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Factors encouraging foreign direct investment (FDI) in the wind and solar energy sector in an emerging country

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ABSTRACT

This study bridges the current research gap by exploring the determinants of foreign direct investment (FDI) in the renewable energy sector in Bangladesh through the OLI and TCE theories. Based on semi-structured interviews with 13 experts, it investigates the determinants of firms' decision-making processes in the UK, Singapore, USA, Denmark, Thailand, China, and South Korea, conducting FDI in the renewable energy sector in Bangladesh. The results show that the institutional environment assumes the highest weight over macroeconomic and natural conditions for attracting FDI in Bangladesh's wind and solar energy projects. In the macro-economy, economic growth and access to local finance are important in attracting FDI. Contrarily, land availability assumes the highest importance for attracting FDI in the natural condition dimension.

1. Introduction

Renewable energy constitutes an important component of energy supply that can optimize the existing energy mix and balance market contradictions while preserving the ecological environment simultaneously [1]. Thus, the development of renewable energy sources has become a key question in transforming toward a low-carbon economy at the national and regional levels [2]. Hence, developed and emerging countries are attracting foreign direct investment (FDI) renewable and sustainable technologies.

Fan and Hao [3] suggested that FDI is essential for renewable energy development. FDI may positively impact the technological advancement of companies in host countries through technology transfer and technology spillovers [4]. Moreover, because the development of renewable energy requires a large amount of input of funds and technology, FDI can effectively provide renewable energy industry funding and technical support [5]. Therefore, investment sources and destination countries must implement effective policies to encourage multinational corporations (MNCs) to invest in the renewable energy sector [6,7]. While emerging countries are attempting to improve the regulatory environment for foreign investors, emerging countries are unsure which specific institutional modifications are most effective in attracting FDI [8]. Daude and Stein [9] suggest that some aspects of the institutional environment matter more than other aspects of attracting FDI. Therefore, assessing the business and institutional climate across several countries is critical for MNC managers before deciding which emerging country will enter via FDI.

Prior international business (IB) literature on emerging markets has generally concentrated on two host nation characteristics. First, the effectiveness or quality of the rule of law or property rights in a country

Abbreviations: FDI, foreign direct investment; OLI, ownership; location, internalization; TCE, transaction cost economies; BEZA, Bangladesh Economic Zones Authority; CSP, Concentrated solar power; EIA, Environmental impact assessment; IB, International business; ICSID, International Center for Settlement of Investment Dispute; IEC, International Electrotechnical Commission; MNC, Multinational corporation; IPP, Independent power producer; NBR, National Board of Revenue; NDC, Nationally determined contributions; PPA, Power purchase agreement; PSP, Private sector participation; SREDA, Sustainable Renewable Energy Development Authority; TOR, Terms of reference; ADB, Asian Development Bank; JICA, Japan International Cooperation Agency; BRIC, Brazil, Russia, India and China; PSMP, Power sector master plan; MW, Megawatt; IDCOL, Infrastructure Development Company Limited; OECD, The Organisation for Economic Co-operation and Development.

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[10,11] is one of the host country's characteristics that influence FDI decisions in emerging markets. Second, establishing a business or initial market entry (e.g., Nicoletti et al. [12]) is another area influencing the FDI decision emerging market. Here, the focus is on the cost of doing business or entry barriers preventing MNCs from entering emerging countries. Both literature streams predominantly used transaction cost economies (TCE) [13] but have paid less attention to other facets of the institutional environment influencing FDI decisions in emerging countries. Therefore, further studies are needed to examine FDI decisions and host country institutions [14] and the TCE and OLI paradigms.

While prior studies have examined the determinants of FDI in renewable energy, there remains a general scarcity of academic studies that systematically unpack the determinants of FDI in renewables in the context of emerging countries [15]. There is a shortage of research on factors that attract wind and solar energy investment in nascent markets that partially open up for renewables. However, they still have a significant share of fossil fuel dependency, especially for fast-growing emerging countries such as Bangladesh, which are in a state of rapid industrialization and largely rely on conventional energy sources to sustain their economic growth. This study aims to bridge the research gap by exploring the determinants of FDI in the renewable energy sector in Bangladesh using institutional theory, OLI, and TCE.

We chose Bangladesh as an empirical setting to study the determinants of FDI in the renewable sector. This is a particularly suitable context, as Bangladesh is part of 11 emerging economies [16,17]. The Bangladeshi government encourages FDI flows in this sector, with supportive policies already implemented. For instance, the Bangladeshi government introduced several incentives, such as tax exemption on income tax for 15 years, duty-free import of equipment and accessories, repatriation of profits with the incorporation of an independent regulatory body, and the sustainable renewable energy development authority (SREDA) to facilitate investment in renewable energy. Investment in renewable energy technologies continues to be set as a priority, and the government has committed to increasing its share of renewable energy through targets set at 5% in 2015, 10% by 2020, and another 6000 MW capacity addition by 2041. It aims to achieve a low-carbon resilient economy as enumerated in its intended nationally determined contributions (NDC) and its power sector master plan (PSMP) 2016 and become a middle-income country by 2021. Despite such supporting measures, barriers remain in FDI in renewable energy development for wind and solar energy projects and currently pales in comparison with other conventional energy FDI (i.e., thermal power plants running on gas, coal, and liquid fuel). FDI to the power sector increased from US$30 million in 2004–2005, accounting for 4% of the total FDI flows, to US$208 million (10% of total FDI flows) and 520 million (22% of total FDI flows) in 2019–2020 (Fig. 1). In 2019–2020, the share of FDI inflows to the power sector surpassed the other major sectors of the economy, including textiles and clothing, banking, and telecommunications [18].

This study contributes to the FDI literature on wind and solar energy in developing countries in several ways.

First, using institutional theory, OLI, and TCE, our study investigates the determinants relevant for attracting wind and solar FDI in the nascent market in Bangladesh. This has not been previously studied and partially opened up for renewables but is not yet mature enough to embrace large-scale utility-scale wind and solar projects. *Second*, this study focuses on a fast-growing emerging country like Bangladesh, which relies on fossil fuels to sustain the high-energy intensity of its growing economy for accelerated GDP growth. However, it cannot sustain such growth for most variable renewables through intermittent power only. This is unlike other emerging countries that have attained a certain level of industrial maturity, such as developed economies and other emerging nations of the non-OECD, such as India and China. Their energy intensity is currently declining to help switch to wide-scale accelerated renewables deployment to sustain their current pace of economic growth. *Third*, this study's results can be generalized to countries similar to Bangladesh, which are in their initial period of rapid industrialization based on conventional energy sources but are not ready to open their economies for wide-scale renewables. *Fourth*, it would help the Bangladeshi government tailoring strategies for FDI in the renewable energy sector. It would also help FDI managers identify the factors for conducting FDI in the Bangladeshi renewable energy sector or other similar countries that currently lack the globally available best practices vis-à-vis the various economic support measures widely popular for deploying accelerated renewables.

The remainder of this paper is organized as follows. The next section presents the conceptual framework and reviews the relevant literature on general FDI determinants and renewable energy sectors. The following section discusses the research methodology. The fourth section presents our findings and analyses. Finally, conclusions and policy inferences are presented in the last section.

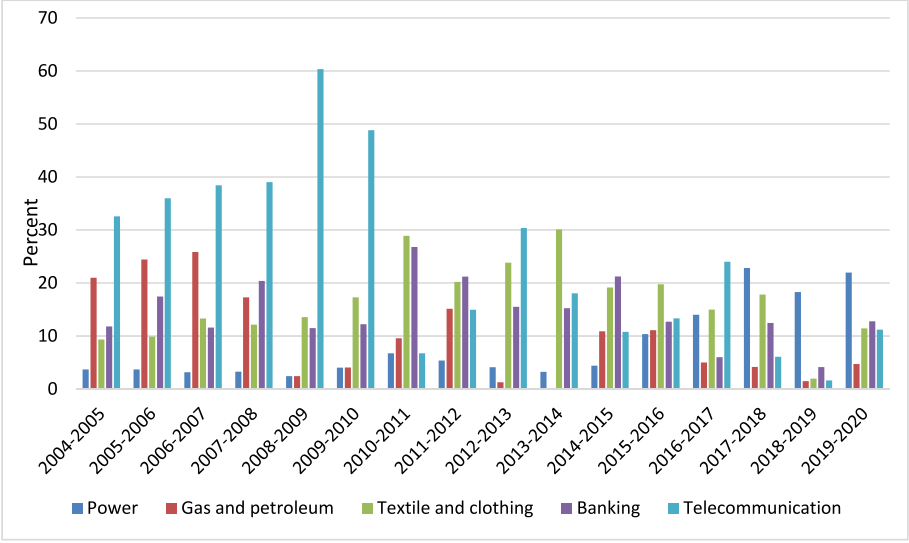

Fig. 1. Proportion of FDI in the Bangladeshi power sector, 2004–2019
Source: Bangladesh Bank (2020).

2. Review of literature

2.1. Theoretical foundation

Our study relies on institutional theory and TCE to explain MNC strategy and investment choices. We also used the location aspect of the OLI paradigm [19], which argues that the locational aspects of the host country matter in investment decisions. According to institutional theory [20,21] formal and informal institutions are vital determinants of strategy and FDI decisions [14,22].

Prior studies have focused on the different facets of formal institutions. For instance, Djankov et al. [23] examined startup or business entry regulations, pollution, products, and bribery. Corcoran and Gillanders [24] focus on the impact of regulations and trade policy on FDI decisions. Scholars in IB and strategic management primarily focus on the relationship between an organization's strategic decisions or performance and tax regulations, contract enforcement, protection of investment, and insolvency laws (e.g., Contractor et al. [25], Cuervo-Cazurra et al. [26], Gan and Qiu [27]). Our study comprehensively aims to explore the impact of institutional, location, and transaction cost-related factors on FDI flows to emerging countries such as Bangladesh.

TCE has been used to examine FDI decisions [28]. Simultaneously, the concepts of TCE could also be used to investigate a firm's decision to invest in a specific emerging country. According to the TCE [29], contracting and negotiation costs are important factors in FDI decisions. MNCs pursuing FDI in an emerging country will incur contract enforcement and monitoring costs, which vary according to the rule of law and other regulatory factors in an emerging country [8].

Dunning [30,31] developed the OLI paradigm, which provides a holistic framework to explain MNCs' investment location decisions. OLI refers to "O" Ownership Advantages, "L" Location Advantages, and "I" Internalization. The basic assumption behind this theory is that an MNC needs to have three kinds of advantages, namely, ownership, internalization, and location, to conduct FDI. Location-specific advantages trigger an actual investment in a given location. According to the OLI framework, the motivation for a firm to locate in a particular country for FDI refers to location-specific circumstances in the host country. Therefore, a country's macroeconomic environment can influence FDI decisions e.g., Asiedu [32], Chakrabarti [33], Eaton and Tamura [34], Arbeláez and Ruiz [35]. Such advantages include large market size, cheap availability of labor or natural resources, GDP growth, inflation, the real exchange rate, and others [36] relevant to our study.

2.2. Empirical studies on the determinants of FDI

This subsection reviews some empirical studies on FDI determinants from the general FDI literature to identify the potential determinants of FDI in wind and solar energy. Empirically tested determinants can be categorized into three dimensions: (i) institutional environment, (ii) macroeconomic environment, and (iii) natural conditions.

2.2.1. Institutional environment

The empirical literature shows that institutions are crucial for attracting FDI. For example, Baklouti and Boujelbene [37] examined factors that attract or deter investment flows in the Middle Eastern and North African countries during the period 1996–2008, finding that the quality of institutions is a significant determinant in attracting FDI, while corruption and regulatory quality assume low significance. Similarly, Ahlquist [38], using a cross-sectional, time-series dataset covering up to 90 developing countries from 1985 to 2002, finds that FDI is attracted to more democratic regimes. Li and Resnick [39] investigate the role of democracy and property rights protection in attracting FDI, positing that democracy has positive and negative effects on attracting FDI, while other studies discuss governance and FDI. For example, Wheeler and Mody [40] find that bureaucratic red tape, political instability, corruption, and the quality of the legal system have no significant impact on the location decisions of US firms.

2.2.2. Macroeconomic environment

The GDP of the host country as the market size has been widely used in empirical studies. For example, MNEs are attracted by the size of the host market because of their greater potential demand and lower costs due to economies of scale [41]. It has been argued that the larger the market size of a host country vis-à-vis the country's GDP, the higher the inflow of FDI into that country [42]. Labor cost is another factor that either draws or deters FDI. For example, higher nominal wage rates deter FDI. Foreign investors are more willing to invest in countries with lower labor costs. However, lower labor costs are sometimes associated with higher transportation costs and lower productivity, which deters [43]. The exchange rate is another factor that attracts or deters FDI. For example, the depreciation of host country's currency leads to an increase in FDI, whereas an appreciation of the host country's currency leads to a decrease in FDI [44].

Trade openness is another independent variable that attracts or deters FDI. For example, several studies (Aqeel and Nishat [45], Pistoresi [46], and Schneider and Frey [47]) find that trade openness positively correlates with FDI flows, whereas Wheeler and Mody [40] find no significant correlation between trade openness and FDI. Finally, the tax structure has a positive or negative correlation with the FDI. For example, Grubert and Mutti [48], Hines and Rice [49] and Loree and Guisinger [50] posit that unfavorable host country corporate taxation deters FDI. Other studies (Wheeler and Mody [40], Ning and Reed [51], Porcano and Price [52]) have confirmed that tax rates positively affect FDI.

2.2.3. Natural condition

Several studies have also focused on the impact of natural conditions on foreign investors' location decisions when conducting FDI. For example, Teixeira et al. [53] analyze the impact of a country's non-renewable energy source endowment on FDI for a wide sample of countries from 1995 to 2012, finding that a country's endowment of non-renewable energy resources matters in attracting FDI. Ledyaeva [54], looking into FDI into Russian regions during the period 1995–2005, finds that market size, big cities and seaports, oil and gas resources, proximity to the European market, and political and legislative risks are the most important determinants of FDI. Other studies, such as Ezeoha and Cattaneo [55] and Ajide and Raheem [56], find a positive correlation between natural resource endowments and FDI.

Regarding natural resource endowments for conducting FDI in renewable energy development, the World Bank [57] found that land acquisition is the most crucial barrier to solar power development in India. Similarly, Friebe et al. [58] find that the availability of wind resources is a crucial determinant for attracting FDI in emerging markets, especially for investment location decisions for German firms for wind energy projects in developing countries.

2.3. Empirical studies on determinants of FDI in renewable energy

This subsection reviews the literature on the determinants and barriers to FDI in wind and solar power in the renewable energy sector. Kathuria et al. [59] investigated the role of state-level institutional differences in attracting FDI in wind energy and found that the state-specific policy index for renewable wind energy is significant in attracting FDI. This study confirms that the institutional environment of a country is the key determinant in attracting FDI using panel data techniques on the wind energy policies of eight Indian states. Zeng et al. [60], reviewing the problems and solutions in renewable energy development in the BRIC countries, find a well-functioning capital market, credit facilities, capacity to adapt policies, and a low reserve ratio monetary policy act as influential factors in attracting FDI to the power sector. Vaccarini et al. [61] investigated Chinese managers'

perceptions of physical distance concerning FDI in the German renewable energy sector. They found that the continuity and consistency of rules and processes in the regulatory dimension are important in conducting FDI in the renewable energy sector. In investigating the barriers to the diffusion of wind and solar energy in Greece, Eleftheriadis and Anagnostopoulou [62], find that the following hinders the development of renewable energy projects in the country: inadequate financial resources, low grid capacity, delay in the issuance of work permits, the opposition of local communities in installing wind firms, and the lack of a stable regulatory framework.

Keeley and Matsumoto [63] find that along with traditional factors such as exchange rate volatility, access to land, and an efficient bureaucracy, industry-specific factors such as priority grid access, feed-in tariffs, and auctions are very important in attracting wind and solar projects. Nousheen et al. [64] investigated the factors influencing renewable energy generation development in Pakistan and found that lack of good governance, renewable energy adoption, and governmental energy policies are crucial barriers to renewable energy development in Pakistan. In contrast, natural resources, the power production approach, renewable energy demand, investment environment, economic returns on investment, environmental effects, and public acceptance of renewable energy are crucial determinants of renewable energy generation. Azam and Haseb [65] analyze the factors that affect FDI into BRIC countries, focusing on the impact of energy on FDI inflows from 1990 to 2018 using a range of estimation techniques. They find that renewable energy consumption, market size, tourism development, and trade openness are significant determinants in attracting FDI, while inflation negatively impacts FDI. Table 1 shows examples of determinants of a firm's decision to conduct FDI in wind and solar energy sectors.

Table 1
Selected studies on the determinants of FDI in the wind and solar energy sector.

Category	Variable	Literature References
A. Institutional environment	1. Administrative procedure	Komendantova et al. [94]; Blackman and Wu [95]; Chirambo [96]; Masud et al. [97]
	2. Effective law enforcement	Komendantova et al. [98]; Friebe [58]; Rector [99]
	3. Corruption	Edsand [100]; Komendantova [101]; Ameyaw and Alfen [102]
	4. Tariff	Friebe [58]; MPEMR [103]; Rector [99]; Mahbub and Jongwanich [103]
	5. Tax incentive	Suberu et al. [104]; MPEMR [103]; Wall et al. [105];
	6. Continuity and consistency of rules and processes	Lamech and Saeed [80]; Besant-Jones [81]
	7. Priority access to the grid	Friebe [58]; MPEMR [103]; Zhao et al. [106]; Zhang et al. [92]; Friebe [58]
	8. Government development plan and renewable target	MOEF [107]; Masud et al. [97]
	9. Technical standard	Khare et al. [108]; Karatayev et al. [109]
B. Macroeconomic Environment	1. Economic growth and development	Edsand [100]; Sen and Ganguly [93]
	2. Real exchange rate	Painuly [67]; Sharma and Vohra [110]; Friebe [58]; Ameyaw and Alfen [102]
	3. Access to local finance	Chirambo [96]; Sindhu et al. [85]; Suberu et al. [104]
	4. Labor cost and skilled labor	Miller [43]; Bilgili and Dogen [111]; Edsand [100]; Sindhu [85]; Byrnes et al. [112]; Karatayev et al. [109]
C. Natural condition	1. Availability of land	Nesamalar et al. [113]; Gatzert and Kosub [114]
	2. Natural resources	World Bank [57]; Faijer and Arends [115]; Nousheen et al. [64]

3. Research method

This study aims to identify the factors that attract scalable wind and solar energy projects in Bangladesh. This study is exploratory in nature, and therefore, a qualitative research design is suitable. Semi-structured interviews were employed for data collection to identify experts—-practitioners who have specialized knowledge to contribute to a given topic in a particular domain obtained through experience [66]. Painuly [67] indicates that interaction with experts using semi-structured questionnaires in the renewable energy domain helps identify factors that help reveal gaps in existing policies and devise ways to overcome these barriers. Experts have been argued to play a critical role in situations where they rely on critical data, which significantly impacts their decisions [68]. It has been argued that there is a lack of central databases or standardized protocols for collecting and analyzing critical data (i.e., from data collection to integration), making it difficult to compare or reproduce the results and subject to researcher bias. In this instance, many studies depend on expert opinions to identify clear traits in the data based on similar observations, characteristics, and experiences [69]. Hence, semi-structured interviews were conducted to document the experts' judgments and opinions and compare them with the extant literature on factors attracting FDI in wind and solar energy sector. This is used in developing economies to gain a first-hand understanding of the area of investigation and identify any missing gaps between theory and the actual ground conditions.

In this study, four stakeholder groups were chosen as experts. They are (i) private FDI renewable power companies, (ii) government officials, (iii) multi-laterals, and (iv) academics. The selection of private power companies in wind and solar energy primarily comprises companies that have signed their power purchase agreements (PPAs). They are either in the final stage of project implementation or have started supplying power to the off-taker (i.e., the Bangladesh power development board). Government officials comprise senior government officials (i.e., chairman and director) of the renewable energy development authority involved in procurement, monitoring project implementation and policymaking, energy specialists from multi-laterals including Asian Development Bank and the World Bank acting as advisors, undertaking research, informing future policy directions and expertise in financing projects (both local and foreign), and academics in the rank of professors who are engaged in teaching and research in renewable energy development. Table 2 shows the respondents' characteristics. The names of the expert interviewees were kept anonymous for the privacy and sensitivity of personal information.

Thirteen semi-structured one-on-one in-depth interviews were conducted from July to August 2020 to gain insight into the factors influencing FDI. Four representative target groups were chosen: private company personnel, government officials, multilaterals, and academics. A purposive sampling technique was used for the data collection. The interview questions are presented in Appendix A.

Examples of key questions to the respondents were:

(i) What is the basic profile of your company?
(ii) What are the strategic factors that are influential in making investment decisions in Bangladesh's renewable energy sector?
(iii) What are the significant renewable energy development policies (incentives, for example, tariffs, affordable land, i.e., solar parks, availability to local financing) that are helping to draw FDI in wind and solar sector?

The process started with a detailed review of the extant literature and identifying the factors influencing investment decisions in developing countries' wind and solar energy projects. This was used to compare and identify new factors in the Bangladeshi context practiced on the ground. This offered a first-hand understanding of the area of investigation and

Table 2
Respondent characteristics.

Respondent characteristics						
Sample (N)	Experts	Position of respondent	Country of origin	Sector	Capacity	Interview date
Company	Expert A	Managing Director	United Kingdom	Solar	28 MW	August 17, 2020
	Expert B	Chairman	Singapore	Solar	50 MW	July 14, 2020
	Expert C	Manager	USA & Denmark	Wind	60 MW	August 24, 2020
	Expert D	Senior Manager	Thailand	Solar	10 MW	August 4, 2020
	Expert E	Deputy General Manager	China	Solar	35 MW	July 27, 2020
	Expert F	Manager	South Korea	Solar	32 MW	July 20, 2020
Multilateral	Expert A	Energy Expert		Multilateral Financial Organization	NA	August 20, 2020
	Expert B	Senior Procurement Officer/Independent consultant		Multilateral Financial Organization	NA	August 27, 2020
	Expert C	Investment Expert		Local Non-Bank Financial Institution	NA	August 12, 2020
Government	Expert A	Chairman		Regulatory and Policymaking Authority	NA	July 23, 2020
	Expert B	Deputy Director		Regulatory and Policymaking Authority	NA	August 25, 2020
Academic	Expert A	Professor & Director		Energy expert	NA	August 29, 2020
	Expert B	Professor		Energy expert	NA	September 03, 2020

identified any missing link between theory and actual ground conditions. Each factor was explained in detail in the semi-structured interviews using the interview material (see Appendix A). The explanation of the factors was supported by literature sources and writing detailed case-based memos and comparing the participants' accounts to develop a common understanding of the factors. The interviewees were then asked to give their opinions about the importance of these factors based on their experiences and cancel out any insignificant factors that seem unimportant in the decision-making process for investing in the Bangladeshi renewable energy sector. Semi-structured interviews are suitable for exploring the perceptions and opinions about complex and sensitive issues [70]. The researcher usually employs this method to gain a deeper insight into the nature of the problem and participants' beliefs, perceptions, and experiences of a given topic, which otherwise cannot be discerned by a questionnaire. The formulation of interview questions was geared toward generating open-ended discussions. Through the process, they gain interviewees' feedback and answers into the issues and have the flexibility to further delve into the areas of concern and gain a much deeper insight into them.

The interviews were conducted via face-to-face meetings and Google Meet and Zoom-based video conferencing. The length of the interviews ranged from one to two hours. All interviews were conducted between July 2020 and August 2020. The total number of experts chosen for this study was 13. The average length of time the experts are working on their respective jobs is 15 years. Although the study's sample size was not large (n = 13), it is argued that as long as there are five well-defined experts in the field, the representative sample is adequate to conduct the research [71]. To avoid any bias, experts were chosen from a representation of FDI companies whose headquarters were diverse in their areas (country of origin) of operation; this was in addition to experts from various stakeholder groups (i.e., government officials, multilaterals, and academics). They represent the Bangladesh renewable energy sector in various capacities (i.e., independent power producer (IPP) contracting, monitoring projects from conception to commissioning, local and foreign financing, strategic investment decision-making, policy development, and teaching and research). At the initiation of the interview process, the interviewees were given a summary of the research proposal. A confidentiality agreement was signed to maintain the privacy and confidentiality of the information and the interviewees' names.

4. Results

4.1. Findings and analysis

Our study aims to comprehensively explore the impact of institutional location and transaction cost-related factors on FDI flows to emerging countries such as Bangladesh. This section presents the determinants of FDI in wind and solar energy sectors of Bangladesh. During the interviews, interviewees were unequivocally requested to provide opinions and views about the significance of factors influencing investment decisions in the renewable energy sector of Bangladesh. The findings obtained from the interviews are presented in the following sections.

4.2. Institutional environments

4.2.1. Administrative procedure

Most respondents indicated that the process for approving power plants from submitting the proposal to obtaining the approved PPA is quite long, with a variation of time lag that extends from one year to two years for certain projects. However, there is a set time limit for each stage from the initial project proposal submission through tariff negotiations and contract awards. However, sometimes these are delayed due to administrative bottlenecks and other externalities beyond project sponsors' control.

All renewable power companies must submit an environmental impact assessment (EIA) report that considers several environmental, social, and legal safeguards, as stipulated vis-à-vis reference (TOR) by the Department of Environment. Interviewees indicated that there was a considerable cost in preparing this report, and sometimes foreign consultants had to be hired for detailed screening and assessment of the environment (project site), including various environmental controls, such as safety and mitigation measures, evaluation of impacts, and other standards for preparing this report. This constitutes a crucial aspect of project approval and investment. Additionally, after contracting awards, companies face increasing hurdles in releasing goods through customs, which sometimes delays project implementation. One respondent opined:

> *"One company faced a particular problem with the advanced income certificate (AIT) in releasing goods from customs. Although power companies can import equipment with a 100% rebate, which makes up 95% coverage by an statutory regulatory order (SRO) accompanied by a no-objection certificate issued by the government and a 5% on AIT released by the national board of revenue (NBR) […] Getting an AIT released by NBR is extremely tough with a wait time of approximately two months. Without having the AIT, they could not obtain a bank guarantee for the release of goods through customs. This delayed the entire project by two months."*

Entry barriers are an important institutional dimension that affect the costs of doing business [23] and firm performance [72]. Our findings

indicate that lengthy bureaucratic processes and delays in starting businesses increase the initial cost of foreign investment, thus discouraging FDI inflows to Bangladesh. Such obstacles are described as "foreign market entry" barriers but could equally well fall under TCE—the obstacles are made worse because MNCs are perceived as foreign [73]. Such additional regulations or procedures are transaction costs for MNCs, considering FDI in the renewable energy sector of Bangladesh.

Our findings support the institutional theory of entry Djankov et al. [23] and are consistent with the empirical findings of Contractor et al. [8], which report that the number of administrative procedures, time, and cost of entry are impeding factors for FDI in an emerging country. The screening of proposed investments by governments can be done to ensure that consumers buy goods or services from "desirable sellers." However, in Bangladesh, inefficient institutions act as vehicles for deterring FDI in Bangladesh. Therefore, we recommend that institutions responsible for reviewing and approving FDI should improve efficiency in processing the approval of FDI in Bangladesh.

4.2.2. Effective law enforcement

All interviewees strongly emphasized the role of effective law enforcement in drawing FDI in Bangladesh's renewable power sector. Interviewees indicated that foreign investors would like to see that their contractual obligations are honored, their revenues are secured, and their long-term interests are protected under the rule of law in Bangladesh. All respondents reiterated that the country had set a good set of laws and processes that complied with international standards. For example, apart from the local court system, which deals with commercial arbitration and specialized issues, Bangladesh has enacted the Arbitration Act 2001 for both domestic and international arbitration. This enaction includes the International Center for Settlement of Investment Dispute (ICSID) rules for settling disputes in local courts and receiving an equitable award. One respondent commented:

> *"The unique advantage of IPPs is that the government is the sole off-taker, which ensures that there will not be any default on payments to IPPs. This protects the IPPs against any changes in law or government and ensures guaranteed payment obligations. Since 1998, Bangladesh has no payment defaults to date."*

Our findings are similar to those of Staats and Biglaiser [74]. They reported a positive relationship between the quality of the rule of law and FDI inflows. Moreover, our findings are consistent with TCE, which argues that contracting and negotiation costs are important economic considerations [29]. A strict rule of law in a nation helps prevent opportunistic behavior by actors involved in market transactions [20]. Furthermore, profits earned by an MNE's affiliate in a host nation diminish if it has to devote time and money to legal enforcement to protect resources and capabilities [19,75].

4.2.3. Corruption

This factor is important for foreign investors to make investment decisions when conducting FDI in the power sector. For example, it was learned that renewable power projects are rarely subject to competitive bidding or tendering processes and are mostly awarded through direct negotiation. This leaves ample room for corruption. Many projects are awarded without due diligence in evaluating technical, commercial, and financial considerations for project approval with the effect that many projects fail to complete on time, incur serious problems in securing finance in the project implementation phase, or end up as lost projects. One respondent opined:

> *"We have gotten used to the rules of the game. Once we implement a small to mid-sized project, it will no longer be a hurdle [….]. Additionally, there are many inefficiencies and corruption that hinder project implementation. Further, in each phase of the paperwork, there are so many hidden charges along with the delay in time […] Investors feel discouraged. Bureaucratic red tapes are everywhere."*

The findings of this study are consistent with the negative view of corruption and suggest that corruption creates additional costs and uncertainty for investors, leading to a reduction in FDI [26]. Corruption acts as an additional tax on investors [76–78]. Our findings indicate that the presence of corruption discourages FDI in Bangladesh's renewable energy sector. Therefore, governments and regulators should actively work to control corruption levels in Bangladesh.

4.2.4. Tariff

The interviewees regarded tariffs as the most crucial factor in drawing FDI in the renewable energy sector in Bangladesh, especially in the renewable energy policy dimension. All respondents stated that high tariffs[1] are a crucial factor influencing their decision to conduct FDI in Bangladesh's wind and solar energy. In our field interviews, we learned that many power companies had secured the highest tariffs in renewable energy projects to a maximum of US$ 17 cents per kilowatt-hour, which is nowhere to be found at the current time in any part of the world. The government is currently offering a much lower tariff for welcoming foreign investors to invest in the power sector; it is still considered significantly high to global standards. One respondent opined:

> *"Tariff is a big motivation to invest in the renewable energy sector as the rate of return is sometimes more than 20%, which is higher than anywhere in the world. Though nowadays the tariff is dropping, the return is still sufficiently high, comparable to world standards."*

Our findings underline that tariffs are vital determinants of FDI in the renewable energy sector in emerging countries.

4.2.5. Tax incentives

This factor significantly influences FDI in solar and wind energy. For example, FDI renewable power companies have been exempted from corporate taxes for 15 years. Most respondents opined that tax exemption is a key determinant of foreign investors' investment in the Bangladeshi renewable energy sector. Additionally, FDI companies are exempt from importing equipment or machinery to set up their power plants. These help increase the after-tax cash flow and earnings of companies operating in the renewable energy sector in Bangladesh. One respondent from an FDI power company stated the following:

> *"Bangladesh offers a 100% corporate income tax exemption for renewable power companies for a period of 15 years, and this has been extended until 2034 […]. This is too good an incentive to draw additional investments in renewables."*

Tax incentives attract FDI in emerging markets [79]. Our findings are consistent with Keeley and Matsumoto [63], who argued that tax exemptions or reductions could encourage private individuals and companies to consider investing in wind and solar energy projects. These incentives can come in the form of capital- or production-based income tax deductions or credits, accelerated depreciation, property tax incentives, sales or excise tax reductions, and value-added tax reductions.

4.2.6. Continuity and consistency of rules and processes

This factor assumes significant importance in FDI generation in the renewable energy sector. A growing number of studies have argued that foreign investors in developing countries would like to see the 'rules of the game' as remaining credible and not altered at the government's convenience once they have made investment decisions based on such

[1] Tariffs are negotiated on a bilateral basis between the IPPs and the government. In Bangladesh, renewable IPPs are subject to a cost-plus tariff awarded on the actual cost of the project and an agreed profit. This tariff is fixed over the lifetime of the project.

rules. This is particularly true in the case of the government's honoring of contracts and regulatory rules [80,81]. In our field interviews with the respondents, almost all noted that the sector is very stable. The government is committed to fulfilling its pledges for the future development of this sector and earning investor confidence by respecting the continuity of its current rules and processes and adapting to any future demand that is friendly to investors' interests and protects their investment. One respondent commented:

> *"The government is sincere to meet its renewable energy development targets and its commitment to combating global climate change. The current net-metering system is a very good initiative for promoting large-scale renewables. However, their implementations are slow due to administrative hurdles, coordination problems, and other issues […] This causes delays in project implementation, as many of the renewable IPPs that have been awarded between 2013 and 2015, only three have been implemented until 2019 […] Hence the government failed to meet its 2020 renewable energy target."*

4.2.7. Priority access to the grid

This factor is important for renewable power companies to invest in the power sector of Bangladesh. As solar and wind energy are intermittent sources of power, they are subject to fluctuations in power generation at different times of the day; in the morning, the power generation is slow, peaking at noon and then slowing again in the afternoon. Therefore, the grid must adjust its load from other sources of power generation (i.e., conventional power plants) to accommodate renewables during peak generation.

The respondents felt that access to the grid at their maximum peak power during the time of the day was very important for the sustainability of their business. However, many respondents expressed concerns about the technical capacity of the grid, which lacks sophisticated processes and flexibility for quick uptake and smooth dispatch of power on a real-time basis. One respondent opined:

> *"Smart grid with a storage capacity of two-three hours will stabilize the grid during supplying intermittent power to the grid along with conventional plants and will keep the flow stable so that system does not trip."*

Our findings reinforce the findings of Keeley and Ikeda [82]. They find that renewable energy policies work as strong determinants of FDI and clarify that regulatory support policies such as guaranteed access to the grid and technical standards strongly impact foreign investors' investment decisions.

4.2.8. Development plan and renewable target

The Bangladesh government has set a target for renewable energy development from various sources, including hydropower, solar, wind, biomass, and biogas, to 5% and 10%, respectively, by 2015 and 2020. This is a target that the government aspires to achieve by developing a 400 MW wind power capacity and another 100 mg utility-scale solar capacity as part of the government's commitment to tackle global climate change, meeting its NDC by 2030. Many respondents mentioned that the country has a good renewable energy development plan and appropriate policies and institutional setup in the Bangladeshi context. This includes various sources of financing (i.e., commercial bank loans and loans from non-bank financial institutions, including multi-laterals) and good government support for attracting FDI in wind and solar energy. Many respondents also reiterated a large mismatch between "what is expected and what happens on the ground." One respondent opined:

> *"A solid development plan needs to be in place which gives the investors an idea in regard to how much the market will grow […] Formulate investment strategy and budget, and when investors see that such development plans are not forthcoming, they lose interest."*

4.2.9. Technical standard

This factor is important for renewable power companies to invest in the Bangladeshi power market. For example, in our field interviews, it was learned that Bangladesh meets a high requirement for product standards (i.e., modules, inverters, charge controllers, and batteries) for installing solar power plants. Additionally, a local supplier market has been developed for renewable power companies. This has been influenced to compensate for the low-quality products from India and China for high-quality Bangladeshi products manufactured locally. In this regard, the SREDA has set standards for installing solar projects in Bangladesh, complying with the International Electro technical Commission (IEC) requirements as a quality benchmark. One respondent opined:

> *"The PV modules are sourced from Bloomberg's tier-one list, and a good foreign investor will not invest without meeting such criteria while for wind projects, such standards cannot be guaranteed."*

4.3. Macroeconomic environment

4.3.1. Economic growth and development

Bangladesh has made robust economic growth over the past decade. Its real gross domestic product grew on average at a healthy rate of approximately 6.5%. In 2017, it registered a gross domestic product growth of 7.2%, while its annual average inflation declined by 5.4%. These have manifested in large-scale infrastructure development, including port facilities (deep seaports), transportation (including superstructure projects, i.e., bridges, elevated highways, and metro rail systems), and a huge capacity expansion in power generation. The increase in power generation was significant between 2010 and 2017, as the total installed capacity increased from 5823 MW to 15,953 MW during this period. The government is set on a path of rapidly accelerated GDP growth, for which power generation and capacity enhancement are seen as principle catalysts to sustain its growing economy. This helps generate large foreign investments in the power sector, including the renewable energy sector.

Our study supports Demirhan and Masca's [83] findings. They examine FDI determinants in developing economies and found GDP growth rate, tax rate, and infrastructure to be important factors in attracting FDI.

4.3.2. Real exchange rate

Most respondents responded that the real exchange rate is important for FDI generation in the renewable energy sector. Most renewable energy projects (i.e., wind and solar) are indexed in the US dollar, and some projects are indexed in the local currency. Projects indexing payments in US dollars are subject to exchange rate exposure when remitting their profits abroad. One respondent opined:

> *"Power companies are exempted from exchange rate fluctuations as the government absorbs any differences in exchange rates while repatriating profits abroad."*

Our findings are consistent with those of Kiyota and Urata [84]. They investigate the effect of exchange rate volatility on FDI from developed economies and find that high volatility in the exchange rate discourages FDI inflows.

4.3.3. Access to local finance

This factor is crucial for FDI in the renewable energy sector. The interviewees indicated that access to local finance was comparatively expensive. Moreover, there are a limited number of venture capitalist funds in the country, which finances renewable energy projects on a limited basis. Additionally, the country lacks a well-functioning capital market and a bond market, which foreign investors can use to raise large funds to finance their power projects. Most investors reiterate that there are limited financing options for setting up renewable power projects in

the country. Local banks and other non-banking financial corporations such as Infrastructure Development Company Ltd. (IDCOL) are reluctant to disburse large loans for setting up renewable energy projects due to project risks, lack of awareness about green projects, large amounts of paperwork, and bureaucracy to obtain approved loans. One respondent opined:

> *"IDCOL' s cost of finance for renewable energy projects is too high, which amounts to 6% or higher and a large number of paperwork to complete, which makes the process hugely complicated and cumbersome. One investor, being tired of it, opted for foreign funds to finance his power project, which he got with 4% of the cost of finance, which local banks and IDCOL can never compete."*

Renewable energy projects are often subject to high investment risk organizations. This is because of their longer payback period, changing new technologies, low maturity level, the intermittency of renewable energy, and evolving government rules and processes that sometimes cause distrust and subject them to high borrowing costs [85]. Diverse channels are required to fund renewable energy projects, such as venture capital, private equity, bank finance, state agencies, and corporate research and development [86–88] to mitigate such risks.

In the economics and finance literature, variation in access to finance worldwide is considered an important institutional factor [8]. The basis of this argument is that well-developed financial institutions enable firms to access credit easily, which can help improve the mobilization and allocation of resources [89,90]. Our findings provide further evidence of the role of access to finance in encouraging FDI in a country. Our findings are consistent with Contractor et al. [8] and suggest that the easier it is for an MNC to obtain local credit in the emerging country, the greater the inflow of FDI. On the contrary, availability and difficulty accessing local finance discourage FDI in emerging economies such as Bangladesh. Local credit availability and borrowing substitutes for the foreign firm must bring its capital to the country, thus reducing the parent MNC's exposure to country risk [91]. Thus, access to local capital positively influences FDI in the Bangladeshi renewable energy sector.

4.3.4. Labor cost and skilled labor

This factor is important for drawing FDI in renewable energy projects. From the Bangladeshi perspective, most respondents reiterated that the labor cost is low by regional standards and that labor cost has a negligible effect on the total project cost. Additionally, renewable power companies work with the minimum amount of labor in the operational project phase, with not more than ten people on-site in the operational project phase. However, one respondent stated they had to deploy large numbers of temporary workers (i.e., 300 people) during the project installation phase, which constituted local and foreign workers.

Skilled labor is another factor most respondents rated as very important in attracting FDI in the renewable energy sector. The availability of a skilled workforce and technical support is important for developing renewable energy power projects. Project installers, engineers, architects, and other technicians working for renewable energy projects should be equipped with sufficient knowledge about the characteristics, benefits, and technical skills needed to develop such projects [92]. It has been suggested that specialized skills are needed to operate and maintain renewable energy hardware and the availability of spare parts for the smooth operation of such projects. Such resources for ready availability of spare parts and specialized skills might be lacking in developing countries [93].

From the field interviews, it was learned that there were many skilled workers in the country, and foreign companies could hire engineers and technicians from local universities and colleges. However, some respondents also expressed concerns about the availability of specialized skilled professionals (i.e., supervisory and management skills) for which workers need to be hired from abroad. For example, one respondent stated:

> *"There is a severe lack of experts in Bangladesh who can implement renewable energy projects […] To mitigate foreign engineers and experts from abroad are hired. Their remuneration and compensation packages are demanding, resulting in higher project implementation costs."*

4.4. Natural condition

4.4.1. Availability of land

Land availability is one of the most important factors in investment decision-making for FDI in the renewable energy sector. All respondents agreed that acquiring land is the most difficult step in setting up power plants. In particular, solar power plants require large tracts of land, which are very difficult to find in a single place as a whole. One respondent opined:

> *"Land acquisition is the deal-breaker in order to implement a renewable energy project. As a rough calculation, it takes approximately 3-4 acres of land to start a renewable energy project. One company is trying to implement a 200 MW project that needs around 600 acres of land […]. Having in one stretch this much amount of land is so challenging. It takes a long time to negotiate with many owners. Subsequently, the land intensiveness of the industry makes project implementation and financing ever more challenging. Even if there is a sound project, this delay in acquiring land does not help to successfully implement the project … The bigger the project, the lesser the chances to implement it."*

4.4.2. Natural resources

Natural resources are important determinants of FDI. Wind and solar energy projects are considered the principal fuels for wind and solar power plants. There are good prospects for installing renewable energy power plants for wind and solar energy in Bangladesh: Bangladesh receives an average of 4–6.5 kWh/m^2 of solar irradiation daily, and the maximum solar radiation is received from March–April with the minimum in December–January. In some areas of the country, solar irradiation is sufficient for running concentrated solar power (CSP) power plants. There is good wind energy development potential for wind in the country's southern coastal belt and inland areas. The wind speed varies from 3.8 kWh/m^2 to 6.4 kWh/me per day, with an average of 5 kWh/m2 per day. A higher wind speed was noted in coastal areas, including the islands. Most of the respondents indicated that the solar irradiation data are sufficient to set up large numbers of solar power plants in the country but are wary about the variability of wind speed in different areas of the country. One respondent opined:

> *"The major hindrance to wind-based energy is the lack of research on wind mapping and feasibility tests on wind-based power generation in Bangladesh. This calls for future study regarding its prospects, technical aspects, and investment options on wind-based power generation only."*

5. Conclusions and future research

This study investigates the key determinants of the investment decision-making process of firms conducting FDI in Bangladesh's wind and solar energy sectors. From Bangladesh's perspective, attracting FDI in wind and solar energy sector is important. This is because these two sources have been identified as key to the country's core strategies for developing renewable energy in its broader energy development strategy for long-term energy security and sustainability. In this regard, drawing FDI in wind and solar energy helps upgrade and expand the country's energy infrastructure, invest in clean energy technologies, and move away from the current system of fossil fuel power generation to an environmentally sustainable and clean energy-efficient economy.

This study identified nine institutional factors, four macroeconomic factors, and two natural conditions as significant determinants for attracting FDI in Bangladesh's wind and solar energy. In light of the

expert opinions conducted through the semi-structured interviews, the institutional environment assumes the highest weight in conducting FDI in the renewable energy sector. This is followed by macroeconomic and natural conditions to attract FDI. In the institutional environment, higher tariffs, tax incentives, and priority access to the grid are key decision-making factors that attract FDI in the renewable energy sector. Economic growth and access to local finance are important factors that influence investment decisions to conduct FDI in the macroeconomic dimension. In the natural condition dimension, the availability of land to set up renewable power projects remains the most influential factor in conducting FDI for wind and solar energy sectors in Bangladesh.

This study has *several practical implications*. To attract sustainable FDI in the renewable energy sector in Bangladesh, we recommend further strengthening of four areas: land acquisition, grid integration for renewable power companies, access to local finance, and control of corruption. *First*, land acquisition is a perennial problem for installing renewable energy projects. This is due to the difficulty in acquiring large tracts of land at suitable locations close to the government's power evacuation centers and the complexity of multiple titles of ownership, lengthy negotiations with owners of, and costly settlements; therefore, the onus lies on the government to acquire land for private project sponsors and lease them to set up renewable power projects. In this regard, the Bangladesh Economic Zones Authority (BEZA) mandated the establishment of large numbers of private economic zones in the country. This could help set up specialized zones, such as solar and wind parks, for sustainable renewable energy generation. The format for this scheme is the selection of sites with sufficient natural resources (i.e., wind and solar energy) that connect them through an integrated infrastructure and transmission system by ready 'plug and play' for power generation. Additionally, owing to the scarcity of renewable power plants, a greater potential has been found to develop rooftop solar across industrial and commercial properties.

Second, the current grid system lacks the capacity and sophisticated processes to accommodate large amounts of variable renewables (wind and solar energy) for grid integration with a downside risk of grid failure to match the frequency of both sources (i.e., conventional thermal power and renewables) in real-time. Hence, emphasis should be placed on smart grids with battery storage capacity for better integration of renewables. This ensures a more decentralized energy supply and bidirectional power flow. Moreover, the installation of large-scale battery systems should be emphasized for storing renewable energy for their ready dispatch at any time of the day. This is due to the intermittency of renewable power with variable sunshine and wind speed during the day, which does not qualify them to match the unhindered and continuing supply of power as with baseload thermal power plants. The development of appropriate grid codes should follow the physical infrastructure for the deployment of renewables.

Third, for access to local finance, emphasis should be placed on increasing the financing capacity of local financing institutions involved in funding green power projects in Bangladesh. This includes state commercial banks, development partners such as ADB, World Bank, and JICA involved in green financing, including private commercial banks, both local and foreign, and non-financial banking corporations. More awareness about green financing should be created among private commercial banks and non-banking financial corporations for mainstreaming green financing in their core activities. This could be mediated through the Bangladesh Bank and the development partners to incentivize the development of various financial tools and methods for promoting green products and generous loan financing options. This is done through regular training, seminars, and workshops, including international collaborations to cross-breed ideas and interconnections with various donor agencies. Additionally, the government needs to have comprehensive strategies for financing green projects through a regulatory framework for proper policies and incentives. These include capital market development and issuing green bonds for impact financing in renewables.

Lastly, regarding corruption, there is a need for a transparent and competitive selection process through competitive bidding at the procurement stage for project approval. It has been suggested that all IPP proposals in wind and solar energy are subject to direct negotiations, which create a lack of transparency, suspicion of corruption and rent, capture by officials, and lack of time-bound screening requirements and evaluation criteria. Sometimes, these results in the quick approval of projects, the risk of long delays, or canceled proposals. Moreover, many projects fail to deliver in the implementation phase after approval due to failure to attain financial closure or inability to secure land, resulting in cancelation or lost projects. In this regard, the government should stop nurturing unsolicited offers and put in a competitive bidding system with structured processes and objective evaluation standards so that the best party qualifies for project approval and ensures the optimum delivery for the benefit of public-private power procurement.

As one of the first studies to identify the key determinants of FDI in Bangladesh's wind and solar sector, this study has some limitations. First, the sample size of renewable power companies (i.e., wind and solar) is small. Second, a whole set of renewable energy support policies popular for drawing investment in renewables, such as feed-in tariffs, renewable energy certificates, auctions, and renewable portfolio standards, are non-existent in Bangladesh. Future research could shed light on how the new draft policy on feed-in tariffs currently under implementation for selected renewables could attract more FDI in the renewable power sector, including the growing potential for rooftop solar for drawing FDI into this sector.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A

Semi-structured interview questions for finding the factors and inhibitors generating renewable energy FDI in wind and solar energy projects

Research objective: This study investigates the factors perceived to be important for generating renewable FDI in wind and solar energy projects and the barriers that impede their sustainable development.

Date: _____ Starting time: _____ Finish time: _____

Firm's name: _____ Position: _____

Interview Questions:

1. What is your company's basic profile? The topics include firm size, firm's ownership (wholly-owned subsidiary, equity joint venture, minimum equity participation), the number of employees, business strategies and goals, competencies, key customers, type of investor (IPP developer, strategic investor, or a combination), and industry segment (in Bangladesh's context, specifically the generation segment for private investment).
2. How long have you worked in this firm, and how long have you worked in your current position?

3. How important do you think FDI is in Bangladesh's renewable energy sector?
4. What are the strategic factors that influence investment decisions in Bangladesh's renewable energy sector?
5. What are the potential barriers to the inhibition of sustainable FDI generation in Bangladesh's renewable energy sector?
6. Apart from the proposed factors, could you also identify some additional factors or disregard some irrelevant ones that have been put forward in the discussion?
7. What are your recommendations for sustainable FDI generation in Bangladesh's renewable energy sector, particularly from a regulatory point of view?
8. What are the significant renewable energy development policies (incentives, such as feed-in tariffs, affordable land, i.e., solar parks, availability of local financing) that help draw FDI in the wind and solar sector?

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