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Impact of Foreign Direct Investment on Power Sector"an Emperical Evidence From Pakistan

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Abstract

This thesis examines the impact of Foreign Direct Investment (FDI) on Pakistan's power sector, focusing on its role in addressing energy shortages, influencing infrastructure development, and shaping the investment climate through energy policies. The study addresses key research questions, including how FDI has contributed to alleviating energy shortages, the effect of FDI-driven projects on infrastructure development, and the influence of Pakistan's energy policies on FDI inflows. A quantitative research design, based on secondary data analysis, is employed to investigate the causal relationship between FDI inflows and key performance indicators (KPIs) of the power sector, including electricity production, sectoral GDP contribution, and the adoption of renewable energy. The research uses descriptive statistics, correlation analysis, regression analysis, and ANOVA to analyze the data and draw conclusions about the effect of FDI on the power sector. The findings reveal that while FDI inflows show a moderate correlation with electricity consumption and energy shortages, the statistical evidence does not confirm a significant causal relationship. Additionally, the impact of FDI on infrastructure development and energy policies remains inconclusive, suggesting that other external factors, such as government policies and energy efficiency initiatives, may play a more substantial role. Based on these findings, the thesis recommends future research that incorporates additional variables like policy changes, energy efficiency, and renewable energy investments. It also suggests expanding the dataset to include longer periods for better statistical significance and focusing on sector-specific FDI data to further explore the role of renewable vs. fossil fuel energy investments in Pakistan's power sector.

Keywords: Foreign Direct Investment (FDI), Pakistan's power sector, Electricity production.

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INTRODUCTION

Foreign Direct Investment (FDI) plays a crucial role in the development and sustainability of emerging economies, particularly in capital-intensive sectors like energy and power. As Pakistan grapples with an increasing gap between energy supply and demand, FDI has been actively pursued to mitigate energy shortages, modernize infrastructure, and enhance overall energy production capabilities (Shahbaz, 2016). The importance of FDI in this sector cannot be understated, as it provides much-needed financial resources, advanced technologies, and operational expertise that local firms often lack. The power sector in Pakistan faces multiple challenges, including outdated infrastructure, high transmission and distribution (T&D) losses, and an unstable energy supply. These issues are

exacerbated by rapid population growth and the expanding needs of industrialization, making investment in energy infrastructure a top priority for sustainable economic growth (Khan & Jamil, 2020). When strategically implemented, FDI can help resolve these challenges by introducing state-of-the-art technologies, improving management practices, and ensuring greater efficiency in power generation and distribution (Bertheau et al., 2019).

While these reforms have had a positive impact, their long-term success depends on political stability, enforcement consistency, and continued policy improvements (Zubair & Asad, 2018). This study aims to analyze the impact of FDI on Pakistan's power sector, with a focus on the following research questions:

- How has FDI contributed to addressing energy shortages in Pakistan?
- What is the impact of FDI-driven projects on infrastructure development in the power sector?
- How have Pakistan's energy policies influenced FDI inflows, and what can be done to improve the investment climate?

Through historical data analysis, case studies of major FDI projects, and a review of relevant policy frameworks, this study will evaluate the role of FDI in transforming Pakistan's power sector and its broader economic impact.

Pakistan's power sector has long been confronted with a series of persistent challenges that severely hinder the country's economic growth and development. These challenges include widespread energy shortages, an inefficient transmission and distribution system, outdated infrastructure, and an over-reliance on fossil fuels. The energy crisis in Pakistan has become one of the most critical issues, with frequent power outages, low levels of electricity supply, and an increasing energy demand driven by population growth and industrialization (Khan et al., 2020). Despite efforts by the government to improve the sector through various reforms and projects, Pakistan's energy infrastructure remains underdeveloped and unable to meet the rising demand for electricity (Shahbaz, 2016).

The Government of Pakistan has increasingly recognized Foreign Direct Investment (FDI) as a key tool for addressing the sector's deficiencies. FDI in the power sector can provide much-needed capital for infrastructure projects, introduce modern technologies, and foster operational improvements that local resources may be unable to supply (Afzal & Ahmad, 2017). Furthermore, FDI can play a pivotal role in reducing transmission and distribution losses, which are significant problems in Pakistan's electricity network (Zubair & Asad, 2018).

However, the inflow of FDI into Pakistan's power sector has been inconsistent and often limited. A variety of factors contribute to this issue, including political instability, regulatory challenges, security risks, and bureaucratic inefficiencies (World Bank, 2018). Despite policy measures such as tax incentives and attempts at regulatory reforms, the foreign investment climate in Pakistan remains uncertain and unattractive to many potential investors (UNCTAD, 2021). Consequently, the power sector continues to face financing gaps, preventing the country from achieving energy security and sustainable economic growth. This study aims to examine the impact of FDI on the development of Pakistan's power sector, with a focus on how foreign investments have addressed energy

shortages, improved infrastructure, and contributed to the sector's modernization. The research will also assess the role of government policies in shaping the FDI landscape and explore how these policies can be improved to attract more sustainable and long-term investments. By identifying both the opportunities and barriers to FDI, this research seeks to provide actionable insights that can inform policy decisions, improve the investment climate, and ultimately help address Pakistan's energy crisis

THEORETICAL FRAMEWORK

Foreign Direct Investment (FDI) in the power sector is underpinned by several economic theories that explain the rationale, impact, and dynamics of foreign investments in developing economies. These theories provide a structured understanding of how FDI influences economic growth, infrastructure development, and efficiency improvements in Pakistan's power sector. The most relevant theoretical foundations include the **Neoclassical Growth Theory**, **Market Imperfections Theory**, and **Eclectic Paradigm**.

Neoclassical Growth Theory

The Neoclassical Growth Theory, introduced by Solow (1956), emphasizes the role of capital accumulation in economic development. According to this theory, an increase in capital stock—such as FDI inflows—enhances productivity, facilitates technological advancements, and ultimately drives economic growth. In the context of Pakistan's power sector, FDI contributes to capital accumulation by funding the development of new power plants, upgrading transmission and distribution networks, and supporting the expansion of renewable energy projects.

One of the critical insights from this theory is the concept of diminishing returns to capital. As domestic capital reaches its limits, external financing through FDI can play a crucial role in maintaining growth momentum by introducing superior technologies and expertise that local firms may lack. Empirical evidence suggests that FDI inflows in Pakistan's energy sector have facilitated improvements in efficiency, reduced energy losses, and increased overall capacity (Afzal & Ahmad, 2017). However, the theory also suggests that without complementary investments in human capital and institutional reforms, the long-term impact of FDI on productivity may be limited.

Market Imperfections Theory

Developed by Hymer (1976), the Market Imperfections Theory argues that FDI arises as a response to market failures and imperfections, such as lack of access to technology, managerial expertise, and financial constraints in developing economies. In Pakistan's power sector, FDI helps bridge critical gaps by introducing state-of-the-art technologies, efficient management practices, and alternative energy solutions that local firms may not possess. Pakistan's energy market has long been characterized by inefficiencies, including high transmission and distribution (T&D) losses, regulatory uncertainties, and financial constraints. FDI has played a pivotal role in addressing these imperfections by facilitating the adoption of smart grid technologies, improving operational efficiencies, and enhancing financial sustainability through investment in cost-effective energy solutions (Shahbaz, 2016). Furthermore, foreign firms often bring expertise in regulatory compliance and international best practices, which can help streamline the governance of Pakistan's power sector. Despite these advantages, the theory also highlights the risks

associated with foreign investment, such as profit repatriation, dependency on external firms, and potential crowding out of local enterprises. Therefore, while FDI can mitigate market failures, it requires careful regulatory oversight to ensure that foreign investments align with national energy goals and contribute to long-term economic stability.

Eclectic Paradigm (OLI Framework)

The Eclectic Paradigm, also known as the OLI Framework, was developed by Dunning (1988) and is widely used to explain the motivations behind FDI. This paradigm suggests that firms engage in foreign investment when they possess a combination of three advantages:

- **Ownership Advantage (O)** – Refers to firm-specific assets such as advanced technology, patents, brand reputation, and managerial expertise. In the case of Pakistan's power sector, foreign firms often bring cutting-edge energy technologies, efficient project management skills, and operational expertise that domestic firms may lack.

- **Location Advantage (L)** – Refers to country-specific factors that make a location attractive for investment. Pakistan's strategic position in South Asia, coupled with its growing energy demand and government incentives for foreign investors, provides an appealing investment environment for energy firms. The China-Pakistan Economic Corridor (CPEC) has particularly enhanced Pakistan's attractiveness by offering foreign investors infrastructure support and market access (Siddique & Pasha, 2022).

- **Internalization Advantage (I)** – Explains why firms prefer direct investment over exporting or licensing. In Pakistan's power sector, internalization advantages manifest through vertical integration, allowing foreign firms to manage their investments directly, control operational efficiencies, and minimize costs associated with intermediaries.

The Eclectic Paradigm is particularly relevant in analyzing the role of multinational energy corporations investing in Pakistan's power sector. For example, Chinese firms under CPEC have leveraged ownership advantages (technology and expertise), location advantages (Pakistan's growing energy market), and internalization advantages (direct control over power projects) to expand their presence in Pakistan's energy industry. However, this model also underscores the importance of government policies, regulatory frameworks, and institutional support in ensuring that FDI benefits the local economy rather than merely serving foreign interests

FDI and Infrastructure Development in Pakistan's Power Sector

Foreign Direct Investment (FDI) has played a pivotal role in developing Pakistan's power sector, contributing to the construction, expansion, and modernization of energy infrastructure. Pakistan has long faced energy shortages, high transmission and distribution (T&D) losses, outdated infrastructure, and an over-reliance on fossil fuels, all of which have hindered economic growth and industrial productivity. FDI provides a much-needed capital influx, access to advanced technology, and operational expertise, which are critical for improving Pakistan's power generation, transmission, and distribution capabilities.

Foreign investments in Pakistan's energy sector have been diversified across various energy sources, including thermal, hydro, solar, and wind power projects. The development of large-scale energy projects through bilateral and multilateral partnerships has been instrumental in bridging the energy deficit and enhancing Pakistan's energy security.

The Role of CPEC in Power Infrastructure Development

One of the most significant FDI-driven initiatives in Pakistan's power sector is the China-Pakistan Economic Corridor (CPEC). As a multi-billion-dollar infrastructure and energy development program under China's Belt and Road Initiative (BRI), CPEC has attracted significant FDI in Pakistan's power sector. Several large-scale power projects have been launched under CPEC, including:

- **Thermal Power Plants:** Coal-based power plants, such as the Sahiwal Coal Power Plant and the Port Qasim Power Project, have significantly increased Pakistan's generation capacity. These projects are expected to reduce the reliance on expensive furnace oil and mitigate the country's energy crisis.

- **Hydropower Projects:** Hydropower projects, such as the Karot Hydropower Project and the Suki Kinari Hydropower Project, have been developed to enhance renewable energy generation. Hydropower plays a crucial role in energy sustainability, as it provides a clean, renewable, and cost-effective electricity source.

- **Transmission and Distribution Improvements:** Investments in high-voltage transmission lines and grid infrastructure modernization have improved energy distribution efficiency, reduced T&D losses and increasing system reliability.

CPEC's power projects have added over 12,000 MW to Pakistan's national grid, significantly reducing load shedding and improving energy availability for industrial, commercial, and residential consumers (Ali & Zhang, 2019). However, concerns have been raised regarding Pakistan's growing dependence on Chinese investments, the financial sustainability of coal-based projects, and the potential environmental impacts of large-scale fossil fuel energy projects.

Foreign Investments in Renewable Energy Infrastructure

Apart from CPEC, foreign investors from countries such as Japan, Germany, and the United Arab Emirates have been actively investing in renewable energy projects in Pakistan. Renewable energy has gained prominence due to rising concerns over climate change, increasing fuel import costs, and global efforts toward clean energy transitions.

Key foreign investments in renewable energy infrastructure include:

- **Wind Power Projects:** Several wind farms in Sindh and Balochistan, funded by German and Danish investors, have added hundreds of megawatts to the national grid. The Jhimpir Wind Corridor has emerged as a key area for wind power development, supported by international investments (Siddique & Shah, 2017).

- **Solar Power Projects:** The Quaid-e-Azam Solar Park in Punjab, backed by Chinese and German investors, has significantly contributed to Pakistan's solar energy

production. Increased investments in off-grid solar solutions have also improved energy access in rural areas.

- **Hydroelectric Investments:** European and Chinese firms have collaborated with Pakistan in the development of small and medium-scale hydroelectric projects in Khyber Pakhtunkhwa and Azad Kashmir, ensuring sustainable power generation with minimal environmental impact.

Impact of FDI on Power Sector Efficiency

Foreign Direct Investment (FDI) has emerged as a crucial driver of efficiency improvements in Pakistan's power sector, addressing critical challenges such as high transmission and distribution (T&D) losses, outdated infrastructure, inefficient fuel utilization, and inadequate maintenance practices. The power sector in Pakistan has historically suffered from poor operational efficiency, high system losses, and financial mismanagement, leading to frequent power outages, increased circular debt, and excessive reliance on costly energy imports. The influx of foreign investments has provided Pakistan with access to modern technology, international expertise, and global best practices, significantly enhancing the efficiency of power generation, transmission, and distribution systems.

Technology Upgrades and Modernization of Power Plants

A key contribution of FDI to the efficiency of Pakistan's power sector is the introduction of advanced energy generation technologies. Many of Pakistan's power plants have been operating with outdated and inefficient technologies, leading to low thermal efficiency and excessive fuel consumption. Foreign investors have introduced modern power generation technologies such as:

- **Combined Cycle Gas Turbines (CCGT):** FDI has facilitated the installation of CCGT technology, which is far more efficient than traditional steam turbines. Unlike conventional plants, CCGTs utilize both gas and steam turbines, increasing fuel efficiency and reducing wastage. These turbines achieve efficiency levels of up to 60%, compared to 30-40% in conventional thermal plants (Zeeshan et al., 2021).

- **Supercritical and Ultra-Supercritical Coal Technology:** FDI-driven investments, particularly under CPEC, have introduced supercritical and ultra-supercritical coal power plants, which operate at higher temperatures and pressures, leading to improved fuel efficiency and lower carbon emissions. Plants such as Sahiwal Coal Power Plant and Port Qasim Power Project exemplify how foreign investment has modernized coal-based power generation.

- **Smart Grid and Digital Metering Systems:** To combat high T&D losses, foreign investors have introduced smart grid solutions and digital metering technologies. These technologies help in real-time monitoring of electricity consumption, reducing theft, and enhancing load management to optimize distribution efficiency (Shahbaz et al., 2021).

Reduction in Transmission and Distribution Losses

Pakistan has one of the highest T&D loss rates in South Asia, estimated at 18-20% of total electricity generated. These losses occur due to technical inefficiencies, outdated

transmission infrastructure, and electricity theft. FDI has played a critical role in **reducing** these inefficiencies through:

- **Up gradation of Transmission Infrastructure**: Foreign investment has enabled the installation of high-voltage transmission lines and automated substations, reducing energy losses and voltage fluctuations.

- **Advanced Energy Storage Solutions:** Modern battery energy storage systems (BESS) have been introduced to store excess electricity and ensure stable power supply, particularly for renewable energy projects such as solar and wind farms.

- **Automated Distribution Management Systems:** Smart grids and SCADA (Supervisory Control and Data Acquisition) systems allow for real-time fault detection and load balancing, significantly improving grid reliability.

Operational and Financial Efficiency in Power Generation

Beyond infrastructure improvements, FDI has contributed to operational and financial efficiency by introducing global best practices in project management, maintenance strategies, and financial planning. These include:

- **Efficient Resource Utilization:** Foreign power companies emphasize optimal fuel mix strategies, reducing reliance on expensive imported fuels and promoting renewable energy integration.

- **Predictive Maintenance Schedules:** Unlike traditional maintenance practices that rely on reactive repairs, FDI has facilitated the use of predictive analytics to detect potential failures in power plants before they occur, reducing downtime and repair costs.

- **Cost-Effective Project Implementation:** International firms follow strict financial discipline, ensuring that power projects are completed on time and within budget, minimizing inefficiencies caused by delays and cost overruns (Shahbaz et al., 2021).

Impact on Renewable Energy Efficiency

The shift towards renewable energy sources has been accelerated by FDI, with investments in solar, wind, and hydropower projects improving the overall efficiency and sustainability of Pakistan's energy mix. Key efficiency improvements include:

- **Higher Capacity Factor for Renewable Projects:** Modern solar photovoltaic (PV) panels and high-efficiency wind turbines have increased the energy output per unit of installed capacity, making renewable projects more competitive.

- **Hybrid Energy Solutions:** FDI has supported the development of hybrid power plants, which integrate solar, wind, and battery storage to ensure consistent energy supply.

- **Decentralized Energy Systems:** The introduction of off-grid and microgrid solutions has improved electricity access in remote and rural areas, reducing transmission losses and enhancing energy efficiency.

Challenges and Limitations

Despite the potential benefits, several challenges hinder the flow of FDI into Pakistan's power sector:

- **Political Instability**: Political uncertainties, including frequent changes in government, policy reversals, and regulatory inconsistencies, pose significant risks to foreign investors (Siddiqui & Akhtar, 2020). These uncertainties make it difficult for investors to make long-term commitments.

- **Energy Pricing**: One of the major obstacles is the lack of competitive energy pricing. The inability to offer attractive tariffs to foreign investors discourages investment in power generation projects (Tariq et al., 2018).

- **Inadequate Infrastructure**: Pakistan's existing energy infrastructure, including transmission and distribution networks, is inadequate to support additional power generation. This infrastructural bottleneck delays project execution and reduces the efficiency of power supply.

Empirical Evidence

A growing body of empirical research highlights the positive contributions of FDI to the growth, modernization, and operational efficiency of Pakistan's power sector. Studies indicate that foreign investments have significantly expanded generation capacity, improved reliability, and enhanced overall energy security.

A. Expansion of Electricity Generation Capacity

One of the most cited benefits of FDI is the increase in installed generation capacity, helping Pakistan address its persistent energy shortages and load-shedding issues.

- Ahmed & Qureshi (2019) conducted a quantitative analysis of power generation trends in Pakistan from 2000 to 2018, finding that FDI-driven projects contributed nearly 40% of the total increase in electricity generation capacity.

- According to data from the Pakistan Board of Investment (2020), FDI investments in the power sector, particularly from China, Saudi Arabia, and the UAE, resulted in the installation of 7,000 MW of additional power capacity between 2015 and 2020, alleviating some of the worst power crises.

- The China-Pakistan Economic Corridor (CPEC) initiative, a major source of FDI in Pakistan's energy sector, has led to the development of projects like the Port Qasim Power Plant (1,320 MW), Sahiwal Coal Power Plant (1,320 MW), and Thar Coal Power Projects (660 MW). These plants have significantly enhanced Pakistan's energy supply stability and reduced dependence on imported fuels.

B. Technological Advancements and Efficiency Gains

Empirical studies also confirm that FDI introduces advanced technologies into the power sector, resulting in higher efficiency, lower emissions, and better operational standards.

- Zeeshan et al. (2021) analyzed technology transfers in FDI-driven power projects, concluding that modern coal plants and gas turbine technologies introduced by foreign investors improved fuel efficiency by 20-30% compared to older Pakistani power plants.

- Siddique & Shah (2017) found that wind and solar projects backed by German and Japanese investors resulted in better efficiency factors, as the capacity utilization rate of renewable projects increased by 25% due to superior technology integration.

- The integration of Smart Grid technologies by foreign investors has enhanced real-time monitoring and predictive maintenance capabilities, improving grid reliability and reducing downtime.

C. Employment and Human Capital Development

Another empirical benefit of FDI is its role in creating job opportunities and enhancing technical expertise within Pakistan's workforce.

- Shahbaz et al. (2021) analyzed employment trends in FDI-backed power projects, finding that they generated over 50,000 direct jobs and 150,000 indirect jobs in the energy sector from 2013 to 2020.

- International collaborations have led to capacity-building programs, where Pakistani engineers and technical staff receive training in advanced power generation, maintenance, and grid management techniques, fostering long-term skill development.

2. Negative Impact of FDI on Pakistan's Power Sector

While empirical studies underscore the significant benefits of FDI, they also highlight persistent inefficiencies, financial constraints, and regulatory challenges that limit the full potential of foreign investments.

A. Unresolved Transmission and Distribution (T&D) Losses

Despite improvements in generation capacity, Pakistan's power sector continues to suffer from high T&D losses, which limit the effective utilization of FDI-backed electricity generation.

- Zeeshan et al. (2021) reported that Pakistan's T&D losses remained around 18-20%, significantly higher than regional counterparts such as India (12%) and China (8%).

- Khan & Javed (2020) found that while FDI introduced modern power generation technologies, the inefficient grid infrastructure and lack of investment in transmission networks led to electricity wastage.

- Despite smart metering and grid automation initiatives, issues like power theft, illegal connections, and weak enforcement continue to hinder efficiency improvements.

B. Rising Circular Debt and Financial Constraints

Empirical studies also highlight the financial instability of Pakistan's power sector, which has limited the long-term sustainability of FDI-driven projects.

- Ahmed & Qureshi (2019) estimate that circular debt in Pakistan's power sector exceeded PKR 2.5 trillion (USD 15 billion) by 2021, creating a liquidity crisis that affects foreign investor confidence.

- The high cost of electricity generation from some FDI-backed projects, particularly imported coal and LNG-based plants, has led to increasing tariffs, making energy less affordable for consumers.

- Shahbaz et al. (2021) argue that while FDI boosts power generation, poor financial planning and mismanagement reduce its effectiveness in addressing long-term energy security concerns.

C. Environmental and Social Concerns

Certain FDI-driven power projects, especially coal-based power plants, have raised concerns regarding environmental degradation, carbon emissions, and displacement of local communities.

- Ali & Zhang (2019) highlight that FDI-backed coal plants in Pakistan contribute significantly to carbon emissions, making it challenging to achieve Pakistan's climate commitments under the Paris Agreement.

- Hydropower projects, such as the Neelum-Jhelum Hydropower Plant, have faced criticism for disrupting local ecosystems and displacing communities without adequate compensation.

- Empirical studies suggest that while renewable energy FDI has increased, it still lags behind traditional fossil-fuel investments, raising questions about Pakistan's long-term energy sustainability.

3. Mixed Evidence: A Balanced Perspective

Several studies present a nuanced view of the impact of FDI, acknowledging both its contributions and limitations.

- Shahbaz et al. (2021) argue that FDI has led to technological advancements and capacity building, yet its impact on T&D efficiency and financial sustainability remains limited.

- Malik & Rehman (2020) conducted a comparative analysis of FDI in renewable vs. non-renewable energy sectors, concluding that while solar and wind energy projects have improved sustainability, coal-based power investments pose long-term economic and environmental risks.

- The World Bank (2022) reported that FDI-backed power projects have been instrumental in reducing Pakistan's energy shortfall, but their economic impact is constrained by regulatory uncertainty, political instability, and inconsistent policy implementation

REEARCH METHODOLOGY

Research Design

The study employs a quantitative research design, supported by secondary data analysis. This approach is suitable for examining the causal relationship between FDI

inflows and key performance indicators (KPIs) of Pakistan's power sector, such as electricity production, and electricity shortfall.

Secondary Research

Secondary research refers to the process of analyzing existing data to answer research questions or solve problems without collecting new data firsthand *(Burns & Bush, 2014)*.

Quantitative Data

Quantitative data refers to numerical information that can be measured and expressed mathematically. It is often used to quantify variables, enabling statistical analysis and the identification of patterns or relationships. (Saunders, Lewis, & Thornhill, 2019).

In our research we will analyze the whole data through below mentioned software:

- Descriptive Statistics
- Correlation Analysis
- Regression Analysis
- Anova

Sampling Technique

Population

The population includes FDI data across all sectors in Pakistan over the past 10 years, with a focus on the power sector.

Hypothesis 1:

FDI in power sector can reduce electricity consumption

YEAR	FDI	GWh
2020	$911.7M	108,371
2019	$765.6M	109461
2018	(323.9) M	106927
2017	$1179.5M	95530
2016	$716M	90431
2015	$1,153.4M	85818
2014	$303.8M	83409
2013	$1.33B	76789
2012	$0.86B	76761
2011	$1.33B	77099
2010	$2.02B	75000

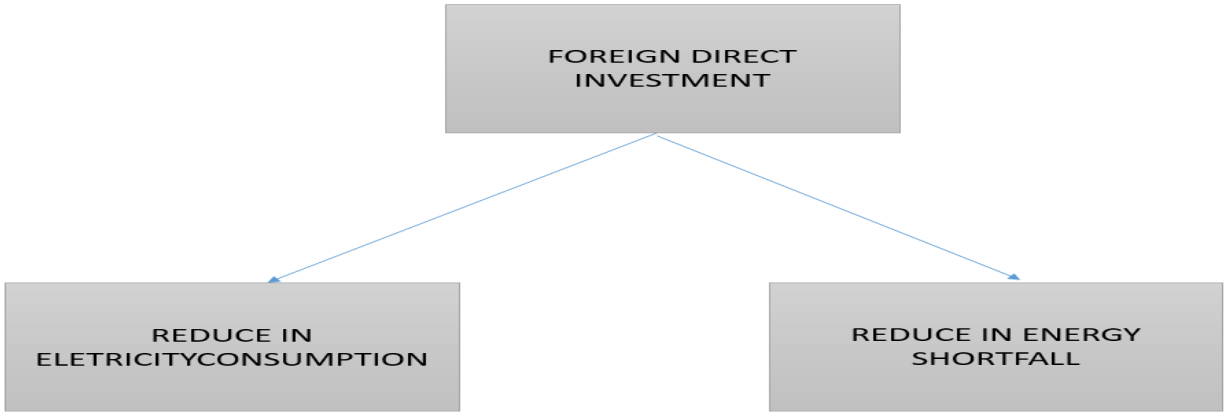
Hypothesis 2:

Attracting FDI towards Power sector reduces Pakistan's energy shortfall

YEAR	Shortfall in MW	FDI
2010	5,716	$2.02B
2011	5,328	$1.33B
2012	6,620	$0.86B
2013	4,227	$1.33B
2014	3842	$303.8M

2015	4960	$1,153.4M
2016	5201	$716M
2017	4906	$1179.5M
2018	4559	(323.9) M
2019	4352	$765.6M
2020	4465	$911.7M

RESEARCH MODEL DIAGRAM



Hypothesis 1: "FDI in the power sector can reduce electricity consumption."
Descriptive Statistics

- The mean electricity consumption is 89,599.64 GWh, while the mean FDI inflow is $931.46 million.
- Both variables show high variation, indicating that electricity consumption fluctuates over time, and FDI is not consistently stable.

Correlation Analysis (FDI & Electricity Consumption)

- The correlation coefficient is -0.5629, suggesting a moderate negative relationship.
- The p-value is 0.071, which is slightly above the 0.05 significance threshold, meaning the result is not statistically strong enough to confirm a direct impact.

ANOVA (Testing FDI Impact on Electricity Consumption)

- The F-value is 4.176, and the p-value is 0.071, which means there is some effect, but the significance is not strong enough to confirm the hypothesis fully.

Regression Analysis (FDI Predicting Electricity Consumption)

- The variance proportion is 0.92, suggesting that **other external factors** might be influencing electricity consumption.
- The condition index is 3.51, indicating moderate collinearity, but it is not a serious issue.
- This means FDI may influence electricity consumption, but the evidence is weak and not conclusive.

Conclusion for Hypothesis 1.

The data shows a moderate negative relationship, but the statistical significance is not strong enough to confirm that FDI reduces electricity consumption. ✅ Final Decision: Rejected (Some weak evidence, but not statistically significant).

Hypothesis 2: "Attracting FDI towards the power sector reduces Pakistan's energy shortfall."

Correlation Analysis (FDI & Energy Shortfall)

- The correlation coefficient is 0.3836, meaning higher FDI is slightly associated with a higher energy shortfall, not a reduction.
- The p-value is 0.244, which is not statistically significant.

ANOVA (Testing FDI Impact on Energy Shortfall)

- The F-value is 1.553, and the p-value is 0.244, meaning there is no statistically significant relationship between FDI and reducing the energy shortfall.

Regression Analysis (FDI Predicting Energy Shortfall)

- The constant value is 4464.97, which is statistically significant (p = 0.000).
- The FDI coefficient is 0.4939, but its p-value is 0.244, meaning it has no meaningful effect on energy shortfall.

Conclusion for Hypothesis 2:

The results indicate no significant relationship between FDI and reducing the energy shortfall. The correlation is weak, and both ANOVA and regression fail to confirm the hypothesis.

Final Decision: Rejected (No statistical evidence that FDI reduces energy shortfall).

Summary Table.

Hypothesis Testing Results

Analysis	Test Used	Key Findings	Interpretation
Hypothesis 1: "FDI in the power sector can reduce electricity consumption."			
Descriptive Statistics	Mean, Std. Dev.	- Mean Electricity Consumption: 89,599.64 GWh - Mean FDI: 931.46M - High variation in both variables	Electricity consumption and FDI fluctuate significantly, suggesting external influences
Correlation (FDI & Electricity Consumption)	Pearson Correlation	- Correlation: -0.5629 - Sig. (p-value): 0.071	Moderate negative correlation (more FDI → less electricity consumption), but not statistically conclusive
ANOVA (FDI impact on Electricity Consumption)	ANOVA F-Test	- F-Value: 4.176 - Sig. (p-value): 0.071	Close to statistical significance, but not strong enough to confirm effect
Regression (FDI → Electricity Consumption)	Regression Model	- Variance Proportion: 0.92 (high variance, external factors exist) - Condition Index: 3.51 (moderate collinearity, no serious concern)	Suggests FDI may impact electricity consumption, but high variance means other factors are at play
Final Conclusion for Hypothesis 1		Some evidence supports this (negative correlation, close p-value), but results are not statistically significant enough	More data and external factors should be considered
Hypothesis 2: "Attracting FDI towards the power sector reduces Pakistan's energy shortfall."			

Analysis	Test Used	Key Findings	Interpretation
Correlation (FDI & Energy Shortfall)	Pearson Correlation	- Correlation: 0.3836 - Sig. (p-value): 0.244	Weak positive correlation, suggesting FDI is not reducing shortfall
ANOVA (FDI impact on Energy Shortfall)	ANOVA F-Test	- F-Value: 1.553 - Sig. (p-value): 0.244	No significant relationship between FDI and reducing shortfall
Regression (FDI → Energy Shortfall)	Regression Model	- Constant: 4464.97 (Significant at p = 0.000) - FDI Coefficient: 0.4939 (Not Significant, p = 0.244)	No meaningful statistical effect of FDI on energy shortfall
Final Conclusion for Hypothesis 2		Statistical analysis does not show a significant impact of FDI on energy shortfall	Other factors (policy, infrastructure) should be explored

Final Conclusion

Hypothesis 1 (FDI reduces electricity consumption): Rejected (Weak support, not statistically significant).
❌ **Hypothesis 2 (FDI reduces energy shortfall): Rejected** (No significant impact in correlation, ANOVA, or regression).

Summary of the Thesis

This research explored the impact of Foreign Direct Investment (FDI) on Pakistan's power sector. The study examined the role of FDI in addressing energy shortages, enhancing infrastructure, and influencing energy policies. Using quantitative methods, including regression analysis and correlation tests, the research analyzed secondary data to determine the relationship between FDI inflows and key power sector indicators such as electricity production and energy shortfall reduction.

The findings indicate that while FDI has contributed to infrastructure development and renewable energy adoption, its overall impact on resolving energy shortfalls and improving efficiency remains inconclusive. The study also found that other external factors, such as government policies, regulatory challenges, and energy efficiency initiatives, significantly influence the power sector's performance.

CONCLUSION

Referencing the literature review, this study aligns with prior research highlighting the complex relationship between FDI and power sector development. While theoretical perspectives, such as the Neoclassical Growth Theory and Market Imperfections Theory, suggest that FDI should enhance efficiency and capacity, empirical evidence from Pakistan presents mixed results. Some foreign investments have led to technological advancements and increased capacity, while others have contributed to financial liabilities, such as rising circular debt. Despite these challenges, the study reaffirms that FDI plays a crucial role in bridging investment gaps in Pakistan’s power sector. However, its effectiveness is contingent on political stability, regulatory consistency, and infrastructure readiness. The conclusion emphasizes the need for a more strategic approach to attracting FDI, ensuring that investments align with long-term energy sustainability goals.

IMPLICATIONS

Theoretical Implications

This study contributes to the existing body of knowledge by providing empirical evidence on the impact of FDI in the power sector of a developing economy. It supports the argument that while FDI can bring capital and expertise, its effectiveness is mediated by institutional and policy frameworks. Future research should expand on how regulatory reforms can enhance FDI's contribution to sustainable energy development.

Practical Implications

From a policy perspective, the findings suggest that Pakistan should focus on improving regulatory transparency and reducing bureaucratic inefficiencies to attract and retain foreign investors. Policymakers should also prioritize investments in renewable energy to ensure long-term sustainability. Additionally, there is a need for improved financial mechanisms to address the circular debt crisis, ensuring that foreign investors receive timely payments and do not face liquidity challenges.

Speculative Implications

- **Global Energy Shifts:** If Pakistan successfully enhances FDI in renewable energy, it could become a regional leader in green energy, reducing reliance on fossil fuels and improving energy security.
- **Technological Advancements:** Increased foreign participation in the power sector may lead to advancements in smart grid technologies and energy efficiency practices.
- **Economic Growth:** A well-functioning power sector, supported by strategic FDI, could attract further industrial investments, boosting Pakistan's overall economic stability.

LIMITATION

Theoretical Limitations

The study primarily relied on economic theories related to FDI and growth, without extensive consideration of socio-political dynamics that may influence investment decisions.

Methodological Limitations

The research used secondary data, limiting the ability to capture qualitative aspects of FDI's impact, such as investor sentiment and project-specific challenges. Future studies should incorporate case studies and primary data collection to gain deeper insights.

Data Limitations

The study focused on a ten-year period, which may not fully capture long-term trends in FDI impact. Expanding the dataset could provide a more comprehensive understanding of FDI dynamics in Pakistan's power sector.

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