pure technological efficiency (PTE) are the outcomes of two components. The DEA gives various weights to the input and output of companies to maximize efficiency in contrast to other companies. Each unit is given a score, with one being the most effective and ranging from zero to one. The CCR model assumes the production function has constant returns-to-scale (CRS). The CCR model's objective score is technical efficiency (TE).

Consider that two DMUs require evaluation. Like DMU_r, which requires X_{ir} quantities of input and generates X volumes of output, each requires a different amount of input and yields a distinct volume of output. It is necessary that each DMU's have at least one positive input and output value, and it is anticipated that none of these values will be negative. The CCR model aims to maximize the weighted output to the weighted input ratio for the NBFIs under consideration. The objective function is maximized for NBFIs under the restriction that no other NBFIs in the sample may attain unit efficiency by utilizing the same weights. As a result, the objective function is:

$$\text{Max } a_r = \frac{\sum_{j=1}^{l} u_j y_{jr}}{\sum_{i=1}^{k} v_i x_{ir}}.$$

Subject to the

$$\frac{\sum_{j=1}^{l} u_j y_{jr}}{\sum_{i=1}^{k} v_i x_{ir}} \leq 1$$

$$u_j, v_{i \geq 0}$$

Here, j = j^{th} output, j = 1,...,l; i = i^{th} input, i = 1,...., k; r = 1, a_r = an objective measure of efficiency for r^{th}; Y_{jr} is the amount of output, X_{ir} is the amount of input, The input weight is V_i, the number of NBFI's is S, the number of outcomes is l, and the number of inputs is k.

3.1 The CRS Model

By limiting the denominator of the target function to unity, the least issue can be simplified to a linear program. Thus, linear programming takes the following structure:

$$\text{Max } a_r = \frac{\sum_{j=1}^{l} u_j y_{jr}}{\sum_{i=1}^{k} v_i x_{ir}}.$$

Subject to

$$\sum_{I=1}^{K} v_i x_{ir} = 1$$

$$\sum_{J=1}^{L} u_j y_{jr} - \sum_{I=1}^{K} v_i x_{ir} \leq 0$$

$$u_j, v_{i \geq 0}$$

J = 1, 2...1, I=1, 2.... K and r= 1, 2.....s. For the NBFI's r, The Linear programming method above yields an efficiency score of (a_r); where,

$$0 \leq a_r \leq 1.$$

3.2 Data and Variables

The production strategy and the intermediate approach are widely used to choose the input and output and compute various efficiency scores in scenarios mentioned in the literature. Berger, A. According to N. & Humphrey, D. B. (1997), both strategies are inefficient since they disregard multiple roles. Intervention of resources and inputs like labor and capital, Many authors, like Sathye, M. (2001), Neal, P. (2004), and others, employ the production approach. Mokhtar, et al. (2008) and Bhattacharya, et al. (2013) employ an intermediation strategy. Most of the empirical studies follow the intermediation method, which uses input and output variables to calculate the numerous efficiency results for different NBFI's.

The current study has chosen 17 non-bank financial companies from Bangladesh for 2016-2021. Total deposits, fixed assets, and operating expenses are considered input variables. Total loans, investments, and operating revenue are considered output variables. For each variable, millions of Bangladeshi Taka are used as a measurement. We used balance panel data from their annual reports for 2016–2021. The DEA was computed and applied using Stata 14.

IV. RESULTS AND FINDINGS

The study's results are presented in Table 1, showing the technical efficiency (TE), pure technical efficiency (PTE), and scale efficiency (SE) scores for the 17 non-bank financial institutions sampled from 2016 to 2021. Notably, the results indicate that only four NBFIs, namely ICB, GSP, IDCOL, and Fareast Finance, achieved perfect scores of 1 in all three categories, suggesting that they are efficiently managing their resources and production scale. However, it is worth noting that IDLC showed a scale inefficiency of 23 percent implying that its production scale is suboptimal despite achieving full efficiency in terms of pure technical efficiency.

Table 1: Efficiency Score of Non-Bank Financial Institutions (NBFIs)

NBFIs	Efficiency	2016	2017	2018	2019	2020	2021	Mean	Inefficiency (%)
ICB	TE	1	1	1	1	1	1	1	0
	PTE	1	1	1	1	1	1	1	0
	SE	1	1	1	1	1	1	1	0
IDLC	TE	1	1	1	1	0.37	0.25	0.77	0.23
	PTE	1	1	1	1	1	1	1	0
	SE	1	1	1	1	0.37	0.25	0.77	0.23
GSP	TE	1	1	1	1	1	1	1	0
	PTE	1	1	1	1	1	1	1	0
	SE	1	1	1	1	1	1	1	0
Lanka bangla	TE	0.79	0.92	0.91	0.90	0.22	0.19	0.66	0.34
	PTE	0.99	1	1	1	0.22	0.19	0.73	0.27
	SE	0.81	0.92	0.91	0.90	1	1	0.92	0.08
Phoenix	TE	0.98	1	0.94	1	0.35	0.39	0.78	0.22
	PTE	1	1	1	1	0.35	0.38	0.79	0.21
	SE	0.98	1	0.94	1	1	1	0.99	0.01
Prime finance	TE	1	1	1	1	1	0.75	0.96	0.04
	PTE	1	1	1	1	1	0.93	0.99	0.01
	SE	1	1	1	1	1	0.81	0.97	0.03
DBH	TE	1	1	0.99	1	0.57	0.41	0.83	0.17
	PTE	1	1	1	1	0.60	0.44	0.84	0.16
	SE	1	1	0.99	1	0.95	0.94	0.98	0.02
IPDC	TE	0.81	0.96	1	0.93	0.34	0.28	0.72	0.28
	PTE	0.88	1	1	0.97	0.34	0.28	0.74	0.26
	SE	0.92	0.96	1	0.96	0.99	1	0.97	0.03

Source: The Author's calculations

Regarding technical efficiency, the Prime and Islamic finance rank second and third, respectively. Prime Finance has average ratings of 0.96, 0.99, and 0.97 for technical efficiency (TE), pure technical efficiency (PTE), and scale efficiency (SE). According to this, TE is 4% inefficient, PTE is 1% inefficient, and SE is 3% inefficient. Given that Islamic finance has mean TE, PTE, and SE scores of 0.96, 0.98, and 0.98, respectively, there is a 4% inefficiency in TE and a 2% inefficiency in PTE and SE. Delta Brac Housing (DBH) has average scores of 0.83, 0.84, and 0.98 in all categories. DBH has a technical efficiency inefficiency of 17%, a pure technical efficiency inefficiency of 16%, and a scale efficiency inefficiency of 2%. DBH has 17% inefficiency in technical efficiency, 16% inefficiency in pure technical efficiency, and 2% inefficiency in scale efficiency. The Union Capital ranks fourth in terms of technical efficiency. The TE, PTE, and SE efficiency scores for Union Capital are 0.80, 0.83, and 0.95, respectively. It translate to 20% inefficiency in technical efficiency, 17% inefficiency in pure technical efficiency, and 5% inefficiency in scale efficiency.

United finance	TE	0.88	0.86	0.92	0.87	0.21	0.14	0.65	0.35
	PTE	0.91	0.89	0.94	0.90	0.38	0.36	0.73	0.27
	SE	0.97	0.96	0.98	0.96	0.55	0.38	0.80	0.20
Union capital	TE	1	1	1	0.95	0.49	0.38	0.80	0.20
	PTE	1	1	1	1	0.50	0.50	0.83	0.17
	SE	1	1	1	0.95	0.98	0.77	0.95	0.05
IDCOL	TE	1	1	1	1	1	1	1	0
	PTE	1	1	1	1	1	1	1	0
	SE	1	1	1	1	1	1	1	0
National housing	TE	0.84	0.83	0.73	0.89	0.49	0.35	0.69	0.31
	PTE	1	1	1	1	0.63	0.51	0.86	0.14
	SE	0.84	0.83	0.73	0.89	0.63	0.70	0.77	0.23
Midas finance	TE	0.79	0.88	0.93	0.94	0.34	0.30	0.70	0.30
	PTE	0.79	0.92	0.96	1	0.75	0.79	0.87	0.13
	SE	1	0.96	0.97	0.94	0.46	0.38	0.78	0.22
First finance	TE	1	1	0.99	1	0.21	0.36	0.76	0.24
	PTE	1	1	1	1	0.74	0.80	0.92	0.08
	SE	1	1	0.99	1	0.29	0.46	0.79	0.21
BD finance	TE	1	1	1	1	0.39	0.34	0.79	0.21
	PTE	1	1	1	1	0.50	0.50	0.83	0.17
	SE	1	1	1	1	0.78	0.69	0.91	0.09
Islamic finance	TE	1	1	1	1	0.78	1	0.96	0.04
	PTE	1	1	1	1	0.90	1	0.98	0.02
	SE	1	1	1	1	0.87	1	0.98	0.02
Fareast finance	TE	1	1	1	1	1	1	1	0
	PTE	1	1	1	1	1	1	1	0
	SE	1	1	1	1	1	1	1	0

Source: The Author's calculation

Phoenix and First Finance were ranked fifth and sixth regarding technical efficiency, respectively. These two NBFIs have technical efficiency scores of 0.78 and 0.76, indicating that they are 22% and 24% less efficient respectively. The Phoenix PTE and SE are 0.79 and 0.99, respectively, indicating a 21% and 1% inefficiency in scale efficiency and pure technical efficiency. In contrast, First Finance has a PTE and SE of 0.92 and 0.79, indicating 8% and 21% inefficiency scale and pure technical efficiency, respectively. Midas Finance is ninth regarding technical efficiency, while IPDC is seventh. Based on IPDC and Midas Finance's technical efficiency scores of 0.72 and 0.70, technical efficiency is inefficient by 28% and 30%, respectively. IPDC has a pure technical efficiency of 0.74 and a scale efficiency of 0.97, with PTE and SE inefficiencies of 26% and 3%, respectively.

Conversely, Midas Finance's PTE and SE are 0.87 and 0.78, respectively, showing 13% and 22% inefficiencies in PTE and SE.BD Finance and National Housing are ranked ninth and tenth in terms of technical efficiency within the sample of NBFIs. Technical inefficiency is 21 percent in BD Finance and 31 percent in National Housing, based on technical efficiency of 0.79 and 0.69 for BD Finance and National Housing, respectively. Technical inefficiency is 21 percent in BD Finance and 31 percent in National Housing, based on technical efficiency of 0.79 and 0.69 for BD Finance and National Housing, respectively. Technical inefficiency is 17% and 9%, respectively, for BD Finance PTE and SE, which are 0.83 and 0.91, respectively. The national housing PTE and SE scores are simultaneously 0.86 and 0.77, indicating that 23% of inefficiency is due to scale inefficiency and 14% is due to pure technical inefficiency. Regarding efficiency scores, United Capital and Lanka Bangla Finance are ranked Tenth and Twelfth, respectively. United Capital's and Lanka Bangla's technical efficiencies of 0.65 and 0.66, respectively, represent technological inefficiencies of 34% and 35%. When the scale efficiency of two companies is compared, Lanka Bangla has an 8% inefficiency and United Capital has a 20% inefficiency.

4.1 Returns to Scale (RTS) of Non-bank Financial Institution

Among the NBFIs in the sample, ICB, GSP, IDCOL, and Fareast Finance exhibit continuous returns to scale (CRS) across the 2016–2021 study period, indicating that they are operating at maximum efficiency. It is impossible to adjust the production scale without diminishing effectiveness. The fact that IDLC runs at its optimal or most productive scale in 2020 and 2021 suggests that scale reduction might have enhanced efficiency during these periods. The fact that Lankabangla shows DRS from 2016 to 2019 and IRS from 2020 to 2021 suggests that it may have adjusted its production scale to be more productive from 2016 to 2019 and 2020 to 2021. Phoenix exhibits DRS in 2016 and 2018, CRS in 2017 and 2019, and IRS in 2020 to 2021, which may indicate that it increased production size in 2020 to 2021 while reducing scale in 2016 and 2018 to increase efficiency. It will need to change the manufacturing size between 2017 and 2019. For CRS in the next five years (2016, 2017, 2018, 2019, 2020) and for IRS in 2021, Prime Finance indicates the ideal or most productive size of production, indicating it could have extended scale by improving efficiency. DBH might have increased its production scale from 2020 to 2021 and decreased scale in 2018 for efficiency; it did not need to modify scale in 2026, 2017, or 2019.

Table 2: RTS of Non-bank Financial Institution

RTS	2016	2017	2018	2019	2020	2021
ICB	Crs	Crs	Crs	Crs	Crs	Crs
IDLC	Crs	Crs	Crs	Crs	Drs	Drs
GSP	Crs	Crs	Crs	Crs	Crs	Crs
Lanka Bangla	Drs	Drs	Drs	Drs	Irs	Irs
Phoenix	Drs	Crs	Drs	Crs	Irs	Irs
Prime Finance	Crs	Crs	Crs	Crs	Crs	Irs
DBH	Drs	Crs	Drs	Crs	Irs	Irs
IPDC	Irs	Drs	Drs	Drs	Drs	Irs
United Finance	Irs	Irs	Irs	Irs	Irs	Irs
Union Capital	Crs	Crs	Crs	Irs	Irs	Irs
IDCOL	Crs	Crs	Crs	Crs	Crs	Crs
National Housing	Irs	Irs	Irs	Irs	Irs	Irs
Midas Finance	Drs	Irs	Irs	Irs	Irs	Irs
First Finance	Crs	Crs	Crs	Crs	Irs	Irs
BD Finance	Crs	Crs	Crs	Crs	Irs	Irs

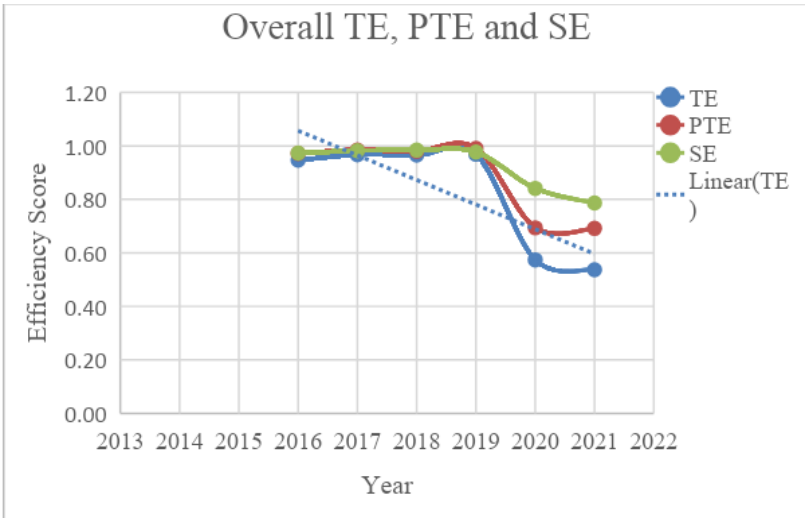
Islamic Finance	Crs	Crs	Crs	Crs	Irs	Crs
Fareast Finance	Crs	Crs	Crs	Crs	Crs	Crs

Source: The Author's calculation.

IPDC shows Drs from 2016 to 2019 and Irs from 2020 to 2021, which indicates that production size may have increased from 2020 to 2021 while declining from 2016 to 2019. The fact that United Finance had Irs for all years has revealed that it should have raised production to improve efficiency. The Union Capital may have raised its production size from 2019 to 2021 in order to maximize efficiency after working at its optimum from 2016 to 2018. In addition to Irs, United Capital also displays Crs from 2016 to 2018. National Housing exhibits Irs all year long, suggesting that it may need to increase manufacturing all year long to increase productivity. The manufacturing scale was probably enlarged for all years before to 2016, as Midas Finance reported Drs for 2016 and Irs for all preceding years. To demonstrate that they consistently outperform the market, First Finance and BD Finance provide their respective Irs from 2020 to 2021 and Crs from 2016 to 2019. They had the potential to generate more during these two periods. Except for 2020, all years in Islamic Finance are stated in pennies. It operates at its highest level throughout the year, except 2020. The efficiency might have improved as a result of production expansion.

V. COMPARISON OF THE EFFICIENCY OF NBFIS

The graph reveals that in 2016, the overall technical efficiency average was 0.95, which representing 5% inefficiency. Efficiency scores improved at a constant rate of 0.97 from 2017 to 2019, showing 3% inefficiency. In the years 2020 and 2021, the technical efficiency score dropped to 0.57 and 0.54, respectively, reflecting inefficiencies of 43% and 46%. This indicates that the COVID-19 pandemic's effects prevented NBFIs from using their creative management abilities to manage the organization's resources and maintain production.



Year	TE	PTE	SE
FY16	0.95	0.97	0.97
FY17	0.97	0.98	
FY18	0.97	0.98	0.98
FY19	0.97	0.99	0.98
FY20	0.57	0.69	0.84
FY21	0.54	0.69	0.79

Figure: The average efficiency score of TE, PTE, and SE.

VI. POLICY OPTIONS

The study on the efficiency of NBFIs suggests that those with scale inefficiencies, rather than pure technical inefficiency, should focus on enhancing their management performance to enhance their technical efficiency. According to the NBFIs, to improve technological efficiency, DRS must either reduce output or diversify its product line. IRS, on the other hand, demonstrates a need to increase production capacity. As a result, while overseeing a variety of financial items, the company's management verified 100% technological efficiency.

VII. CONCLUSION

The contribution of non-banking financial institutions (NBFIs) in Bangladesh is crucial for economic growth. Over time, NBFIs' influence on Bangladesh's financial industry has increased along with that of the conventional banking sector. The challenge posed by NBFIs to the traditional banking sector is growing. NBFIs have remarkably aided financial inclusion and made progress in closing the credit gap for retail consumers in Bangladesh's underserved and unbanked areas. NBFIs play a significant role in delivering a range of consumer services and bridging the financial services supply and demand gap for those needing loans.

Our metrics evaluate the operational effectiveness and scale economies of 17 NBFIs operating in Bangladesh. This analysis reveals that only ICB, GSP, IDCOL, and Fareast Finance received scores of one, indicating excellent efficiency in the three categories of technical efficiency, pure technical efficiency, and scale efficiency. Throughout the period, Lanka-Bangla Finance, United Finance, and National Housing have all consistently been inefficient NBFIs. The findings make it evident that the technical inefficiency in Bangladesh's non-bank financial institution industry is a result of poor input utilization, including managerial and scale inefficiencies, as well as inability to work at their maximum capabilities. Policymakers should take measures to increase the size and effectiveness of the non-bank financial sector to expand the financial sector of Bangladesh. Regulatory agencies should take extra precautions in order to improve efficiency through economies of scale. Future research may assess how information technology (IT) impacts NBFI performance in Bangladesh.

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