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RETRACTED: Green Investment for Sustainable Business Development: The Influence of Policy Instruments on Solar Technology Adoption

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Green investment in sustainable energy can overcome the dependence on fossil fuels worldwide. Renewable energy policies have become the key issue in both developing and developed countries; there is a need to focus on energy-related policies by regulatory authorities of these countries. The current study critically analyzes the performance of the existing renewable energy policy instruments to attract foreign direct investment (FDI) for solar energy development in Pakistan. We evaluate the moderating role of good governance and financial support between the nexus of renewable energy policy instruments and green FDI for the sustainable development of solar energy in the country. The present study used non-probability (purposive) sampling to collect data from 43 respondents (private investors, government officials, energy experts, and policymakers) by conveying an energy policy-related questionnaire survey. The response rate was 82.69%. The study has used partial least squares structural equation modeling to assess formulated hypotheses. The results indicate that the feed-in tariffs is the most effective policy instrument to attract FDI in the country's solar energy sector. The fiscal measures positively impact the green FDI for solar energy. The results further reveal that good governance and financial support positively and significantly moderate the nexus of renewable energy policy instruments and green FDI for solar energy. The main barriers have been identified over the whole solar energy spectrum. The study findings provide essential policy recommendations and a considerable manual for

Abbreviations: ARE, alternative energy; B2B, business to business; FDI, foreign direct investment; GFDI, green foreign direct investment; GW, Gigawatt; GWh, Gigawatt hour; IRENA, International Renewable Energy Agency; MW, Megawatt; MWh, Megawatt hour; NGO, non-government organization; RE, renewable energy; CAGR, compound annual growth rate; RPS, renewable portfolio standards; PV, photovoltaic; CO_2, carbon dioxide; SEM, structural equation modeling; PLS, partial least square; CR, composite reliability; AVC, average variance extracted; HTMT, heterotrait–monotrait; R&D, research and development; NEPRA, National Electric Power Regulatory Authority; AEDB, Alternative Energy Development Board; WAPDA, Water and Power Development Authority; CCO_2, consumption-based carbon emissions.

energy-related regulators, policymakers, and government institutions to adopt advanced renewable energy policy instruments to attract FDI in Pakistan.

Keywords: renewable energy, policy instruments, foreign direct investment, solar energy development, instrumental analysis, Pakistan

INTRODUCTION

Climate change and environmental problems have grabbed predominant attention in the past decade (Alola et al., 2021; Fareed et al., 2021; Adebayo et al., 2022a; Adebayo et al., 2022b) in political and economic discussions (Sun et al., 2019; Razzaq et al., 2021; Nuvvula et al., 2022; Wen et al., 2022). Modern life depends on reliable energy resources (Elavarasan et al., 2021; Wu et al., 2021; Abbasi et al., 2022; Ahmad et al., 2022; Miao et al., 2022); however, Pakistan faces a severe energy crisis, which has destructive impacts on the national economy (Tanveer et al., 2021). The energy shortage seriously affects people's professional and nonprofessional activities (Xiang et al., 2022). Like other developing countries, Pakistan requires massive energy to support its industry and large population (Ikram et al., 2019, 2020; Irfan et al., 2020). The electricity gap between demand and supply has been uncontrolled in the past few years, and this gap is pronounced in the summer season. The country faces the worst load shedding, that is, 10–12 h per day in urban areas and 16–18 h in rural areas (Chandio et al., 2021). In Pakistan, at least 51 million people, representing 27% of the total population, have no access to electricity, and half the population is deprived of clean cooking facilities (Irfan et al., 2021d). In Pakistan, by the end of May 2021, the total installed electricity generation capacity was 34,501 MW. It will increase to 53,315 MW by 2030.

Pakistan has a total potential of RE of about 167.7 GW, which is more than the country's total electricity demand (Ashraf and Iqbal, 2020). The National Electric Power Regulatory Authority (NEPRA) assesses a 66% share of thermal plants, and the remaining 34% is renewable energy encompassing solar, wind, hydroelectric, and bagasse-based technologies. The total energy production with power generation from 2019 to 2020 was 121,691 GWh (NEPRA, 2021a). The national energy mix by the end of May 2021, that is, the total energy production with power generation during the fiscal year 2019–2020, was 121,691 GWh, which includes 32% from hydroelectric plants, 57% from thermal plants, 8% from nuclear plants, and 3% from renewable energy (NEPRA, 2021b). The average electricity demand of the country is 17,000 MW; however, the authentic power generation is 14,000 in any season, and the government has to face a 3,000 MW average deficit that can rise up in summer to 5200 MW. The alternative renewable energy (ARE) policy has a clear direction that the country will achieve targets such as 20% of its electricity mix by 2025 and 30% by 2030 (GOP-Government of Pakistan, 2019). Conventional energy generation methods are required to replace the RE resources to achieve sustainable economic growth in Pakistan (Muhammad Kamran Khan et al., 2020). According to the Asian Development Bank, Pakistan's electricity consumption (kWh per capita) is 892. It is assumed to surge up with a CAGR of 5.8% by 2030 (SAARC, 2020). Currently, fossil fuels are the primary energy generation source of the country. The existing RE share is insufficient in the total energy mix due to unsuitable policies in the country.

The national economy is unable to afford a massive dependency on fossil fuels. Hence, the government needs to develop a new energy economy to adequately utilize RE sources such as solar, wind, or biogas to produce energy that can decrease the energy crisis. Pakistan has a vast solar power potential. Attractive policy incentives, a large market base, tropical geography, and research facilities can tackle the country's energy crises (Raina and Sinha, 2019). Currently, the government uses about 67% of the nonrenewable resources to meet the energy demand that is growing at 10% annually (Rafique and Rehman, 2017; Awan and Knight, 2020). Pakistan's RE sector only contributes 0.5% of the energy need, which is negligible (NEPRA, 2021a). By the end of 2020, the worldwide solar power installed capacity was 707 GW (IRENA, 2020). The SolarPower Europe agency explored that the worldwide solar capacity was 900 GW at the end of 2021 with a low scenario and 971 GW with a high system (Global solar council, 2021). Fortunately, the geographical location of Pakistan has plentiful potential for all types of renewable energy sources such as wind energy, solar energy, and bio-energy, which are nearly about 81 million tons/annum. The huge potential of biomass production to produce bio-energy by applying pyrolysis, gasification, transesterification, and combustion with different technologies can play a vital role in the economy of the country. The solar isolation is blessed with 5.5 Wh $m^{-2}d^{-1}$ in Pakistan, and the duration of annual mean sunshine is 8–10 hd^{-1} all over the country. The wind power potential is more than 20,000 MW, and the wind speed is 5–7 $m\,s^{-1}$ in the coastal regions of Baluchistan and Sindh (Ghafoor et al., 2016). Pakistan has a 136.05–287.36 W/m^2 intensity of solar radiation on an average monthly, but the practical intensity of solar radiation is observed as more than 200 W/m^2. In Cherat, 76.49 W/m^2 is the lowest intensity of solar radiation, but in Gilgit, 339.25 W/m^2 is the highest solar radiation during December. In Pakistan, Southern Punjab, Sindh, and Baluchistan have an average solar radiation intensity from 1,500 W/m^2 to 2,750 Wm^2/day and 10 h a day throughout the year. Pakistan has the energy potential to produce 45–83 MW per month from 100 m^2 in the regions mentioned above (Adnan et al., 2012b). This study focuses on four RE policy instruments for attracting foreign direct investment (FDI), producing wind energy, solar energy, and bio-energy. The policy instruments, namely, renewable portfolio standard (RPS), feed-in tariff (FIT), fiscal measure (FM) or tax incentives, and emission trading schemes (ETS) are for attracting investors in Pakistan to develop the solar energy sector. An FIT is a process implemented to develop and encourage RE technology investments, especially solar energy. This policy typically offers long-term contracts to producers (15–20 years) and deals with RE payments as advanced renewable tariffs for RE technologies. FIT is an extra incentive that funds the higher costs of renewables and lowers the generation costs for exporting generated energy and paying for any necessary upgrades to the electrical grid (United Nations ESCAP, 2012). The most powerful policy instrument can attract an FDI in RE projects. FM indicates a positive and significant impact on RE, especially in solar energy (Wall et al., 2019). RPS policies effectively promote wind energy generation in the United States (Menz and Vachon, 2006; del Río and Bleda, 2012). ETS aims to reduce carbon emissions through the market for tradable emission permits and sets a limit for carbon emission levels. In Europe and the United States, the other policy instruments indicate that interactions with ETS, energy production payment (EPP), and tendering (TEND) are negatively correlated with ETS depending on the abatement costs of various technologies and the admissible limit level of carbon emission. RE sources can be widespread expansion through policy instruments. E.T.S policy instruments are sometimes less efficient to EPP and TEND. Based on this evidence, we have selected these four policy instruments.

The literature has a gap concerning renewable energy policy instruments. The gap between power supply and demand has intensified due to large population. In Pakistan, the renewable energy sector has primarily inaccessible 1) renewable energy generation sources, 2) advanced directions of the energy sector, 3) arguments and renewable energy introduction, 4) complete energy sector evaluation, 5) energy mix, and 6) renewable energy sector's demand and supply gap. Even though the renewable energy sector has stayed under discussion by previous researchers (Kamran, 2018; Zafar et al., 2018; Irfan et al., 2019; Wang et al., 2020) and despite all research studies, some specific gaps have been identified, that is, 1) the proper utilization of the existing policy instruments and adopting new RE policy instruments to attract foreign investors by giving them tax incentives in RE investments; 2) assuming new instruments in the existing policy to attract foreign investors in the RE sector of Pakistan, principally solar energy; 3) the need to adopt advanced and effective policy instruments, such as modern FIT, tax incentives for solar energy, and RPS, which can globally attract FDI in the RE sector; and 4) green investment required by the country through the analysis of RE policy and policy instruments. In the current study, we have hypothesized on the RE policy instruments related to green FDI and have employed quantitative methods by PLS-SEM to test these hypotheses. This study is categorized into various sections. The next section discusses the research hypothesis development with a detailed literature review. The Research Methodology section provides the research design. The section Data Analysis and Results discusses testing of the hypotheses. The Discussions section discusses the findings of the study and its implications. Finally, the Conclusion section concludes the study and offers policy recommendations.

HYPOTHESIS DEVELOPMENT

Feed-in Tariff and Green Foreign Direct Investment

An FIT is a policy tool designed to promote renewable energy sources through investment. It promises to pay above the market price to small-scale solar energy or wind energy producers for what they deliver to the grid. Policies are to regulate and stabilize the price of RE (Mohsin et al., 2021). For producers, who produce clean energy, a remuneration will be provided to them through this mechanism. Based on the empirical finding in the literature, FIT is positively and significantly associated with attracting the total GFDI, such as in solar, wind, and the subsector of biomass (Wall et al., 2019). The present study evaluates the role of the RE policy instruments in attracting the GFDI in developing countries like Pakistan. FIT has a positive effect on the per-year capacity added by a country of per capita photovoltaic. The literature has underestimated the potential impact of FIT because a well-designed FIT has a much more significant effect than the average currently applied FIT effect. The well-designed FIT can be seven times greater than the total effect of the average FIT. Consistency significantly affects the effectiveness of the FIT when the tariff of FIT is low (Dijkgraaf et al., 2018). A previous research indicates that FIT has a positive and significant impact on numerous patent activities, especially in solar power (Böhringer et al., 2017). The RE production capacity is positively associated with economic growth. The policies of RE generation can increase the openness for foreign capital (Fotio et al., 2022). Pakistan has implemented an FIT policy to develop and promote the RE sector and eliminate the gap between demand and supply. With the inappropriate implementation of FIT policy in the RE sector, Pakistan's desired outcomes were not achieved. The FIT policy failed to create a healthy competition between the Government of Pakistan and its private and local investors in generating electricity (Pakistan, 2006).

Pakistan must revise its FIT policy to provide a stable political environment and financial incentives for solar energy development. RE policy instruments such as RPS, auctions, and FIT are the most effective instruments to reduce the RE project risk by increasing returns (Polzin et al., 2019). The FIT policy instrument is superior to attracting foreign investments in the solar energy sector due to its long-term agreements. Tax incentives and monetary subsidies positively promote the RE investment of the government of China, but the tax incentives have a more significant impact. The main supporting force is the subsidies to the development of micro-, small-, and medium-sized RE enterprises provided by the government of China (Yang et al., 2021). The empirical analysis shows that the FIT policy enhanced inventory turnover and profitability. The FIT policy is more favorable for private enterprises to increase inventory turnover. The solar photovoltaic industry of China has faced substantial effects on sustainable development by the FIT (Xia et al., 2020). The FIT policy tool has proved to reduce welfare loss (Ye et al., 2017). The policy of the region that could direct economic growth, globalization, and utilization of RE has indicated a significant effect on CCO_2 (Adebayo et al., 2022b). China had initiated these FIT policies in 2011 to promote the adoption of solar PV power (Polzin et al., 2019).

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FIT policies aim to bring down the cost of RE by accelerating circulation and encouraging the learning of green technology. The government purchases green energy under the FIT mechanism and sets it above the market price. We suggest the first hypothesis based on the above arguments.

Hypothesis 1. (H1): There is a positive association between FIT and green foreign direct investment

Renewable Portfolio Standard and Green Foreign Direct Investment

The RPS mechanism presents electricity companies with RE resources or the production of a particular share of electricity. The impact of RPS on the overall electricity capacity is a one-third increase, remains significantly positive for wind and solar capacities, and shows the most considerable effect with consistent estimates. RPS is extremely negative or insignificant for geothermal and biomass power (Janak, 2021). The RPS policy instrument has a positive significance in reducing the investment risk and increasing the return for foreign investors when designed in a particular way in solar energy. However, unfortunately, RPS is not implemented in Pakistan (Zhang et al., 2017). RPS can attract GFDI in the RE sector worldwide (Wall et al., 2019). Pakistan requires policy instruments for achieving ambitious targets. For the green pathway, the government is required to provide financial, legislative, and solid political commitments and overcome the demand–supply gap through the electricity of thermal power generation (Aized et al., 2018). This policy instrument is primarily adopted in developed countries to attract foreign investors to invest in the RE sector. Still, it needs to be adopted in developing countries like Pakistan. RPS obligations have proved and empirically confirmed effective instruments through different studies to promote investment in RE. The study indicates that RPS obligations positively and significantly affect energy generation, especially in European countries' bioenergy developments (Bolkesjø et al., 2014). RPS policies effectively promote wind energy generation in the United States (Menz and Vachon, 2006; del Río and Bleda, 2012). RPS and RE policy reforms are effective sources in promoting China's solar and wind power generation (Dong and Shi, 2019). RPS policies can be more effective if combined with carbon pricing policies because these policies discourage conventional fossil sources from generating electricity. Several states in the United States have implemented these policies to encourage incentives, growth, and development of alternative energy technologies (Ogunrinde et al., 2018). The influence of RE use on CO_2 emissions is negative, while economic growth, urbanization, financial development, and agriculture have a positive impact on CO_2 (Adebayo et al., 2022a). As a result of the above discussion, we suggest the second hypothesis.

Hypothesis 2. (H2): There is a positive association between RPS and green foreign direct investment

Fiscal Measures and Green Foreign Direct Investment

The government pays one-time fully or partially capital-covering investment costs to promote investments in RE. FM supports the RE investments through tax reductions. For the green pathway, the government is required to provide financial, legislative, and solid political commitments and overcome the demand–supply gap through the electricity of thermal power generation (Aized et al., 2018). FM or tax incentives indicate a positive and significant impact on Pakistan's solar energy projects and alternative energy projects by foreign investors. Carbon taxation and emission trading are carbon pricing instruments that attract GFDI in Pakistan. With foreign investors using tax incentives, FM shows a positive and significant impact on RE projects, particularly solar energy (Muhammad Kamran Khan et al., 2020). Export diversification and RE can increase the load capacity factor with maintenance of environment quality (Fareed et al., 2021). Pakistan has faced policy issues in the RE sector, so private and foreign investors are confused about investing. Financial and tax incentives need to be provided to local and foreign investors to resolve these issues. Fiscal instruments promote environmental goals by being cost-effective and highlighting tax cases, which include other financial tools that achieve the ecological target by complementing each other (Kamran et al., 2020). The most common solutions to protect the environment from polluting industries and convert them into clean energy resources are the carbon taxation on solar, wind, and geothermal sectors (Hao et al., 2021; Iqbal et al., 2021; Zhang et al., 2021; Elavarasan et al., 2022; Fang et al., 2022; Irfan et al., 2022). Fiscal policy reforms in energy projects will increase return rates and tax revenues refunded to investors (Islam et al., 2021; Khan et al., 2021). RE projects for hometown investors will become more exciting and feasible, and that is why the supply of money investments will increase (Gielen et al., 2019; Alola et al., 2021). Based on these results, we propose the third hypothesis as follows.

Hypothesis 3. (H3): There is a positive association between FM and green foreign direct investment

Emission Trading Scheme and Green Foreign Direct Investment

The ETS scheme used for clean energy production, consumption, and regulation of the market emission trading, "cap and trade," or allowance trading is a market-based approach to controlling and reducing pollution and greenhouse gas emissions cost-effectively. The empirical evidence disclosed that ETS and REC positively impact investment in RE, especially in the wind sector (Wall et al., 2019). ETS has two primary components: a limit on pollution and tradable allowances equal to the limit (specific emissions quality). It allows the buying and selling of greenhouse emissions for cost reduction and financial incentives. The earlier study discussed that ETS has no statistical significance to attract FDI at the comprehensive level but is positively associated with solar energy development. The empirical evidence disclosed that ETS and REC positively impact investment in RE, especially in the wind sector (Lin and Jia, 2020). The solar energy sector of Pakistan is required to adopt ETS to attract investors for energy production at a low cost. ETS works as a spring of RE generation and its revenue as a subsidy. ETS is also used for government

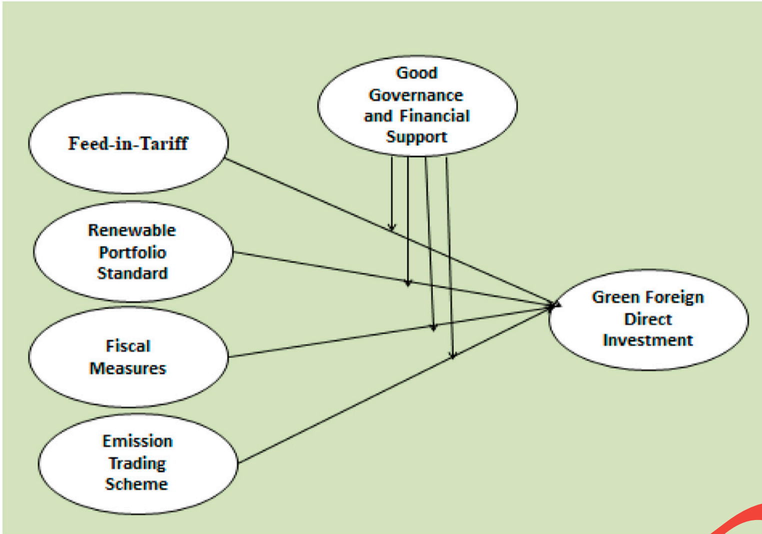

FIGURE 1 | Conceptual framework.

investment and consumption, which helps mitigate economic losses and caused investment by the government of China (McCrone et al., 2020). ETC aims to reduce carbon emissions through the market for tradable emission permits and sets a limit for carbon emission levels. In Europe and the United States, the other policy instruments indicate that interactions with ETS, energy production payment (EPP), and tendering (TEND) are negatively correlated with ETS, depending on the abatement costs of various technologies and limit levels of carbon emission. RE sources can be a widespread expansion through the ETS policy instrument (Keeley et al., 2018). Therefore, we suggest the fourth hypothesis based on the arguments above.

Hypothesis 4. (H4): There is a positive association between ETS and green foreign direct investment

The Moderating Role of Good Governance and Financial Support Between FIT and Green Foreign Direct Investment

Good governance is a process in which public institutions conduct public affairs and control public resources to promote rules and regulations. The complementarity between the indicators negatively affects CO_2 emissions of political and institutional governance and the financial sector. A good accompanied political and institutional governance can reduce carbon emissions with the development of the financial industry (Omri et al., 2021). The professional skills of deliverers should be strengthened and continuously maintained to improve their impact and output in renewable energy, and these are good governance guidelines (Majuri et al., 2020; Ahmad et al., 2021). Pakistan needs good governance in all sectors of life, but it is mainly required in the RE sector to eliminate the energy crisis by attracting GFDI. The green growth-related governance indicators with the highest maximum criterion value are 0.644 of the rule of law that plays a primary role in Pakistan. Good governance can play a vital role in achieving environmental sustainability objectives. All governance indicators can assist the legislators and organizations in understanding the importance of ISO 14001 certification to encourage sustainable practices in Pakistan (Abid et al., 2021). The country faces internal and external challenges, but good governance is a primary issue in political, sectarian, ethnic, and resource-based conflicts. Pakistan has focused on four types of indicators: the eradication of corruption, injustice, poverty alleviation, and nepotism; if it has taken them seriously, it will go a far way to ensure good governance in the country. Germany and Pakistan are already collaborating on renewable energy projects (Issue, 2019). Good governance supports the relationship of water availability with environmental degradation and renewable energy, but it has a weak relationship with FDI and environmental degradation (Ryota, 2018; Kousar et al., 2020). Moreover, we investigate the GFDI performance in the RE sector with the association of policy instruments. Finally, we have identified some specific research gaps after studying the literature in the proper utilization of the existing policy instruments and adopting new RE policy instruments to attract foreign investors by giving them tax incentives in RE investments. The policy gap by assuming new instruments to attract foreign investors in the RE sector of Pakistan, principally solar energy. There is a need to adopt advanced and effective policy instruments, including modern FIT, tax incentives for solar energy, and RPS, which can globally attract FDI in the RE sector. The country is requires green investment through the analysis of RE policy and policy instruments. The relationship of all parameters with green FDI is indicated in **Figure 1**. We suggest the fifth hypothesis, as a result, based on the above discussion.

Hypothesis 5. (H5): Moderating role of good governance and financial support between FIT and green foreign direct investment

Hypothesis 6. (H6): Moderating role of good governance and financial support between RPS and green foreign direct investment

Hypothesis 7. (H7): Moderating role of good governance and financial support between FM and green foreign direct investment

Hypothesis 8. (H8): Moderating role of good governance and financial support between ETS and green foreign direct investment

Research Methodology

The present study has applied a non-probability (purposive) sampling to collect data and attract GFDI in the solar energy sector for sustainable development. We have adopted four policy instruments for employing purposive sampling to present our sample from private investors, government officials, energy experts, and policymakers. We have surveyed from April to September (2021) to achieve this goal. Researchers faced stimulation of the delta variant that is the subtitle of coronavirus (COVID-19) when its pandemic was at the highest place in Pakistan (Irfan et al., 2021a; Irfan et al., 2021c); it was a very tough job to meet the related respondents. The researchers used social media apps to fulfill this purpose. Mobile applications, namely, WhatsApp and LinkedIn, were used to supply questionnaires. Purposive sampling is considered significant for assessing the entire population and theoretical generalization (Calder et al., 1981). The present research aims to evaluate RE policy instruments to attract GFDI and examine the moderating role of good governance and financial support among the nexus between RE policy instruments and GFDI in Pakistan. The respondents were selected using the following criteria: 1) respondents from different areas with diverse fields. The sector-wise quantity of the respondents was listed, such as private investors (11), government officials (7), energy experts (9), and policymakers (17); 2) relevant experience of the respondent was considered; and 3) the minimum limit for qualification of the respondent was a Bachelor's degree. The respondents were selected from diverse cultures and behaviors with a heterogeneous background according to the recruitment criteria. From this perspective, the selected sample size in this study is considered significant, and the findings are fruitful and considerable as these have been generated based on such a sample size with the heterogeneous attributes of the respondents.

Sample and Procedure

In this research, a total of 97 respondents were visited by different professionals, such as investors, RE experts, government officials, and policymakers. Among these, 89 agreed to participate in the study. After getting the respondents' consent, the researchers provided opened- and closed-hand questionnaires using a smartphone *via* WhatsApp and LinkedIn. Last, we received 82 filled questionnaires from the total respondents enrolled in this questionnaire survey. However, we had to discard four questionnaires due to non-relevant, inadequate, and unmatched responses. The calculated response rate was 87.64%. Finally, a total of 78 sample results showed valid responses from the different respondents for the analysis in this study. We had collected the personal data of the respondents through personal relations for investors using institutional websites for RE experts and policymakers and approached RE bodies for government officials. All findings are produced concerning the fair representation of the study sample. The respondents' demographic features (gender, age, experience and education) have heterogeneous backgrounds and respond properly in this research. The questionnaires have two sections: the first section covers the respondent's details, and the second section covers the questionnaires related to RE policy instruments to attract GFDI, sustainable solar energy development, and enhancement of energy supply and low-cost energy. **Table1** indicates the demographic profile of the respondents.

TABLE 1 | Demographic profile of the respondents.

Range	Features	Frequency	Percentage
Gender	Male	53	67.94
	Female	25	32.05
Education	Bachelor's	31	39.74
	Master's	28	35.89
	MS/M.Phil	19	24.35
Age, years	Less than 30	3	3.84
	31–40	21	26.92
	41–50	23	29.48
	51–60	18	23.07
	60 and above	13	16.66
Representative sector	Private investors	23	29.48
	Government officials	17	21.79
	Energy experts	22	28.20
	Policymakers	16	20.51
Work experience	1–3 years	11	14.10
	4–6 years	34	43.58
	7–10 years	17	21.79
	11–13 years	9	11.53
	>13 years	7	8.9

Instrument and Variables for the Measurement

The present study used scale items from the previous literature. The construct of feed-in tariff (FIT) policy instruments was measured with seven items (FIT). These seven items were taken and modified from a previous study (Cherrington et al., 2013). The eight items measuring the emission trading scheme (ETS) were adopted and modified from the study by Chen et al. (2017). Four items measuring the fiscal measures (FM) in the study were adopted and modified from the study by Onofrei et al. (2020). Six items measuring renewable portfolio standard (RPS) were adopted and modified from the study by Wall et al. (2019). Five items measuring good governance and financial support

TABLE 2 | Convergent validity analysis.

Constructs	Items	Loadings	Alpha	CR	AVC
Emission trading scheme	ETS1	0.921	0.978	0.981	0.865
	ETS2	0.942			
	ETS3	0.930			
	ETS4	0.931			
	ETS5	0.939			
	ETS6	0.926			
	ETS7	0.928			
	ETS8	0.924			
Feed-in tariff	FIT1	0.776	0.889	0.911	0.593
	FIT2	0.786			
	FIT3	0.778			
	FIT4	0.798			
	FIT5	0.715			
	FIT6	0.740			
	FIT7	0.792			
Fiscal measure	FM1	0.864	0.899	0.929	0.766
	FM2	0.876			
	FM3	0.882			
	FM4	0.880			
Green foreign direct investment	GFDI1	0.820	0.827	0.879	0.594
	GFDI2	0.818			
	GFDI3	0.843			
	GFDI4	0.651			
	GFDI5	0.703			
Good governance and financial support	GGFS1	0.982	0.965	0.974	0.884
	GGFS2	0.753			
	GGFS3	0.981			
	GGFS4	0.982			
	GGFS5	0.982			
Renewable portfolio standard	RPS1	0.836	0.893	0.919	0.655
	RPS2	0.853			
	RPS3	0.705			
	RPS4	0.760			
	RPS5	0.838			
	RPS6	0.853			

(GGFS), and all items of this moderator variable, had been adopted and modified from Ciborra and Navarra (2010) and Supriyati et al. (2019). Finally, five items measuring the GFDI had been taken as dependent variables and were adopted and modified from the studies of Hu et al. (2018) and Luo et al. (2021). We have employed a five-point Likert scale for assessing these items, specified as 1 for "strongly agree" and 5 for "strongly disagree."

Data Analysis and Results

The data were analyzed using this study's structural equation modeling approach (Ali et al., 2021; Irfan et al., 2021b). PLS-SEM is a component focus method used to analyze this study's rational dimensions (Urbach and Ahlemann, 2010). Many studies have used PLS-SEM due to its appropriateness and literature evidence (Hair et al., 2019; Ying et al., 2020); hence, the authors have employed it in this study. The use of structural equation modeling (SEM) in modern research can bring many benefits for fair analysis when compared to other approaches of traditional statistical analysis (Irfan and Ahmad, 2021; Irfan and Ahmad, 2022). PLS-SEM can assist our statistical analysis concerning the accuracy of results, efficiency in calculation, and convenience in findings (Henseler et al., 2015; Franziska et al., 2016). PLS-SEM is a second-generation technique, but it can solve issues regarding the first-generation analysis. PLS-SEM is a multivariate analysis instrument and is also helpful for analyzing abundant variables in the same model and time. PLS-SEM can simultaneously deal with multiple and complex relationships due to this unique quality; it is constantly widespread in business research (Chin and Newsted, 1999).

Management and social science research must adopt a suitable statistical tool because an improperly adopted analytical technique can explore inaccurate findings (Ramayah et al., 2010). PLS-SEM has two-stage analysis methods such as the measurement and structural assessment models, which provide results in two steps (Osborne, 2010). The measurement assessment model can provide the internal model assessment through validity and reliability of the currently used RE policy instruments in this study for attracting GFDI in Pakistan. The structural assessment model has many features, such as testing relationships and hypotheses or external model evaluation and risk assessment of the model for the RE policy instruments in this

TABLE 3 | Cross-loadings.

Items	ETS	FIT	FM	GFDI	GGFS	RPS
ETS1	**0.921**	–0.155	0.38	0.446	0.455	0.455
ETS2	**0.942**	–0.119	0.4	0.467	0.445	0.471
ETS3	**0.93**	–0.117	0.407	0.448	0.438	0.475
ETS4	**0.931**	–0.149	0.376	0.459	0.464	0.462
ETS5	**0.939**	–0.114	0.396	0.468	0.45	0.468
ETS6	**0.926**	–0.091	0.354	0.495	0.464	0.446
ETS7	**0.928**	–0.145	0.376	0.458	0.459	0.455
ETS8	**0.924**	–0.094	0.351	0.492	0.46	0.444
FIT1	–0.084	**0.776**	-0.121	-0.111	0.002	-0.091
FIT2	–0.096	**0.786**	-0.08	-0.075	0.026	-0.035
FIT3	–0.074	**0.778**	–0.089	–0.113	0.052	–0.003
FIT4	–0.158	**0.798**	–0.131	–0.14	–0.01	–0.061
FIT5	–0.069	**0.715**	–0.056	–0.028	0.088	0.042
FIT6	–0.05	**0.74**	–0.044	–0.076	0.044	–0.005
FIT7	–0.123	**0.792**	–0.048	–0.137	0.016	–0.07
FM1	0.35	–0.093	**0.864**	0.323	0.275	0.309
FM2	0.354	–0.096	**0.876**	0.328	0.326	0.389
FM3	0.345	–0.107	**0.882**	0.309	0.29	0.373
FM4	0.376	–0.097	**0.88**	0.368	0.347	0.403
GFDI1	0.398	–0.058	0.327	**0.82**	0.489	0.455
GFDI2	0.43	–0.142	0.359	**0.818**	0.437	0.46
GFDI3	0.404	–0.143	0.319	**0.843**	0.366	0.447
GFDI4	0.359	–0.099	0.185	**0.651**	0.264	0.305
GFDI5	0.338	–0.108	0.242	**0.703**	0.24	0.261
GGFS1	0.46	0.027	0.322	0.455	**0.982**	0.765
GGFS2	0.442	0.021	0.373	0.451	**0.753**	0.719
GGFS3	0.463	0.027	0.324	0.456	**0.981**	0.758
GGFS4	0.462	0.026	0.324	0.443	**0.982**	0.773
GGFS5	0.459	0.028	0.319	0.444	**0.982**	0.763
RPS1	0.386	–0.094	0.33	0.409	0.657	**0.836**
RPS2	0.451	–0.015	0.351	0.449	0.72	**0.853**
RPS3	0.315	–0.068	0.329	0.391	0.52	**0.705**
RPS4	0.398	0.006	0.348	0.38	0.642	**0.76**
RPS5	0.379	–0.097	0.332	0.406	0.657	**0.838**
RPS6	0.456	–0.015	0.36	0.45	0.709	**0.853**

study. We have employed PLS 3.0 software in the present study for the primary data analysis. PLS-SEM is used to scrutinize the links among the understudy model variables. Additionally, the structural equation modeling of covariance has a low statistical power than the partial least-square path modeling. PLS-SEM has preference and importance due to intercepting relationships while studying variables.

Furthermore, the variance-based SEM known as smart-PLS uses PLS, known as the path modeling approach to evaluate the nexus among the variables (Solangi et al., 2019). The main purpose of adopting the smart-PLS research hypotheses is to test and easily adopt a complex model in business research. There are two main approaches to smart-PLS: in this study, we have adopted both for research analysis, namely, the measurement assessment model and structural assessment model. The measurement assessment model can check the validity and reliability of constructs through discriminant and convergent validity. The convergent validity concerning correlation among all research items can be evaluated by using item loadings, composite reliability, and Cronbach's alpha. However, the cross-loading, heterotrait–monotrait ratio, and the Fornell–Larcker criterion were used to evaluate the correlation among the research variables associated with discriminant validity. Moreover, the measurement model could test and review the hypotheses using path analysis; the present study's analysis has been discussed in the Discussion section.

The present study has shown the links among the variables using path analysis. The current study results indicate that RE policy instruments such as feed-in tariff, renewable portfolio standard, fiscal measure, and emission trading schemes positively impact GFDI in Pakistan, and they accept H1, H3, and H4 and not H2. Moreover, the findings of this research also express that good governance and financial support significantly moderated the nexus between the feed-in tariff and fiscal measure and GFDI for solar energy in Pakistan; they accept H4 and H6. Finally, the findings of the measurement assessment model have indicated the nexus of convergent validity between the adopted RE policy instrument items in the current study. The table of convergent validity shows that the values of Alpha and CR are more significant than 0.70, while the values of AVE (Average Variance Extracted) and loading are greater than 0.50. The values of all items indicated convergent validity and high connection among all of the items. The study results also include correlation assessment among all items known as convergent validity. The figures of the convergent validity table highlighted that the CR values are more than 0.70, the AVE values are greater than 0.50, the Alpha values are more than 0.70, and the factor loadings have significant values more than 0.50. The above values indicated a valid convergent validity and high correlation among the items. **Table 2** shows all the results concerning convergent validity.

Measurement Assessment Model

In the current research study, the measurement assessment model is highly required to conduct validity and reliability tests of all constructs treated in the present model. The measurement assessment model approves the factor loadings of all items and confirms the validity and reliability of the constructs (Hair et al., 2019). The measurement assessment model is dependent on reliability tests such as internal consistency reliability and item reliability and on validity tests such as discriminant validity and convergent validity (Hair et al., 2011). The item reliability has been measured above the outer loading, and internal consistency reliability has been measured over CR. Finally, the convergent validity has been measured over AVE. The cross-loadings of all items are in a higher position along with the inception value of 0.50 (see **Table 2**. The present study analysis confirms that all values of the average factor loadings must be greater than 0.50, and each observation should contribute to the constructed variables. The suggested value of 0.50 should exceed the AVE. The measurements should be considered reliable when the value of CR of each standard surpasses the cutoff point of 0.70. The results of the selected RE policy instruments indicate that all the values of CR were between 0.879 (GFDI) and 0.981 (emission trading scheme). All values of AVE were between 0.593 (feed-in tariffs) and 0.884 (good governance and financial support). All the values of other additional loadings were between 0.50 and 0.982. The measurement assessment model indicates all the verified reliability and validity values in **Tables 2** and **3**. All items'

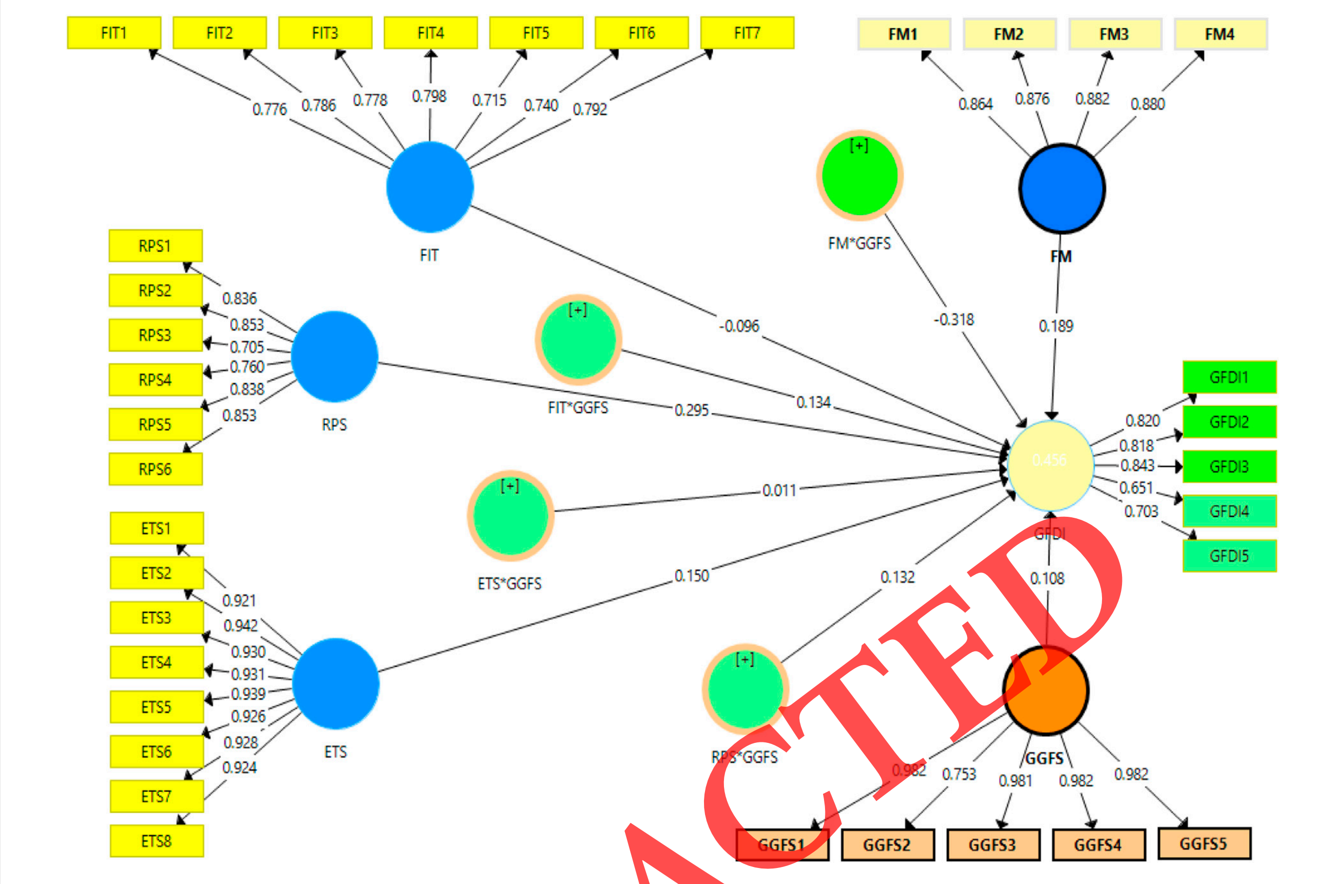

FIGURE 2 | Measurement assessment model.

convergent validity is valid in this model, and the real factor loading values are more significant than 0.50.

The assessment of correlation among the variables is presented in the research study findings as discriminant validity. There is a low correlation among the variables by indicating these values, and the discriminant validity is verified for the selected RE policy instruments in this study for solar energy. In **Table 3**, the bold values of all factors indicate a strong relationship, while it shows weak relationships with the other row-wise factors. These cross-loading table values are compared row-wise with other factors to check discriminant validity. Good governance and financial support values show strong discriminant validity in this study because row-wise, all values are greater than the other factors and so on. All bold values are greater than the values to their left and right in **Table 3**. **Figure 2** shows the measurement assessment model that displays the factor loadings of the variables.

Using the HTMT ratio of correlation measures the discriminant validity, which is more appropriate than the Fornell–Larcker criteria because many researchers criticize it (Akbar et al., 2019). If the value of discriminant validity is less than 0.85, it will be considered valid (Cohen, 1988) or 0.90 (Irfan et al., 2021b). **Table 4** shows that all values are lower than 0.90. The discriminant validity has also been indicated in the findings section nexus among the variables. The discriminant validity is tested through cross-loadings. The discriminant validity is valid and has a low connection among the variables. **Table 5** shows all highlighted values. The HTMT ratio is the latest approach used to test discriminant validity. The figures of the HTMT ratio indicate lower values than 0.90. These values are expressed as valid discriminant validity with less correlation among variables (see **Table 4**).

Structural Assessment Model

The structural assessment model and measurement assessment model are the two important steps of smart-PLS. We discuss here the structural assessment model which deals with checking the relationship between endogenous and exogenous variables. This model presents the various types of statistical values, namely, path coefficient (β values), coefficient of determination (R^2), predictive relevance (Q^2), effect size (f^2), and t-values. The criteria are provided by the PLS-SEM literature to estimate the level of significance of the path coefficient and evaluate the hypotheses. The bootstrapping process is applied by using 5,000 subsamples with a 5% significance level (one-tailed) to evaluate the significance level of the hypotheses (Hair et al., 2011). The results show that only H2 is not accepted, while the remaining hypotheses results are ETS ($\beta = 0.150$, $t = 2.229 > 1.64$, $p < 0.05$), ETS

TABLE 4 | Heterotrait–monotrait ratio.

Variables	ETS	FIT	FM	GFDI	GGFS
ETS					
FIT	0.130				
FM	0.435	0.118			
GFDI	0.557	0.152	0.430		
GGFS	0.503	0.050	0.38	0.522	
RPS	0.527	0.086	0.471	0.582	0.868

Notes: N = 43; ETS, emission trading scheme; FIT, feed-in tariff; FM, green foreign direct investment; GGFS, good governance and financial support; RPS, renewable portfolio standard.

relationship (moderator) (β = 0.011, t = 0.227 > 1.64, $p < 0.05$), feed-in tariff (FIT) (β = −0.096, t = 1.983 > 1.64, $p < 0.05$), FIT relationship (moderator) (β = 0.134, t = 2.154 > 1.64, $p < 0.05$), fiscal measure (FM) (β = 0.189, t = 2.781 > 1.64, $p < 0.05$), FM relationship (moderator) (β = -0.318, t = 4.820 > 1.64, $p < 0.05$), renewable portfolio standard (RPS) (β = 0.295, t = 3.418 > 1.64, $p < 0.05$), and RPS relationship (moderator) (β = 0.132, t = 2.014 > 1.64, $p < 0.05$) and have a significant and positive impact on GFDI.

The model has substantial explanatory power because the value of R^2 for ETS→GFDI is 0.439, which indicates that the RE policy instruments can attract GFDI for solar power projects. However, the efficiency and effectiveness of the model are not only measured with the value of R^2; this individual value cannot assist the model (Hair et al., 2021). Subsequently, in Q^2, the predictive relevance measurement of the structural assessment model is an appropriate method. The Q^2 value is considered more refined and sophisticated than 0 and is demonstrated with the latent exogenous standards by extreme predictive relevance (Akbar et al., 2019). In the present study, the Q^2 value is 0.251, indicating that the model has positive and significant predictive relevance and suggesting that the GFDI in solar energy increases through adopted RE policy instruments such as FIT. ETS, FM, and RPS in this study. There is a technical value of f^2. This includes 0.02, 0.15, and 0.35 and displays the three types of effects, that is, small, medium, and large, respectively (Cohen, 1988). Therefore, there are differentiations in the effect size of the f^2 values from medium to large (see **Table 5**). Many kinds of statistical techniques are used in this study, which are presented in **Table 5**. **Figure 3** shows the structural assessment model. In the present study, all variables indicate a positive and significant relationship in the model, and the t-values display more serious than 1.64, and the emission trading scheme does not have a positive and significant impact on the GFDI for solar energy. The results of the present study indicate that the values of the moderating variables have a significant relationship with the positive signs in the structural model to attract GFDI for solar energy in Pakistan.

DISCUSSIONS

Main Findings

The shortfalls of energy and severe load-shedding of electricity in Pakistan have compelled policymakers and local people to consider alternative energy sources. The RE policy instruments are positively associated with GFDI. The findings of this study indicate that the FIT policy instrument is the most suitable RE policy instrument to attract GFDI based on solar and wind energy. The results support a past study (Wall et al., 2019), which described that the FIT policy positively increases the renewable energy share. The FIT policy tool ensures the compensation for renewable energy producers on a specific period at a fixed rate. Furthermore, the results reveal that the selected policy instruments of RE in this study, such as RPS, FM, FIT, and ETS, have positively significant correlation with GFDI, especially in the solar energy sector in Pakistan. The results of this study are in line with past studies (Adnan et al., 2012a), which show that the FIT policy is an important policy instrument that can attract worldwide FDI in renewable energy. The study shows that FDI is the most effective policy instrument that can play a vital role to attract GFDI for the solar energy sector in Pakistan and internationally. These results align with the past study of Liao and Shi (2018), which shows that RE policy instruments such as FIT facilitate RE generation growth across international economies. The RPS policy has a positive role in attracting GFDI for solar energy, but it has not been implemented in Pakistan. The results of the current study match with those of a past study (Mirza et al., 2009), which shows that the RPS policy instrument has a positive significance in reducing the investment risk and increases returns for foreign investors when designed in a particular way in the solar energy sector. FM or tax incentives indicate a positive and significant impact on alternative energy projects, particularly in solar energy projects through foreign investors in Pakistan. The results of this study are the same as

TABLE 5 | Structural assessment model results (hypothesis testing).

Hypotheses	Relationship	Beta	SD	T-statistics	P values	Supported	R^2	Q^2	f^2
H1	ETS→GFDI	0.150	0.067	2.229	0.014	Yes	0.439	0.251	0.025
H2	ETS*GGFS→GFDI	0.011	0.048	0.227	0.41	No		0.243	0.021
H3	FIT→GFDI	−0.096	0.048	1.983	0.025	Yes			0.16
H4	FIT*GGFS→GFDI	0.134	0.062	2.154	0.017	Yes			0.030
H5	FM→GFDI	0.189	0.068	2.781	0.003	Yes			0.048
H6	FM*GGFS→GFDI	−0.318	0.066	4.820	0.000	Yes			0.135
H7	RPS→GFDI	0.295	0.086	3.418	0.000	Yes			0.043
H8	RPS*GGFS→GFDI	0.132	0.066	2.014	0.023	Yes	0.456		0.028

Notes: N = 43; ETS, emission trading scheme; FIT, feed-in tariff; FM, green foreign direct investment; GGFS, good governance and financial support; RPS, renewable portfolio standard.

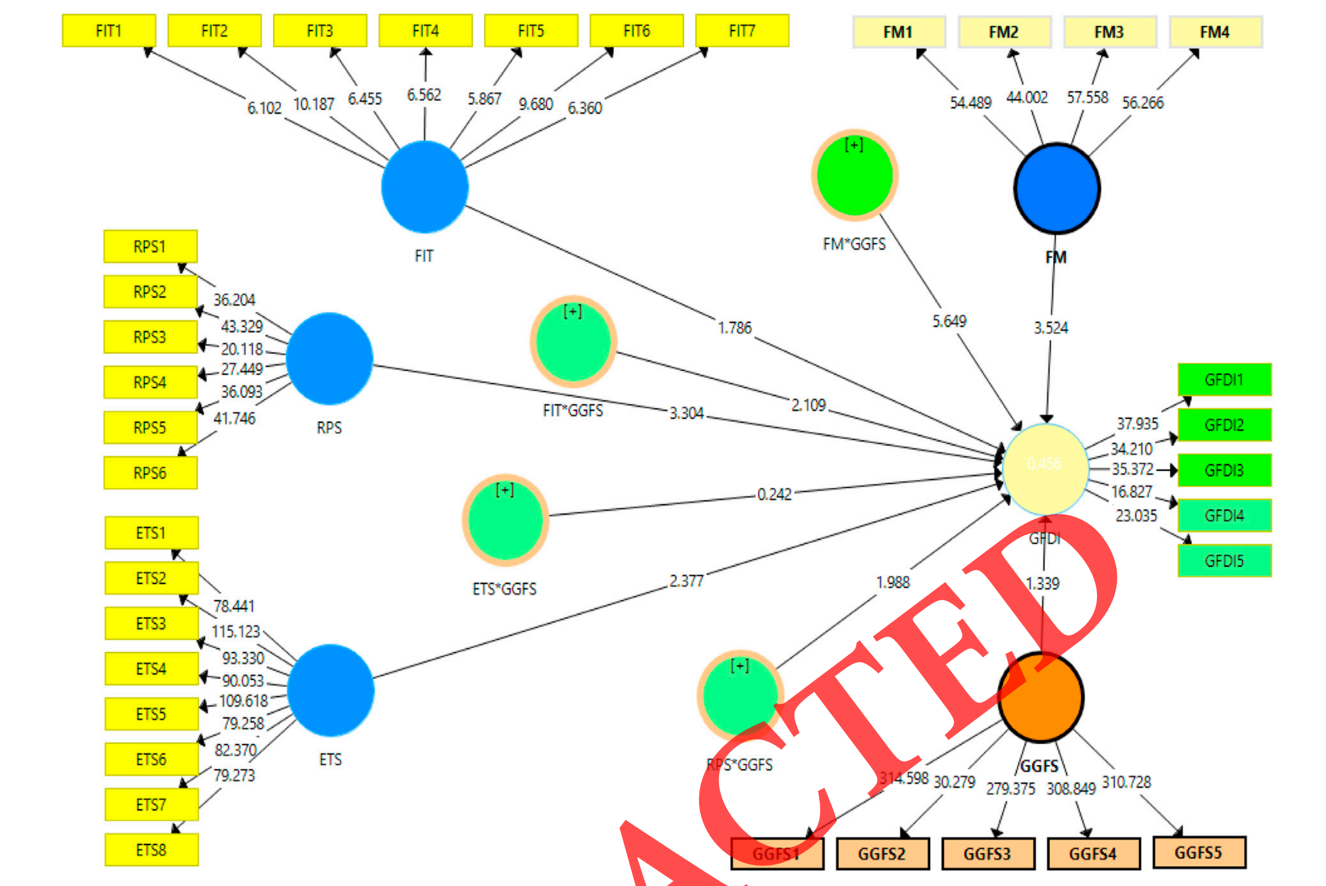

FIGURE 3 | Structural assessment models.

those of a past study (Mehran Idris Khan et al., 2020), which shows that FM has a positive and significant impact on solar energy projects to attract foreign investors using tax incentives. Conversely, public investments indicate a negative relationship with GFDI, and investors do not depend on government funds.

The vast potential of renewable energy sources is not appropriately utilized to overcome the energy shortage in Pakistan due to the lack of promoting policies and attractive infrastructure (Rafique et al., 2020). The present study will fill the policy gap by assuming advanced instruments in the existing policy to attract foreign investors in the solar energy sector. FIT, tax incentives, and RPS are the most powerful policy instruments which globally attract FDI in the RE sector. Many researchers found challenges in RE policy instruments. Still, no single researcher has described and evaluated the existing RE policy instruments over different factors to realize the best policy instrument to attract FDI for Pakistan. It is essential to conduct comprehensive research to bridge this research gap. This study will realize the most effective policy instrument to attract FDI for Pakistan. We have compared the efficacy of four RE policy instruments, namely, FIT, RPS, FM, and ETS, to attract investors for Pakistan to develop the solar energy sector. The research findings indicate that the FIT policy for solar energy is the best policy instrument due to many factors such as long-term (15–20 years) contracts, cost-based compensation, price certainty, and different prices for different RE sources. The model has substantial explanatory power because the value of R^2 for ETS→GFDI is 0.439, which indicates that the RE policy instruments can attract GFDI for solar power projects. Subsequently, in Q^2, the predictive relevance measurement of the structural assessment model is an appropriate method. In the present study, the Q^2 value is 0.251, which indicates that the model has a positive and significant predictive relevance and suggests that GFDI in solar energy increases through adopted RE policy instruments, such as FIT, ETS, FM, and RPS. In the present study, all variables indicate a positive and significant relationship in the model of this study, where the t-values display more serious than 1.64, and the emission trading scheme has no positive and significant impact on GFDI for the solar energy sector.

Major Challenges and the Future Prospects

The FIT policy is significant for Pakistan if it is adequately implemented. Additionally, we have discussed the significant barriers associated with solar energy in Pakistan through semi-structured interviews with private investors, government officials, energy experts, and policymakers. Finally, policy recommendations are proposed for the government institutions and policymakers to revise RE policy instruments and attract foreign and local investors to develop solar energy for Pakistan by eliminating these barriers.

Pakistan has a massive potential in RE, particularly in solar energy; however, the energy sector faces specific policy barriers, which are a significant hurdle to attracting FDI in Pakistan. Therefore, the country needs to remove and overcome these tremendous barriers to attract investments from international investors by employing alternative RE technologies effectively and efficiently. RE policies are not clearly defined for international and local private investors' participation in the RE sector, especially solar energy. Delay in allotments or clearance for international or local private investors discourages renewable projects. Buying power generators at a fixed-rate power purchase agreement structure is an insufficient incentive at fluctuating costs for RE sources for international or local power generators. The environmental structure is insufficient and weak for local and international investors. The existing FIT system is not justified and implemented adequately to attract FDI. It is mainly focused on the old and traditional power sources and lacks international-level policies for RE. Subsidies have a misbalance, and the central part of grants is provided to petroleum fuels compared to renewable sources to attract FDI. Unsatisfactory cooperation and coordination among the various policymaker ministries, agencies, institutes, and other stakeholders can delay the policy implementation. Delays in project allotments in renewable energy to international or local investors are significant reasons to demotivate international investors and limit the development, promotion, and commercialization in RE. The energy sector is deprived of overall coordination due to the absence of a central body. That is why R&D activities have repeated results. Being ineffective and lacking international-level legislation, the existing energy policies are non-effective to electricity prices and present regulations leading to misuse of subsidies and grants. The RE sector of Pakistan faces non-incorporation issues in the regulatory policy, and renewable technology penetration is limited due to the lack of awareness among policy regulators.

The RE sector faces technical barriers, high-risk perceptions, and resource assessment uncertainties to obtain financial loans. Small-scale projects of RE are facing the issue of financial resources and inappropriate lending facilities. International investors hesitate to invest in the RE sector of Pakistan due to many factors, including the short payback period and the high discount rate. However, these conditions can attract the investors, such as low capital costs of generation options, availability of a high efficiency, and shorter growth periods. The investment cost is a barrier due to the non-provision of financial support in the RE industry. Due to non-financial supports, incomplete working capital requirements, weak consumer service infrastructure, and operating and maintaining equipment, the RE policy always failed due to political issues in Pakistan. The fundamental and developing RE systems require an essential change, but the government machinery has failed in front of some politicians in making the necessary change. Pakistan faces operational RE issues, like weak plans, political influences, unrealistic targets, and small environmental R&D. The primary deficiency of the democratic government in Pakistan is prioritizing the policy of theory but a little bit to practice. Political parties misuse their power, and all subsidies of the renewable energy sector are used in another sector. The alternative energy sector is facing an absolute lack of politicians' will. Conflicts among political parties are the major issues for the energy sector in Pakistan. Political parties are working for the next election and not for the public issues in Pakistan. Political parties need to revise their democratic rule and consider energy shortage as a national issue.

The local technology of the solar system is not matched in Pakistan, and the country's federal government is not producing solar cells. The country depends on import-based technology for equipment and all essential parts. The solar radiation intensity is not checked with authentic solar maps. Large projects of solar energy depend on foreign sources to install and operate. Pakistan faces technical complications, such as inefficient knowledge of maintenance and operations, insufficient research and development initiatives, limited infrastructure availability, and unavailability of standards and energy storage. There is a lack of procedures and guidelines in RE technology with regard to performance, reliability, and durability. Due to these issues, RE cannot achieve large-scale commercialization goals. The primary technical issue is storage disturbing electricity grids due to the misbalance in demand and supply. Finally, the study has discussed conclusions in the last section. Hence, interested researchers must also identify the rest of the elements to adopting solar energy while considering the results of this study. We have selected RE policy instruments in developing countries such as Pakistan. Thus, the current study results are not equally valid for developed and underdeveloped countries. Therefore, the authors in the future must investigate the encouragements to attract investors for investment in solar energy in developed countries. Numerous factors and policy instruments other than those in this study affect GFDI. Upcoming researchers of this field are needed to analyze the other factors, except those that the current study has discussed. The single-source data collected in this study are not comprehensive for data collection. For the betterment of data validity, future scholars are encouraged to apply more data collecting sources while replicating the present research. Similarly, the research has evaluated the RE policy instruments currently working to attract FDI and those launched by the national policy in Pakistan being a developing economy. Consequently, the present study is equally valid for developed and developing nations. Therefore, authors in the future must identify the impact of other policy instruments on RE to attract FDI in both underdeveloped and developed countries.

CONCLUSION

Every country's progress and economic growth depend on a balanced energy supply in all sectors, even developed or developing economies. Developing economies such as Pakistan produce electricity through traditional fossil fuels to satisfy their county's need. Still, the demand and supply of energy have been unbalanced due to the increasing population and developments in heavy industries. Furthermore, the results reveal that the selected policy instruments of RE in this study, such as RPS, FM, FIT, and ETS, have been positively significant with GFDI, especially in the solar energy sector in Pakistan (see **Table 5**). The study has shown that FIT is the most effective policy instrument to play a vital role in attracting GFDI for solar energy in Pakistan and internationally. The RPS policy has a positive role in attracting GFDI for solar energy, but it has not been implemented in Pakistan. FM or tax incentives indicate a positive and significant impact on alternative energy projects, particularly in solar energy projects through foreign investors in Pakistan. Conversely, public investments indicate a negative relationship with GFDI; investors do not depend on government funds. The study also indicates that carbon taxation and emission trading are carbon pricing instruments that significantly attract GFDI, but it is not implemented in Pakistan. Government funds or public investment for solar energy projects are not attracting private foreign investment due to the fact that they are not observed to be stable in the long run.

We investigated in this article that RE policy instruments are not fully facilitated to attract GFDI in the RE sector, especially in solar energy for Pakistan. Furthermore, Pakistan's RE policies and tax incentives are not satisfactory in attracting FDI or investors to invest in the solar power sector of Pakistan. We discovered that other factors also play a prominent role in attracting GFDI instead of policy instruments. The results indicate that the FIT policy attracts GFDI in RE for all categories, but it is not correctly implemented in Pakistan. RPS and FM (tax incentives) policies are also positive and significant in attracting FDI for solar energy in Pakistan and significantly impacting Pakistan's solar and other alternative energy projects through foreign investors. The present study results indicate that the values of moderating variables (good governance and financial support) have a significant relationship with the positive signs in the structural model to attract GFDI for solar energy in Pakistan. Carbon pricing instruments such as carbon taxation and emission trading attracted GFDI in Pakistan. The government's funds or investments for solar energy projects are not attracting private foreign investment due to the fact that they are not perceived as stable in the long run. Pakistan has an insufficient technical infrastructure and inappropriate financial resources to achieve the extension of RE technologies.

These results are applicable in other South Asian countries such as India, Sri Lanka, and Bangladesh by adopting FIT, RPS, FM, and CT policy instruments to attract FDI in the RE sector, especially solar energy. To develop and promote the RE sector, the government of Pakistan has advised specific policy recommendations to overcome the solar energy barriers discussed above (Aized et al., 2018; Irfan et al., 2019). Institutions relating to RE, the government, NGOs, and stakeholders should increase solar energy demand in Pakistan by working in a coherent and integrated way. These conclusions are drawn implicitly; there is a need to conduct further qualitative studies elsewhere in the scope of this research. However, we recommend this exciting and potential research direction for advanced research. Therefore, future authors must analyze the influences of other RE policy instruments such as CT to attract GFDI for solar power projects in other developing economies. Furthermore, with regard to data limitation, future studies are required to increase a large sample of the countries and country-level FDI data. The same survey can also be conducted in other Asian developing countries or states to check the availability of RE policy instruments for provincial governments to attract GFDI with low-carbon energy technologies.

Policy Recommendations

Moreover, the government should hire international and local professionals specializing in solar energy from developed nations. The country should increase RE resources by adopting RPS and FIT and reducing the heavy burden from fossil fuel power. These policy instruments can attract and motivate power producers to invest in solar energy. The country should establish sustainable and innovative financing programs to expand RE technologies. For the promotion and development of RE, the government should maintain an RE fund and lend based on attractive terms and conditions, especially for small investors. NEPRA and AEDB should consult to solve the limits of tariffs, define criteria for taxes, and purchase power from non-utility producers. Design specific power purchase mechanisms for wind and solar generation projects on a commercial scale.

The current study creates both empirical and theoretical implications. The significant literary research contributes to RE policy and CO_2 emission reduction literature globally. This study compacts with the influence of four policy instruments of RE, FIT, RPS, FM, and ETS, to attract GFDI in the country. This study adds to the literature by introducing the impact of these four RE policy instruments on GFDI for both developed and developing countries like Pakistan. The current study provides practical guidelines to the full institutional RE government bodies, ADEB and NEPRA, to adopt and adequately implement the existing policy instruments to attract local and foreign investors in the sustainable development of solar energy projects in Pakistan. The research study is of extreme importance to the RE policymakers and competent authorities of the energy sector such as Pakistan because the appropriate guideline of this research study improves the performance of the energy sector by attracting GFDI in solar energy projects. The best planning for RE policy instruments can attract local and foreign investors to improve the performance of solar energy projects by increasing GFDI in the country. Hence, RE policy instruments can attract a considerable investment and FDI in solar energy projects if the policy instruments are adequately defined by the competent government bodies and a government-owned statutory body: the WAPDA in Pakistan.

Additionally, Pakistan's RE policies and tax incentives are not satisfactory in attracting FDI or investors to invest in the solar power of Pakistan. We also discovered that other factors play a prominent role in attracting GFDI instead of policy instruments. For example, an FIT policy has been proved to attract GFDI in RE for all categories, but it is not correctly implemented in Pakistan.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusion of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

This research study was conducted according to the Declaration of Helsinki guidelines and with the approval of the Institutional Review Board of the Superior University, Pakistan (protocol code 815-3 on 10-09-2021). The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

SA: Conceptualization, writing—original draft, formal analysis, data handling, variable construction and methodology, and writing—review and editing. QY: supervision and funding acquisition. MI: Software, Methodology, Writing-review and editing, WA: Writing-review and editing. DWA: Writing-review and editing. AA-D: Writing-review and editing.

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