A Governance Perspective on Electricity Industry Performance in India

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CERTIFICATE OF AUTHORSHIP

I, (Harbans Lal Bajaj) declare that this thesis, is submitted in fulfilment of the requirements for the award of the degree of Doctor of Philosophy, in the Faculty of Engineering and Information Technology at the University of Technology Sydney. This thesis is wholly my own work unless otherwise reference or acknowledged. In addition, I certify that all information sources and literature used are indicated in the thesis. This document has not been submitted for qualifications at any other academic institution. This research is supported by the Australian Government Research Training Program.

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ABSTRACT

This research develops a 'governance perspective' on the performance of the Indian electricity industry, with specific emphasis on identifying the causes of persisting poor industry performance, and ways to improve it. This research emphasis is predicated on the argument that the contemporary, quintessentially industry-centric, focus on identifying causes and remedial measures is deficient, as it ignores climacteric socio-economic, political and cultural influences (the *raison d'état* of the industry) on industry performance. The methodological framework employed in this research comprises two complementary analytical approaches, namely: a) a qualitative approach, drawing upon the basic tenets of *state-society relational* models; and b) a quantitative statistical approach comprising a suit of three econometric models, viz., granger-causality, mixed-effect, and multilevel-regression. Each of these approaches assesses the impacts of national and electricity governance paradigms on the configuration (structure-ownership-regulation) and performance of the electricity industry, albeit from different yet complementary lenses, for example, historic (for qualitative), and statistical (for quantitative). Collectively therefore these approaches provide a robust basis for validating the insights gained from the 'other' approach. The analyses undertaken in this research suggests that the governance processes of the India electricity industry have historically been overwhelmingly influenced by the wider national governance priorities and agendas for promoting socio-economic development, and that these priorities and agendas have quintessentially reflected a rather narrow set of dominant, 'politically-powerful', economic and socio-cultural interests of the time. By this reasoning, electricity has traditionally been seen simply as a means to promote these (dominant) interests. The question of industry performance has therefore (and understandably so) become sub-servient to the more pressing need to promote (narrow) political interests. Outcome: persistent poor industry performance. This research further posits that industry performance can be improved by a state-led effort to extend the ambit of dominant interests by, in particular, including 'local' (and currently, marginalised) interests.

1 INTRODUCTION

1.1 Indian electricity industry: A backdrop

Energy (electricity in particular) is a key driver for the socio-economic development of a nation. It is even more critical for a developing country like India (the country of focus of this research) where electricity produces a lifeline for a multitude of people whose basic human needs of health, education and poverty alleviation are a priority. The provision of sufficient and affordable electricity is, therefore, a priority for promoting economic development, for creating job opportunities, for fostering growth, for improving living standards, and for bridging social inequalities that exist in the country.

In view of its significance, the development of energy sector, electricity sector in particular, has traditionally been accorded a high priority by the Indian policy makers. For example, the energy sector has accounted for nearly 23% of total capital outlays over the period 1951-2017, of which electricity sector alone has accounted for around 17% (see Table 1-1). In addition, the country's policy makers have established an elaborate array of institutions to deal with various facets of the electricity business, namely, policy making, planning, financing, implementation and operation. Further, the Seventh Schedule of the Constitution of India has placed the issue of electricity on the Concurrent List (Sl, No. 38 of List-III Concurrent List, Constitution of India), implying that the responsibility for the electricity industry is jointly shared between the Centre and the States of the Indian federal system. Accordingly, since independence in 1947, both the Central and the State governments in India have been able to legislate on electricity matters.

Table 1-1: Plan expenditure and the share of energy sector

	Plan outlays (Rs.Cr.)	Share of energy sector (%)				
		Power	Oil & Gas	Coal	Renewable	Total
1951-1956	2,070	-	-	-	-	19.7
1956-1961	4,800	09.7	0.8	1.9	-	12.4
1961-1966	7,500	14.6	2.6	1.3	-	18.5
1969-1974	15,900	18.6	1.9	0.7	-	21.2
1974-1979	38,853	18.7	3.6	2.9	-	25.2
1980-1985	97,500	16.7	7.8	3.5	0.1	28.1
1985-1990	180,000	17.4	7.3	3.2	0.3	28.2
1992-1997	434,100	18.4	5.5	2.4	0.2	26.5
1997-2002	859,200	14.5	8.6	2.3	0.4	25.8
2002-2007	1,525,639	22.3	7.9	2.5	0.6	33.3
2007-2012	3,644,719	15.7	5.9	1.0	0.3	22.8
2012-2017	7,669,807	16.9	1.0	1.5	0.5	13.4

Notes: 1. Rs Cr: Rupee Crore (1 US $ ≈ Rs 65, currently)

2. Outlays, at current prices, expressed in terms of the base year of the respective Plans.

Sources: Planning Commission five-year plans (various)

The legislative scope of these two levels of the government was more formally defined in the Electricity (Supply) Act of 1948. The backdrop for this Act was provided by several national, local and global factors including belief in energy-growth nexus; primacy of poverty alleviation since independence in 1947; emphasis on self-sufficiency through the development of local small-scale and heavy industry; politically significant and large agriculture sector; availability of indigenous resources; technological development in large scale coal-based power generation and transmission; and lessons from overseas experience, especially the experience with national power grid in the UK by locating power stations at coal pitheads and connecting them with transmission lines to supply power to the whole country, etc.

Against this backdrop, the Indian Electricity (Supply) Act of 1948 was enacted and led to the establishment of State Electricity Boards (SEBs). The SEBs were owned by the State governments and were normally operated as extensions of the State ministries. They were vertically integrated utilities that were responsible for electricity generation, transmission, distribution and retail in the states. There also existed several organisations at the national level (*e.g.,* Central Electricity Authority) that played important roles in the electricity industry in India. The roles of these organisations were however mainly limited to policy-making and planning at the national level (Kale 2004).

In the 1960s, the State governments gradually realised the political appeal of electricity, and began to actively intervene in the operation and management of the SEBs, particularly in tariff setting. The SEBs were usually required to provide electricity at low tariffs to agricultural consumers, even though the cost of serving remote rural areas was high (Dubash & Rajan 2001). This was driven by a range of factors including, for example, shift in developmental priority in favour of agricultural sector in the 1960s and 70s, caused by chronic food shortages, increased reliance on food imports, fear of losing national sovereignty, emergence of powerful farmer organisations at the state level in the late 1960s, and the needs to win support from these organisations which represented a significant proportion of the electorate. Agriculture subsidies therefore became commonplace in the 1970s and 80s (Dubash & Rajan 2001; Ganguly & Mukherji 2011).

These subsidies however began to negatively affect the financial health of the SEBs. The Electricity (Supply) Act 1948 required the SEBs to earn a 3% minimum return on net fixed assets. But most SEBs could not comply with this statutory requirement due to lower-than-cost electricity tariffs. In fact, revenues generated by the SEBs were insufficient even for financing necessary system maintenance, resulting in poor quality

of supply and chronic power shortages. Further capacity expansion from their own resources was therefore simply beyond the capacity of the SEBs (Tongia 2009).

In addition, electricity subsidies provided by the SEBs to agricultural consumers were normally in the form of flat-rate bills based on the capacity of water pumps rather than metered consumption. This enabled the SEBs to hide network losses and theft of electricity under the category of agricultural consumption, creating little incentives for improving efficiency and quality of supply (Dubash & Rajan 2001).

Further, in order to offset the losses associated with electricity subsidies to agricultural customers, the SEBs usually charged high tariffs from industrial consumers. In the 1980s, this cross-subsidisation, together with unreliable and insufficient electricity supply, led to many industrial customers eschewing high-cost electricity from the SEBs in favour of self-generated electricity. This left the SEBs with fewer financially valuable customers, and further worsened their financial condition (Kale 2004).

In response to the poor financial and technical performance of the SEBs, the Central government established the National Thermal Power Corporation (NTPC) and National Hydro Power Corporation (NHPC) in 1975. These companies generated electricity and sold it to more than one SEB for distribution. They (especially, the NTPC) were expected to deliver a rapid expansion of generation capacity, which, it was argued, will alleviate supply shortages in the country. They were also expected to form a model of modern operational practices with high efficiency and supply quality that the SEBs could follow (Tongia 2009).

In addition, the Central government also created the National Power Transmission Corporation in 1989, which was subsequently renamed as Power Grid Corporation of India Limited (Powergrid). The Powergrid was expected to develop a national grid that

could enable more efficient coordination of electricity supply in the country. In the following years, the Powergrid took over transmission assets of NTPC and NHPC and assumed responsibility for all inter-state power transmission systems. Since then, all the extra high voltage alternating current (EHVAC) and high voltage direct current (HVDC) transmission lines in the country have come under the purview of Powergrid.

Although central government intervention alleviated the supply shortages in the short-term, it failed to improve the financial and technical performance of the SEBs in the long-term. Chronic power shortages, low electrification rates, high system losses, and insufficient investments in developing new capacity remained commonplace. The SEBs remained heavily debt-ridden and largely unable to finance power system maintenance and capacity additions to serve rising electricity demand (Tongia 2009).

As a response, steps were taken by the Indian government in the early 1990s to reform the electricity industry. In 1991, the Central government amended the 1948 Electricity (Supply) Act, to allow private investors to establish, operate and maintain power plants (Dubash and Rajan 2001). Shortly after making this legislative change, eight showcase Independent Power Producer (IPP) projects were assigned by the Central government with 'fast track clearance', which allowed these projects to leap over licensing hurdles in order to expeditiously address the power shortages. Encouraged by these reforms, private investors made about 190 proposals for IPPs by 1996 (Tongia 2009). If completed, these projects would add over 75,000 MW of generation capacity. But most of these proposed projects did not materialise, partly due to local unrest about these projects. Consequently, by 2002, IPPs had only added 10,800 MW of capacity (Dubash & Rajan 2001).

In addition, commissioned IPP projects were normally operated based on power purchase agreements (PPAs) between IPPs and SEBs. The PPAs were strongly in favour of private

investors, with a guaranteed 16 per cent rate of return, a five-year tax holiday, full repatriation of profits in dollars, and take-or-pay clause. These PPAs provided little incentives for IPPs to minimise the costs of supply because all the costs could be passed onto the SEBs. As a result, electricity generated from the IPPs was usually much more expensive than that from comparable NTPC and SEB power plants (Kale 2004). Further, most IPPs were designed to meet base-load demand even though peak demand was the most pressing need of the time. This, together with take-or-pay clause, meant that power plants with lower costs were frequently replaced by IPPs with higher costs to meet base-load demand. This contributed to deepening fiscal woes for the SEBs, and higher tariffs in some states (Dubash & Rajan 2001).

By the mid-1990s, there was a growing concern in India that the reform focusing on encouraging IPPs would not improve the financial and technical performance of the electricity industry, because it left untouched the fundamental weaknesses of the SEBs, namely: 1) heavily subsidised and below cost electricity tariffs; 2) continued practice showing transmission and distribution losses and theft of power as agricultural consumption; and 3) high cost of electricity purchased from expensive IPPs (Kale 2014a).

As a response, several State governments (*e.g.,* Andhra Pradesh, Orissa, and Uttar Pradesh) began to reform their SEBs in the 1990s. These reforms included: 1) restructuring of the SEBs into separate generation, transmission, and distribution entities; 2) privatisation of separated electricity entities, especially distribution entities; and 3) creation of independent regulators – the State Electricity Regulatory Commissions (SERCs). These reforms were expected to depoliticise the SEBs and their tariff setting, and to improve efficiency and quality of supply (Kale 2004). While the actual outcomes of these state reforms have been mixed, they did succeed in highlighting the central

problems of the electricity industry, namely, highly politicalised tariff-settings and SEBs' financial woes (Sen & Jamasb 2013).

In 2003, the Central government sought to deepen and formalise the reforms that had already been initiated in some states. The Electricity Act of 2003 was enacted in May 2003. It replaced all existing legislation in the electricity industry and prepared the ground for a fundamental reform of the Indian electricity industry. Key elements of this reform included restructuring of the SEBs, creation of independent regulators, open-access to networks, and introduction of market competition (Sen & Jamasb 2013).

1.2 Performance of the Indian electricity industry

The above discussion suggests that the development of the electricity industry has long been accorded a high priority by the Indian policy makers, as reflected in the magnitude of investments made in the industry, and the establishment of an extensive governance framework (including, laws, rules, regulations and institutions) for the industry. Despite this, the Indian electricity industry has persistently performed poorly (Pargal & Banerjee 2014). While industry performance is a much expansive concept, it is discussed, in the context of this research, in terms of four performance indicators. They include: adequacy, reliability, affordability, and returns on public investment. The selection of these indicators – it is argued – is highly appropriate for a country that has experienced persistent shortages of electricity supply, where the quality of supply continues to be poor, where a significant majority of people requiring access to electricity to uplift their economic and political well-being, are simply not in a position to pay for it, and where public exchequer is under duress with equally competing demands for allocation of investment funds.

Adequacy

Electricity shortages (total and peak) for India, over the period 1975-2015, are presented in Table 1-2. As shown in the table, total and peak shortages of electricity supply were severe in India in the 1970s and 80s. Total electricity shortages seemed to have improved in recent years, falling from 16.0 per cent in 1980-81, to less than 4.0 per cent in 2014-15. Similarly, peak shortages also dropped from 18.3 per cent in 1995-96, to 4.7 per cent in 2014-15.

These statistics of reduction in shortages should however be read with caution. There are two reasons for that. *One*, these statistics are estimated as percentage of electricity required by consumers with very low levels of consumption. In fact, India's average electricity consumption per capita (about 750 kWh per capita) is among the lowest in the world (see Figure 1-1). It is approximately 25 per cent of world average, and less than 35 per cent of major developing countries (*e.g.,* China, Malaysia, and Thailand), and around 10 per cent of OECD countries. The increase of India's average electricity consumption level to the world average (around 3,100 kWh per capita) would have led to about a 300% increase in the country's electricity requirement in 2014-15.

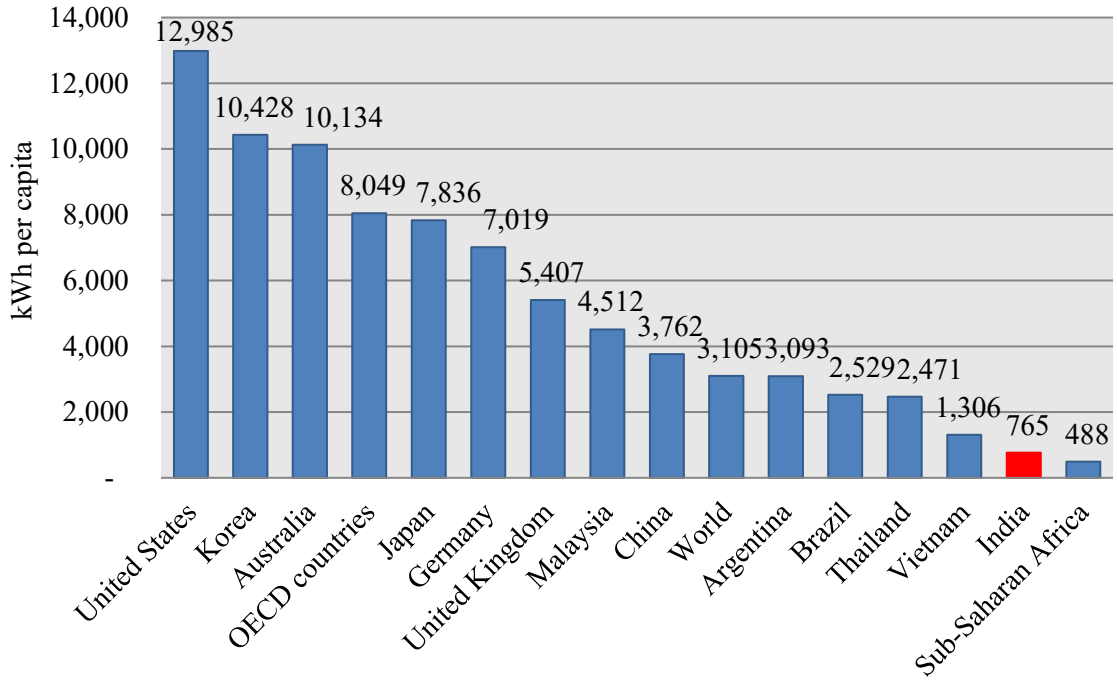
Two, shortages are estimated as percentage of electricity required by those with access to electricity; they do not consider the large number of consumers in the country who do not currently have access to electricity (more than 200 millions). The provision of electricity to these consumers would considerably increase the country's total electricity requirement – by about 181,000 GWh (almost one fifth of the country's electricity requirement in 2014-15), if the consumption level of these consumers is assumed to be equal to the country's average consumption level (about 760 kWh per capita).

Table 1-2: Total and peak electricity shortages

	Total				Peak			
	Requirement (GWh)	**Availability (GWh)**	**Shortage (GWh)**	**Shortage (%)**	**Requirement (MW)**	**Availability (MW)**	**Shortage (MW)**	**Shortage (%)**
1975-76	83,508	74,909	8,599	10.3	-	-	-	-
1980-81	92,324	77,506	14,818	16.0	-	-	-	-
1985-86	170,746	157,262	13,484	7.9	28,090	24,215	3,875	13.8
1990-91	267,632	246,560	21,072	7.9	44,005	37,171	6,834	15.5
1995-96	389,721	354,045	35,676	9.2	60,981	49,836	11,145	18.3
2000-01	507,216	467,409	39,807	7.8	74,872	65,628	9,244	12.3
2005-06	631,757	578,819	52,938	8.4	93,255	81,792	11,463	12.3
2010-11	861,591	788,355	73,236	8.5	122,287	110,256	12,031	9.8
2014-15	1,068,943	1,030,800	38,143	3.6	148,166	141,160	7,006	4.7

Sources: Central Electricity Authority (2015) and World Bank (1981)

Figure 1-1: Electricity consumption per capita in 2013



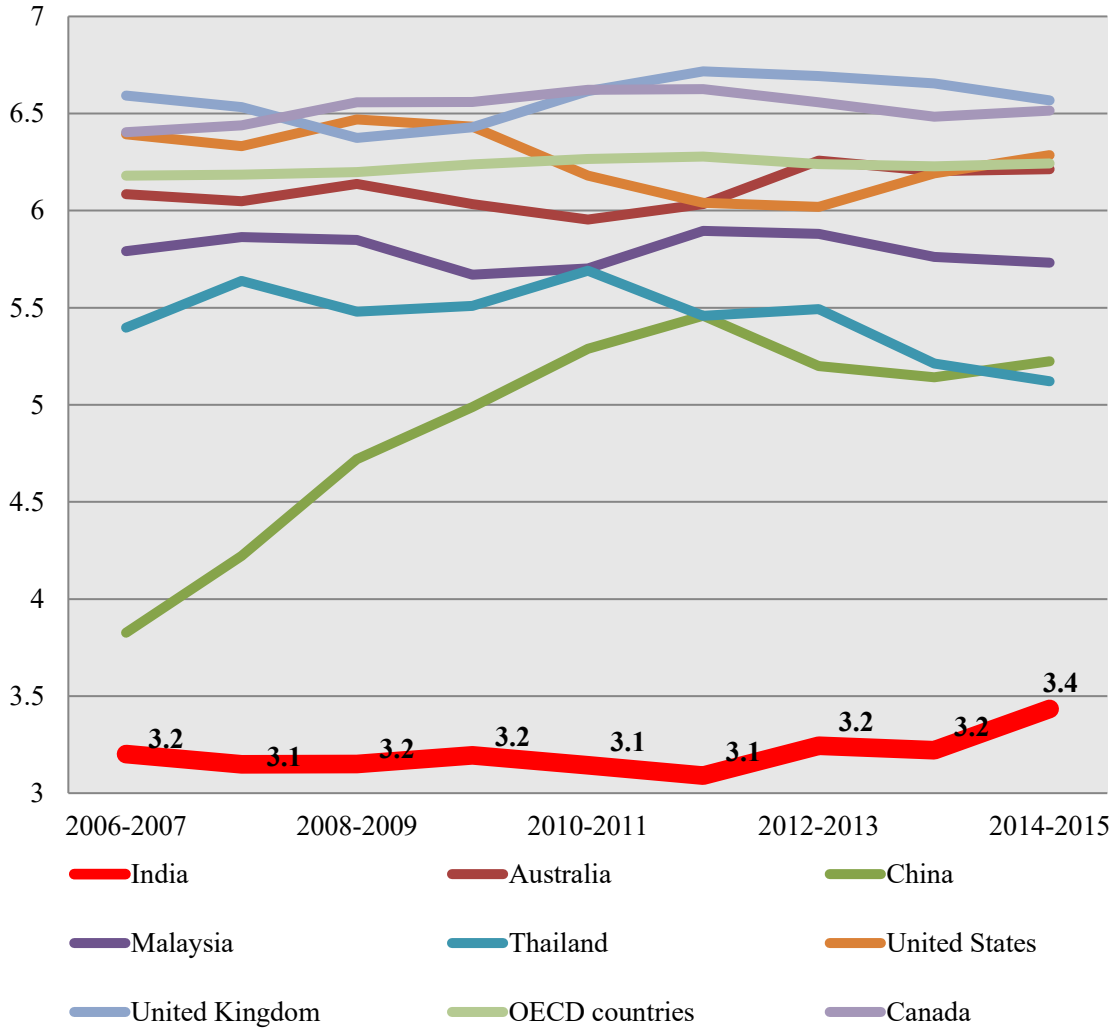
Source: World Bank (2014), World Development Indicators

Reliability

Quality of electricity supply index is part of the Global Competitiveness Index developed by the World Economic Forum (World Economic Forum 2016). This index measures the reliability of electricity supply in a country (*i.e.,* degree of supply interruptions and voltage fluctuations). It ranges from 1 (not reliable at all) to 7 (extremely reliable). A snapshot of the quality of electricity supply index, for major developed and developing countries, over the period 2006 to 2015, is presented in Figure 1-2. As shown in the figure, the quality of electricity supply index for India has been in the range of 3.1 to 3.4 over this period. This is significantly low in comparison with the average of most developed and several developing countries, with an average rate of 5 and above (a rate of 5 is considered to be a highly reliable system). This suggests that electricity supply is highly unreliable in India. In fact, the Enterprise Surveys conducted by the World Bank in 2014

reported that firms in India experienced power outages about 14 times in a typical month, and most of these outages lasted for more than an hour. Such unreliable electricity supply caused about 2% reduction in their annual profits (World Bank 2014). Similarly, about one fifth of households with electricity reported in 2005 electricity outages of up to four hours a day. The state of Bihar and Uttar Pradesh had the worst supply reliability in the country. They had average electricity outages of 16 and 20 hours per day, respectively. In response to this unreliable electricity supply, most households (around 70%) use expensive backup generators for lighting (Banerjee et al. 2015).

Figure 1-2: Quality of electricity supply index



Source: World Economic Forum (2017), quality of electricity supply index

Affordability

Affordability is defined – in the context of the present discussion – as electricity expenditure by consumers as proportion of their total incomes. In this research, affordability is estimated for agricultural, household and industrial consumers, based on their electricity expenditures and total incomes. Electricity expenditures by these consumers are estimated from data on electricity prices and electricity consumption. These data are sourced from IEA databases (IEA 2016a, 2016b). Total incomes for agricultural and industrial consumers are estimated based on the share of their value added in the overall GDP while total incomes for household consumers are estimated based on household final consumption expenditure, as a percentage of GDP. Data for agricultural and industrial value added and household final consumption expenditure are sourced from the World Bank national account databases (World Bank 2016b).

The estimations of affordability (as noted above) are presented in Figures 1-3 to 1-5. A review of the figures suggests that electricity expenditure in India accounts for about 1.3% of agricultural income, and 0.5% of household income. These ratios are low in comparison with other countries, such as, Australia (1.5% and 1.8%), France (3.7% and 2.1%), Korea (3.5% and 1.0%), United Kingdom (4.7% and 1.5%), and United States (1.5% and 1.5%). This implies that electricity is generally affordable for agricultural and household consumers in India. This is understandable if one takes note the fact that agricultural and household electricity prices are heavily subsidised in India (Dubash & Rajan 2001). These subsidies are however mistargeted and mainly benefit large and wealthy agricultural and household consumers. It has even been reported that there is significant popular rural opposition against the provision of electricity subsidies, which

is perceived by the rural poor as a way of further empowering the rich farmers (Reddy 2000).

Conversely, electricity affordability for industry in India (2.8%) is much higher as compared with the ratios in other countries, such as, less than 0.5% in Japan, New Zealand, United Kingdom, and United States, 1.3% in Denmark, 2.1% in Australia and 2.5% in France (see Figure 1-5). This implies that electricity is relatively expensive for industrial consumers in India. In fact, many industrial consumers find cheaper to have their own on-site power plants rather than purchasing electricity from the grid (Planning Commission 2006a).

Figure 1-3: Affordability for agricultural consumers in 2013

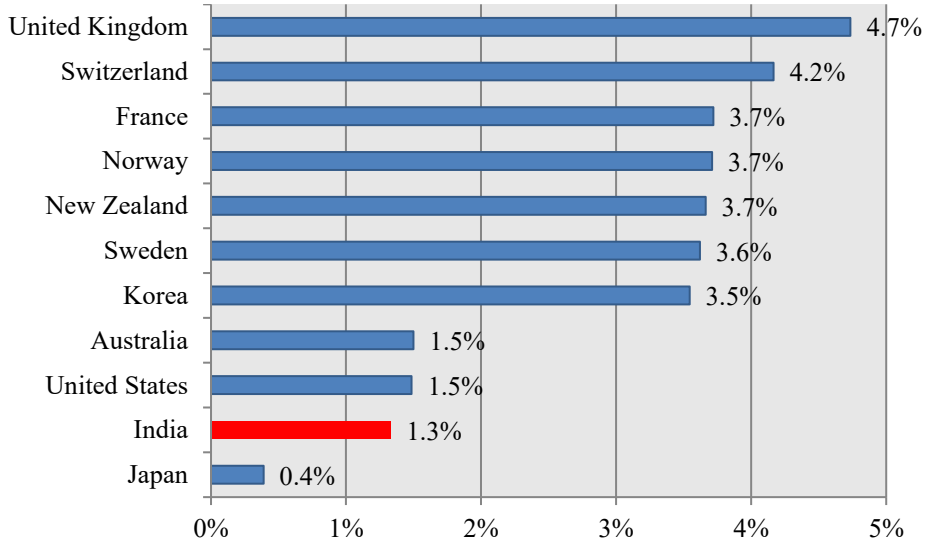


Figure 1-4: Affordability for household consumers in 2013

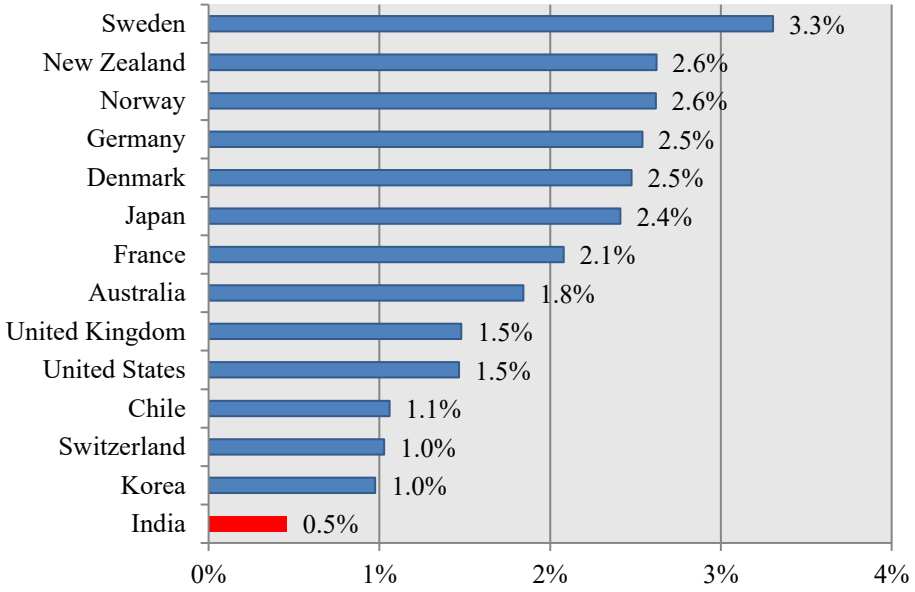
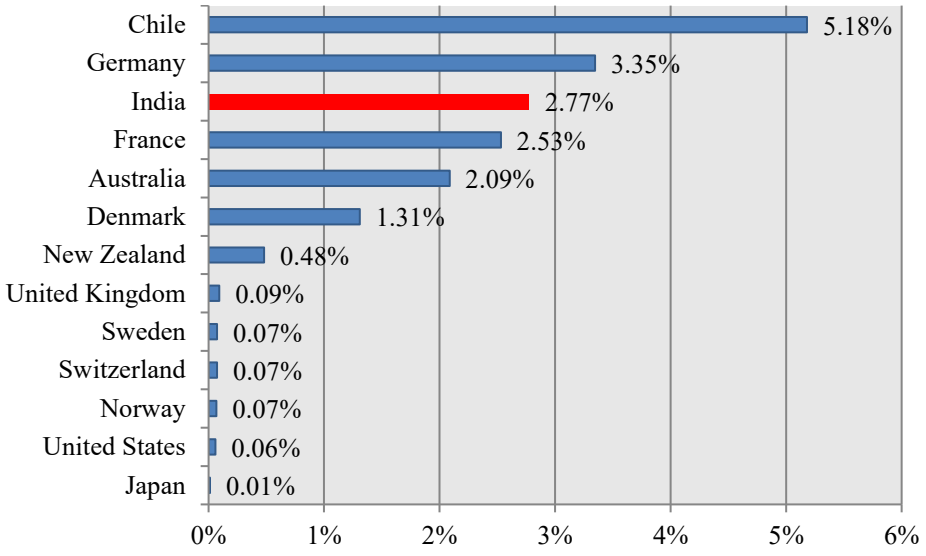


Figure 1-5: Affordability for industrial consumers in 2013



Returns on public investment

Returns on public investment in power projects in India have been generally poor, in fact negative, for state electricity utilities over the period 1991-2001 (see Table 1-3). In fact, revenue earned by public electric utilities is not even sufficient to recover costs of supply. This is reflected in the large and ever-increasing commercial losses made by these utilities (Table 1-3). For example, commercial losses of SEBs were about Rs 41 billion in 1990-

91. In the following years, these losses increased steadily, reaching more than Rs 71 billion in 2013-14. This is equivalent to 0.6 per cent of India's GDP, and 9.2 per cent of the country's gross fiscal deficit in 2013-14. Compared with the country's 12th Five-year Plan (2012-17) outlays for different sectors, these losses account for about 5 per cent of energy spending, or nearly 3 per cent of social service spending (such as, spending on education and health care).

Table 1-3: Returns on public investment

	1990-91	1995-96	2000-01	2005-06	2010-11	2013-14
Rate of return (%)						
- Without subsidy[1]	-12.1	-16.4	-39.1	-	-	-
- With subsidy[2]	-9.5	-2.2	-27.5	-	-	-
Commercial losses (Rs. Crore)						
- Without subsidy[1]	-4,124	-8,770	-25,259	-31,723	-65,997	-71,271
- With subsidy[2]	-3,083	-1,178	-17,794	-19,166	-43,766	-31,148

Notes: 1. Before receiving subvention from the state governments
2. After receiving subvention from the state governments

Sources: Planning Commission (various)

Based on the above discussion, it can be argued that the performance of the Indian electricity industry has been persistently poor, notwithstanding the fact that some performance improvements have been made in recent years. It is extremely important to identify the causes for poor performance, because poor industry performance is not only damaging for the industry, it is extremely damaging for the wider economy and society, given the criticality of electricity as an essential ingredient for economic and social progress.

1.3 Causes of poor industry performance

Over the years, several studies have been undertaken to identify the causes of persistent poor performance of the electricity industry in India. They include, for example, Ahn & Graczyk (2012), Chikkatur et al., (2009), Kannan and Pillai (2001a and 2001b), Khurana and Banerjee (2015), Planning Commission (2001 and 2006), Shunglu Committee (2011), Venkataraman Committee (1964), and World Bank (1979, 1984 and 1999). Appendix A provides a more detailed discussion of these studies. Table 1-4 presents the key features of these studies, in particular causes of poor performance, and the indicators in terms of which performance is measured in each study.

Table 1-4: Key features of existing studies on the causes of poor performance

Key studies	Performance indicators	Causes of poor performance
Venkataraman Committee (1964)	- Large financial losses of SEBs	- Lower-than-cost electricity tariffs, due to the provision of subsidies to the industry
World Bank (1979)	- Inadequate power supply	- Slow growth of supply capacity, due to significant delays in project execution - Underutilisation of existing capacity, due to inadequate network capacity and poor facility maintenance
World Bank (1984)	- Inadequate power supply	- Delays in project execution, due to insufficient financial resources, inadequate supply of construction materials (*e.g.,* cement and steel), frequent revisions in the design of the power plants, and shortages of qualified engineers and technicians. - Inadequate network capacity, due to insufficient investment
World Bank (1999)	- Inadequate power supply	- Overconsumption encouraged by subsidised electricity tariffs
Planning Commission (2001)	- Inadequate power supply	- Insufficient supply capacity, due primarily to the inability of the central and state governments to mobilise sufficient financial resources for capacity expansion
Kannan & Pillai (2001a)	- Large financial losses of SEBs	- High cost of supply, due primarily to inefficiency of the SEBs (*e.g.,* overstaffing) - Lower-than-cost electricity tariffs
Kannan & Pillai (2001b)	- Inadequate and unreliable power supply	- Poor technical efficiency of most power plants, due to poor facility maintenance, poor design of thermal boilers, and service of power plants in excess of their useful operating life - High network losses
Jain (2006)	- Electricity poverty	- Non-discriminatory subsidies to rural consumers that mainly benefit medium and large consumers

Table 1-4: Key features of existing studies on the causes of poor performance (continued)

Key studies	Performance indicators	Causes of poor performance
Planning Commission (2006b)	- Inadequate and unreliable supply - High electricity tariffs for industry, commerce and large households - Electricity poverty	- Insufficient funding to finance necessary capacity expansion and facility maintenance, due to high technical and commercial losses of public electric utilities - High cost of supply - Cross-subsidisation - Mistargeted subsidy programs that mainly benefit large agricultural and household consumers
Chikkatur, Sagar & Sankar (2009)	- Inadequate power supply	- Underutilisation of existing capacity, due to insufficient and poor quality of coal for generation - Inappropriate contractual arrangements for coal supply (*e.g.,* no penalty on non-compliance) - Non-differentiation between coal with different quality in the pricing-settings that encourage the supply of low quality coal
Kodwani (2009)	- Inadequate and unreliable supply - Large financial losses of SEBs	- Insufficient investment and irrational pricing - Inability of the regulators (SERCs) to establish an independent, transparent and unbiased regulatory framework for the industry, due to their strong reliance on government resources (*e.g.,* funding and staff deputation)
Shunglu Committee (2011)	- Large financial losses of public electric utilities	- Inadequate cost realisation - Delays in tariff increase, due to late submission of tariff proposals by electric utilities or submission in unacceptable forms (no audit reports) - Lower-than-cost electricity tariffs, due to frequent government intervention in tariff-settings empowered by section 108 of the Electricity Act - Widespread power thefts and significant network losses
Ahn & Graczyk (2012)	- Inadequate power supply	- Underutilisation of existing capacities, due to insufficient fuel supplies (*i.e.,* coal and gas) - Slow growth of generation capacity, due to inadequate domestic supply of generation equipment

Table 1-4: Key features of existing studies on the causes of poor performance (continued)

Key studies	Performance indicators	Causes of poor performance
Pargal & Banerjee (2014)	- Large financial losses of public electric utilities	- High fuel costs, due to shortage of domestic fuel supply (mainly coal) and poor procurement planning of public electric utilities (heavily reliance on spot market for fuel procurement) - Lower-than-cost electricity tariffs - Insufficient government compensation for electricity subsidies
Pargal & Mayer (2014)	- Large financial losses of public electric utilities	- Inefficiencies of public electric utilities (*e.g.,* poor investment decisions) that lead to large financial losses - Unaccountability of these utilities, caused by frequent political interference - Inability of the regulators (SERCs) to encourage loss reduction, due to insufficient technical, financial and human resources to perform their regulatory functions, and limited autonomy
Khurana & Banerjee (2015)	- Large financial losses of public electric utilities	- High cost of supply, due largely to high fuel costs - Lower-than-cost electricity tariffs

A review of the table suggests that although existing studies have identified a diverse range of causes of the poor performance of the Indian electricity industry, there however is a commonality of views on the underlying causes for poor performance. The main causes for poor performance can be grouped under the following categories: 1) underutilisation of existing capacities, due to insufficient and low quality fuel supplies (*i.e.,* coal and gas), poor facility design and maintenance, and inadequate network capacity; 2) widespread and prolonged delays in project execution, due to insufficient financial resources, inadequate domestic supply of construction materials (*e.g.,* cement and steel) and electrical equipment, shortages of qualified engineers and technicians, and significant revisions in project execution; 3) poor management of electric utilities, mainly caused by frequent state interventions in their day-to-day operation; 4) high financial losses of electric utilities caused by subsidised electricity prices that are normally lower than the cost of supply, high network losses that are due to high technical losses or widespread theft of power, and low payment collection; and 5) inability of the regulators (SERCs) to create an independent, transparent and unbiased regulatory framework for the industry, due to insufficient technical, financial and human resources to perform the regulatory functions, and limited autonomy.

Limitations of existing studies and premise of this research

It is clear from the previous discussion that existing studies overwhelmingly tend to attribute poor industry performance to industry-centric factors, that is, factors that are proximate to the industry, or within the immediate confines of the industry. They include, for example, underutilisation of capacity, low quality fuel, poor system design, inadequate network capacity, lack of financial resources, poor management, *etc*. These studies then suggest ways to improve performance by addressing these factors, for

example, improved capacity utilisation, better quality fuel, improved system design, extending network capacity, and improving industry management.

Such industry-centric focus for understanding causes (reasons) for poor industry performance (and for measures to improve performance) – this research contends – is highly deficient. Why? Because the concept of industry performance is a nuanced concept, and it is context-specific. Performance is, in fact, an outcome of an admixture of layers and layers of mutually interacting and unpredictably reinforcing underlying influences. For example, delays in project execution could happen due to a variety of reasons, such as, unrealistic prior estimation of project execution times, delays in procurement of construction materials, lack of qualified engineers and technicians, *etc*. These, in turn, could be due to ineffective planning processes, which could further be direct outcomes of deficient policy processes. These policy processes may themselves be weak due to their inability to effectively articulate underlying interests; these interests themselves may have cultural, historical and global roots. Similar arguments could be built for other proximate factors. Further, these varied proximate factors and underlying influences may be correlated. For example, poor system design may create need for more-than-planned maintenance, which may lead to low capacity utilisation and inadequate network capacity. Similar arguments could be built for the underlying influences and their interactions with the proximate factors.

In short, the existing industry-centric focus (of attributing industry performance to its proximate factors) is highly deficient – as argued above. It is therefore unlikely to provide, on its own, meaningful insights into the causes (reasons) for poor industry performance, hence guidance for designing measures to improve industry performance. Such insights and guidance can only be gained – this research contends – if one is able to identify the

varied influences that shape the proximate factors. It is based on these insights then that remedies for improving the performance of the Indian electricity industry can be identified – the argument continues.

The task of identifying the varied influences is however extremely difficult, due to their multiplicity, possible correlations, perspectives, and viewpoints (as also noted above). Notwithstanding this difficulty, a sufficiently useful idea about these influences can be gained by grouping these factors into specific 'defining' realms and, through a multi-stage processes, delineating their significance. *Institutional theory* does provide a coherent framework within which an understanding of underlying influences could be developed. This theory divides institutions into formal and informal (North & Thomas 1973). Formal institutions often refer to rules that are made explicit or written down. They include, for example, constitution, laws, and regulations (North 1990). Informal institutions usually refer to socially shared norms that produce regularities in behaviour with respect to particular human interactions. Some examples of informal institutions include: beliefs, customs, conventions, ideologies, and traditions (Kingston & Caballero 2009). A core premise of institutional theory is that the performance of an industry (electricity industry, in this instance) is influenced by the formal institutions, which in turn derive their legitimacy from the underlying informal institutions (Williamson 2000).

As the scope of 'institutions' can be rather expansive and somewhat diffuse, in the context of this paper, the concept of 'governance' is used instead. Governance refers to the structure (such as, hierarchy, network, and market) and processes (for example, control, coordinate, and steer) by which various state and social actors pursue their interests in governing socio-economic activities of a country (see Table 1-5). The outcomes of this pursuit of interest are the setting, application and enforcement of institutions for shaping

human behaviour in these activities (Kjaer 2004). This suggests that the concept of governance tends to emphasise the dynamic aspect of institutions, that is, the ongoing processes of creating, applying and enforcing institutions for governing socio-economic activities, and the role of various state and social actors in shaping these processes. The use of this concept could therefore enable a perspective to be developed on the influence of socio-economic institutions (*e.g.,* central planning, and market competition) in shaping the configurations of electricity industry in India (*i.e.,* industry structure, ownership, regulation), the underlying dynamics of these configurations, and hence, the performance of the industry. Further, rather than engaging in a comprehensive, but less than useful, consideration of the specific institutions for governing socio-economic development in India, the governance perspective developed in this research focuses on the underlying philosophy of the socio-economic institutions – the national governance paradigm. This perspective, in conjunction with the existing industry-centric thinking, can provide much richer insights into why the Indian electricity industry has persistently performed poorly, and what can be done to improve its performance.

Table 1-5: Definitions of governance

		Definitions of governance
Governance as structure	Jessop (1998)	Any mode of coordination of interdependent activities including, for example, anarchy of exchange, organisational hierarchy, and self-organising heterarchy
	Rhodes (1997)	Self-organising, inter-organisational networks characterised by interdependence, resource exchange, rules of the game, and significant autonomy from the state
	Risse (2012)	Institutionalised modes of social coordination to produce and implement collectively binding rules, or to provide collective goods
	Rosenau (1995)	Systems of rule at all levels of human activity – from the family to the institutional organisation – in which the pursuit of goals through the exercise of control has transnational repercussions
	Salamon (2002)	An elaborate system of third-party government in which crucial elements of public authority are shared with a host of nongovernmental or other-governmental actors, frequently in complex collaborative systems
	Torfing (2012)	Networks of interdependent actors that contribute to the production of public governance
Governance as process	Ansell & Torfing (2016)	The process of steering society and the economy through collective action and in accordance with common goals
	Bevir (2012)	All of processes of governing, whether undertaken by a government, market or network, whether over a family, tribe, formal or informal organisation or territory and whether through the laws, norm, power or language.
	Dixit (2008)	Processes that support economic activity and economic transactions by protecting property rights, enforcing contracts, and taking collective action to provide appropriate physical and organisational infrastructure
	Heritier (2002)	Types of political steering in which non-hierarchical modes of guidance are employed
	Kooiman (1993)	All those activities of social, political and administrative actors that…guide, steer, control or manage society
	Pierre & Peters (2000)	An ongoing process of steering, or enhancing the institutional capacity to steer and coordinate
	UNDP (1997)	Exercise of economic, political and administrative authority to manage a country's affairs at all levels

1.3 Research objectives

Against the above background, the primary objective of this research is to develop a governance perspective on the causes of the poor performance of the Indian electricity industry, and to identify ways to improve industry performance. In order to achieve this objective, three specific objectives have been set in this research. These are as follows:

Objective 1: To examine the evolution of *national governance paradigm*, with the aim of gaining insights into the influences of political, socio-economic and cultural factors in shaping this evolution, and to develop an understanding of the impacts of this evolution on shaping the *electricity governance paradigm* in India.

Objective 2: To assess the impact of national and electricity governance paradigms on shaping the structure-ownership-regulation and performance of the Indian electricity industry.

Objective 3: To develop recommendations on how insights gained from objectives 1 to 2 could contribute to developing policy prescriptions for improving the industry performance.

1.4 Research methodology

Clearly, addressing these objectives is a multidisciplinary task. This requires recourse to concepts and methodologies belonging to several disciplines, such as, technology, engineering, economics, political sciences, and sociology. As a result, a combination of methodologies is employed in this research. These methodologies are divided into two parts – a qualitative framework, and a quantitative framework. The qualitative framework essentially draws upon the basic tenets of the *state-society relational* approach for

analysing governance. It seeks to analyse the impacts of national and electricity governance paradigms on shaping the electricity institutions (*i.e.,* industry structure, ownership, regulation), the underlying dynamics of these institutions, and hence, the performance of the industry. The quantitative framework is based on three econometric models, namely, granger causality model, mixed effect model, and multilevel regression model. These models statistically assess the impacts of national and electricity governance paradigms on the structure-ownership-regulation and performance of the Indian electricity industry. This assessment is expected to lend credence to the insights gained from the qualitative analysis (not just confined to select examples or historical events). Details about these two frameworks are provided in Sections 1.4.1 (qualitative framework) and 1.4.2 (quantitative framework).

1.4.1 Qualitative framework

There has been a long tradition of discussion on governance in social sciences. This tradition can be traced back to the work of Thucydides in the 5th century on the failure of governance of Athens (Thauer 2016). Most of the early discussion on governance viewed 'governance' as a synonym for 'government': providing direction to the economy and society by the exercise of authority. This discussion was accordingly primarily confined to the field of political sciences, and was not widely used in other fields of social sciences (such as, sociology and economics) (Kjaer 2004; Lynn 2012).

The situation began to change in the 1980s, driven primarily by shift in the nature and role of the government in the governance of social and economic activities following the neoliberal reforms of the times (Bevir 2012). This shift led to a growing interest among social scientists in understanding the processes of state restructuring and the emerging new forms of governance (*e.g.,* market and network) in various arenas of social and

economic activities, such as, international trade, national-level regulation of the macro-economy, and industry management (Pierre 2002). This interest resulted in a growing popularity of the study of 'governance', as evidenced by the rising number of publications on this topic, and its broad coverage (ranging from international relations, to sociology, to political science, to economics, and to business management) (Kjaer 2004; Levi-Faur 2012). This popularity, ironically, is also a contributing factor to the increasing ambiguity of the concept of governance because different scholars tend to define governance in accord with their own intellectual preferences. Several definitions of 'governance' have accordingly emerged in the literature (Peters 2012).

Despite this ambiguity, most studies appear to view governance as patterns of control; they then focus on the analysis of different aspects of these patterns of control, particularly structural and implementational (Bevir 2011; Risse 2012). Some studies focus on analysing the structural aspects of governance. In these studies, governance is normally defined as a system of formal and informal institutions for controlling human interactions (*i.e.,* social, political and economic). Some examples of this definition are: 'institutionalised modes of social coordination' (Risse 2012), 'system of rules at all level of human activity' (Rosenau 1995), and 'method through which power is exercised in the management of a country's political, economic and social resources for development' (World Bank 1993a). There are accordingly different types of governance structures. They include, for example, market or hierarchy (*e.g.,* authoritative control) for governing economic transactions (Williamson 1975), command and control or public-private collaboration for regulation (Lobel 2012), and anarchy, autocracy and democracy for governing political decision-making (Kjaer 2004).

Other studies emphasise analysis of the implementational aspects of governance. They tend to examine the actual processes of governing that are carried out within specific underlying governance structures. Thus, these studies usually define governance as an ongoing process of governing human interactions (*i.e.,* social, political and economic). Some examples of this definition include: 'all of processes of governing' (Bevir 2012), 'processes that support economic activity and economic transactions' (Dixit 2008), and 'exercise of economic, political and administrative authority' (UNDP 1997).

As discussed above, existing literature views governance as patterns of control over human interactions (*i.e.,* social, political and economic). As also noted above, these patterns of control encompass two important aspects, namely, structure (*i.e.,* institutions for governing human interactions) and processes (*i.e.,* actual processes of governing human interactions within the underlying governance structures). Consistent with this view, this research defines national governance as a system of structures and processes for governing social and economic activities (in India), intended to promote the country's developmental priorities. This research then seeks to analyse the evolution of national governance and its influence on shaping the electricity governance as well as the institutional configurations and performance of the electricity industry.

There exist three broad types of approaches for analysing governance, namely, *state-centred* approach, *society-centred* approach, and *state-society relational* approach (Bell and Hindmoor, 2009; Jessop, 2016).

1. The state-centred approach originated from the ideology held by several prominent political philosophers of the 16th century (such as, Machiavelli, Luther and Bodin), who stressed the importance of absolute and indivisible power of the state in governance (Daniel, 2016). It gradually took shape in the 1970s as a response to

growing state involvement in socio-economic development in the post-war years (1950s and 60s) and perceived inadequacies in society-centred explanations (such as, elitism, pluralism, and Marxism) of this phenomenon (Amenta, 2005; Skocpol, 1985). This approach is built on Max Weber's view of the state as an autonomous actor able to pursue its own goals in governing socio-economic activities of a country (Stepan, 1978). This autonomy is primarily derived from the capacity of the state, not possessed by other social actors, to make policy decisions, due to its control of administrative, legal, bureaucratic, and coercive (*e.g.,* police and military) resources (Kjaer, 2004; Skocpol, 1985). The state-centred approach accordingly tends to focus on analysing governance as reflective of the autonomy and capacity of the state to formulate and implement policies to promote its priorities and agendas, such as, economic restructuring (Evans, 1995; Rueschemeyer and Evans, 1985), industrialisation (Amsden, 1989; Johnson, 1982), and welfare (Smyth and Wearing, 2002).

2. The society-centred approach traces its origins to Marxism, structure-functionalism, and pluralism (Kjaer, 2004). The recent academic interest in this approach has an empirical background in the widespread recognition of the increased influence of non-governmental actors in socio-economic governance following the neoliberal reform of the 1990s (Torfing, 2012). The society-centred approach asserts the centrality of society in the process of governing socio-economic activities of a country. It considers the state as either 'an arena' within which various social actors try to shape the making of policy decisions in pursuit of their own interests (Dahl, 1961; Miliband, 1969; Truman, 1951), or an actor that has to share its authority with a range of social actors (*e.g.,* civil society associations, and interest-groups) in socio-economic governance (Bevir and Rhodes, 2003; Salamon, 2002). The main focus of this approach is

accordingly to analyse the influence of various forms of societal relations and governance networks (such as, public-private partnerships, strategic alliances, and inter-organisational networks) in shaping governance (Marsh, 1998; Rhodes, 1997; Sorensen and Torfing, 2007).

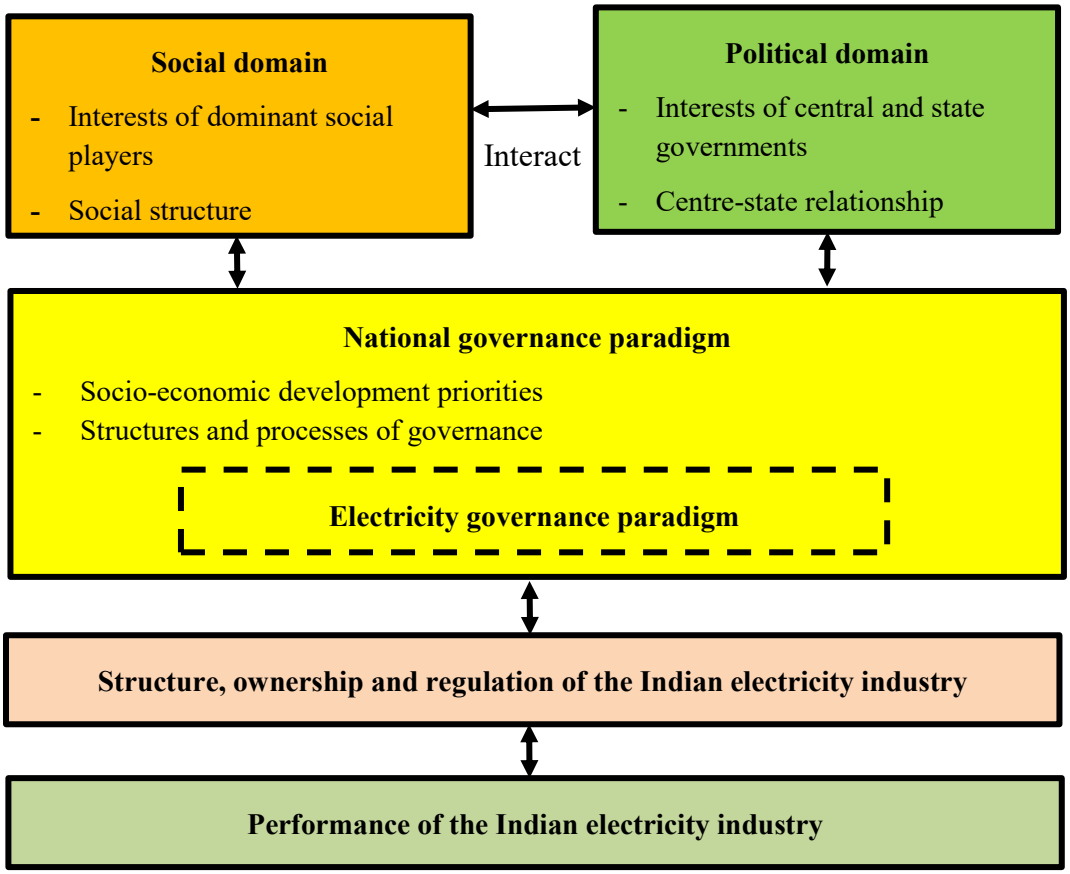
3. The state-society relational approach rejects one sided state- or society-centred approaches to governance on the grounds that state and society are not separate, polar opposites (Sellers, 2011). Rather, they 'are interdependent and interpenetrate in a multitude of different ways … arguments about which of these factors are more important tend to divert us from the more important issues of understanding the complex and changing interaction between state and society' (Block, 1987, p 21). This approach accordingly focuses on the analysis of interactions and interdependency between the state and society in socio-economic governance (Sellers, 2011). It recognises the importance of the state in making policy decisions for governing socio-economic activities of a nation, but suggests that the governance capacity of the state largely depends on how it interacts with various social actors (Jessop, 2016; Kohli, 2002; Migal, 2001). For example, the state could choose to govern unilaterally through the exercise of 'despotic' power. This may however lead to a loss of state legitimacy, and hence adversely affect its governance capacity (Bell and Hindmoor, 2009; Hall and Ikenberry, 1989). In contrast, the state could also choose to govern in partnership with various social actors. This may help the state acquire greater legitimacy, and consequently improve its governance capacity (Bell and Hindmoor, 2009). This may however also lead to anomic democracy, in which 'conflicting goals and specialised interests crowd in one upon another, with executives, cabinets, parliaments, and bureaucrats lacking the criteria to discriminate among them' (Crozier et al., 1975, pp 161).

The above discussion suggests that these three approaches tend to have different focus in the analysis of governance. For example, the state-centred approach focuses on analysing the role of the state in governance. In contrast, the society-centred approach stresses the centrality of society in the analysis of governance. The state-society relational approach rejects this state-society distinction in the analysis of governance. Rather, it focuses on the influence of state-society interactions in shaping governance.

The state-society relational approach is useful in the context of this paper. This is mainly because both, the state and society, have important influence in shaping the governance of socio-economic activities of India. For example, the Indian state remains a critical actor in formulating and implementing policies for promoting socio-economic development of the country, despite significant efforts to reduce its involvement in national economy since 1991, through liberalisation, privatisation, and de-regulation (Chatterjee, 2011). The capacity of the Indian state to pursue its policies has however often been 'softened' by powerful social actors (such as, business groups, and farmer organisations), who seek to thwart these policies in pursuit of their own interests and preferences (Harriss, 2013; Kohli, 1990; Sinha, 2010).

Accordingly, the analytical framework adopted in this paper is built on the state-society relational approach. This framework analyses how Indian state and society have interacted with each other over the past decades, how this interaction has shaped the governance of socio-economic activities of the country, how such national governance has then shaped the way electricity industry is governed, and finally how electricity governance has shaped the structure, ownership, and regulation of the industry, thus influencing its performance. An overview of the broad contours of the qualitative framework employed in this research is provided in Figure 1-6.

Figure 1-6: Governance framework adopted in this research



1.4.2 Quantitative framework

The quantitative framework of this research seeks to statistically assess the impact of governance paradigms (national and electricity) on shaping the structure-ownership-regulation as well as performance of the Indian electricity industry. While fuller details of this framework will be presented in Chapter 4, its salient points are explained in this section.

This framework consists of two sub-frameworks: framework for assessing *mediation effects*, and framework for assessing *moderation effects*. While the framework for assessing mediation effects focus on examining direct impact of governance paradigms (national and electricity) on shaping the industry structure-ownership-regulation (see Section 4.4.1), the indirect impact are the main focus of the framework for assessing

moderation effects (see Section 4.4.2). These two sub-frameworks could assist with developing an understanding of the direct and indirect effects of governance paradigms on the Indian electricity industry, particularly its structure-ownership-regulation and performance. It is in this understanding – this research contends – resides the understanding of why the Indian electricity industry has persistently performed poorly, and what could be done to improve its performance.

1.5 Scope of this research

This research focuses on analysis of the influence of India's governance paradigms (national and electricity) on the shaping of the contours of the Indian electricity industry (*i.e.,* its structure, ownership and regulation) as well as the industry performance. This analysis is carried out in this research from the time of the introduction of electricity in India (1870s) to the present time. This timeframe encompasses major changes in the structure, ownership and regulation of the industry. It therefore allows the development of insights into how these changes have been shaped by the underlying governance paradigms, and how they have influenced the performance of the industry. These insights would further contribute to the development of much fuller understanding of the fundamental causes for the persistent poor industry performance, hence for measures to improve performance.

1.6 Data considerations

This research is data intensive, and requires a broad range of historical information/data to develop key lineaments of India's governance paradigm (national and electricity) and of the structure, ownership and regulation of the electricity industry. This information/data is typically embedded in historical and evolutionary accounts of India's socio-economic development and electricity industry. This research has collected this

information/data from a variety of sources including, for example, government agencies (*e.g.,* Planning Commission), international development agencies (*e.g.,* the World Bank), and relevant literature (such as, conference papers, reports, books, and journal articles). The information/data gaps were filled through data mining and interviews with energy experts in the country.

1.7 Significance of this research

To the best of knowledge of the author, this research is the first comprehensive analysis of the influence of India's governance paradigms (national and electricity) on shaping the contours of the country's electricity industry (*i.e.,* structure, ownership and regulation), and by implication, on industry performance. It represents a point of departure from the conventional, industry-centric, focus of most existing studies that ascribe industry performance to the proximate (industry-centric) factors, and hence seek remedies to improve industry performance within the immediate confines of the industry. The general approach, adopted in this research, this author contends, would provide meaningful insights into the 'fundamental' causes behind the poor performance of the Indian electricity industry and contribute to the development of practical policy responses for improving its performance.

The potential beneficiaries of this research would include: 1) Indian policy makers and planners who may benefit from the insights provided by this research to make more informed policy decisions; 2) potential investors who would be able to develop better appreciation for issues confronting the Indian electricity industry, and hence make more informed investment decisions; 3) multilateral funding agencies (for example, the World Bank and Asian Development Bank) which could use the insights gained from this research to restructure their assistance packages to India in a way that better reflect the

Indian realities; 4) academic and research community which can use the methodological frameworks employed in this research for examining an issue of contemporary importance in the context of a developing country; and 5) society at large who may find this research as an effective medium for articulating their viewpoints and addressing their concerns.

1.8 Organization of this thesis

This thesis comprises of six chapters:

Chapter 2 examines the evolution of national governance paradigm in India and its underlying drivers. It also analyses the impacts of this paradigm on shaping the governance paradigm for electricity.

Chapter 3 examines the impacts of governance paradigms (national and electricity) on shaping the structure-ownership-regulation and performance of the electricity industry in India.

Chapter 4 statistically assesses the impacts identified in the previous chapters.

Chapter 5 demonstrates how insights gained from previous analyses can be applied to improve the performance of the Indian electricity industry.

Chapter 6 provides the summary of the main findings of this thesis. It also discusses limitations of this research and recommendations for future research.

2 INDIA'S NATIONAL AND ELECTRICITY GOVERNANCE PARADIGMS

2.1 Introduction

In the previous chapter, a framework is proposed for analysing changes in national governance paradigm and how these changes have altered the way the Indian electricity industry is governed. This framework seeks to develop an understanding of the interactions between the state and society and the effects of these interactions in shaping India's governance paradigms (national and electricity). This understanding, it is argued in the previous chapter, could provide much deeper insights into the causes of poor performance of the Indian electricity industry, and hence for designing policy prescriptions for improving industry performance.

This framework (approach) is applied in this chapter to analyse: 1) the evolution of national governance paradigm and its underlying drivers; and 2) the influence of this evolution on the shaping of electricity governance paradigm. This analysis is conducted for four time periods, namely, the colonial period (late 18th century to 1946), the centre-dominated period (1947 to 1960s), the populist period (1970s to 1980s), and market reform period (1990s to the present). This timeframe encompasses major changes in India's governance paradigms (national and electricity). It therefore allows a meaningful understanding to be developed of the changes in India's governance paradigms (national and electricity) and their effects in shaping the structure, ownership, and regulation of the industry as well as industry performance.

This chapter is organised as follows. Section 2.2 assesses the historical evolution of the national governance paradigm and its impacts on the shaping of electricity governance paradigm. Section 2.3 provides a summary of the major findings of this chapter.

2.2 National and electricity governance paradigms in India

2.2.1 Colonial period (late 18th century to 1946)

India's governance paradigm for socio-economic development in the colonial period (late 18th century to 1946) is referred to as colonial governance in this research. This governance paradigm emphasised a socio-economic order under which private investors (especially, British) are allowed to freely pursue their self-interests with minimum governmental intervention. This pursuit of private interests, it was believed, would spontaneously generate benefits for the country as a whole. Accordingly, this governance paradigm strongly favoured: 1) domestic market open to British products and capital; and 2) government presence confined to the provision of basic infrastructure (such as, law, order, education and roads) for supporting this movement (Ambirajan 1978).

The colonial governance paradigm of the time was imposed on India by Great Britain through the colonisation process. This colonisation process was primarily informed by three factors. They include:

1) *Trade as an economic necessity.* The British colonisation of India was essentially driven by its business interests in the country. These interests, as argued by Stokes (1959), were to use colonial control 'as an instrument for ensuring the necessary conditions of law and order by which the potentially vast Indian market could be conquered for British industry' (Stokes 1959).

   Hobson (1902) further explains the underlying momentum behind these business interests in terms of wealth misdistribution in Great Britain. Hobson argues that the wealth was increasingly concentrated into a few monopolist organisations (such as, manufacturers' associations, cartels, and syndicates) in Britain in the 19th century. This misdistribution of wealth led to a rapid growth in productive capacity, which was

much faster than the growth of domestic consumer demand because these monopolist organisations were more likely to invest their surplus capital for increasing productive capacity in search of greater profits, instead of distributing them to the mass population (*e.g.,* increased salary). This, in turn, created strong incentives for the country to export the domestically produced surplus capital and products to less developed regions of the world (Hobson 1902).

Hunt (2002) also expresses similar view that 'When productive capacity grew faster than consumer demand, there was very soon an excess of this capacity (relative to consumer demand), and, hence, there were few profitable domestic investment outlets. Foreign investment was the only answer'. Hunt further stresses that 'insofar as the same problem existed in every industrialized capitalist country, such foreign investment was possible only if non-capitalist countries could be "civilised", "Christianised", and "uplifted" - that is, if their traditional institutions could be forcefully destroyed, and the people coercively brought under the domain of the "invisible hand" of market capitalism. So, imperialism was the only answer' (Hunt 2002).

2) *A feeling of cultural superiority.* Many British people believed that their culture was superior to that of the colonial people. It was therefore an important duty of them (or the white man's burden) to impose their customs and traditions on the people they colonised, even at the cost of war. This would, they believed, further bring about order, education, peace, and prosperity to the colonised people (O'Brien & Williams 2010). Palmerston, the then British Foreign Secretary, clearly expressed this belief that 'I may say without any vain glorious boast that we stand at the head of moral, social and political civilisation. Our task is to lead the way and direct the march of other nations'.

This would, as argued in a Commons' Committee report of 1837, provide the colonised people with 'the opportunity of becoming partakers of that civilisation, that innocent commerce, that knowledge and that faith with which it has pleased a gracious Providence to bless our own country' (Lynn 1999).

3) *Colonial domination*. Britain's colonial domination was built on its military strength, and more importantly, its accommodation with indigenous and traditional Indian society, through close collaboration with local dominant castes and other 'big men', to control those below them in the social hierarchy (Burroughs 2001). These local leaders often exercised administrative control on behalf of the British rulers, and acted as mediators between the British unitary centre and the local communities in resolving local issues, such as, tax collection (Krishna 2010). As a result, the traditional patron-client relationships (such as, caste) between landowning class and local communal villagers were largely maintained in the colonial period. In these relationships, local communal villagers were subordinate to landowning class, because landowners usually had larger wealth and hence greater political influence (Krishna 2010). This subordination was also legitimised by the basic religio-cultural values of the local community (Dumont 1970).

Colonial governance paradigm for electricity

Consistent with the wider colonial governance paradigm, between late 19th century and 1946, the India's electricity governance paradigm mainly focused on the furtherance of private interests (especially, British). The colonial government assumed a largely passive role in regulating the electricity industry. This regulatory role mainly included ensuring general safety of electricity supply and usage, and granting licenses for electricity undertakings (Kale 2014b). This role was defined in several legislations passed in the late

19th century and up to the year 1946. Specific details about some of the key legislations are presented as follows.

1) The first legislation endeavouring to regulate the use of electricity in India was enacted in 1887 on the passage of the Electricity (XIII of 1887) Act. This Act mainly aimed to ensure general safety of electricity for the public. It provided for 'the protection of person and property from injury, due to contact with, or proximity of, appliances or apparatus used in the generation or supply of electricity' (Garg, Gaha & Bajaj 2008). It also provided for making rules for preventing telegraph lines from being affected by electricity appliances or apparatus. Under this Act, any people, who were intended to undertake electricity business or to use electricity for public purpose or in public place where there was likelihood of the public being affected, was required to give at least one week notice to the District Magistrate or the Police Commissioner (Garg, Gaha & Bajaj 2008).

2) In 1903, the 1887 Act was replaced by the Indian Electricity Act of 1903. This was aimed to consolidate provisions for regulating electricity supply in the country. This Act required electricity business to be governed by the terms and conditions of the license granted by local governments. It also required that the licensee should not discriminate any consumers in the licensed area (Garg, Gaha & Bajaj 2008).

   Many practical problems were witnessed after the passing of the 1903 Act. For example, the 1903 Act required the sanction of the Governor-General in Council for the establishment of power systems in 'cantonments and similar places in the occupation of Government for naval or military purposes'. But some of these places 'are situated within larger areas, in respect to which the Local Government is empowered to grant licenses'. As a result, 'separate, and not necessarily consistent,

licenses have been granted by the Governor-General in Council and the Local Government, respectively, to the same licensee for the same purpose, in one and the same place'. This has in turn significantly reduced the interests of private investors in electricity, 'as it has hitherto been virtually impossible for a company to obtain a license under two or three years', and 'the financial position may, and in fact frequently does, change completely between the date of the application and the granting of the license' (The Indian Electricity Act 1910).

3) In response to these problems, the 1903 Act was amended and re-enacted as the Electricity Act of 1910, on 18th March, 1910. The 1910 Act was a comprehensive legislation to 'regulate the generation, supply and use of electricity and dealt with licensing, regulation and safety'. It gave considerable regulatory authority to the local governments, particularly the granting of licenses related to electricity supply. The Governor-General in Council was made only responsible for rule-making (Garg, Gaha & Bajaj 2008).

2.2.2 Centre-dominated period (1947 to 1960s)

The early-to-mid 20th century witnessed considerable turbulences in the global socio-economic and political landscapes such as, the Great Depression and two World Wars. These turbulences significantly reduced the military and economic strength of Great Britain. The British colonial government was no longer able to contain the rising Indian nationalism led by the National Congress Party (NCP). India eventually attained independence on 15 August, 1947.

In the years after the independence (1947 to 1960s specifically), India's national leadership strongly favoured a socialist governance paradigm in which the government (especially, central) would control 'the commanding heights of the economy', and

promote rapid industrialisation of the country, by setting up new public companies in heavy and infrastructure industries, and by tightly regulating private investments in other industries (such as, manufacturing industries for producing consumer and intermediate goods) (Kennedy 2014). Rapid industrial growth, it was strongly believed, would contribute to self-sufficiency, and eradication of poverty and backwardness (Chatterjee 2010).

This governance paradigm for post-independence socio-economic development is referred to as centre-dominated governance in this research. It essentially reflected the vision of development held by the then Indian political leaders, particularly Gandhi and Nehru. The ability of these political leaders to pursue their developmental vision was built upon the Congress Party's political dominance of the time. Details are discussed as follows.

1) *Gandhism*: Gandhism is a body of ideas based on Mohandas Gandhi's (the preeminent leader of the Indian Independence Movement) vision of development. To Gandhi, development is not just material or economic; it has to be moral. It should be able to instil the values of equality, harmony and freedom in the people (Thakker 2011). These values could however be undermined by market capitalism, because this model of development 'is exploitative in nature and generates inequalities and conflicts, and all these evils of transformational growth are accentuated under a dependency type of development' (Ghosh 2007). Gandhism accordingly seeks to develop an alternative model for India's development. It views social harmony, self-sufficiency, and cooperation as alternatives to competition and class conflicts. It also emphasises the eradication of poverty, social conflicts, and backwardness in India (Frankel 2005). Gandhism laid the ideological basis for the post-war socio-economic development of

India, by focusing the attention of the Congress Party leaders on moral aspects of development.

2) *Nehruism:* The practical guidance for India's postcolonial development came primarily from the beliefs held by Jawaharlal Nehru, India's first prime minister after independence. Nehru strongly believed in large-scale industrialisation, and viewed it as the best way of achieving self-sufficiency, poverty reduction and improved living standard (Parekh 1991). As Nehru put it, 'It can hardly be challenged that, in the context of the modern world no country can be politically and economically independent, even within the framework of international interdependence, unless it is highly industrialised and has developed its power resources to the utmost. Nor can it achieve or maintain high standards of living and liquidate poverty without the aid of modern technology in almost every sphere of life. An industrially backward country will continually upset the world's equilibrium and encourage the aggressive tendencies of more developed countries' (Nehru 1946, p. 413).

   Nehru's beliefs in large-scale industrialisation also came from cultural considerations. To Nehru, the 'very basic problem' of India was agriculture. Agriculture, as argued by Nehru, 'is a primitive and culturally inferior activity. It heavily relies on the forces of nature, and makes people a plaything of nature'. This encourages 'fatalistic' and 'obscurantist' ways of thought. These ways of thought, in his view, 'fragmented the country, confined the vision of the people to the narrow limits of his village, and are a breeding ground of ignorance, traditionalism, passivity, narrow-mindedness and superstition' (Parekh 1991). Large-scale industrialisation is the means not only to deliver material development (such as, poverty reduction and better living standards), but also to change these 'antiquated' ways of thought (Parekh 1991).

As influenced by Nehruism, the main current of intellectual thought of the Indian government stressed the need for the formation of a developmental state which intervened in the economy, planning and guiding the industrialisation programs, and trying directly to promote the welfare of the population (Roy 2012). For example, the Ministers of Industries met in Delhi in 1938 and adopted a resolution which said, 'This conference … is of the opinion that the problems of poverty and unemployment…cannot be solved without industrialisation. As a step towards such industrialisation, a comprehensive scheme of national planning should be formulated. This scheme should provide for the development of heavy key industries, keeping in view our national requirements, the resources of the country, as also the peculiar circumstances prevailing in the country' (Mishra 2014).

3) *Political domination of the Congress Party.* The Indian politics in the 1950s and 60s was dominated by the Congress Party. The Party ran governments at the centre as well as in the states. For example, in the first three general elections after independence, the Congress Party won about 45 per cent of the votes and 75 per cent of the seats in the Parliament. The largest opposition parties (such as, the Socialist party in 1951, the Praja Socialist party in 1957, and the Communist party in 1962) could only manage about 10 per cent of the votes and less than 5 per cent of the seats in the Parliament. Besides, the Congress Party also won elections in nearly all Indian states until 1967. The only exception was Jammu and Kashmir, where the National Conference party was the ruling party after the 1951 election. But its party leaders were removed in 1953. After that, this party virtually became part of the Congress Party (Mitra 2011a; Sridharan 2010).

This political dominance could be explained partly by the Party's widespread popularity, derived from the nationalist legacy and the hope that the Party would be able to improve the welfare of the population, and partly by the Party's incorporation within its own organisation of the society's traditional authority in various localities, such as, high castes, village leaders and landowners (Kohli & Singh 2013). The Congress Party used the inherited influence of these local leaders to garner votes in the local communities. In exchange for bringing in vote, these local leaders were provided with privileged access to agencies of the government. When ordinary villagers need to make contact with government officials, they would have to do it through the meditation of their village leaders. Thus, the dominant position of these leaders was preserved. Their dominant position was also bolstered by letting development benefits from government-financed projects (such as, employment) pass as patronage through their hands (Krishna 2010).

The dominance of a single party, this research argues, ensured policy consistency and coherency in the 1950s and 60s. This is so because the central government was heavily reliant on the state governments for the implementation of its policies; a strong political centre could bring the state governments under effective central control through the exercise of party discipline, hence a relatively smooth implementation of centre-led development programs (Hardgrave 1970).

Centre-dominated governance paradigm for electricity

The centre-dominated governance paradigm, in the context of the electricity industry, meant the government (especially, central) assuming the lead in developing the industry, and using electricity as a vital input to support the country's large-scale industrialisation

programs. As argued by Dr. Bhimrao Ramji Ambedkar, the chair of the committee on public utilities and electricity:

> 'It is necessary that those who are placed in charge of the subject should have the fullest realisation of (electrification's) significance and its objective. If you agree with me in this, I will request you to ask yourselves the question, "Why do we want cheap and abundant electricity in India?" The answer is that without cheap and abundant electricity no effort for the industrialisation of India can succeed. This answer brings out only a part of the significance of the work this Committee has to undertake. Ask another question, "Why is industrialisation necessary?" and you will have the full significance made clear to you at once; for the answer to the question is, we want industrialisation in India as the surest means to rescue the people from the eternal cycle of poverty in which they are caught' (Kale 2014a).

The central role of the government in developing the electricity industry was envisioned in the Electricity (Supply) Act of 1948. According to this Act, the central and state governments share the responsibilities of developing the Indian electricity industry. At the central level, the 1948 Act provided for the establishment of the Central Electricity Authority (CEA), responsible for providing board guidance and coordination. The Act also mandated the creation of State Electricity Boards (SEBs) at the state levels. The SEBs were mainly charged with the responsibility of operating electricity system within each state, and of controlling and regulating other electricity undertakings (mostly, private licensees) (World Bank 1979).

Despite this, central authority usually overrode state authorities, especially under the dominating central government of the time (Tongia 2009). This was further assisted by the fact that the central government was a major source of electricity finance and played

dominant role in infrastructure planning (including, power) (Henderson 1975). As a result, electricity was often used as a tool to promote the country's large-scale industrialisation programs. As shown in Table 2-1, for instance, industrial sector was overwhelmingly the major single consumer of electricity in the 1960s, accounting for more than 70 per cent of total electricity consumption in the country.

The industrial sector also received electricity at subsidised rates. As shown in Table 2-2, in 1971-72, average electricity tariffs for industrial consumers were 10.6 paise per kWh. They were low as compared to 15.5 paise per kWh for agricultural consumers, 30.5 paise per kWh for domestic consumers, and 31.3 paise per kWh for commercial consumers.

Table 2-1: Electricity consumption by sector (%)

	1960/61	1965/66	1970/71
Industry	73.7	72.8	70.0
Agriculture	4.9	6.3	9.2
Domestic	8.8	7.8	7.9
Commercial & government	5.0	5.5	5.3
Railway	2.7	3.5	2.8
Public lighting	1.0	0.9	1.0
Others	3.8	3.2	3.3

Source: Henderson (1975)

Table 2-2: electricity tariffs (paise per kWh), 1971-72

	Industrial	Agricultural	Domestic	Commercial	Average
Andhra Pradesh	13.4	14.7	32.4	31.5	18.0
Assam	7.6	14.0	33.1	51.1	16.2
Bihar	17.0	26.0	41.7	43.9	15.9
Delhi	15.5	13.9	17.2	21.4	15.2
Gujarat	12.2	18.1	32.6	28.6	14.7
Haryana	10.4	16.3	29.6	23.7	10.5
Karnataka	5.6	14.1	25.3	39.4	8.0
Kerala	6.0	11.9	39.4	41.2	9.5
Madhya Pradesh	11.7	22.1	28.0	26.6	13.8
Maharashtra	10.9	17.9	27.3	26.4	9.8
Orissa	6.2	12.2	23.6	28.3	7.4
Punjab	10.4	8.8	23.5	19.9	8.2
Rajasthan	11.4	14.8	37.7	38.7	13.7
Tamil Nadu	8.3	10.0	32.7	33.4	12.3
Uttar Pradesh	10.1	19.7	31.5	30.4	13.6
West Bengal	13.1	13.3	33.0	16.1	11.7
All India	**10.6**	**15.5**	**30.5**	**31.3**	**12.4**

Source: Henderson (1975)

2.2.3 Populist period (1970s to 1980s)

India's socio-economic development in the 1950s and 60s was relatively sluggish and elitist. This left the majority of the population (especially rural) without any significant improvement in living standards (Kohli & Singh 2013). The lack of improvement in living standards resulted in growing scepticism about post-independence national governance paradigm that emphasised large-scale industrialisation. Acute food shortages and severe foreign exchange crises of the 1960s further lent credence to this scepticism, as these crises apparently symbolised the failure of industry-driven development (Mitra 2011a). This scepticism created momentum for changes in the national governance paradigm. These changes included: 1) a populist and personalistic transformation of the Congress Party, which led to the creation of a system of political authority based on personal loyalties to the top Congress Party leaders (particularly, Indira Gandhi); 2)

provision of welfare packages to the country's poor people (such as, low caste peasants, factory workers or women) in ways that created an impression that they were a gift from the central leadership, Indira Gandhi in particular; and 3) a shift in developmental priority from large-scale industrialisation to accelerated agricultural production by using new technologies (*e.g.,* high-yielding crops) and price subsidies (Kaviraj 1986; Kohli & Singh 2013; Varshney 1995).

The national governance paradigm that emerged from these changes is referred to as *populist governance* in this research. The creation of this paradigm was inspired by a combination of social and political factors. They include:

1) *Growing social activism*. India experienced growing social activism in the late 1960s and early 1970s (Baviskar 2010). For example, in 1967, a locally-organised peasant movement arose in Naxalbari in the eastern state of West Bengal. This movement advocated 'land to tiller' programs, and a violent overthrow of the state government and local landowners by peasants and rural labourers. While it was brutally supressed by the West Bengal government, its influence extended to many other areas of the country, particularly in the states of Bihar, Andhra Pradesh, Chhattisgarh, Jharkhand, and Maharashtra (Baviskar 2010).

   Besides, the early 1970s also witnessed several large-scale labour protests. In 1974, for instance, railway workers organised a massive country-wide strike; they demanded a raise in salary, in the backdrop of declining incomes and rising inflation. This strike lasted for 20 days, and was crushed by a huge police and paramilitary operation; thousands of workers were sent to jail and lost their jobs (Sherlock 1989).

   In addition, there were also widespread anti-corruption protests in many parts of the country (especially, in the states of Bihar and Gujarat). These protests were initially

led by students, but soon became a popular nationwide anti-corruption movement. This movement later escalated into a call for 'total revolution' at a huge rally in New Delhi on 25 June 1975, claiming that the government had lost all moral claims to rule. Later that night, a state of emergency was promulgated by the government, resulting in many opposition leaders and tens of thousands of activists from all over the country being arrested (Baviskar 2010).

This growing social activism essentially reflected the gradual erosion of traditional social authority, that had in the past enabled local influential people (such as, high castes and village leaders) to control those below them in the social hierarchy (Kohli 1990). New social actors (such as, students, industry workers, and peasants and rural labours) entered the political domain and began to press diverse demands upon the government, such as, anti-corruption, raise in salary and working conditions, and land reforms (Baviskar 2010). In order to maintain social and political stability, the central leadership sought to accommodate at least rhetorically and symbolically diverse social demands by personalistic and populist policies (Kohli & Singh 2013).

2) *Internal conflicts of the Congress Party*. As argued by Kaviraj (1986), Indira Gandhi's accession to power was not due to 'either political support, control over party machinery, personal charisma or personal intrigues'. Rather, it was due to 'her weakness, and the fact that she was not too strongly associated with any policy line to give offence to any of the groups which dominated the polycentric structure of the Congress party after Nehru's death'. Accordingly, her rise to power essentially reflected a stalemate between dominant factional interests within the Congress Party. These factional interests believed that 'she would make way after sometime for

someone with clearer policy preferences, or if she survived, she could be encouraged, pressured or cajoled into line' (Kaviraj 1986).

It is therefore understandable that the primary objective of Indira Gandhi after seizing power was to consolidate political control, by creating a new system of authority based on personal loyalties to her, bypassing the old party elites (*i.e.,* the upper-caste intelligentsia, business community and landowners) (Kaviraj 1986). New candidates were selected from among locally prominent and influential wealthy persons (such as, rich farmers) who could finance and win elections (Tenhunen and Saavala 2013). These new state and local Party leaders, as argued by Kaviraj (1986), 'were more in the nature of political "contractor" who were willing to go to any length to dragoon votes, systematically replacing discursive techniques with money and subtle forms of coercion' (Kaviraj 1986).

Populist governance paradigm for electricity

Consistent with the populist governance paradigm, the 1970s and 80s witnessed a gradual shift in India's developmental policies towards populism, focusing on satisfying the demands of various social groups (such as, farmer associations), by distributing public resources and privileges to these groups. The electricity industry was considered as an important instrument for subserving these policies. For example, it was common for the state governments to require the State Electricity Board (SEBs) to provide electricity subsidies (*e.g.,* low electricity tariffs) to agricultural consumers, even though the costs of serving remote rural areas were high (Dubash & Rajan 2001). Wealthy large and intermediate farmers were the main beneficiaries of these subsidies. This is mainly because these wealthy farmers, though small in number, were usually 'the patriarchs of their clans and communities and functioned as political intermediaries who could deliver

blocs of votes to their favoured political party' (Lal 2005). It would be therefore very risky for local political parties to alienate the demands of these powerful wealthy farmers, in the backdrop of mounting democratic activism and volatile swing votes in the 1970s and 80s (Lal 2005).

2.2.4 Market reform period (1990s to the present)

The 1980s saw a considerable increase in the Indian government's fiscal deficit. The deficit reached more than 10 per cent of the GDP in the late 1980s, due primarily to escalating public expenditure on interest repayments on commercial borrowings, large amount of subsidies for targeted beneficiaries in agriculture and industry, and rising defence expenditure (Ganguly & Mukherji 2011). The balance-of-payment crisis broke out in 1991, as the government could not guarantee its debt repayments, and the international banks lost their confidence in the country. This crisis was further exacerbated by the collapse of India's important trade partner (the Soviet Union) in 1990, and rising oil bills in the early 1990s caused by the Iraq War (Tenhunen & Saavala 2012).

In response, India turned to the International Monetary Fund (IMF) for financial assistance to avoid defaults on loans. As part of the conditions for receiving such assistance, the Indian government agreed to implement market reforms (Weinraub 1991). These reforms were primarily based on neoliberal ideology that state-centric governance paradigm is inherently inefficient, due to bureaucratic inefficiencies, lack of market-styled incentives, and highly political bias, especially of strong interest groups (Harvey 2005). Neoliberalism accordingly suggested a rollback of the state, limiting itself to 'steering' the policy development processes for socio-economic development and leaning the rest to the market. It specifically emphasised the replacement of the state by an entrepreneurial system based on market competition and private ownership (Bevir 2009).

Such market-oriented governance paradigm, neoliberalists argued, would achieve optimum economic performance with respect to efficiency, economic growth, and technical progress. This would then lead to improved living standards for the population (Harvey 2005).

The Indian government started to implement neoliberal reform in 1991. Some key components of these reform programs included: financial and trade liberalisation (such as, removal of exchange rate controls and trade restrictions), reduction of public deficit by cutting public expenditure and privatisation of public-owned companies, dismantling of the industrial licensing system (*i.e.,* licence Raj), and gradual removal of protection in selected sectors (such as, industry, infrastructure and agriculture) (Shylajan, Sreejesh & Suresh 2011).

These reform programs have however only been partially implemented. In some areas (such as, encouragement of private investment), reforms have been implemented with relative ease, while in others (particularly, removal of protection in agriculture) there have been strong resistance; the progress of reform has therefore been slow (Mitra 2011a). This partial implementation of market reform is essentially reflective of mixed views on this type of reform in India. Some points to support this observation are presented below.

1) *Strong rural resistance to reform.* The resistance to reform mainly came from rural elites (such as, rich peasants and capitalist farmers), who had come to rely on enormous quantities of low-cost electricity for pumping water, fearing that market reform would lead to the removal of electricity subsidies that the government currently provide to them (Lal 2005). This resistance was often expressed as part of rural opposition to the economy-wide reforms. For example, the Karnataka Rajya Ryot Sangha (KRRS), one of India's major farmer organisations, led a number of

protests against market liberalisation in the early 1990s. Market liberalisation, it was argued, is part of the larger strategy of international capital for 'trapping India in the vicious circle of exploitation and converting her into a neo-colony' (Assadi 1997, p. 530). It would, the argument continued, adversely affect Indian agriculture by, for example, a gradual withdrawal of agricultural subsidies and price support, introduction of seed-manufacturing multinational companies that will destroy the autonomy of Indian farmers, and use of genetically-modified food that has the potential to destroy India's biodiversity (Assadi 1997).

Similar protests were witnessed in several other states. For example, the Bharatiya Kisan Union (BKU) of Punjab staged a protest in New Delhi in 2004. This protest was against the reduction of government's price support on cotton crops. In Rajasthan, the Kisan Mazdoor Vyapari Sangh (KMVS) organised several large-scale protests in 2006 against rising electricity and water tariffs (Pai 2010).

Further justification for this rural resistance to reform came from rising farmer suicides in the country. Farmer suicides were considered as a product of 'a crisis rooted in economic reforms', that is, in the shift in agricultural governance due to market liberalisation (Patnaik 2004; Rao 2004). For example, in 1998, more than 1,000 farmers from Andhra Pradesh staged a massive protest in New Delhi. This protest was organised by the Rytanga Atmahatyala Nivarna Aikya Porata Vedika (Platform for United Struggle to Prevent the Suicide of Farmers) of the southeast state of Andhra Pradesh. They submitted a memorandum to the Lok Sabha (lower house of the Indian Parliament), which argued that the farmer suicides were primarily caused by market reform pursued by the central government for the last seven years (Pai 2010).

2) *Growing political regionalism*. Strong rural resistance to reform was also encouraged by growing political regionalism. Since 1989, no national party could win majority in the Parliament alone. Rather, they always needed to collaborate with state parties to form coalition government. This led to a weakened central government on one hand and increasingly empowered state governments on the other hand (Chatterjee 2010). Given the relatively strong influence of the landed elites (such as, rich peasants and capitalist farmers) on the state governments, it became difficult for the state governments to fully implement market reform, especially in rural areas (Mitra 2011b).

3) *Increasing business influence in policy-making*. A considerable increase in the influence of domestic business groups in policy-making (especially, at the central level) has been witnessed since the 1980s (Chatterjee 2010). For example, it was observed that the central government has regularly consulted with domestic business groups (especially, national business associations, such as, the Federation of Indian Chambers of Commerce & Industry, the Confederation of Indian Industry, and the Associated Chambers of Commerce and Industry of India) on economic and trade policies (Sinha 2010).

   There are two contributory factors for this increased business influence on policy-making. One, post-war industrialisation created new business groups in engineering, metals, and chemicals, *etc*. While the economic strength of these new business groups grew, they found that their further growth was constrained by the fact that access to key resources (*e.g.,* capital) was controlled by the country's economic planners, who naturally favoured traditional business groups, which had a proven track record and established connections with the government. This in turn created incentives for these

new business groups to gain political power, with the aim of influencing the economic planners' decisions (Chibber & Usmani 2013).

Two, the political influence of these business groups was further strengthened by a widely held view by the Indian society that the 1970s is a lost decade due to economic stagnation. This view significantly increased the leverage of groups (such as, major business groups, and some bureaucratic and political leaders) that were critical of state-centric economic planning, because the disappointing economic outcomes of the 1970s provided them with larger scope for criticising state-centric economic planning (Chibber & Usmani 2013).

The increased business influence in policy-making contributed to a fair degree of policy coherence and stability, especially in some key areas such as market liberalisation in the urban areas. This is so because domestic business groups had a clear policy preference for market liberalisation and privatisation of public companies, as this would lead to dismantling of controls and regulations on domestic investment, and hence open new profit-making opportunities for them (Chibber & Usmani 2013; Kohli & Singh 2013).

Partial market-oriented governance paradigm for electricity

Consistent with the country's wider shift towards market-oriented governance paradigm, several legislative changes were made in the 1990s and 2000s to reduce the role of the government in the electricity industry. For example, the Electricity Act of 1948 was amended in 1991, to allow private participation in generation, in the form of independent power producers (IPPs). In 1998, the central government passed the Electricity Regulatory Commissions Act of 1998. This Act set up the Central Electricity Regulatory Commission (CERC), responsible for regulating central government owned utilities and

matters related to interstate exchange of electricity. It also provided for the creation of State Electricity Regulatory Commissions (SERCs). The SERCs are extensions of the CERC at the state level, responsible for rationalising retail tariffs, regulating wholesale and network prices, and intrastate matters (such as, intrastate electricity trading) (Garg, Gaha & Bajaj 2008). In 2003, the central government enacted the Electricity Act of 2003. This Act sought to deepen and formalise electricity market reforms that were already underway in some regions. Key elements of this Act included: introduction of market competition, open-access to networks, and free entry of new power generators (Pargal & Banerjee 2014).

These legislative changes led to the implementation of electricity market reforms that emphasised private ownership, market mechanisms for electricity trading, elimination of subsidies and price control, and sector-specific regulator for overseeing the operation of power systems (Tongia 2009). The progress of this reform has however been quite slow (especially, in the rural areas) due to strong political resistance. For example, when the governments initiated pricing reforms, they were usually faced with vocal and organised agricultural sector that viewed removal of electricity subsidies and market-based electricity pricing as detrimental to its interests (Joseph 2010). Thus, although reforms of the State Electricity Boards (SEBs) had begun and regulatory agencies were set up in every state, the reforms remain largely ineffective. As argued by the World Bank, 'Boards remain state-dominated, lack sufficient decision-making authority in practice, and are rarely evaluated on performance. Political interference in appointments to and by the board and in decision making on business aspects remains common, and board member training and peer evaluation are conspicuous by their absence' (Pargal & Banerjee 2014).

2.3 Summary

This chapter has shown that the national governance paradigm in India was informed by various political, socio-economic and cultural influences, arising from the interactions between the Indian society and the state (see Table 2-3). This chapter has also shown that the electricity governance paradigm was essentially a reflection of the underlying national governance paradigm. Some key findings of this chapter are summarised as follows.

- India's national governance paradigm in the colonial period (late 18th century to 1946), referred to as colonial governance in this research, emphasised a socio-economic order under which colonisers were allowed to freely pursue their self-interests with minimum governmental intervention. This pursuit of colonial interests, it was believed, would spontaneously generate benefits for the colonising countries. Accordingly, this governance paradigm strongly favoured: 1) domestic market open to British products and capital; and 2) government presence confined to the provision of basic infrastructure (such as, law, order, education and roads) for supporting this movement.

- Britain's colonial domination was built on its military strength, and more importantly, its accommodation with indigenous and traditional Indian society, through close collaboration with local dominant castes and other 'big men', to control those below them in the social hierarchy.

Table 2-3: Evolution of the national governance paradigm and its underlying influences

	Colonial period (late 18th century ~ 1946)	Centre-dominated period (1947 ~ 1960s)	Populist period (1970s ~ 1980s)	Market reform period (1990s ~ the present)
National governance paradigm	**Colonial governance** - Emphasis on the pursuit of colonial interests - Domestic market opening to colonial products and capitals - Government presence confined to the provision of basic infrastructure, such as, law, order, education, and roads	**Centre-dominated governance** - Tight public (especially, central) control of the economy - Rapid industrialisation	**Populist governance** - Accelerated agricultural production - Provision of welfare packages to targeted social groups	**Partial market-oriented governance** - Emphasis on market competition and private ownership - Reduced scope for government involvement in socio-economic development - Partial implementation due to strong resistance
Underlying influences	- British business interests - A feeling of cultural superiority - British colonial domination - Close collaboration with local dominant castes and village leaders	- Gandhism that emphasised moral aspects of development - Nehruism that stressed the importance of industrialisation in promoting social and economic development - Political dominance of a single party - Incorporation within party organisation of the society's traditional authority	- Food shortages and lack of improvement in living standards - Gradual erosion of traditional social authority in the local community - Rising social activism - Factional fights within the Congress Party	- Mixed views on reform - Support from domestic business groups - Opposition from farm organisations - Growing political regionalism with weakened central government and increasingly empowered state governments

- Consistent with the wider colonial governance paradigm, between late 19th century and 1946, electricity governance paradigm in India mainly focused on the furtherance of business interests (especially, British). The colonial government assumed a passive role in regulating the electricity industry. This regulatory role was confined to ensuring general safety of electricity supply, and issuing licenses to electricity undertakings.

- India attained independence on 15 August 1947. In the years after the independence (1947 to 1960s), the country's national leadership strongly favoured a socialist governance paradigm in which the government (especially, central) controlled 'the commanding heights of the economy', and promoted rapid industrialisation by creating public companies in industrial and infrastructure sectors, and by tightly regulating private investments in other industries (such as, manufacturing). This, it was strongly believed, would lead to self-sufficiency and the eradication of poverty, unemployment and backwardness.

- This post-independence governance paradigm for socio-economic development, referred to as centre-dominated governance in this research, derived its ideological basis from Gandhism that focused the attention of Congress Party leaders to moral aspects of development (such as, employment creation and elimination of inequity). Its practical guidance came from the vision of development held by Jawaharlal Nehru, India's first prime minister after independence. He had a strong belief in large-scale industrialisation, and viewed it as the best way to achieve self-sufficiency, poverty reduction and improvement in living standards.

- The ability of the Congress Party to establish its perceived national governance paradigm was built on the Party's political dominance of the time. This political

dominance was built upon the Party's widespread popularity, derived from its nationalist legacy, and its incorporation within its own organisation of the society's traditional authority in various localities, such as, high castes, village leaders, and landowners.

- The centre-dominated governance paradigm, in the context of the electricity industry, meant the government (especially, central) assuming the lead in developing the industry, and using electricity as a vital input to support the country's large-scale industrialisation programs.
- A combination of economic stagnation, severe food shortages, and lack of improvement in living standards created momentum for changes in national governance paradigm. The changes included: 1) a populist transformation of the Congress Party, leading to the creation of a system of political authority based on personal loyalties to the top Congress Party leaders; 2) provision of welfare packages to the country's poor people in ways that created an impression that they were the gift from the central leadership; and 3) a shift in developmental priority from industrialisation, to accelerated agricultural production, using new technologies and subsidies.
- The national governance paradigm that emerged from these changes is referred to as populist governance in this research. The primary motivation for this governance paradigm was growing social activism in the late 1960s and early 1970s. In order to maintain political stability, the central leadership sought to accommodate (at least rhetorically and symbolically) diverse social demands by personalistic and populist policies. This accommodative strategy was also motivated by factional fights within the Congress Party, between the central leadership and old party elites (such as, the

upper-caste intelligentsia, business community and landowners). This strategy created a system of authority based on personal loyalties to the central leadership, bypassing the old party elites.

- Consistent with the populist governance paradigm, the 1970s and 80s witnessed a gradual shift in India's developmental policies towards populism, focusing on satisfying the demands of various social groups (such as, farmer associations), by distributing public resources and privileges to these groups. The electricity industry was considered as an important instrument for subserving these policies.

- The 1980s saw a considerable increase in India's fiscal deficit. Faced with a severe balance of payment crisis, the Indian government agreed to implement market reform in the early 1990s, as the condition of receiving financial assistance from the IMF. This reform was primarily based on neoliberal ideology that considered state-centric governance as inherently inefficient, due to bureaucratic inefficiencies, lack of market-styled incentives, and highly political biases, especially of strong interest groups. Neoliberalism accordingly suggested a rollback of the state, limiting its role to 'steering' socio-economic development. This market-oriented governance paradigm would then achieve optimum economic performance with respect to efficiency, economic growth, and technical progress, resulting in improved welfare of the population, the argument continued.

- The market reforms have however only been partially implemented. This essentially reflects mixed perceptions on reform in India. On the one hand, the domestic business groups strongly supported market reform based on the belief that it would lead to a dismantling of controls and regulations on domestic investment, and open new profit-making opportunities for them. This, assisted by increased business influence at the

central level, resulted in a fair degree of policy coherence and stability, especially in the areas of market liberalisation. On the other hand, market reform faced strong rural resistance, due to the fear that it would adversely affect rural interests (*e.g.,* removal of electricity subsidies). Given the relatively greater influence of landed interests on state governments, the implementation of market reform has been quite slow at the state levels.

- As part of the country's wider shift towards market-oriented governance paradigm, several legislative changes were made in the 1990s and 2000s to reduce the government's role in the electricity industry. These changes led to the implementation of electricity market reform that emphasised private ownership, market mechanisms for electricity trading, elimination of subsidies and price control, and establishment of sector-specific regulators for overseeing the operation of the power systems. The progress of this reform has however been quite due to strong rural resistance.

The above discussion suggests that the electricity governance paradigm in India, over the four distinctive time periods (namely, colonial, centrist, populist, and neo-liberal), have predominately been shaped by the underlying governance paradigm for socio-economic development of the country. Further, the discussion also suggests that underlying national governance paradigm of a time is essentially reflective of the dominant political and socio-economic interests of the time. This suggests that electricity governance is merely a process of serving dominant political and socio-economic interests of the time. In such environments, consideration of industry performance assumed a dormant role. Poor industry performance is therefore a 'natural' outcome. This viewpoint is further discussed in Chapter 3 of this thesis, through an analysis of the impact of governance paradigms

(national and electricity) on the structure-ownership-regulation as well as performance of the Indian electricity industry.

3 INDUSTRY STRUCTURE-OWNERSHIP-REGULATION AND PERFORMANCE

3.1 Introduction

As shown in the previous chapter, the electricity governance paradigm in India has historically been shaped by the underlying governance paradigm for socio-economic development of the country, which in turn derived its legitimacy from the dominant political and socio-economic interests of the time. This suggests that electricity governance is merely a process of serving dominant political and socio-economic interests of the time. This, it is argued in this chapter, has made issues of industry performance subordinate to broader political and socio-economic interests. Poor industry performance is therefore a natural outcome.

The veracity of this argument is assessed in this chapter, through an analysis of changes in the structure-ownership-regulation of the Indian electricity industry, as guided by the underlying electricity governance paradigm, and how these changes have affected the industry performance. This analysis is conducted for four time-periods, to coincide with major changes in the structure-ownership-regulation of the Indian electricity industry. These time periods are: the colonial period (late 19th century to 1946), the centre-dominated period (1947 to 1960s), the populist period (1970s and 80s), and the market reform period (1990s to the present). The analyses of structural, ownership and regulatory changes in these four-time periods – this research argues – will allow a meaningful understanding to be developed of the nature of these changes, how they have been shaped by the underlying electricity governance paradigm, and what is their impact on industry performance.

This chapter is organised as follows. Section 3.2 assesses the impact of electricity governance paradigm on the industry structure-ownership-regulation and performance. Section 3.3 summarises the major findings of this chapter. Some broad conclusions of the chapter are also presented in this section.

3.2 Industry structure-ownership-regulation and performance

This section provides an overview of the key lineaments of the structure-ownership-regulation and performance of the Indian electricity industry, with the view to assess the impact of electricity governance paradigm on these lineaments.

3.2.1 Colonial period (late 18th century to 1946)

Consistent with the wider colonial governance paradigm of the times, between late 19th century and 1946, electricity governance paradigm in India largely emphasised the furtherance of private interests (especially, British). The colonial government assumed only a passive role in regulating the electricity industry, with regulation primarily confined to the areas of safety and licensing (see Section 2.2.1). This electricity governance paradigm led to the development of electricity industry typified by highly fragmented structure, predominately private ownership, and minimal regulation.

Structure, ownership and regulation

The electricity governance paradigm of the times (*i.e.,* colonial) provided private investors (especially, British) with the freedom to exploit potential business opportunities associated with electricity. The government assumed only a passive role in regulating the electricity industry. This role was primarily confined to the areas of safety and licensing. For example, the electric utilities were regulated to protect 'person and property from injury, due to contact with, or proximity of, appliances or apparatus used in the generation

or supply of electricity'. They were also regulated to 'prevent telegraph lines from being affected by electricity appliances or apparatus' (Garg, Gaha & Bajaj 2008). Besides, electric utilities were required to obtain licenses for supplying electricity to any area or individual. The licensee had the monopolistic right of supplying electricity to its franchised area. There was no tariff regulation on licensee. Each licensee was required to maintain accounts in a format prescribed in the license. These accounts would be regularly inspected by the government to prevent the licensee from abusing its monopoly power (Sankar & Ramachandra 2000).

Electricity was firstly introduced in India in 1879, when a demonstration of electric lighting was made in Calcutta (today Kolkata) by a British company (Tongia 2009). In the following years, a steady development of the electricity industry was witnessed in the country. Between 1907 and 1912, for example, India's imports of electrical machinery increased by about 30 per cent while imports of steam-driven machinery dropped by more than 60 per cent, suggesting an increasing popularity of electricity in the country (Speyer 1913).

Most of this development was undertaken by British investors. There were also a few prominent Indian-owned power companies, notably Tata & Sons. Tata & Sons was granted licenses for three large hydro projects in the early 20th century. These hydro projects were among the largest in the country in terms of installed capacity and electricity sales. They were operated by three companies controlled by Tata & Sons. They included: the Tata Hydro-Electric Power Supply Company, the Andhra Valley Power Supply Company, and the Tata Power Company (Kale 2014b).

There also existed a few public owned electric utilities, particularly in less industrialised states with spatially scattered economic activities (hence lack of large and concentrated

demand for electricity) (Kale 2014b). For example, in Madras (a princely state under indirectly British rule), the government took the lead in developing the electricity industry, and built several power stations in the state. These stations included, for example, Aruvankadu hydro power station, Mettur hydro power station, thermal power stations at Bezawada, Vizagapatam, and Cocanada, and Papanasam hydro power station (Rao & Lourdusamy 2010).

Table 3-1 shows installed capacity and ownership of the five largest Indian electric utilities of the times.

Table 3-1: Major Indian electric utilities in the early 20th century

Electric utilities	Installed capacity (kW)	Ownership
Tata Hydro-Electric Power Company	32,000	Domestic private
Mysore Government Cauvery Falls Company	12,000	Public
Calcutta Electric Supply Corporation	10,000	British
Bombay Electric Supply and Tramway Company	7,000	British
Rangoon Electric Tramway and Supply Company	5,900	British

Source: Speyer (1913)

Performance

Most capacity of the time was built to serve big cities and urban towns, where industry and population were at their greatest density. Smaller rural towns and villages were largely untouched by this new technology (Kale, 2014b). This can be explained by the lack of interests by private investors in building power projects in remote, economically unattractive rural areas. This view gets substantiated by a review of the installed capacity, generation and consumption of the time, as presented in Table 3-2. This table shows that

in the British provinces, most installed capacity (more than 58 per cent) was located in Bombay and Bengal (economic centres of the times), implying the profit-orientation of private investors (particularly, British) who were only interested in building power projects in areas where electricity businesses were considered economically viable. These two provinces also had the largest amount of electricity generation and consumption among the British provinces. Similarly, in the Indian states, more than 40 per cent of the installed capacity was situated in Mysore. This state also had the largest electricity generation and consumption among the Indian states.

Table 3-2: Installed capacity, generation and consumption in 1944

	Installed Capacity		Generation		Consumption	
	kW	%	GWh	%	GWh	%
			British provinces[1]			
Ajmer-Merwara	1,394	0.1	3	0.1	2	0.1
Assam	2,524	0.2	4	0.1	3	0.1
Baluchistan	1,250	0.1	3	0.1	2	0.1
Bengal	336,622	29.6	846	25.2	739	26.1
Bihar	27,162	2.4	74	2.2	67	2.4
Bombay	323,999	28.5	1,323	39.5	1,139	40.2
Berar	20,563	1.8	39	1.2	33	1.2
Coorg	74	0.0	0	0.0	0	0.0
Delhi	22,285	2.0	71	2.1	61	2.2
Madras	135,740	12.0	370	11.1	292	10.3
NWFP	10,630	0.9	16	0.5	13	0.5
Orissa	1,221	0.1	1	0.0	1	0.0
Punjab	89,539	7.9	195	5.8	149	5.3
Sind	17,558	1.5	37	1.1	30	1.1
United Province	144,935	12.8	367	11.0	304	10.7
Total	**1,135,496**	**100.0**	**3,350**	**100.0**	**2,835**	**100.0**
			Indian states[2]			
Baroda	4,761	3.3	7	1.5	6	1.5
Bikaner	4,000	2.8	11	2.3	8	2.0
Cochin	2,919	2.0	5	1.1	7	1.9
Gwalior	3,846	2.7	9	1.7	7	1.7
Hyderabad	12,901	8.9	28	5.7	24	6.1
Indore	2,980	2.1	8	1.6	7	1.7
Jaipur	2,995	2.1	6	1.2	4	1.1
Jodhpur	2,600	1.8	5	1.1	4	1.1
Kashmir	4,270	3.0	21	4.2	12	3.1
Mysore	61,000	42.2	280	57.1	217	55.0
Rampur	4,200	2.9	7	1.5	6	1.4
Travancore	16,947	11.7	70	14.3	58	14.8
Other states	21,069	14.6	34	6.9	34	8.6
Total	**144,488**	**100.0**	**491**	**100.0**	**394**	**100.0**

Notes: 1. British provinces refer to regions directly ruled by the British Crown as colonial possessions of the United Kingdom.
2. Indian states refer to regions ruled by local or regional Indian rulers in a subsidiary alliance with the British Crown.

Source: Kale (2014a)

3.2.2 Centre-dominated period (1947 to 1960s)

After independence in 1947, the new government of India adopted socialist governance paradigm for socio-economic development of the country, with the public sector assuming an ever-larger role in the economy (see Section 2.2.2). Electricity was viewed as a vital input for socio-economic development. It was therefore placed under public control, as it was believed that only public sector could forgo immediate profit and supply electricity to less-developed areas where electricity supply was considered as economically-unviable (Rao 2002).

The belief in public control of the industry was primarily legitimised on the basis of the country's unsatisfactory experience with private electric utilities in the colonial period. As argued in the Constituent Assembly debates of 1948:

> 'But what these (private) corporations did was to take away the cream of income from the public and not contribute even a little or a farthing to the expansion of power to the rural areas…Corporations were easily established in towns (where) for lighting and other purposes they were charging at the rate of 4 annas per unit whereas under the terms of license they were obliged to supply power for agricultural and industrial purposes at the rate of 9 pies per unit. Therefore, these corporations always concentrated their efforts only in cities where on account of lighting they would get the largest portion of income, but they tried least to get into the villages and giving power to lift up water from wells and so on' (Constituent Assembly Debates 1948, p.41, cited in Kale 2014a).

The belief in public ownership was further supported by the capital-intensive nature of the electricity industry; to build large-scale power stations and long-distance high voltage transmission networks required large investments. Investments of such magnitude could

be more effectively financed by the public sector, because the government was normally considered as the most creditworthy entity and was therefore able to borrow money at the lowest rates (World Bank 1993b).

This belief led to important changes in the Indian electricity industry (particularly, its structure, ownership, and regulation) in the post-independence years (1947 to 1960s). These changes were primarily made to ensure that electricity could be used as an instrument for subserving the wider social and economic developmental policies of the country, with particular focus on promoting rapid industrialisation (see section 2.2.2). Specific details about some of the key changes in the structure, ownership and regulation of the Indian electricity industry are discussed in the following paragraphs.

Structure, ownership and regulation

At the time of independence, the Indian electricity industry was predominantly owned by the private sector. In 1948, the Indian government enacted the Electricity (Supply) Act, 1948. This Act brought all electricity generation, transmission and distribution under public control. It also led to the establishment of vertically integrated public electric utilities (*i.e.,* State Electricity Boards), responsible for generation, transmission, distribution and retail of electricity within state territories, and for the control and regulation of other electricity undertakings (such as, private utilities and municipalities) (Rao & Lourdusamy 2010).

This vertically integrated structure was justified on the grounds of natural monopoly characteristics of the electricity industry, *i.e.,* a single company that integrated all segments of the electricity industry can supply electricity at the lowest costs, because it could avoid wasteful duplication, particularly of transmission networks. It could also enable significant cost reductions arising from the pursuit of scale economies *i.e.,* the

larger the number of consumers served, the lower the average costs of electricity supply (Gilbert, Kahn & Newbery 1996).

As originally conceived, the SEBs were expected to be self-regulated and autonomous public corporations. They would be controlled by a Board, appointed by the respective state government. The Board would be responsible for the SEB's actions, with duties laid down by the Electricity (Supply) Act of 1948, and with independence in their day-to-day operations. The Board would be subjected to broad instructions and guidance in policy matters from the state governments (Rao & Lourdusamy 2010).

In practice however, the autonomy of the SEBs was limited. Most SEBs worked under tight control by the state governments. The chairman and members of the SEBs were usually directly appointed by the state governments. It was also common for the Minister in charge of electricity in the state to get involved in the day-to-day operation of the SEBs (Santhakumar 2008). This tight government control implied that the government (especially, state) had important influence in the regulation of electricity industry. This also implied that the industry could be easily used as an instrument to support prevalent political objectives rather than operated based on considerations of economic efficiency and cost minimisation.

Performance

The 1950s and 60s witnessed large public investments on power projects, rising from Rs. 2.6 billion in the period 1951-1956, to Rs. 12.5 billion in the period 1961-1966 (World Bank 1979). These investments led to a rapid expansion of the public sector. As a result, the public sector began to dominate the industry in the early 1970s. As shown in Table 3-3, in 1971-72, the SEBs supplied 66 per cent of electricity sold in the country, while other public electric undertakings (such as, municipalities and government departments)

supplied 13 per cent. Electricity supplied by private utilities accounted for only 21 per cent of total electricity supply.

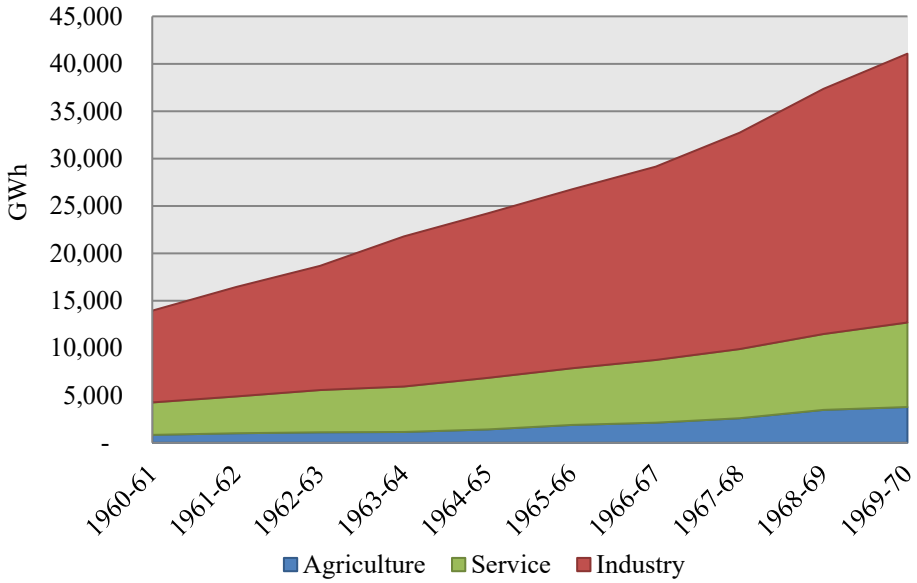
Table 3-3: Electricity supply in India, 1971-72

	Supply (GWh)	Shares (%)
Public sector		
- SEBs	31.3	66
- Other public undertakings	6.1	13
Private sector	9.7	21
Total	**47.1**	**100**

Source: Central Water and Power Commission (1972)

Most of these investments were made to support the country's priority large-scale industrialisation programs (see Section 2.2.2). Industrial consumption was accordingly accorded a high priority. As a result, industrial sector became the largest electricity consumer in the 1960s, accounting for around 70 per cent of the country's total electricity consumption (see Figure 3-1).

Figure 3-1: Electricity consumption by sector in the 1960s



Source: World Bank 1974

In addition, in the 1950s and 60s, residential and commercial customers were charged higher electricity prices to compensate for the provision of subsidies to industrial consumers. For instance, in 1965-66, industrial electricity prices were 5.4 paise per kWh. They were much less than residential (23.0 paise per kWh) and commercial (17.4 paise per kWh) prices. As a result, electricity sold to the industry normally had the lowest average revenue as compared to electricity sold to other sectors (*i.e.,* domestic, commercial and agricultural) (Venkataraman 1972).

3.2.3 Populist period (1970s to 1980s)

The 1970s and 80s witnessed a gradual shift in India's social and economic policies towards populism, focusing on satisfying the demands of various interest groups (such as, farmer associations), by distributing public resources and privileges to these groups (see section 2.2.3). The electricity industry was considered as an important instrument for subserving these policies. Some points to support this observation are presented as follows.

1) Driven by social security concerns, the state governments frequently encouraged the SEBs to hire more people. Jobs were created even when they were not required or could not be afforded by the SEBs (Rao 2002). As a result, over-employment was common in most SEBs. In 1991-92, for example, number of employees per GWh of electricity sold was in the range of 2.5 to 14.6, with the average of 4.5 (see Table 3-4). This was high as compared with other countries, such as, about 0.2 in Chile, Norway and the United States, around 0.6 in Argentina, New Zealand and United Kingdom, and less than 2.5 in some Asian developing countries, such as, China, Philippines, and Indonesia (Kannan & Pillai 2001b).

Table 3-4: Employment, sales and labour productivity in 1991-92

	Num. of employees	Electricity sale (GWh)	Employees per GWh sold
Andhra Pradesh	71,979	266,322	3.7
Assam	23,201	338,735	14.6
Bihar	42,430	322,468	7.6
Delhi	26,100	86,130	3.3
Gujarat	45,991	114,978	2.5
Haryana	45,000	234,000	5.2
Himachal Pradesh	11,362	77,262	6.8
Jammu & Kashmir	16,449	177,649	10.8
Karnataka	45,217	185,390	4.1
Kerala	23,957	98,224	4.1
Madhya Pradesh	82,911	406,264	4.9
Maharahtra	111,514	390,299	3.5
Meghalaya	4,596	49,637	10.8
Orissa	33,008	201,349	6.1
Punjab	71,416	357,080	5.0
Rajasthan	59,008	312,742	5.3
Tamil Nadu	95,299	476,495	5.0
Uttar Pradesh	98,809	434,760	4.4
West Bengal	39,876	267,169	6.7
Average	**49,901**	**224,555**	**4.5**

Source: Planning Commission (1999)

2) Contracts for construction and manufacturing in the electricity industry were frequently awarded to politically well-connected contractors. In exchange, these contractors paid the politicians significant amounts of commissions, which in turn would be used to finance their election campaigns (Rao 2002). According to an interview with a former SEB chairman, the list of contractors hired for projects in the electricity industry in a particular northern state changed immediately after the change of political party in office (Kale 2004).

3) It was also common for the state governments to require the SEBs to provide electricity subsidies (*e.g.,* low electricity tariffs) to agricultural consumers, even though the costs of serving remote rural areas were high (Dubash & Rajan 2001). Wealthy large and intermediate farmers were the main beneficiaries of these subsidies. This is mainly because these wealthy farmers, though small in numbers, were usually 'the patriarchs of their clans and communities and functioned as political intermediaries who could deliver blocs of votes to their favoured political party' (Lal 2005). It would be therefore very risky for political parties to alienate the demands of these powerful wealthy farmers, in the backdrop of mounting democratic activism and volatile swing votes (Lal 2005).

   These wealthy farmers were also politically well-organised. They had formed several farmer organisations to participate in the electoral politics to pressurise the political parties to satisfy their demands. The political parties normally responded positively to these demands in order to win political support from these powerful organisations (Jain 2006).

   The provision of agricultural subsidies were usually justified on the ground that irrigation (most of which used electricity) was an important means of raising the level of agricultural production, as India's agricultural production was heavily reliant on rainfall, and even a partial failure of the monsoon could lead to a significant reduction in agricultural production (Mahalanobis 1955). The importance of irrigation in raising agricultural production was also reinforced by the fact that irrigation is a basic input on which modern techniques of agricultural production (such as, high-yielding seeds and chemical fertilisers) depended significantly, because irrigation could enable the use of better seed-fertiliser combination and multiple cropping (Jain 2006). Higher

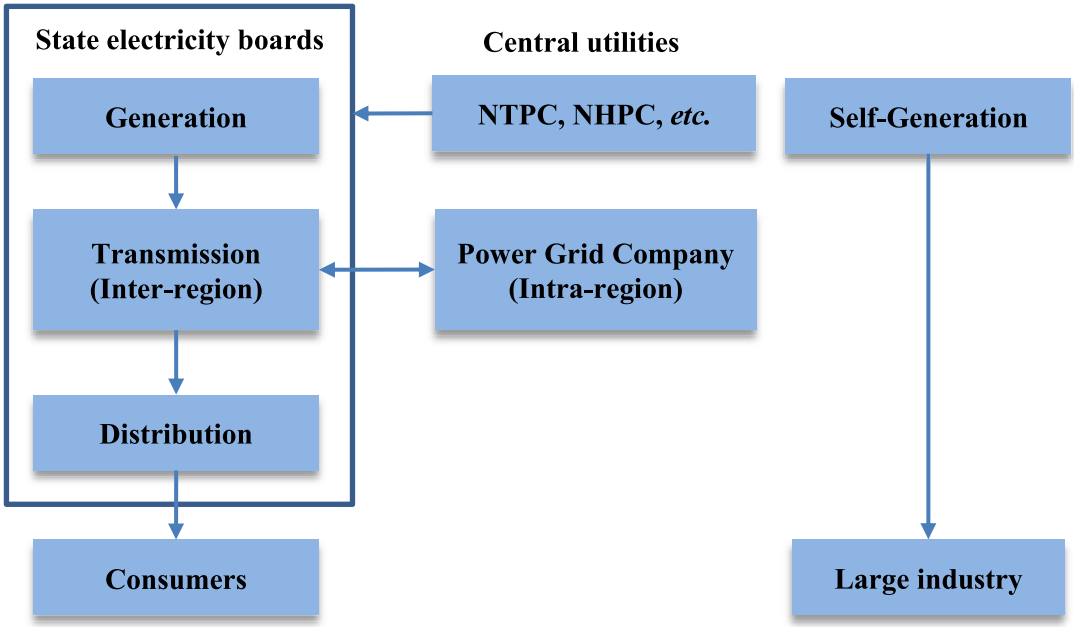
> agricultural production was considered by the Indian planners as an important means of eradicating poverty and backwardness. This is so because the lives of large number of very poor in India were reliant on the agricultural sector, and hence there existed opportunities for their economic advancement. These opportunities could be realised, it was believed, if cheap electricity was available (Rao 2002).

The use of electricity for subserving populist policies however adversely affected industry performance. For example, the provision of agricultural subsidies resulted in significant unrecovered costs of electricity supply. In the 1970s, SEB tariffs were on average only 52% of their long-run marginal costs (LRMCs). While the SEBs made some tariff adjustments in the 1980s, average tariffs continued to recover only between 50% and 60% of LRMCs (World Bank, 1999). These costs led to considerable financial losses for the SEBs. Most SEBs could not comply with the statutory requirement of 3% minimum return on net fixed assets. In fact, revenues generated by the SEBs were insufficient even for financing necessary system maintenance and expansion, resulting in poor quality of supply and chronic power shortages (Tongia, 2009).

In response, the government amended the 1948 Act, which allowed the central government to establish electricity generation companies with a view to support the SEBs to meet rising electricity demand. This led to the establishment of major central electric utilities, such as, the National Hydroelectric Power Corporation (NHPC), and the National Thermal Power Corporation (NTPC). As a result, prior to electricity reform in the early 1990s, the Indian electricity industry was jointly controlled by state and central electric utilities. The SEBs, fully owned by respective state governments, controlled most of the generation (about two-thirds) and transmission (within regional boundaries) capacities in the country. They also carried out electricity distribution in most areas of

India, except a few metropolitan areas (such as, Bombay and Calcutta) that were covered by private utilities. The centre-owned electric utilities (such as, NTPC, and NHPC) controlled about one-third of the generation capacity, and sold electricity to the SEBs for distribution. A centre-owned grid company (namely, Power Grid Company) controlled intra-regional transmission networks (Santhakumar 2008). Some industrial consumers also used self-generated power. This, it is estimated, accounted for about 20 per cent of their total requirements (World Bank 1990). Figure 3-2 depicts the structure and ownership of the Indian electricity industry before the onset of electricity reform.

Figure 3-2: Structure and ownership of India's electricity industry in the 1980s



3.2.4 Market reform period (1990s to the present)

In the 1970s and 80s, the Indian electricity industry was primarily viewed as an instrument for subserving the populist policies, even though the SEBs were required by the Electricity (Supply) Act of 1948 to function as autonomous public corporations. The use of electricity industry to support populist policies led to significant economic costs for the SEBs, because 'the patronising policies of the state resulted in excessive employment,

especially at the non-technical, administrative level, involving unwarranted cost increases and in irrational pricing practices for subsidised power sales, irrespective of considerations of costs, leading to substantial losses' (Kannan & Pillai 2001a, p. 245).

Until the early 1990s, these costs were largely offset by the governments primarily through foreign borrowings. In mid-1991, the capacity of the governments to further offset the costs of electricity industry reached its limit, as foreign lenders lost their confidence in the country, in the face of rising inflation and mounting public debts (Basu 1993). In response, India turned to the IMF for financial assistance. As part of the bailout deal with the IMF, the Indian government started to implement market reforms of the economy (including the electricity industry) in 1991 (see section 2.2.4).

The serious power shortages in the early 1990s gave further immediacy to these reforms. There were power shortages in many parts of the country, especially during the peak hours. The SEBs were debt-stricken, with losses of roughly Rs 40 billion ($0.85 billion) or around 0.7 per cent of the country's GDP at the time. They were therefore unable to alleviate power shortages by adding new supply capacity on their own (Pargal & Banerjee 2014).

These external and internal crises set in motion the market reform of electricity industry in India. Initially, the government encouraged private investment in generation, as a response to immediate crisis of supply shortages. In the mid-to-late 1990s, the reform was deepened in several states, emphasising restructuring and privatisation of SEBs and independent regulation. In 2003, a new Electricity Act was enacted to consolidate and replace all previous federal acts governing the electricity industry, and to further promote market reform in the industry (Kale 2014a).

Despite these reform efforts, the reform has only been partially implemented, due to significant political resistance. This resistance essentially reflected a mixed reception of the reform in the Indian society. Support for reform mainly came from international capital, on the lookout for attractive investments, and domestic business community, based on the expectations that the reforms could create new investment opportunities for them. Opposition for reform mainly came from the farmers, who had come to rely on enormous quantities of low-cost electricity for pumping water, and utility employees who feared losing their jobs if the bloated SEBs were privatised. Some government officials and political parties (especially, at the state level) also opposed reforms, fearing that the reforms would reduce their control of the industry, which is viewed as an important source of political power. Some points to support this observation are presented in the following paragraphs.

Introduction of Independent Power Producers (IPPs)

The first phase of reform (early-to-mid 1990s) primarily focused on encouraging private investment in the electricity industry in the form of Independent Power Producers (IPPs). Other important aspects of market reforms (such as, restructuring of the SEBs, independent regulation and market competition) were largely ignored. For example, in 1991, the government of India published a series of notifications seeking to encourage private investment in generation. These notifications permitted private investors to establish, operate and maintain power plants of virtually any size; and to enter into long-term Power Purchase Agreements (PPAs) with SEBs. They also provided generous incentives to private investors including, for example, a guaranteed minimum 16 per cent rate of return, a five-year tax holiday, and counter-guarantees from the central government to cover payment default by SEBs. Some of these notifications were later

enacted in parliament – to become the Electricity Laws (Amendment) Act of 1991 (Dubash & Rajan 2001). In 1992, eight showcase IPP projects were assigned by the government with 'fast track clearance', with the aim of speeding up the process of introducing IPPs for capacity additions (Tongia 2009). Table 3-5 provides detailed information about these eight fast-track projects.

This first phase of reform received bipartisan support in the parliament. For example, in the Lok Sabha (lower house of the Parliament), during a debate on issues related to electricity reform, the Minister argued that reform was 'necessitated by a paralysing scarcity of financing for the electricity industry' (Lok Sabha Debates 1991, cited in Kale 2014a). Similarly, the largest opposition party, Bharatiya Janata Party (BJP), argued that electricity is a sector 'where the States have failed to fulfil their responsibilities…The BJP has consistently been advocating the cause of liberalisation, deregulation and privatisation, wherever necessary' (Lok Sabha Debates 1991, p 81, cited in Kale 2014a).

Table 3-5: Fast-track IPP projects

Project	Investor	Location	Capacity (MW)	Investment (Rs. billion)	Fuel	Technology
Dabhol	Enron	Maharashtra	Phase I : 740 Phase II: 1,444	Phase I : 28 Phase II: 63	Natural gas/naphtha	CCGT
Jegurupadu	GVK Reddy	Andhra Pradesh	216	8	Natural gas/naphtha	CCGT
Godavari	Spectrum Power Generation	Andhra Pradesh	208	7	Natural gas/naphtha	CCGT
Ib Valley TPS	AES Transpower, USA	Orissa	500	24	Coal	n.a.
Neyveli	ST-CMS Electric Co.	Tamil Nadu	250	12	Lighite	n.a.
Mangalore	Mangalore Power Co.	Karnataka	1,013	43	Coal	n.a.
Visakhapatnam	Ashok Leyland and National Power Plc., UK	Andhra Pradesh	1,040	n.a.	Coal	n.a.
Bhadravati	Nippon Denro Ispat	Maharashtra	1,072	46	Coal	n.a.

Source: IEA (2002)

This bipartisan support for reform was primarily built upon the need to attract private investments, and the absence of any significant broad-based opposition to reform. Details are presented as follows.

1) *Needs to attract private investments*. The World Bank estimated that annual investments of $100 billion were required in developing countries to meet rising electricity demand in the 1990s. Only about $20 billion was available from international development organisations, such as, the World Bank. This left a gap of about $80 billion. Hence, it was suggested that the only possible source of funds was the private sector (especially, foreign), in view of the fact that the Indian government was debt-stricken and unable to finance further capacity expansion in the electricity industry, and domestic capital did not appear to be able to make a significant contribution (D'Sa, Murthy & Reddy 1999).

2) *Absence of broad-based opposition to reform*. The reform policies of introducing IPPs were not perceived to threaten the main interests in the electricity industry (such as, rural interests in electricity subsidies) because these policies were not discussed in the context of privatisation of the SEBs that could lead to large-scale layoffs and widespread labour protests, and removal of electricity subsidies that could adversely affect the interests of wealthy farmers, who were the main beneficiaries of these subsidies (Kale 2014a).

State level reform: restructuring, privatisation and re-regulation

In some states (such as, Orissa, Haryana, and Andhra Pradesh), the governments decided to restructure and privatise the SEBs, and to introduce independent regulation in the mid-1990s, in an effort to deepen market reform of the electricity industry. The initial impetus for this reform came from the World Bank, as the Bank had made the reforms conditional

for receiving further financial assistance to these states (Kumar & Chatterjee 2012). The actual implementation of this reform was however slow, due to strong farm and labour resistance. For example:

1) In Orissa, the electricity board was restructured in 1996. This led to the creation of two generation companies, one transmission company, and four distribution companies. These companies were then sold to private investors. A state electricity regulatory commission was also established to insulate the industry from the influence of the government. Many regulatory responsibilities, previously assumed by the government, were transferred to the regulatory commission. These responsibilities included, for example, licensing and tariff-setting (Dixit, Sant & Wagle 1998).

   This reform was strongly advocated by the World Bank. The Bank had made the implementation of market reform in the electricity industry as a necessary condition for receiving further financial assistance to the industry (Rajan 2000). The Orissa government was quite supportive of this reform, and viewed it as important way of reducing the state's large fiscal deficit. According to an interview with a senior former public official, 'the chief minister clearly saw impending bankruptcy looming, and quickly came to see the Bank's proposals as the only way out' (Dubash & Rajan 2001, p. 3377). This strong government support for reform was also built on the absence of powerful farm lobby in the region, as agricultural consumption only accounted for 5.7 per cent of total electricity sales in Orissa, as compared to around 40 per cent in large agricultural states, such as, Andhra Pradesh, Haryana, and Karnataka (Rajan 2000).

2) In 1998, the Haryana electricity board was incorporated into two separate companies, namely, Haryana Power Generation Corporation Ltd, and Haryana Vidyut Prasaran Nigam (HVPN) (in charge of electricity networks). In 1999, the distribution activity

of HVPN was separated into two companies, namely, Uttar Haryana Bikli Vitran Nigam (in charge of Northern Haryana) and Dakshan Haryana Bijli Vitran Nigam (in charge of Southern Haryana). There were also plans to privatise these distribution companies. These plans were however abandoned, due to strong resistance (Ruet 2005). This resistance was largely caused by concerns about electricity price increases and staff layoffs that could result from privatisation of electric utilities (Dubash & Rajan 2001).

3) In Andhra Pradesh, the state electricity board was unbundled into two companies, namely, AP Genco and AP Transco (in charge of electricity networks). In 2000, the distribution segment was separated from the AP Transco, and four zonal distribution companies were created. These companies were not privatised. The state government simply adopted measures to improve their efficiency by, for example, tariff rationalisation and financial incentives for performance improvement. A stringent anti-theft legislation was also introduced, resulting in a 3% reduction in thefts in the years after reform. The state government also managed to dramatically reduce its network losses (Sen & Jamasb 2013).

   The electricity reform in Andhra Pradesh was considered as largely successful. But this success was short-lived. In 2002, the Chief Minister announced that farmers would receive 9 hours of guaranteed supply daily, and rural homes would receive 24-hour supply, in an effort to win the coming election. This resulted in annual additional losses of about Rs.10 billion. After election, the newly elected government announced at its inauguration ceremony that it would provide free electricity to all farmers (Tongia 2009).

Central level reform: Electricity Act 2003

On 10 June 2003, the Indian central government enacted the Electricity Act 2003. This Act repealed all existing federal legislations on electricity, and consolidated the provisions in one Act. This Act sought to introduce market competition in the electricity industry by, for example, de-licensing thermal generation, open access to networks, unbundling and privatisation of SEBs, and establishment of market-based regulatory arrangements (Ranganthan 2004).

The implementation of the 2003 Act however met strong resistance. This resistance essentially came from farmers and utility employees. For example, farmers actively opposed the removal of electricity subsidies and metering in various political and social forums. Utility employees viewed public jobs as a passport to security, fearing that privatisation would make them lose their jobs (Lal 2005).

Besides, this resistance was also usually used by the government officials and political parties (especially, at the state level) as a scapegoat to mask their own resistance, because electricity industry was viewed by them as an important source of political power. As argued by Lal (2005), 'candidates and parties incur astronomical, undeclared expenses and then seek "returns on investment" when in office' (Lal 2005, p. 652). Besides, electricity industry was also seen as an important source of dispensing favours (such as, jobs and subsidies) for gaining political support, especially during elections. Min & Golden (2014) found increased electricity losses in periods immediately prior to state assembly elections in Uttar Pradesh, implying that political parties had deliberately provided electricity to unbilled users in exchange for their political support in elections.

The strong resistance to reform (as discussed above) led to a slow implementation of the 2003 Act. Immediately after the 2004 election, for example, the new coalition government

called for a review of the 2003 Act, with specific emphasis on those parts relating to SEB restructuring and elimination of electricity subsidies. This was driven by concerns that market reform in the economy (including the electricity industry) would adversely affect India's social conscience, taking into consideration the country's vast disparities in incomes and living conditions (Bhattacharyya 2007). A second review was called in 2007, in response to growing local dissatisfaction about the reform programs (Kumar & Chatterjee 2012).

The slow implementation of reform resulted in the establishment of a dual market in the Indian electricity industry. On the one hand, the conditions of SEBs remained largely unchanged, continuously subjected to political interference. As argued in the World Bank report, 'Boards remain state-dominated, lack sufficient decision-making authority in practice, and are rarely evaluated on performance. Political interference in appointments to and by the board and in decision making on business aspects remains common, and board member training and peer evaluation are conspicuous by their absence' (Pargal & Mayer 2014).

On the other hand, large consumers (especially, industrial consumers, residential association and cooperatives) were allowed to build their own captive power or to purchase electricity from other private generators. They could also sell their surplus electricity to the grid (Sen & Jamasb 2013). Electricity trading initially took the form of unscheduled interchange transactions, and was usually undertaken to address power shortages at local levels by purchasing surplus captive generation capacity in the region. In 2006, for example, a small urban agglomeration in Maharashtra (Pune) faced a power deficit of 90 MW, equivalent to 2 to 4 hour of power cuts a day. In this region, the industry had unutilised captive capacity of more than 100 MW. The industry reached an agreement

with residential and commercial consumers to produce electricity for the duration of scheduled power cuts (Nag 2010).

Two power exchanges were also established to facilitate electricity trading. These power exchanges operated with day-ahead and week-ahead contracts, based on prices arrived at through double-sided auctions. The volume of electricity traded on the exchanges increased steadily from around 8 per cent of total generation in 2009-10, to about 11 per cent in 2012-13 (Pargal & Banerjee 2014).

The reform of the Indian electricity industry has encouraged large private investments in electricity generation, resulting in a more than threefold increase in generation capacity over the period 1992-2017, from 78 GW in 1992, to 330 GW in 2017 (Central Electricity Authority, 2017). Despite this rapid capacity expansion, however, electricity remains inaccessible to a significant proportion of the population (more than 240 million in 2016) (IEA, 2018). Even those who have access often receive unreliable electricity supply with frequent outages (Banerjee et al., 2015). Besides, the electric utilities (SEBs) have continued to register large financial losses, and hence accumulated large debts. These debts amounted to 4.3 trillion rupees (about $67 billion) in 2015, equivalent to more than 3 per cent of the country's GDP (Upadhyay, 2017).

3.3 Summary and conclusions

This chapter has assessed changes in the structure-ownership-regulation of the electricity industry in India, as guided by the underlying electricity governance paradigm, and the impact of these changes on industry performance. Key findings of this assessment are summarised as follows.

- Consistent with the wider colonial governance paradigm, between late 19th century and 1946, the electricity governance paradigm in India emphasised the furtherance of

private interests (especially, British). The colonial government assumed only a passive role in regulating the electricity industry, primarily confined to the areas of safety and licensing. This electricity governance paradigm led to the development of electricity industry typified by highly fragmented structure, predominately foreign ownership, and minimal regulation. Power supply was mainly confined to major cities and towns, where economic activities concentrated. Rural areas were largely untouched by electricity.

- In the years after independence (1947 to 1960s, specifically), the new government of India took a socialist approach for governing socio-economic development, with the public sector assuming an ever-larger role in the economy. This approach viewed electricity as a vital input for socio-economic development. It therefore placed the electricity industry under tight public control. This is so because only public sector, it was believed, could forgo immediate profit, and supply electricity to less-developed areas where electricity supply was considered as economically-unviable.

- This belief led to important structural, ownership and regulatory changes in the Indian electricity industry, for example, creation of public-owned, vertical-integrated utilities (SEBs), and introduction of tight regulatory control of the industry. These changes enabled the use of electricity by the government as an instrument for promoting rapid industrialisation, which was viewed as the means to achieve self-sufficiency, eradication of poverty, and reduced unemployment and backwardness. This resulted in a rapid expansion of generation capacity, mainly to meet rising industrial demand. The industry also received subsidised electricity.

- The mid-to-late 1960s witnessed mounting democratic activism by previously quiet social groups (such as, peasants, workers and students). The government (keen to

maintain social stability) began to implement, in the 1970s and 80s, populist policies to (at least rhetorically and symbolically) satisfy the interests of various social groups. Electricity was considered as an important instrument for furthering the populist policies, resulting in significant financial costs for the SEBs.

- Until the early 1990s, these financial costs were largely offset by the governments, primarily through foreign borrowings. In mid-1991, the capacity of the governments to further offset financial costs of the industry reached its limit, as foreign lenders lost their confidence in the country, in the face of rising inflation and mounting public debt. In response, India turned to the IMF for financial assistance. As part of the bailout deal with the IMF, the Indian government began to implement market reforms of the economy (including the electricity industry). Serious power shortages in the early 1990s gave further immediacy to these reforms.

- Key component of these reforms included: restructuring and privatisation of SEBs, encouragement of IPPs, introduction of market competition, elimination of subsidies and price control, and establishment of sector-specific regulators for overseeing the operation of the power systems.

- These reforms have only been partially implemented, due to strong political resistance. This resistance essentially reflected a mixed reception of these reforms in the Indian society. Support for reform mainly came from international capital, on the lookout for attractive investments, and domestic business groups, based on the view that these reform could lead to new investment opportunities for them. Opposition for reform mainly came from the farmers, who had come to rely on enormous quantities of low-cost electricity for pumping water, and utility labour who feared losing their jobs if the bloated SEBs were privatised. Some government officials and political parties

(especially, at the state levels) also opposed reform, fearing that reform would reduce their control of the electricity industry, which was viewed by them as an important source of political power.

- Despite this resistance, some progress has been made, especially in the areas of market opening, due to strong business support based on the belief that such reforms could provide them with profit-making opportunities. This has encouraged large private investments in electricity generation, resulting in a rapid expansion of generating capacity. Electricity supply however remains inaccessible and unreliable to a significant proportion of the population, especially in rural areas, as profit-seeking private investors, mainly interested in commercially attractive investments in the industry, have showed little interest in extending electricity access to remote rural areas. Besides, public utilities are still debt-stricken, and are therefore unable to finance necessary maintenance and capacity expansion.

The analysis in this chapter clearly demonstrates that electricity industry has historically been considered in India as an important instrument for subserving wider policy priorities and agendas. These priorities and agendas have essentially been shaped by the underlying electricity and national governance paradigms, which have drawn their legitimacy from the dominant political and socio-economic interests of the time. This perspective has made electricity governance as merely a process of serving the dominant interests of the time. Issues of industry performance have therefore assumed a dormant role. The outcome is persistently poor performance of the industry. For example, in the formative years (late 18th century to 1946), the development of electricity industry in India tended to emphasise furtherance of private interests (especially, British). As a result, power supply of the time was mainly confined to major cities and towns, where economic activities concentrated.

Rural areas were largely untouched by electricity. After independence, the new government of India realised the political appeal of the electricity, and started to actively intervene in the development of the industry, to support its large-scale industrialisation programs. As a result, most capacity was built in the 1950s and 60s to meet rising industrial demand. Industrial consumers were also cross-subsidised by other consumer groups, such as, agricultural and households. The industry performance further deteriorated in the 1970s and 80s, as Indian governments (keen to maintain social stability) channelled large public resources to meet the heterogeneous and often conflicting social demands. This largess however significantly reduced the capability of the governments to improve the performance of electricity industry, particularly in a country (like India) beset with economic scarcity, large poverty and backwardness. The recent market reform has therefore only made limited contribution to improving the industry performance, due primarily to slow implementation of the reform, caused by strong political resistance.

4 CAUSES OF POOR INDUSTRY PERFORMANCE: SOME FURTHER ANALYSIS

4.1 Introduction

This chapter of the thesis develops a quantitative analysis of the impact of electricity and national governance paradigms on the structure-ownership-regulation and performance of the Indian electricity industry. The main purpose of this analysis is to lend credence to the argument made in the previous chapter, namely, that the causes of poor industry performance are deeply rooted in the electricity governance processes, which have historically favoured the use of electricity as a means to subserve wider governance priorities and agendas, aimed at promoting socio-economic development of India. Consequently, the issue of industry performance has assumed a dormant role, and the outcome is persistently poor performance of the industry.

This chapter is organised as follows. Section 4.2 reviews major analytical approaches for assessing the performance of electricity industry and its underlying influencing factors. It also discusses the appropriateness of these approaches in the context of this research. Section 4.3 presents the salient features of the approach developed in this research for assessing the performance of the Indian electricity industry and its underlying influencing factors. Section 4.4 discusses the empirical results of this assessment. Section 4.5 provides the some broad conclusions of this chapter.

4.2 Review of existing studies

Several studies have been undertaken to assess the performance of electricity industry and its underlying influencing factors (such as, privatisation, removal of subsidies, and introduction of market competition). They include, for example, Erdogdu (2011), Nagayama (2007), Pompei (2013), and Steiner (2001). Appendix C provides a more

expanded list of these studies. The first part of this section (4.2.1) presents the key features of these studies, in particular, their objective, scope, methodology and major findings. These features are then analysed in section 4.2.2 with the aim of identifying major limitations

4.2.1 Key features of existing studies

The main objective of **Erdogdu (2011)** is to analyse the impact of electricity reforms on the efficiency of electricity supply. In this study, a market reform index is created to measure the degree of electricity reforms. The index ranges from 0 to 8, with higher value indicating higher degree of market reforms. The efficiency of electricity supply is measured in this study in terms of specific indicators, for example, plant load factor, network losses, and generation per employee. Mixed effect regression models are used in this study, using panel data for 92 developed and developing countries, covering the period 1982-2008. The analysis in this study suggests that electricity reforms have positive impacts on efficiency of electricity supply, implying that reforms have resulted in efficiency improvements. But these positive impacts, the analysis also reveals, are rather limited. Besides, the analysis also finds that country-specific factors (such as, income level) are more important determinants of industry efficiency than electricity reforms.

In **Erdogdu (2014)**, the main objective is to analyse the impact of electricity reforms on investment, security of supply, and CO_2 emissions. Multiple regression models are employed in the study, using panel data from 55 countries, covering the period from 1975 to 2010. Electricity reforms are measured in this study in terms of market openness index. The values of the index range from 0 to 6, with higher value indicating higher degree of market opening. Industry performance is measured in terms of private investment in

electricity industry, reserve margin (a proxy for security of supply), and CO_2 emissions per kWh. The results of the study suggest that electricity reforms have led to declined private investments (especially in developing countries), high levels of self-sufficiency in electricity supply, and lower CO_2 emissions from electricity generation.

Fiorio & Florio (2013) analyses the impact of industry ownership on residential electricity prices. A panel data of 15 European countries, covering the period 1978 to 2008, are used in this study. A dynamic panel data model (including lagged dependent variables) is used for analysis. The analysis suggests that public ownership tends to lower residential electricity prices in most Western European countries.

In **Gugler, Rammerstorfer & Schmitt (2011)**, the main objective is to examine the impact of regulatory reforms on investment. It employs a dynamic panel regression model, using panel data from 16 European countries, over the period 1998 to 2007. Regulatory reforms are measured in the study in terms of free access regulation and ownership unbundling. The study suggests that there is a trade-off between vertical unbundling and competition. Ownership unbundling and free access regulation tend to increase the level of competition, but comes at the cost of lost vertical economies, which may in turn lead to reduced investment.

The main objective of **Hattori & Tsutsui (2004)** is to analyse the impact of electricity reforms on electricity prices. A panel data of OECD countries, covering the period 1987 to 1999, is used in the analysis. A multiple regression model that controls for country-specific time-invariant effects is used in the study. Electricity reforms are measured in terms of six indicators, namely, unbundling, third party access, wholesale competition, private ownership, time to liberalisation, and time to privatisation. The analysis suggests that introduction of retail competition is likely to lower industrial electricity prices, and

that restructuring and introduction of market competition tends to increase electricity prices.

Nagayama (2007) examines the impacts of electricity reforms on electricity prices. Panel data for 83 developed and developing countries, covering the period 1985–2002, are used in this study. The analytical method adopted in the study is mixed effect regression model. In this model, electricity reforms are measured in terms of six indicators, namely, introduction of IPPs, privatisation of electric utilities, unbundling, establishment of independent regulator, introduction of wholesale competition, and introduction of retail competition. The results of the study suggest that unbundling could only lead to lower electricity prices if it coexists with the establishment of independent regulator. Besides, introduction of IPPs and privatisation seem to have contributed to lower electricity prices in some regions.

In **Nagayama (2010)**, the main objective is to examine the impact of electricity reforms on investment and network losses. Panel data from 86 countries, covering the period 1985 to 2006, are used in the study. The method used by this study is fixed effect regression model. The main findings of this study suggest that electricity reforms (particularly, introduction of IPPs, restructuring, establishment of independent regulator, and introduction of market competition) has positive impacts on installed capacity, implying that the reforms tend to encourage more investment in the electricity industry. Besides, the study suggests that reforms are negatively correlated with network losses, and that deeper reforms would further reduce network losses.

In **Pompei (2013)**, the main objective is to analyse the impacts of regulatory reforms on the efficiency of electricity supply in European countries. Regulatory reforms are measured in terms of three indicators, namely, entry regulation, importance of public

ownership, and degree of vertical integration. Efficiency of electricity supply is measured in the study in terms of total factor productivity (TFP) and reserve margin. Panel data for 19 European countries, covering the period 1994 to 2007, are used in the analysis. A dynamic panel data model is used in the analysis. The analysis suggests that there are significantly negative effects of regulatory reforms on the efficiency of electricity supply, and that open access regulation has negatively impacted technical efficiency.

Steiner (2001) examines the impact of electricity reforms on the efficiency of electricity supply. The efficiency of electricity supply is measured in terms of industrial prices, ratio of industrial to residential prices, capacity utilisation rate, and reserve margin. A multiple regression model that controls for country-specific effects is used in the study. Panel data of 19 OECD countries, covering the period 1986-1996, is used in the study. The results of the study suggest that electricity reforms have led to higher efficiency of electricity supply. The results also suggest that most efficiency gains have been transferred to industrial consumers through lower electricity prices.

The main objective of **Zhang, Parker & Kirkpatrick (2008)** is to assess the impacts of electricity reforms on the performance of electricity industry. This study uses panel data of 36 developing and transitional economies, covering the period 1985 to 2003. Electricity reforms are measured in the study in terms of privatisation, competition, and regulation. Four indicators are used to measure the performance of electricity industry (generation per capita, installed capacity per capita, generation per employee, and capacity utilisation rate). A fixed effect model that controls for country-specific and time-specific effects is used in the study. The results of the study suggest that privatisation could only lead to higher capacity utilisation rate (hence higher efficiency of electricity supply) and higher generation and capacity per capita if it is coupled with the existence

of an independent regulator. The results also suggest that competition does not seem to have significant impacts on industry performance.

4.2.2 Some observations

The previous section reviews major studies for assessing the performance of electricity industry and its influencing factors. Key features of these studies are summarised in Table 4-1.

Table 4-1: Existing studies on the performance of electricity industry and influencing factors: Key features

	Objectives	Scope	Influencing factors	Performance indicators	Methodology	Main results
Erdogdu (2011)	Examine the impact of electricity reform on the efficiency of electricity supply	- 92 developed and developing countries - 1982 to 2008	- Market reform score (0-8)	- Load factor - Reserve margin - Network losses - Generation per employee	- Mixed effect model	- Electricity reforms have limited impact on the efficiency of electricity supply - Country-specific factors (such as, income level) are important determinants of industry efficiency
Erdogdu (2014)	Analyse the impact of electricity reform on investment, security of supply, and CO_2 emissions	- 55 developed and developing countries - 1975 to 2010	- Market openness index (0-6)	- Private investment - CO_2 emissions per kWh - Reserve margin	- Multiple regression model	- Electricity reforms have led to declined private investment (especially in developing countries) - Electricity reforms have resulted in high levels of self-sufficiency in electricity supply, and lower levels of CO_2 emissions
Fiorio and Florio (2013)	Assess the impact of ownership on residential electricity prices	- 15 EU countries - 1978 to 2008	- Ownership of the utilities	- Residential electricity prices	- Dynamic panel data model	- Public ownership tends to lower electricity prices for residential consumers
Gugler et al. (2011)	Assess the impact of regulatory reform on investment	- 16 EU countries - 1998 to 2007	- Ownership unbundling - Free access regulation	- Investment	- Dynamic panel regression models	- Ownership unbundling and free access regulation have led to lower investment

Note: Table continues on next page.

Table 4-1: Existing studies on the performance of electricity industry and influencing factors: Key features (Continued)

	Objectives	Scope	Influencing factors	Performance indicators	Methodology	Main results
Hattori and Tsutsui (2004)	Analyse the impact of electricity reform on electricity prices	- OECD countries - 1987 to 1999	- Unbundling - Third party access - Wholesale competition - Private ownership - Time to liberalisation and privatisation	- Electricity prices	- Multiple regression model	- Retail competition tends to lower electricity prices for industrial consumers - Restructuring and market competition tend to increase electricity prices
Nagayama (2007)	Examine the impact of electricity reform on electricity prices	- 83 developing countries - 1985 to 2002	- Introduction of IPPs - Privatisation - Unbundling - Independent regulation - Wholesale and retail competition	- Residential electricity prices - Industrial electricity prices	- Ordinary least-square model - Fixed effect model - Random effect model	- Unbundling could lower electricity prices if it coexists with independent regulation- - Introduction of IPPs and privatisation seem to have lower electricity prices in some regions
Nagayama (2010)	Assess the impact of electricity reform on investment and network losses	- 86 developed and developing countries - 1985 to 2006	- Unbundling - Market competition - Independent regulation - Private ownership	- Generation capacity per capita - Network losses	- Mixed effect model	- Electricity reforms are likely to encourage more investment - Electricity reforms tend to reduce network losses

Note: Table continues on next page.

Table 4-1: Existing studies on the performance of electricity industry and influencing factors: Key features (Continued)

	Objectives	Scope	Influencing factors	Performance indicators	Methodology	Main results
Pompei (2013)	Assess the impact of regulatory reform on the efficiency of electricity supply	- 19 EU countries - 1994 to 2007	- Entry regulation - Public ownership - Vertical integration	- Productivity and efficiency of electricity supply	- Dynamic panel data model	- Regulatory reforms have negative impacts on the efficiency of electricity supply
Steiner (2001)	Examine the impact of electricity reform on the efficiency of electricity supply	- 19 OECD countries - 1986 to 1996	- Privatisation - Market competition - Restructuring - Price regulation	- Industrial electricity prices - Industrial to residential price ratio - Capacity utilisation - Reserve margin	- Multiple regression model	- Electricity reforms have improved the efficiency of electricity supply - Most efficiency gains have been assumed by industrial consumers through lower electricity prices
Zhang, Parker & Kirkpatrick (2008)	Analyse the impact of electricity reform on investment and the efficiency of electricity supply	- 36 developing countries and transitional economies - 1985 to 2003	- Privatisation - Competition - Regulation	- Generation per capita - Installed capacity per capita - Generation per employee - Capacity utilisation	- Fixed effect model	- Privatisation could improve efficiency and attract more investment if coupled with independent regulation - Competition tends to increase efficiency and attract more investments

Source: Developed by the author based on discussion in Section 4.2.1.

Some observations, based on the discussion in Section 4.2.1 and information summarised in Table 4-1, are as follows:

a) The dominant objective of existing studies has been to analyse the impact of electricity reform on the performance of electricity industry. The analytical frameworks employed in these studies therefore primarily focus on empirically assessing the causal relationship between electricity reform and the performance of electricity industry. These frameworks typically involve three components: 1) measure the extent of electricity reform in terms of specific indicators that reflect various elements of reform, for example, introduction of IPPs, degree of market competition, and establishment of independent regulators; 2) measure industry performance in terms of specific indicators, for example, capacity and generation per capita, electricity prices, network losses; and 3) empirically assess the causal relationship between reform and performance indicators by using a variant of regression models, such as, mixed effect model, dynamic panel data model, or multiple regression model.

b) The existing frameworks for assessing industry performance and its underlying influencing factors – this research argues – are deficit, because they tend to focus on the impact of industry-specific factors (*e.g.,* electricity reform) on industry performance, and largely ignore the impact of wider socio-economic interests that have shaped the ways electricity industry is governed. These interests, as presented in Chapters 2 and 3 of this thesis, did however exert significant influence on shaping the industry structure-ownership-regulation and hence performance. An understanding of this influence is therefore a pre-requisite for developing deeper insights into the causes (reasons) of poor industry performance. It is based on these insights that

remedies for improving the industry performance can be identified – this thesis contends.

4.3 Analytical framework proposed in this research

The forgoing analysis has identified some of the methodological weaknesses of existing studies. An alternative framework is developed in this section to overcome these weaknesses. This framework considers wider socio-economic interests that have shaped the national and electricity governance paradigms in India, and seeks to analyse how these interests have influenced the structure-ownership-regulation for governing the Indian electricity industry, and hence how they have affected industry performance.

Two types of effects (impacts) of wider influencing factors on the structure-ownership-regulation and performance of the Indian electricity industry can be identified, namely, mediation effects, and moderation effects (see Figure 4-1). Mediation effects, in the context of this research, are referred to as the direct effects of wider influences (X_1) on shaping the industry structure-ownership-regulation (X_2), which in turn influence the industry performance (Y). Moderation effects are referred to as the indirect effects of wider influences (X_1) on shaping the ability of the industry structure-ownership-regulation (α_1) to influence industry performance (Y). Accordingly, the framework proposed in this research consists of two sub-frameworks: framework for assessing mediation effects, and framework for assessing moderation effects. Details about these two sub-frameworks are presented in Sections 4.3.1 and 4.3.2, respectively.

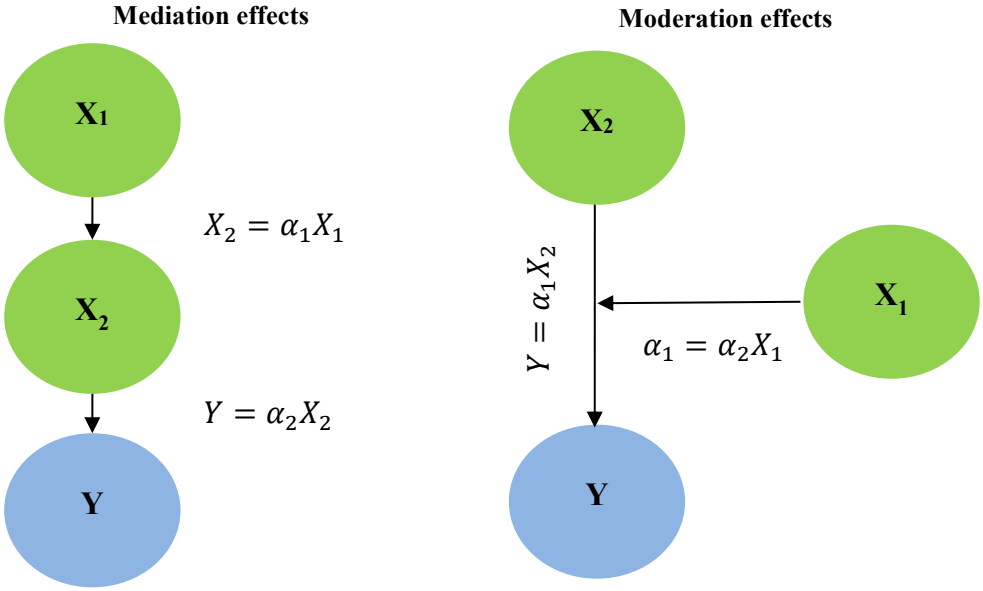


Figure 4-1: Mediation and moderation effects

4.3.1 Framework for assessing mediation effects

Figure 4-2 shows the overall framework for assessing mediation effects. This framework examines the impact of wider influencing factors (WIF) on shaping the industry structure-ownership-regulation (EI), which in turn influence the industry performance (IP). It consists of two models: granger causality model, and mixed effect model.

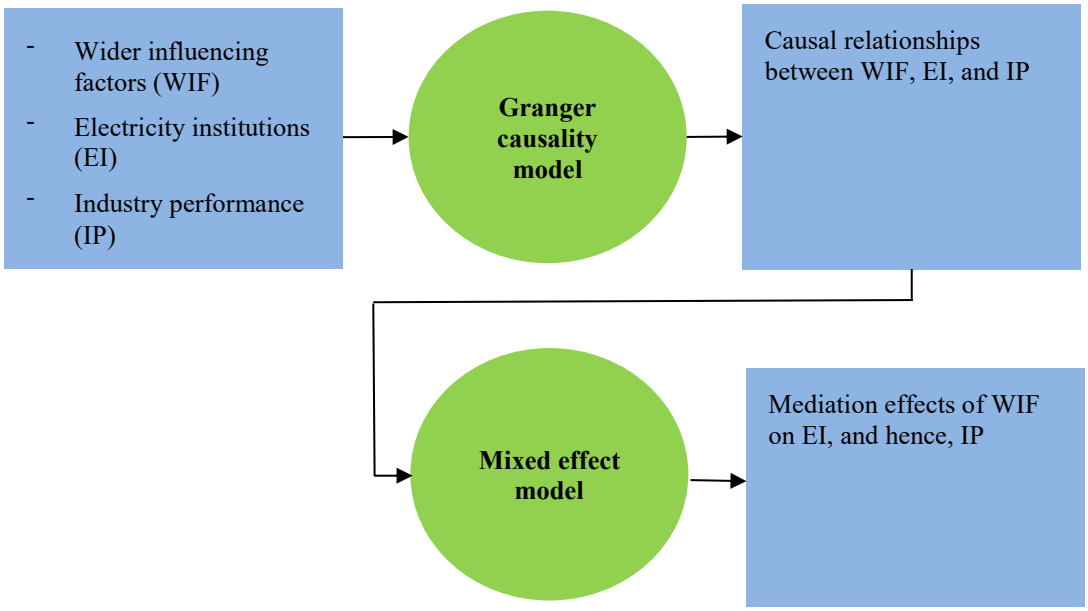


Figure 4-2: Framework for assessing mediation effects

Granger causality model

Granger causality model is a statistical model for examining causality between variables. The basic ideas behind this model are as follows. If a variable X causes another variable Y, then past value of X should contain information that can explain the present value of Y (Seth 2007). As Koop puts it, '…time does not run backward. That is, if event A happens before event B, then it is possible that A is causing B. However, it is not possible that B is causing A. In other words, events in the past can cause events to happen today, future events cannot' (Koop 2000, p.175, cited in Gujarati, 2011).

The simplified Granger causality models adopted in this research are presented below (1 and 2). Each of these models contains two equations.

$$EI_t = \sum_{j=1}^{p} a_{11} EI_{t-j} + \sum_{j=1}^{p} a_{12} WIF_{t-j} + \lambda_1 T + \varepsilon_{1t} \quad (4.1)$$

$$WIF_t = \sum_{j=1}^{p} a_{21} WIF_{t-j} + \sum_{j=1}^{p} a_{22} EI_{t-j} + \lambda_2 T + \varepsilon_{2t} \quad (4.2)$$

(1)

$$IP_t = \sum_{j=1}^{p} a_{11} IP_{t-j} + \sum_{j=1}^{p} a_{12} EI_{t-j} + \lambda_1 T + \varepsilon_{1t} \quad (4.3)$$

$$EI_t = \sum_{j=1}^{p} a_{21} EI_{t-j} + \sum_{j=1}^{p} a_{22} IP_{t-j} + \lambda_1 T + \varepsilon_{1t} \quad (4.4)$$

(2)

Model (1) aims to test whether there exists a causal relationship between the wider influencing factor (WIF) and industry structure-ownership-regulation (EI). It specifies each of these two variables as a function of the lags (j) of both WIF and EI. ε_{1t} and ε_{2t} are error terms. The causal relationship between WIF and EI can be determined based on the following principles.

1. WIF causes EI if the estimated a_{12} in equation (4.1) are statistically different from zero, and the estimated a_{22} in equation (4.2) are statistically close to zero.

2. EI causes WIF if the estimated a_{12} in equation (4.1) are statistically close to zero, and the estimated a_{22} in equation (4.2) are statistically different from zero.
3. There exists a bilateral causality between WIF and EI if the estimated a_{12} and a_{22} in both equations are statistically different from zero.
4. No causality exists between WIF and GS if the estimated a_{12} and a_{22} in both equations are statistically close to zero.

Model (2) aims to test whether there exists a causal relationship between industry structure-ownership-regulation (EI) and industry performance (IP). It specifies each of these two variables as a function of the lags (j) of both EI and IP. ε_{1t} and ε_{2t} are error terms. The causal relationship between EI and IP will be determined based on principles similar to model (1).

The number of lagged terms (j) to be introduced in Granger causality model is normally decided through a trial and error process. In this process, Akaike information criterion (AIC) is estimated for various lags. The lags that could produce the lowest AIC will be selected (see Table E-2 in Appendix E).

Mixed effect model

Mixed effect model is based on Ordinary Least Regression (OLR) model with the consideration of either fixed or random country-specific effects. The simplified models adopted in this research are presented as models (3) and (4).

$$EI_{it} = a_0 + a_1 WIF_{it} + Z_{it} + \delta t + \varepsilon_{it} \quad (3)$$

Model (3) aims to assess the effects of wider influencing factors (WIFs) on industry structure-ownership-regulation (EI). It specifies EI_{it}, as a function of WIF_{it}, for state i and year t. Z_{it} denotes unobserved state-specific factors that are independent of wider

influencing factors but have important influence on shaping industry structure-ownership-regulation. a_0 and ε_{it} are constant term and normal errors, respectively.

$$IP_{it} = a_0 + a_1 EI_{it} + Z_{it} + \delta t + \varepsilon_{it} \quad (4)$$

Model (4) aims to assess the effects of industry structure-ownership-regulation (EI) on industry performance (IP). It specifies IP_{it}, as a function of EI_{it}, for state i and year t. Similar to model (3), Z_{it} denotes unobserved state-specific factors that are independent of electricity structure-ownership-regulation, but have important influence on shaping the industry performance. a_0 and ε_{it} are constant term and normal errors, respectively.

The unobserved state-specific effects (Z_{it}) may be caused by state-specific factors including, for example, cultural background, energy endowment, climate and geographical location. These effects are included in this model because we are not sure whether explanatory variables (*i.e.,* WIF and EI) in our models capture all relevant characteristics of the state, so that we cannot directly use an OLR model. If we were to do so, it would generate an omitted variable bias, and over- or under-estimation. Therefore, we try to include these effects in this model by using either fixed effects (FE) or random effects (RE) models. In FE model, these effects are assumed to be identical for each state, and to be time independent. In RE model, these effects are estimated as stochastic, arising from random causes. The validity of these two models in this research will be tested by using Hausman test (Nagayama 2007).

4.3.2 Framework for assessing moderation effects

The framework for assessing moderation effects examines the impact of wider socio-political influences (WIF) on the ability of industry structure-ownership-regulation (a_1) to influence industry performance (IP). This framework is built upon multilevel regression models. The multilevel regression models normally involve a multilevel

system of regression equations. These equations are made up of at least one dependent variable measured at the lowest level, and several independent variables at higher levels (Hox 1995). These models are selected because performance indicators for a particular Indian state tend to be highly dependent on each other, due to the existence of time- and state-specific effects. Such dependence however violates the basic assumptions (independence of the observations) of standard statistical models (*e.g.,* ordinary least regression with interaction terms), resulting in spurious estimates (Hox 1995).

The simplified multilevel regression model adopted in this research is formulated as:

$$IP_{it} = a_0 + a_1 EI_{it} + \varepsilon_{it} \quad (1)$$

$$a_1 = b_0 + b_1 WIF_{it} + \delta_{it} \quad (2)$$

where IP represents the performance of the Indian electricity industry, for state i and year t. It is a function of industry structure-ownership-regulation (EI) (see equation 1). In this function, a_1 represents the ability of EI to shape IP. This ability is a function of wider influencing factor (WIF) (see equation 2). a_0 and b_0 are constant terms. ε and δ are error terms.

4.3.3 Variable selection and data considerations

Table 4-2 presents definitions of the variables selected in this research to measure industry performance (IP), industry structure-ownership-regulation (EI), and wider influences (WIF).

Table 4-2: Definition of variables

	Variables	Definitions
Industry performance (IP)	Energy deficit (ED)	Total electricity deficit (% of total electricity requirement)
	Peak deficit (PD)	Peak electricity deficit (% of electricity requirement during the peak hours)
	Forced outage rate (FoR)	Number of hours electricity services is on forced outage (% of total number of hours in a year)
	Network losses (NL)	Network losses (% of total electricity supply)
	Price-cost ratio for industry (PCI)	Ratio between industrial electricity prices and average costs of electricity supply
	Price-cost ratio for agriculture (PCA)	Ratio between agricultural electricity prices and average costs of electricity supply
Electricity institutions (EI)	Structure (S)	Introduction of market competition
	Degree of privatisation (P)	Private generation (%of total generation)
	Regulation (R)	Establishment of independent regulator
Wider influences (WIF)	Rural interests (RI)	Rural population (% of total population)
	Domestic business interests (DBI)	Industry value added (% of gross state domestic product)
	External pressures for reform (EP)	Interest payments on external debt, public guaranteed (current US$)
	Centre-state relationship (CSR)	Does the state ruling party the same as the central ruling party? 1 yes, 0 no

The following paragraphs provide a detailed discussion of these variables.

In this research, six variables are selected to measure the performance of the Indian electricity industry. They include: energy deficit, peak deficit, forced outage rate, network losses, price-cost ratio for industry, and price-cost ratio for agriculture. These variables are selected because they provide measures of the adequacy, reliability, and affordability of electricity provided by the Indian electricity industry. These three aspects of industry performance, as argued in the Chapter 1, are highly appropriate for a country (like India) where the provision of sufficient, reliable and affordable electricity is a priority for promoting socio-economic development.

Three variables are selected to capture changes in industry structure-ownership-regulation, arising from the introduction of market reforms since the early 1990s. They include: industry structure (S), degree of privatisation (P), and establishment of independent regulator (R). Dummy variables are used to analyse the impacts of these variables on the performance of the Indian electricity industry.

In this research, four variables are used to measure the wider influences that have shaped the national and electricity governance paradigms of the country. These variables include: rural interests, domestic business interests, external pressures for reform, and centre-state relationship. These variables are selected because they provide measures of the main influences behind changes in the national governance paradigm. For example, as discussed in the Chapter 2 of this thesis, the opposition to economy-wide market reform mainly came from rural elites (such as, rich peasants and capitalist farmers), who had come to rely on large amounts of government subsidies (such as, subsidised electricity), fearing that reform would lead to the removal of subsidies that the government currently provided them. The support for this reform mainly came from domestic business

community, based on the expectations that reforms could create investment opportunities for them. Besides, pressures from external players (such as, the World Bank), as shown in the Chapters 2, provided impetus to implement market reforms, as the Bank had made reform as a condition for giving financial assistance to the country.

Data for the above noted variables was collected from a variety of sources (see Appendix D). Industry performance data was taken from various publications of the Planning Commission; this included data on energy (ED) and peak (PD) deficits, forced outage rates (FoR), network losses (NL), prices and costs of electricity supply for calculating price-cost ratios for industry (PCI) and agriculture (PCA). Data for institution-related variables (S and R) was developed based on the year of introduction of various components for reform (see Table D-11 in Appendix D). Private generation (% of total generation) was used as a proxy for the degree of privatisation (P). It was taken from various publications of the Planning Commission. Data for governance paradigms were taken from various sources. For example, rural population, as a proxy for rural interest (RI), was taken from the Indian census data. Industry value added, as a proxy for domestic business interest (DBI), was taken from various publications of the Reserve Bank of India. Public guaranteed interest payments on external debt, as a proxy for external pressure for reform (EP), were taken from the database of the World Bank. A profile of Centre-State relationships (CSR) was developed based on data taken from various publications of the Election Commission of India.

Panel data for 17 Indian states, covering the period 1990-2015, are used in this research. Some descriptive statistics of the data are presented in Table 4-3.

Table 4-3: A summary of descriptive statistics

Variables	Obs.	Mean	Min.	Max.	S.D.	Skewness	Kurtosis
Energy deficit (ED)	422	7.8	0	31.9	6.9	1.2	1.0
Peak deficit (PD)	422	12.5	0	48.4	9.7	0.8	0.7
Forced outage rate (FoR)	422	15.8	1.6	58.6	12.0	1.6	2.0
Network losses (NL)	422	26.2	5.5	63.0	10.6	1.0	0.8
Price-cost ratio for industry (PCI)	422	1.3	0	3.4	0.5	0.7	1.8
Price-cost ratio for agriculture (PCA)	422	0.3	0	2.0	0.3	2.1	5.7
Structure (S)	422	0.4	0	1	0.5	0.4	-1.8
Degree of privatisation (P)	422	0.1	0	0.9	0.2	2.1	5.4
Regulation (R)	422	0.6	0	1	0.5	-0.3	-1.9
Rural interests (RI)	422	0.7	0.5	0.9	0.1	0.007	-0.8
Domestic business interests (DBI)	422	0.4	0.2	0.7	0.1	0.006	-0.5
External pressures for reform (EP)	422	21.6	20.8	22.2	0.4	-0.4	-1.4
Centre-state relationship (CSR)	422	0.3	0.2	0.5	0.1	0.5	-0.9

Notes:
1. obs. = observations; S.D. = standard deviation
2. Skewness is a measure of the asymmetry of the probability distribution of a variable about its mean.
3. Kurtosis is a measure of the 'tailedness' of the probability distribution of a variable.

A review of the table suggests that the performance of the Indian electricity industry has been generally poor. Over the sample period 1990-2015 and across selected 17 Indian states, for example, the mean of energy and peak deficits were 7.8% and 12.5%, respectively. Besides, the forced outage rates were in the range of 1.6% to 58.6%, with the average of 15.8%. Similarly, network losses were in the range of 5.5% and 63.0%, with the average of 26.2%.

Besides, standard deviation is relatively high for some variables. For example, energy deficit deviates from its mean by 6.9 on average. The corresponding figures are 9.7 for peak deficit, 12.0 for forced outage rate, and 10.6 for network losses. This relatively high value of standard deviation suggests that there are significant differences across the sample period and the selected 17 Indian states in terms of these variables.

In addition, most variables are normally distributed as their skewness and kurtosis are in the range of -1 and 1. There are also some exceptions. For example, energy deficit, forced outage rate, price-cost ratio for agriculture, and degree of privatisation are positively skewed. Forced outage rate, price-cost ratio for agriculture, and degree of privatisation, have relatively high positive values of kurtosis, suggesting that these variables have significantly high peaks.

The relationships among the selected variables are shown in a form of correlation matrix, in Table 4-4. A review of the table suggests that many of the variables are strongly correlated with each other. For example, the establishment of independent regulator (R) is highly correlated with the introduction of market competition (S) and privatisation (P). External pressure for reform (EP) is highly correlated with rural interest (RI) and domestic business interest (DBI). This needs to be accounted for in conducting the analysis, because the inclusion of highly correlated variables into the same statistical model might

cause multi-collinearity, resulting in imprecise estimation of coefficients (Gujarati 2011). Since these coefficients are reflective of the magnitude of impacts that an explanatory variable may have on the performance of electricity industry in India, the existence of multi-collinearity among these variables means that the model is not able to precisely estimate their impacts on industry performance.

Table 4-4: Correlation matrix of selected variables[1]

	ED	PD	NL	FoR	PCI	PCA	S	P	R	RI	DBI	EP	CSR
ED	1												
PD	0.749**	1											
NL	0.282**	0.173**	1										
FoR	0.041	0.057	0.149**	1									
PCI	-0.126**	-0.140**	-0.501**	-0.134**	1								
PCA	-0.082	-0.252**	0.105*	0.311**	0.149**	1							
S	-0.165**	-0.320**	-0.057	-0.147**	0.233**	0.228**	1						
P	-0.263**	-0.215**	-0.366**	-0.071	0.194**	0.036	0.176**	1					
R	-0.224**	-0.356**	-0.040	-0.091	0.132**	0.264**	0.684**	0.300**	1				
RI	-0.022	-0.034	-0.191**	0.465**	-0.270**	0.193**	-0.106*	-0.142	-0.226**	1			
DBI	-0.189**	-0.262**	-0.285**	-0.417**	0.326**	0.054	0.424**	-0.501**	0.510**	-0.617**	1		
EP	-0.013	0.180**	0.042	0.039	-0.073	-0.302**	-0.541**	-0.256**	-0.669**	0.162**	-0.509**	1	
CSR	0.097*	0.178**	-0.090	-0.025	-0.031	-0.056	-0.064	-0.060	-0.101*	0.031	0.072	-0.141**	1

Note 1: ** = Correlation is significant at the 0.01 level (2-tailed); * = Correlation is significant at the 0.05 level (2-tailed).

Source: Table E-1 in Appendix E

4.4 Empirical results and discussion

This section examines both the mediation and moderation effects of wider influencing factors (WIF) on shaping electricity institutions (*i.e.,* industry structure, ownership and regulation), and hence industry performance.

4.4.1 Mediation effects

The estimation results from Granger causality models (as in the form of models 1 and 2) and mixed effect models (as in the form of models 3 and 4) are summarised in Tables 4-5 and 4-6, respectively.

Table 4-5: Estimation results of Granger causality models[1,2]

	Structure (S)	Privatisation (P)	Regulation (R)
Wider influencing factors (WIF) ↔ Electricity institutions (EI)			
RI	×	×	×
DBI	→	×	←
EP	↔	←	←
CSR	×	×	×
Industry performance (IP) ↔ Electricity institutions (EI)			
ED	←	←	←
PD	←	×	←
FoR	↔	×	×
NL	←	×	↔
PCI	←	×	←
PCA	×	×	←

Notes: 1. ED=energy deficit; PD=peak deficit; FoR=forced outage rate; NL=network losses; PCI=price-cost ratio for industry; PCA=price-cost ratio for agriculture; RI=rural interest; DBI=domestic business interest; EP=external pressure for reform; and CSR=centre-state relationship

2. '←', '→', and '↔' indicate the direction of the causal relationship between the variables, and '×' indicates no causal relationship between the variables

Source: Table E-3 in Appendix E

Table 4-6: Estimation results of mixed effect models

	Structure (S)	Privatisation (P)	Regulation (R)
Wider influencing factors (WIF) → Electricity institutions (EI)			
RI	-	-	-
DBI	↑ (3.11)	-	-
EP	↓ (-0.62)	-	-
CSR	-	-	-
Electricity institutions (EI) → Industry performance (IP)			
ED	↑ (1.46)	↑ (7.93)	↑ (1.97)
PD	↑ (5.56)	-	-
FoR	↓ (-1.71)	-	-
NL	-	-	↓ (-2.42)
PCI	↑ (0.11)	-	-
PCA	-	-	↑ (0.20)

Notes: 1. '↑' means positive impacts with statistically significant at 10% level or above; '↓' means negative impacts with statistically significant at 10% level or above; '-' means that the coefficient is either not statistically significant even at 10% level or is not estimated due to the non-existence of causal relationship between the variables

2. Regression coefficients are shown in the bracket

Source: Tables E-4 and E-5 in Appendix E

Key observations, based on a review of Tables 4-5 and 4-6, are as follows:

a) Wider influencing factors (especially, domestic business interests, DBI) have significant positive impact on industry structure (3.11, as shown in Table 4-6). This suggests that domestic business interests are the main drivers behind the introduction of market competition in the Indian electricity industry. This is understandable if one takes notes of the fact that private sector (especially domestic) has shown significant interests in market opening of the electricity industry, with the expectation that this will provide new profit-making opportunities. These interests have resulted in the development of a solid domestic support for market opening of the industry. This support mainly includes companies working as engineering, procurement and construction contractors for the industry (Pargal & Banerjee 2014).

b) There is an inverse relationship between external pressure for reform (EP) and industry structure (S) (see Table 4-6). This relationship may be explained by the general distrust among the Indian society towards globalisation and foreign economic interests. High level of public debt may provide leverage for market reform; but it could also create a fear of loss of national sovereign to foreign interests.

c) Table 4-5 shows that there is no causal relationship between rural interests (RI) and electricity institutions (EI). This may reflect mixed views on electricity reform (as part of the economy-wide market reform) in the rural communities across the states. In some states (such as, Andhra Pradesh, Karnataka, and Punjab), for example, wealthy big farmers have already taken to capitalist agriculture. They were therefore largely supportive of market reform, based on the belief that this could provide them with better access to foreign technology, capital and markets. In other states, the

farmer organisations strongly opposed market reform, fearing that this reform could reduce benefits (*e.g.,* electricity subsidies) that they currently enjoy (Pai 2010).

d) The impact of the structure-ownership-regulation of electricity industry on industry performance is mixed. For example:

   - As shown in Tables 4-5, electricity institutions have impacted total and peak electricity deficits (ED and PD). These impacts, as presented in Table 4-6, are positive. For example, industry structure (S) has positive impacts on total (1.46) and peak (5.56) electricity deficits. Besides, privatisation (P) and establishment of independent regulator (R) also have positive impact on total electricity deficits (7.93 and 1.97, respectively). These positive impacts suggest that electricity reform in India (namely, introduction of market competition, privatisation and re-regulation) has contributed to reduced electricity deficits. This can be explained by the fact that this reform has encouraged large private investments for capacity expansion (thereby lower total and peak electricity deficits). For example, recent years witnessed a considerable increase of private-owned capacity in India, from only 2.5 GW in 1991, to more than 62 GW in 2012. As a result, generation capacity in India grew almost threefold from 78 GW in 1992, to 214 GW in 2012 (Pargal & Banerjee 2014).

   - According to Table 4-6, industry structure (S) has negative impact (-1.71) on forced outage rates (FoR). This is understandable if one notes that market competition may create pressure for suppliers to provide better maintenance, hence lower forced outage rates.

e) Table 4-6 shows that independent regulation (R) has a negative impact (-2.42) on network losses. This seems to support the observation made by some studies (see, for example, Pargal and Banerjee, 2014) that most state regulators (SERCs) are unable to perform their regulatory functions, due to insufficient technical, financial and human resources. As a result, network companies have struggled to control losses, especially in rural areas. Besides, the payment collection is also difficult in these areas, thus contributing to worsening the financial outlook of network companies, and further dampening their ability to improve technical performance (*e.g.,* lower network losses).

f) Industry structure (S) seems to have widened the gaps between electricity price and cost for industrial consumers, as indicated by a strong causal relationship between structure and price-cost ratio for the industry (see Table 4-5), and positive impact of structure on PCI (0.11 in Table 4-6). This can be explained by 1) significant cost reduction, driven by increased market competition; and 2) continued cross subsidisation between industrial and agricultural consumers, resulting in higher industrial electricity prices.

g) The establishment of independent regulator (R) seems to have increased agricultural prices, hence higher price-cost ratio for agriculture, as indicated by a positive impact (0.20) of independent regulation (R) on PCA. This is probably due to the implementation of pricing reforms by the regulators (SERCs) in various Indian states aimed at reducing the level of agricultural subsidies.

4.4.2 Moderation effects

The estimation results from multilevel regression models are summarised in Table 4-7.

Table 4-7: Estimation results of multilevel regression models

	ED	PD	FoR	NL	PCI	PCA
S	-	-	-	-	-	-
S×RI	-	-	-	-	-	-
S×DBI	-	-	-	-	-	↑ (0.8)
S×EP	-	-	-	-	-	-
S×CSR	-	-	-	-	-	-
P	↑ (219.4)	↑ (244.9)	-	-	-	↑ (9.4)
P×RI	↓ (-195.7)	↓ (-209.9)	-	-	-	↓ (-7.8)
P×DBI	↓ (-140.9)	↓ (-170.1)	-	-	-	↑ (8.5)
P×EP	-	-	-	-	-	-
P×CSR	↑ (235.5)	↑ (286.4)	-	-	-	↑ (3.6)
R	↑ (17.1)	-	-	-	↓ (-1.2)	-
R×RI	↓ (-13.7)	-	-	-	↑ (1.5)	-
R×DBI	↓ (-11.7)	-	-	-	-	-
R×EP	-	-	-	-	-	-
R×CSR	-	-	-	-	-	-

Notes: 1. S = industry structure; P = privatisation; R = independent regulation ; RI = rural interests; DBI = domestic business interests; EP = external pressure for reform; and CSR = central-state relationship

2. '↑' means positive impacts with statistically significant at 10% level or above; '↓' means negative impacts with statistically significant at 10% level or above; '-' means that the coefficient is not statistically significant even at 10% level

3. Regression coefficients are shown in the bracket

Source: Table E-6 in Appendix E

A review of the table suggests that wider influencing factors have significant impact on the ability of electricity reform (through, for example, introduction of market competition, privatisation, and establishment of independent regulation) to improve the performance of the industry. For example:

a) Rural interests (RI) have adverse impacts on the ability of the industry structure-ownership-regulation to influence industry performance. As shown in Table 4-7, for example, privatisation (P) has positive impacts on total (219.4) and peak (244.9) electricity deficits, suggesting that privatisation has the effect of reducing electricity deficits. These effects could however be reversed if privatisation coexists with strong rural interests, as indicated by negative impacts (-195.7 and -209.9) of the interaction term (P×RI) on total and peak electricity deficits. Similarly, the establishment of independent regulator (R) has a positive impact on total electricity deficits (17.1), implying that independent regulation has the effects of reducing electricity deficits. These effects could however be reversed by rural interests, as reflected by negative impact (-13.7) of independent regulator, together with rural interests, on total electricity deficits.

b) Table 4-7 suggests that privatisation (P), together with strong domestic business interests (DBI), could lead to higher deficits of total and peak electricity supply. This can be explained by two reasons. One, the IPP policy of the early 1990s has encouraged large private (especially, domestic) investment in generation in the form of independent power producers. Most commissioned IPP projects were designed to meet base-load demand even though peak demand was the most pressing need of the time. These projects therefore made limited contribution to alleviating the power shortages of the times (Mukherjee 2014).

Two, after the enactment of the Electricity Act of 2003, competitive bidding was introduced for private participation in generation. During the 11th Five-Year Plan period (2007-2012), several biddings were made by private investors with low tariffs, which would not fully recover the cost of supply, in the backdrop of rising imported coal prices (Mukherjee 2014). This may has resulted in delays in project execution, which would further contribute to widening the gaps between electricity supply and demand.

c) Domestic business interests (DBI) appear to support the implementation of pricing reforms in India. For example, Table 4-7 shows that privatisation has a positive impact (9.4) on price-cost ratio for agriculture, suggesting the increase of agricultural prices due probably to a gradual removal of electricity subsidies. This impact could become deeper if privatisation coexists with strong domestic business interests, as indicated by positive impacts (8.5) of the interaction term (P×DBI) on price-cost ratio for agriculture.

d) Central and state relationship (CSR) seems to have contributed to smooth implementation of market reform in the Indian electricity industry. For example, Table 4-7 shows that privatisation has a positive impact on total (219.4) and peak (244.9) electricity deficits. This impact could become deeper if privatisation has taken place in states with good centre-state relationship, as reflected by positive impacts (235.5 and 286.4) of the interaction between privatisation (P) and centre-state relationship (CSR) on electricity deficits. This can be explained by the political structure of cooperative federalism in India. This structure features consensus building and multi-level decision making. It comprises two interdependent constitutive elements, *i.e.,* the central and state governments (Mitra & Pehl 2010).

This political structure frequently gives rise to tensions between central and state governments, as they sometimes have different and conflicting interests in regard to socio-economic governance (Garg, Gaha & Bajaj 2008). Good relationship between central and state governments could facilitates consensus building, and consequently contribute to smooth implementation of market reform in the electricity industry.

4.5 Summary

This chapter has assessed the impacts of wider socio-economic interests on the structure-ownership-regulation and performance of the Indian electricity industry. Key findings of this assessment are summarised as follows.

- The wider interests (*e.g.,* rural interests, and domestic business interests) have exerted significant influence in shaping the structure-ownership-regulation of the electricity industry in Indian, and consequently affecting the industry performance.
- Rural interests (RI) seems to have opposed the implementation of market reform in the Indian electricity industry. This is reflected by adverse impact of rural interests on the ability of market reform to improve the performance of electricity industry, as presented in Section 4.4.2. The rural opposition however varies across the country, as indicated by no significant causal relationship between rural interests and industry structure-ownership-regulation (see Table 4-5). This probably reflects mixed views on electricity reform in rural communities across the country.
- Domestic business interests (DBI) seems to have favoured the introduction of market competition in the electricity industry, as reflected by its positive impact on industry structure. The introduction of market competition has led to some improvements in the industry performance, such as, lower electricity deficits, reduced forced outage rates, and reduced cross subsidisation. Besides, domestic business interests also seem

to have encouraged private investment in the electricity industry. This investment has however only made a limited impact on reducing electricity deficits, due probably to slow project execution.

- Better central and state relationship (CSR) appears to have contributed to smooth implementation of market reform in the electricity industry, as reflected by a more significant impact of privatisation on reducing electricity deficits, if privatisation has taken place in states with good centre-state relationship (see Section 4.4.2).

In summary, the analysis of this chapter has demonstrated the significance of wider socio-economic interests in shaping the structure-ownership-regulation and performance of the Indian electricity industry. This further provides validation to the argument made in Chapter 3 that causes of poor industry performance are deeply rooted in the electricity governance processes, which have historically favoured the use of electricity as the means of subserving wider governance priorities and agendas, aimed at promoting socio-economic development of India. These priorities and agendas have arisen from a range of political and socio-economic interests. This perspective makes electricity governance merely a process of serving dominant interests of the time. In these processes, issues of industry performance become subordinate to wider interests, thereby limited action for improving industry performance.

This research therefore suggests that the performance of the Indian electricity industry can only be improved by an appreciation of the influence of these wider socio-economic interests that have shaped the contours of the industry, because this appreciation could enable a considered accommodation, into the electricity governance processes, of dominant socio-political interests of the time, which will in turn improve the efficacy of electricity governance, and hence contribute to better industry performance. The next

chapter will develop the strategy for improving the efficacy of electricity governance, and demonstrate how this strategy can contribute to improving the performance of electricity industry.

5 SOME SUGGESTIONS FOR IMPROVING INDUSTRY PERFORMANCE

5.1 Introduction

The analysis in the previous chapters showed that the structure-ownership-regulation of the Indian electricity industry is essentially determined by the underlying electricity and national governance paradigms. The contours of these paradigms in turn are shaped by the dominant socio-economic interests of the time. This perspective on electricity industry essentially makes electricity governance a process of serving dominant interests of the time. In such processes, issue of industry performance therefore assumed a dormant role. Poor industry performance is therefore a natural outcome.

Against the above backdrop, this research argues that a way to rectify the situations is to improve the efficacy of electricity governance processes, through a considered accommodation, into these processes, of dominant socio-economic interests of the time. This chapter aims to develop a strategy for better accommodating these socio-economic interests, and to demonstrate how this accommodation strategy can contribute to improved efficacy of electricity governance processes, and hence better industry performance.

This chapter is structured as follows. Section 5.2 reviews existing strategies in the literature for improving the efficacy of governance processes. This section also discusses the appropriateness of these strategies in the context of India. Based on these approaches, Section 5.3 presents some thoughts on how India's electricity governance processes can be improved, and how this improved governance can contribute to better industry performance. Section 5.4 provides a summary of the main findings of this chapter.

5.2 Existing strategy for improving the efficacy of governance

Several studies have been undertaken to understand the causes of poor governance, and to provide suggestions for improving its efficacy. These studies include, for example, Crozier et al. (1975), Dahrendorf (1980), Kohli (1990), Huntington (1968), Shifter (2008), United Nations (2004) and World Bank (2017). Section 5.2.1 presents the key features of these studies, in particularly their scope, causes of poor governance, and suggestions for improving the efficacy of governance. These features are then, in Section 5.2.2, analysed with the aim of identifying the most appropriate approaches for improving India's electricity governance processes as the means of improving the performance of electricity industry in the country.

5.2.1 Key features of existing studies

Crozier, Huntington & Watanuki (1975) attributes poor governance in major developed countries (such as, Japan, Western European countries, and the United States) in the early-to-mid 1970s to the inability of the governments to build consensus for addressing pressing issues facing these countries (such as, rising inflation). As argued in this study, 'Conflicting goals and specialised interests crowd in one upon another, with executives, cabinets, parliaments, and bureaucrats lacking the criteria to discriminate among them. The system becomes one of anomic democracy, in which democratic politics becomes more an arena for the assertion of conflicting interests than a process for the building of common purposes' (Crozier, Huntington & Watanuki 1975, pp 161). This inability to build consensus, as argued in Crozier, Huntington & Watanuki (1975), is primarily caused by a de-legitimation of government, due to: 1) a gradual erosion of social institutions (*e.g.,* trade unions, business enterprises, professional associations, churches, and civic groups); 2) the disaggregation of needs and interests as indicated by the rising

number of political parties; and 3) the 'overloading' of government. Accordingly, a re-legitimisation of government is suggested as the means of improving the efficacy of governance. This, it is further suggested, can be achieved by, for example, creation of new socio-political institutions for promoting cooperation among various social groups, and reinvigoration of political parties to adapt to changing needs and interests of the electorate.

Coppedge (2001) argues that the efficacy of governance may sometimes be undermined by representative democracy. This argument is explained as follows. In representative democracy, it is preferable to have 'a large number of parties, to represent all possible combinations of positions on all the relevant issues; and rigid parties that resist compromising on the mandate received from the voters and have sharp issue differences with other parties'. Such a party system, however, tends to be 'divisive, polarised, and indecisive' (Coppedge 2001, pp 180). It could therefore undermine the efficacy of governance by making it difficult to build consensus for policy making.

It is argued in **Dahrendorf (1980)** that poor governance of many developed countries (such as, Germany, United Kingdom, and United States) in the mid-to-late 1970s was primarily caused by the lack of legitimacy of the governments. He explained this argument as follows. In these countries, the governments of the times were unable to 'satisfy rising expectations' and to 'absorb changes in values and social structure' (Dahrendorf 1980, pp 406). As a result, 'people ceased to expect the election of their party to make them better off'. The outcome of this is 'not a politics of protest, but a politics of quiet disillusion, a politics in which lack of involvement or indifference to organised party politics' (Dahrendorf 1980, pp 396). The legitimacy of the governments was therefore adversely affected, because what they do is not 'right both in the sense of complying with

certain fundamental principles, and in that of being in line with prevailing cultural values' (Dahrendorf 1980, pp 397).

Kohli (1990) argues that India's problems of poor governance are primarily caused by 'a steadily widening gap between institutional capacities and socioeconomic problems' (Kohli 1990, pp 384). This gap, it is further argued, is caused by 'a persistent tension between the state's representative and developmental functions' (Kohli 1990, pp 399). Kohli explains this argument as follows. In India, it is always difficult for political leaders to build a stable ruling coalition, due to the difficulty to establish a coherent ruling coalition that could internalise various socio-economic conflicts of a highly fragmented society. This difficulty tends to encourage the election of leaders with personal and populist appeal as the solution for building a popular base of support. Personalistic and populist leaders are, however, seldom effective at building institutions for promoting socio-economic development, because: 1) effective institutions would ultimately weaken the personal power of political leaders; and 2) nationalistic and redistributive policies central to populism are always inconsistent with socio-economic development goals. The outcome is stagnant socio-economic development and growing political disorder, which further contribute to the difficulty of building a sustained ruling coalition. Accordingly, Kohli suggests that the problems of poor governance in India can only be resolved by reducing the tension between 'representation' and 'development'. He further suggests that well-organised political parties are important means of reducing this tension, because such parties could build stable coalitions around coherent development programs.

Levitsky (2008) attributes poor governance of the Argentinean government to persistent and widespread institutional weakness. The institutions for governing 'numerous areas of political and economic life', it is argued, are 'widely contested, frequently circumvented

or violated, and repeatedly changed'. This resulted in 'high levels of uncertainty, narrow time horizons, and minimal trust and cooperation, all of which leaves both the economy and the polity vulnerable to crisis' (Levitsky 2008, pp 99-100). The economic and political crisis further weakened the economic and political institutions, as it 'triggers efforts to circumvent or change the rules' (Levitsky 2008, pp 122). During the 2001-02 crises, for example, many Argentines complained about the absence of judicial independence. They demanded a purge of the Supreme Court. The President's purge of the Court however weakened the legal institutions by enhancing executive control over the Magistrates Council, a body created by the 1994 Constitution to oversee the appointment and removal of federal judges (Levitsky 2008).

Huntington (1968) attributes poor governance of many developing countries in the 1950s and 60s to political instability. This political instability, it is argued, is caused by 'rapid social change and the rapid mobilisation of new groups into politics coupled with the slow development of political institutions' (Huntington 1968, pp 4). Social changes (such as, urbanisation, increases in literacy and education, and mass media expansion) 'extend political consciousness, multiply political demands, broaden political participation', which in turn creates demand for new political institutions that could incorporate these changes. This demand however is largely unmet, resulting in political instability and disorder.

Mainwaring (1993) argues that presidentialism is one of the main factors responsible for poor governance. This argument is explained as follows. Under presidential system, the president may not always enjoy legislative support, due to factors including: 1) the president's party does not enjoy a majority in the legislature; 2) the president is unable to build a coalition of parties that provides a majority; and 3) the president is unable to

govern by creating shifting coalitions. As a result, even though presidents are powerful relative to the legislature in most presidential democracies, they often have difficulties in implementing their policy agendas (thereby poor governability), because of legislature opposition. Besides, Mainwaring also argues that the tendency toward executive/legislative deadlock is particularly acute in multiparty systems, because coalition-building is more difficult under multiparty systems, thereby complicating executive/legislative deadlock problems associated with presidentialism.

Nasr (1992) argues that the crisis of governance in Pakistan in the late 1980s is primarily attributable to weak government of the times that encouraged the pursuit of patronage. The pursuit of patronage resulted in the erosion of institutions (such as, government agencies and public utilities) for governing socio-economic development of the country. The economic performance of the country was therefore sluggish. This sluggish development in turn led to widespread social discontent, which further weakened the government. Further, Nasr attributes the weak government to three factors, namely, its lack of political power, due to the presence of strong military influence; organisational weaknesses of the ruling party because of strong personal rules; and unpopular party leaders.

It is argued in **Santiso (2001)** that governance of a country is primarily attributable to its democratic institutions, *i.e.,* an efficient executive, a functioning legislature, an independent judiciary, and effective and balanced separation of powers. Therefore, for the country to improve its governance, it will need to explicitly improve its democratic institutions.

As argued in **Sauquet & Vielajus (2009)**, poor governance of many African, Andean American and Central Asian countries is primarily caused by poor participation in

democratic elections, as it seriously undermines the legitimacy of elected governments. This poor participation, it is further argued, is the outcomes of conflicts between 'traditional' and 'democratic' leader selection models in these countries. Under the traditional model, for example, the elders normally have greater say over the leader selection in many African towns and villages. This is in conflict with the democratic leader selection model, because this model gives equal weights to an eighteen-year-old as that of an elder in the leader selection. Accordingly, the resolution of these conflicts is suggested as the way to improve the efficacy of governance in these countries. The encouragement of greater social participation in shaping the leader selection models is considered as important means to achieve resolution of conflicts.

Shifter (2008) attributes poor governance of major Latin American countries to 'a nagging institutional deficit' that reduces the ability of the governments of these countries to satisfy growing social demands, such as, poverty reduction, social inclusion, and better delivery of public services (*e.g.,* health, energy and education). The failure of the governments to satisfy these demands is 'a recipe for enormous social frustration and discontent', which further undermines the legitimacy of the governments (thereby poor governance) (Shifter 2008, pp 5). Institutional reforms focused at improving the ability of the governments to satisfy rising social demands are accordingly suggested as the means of improving the efficacy of governance in these countries. It is also suggested that political leadership is important for promoting these reforms, because effective political leadership could contribute to the formation of a national consensus to pursue necessary institutional reforms that could address growing social demands in these countries.

United Nations (2004) argues that limited public involvement in policy-making processes is the main causes of poor governance in most African countries. This limited

public involvement, it is further argued, is due to factors, such as, inadequate legal and institutional arrangements for public involvement, and insufficient resources (human, financial and technical) for parliamentarians to engage the public. Accordingly, improved legal and institutional arrangements and better provision of resources are suggested as the means of encouraging public involvement in policy-making processes; hence better governance.

World Bank (1989) argues that 'underlying the litany of Africa's development problems is a crisis of governance' (World Bank 1989, pp 60). This crisis, it is further argued, is caused by widespread corruption in most African countries. 'A concerted attack on corruption from the highest to the lowest levels' is accordingly suggested as the means of improving the efficacy of governance in these countries. This involves 'setting a good example, by strengthening accountability, by encouraging public debate, and by nurturing a free press'. This also involves 'empowering women and the poor by fostering grassroots and non-governmental organisations, such as, farmer associations, cooperatives and women's groups' (World Bank 1989, pp 6).

World Bank (2016a) argues that poor governance is the direct outcome of 'unhealthy' political engagement, such as, vote buying, patronage, and strong interest group influence. This is so because unhealthy political engagement would provide 'adverse political incentives' for political leaders to 'extract private benefits from the public sector'. As a result, effective policies for promoting socio-economic development are not always adopted and implemented. This would negatively affect development outcomes, which in turn undermine the legitimacy of the government, further weakening its ability to adopt and implement development policies. Further, unhealthy political engagement, as argued in World Bank (2016a), is primarily caused by the lack of public involvement and

transparency in political decision-making processes. Accordingly, higher degree of public engagement and transparency is suggested as the means of improving the 'health' of political engagement (thereby improved governability).

In **World Bank (2017)**, power asymmetries are identified as the main causes of poor governance of many developing countries. This is so because power asymmetries may cause: 1) the *exclusion* of social groups (such as, labour unions) from policy-making processes; 2) the *capture* of policy-making processes by influential socio-political groups (such as, large industrial groups); and 3) *clientelism* that encourages the use of public resources (*e.g.,* favourable policies) to gain electoral support from certain social groups (such as, farmer organisations). These three factors would lead to the selection and implementation of developmental policies that are unreflective of the interests of major socio-political groups. As a result, these socio-political groups may pursue their interests through either violent (such as, insurgency) or non-violent (such as, street protest) ways, which would further undermine socio-political stability, thus negatively affecting the governance of the countries. Accordingly, re-balance of power for making political decisions is suggested as the way to improve the efficacy of governance. This power re-balance, it is further suggested, can be achieved by encouraging existing power elites to adopt rules that allow political participation by previously banned socio-political groups. Collective action of citizens (such as, voting) and international influence are also suggested as important means for encouraging these rule changes.

5.2.2 Some observations

The previous section reviewed existing studies conducted to identify the causes of poor governance, and to suggest approaches for improving the efficacy of governance (see Table 5-1).

Table 5-1: Existing studies on improving the efficacy of governance: Key features

Authors	Scope	Causes of poor governance	Suggestions for improving the efficacy of governance
		Society-centred approach	
Santiso (2001)	- Major developing countries	- Weak democratic institutions typified by inefficient executive, malfunctioning legislature, and judiciary with limited autonomy	- Improved democratic institutions with efficient executive, functioning legislature, and independent judiciary
Sauquet and Vielajus (2009)	- Major developing countries	- Lack of legitimacy of elected governments, due primarily to poor participation in democratic elections - This poor participation is caused by the conflicts between 'traditional' and 'democratic' leader selection models	- A resolution of the conflicts between 'traditional' and 'democratic' leader selection models
United Nations (2004)	- Major African countries	- Limited public involvement in policy-making processes - Caused by inadequate legal and institutional arrangements for public involvement, and insufficient resources for parliamentarians to engage the public	- Legal and institutional reforms focused at encouraging public involvement in policy-making processes - Better provision of resources

Note: Table continues on next page.

Table 5-1: Existing studies on improving the efficacy of governance: Key features (Continued)

Authors	Scope	Causes of poor governability	Suggestions for improving governability
World Bank (1989)	- Major African countries	- Widespread corruption	- A concerted attack on corruption - This involves 'setting a good example, by strengthening accountability, by encouraging public debate, and by nurturing a free press' - This also involves encouragement of social participation by fostering non-governmental organisations (such as, farmer associations)
World Bank (2016a)	- Major developing countries	- 'Unhealthy' political engagement (such as, vote buying, patronage, and strong interest group influence) - Due to the lack of public involvement and transparency	- Higher degree of public engagement and transparency in political decision-making processes
World Bank (2017)	- Major developing countries	- Power asymmetries - Selection and implementation of policies that are unreflective of the interests of major socio-political groups	- Re-balance of decision-making power - Collective action of civil society and international influence are considered as important for promoting this power re-balance.

Note: Table continues on next page.

Table 5-1: Existing studies on improving the efficacy of governance: Key features (Continued)

Authors	Scope	Causes of poor governability	Suggestions for improving governability
		State-centred approach	
Crozier, Huntington & Watanuki (1975)	- Major developed countries - Early-to-mid 1970s	- Inability of the governments to build consensus for addressing pressing issues (such as, rising inflation) - This inability is primarily caused by de-legitimation of government, due to gradual erosion of social institutions (such as, trade unions, churches, and civic groups), disaggregation of interests, and overloading of government.	- Re-legitimation of government by, for example, creation of new socio-political institutions for promoting cooperation among various social groups, and reinvigoration of political parties to adapt to changing needs and interests of the electorate.
Coppedge (2001)	- Latin American countries	- Inability of the governments to build consensus for policy making - This inability is primarily caused by representative democracy with 'divisive, polarised, and indecisive' party systems	N.A.
Dahrendorf (1980)	- Major developed countries - Mid-to-late 1970s	- Lack of legitimacy of governments, due primarily to their inability to 'satisfy rising expectations' and to 'absorb changes in values and social structure'	N.A.

Note: Table continues on next page.

Table 5-1: Existing studies on improving the efficacy of governance: Key features (Continued)

Authors	Scope	Causes of poor governability	Suggestions for improving governability
Kohli (1990)	- India - 1980s	- A gap between institutional capacities and socio-economic problems, due to 'a persistent tension between the state's representative and developmental functions'	- A resolution of the tension between 'representation' and 'development'
Levitsky (2008)	- Argentina	- Persistent and widespread institutional weaknesses for governing political and economic activities	N.A.
Huntington (1968)	- Major developing countries - 1950s and 60s	- Political instability, due to mismatch between rapid social changes and slow development of political institutions to adapt to these changes	N.A.
Mainwaring (1993)	- Major developing and developed countries with presidential systems	- Presidentialism that is vulnerable to executive/legislative deadlock - This deadlock is further complicated by multiparty systems	N.A.

Note: Table continues on next page.

Table 5-1: Existing studies on improving the efficacy of governance: Key features (Continued)

Authors	Scope	Causes of poor governability	Suggestions for improving governability
Nasr (1992)	- Pakistan - 1980s	- Weak government that encouraged pursuit of patronage - Three factors are responsible for this weakness including: lack of political power, organisational weakness of the ruling party, and unpopular party leaders	N.A.
Shifter (2008)	- Major Latin American countries	- Institutional weaknesses that reduce the ability of the governments to satisfy growing social demands, such as, poverty alleviation, social inclusion, and better delivery of public services	- Institutional reforms focused at improving the ability of governments to satisfy rising social demand - Political leadership is considered as important for implementing these reforms

Note: N.A. means suggestions for improving the efficacy of governance are not provided in the study

Source: Developed by the author based on discussion in section 5.2.1

This review suggests that there are two main approaches for improving the efficacy of governance in the literature, namely, *society-centred approach*, and *state-centred approach*. These two approaches attribute poor governance to different causes, and accordingly seek to improve the efficacy of governance in quite different ways.

1) The *society-centred approach*, for example, primarily attributes poor governance to weak society that fails to articulate its interests in the political decision-making processes, due to factors, such as, insufficient resources (human, financial, and technical) for public engagement (United Nations 2004), lack of transparency in the political decision-making processes (World Bank 2016a), and power asymmetries that encourage political capture and clientelism (World Bank 2017). As a result, the governments always select and implement policies that are unreflective of the interests of major social groups (such as, farmer organisations, labour unions, and professional associations). These social groups therefore frequently seek to pursue their interests through either violent (such as, insurgency) or non-violent (such as, street protest) ways, which in turn undermine socio-political stability, and hence adversely affect the governability of the country. Accordingly, the *society-centred approach* suggests several ways to better accommodate various social interests, as the means of improving the efficacy of governance. They include, for example, better provision of resources for parliamentarians to engage the public (United Nations 2004), higher degree of transparency in political decision-making processes (World Bank 2016a), and more equal power distribution among the society (World Bank 2017).
2) In contrast, the *state-centred approach* tends to attribute poor governance to weak state, such as, weak political institutions (Levitsky 2008, Mainwaring 1993), polarised and fragmented party systems (Coppedge 2001), and ineffective political parties

(Nasr 1992). These factors, it is argued, frequently lead to gridlock and rigidness in political decision-making, which in turn reduce the ability of the government to make difficult political decisions to satisfy the needs and interests of major social groups (such as, farmer organisations, labour unions, and business associations). This always leads to widespread social discontent, which further weakens the governability of the country. Further, this approach argues that weak state is deeply rooted in the underlying 'social structure' that enables the society to resist political authority and prevent the development of a strong state (Huntington 1968, Fukuyama 2011). Accordingly, the *state-centred approach* suggests a stronger state as the means of improving the efficacy of governance. It also suggests that the strength of the state can be enhanced by a better accommodation of social demand by, for example, creation of new socio-political institutions for promoting cooperation among various social groups (Crozier et al. 1975).

3) Based on the above discussion, this research argues that the *state-centred approach* would be the most appropriate approach for improving the efficacy of electricity governance in India. This is mainly because poor governance of India, as shown in Chapter 2, is primarily caused by a weak Indian state (*e.g.,* growing political regionalism, multiple party competition, and unstable ruling coalition) that has become increasingly incapable of satisfying the interests and needs of various social groups (such as, farmer organisations, labour unions, and business associations). The *state-centred approach*, referred to above, is focused on strengthening the state as the means of improving the efficacy of governance. It can, this research contends, provide appropriate guidance for developing policy measures to improve the efficacy of governance in India.

5.3 Some suggestions for improving India's electricity governance

This section will present some thoughts on how to strengthen the Indian state as the means of improving electricity governance in the country. It will also demonstrate how this improved governance can contribute to better performance of electricity industry in India.

Nature of the weak Indian state: A disconnection between the state and society

The indigenous and traditional Indian society was structured based on a multiplicity of patron-client relationships (such as, kinship, caste, and religion), dominated by a small group of local elites (such as, dominant castes, ethnic leaders and wealthy land owners) (Krishna 2010). This social structure has historically empowered the Indian society to resist the development of a strong state that 'could aspire to reach deeply into society and change its fundamental social institutions…not under an indigenous Hindu government, not under the Moghuls, and not under the British' (Fukuyama 2011, pp 187). After independence, the Indian state did not put in place a new structure of authority in the local communities; but rather built up its authority by accommodating the indigenous social structure, through close collaboration with local elites, to control those below them in the local communities (Krishna 2010).

This strategy however disconnects the state authority from the local society. As Fuller and Harriss (2000) put it, 'the state can and often does appear to people in India as a sovereign entity set apart from society…a local administrative office, a government school, a police station; to enter any of these is to cross the internal boundary into the domain of the state' (Fuller & Harriss 2000, pp23).

This disconnection weakens the governability of the country, especially at the local level. Because local leaders, sensitive to the base of their political support, have often remained adamantly independent, as, for example, in their refusal to levy taxes on agricultural

income as the central government has recommended (Hardgrave 1970). Similarly, as argued by Weiner (1962), 'There is a marked change in attitudes…as one leaves the offices of ministers and planners in New Delhi and enters the homes of state legislators…the distance of the national leadership from rural political pressures disposes them toward a program which they justify on economic grounds, while state and local leaders are sensitive within their constituencies and are therefore disposed towards policies on political considerations' (Weiner 1962, p. 152).

Suggested strategy for strengthening the Indian state

This research suggests a strategy to strengthen the Indian state, as the means of improving the efficacy of electricity governance in the country. This strategy seeks to directly connect the state authority and local communities, bypassing the powerful local elites. Some key aspects of this strategy are presented below.

1) *Strong political parties*: Strong political parties with effective party organisation are needed to directly connect the state authority and local communities. Because the interests of local communities (especially, in the rural areas) are primarily articulated in the country's policy-making processes through the mediation of powerful local elites. This always leads to ineffective interest articulation, as these elites may tend to pursue their own interests (such as, wealth and power) at the expense of the wider society. The resulting social discontent is frequently mobilised by opportunistic politicians for the pursuit of their political interests (such as, winning an election). This political mobilisation may provide some short-term partisan benefits; but would dampen the governability of the country over the long-term (also see Kohli 1990).

   Besides, it has been witnessed in recent years that young and educated villagers (also known as *naya neta*) are becoming new local leaders in demanding benefits from the

government (Krishna 2010). These local leaders could be incorporated into party organisations, acting as the connection between political parties and local communities. The incorporation of these new local leaders into the party organisations means that they could be subject to party discipline in the process of political mobilisation, hence reducing the magnitude of undisciplined political mobilisation.

2) *Strong political leadership*: Political leadership is weak in India, focusing primarily on the sectarian demands – caste, language, religion, *etc.* (Guha 2010). This weak leadership, this research argues, tends to weaken the Indian state by encouraging political fragmentation. The increasingly fragmented Indian polity further highlights the importance of maintaining political support at the local level, thereby increased needs for political parties to collaborate with powerful local elites.

   Accordingly, this research suggests that strong political leadership, focusing on the interests of the country as a whole, is important to strengthen the Indian state, because it would reduce the magnitude of political fragmentation in India. The outcome would be reduced needs for political parties to collaborate with local elites. Thus, they would be more willing to build direct connection with the local communities.

3) *Well-defined vision for national development*: The prevalent strategy for political mobilisation in India, as argued by Guha (2010), emphasises 'a rhetoric of fear – warning the members of a caste, or religion, or region, that they would be swamped by their enemies if they do not bind together' (Guha 2010, pp 295). This mobilisation strategy, this research argues, tends to weaken the Indian state by encouraging political fragmentation, which provides strong incentives for political parties to collaborate with powerful local elites, hence little incentives for them to build strong connection with local communities.

Therefore, this research suggests an alternative strategy for political mobilisation, focusing on national socio-economic development, as the means of encouraging political parties to build strong connection with the local communities. This is because socio-economic development (*vikaas*) has increasingly become the priority for India. A political party with a well-defined vision for national development is therefore more likely to win electoral support from the local communities. The outcome would reduce the need for political parties to rely on powerful local elites for political support.

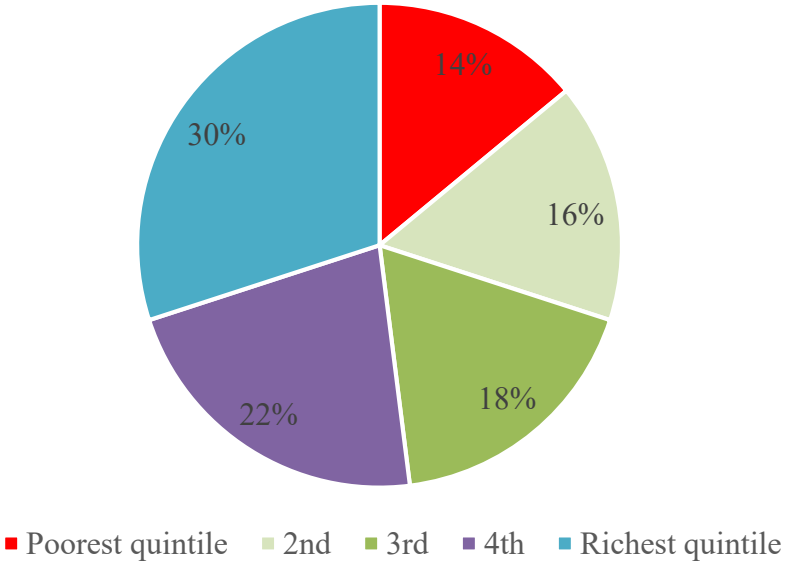
Contribution to better performance of electricity industry

The suggested strategy for improving the efficacy of electricity governance as noted above could contribute to better performance of the electricity industry. Some points to further lend credence to this viewpoint are provided as follows.

1) Electricity subsidies are identified by several studies (such as, Pargal and Banerjee 2014 and Dubash, and Rajan 2001) as one of the main causes of poor industry performance. For example, state electric utilities (SEBs) are frequently required by state governments to subsidise rural consumers (especially, agricultural) through low-than-cost electricity prices or even free electricity. The main motivation for the provision of these subsidies, it is argued, is to gain electoral support from rural communities that represent a significant proportion of the population. The outcomes of these subsidies are however huge financial losses for state electric utilities. These utilities had to be bailed out twice in recent years, costing $7.4 billion in 2001, and $18.7 billion in 2012 (Khurana & Banerjee 2015).

2) It is well known that wealthy large and intermediate farmers are the main beneficiaries of these subsidies. Because these wealthy farmers, though small in numbers, are usually ‘the patriarchs of their clans and communities and function as political

intermediaries who could deliver blocs of votes to their favoured political party' (Lal 2005). It would be therefore highly unlikely for political parties to alienate the demands of these powerful local elites, especially in the backdrop of growing political regionalism. This observation gets substantiated by the fact that, in India, the richest quintile in 2010 received more than twice as much of the total electricity subsidy as the poorest quintile (see Figure 5-1).



Source: Mayer et al. 2015

Figure 5-1: Subsidy distribution across India, 2010

3) The strategy to directly connect the state authority and local communities, as discussed in the earlier parts of this section, could significantly reduce the need for political parties to rely on local elites (such as, wealthy farmers) for political support. The state governments are therefore more likely to implement pricing reforms aimed at reducing the level of electricity subsidies.

5.4 Summary

This chapter has provided some thoughts on how the efficacy of electricity governance could be improved in India, and how this improved electricity governance could contribute to better performance of the electricity industry. Main points of this chapter are summarised as follows:

Existing approaches to improve the efficacy of governance

- In the literature, there are two main approaches for improving the efficacy of governance, namely, *society-centred approach*, and *state-centred approach*. The *society-centred approach* primarily attributes poor governance to weak society that fails to articulate its interests in the political decision-making processes. Thus, the governments always select and implement policies that are unreflective of the interests of major social groups (such as, farmer organisations, labour unions, and professional associations). These social groups therefore frequently seek to pursue their interests through either violent (such as, insurgency) or non-violent (such as, street protests) ways, which in turn undermine socio-political stability, and hence adversely affect the efficacy of governance in the country. This approach accordingly emphasises strengthening society, and offer several approaches for doing so.
- In contrast, the *state-centred approach* attributes poor governance to weak state that is unable to make difficult political decisions to satisfy the needs and interests of major social groups (such as, farmer organisations, labour unions, and business associations). This always leads to widespread social discontent, which in turn weakens the governability of the country. Further, this approach argues that the weak state is deeply rooted in the underlying 'social structure' that enables the society to resist political authority and prevent the development of a strong state. Accordingly,

the *state-centred approach* suggests a stronger state as the means of improving the efficacy of governance. It also suggests that the strength of the state can be enhanced by a 'restructure' of the society by, for example, creation of new socio-political institutions for promoting cooperation among various social groups.

- Based on the above discussion, this research argues that the *state-centred approach* would be the most appropriate approach for improving electricity governance in India. This is mainly because poor electricity governance, as discussed in Chapter 2, is primarily caused by a weak Indian state (typified by growing political regionalism, multiple party competition, and unstable ruling coalition) that has become increasingly incapable of satisfying the interests and needs of various social groups (such as, farmer organisations, labour unions, and business associations). The *state-centred approach* is focused on strengthening the state as the means of improving the efficacy of governance. It can, this research contends, provide appropriate guidance for developing policy measures to improve electricity governance in India.

Nature of the weak Indian state: A disconnection between the state and society

- The indigenous and traditional Indian society is structured based on a multiplicity of patron-client relationships (such as, kinship, caste, and religion), dominated by a small group of local elites (such as, dominant castes, ethnic leaders and wealthy land owners). The Indian state has traditional sought to sustain this social structure by closely collaborating with local elites in the governance of the country. This strategy has however disconnected the state authority from the local society, which further undermines the efficacy of governance in the country, especially at the local level. The local leaders, sensitive to the base of their political support, have often remained adamantly independent.

Some thoughts on strengthening the Indian state

- This research accordingly argues for building a direct connection between the state authority and local communities, bypassing the powerful local elites, as the means of strengthening the Indian state (thereby improved electricity governance). Some thoughts on how to build this direct connection between the state authority and local community are as follows.

    1) *Strong political parties*: Strong political parties with effective party organisation are needed to connect the state authority and local communities. Besides, young and educated villagers (also known as *naya netas*) could be incorporated into party organisations, acting as the connection between political parties and local communities. The incorporation of these new local leaders into the party organisations means that they could be subject to party discipline in the process of political mobilisation, hence reducing the magnitude of undisciplined political mobilisation.
    2) *Strong political leadership*: Political leadership is weak in India, focusing primarily on the sectarian demands – caste, language, religion, *etc*. Such leadership, this research argues, tends to weaken the Indian state by encouraging political fragmentation, which further encourages political parties to rely on local elites for political support. Accordingly, this research suggests that strong political leadership, focusing on the interests of the country as a whole, is important to strengthen the Indian state, because it would reduce the magnitude of political fragmentation.
    3) *Well-defined vision for national development*: The prevalent strategy for political mobilisation in India primarily emphasises ‘a rhetoric of fear’. This mobilisation

strategy, this research argues, tends to weaken the Indian state by encouraging political fragmentation, which provides little incentives for political parties to build direct connection with local communities. Accordingly, this research suggests an alternative strategy for political mobilisation, focusing on 'a rhetoric of hope', as the means of encouraging political parties to build direct connection with the local communities. Because socio-economic development (*vikaas*) has increasingly become the priority for India. A political party with a well-defined vision for national development is more likely to win electoral support from the local communities. The outcome would be reduced need for them to rely on powerful local elites for political support.

Contribution to better performance of electricity industry

- The above discussion presented several ways for directly connecting the state authority and local communities in India as the means of improving the efficacy of governance. This, this research argues, will contribute to improving the performance of electricity industry. This is because electricity governance in India has historically favoured the use of electricity as a vehicle for pursuing wider policy priorities and agendas (see Chapter 2). Such pursuit of wider policy priorities has however made issues of industry performance (such as, capacity expansion, cost reduction, and quality improvement) subordinate to wider priorities. The outcome is persistently poor industry performance.

6 CONCLUSION AND RECOMMENDATIONS FOR FURTHER RESEARCH

6.1 Conclusion

The main objective of this research is to develop a governance perspective on the performance of electricity industry in India, with specific emphasis on understanding the causes of poor industry performance, and identifying ways to improve this performance. The backdrop for this research is as follows. In view of its significance, the development of electricity industry has traditionally been accorded a high priority by the Indian policy makers, as reflected in the magnitude of investments made in the industry, and the establishment of expansive governance framework (including, laws, regulations and institutions) for the industry. Despite this, the Indian electricity industry has persistently performed poorly. Existing studies overwhelmingly tend to attribute poor industry performance to industry-centric factors, that is, factors that are proximate to the electricity industry (*e.g.,* poor facility maintenance, insufficient fuel supply, widespread theft of power, and inappropriate regulation). Such industry-centric focus for understanding causes (reasons) for poor industry performance – this research contends – is deficient, because the concept of industry performance is a nuanced concept, and it is context-specific. Performance is, in fact, an outcome of an admixture of layers and layers of mutually interacting and unpredictably reinforcing underlying influences. This research is accordingly founded on the premise that much deeper insights into the causes of poor industry performance, and ways to improve this performance, could only be gained if one is able to identify the varied influences that shape the proximate factors, and (hence) affect industry performance. It is based on these insights then that remedies for improving the performance of the Indian electricity industry can be identified.

The task of identifying the varied influences is however extremely difficult, due to the multiplicity of the factors, possible correlations, and context-connects. Notwithstanding this difficulty, a sufficiently useful idea about these influences can be gained by grouping them into specific 'defining' realms and, through a multi-stage process, delineating their significance. *Institutional theory* does provide a coherent framework for this purpose. This theory divides institutions into formal and informal. Formal institutions refer to these rules that are explicit or written down. They include, for example, constitution, laws, and regulations. Informal institutions refer to socially shared norms of behaviour, such as, beliefs, customs, and conventions. A core premise of institutional theory is that the performance of an industry (electricity industry, in this instance) is shaped by underlying formal institutions, which in turn derive their legitimacy from the underlying informal institutions.

As the scope of 'institutions' can be rather expansive and somewhat diffuse, in the context of this research, the concept of 'governance' is used instead. Governance refers to the structure (such as, hierarchy, network, and market) and processes (for example, control, coordinate, and steer) by which various state and social actors pursue their interests in governing socio-economic activities of a country. The outcomes are the setting, application and enforcement of institutions for shaping human behaviour in these activities. This suggests that the concept of governance tends to emphasise the dynamic aspect of institutions, that is, the ongoing process of creating and implementing institutions for governing socio-economic activities, and the role of various state and social actors in shaping this process. The use of this concept could therefore enable a perspective to be developed on the understanding of the influence of socio-economic institutions (*e.g.,* central planning, and market competition) in shaping the configurations of electricity industry in India (*i.e.,* industry structure, ownership, regulation), the

underlying dynamics of these configurations, and hence, the performance of the industry. This perspective, in conjunction with the existing industry-centric thinking, can provide much richer insights into why the Indian electricity industry has persistently performed poorly – this research contends.

The approach adopted in this research to develop a governance perspective on the performance of electricity industry in India is a combination of both qualitative and quantitative frameworks. The qualitative framework draws upon the basic tenets of the *state-society relational* approach. This framework analyses how Indian state and society have interacted with each other over the past decades, how this interaction has shaped the governance of socio-economic activities of the country, how such national governance paradigm has then shaped the way electricity industry is governed, and finally how electricity governance has shaped the structure, ownership, and regulation of the industry, thus influencing its performance. The quantitative framework of this research is based on three econometric models, namely, granger causality model, mixed effect model, and multilevel regression model. This framework seeks to statistically assess the impact of national and electricity governance paradigms on shaping the structure-ownership-regulation as well as performance of the Indian electricity industry.

The main conclusions of this research, in summary, are presented below.

National and electricity governance paradigms

- India's national governance paradigm in the colonial period (late 18th century to 1946), referred to as *colonial* governance in this research, emphasised a socio-economic order under which colonisers were allowed to freely pursue their self-interests with minimum governmental intervention. Such governance, it was believed, would spontaneously generate benefits for the colonising countries. Accordingly, this

governance paradigm strongly favoured: 1) domestic market opening to British products and capital; and 2) government presence confined to the provision of basic infrastructure (such as, law, order, education and roads).

- Britain's colonial domination was built on its military strength, and more importantly, its accommodation with indigenous and traditional Indian society, through close collaboration with local dominant castes and other 'big men', to control those below them in the social hierarchy.

- Consistent with the wider colonial governance paradigm, between late 19th century and 1946, electricity governance paradigm in India mainly focused on the furtherance of business interests (especially, British). The colonial government assumed a passive role in regulating the electricity industry. Their regulatory role was confined to ensuring general safety of electricity supply, and issuing licenses to electricity undertakings.

- India attained independence on 15 August 1947. In the years after the independence (1947 to 1960s), the country's national leadership strongly favoured a socialist governance paradigm in which the government (especially, central) controlled 'the commanding heights of the economy', and promoted rapid industrialisation by creating public companies in industrial and infrastructure sectors, and by tightly regulating private investments in other industries (such as, manufacturing). This, it was strongly believed, would lead to self-sufficiency and eradication of poverty, unemployment and backwardness.

- This post-independence governance paradigm for socio-economic development, referred to as *centre-dominated* governance in this research, derived its ideological basis from Gandhism that focused the attention of Congress Party leaders to moral

aspects of development (such as, employment creation and elimination of inequity). Its practical guidance came from the vision of development held by Jawaharlal Nehru, India's first prime minister after independence. He had strong belief in large-scale industrialisation, and viewed it as the best way to achieve self-sufficiency, poverty reduction and improvement in living standards.

- The ability of the Congress Party to establish its perceived national governance paradigm was built on the Party's political dominance at the time. This dominance was built upon the Party's widespread popularity, derived from its nationalist legacy, and its incorporation within its own organisation of the society's traditional authority in various localities, such as, high castes, village leaders, and landowners.

- The centre-dominated governance paradigm, in the context of the electricity industry, meant the government (especially, central) assuming the lead in developing the industry, and using electricity as a vital input to support the country's large-scale industrialisation programs.

- A combination of economic stagnation, severe food shortages, and lack of improvement in living standards created momentum for changes in national governance paradigm. The changes included: 1) a populist transformation of the Congress Party, leading to the creation of a system of political authority based on personal loyalties to the top Congress Party leaders; 2) provision of welfare packages to the country's poor people in ways that created an impression that they were the gift from the central leadership; and 3) a shift in developmental priority from industrialisation, to accelerated agricultural production, using new technologies and subsidies.

- The national governance paradigm that emerged from these changes is referred to as *populist* governance in this research. The primary motivation for this governance paradigm was growing social activism in the late 1960s and early 1970s. In order to maintain political stability, the central leadership sought to accommodate (at least rhetorically and symbolically) diverse social demands by personalistic and populist policies. This accommodative strategy was also motivated by factional fights within the Congress Party, between the central leadership and old party elites (such as, the upper-caste intelligentsia, business community and landowners). This strategy created a system of authority based on personal loyalties to the central leadership, bypassing the old party elites.

- Consistent with the populist governance paradigm, the 1970s and 80s witnessed a gradual shift in India's developmental policies towards populism, focusing on satisfying the demands of various social groups (such as, farmer associations), by distributing public resources and privileges to these groups. The electricity industry was considered as an important instrument for subserving these policies.

- The 1980s saw a considerable increase in India's fiscal deficit. Faced with a severe balance of payment crisis, the Indian government agreed to implement market reform in the early 1990s, as the condition of receiving financial assistance from the IMF. This reform was primarily based on neoliberal ideology that considered state-centric governance as inherently inefficient, due to bureaucratic inefficiencies, lack of market-styled incentives, and highly political biases, especially of strong interest groups. Neoliberalism accordingly suggested a rollback of the state, limiting its role to 'steering' socio-economic development. This *market-oriented* governance paradigm would then achieve optimum economic performance with respect to

efficiency, economic growth, and technical progress, resulting in improved welfare of the population, the argument continued.

- The market reforms have however only been partially implemented. This essentially reflects mixed perceptions on reform in India. On the one hand, the domestic business groups strongly supported market reform based on the belief that it would lead to a dismantling of controls and regulations on domestic investment, and open new profit-making opportunities for them. This, assisted by increased business influence at the central level, resulted in a fair degree of policy coherence and stability, especially in the areas of market liberalisation. On the other hand, market reform faced strong rural resistance, due to the fear that it would adversely affect rural interests (*e.g.,* removal of electricity subsidies). Given the relatively greater influence of landed interests on state governments, the implementation of market reform has been quite slow at the state levels.

- As part of the country's wider shift towards market-oriented governance paradigm, several legislative changes were made in the 1990s and 2000s to reduce the government's role in the electricity industry. These changes led to the implementation of electricity market reform that emphasised private ownership, market mechanisms for electricity trading, elimination of subsidies and price control, and establishment of sector-specific regulators for overseeing the operation of the power systems. The progress of this reform has however been quite slow due to strong rural resistance.

Electricity industry structure-ownership-regulation and performance

The analysis of national and electricity governance paradigms (as noted above) suggests that the electricity governance paradigm in India, over four distinctive time periods (namely, colonial, centrist, populist, and neo-liberal), have predominately been shaped by

the underlying governance paradigm for socio-economic development of the country. Further, the analysis also suggests that underlying national governance paradigm of a time is essentially reflective of the dominant political and socio-economic interests of the time. This suggests that electricity governance is merely a process of serving dominant political and socio-economic interests of the time. In such environments, industry performance has assumed a dormant role. Poor industry performance is therefore a 'natural' outcome. This viewpoint is further discussed as follows:

- Consistent with the wider colonial governance paradigm, between late 19th century and 1946, the *electricity governance paradigm* in India emphasised the furtherance of private interests (especially, British). The colonial government assumed only a passive role in regulating the electricity industry, primarily confined to the areas of safety and licensing. This electricity governance paradigm led to the development of electricity industry typified by highly fragmented structure, predominately foreign ownership, and minimal regulation. Power supply was mainly confined to major cities and towns, where economic activities concentrated. Rural areas were largely untouched by electricity.

- In the years after independence (1947 to 1960s, specifically), the new government of India took a socialist approach for governing socio-economic development, with the public sector assuming an ever-larger role in the economy. This approach viewed electricity as a vital input for socio-economic development. It therefore placed the electricity industry under tight public control. This is so because only public sector, it was believed, could forgo immediate profit, and supply electricity to less-developed areas where electricity supply was considered as economically unviable.

- This belief led to important structural, ownership and regulatory changes in the Indian electricity industry, for example, creation of public-owned, vertical-integrated utilities (SEBs), and introduction of tight regulatory control of the industry. These changes enabled the use of electricity by the government as an instrument for promoting rapid industrialisation – as the means of achieving self-sufficiency and the eradication of poverty, and reduced unemployment and backwardness. This resulted in a rapid expansion of generation capacity, mainly to meet rising industrial demand. The industry also received subsidised electricity.

- The middle-to-late 1960s witnessed mounting democratic activism by previously quiet social groups (such as, peasants, workers and students). The government (keen to maintain social stability) began to implement in the 1970s and 80s populist policies to (at least rhetorically and symbolically) satisfy the interests of various social groups. Electricity was considered as an important instrument for supporting the populist policies, resulting in significant financial costs for the SEBs.

- Until the early 1990s, these financial costs were largely offset by the governments, primarily through foreign borrowings. In mid-1991, the capacity of the governments to further offset the financial costs of the industry reached its limit, as foreign lenders lost their confidence in the country, in the face of rising inflation and mounting public debt. In response, India turned to the IMF for financial assistance. As part of the bailout deal with the IMF, the Indian government began to implement market reforms of the economy (including the electricity industry). Serious power shortages in the early 1990s gave further immediacy to these reforms.

- Key component of these reforms included: restructuring and privatisation of SEBs, encouragement of IPPs, introduction of market competition, elimination of subsidies

and price control, and establishment of sector-specific regulators for overseeing the operation of the power systems.

- These reforms have only been partially implemented, due to strong political resistance. This resistance essentially reflects a mixed reception of these reforms by the Indian society. Support for reform mainly came from international capital, on the lookout for attractive investments, and domestic business groups, based on the view that these reform could lead to new investment opportunities for them. Opposition to reform mainly came from the farmers, who had come to rely on enormous quantities of low-cost electricity for pumping water, and utility labour who feared losing their jobs if the bloated SEBs were privatised. Some government officials and political parties (especially, at the state levels) also opposed reform, fearing that reform would reduce their control of the electricity industry, which is viewed by them as an important source of political power.

- Despite this resistance, some progress has been made, especially in the areas of market opening, due to strong business support based on the belief that such reforms could provide them with profit-making opportunities. This has encouraged large private investments in electricity generation, resulting in a rapid expansion of generating capacity. Electricity supply has however remained inaccessible to, and unreliable for, a significant proportion of the population, especially in rural areas, as profit-seeking private investors, mainly interested in commercially attractive investments in the industry, showed little interest in the remote rural areas. Besides, public utilities are still debt-stricken, and are therefore unable to finance necessary maintenance and capacity expansion.

Causes of poor industry performance

The analysis (as noted above) revealed that electricity industry has historically been considered in India as an important instrument for subserving wider policy priorities and agendas. These priorities and agendas have essentially been shaped by the underlying national governance paradigms, which have drawn their legitimacy from the dominant political and socio-economic interests of the time. This perspective has made electricity governance as merely a process of serving the dominant interests of the time. Issues of industry performance have therefore assumed a dormant role. The outcome is persistently poor performance of the industry.

This viewpoint on electricity governance processes is further validated in this research through a statistical assessment of the impact of wider socio-economic interests (that have shaped the national and electricity governance paradigms) on the electricity industry structure-ownership-regulation and performance. Further, two types of effect (impact) are considered in the assessment, namely, mediation effects, and moderation effects. Mediation effects, in the context of this research, are referred to as the direct effects of wider interests on shaping the industry structure-ownership-regulation, which in turn influence the performance of the industry. Moderation effects are referred to as the indirect effects of wider influences on shaping the ability of the industry structure-ownership-regulation to influence industry performance. Key findings of this assessment are summarised as follows.

- Rural interests seem to have opposed the implementation of market reform in the Indian electricity industry. This is reflected by the adverse impact of rural interests on the ability of market reform to improve the performance of electricity industry, as presented in Section 4.4.2. The rural opposition however varies across the country, as

indicated by no significant causal relationship between rural interests and industry structure-ownership-regulation (see Table 4-5). This probably reflects mixed views on electricity reform in rural communities across the country.

- Domestic business interests (DBI) seems to have favoured the introduction of market competition in the electricity industry, as reflected by its positive impact (3.11 in Table 4-6) on industry structure. The introduction of market competition has led to some improvements in the industry performance, as indicated by its positive impact on total (1.46) and peak (5.56) electricity deficits, and negative impact on forced outage rate (-1.71), as presented in Table 4-6.
- Better central and state relationship (CSR) appears to have contributed to smooth implementation of market reform in the electricity industry, as reflected by a more significant impact of privatisation on reducing electricity deficits, if privatisation had taken place in states with good centre-state relationship (see Section 4.4.2).

In summary, the above analysis has clearly demonstrated the significance of wider socio-economic interests in shaping the structure-ownership-regulation and performance of the Indian electricity industry. This provides further validation to the viewpoint that causes of poor industry performance are deeply rooted in the electricity governance processes, which have historically favoured the use of electricity to subserve wider policy priorities and agendas for socio-economic development of India, arising from a range of political and socio-economic interests. This perspective makes electricity governance merely a process of serving dominant interests of the time. In these processes, issues of industry performance become subordinate to wider interests, thereby limited action for improving industry performance.

This research therefore suggests that the performance of the Indian electricity industry can only be improved by an appreciation of the influence of these wider socio-economic interests that have shaped the contours of the industry, because this appreciation could enable a considered accommodation, into the electricity governance processes, of dominant socio-political interests of the time, which will in turn improve the efficacy of electricity governance, and hence contribute to better industry performance.

Suggestions to improve the industry performance

This research demonstrates how the efficacy of electricity governance processes can be improved, through a considered accommodation, into these processes, of various socio-economic interests, and how this improved electricity governance can contribute to better industry performance.

Existing approaches to improve the efficacy of governance

- In the literature, there are two main approaches for improving the efficacy of governance, namely, *society-centred approach*, and *state-centred approach*. The *society-centred approach* primarily attributes poor governability to weak society that fails to articulate its interests in the political decision-making processes. Thus, the governments always select and implement policies that are unreflective of the interests of major social groups (such as, farmer organisations, labour unions, and professional associations). These social groups therefore frequently seek to pursue their interests through either violent (such as, insurgency) or non-violent (such as, street protests) ways, which in turn undermine socio-political stability, and hence adversely affect the efficacy of governance in the country. This approach accordingly emphasises strengthening society, and offer several approaches for doing so.

- In contrast, the *state-centred approach* attributes poor governance to weak state that is unable to make difficult political decisions to satisfy the needs and interests of major social groups (such as, farmer organisations, labour unions, and business associations). This always leads to widespread social discontent, which in turn weakens the governability of the country. Further, this approach argues that the weak state is deeply rooted in the underlying 'social structure' that enables the society to resist political authority and prevent the development of a strong state. Accordingly, the *state-centred approach* suggests a stronger state as the means of improving the efficacy of governance. It also suggests that the strength of the state can be enhanced by a 'restructure' of the society by, for example, creation of new socio-political institutions for promoting cooperation among various social groups.

- Based on the above discussion, this research argues that the *state-centred approach* would be the most appropriate approach for improving electricity governance in India. This is mainly because poor electricity governance, as discussed in Chapter 2, is primarily caused by a weak Indian state (typified by growing political regionalism, multiple party competition, and unstable ruling coalitions) that has become increasingly incapable of satisfying the interests and needs of various social groups (such as, farmer organisations, labour unions, and business associations). The *state-centred approach* is focused on strengthening the state as the means of improving the efficacy of governance. It can, this research contends, provide appropriate guidance for developing policy measures to improve electricity governance in India.

Some thoughts on improving electricity governance in India

- The indigenous and traditional Indian society is structured based on a multiplicity of patron-client relationships (such as, kinship, caste, and religion), dominated by a

small group of local elites (such as, dominant castes, ethnic leaders and wealthy land owners). The Indian state has traditionally sought to sustain this social structure by closely collaborating with local elites in the governance of the country. This strategy has however disconnected the state authority from the local society, which further undermines the efficacy of governance in the country, especially at the local level. The local leaders, sensitive to the base of their political support, have often remained adamantly independent.

- This research accordingly argues for building a direct connection between the state authority and local communities, bypassing the powerful local elites, as the means of strengthening the Indian state (thereby improved electricity governance). Some thoughts on how to build this direct connection between the state authority and local community are as follows.

    - *Strong political parties*: Strong political parties with effective party organisation are needed to connect the state authority and local communities. Besides, young and educated villagers (also known as *naya netas*) could be incorporated into party organisations, acting as the connection between political parties and local communities. The incorporation of these new local leaders into the party organisations means that they could be subject to party discipline in the process of political mobilisation, hence reducing the magnitude of undisciplined political mobilisation.

    - *Strong political leadership*: Political leadership is weak in India, focusing primarily on the sectarian demands – caste, language, religion, *etc*. Such leadership, this research argues, tends to weaken the Indian state by encouraging political fragmentation, which further encourages political

parties to rely on local elites for political support. Accordingly, this research suggests that strong political leadership, focusing on the interests of the country as a whole, is important to strengthen the Indian state, because it would reduce the magnitude of political fragmentation.

- *Well-defined vision for national development*: The prevalent strategy for political mobilisation in India primarily emphasises 'a rhetoric of fear'. This mobilisation strategy, this research argues, tends to weaken the Indian state by encouraging political fragmentation, which provides little incentives for political parties to build direct connection with local communities. Accordingly, this research suggests an alternative strategy for political mobilisation, focusing on 'a rhetoric of hope', as the means of encouraging political parties to build direct connection with the local communities. Because socio-economic development (*vikaas*) has increasingly become the priority for India. A political party with a well-defined vision for national development is more likely to win electoral support from the local communities. The outcome would be reduced need for them to rely on powerful local elites for political support.

Contribution to better performance of electricity industry

- The above discussion presented several ways for directly connecting the state authority and local communities in India as the means of improving the efficacy of electricity governance. This, this research argues, will contribute to improving the performance of electricity industry. This is because electricity governance in India has historically favoured the use of electricity as a vehicle for pursuing wider policy priorities and agendas (see Chapter 2). Such pursuit of wider policy priorities has

however made issues of industry performance (such as, capacity expansion, cost reduction, and quality improvement) subordinate to wider priorities. The outcome is: persistently poor industry performance.

6.2 Some recommendations for further research

This research has analysed the performance of Indian electricity industry from an institutional perspective. This analysis has provided an in-depth understanding about the causes of poor industry performance, and ways of improving performance. However, there is still scope for further improvements in this analysis. Some suggestions include:

- The approach employed by this research to analyse national and electricity governance paradigms in India largely focuses on the influence of political and socio-economic interests at the national level. This, this research argues, could be improved by incorporating the analysis of regional and local political and socio-economic interests. The potency of this argument becomes evident if one takes note the fact that significant variation existed in the electricity industry structure-ownership-regulation and performance at the regional and local levels.

- This research primarily focuses on assessing the overall impact of national and electricity governance paradigms on the performance of the Indian electricity industry. While useful, such focus prevents a deeper understanding of the impact of national and electricity governance paradigms on the performance of individual segments of the industry (*e.g.,* generation, transmission and distribution). This understanding is extremely valuable for identifying ways to improve the performance of these segments. Further research is therefore needed to develop such an understanding.

- The data used in this research to analyse the impact of national and electricity governance paradigms on the performance of the Indian electricity industry is

incomplete, due to the lack of data availability of several variables, such as, forced outage rate, and electricity prices. The availability of these data could provide more accurate estimation of the impact.

- Suggestions made in Chapter 5 for improving the efficacy of electricity governance processes are mainly a supplement to the main topic of this thesis, namely, development of a governance perspective on the causes of poor performance of the Indian electricity industry (Chapters 2 to 4). This chapter demonstrates the merits of improved electricity governance processes through a more considered accommodation of various socio-economic interests in these processes. The discussion on this chapter, this research argues, sets a foundation for future research on the topic of improving the efficacy of electricity governance.

Appendix A: Existing literature on the causes for the poor performance

Over the years, many studies have been undertaken to identify the causes for the poor performance of the Indian electricity industry. These studies attribute this poor performance to two groups of factors, namely, technico-economic (such as, slow project execution, insufficient network capacity, and poor maintenance) and institutional (*e.g.,* legislation that empowers the government to intervene in making regulatory decisions. Details about these studies are presented in the following paragraphs.

Causes for inadequate electricity supply

Some studies focus on the analysis of technico-economic factors and their influence in shaping electricity supply and demand balance. These studies include, for example, Ahn & Graczyk (2012), Bost et al., (2006), Government of India (1980), and World Bank (1979 and 1999). Several technico-economic factors are identified by these studies as being responsible for inadequate electricity supply in India. These factors include:

Some technico-economic factors are at the supply side. These factors include a) slow growth of installed generating capacity, due primarily to widespread and prolonged delays in the execution of power projects; and b) significant underutilisation of existing generating capacity, mainly due to lateness and inadequacy of network facilities, insufficient and low quality fuel supply (*e.g.,* coal and lignite), and poor maintenance (Ahn & Graczyk 2012; Bose et al. 2006; World Bank 1979).

At the demand side, overconsumption encouraged by highly subsidised electricity prices is identified as being responsible for power shortages in India. These subsidies, it is argued, make electricity prices artificially low. These low prices have in turn encouraged high levels of electricity consumption, and consequently lead to excessive investment requirements for capacity expansion. These requirements are however far beyond the

capacity of the electricity industry to mobilise, hence power shortage (Sankar & Ramachandra 2000; World Bank 1999).

There are also some studies that attribute India's power shortages to institutional factors. For example, according to Sharma (1990), India's continued shortfall of electricity supply is primarily caused by a slow capacity expansion, resulting from widespread and prolonged delays in the execution of power projects. These delays in project execution, as argued by Sharma (1990), are mainly attributable to the institutional arrangements for governing the industry planning. In these arrangements, investment decisions are shared between the central and the state governments. The State Electricity Boards (SEBs) are made responsible for proposing power projects that would support state developmental priorities (*e.g.,* poverty reduction). These proposed projects are assessed and approved by the Central Electricity Authority (CEA). The approval and associated funding are given based on the ability of proposed projects to meet certain selection criteria, such as, low cost, high returns on investment, and contribution to national developmental priorities. This ability is normally assessed based on information and data provided by the SEBs. There are no mechanisms to confirm the accuracy of these information and data. Given the severe competition among the SEBs for limited central government resources, it is a common practice for them to provide inadequate and incorrect information and data (*e.g.,* underestimated project costs), with the aim of demonstrating the advantages of their proposed projects. Hence, revisions become inevitable during the project execution process, causing significant delays in the project execution (Sharma 1990).

Insufficient inter-state connections are identified in the World Bank (1979) as one of the main causes for power shortages in India, as this could restrict generation in some states while their neighbouring states are suffering from severe supply shortages. The lack of

inter-state connections, it is argued, is mainly attributable to the planning of the Indian electricity industry that has been carried out in too limited an institutional framework, largely due to the natural concentration of the state electricity boards on matters within their own boundaries and spheres of responsibility. As a result, there is always a bias against major power projects which extend beyond state boundaries. This largely accounts for the fact that only slow progress has been made with respect to a number of major power projects (especially, inter-state connections) that have the ability of alleviating the power shortages (World Bank 1979).

According to Chikkatur et al., (2009), several institutional factors are responsible for insufficient and low quality coal for power generation (the main causes for power shortages as noted above). For example, existing contractual arrangements for coal supply are inappropriate. There is no penalty on non-compliance, and no control on coal quality (such as, ash content, and calorific value). As a result, it is at low costs for coal suppliers to breach the contracts, supplying low quality coal at quantity lower than the contracted amount. Besides, the existing coal pricing mechanisms provides little incentive to coal producers to improve coal quality, because coal are priced based on wide bands of useful heat values (UHV) under the current mechanism. Low quality unwashed coal is usually in the same price band as high quality washed coal (Chikkatur, Sagar & Sankar 2009).

Large technical losses of the power system are identified as one of the main causes for power shortages in India. The large technical losses are in large part caused by the tariff-setting mechanisms that charge agricultural consumers based on the capacity of water pumps rather than metered consumption. These mechanisms enable the SEBs to hide technical losses of the power system under the category of agricultural consumption,

hence creating little incentives for them to reduce these technical losses (Kannan & Pillai 2001a; Reddy & Sumithra 1997).

As noted above, overconsumption encouraged by subsidised electricity prices is one of the main causes for persistent power shortages in India. The provision of electricity subsidies can be attributable to three main institutional factors that reduce the decision-making authority of the regulators (such as, in tariff-settings). One, most electricity regulators lack financial independence, heavily reliance on state grants for their budgets. Two, state governments always have strong influence in recruitment decisions of electricity regulators (Pargal & Mayer 2014). Three, the Electricity Act of 2003 gives the state governments the ability to provide binding 'directions' to the regulators in matters of policy involving the public interest. As a result, most regulators are often more concerned with state governments' agenda, thereby compromising their regulatory responsibilities. This Act also provides the state governments with authority to select members of the regulator. It has become a common practice of individuals working with the state governments or in state-owned electricity companies being appointed as chairman or members of the regulator. This makes it difficult for the regulator to be independent, as its key members have strong connections with the state governments (Shunglu Committee 2011).

Causes for unaffordable electricity supply

Electricity prices in India are largely unaffordable for industrial consumers. This is primarily caused by cross-subsidisation of industrial consumers to agricultural and residential consumers (Chattopadhyay 2004). The cross-subsidisation is largely due to government interference in price determination, favouring agricultural and residential consumers (Dubash & Rajan 2001). This government interference is enabled by several

institutional factors. For example, before the enactment of the 2003 Electricity Act, for example, the SEBs were required by law to secure approval from the state governments in tariff determination (Kale 2004). As argued by Kannan and Pillai (2001a), 'it is true that the Board is the primary authority to fix electricity tariff rates. But there is a statutory power reserved in favour of the Government under Section 22-B to issue, when conditions exist, necessary orders to ensure equitable distribution of electrical energy. When the power is so exercised by the Government, it can also fix the tariff rates, for, the fixation of tariff rates is incidental to the power to regulate supply, distribution, and consumption and use of electrical energy and is also part of the regulatory process of equitable distribution of electrical energy. The Government is free to make their own classification of consumers for fixation of different rates of electricity tariff and they are not bound by the specification, categorisation, designation or division made by the Board for purposes of levying electricity charges' (Kannan & Pillai 2001a).

In recognition of strong state government interference in tariff-settings and its detrimental effects on industry finance, the Electricity Act of 2003 were enacted to remove the responsibilities of tariff-settings from the SEBs and state governments, and vested them in independent regulatory agencies. These regulatory agencies were required to determine electricity tariffs at the level that all validated expenses of the utility get recovered along with reasonable return on the investment made by the utility. But in practice the regulatory agencies have usually failed to set up the tariff at the cost-recovery level. This is largely due to widespread and prolonged delays in adjusting electricity tariff, caused by the fact that most distribution companies did not submit their tariff proposals in time or submitted the proposals in unacceptable forms (without account audited reports) as the regulatory agencies cannot estimate the cost of supply based on the best available data as required by law (Shunglu Committee 2011).

In addition, the section 108 of the 2003 Act gives power to the state governments in matters related to public interests. Some state governments have used this power to require the regulatory agencies to reserve the cheapest available electricity for specified category of consumers while determining tariffs. This in turn resulted in increasing the incidence of cross-subsidisation rather than reducing it (Shunglu Committee 2011).

Causes for unreliable electricity supply

Electricity supply in India is highly unreliable. Forced outage rate for power plants (especially, state government owned) are high as compared to other countries, such as, European countries. Three factors are identified in the literature as being responsible for the unreliable electricity supply in India. One, extended service of major power plants (Kannan & Pillai 2001b). As estimated by the Indian government in 2000, for example, more than 11,000 MW thermal generating capacity (about 19% of total thermal capacity) have already completed more than 20 years of their useful design life of 25 years. Similarly, about 35 hydro power plants have been operational for more than 30 years in excess of their useful operating life (Government of India 2000).

Two, poor maintenance of existing power plants, due to the lack of financial resources of the electric utilities. The lack of financial resources is attributable to large gap between electricity costs and prices, due to high supply costs, technical losses of the network, power theft and low bill collection rate (Kannan & Pillai 2001b; Khurana & Banerjee 2015).

Three, unreliable electricity supply is also encouraged by the tariff regime. As argued in Rao (2002), for example, ‘The engineers running the generating stations at the central level kept pushing power into the grid, even when it was not required, thus pushing

frequency well above that desired, because they were paid incentives for generating more power in relation to capacity, not for maintaining grid stability' (Rao 2002).

Causes for poor returns on public electricity investments

Poor returns on public investments in power projects are primarily caused by the large gap between electricity costs and prices (about 20 to 30 per cent) (Kannan & Pillai 2001a; Khurana & Banerjee 2015). This gap can be attributed to three technico-economic factors. One, rising cost of power purchase, due largely to poor purchase management. For example, most distribution companies do not have a clear plan for power purchase in advance. As a result, they do not rely on long-term contracts with electricity suppliers to achieve an efficient power procurement cost; rather they usually purchase electricity at high prices in short-term markets (Khurana & Banerjee 2015; Pargal & Banerjee 2014).

Two, the provision of lower-than-cost electricity to subsidise targeted social groups (*e.g.,* agricultural and residential consumers). As argued by Kannan and Pillai (2001a), 'the socio-political compulsions of distributional solicitude of the governments have resulted in significant distortions in setting tariffs for various consumer categories in line with the cost involved in supplying each group' (Kannan & Pillai 2001a). This governmental interference in tariff-setting, as noted previously in this section, is encouraged by several institutional factors, such as, the section 108 of the Electricity Act of 2003 that gives power to the state governments in matters related to public interests (*e.g.,* tariff increase for agricultural and residential consumers).

Three, high network losses, due to large technical losses of the network, power theft and low bill collection rate (Khurana & Banerjee 2015). For example, average network losses were about 22 per cent in India in 1995-96. This has increased to about 24 per cent in 2010-11. In that year, the technical losses for some states (such as, Bihar, Jammu &

Kashmir, and Jharkhand) were even higher than 30 per cent. Such high technical losses mean that a significant proportion of electricity purchased by the public distribution companies would not get paid, hence large commercial losses for these public companies (Planning Commission 2014). These high network losses are also encouraged by the provision of electricity subsidised, because the electric utilities could hide the network losses as part of the agricultural consumption. This in turn creates little incentive for these utilities to reduce the network losses (Dubash & Rajan 2001).

Appendix B: Key features of the Indian society

Indian has a multi-religious and multi-cultural society. As the then Prime Minister of India, Jawaharlal Nehru, put it:

> 'The diversity of India is tremendous; it is obvious; it lies on the surface and everybody can see it. It concerns itself with physical appearances as well as with certain mental habits and traits. There is little in common, to outward seeming, between the Pathan of the North-West and the Tamils in the far South. Their racial stocks are not the same, though there may be common strands running through them; they differ in face and figure, food and clothing, and, of course, language…All of them have their own distinctive features, all of them have still more distinguishing marks of India, It is fascinating to find how the Bengalis, the Marathas, the Gujratis, the Tamils, the Andhras, the Oriyas, the Assamese, the Canarese, the Malayalis, the Sindhis, the Punjabis, the Pathans, the Kashmiris, the Rajputs, and the great central block comprising the Hindustani-speaking people, have retained their peculiar characteristics for hundreds of years, have still more or less the same virtues and feelings of which old tradition or record tells us, and yet have been throughout these ages distinctively Indian, with the same national heritage and the same set of moral and mental qualities' (Nehru 1961, p. 61).

Some statistics to support this observation are presented as follows. Table B-1 shows main religions in India. A review of the table suggests that most Indian people (about 80 per cent) believe in Hinduism. Hinduism is not a distinctive religion; it comprises many sects and denominations, such as, Shaivism, Vaishnavism, and Shaktism (Mitra 2011a). India also has a large Muslim community, accounting for 14.2 per cent of the population. This Muslim community comprises of several major group affiliations and divisions. The

majority of them are Sunni. There also exist sizeable Shi'ite minority groups (Tenhunen & Saavala 2012). Christians comprise the third-largest religious group in India. Most of them are present in three Indian states, namely, Nagaland, Meghalaya, and Mizoram (Mitra 2011a). Other main religions in the country include: Sikhs, Buddhists, and Jains (see Table B-1).

Table B-1: Religions in India

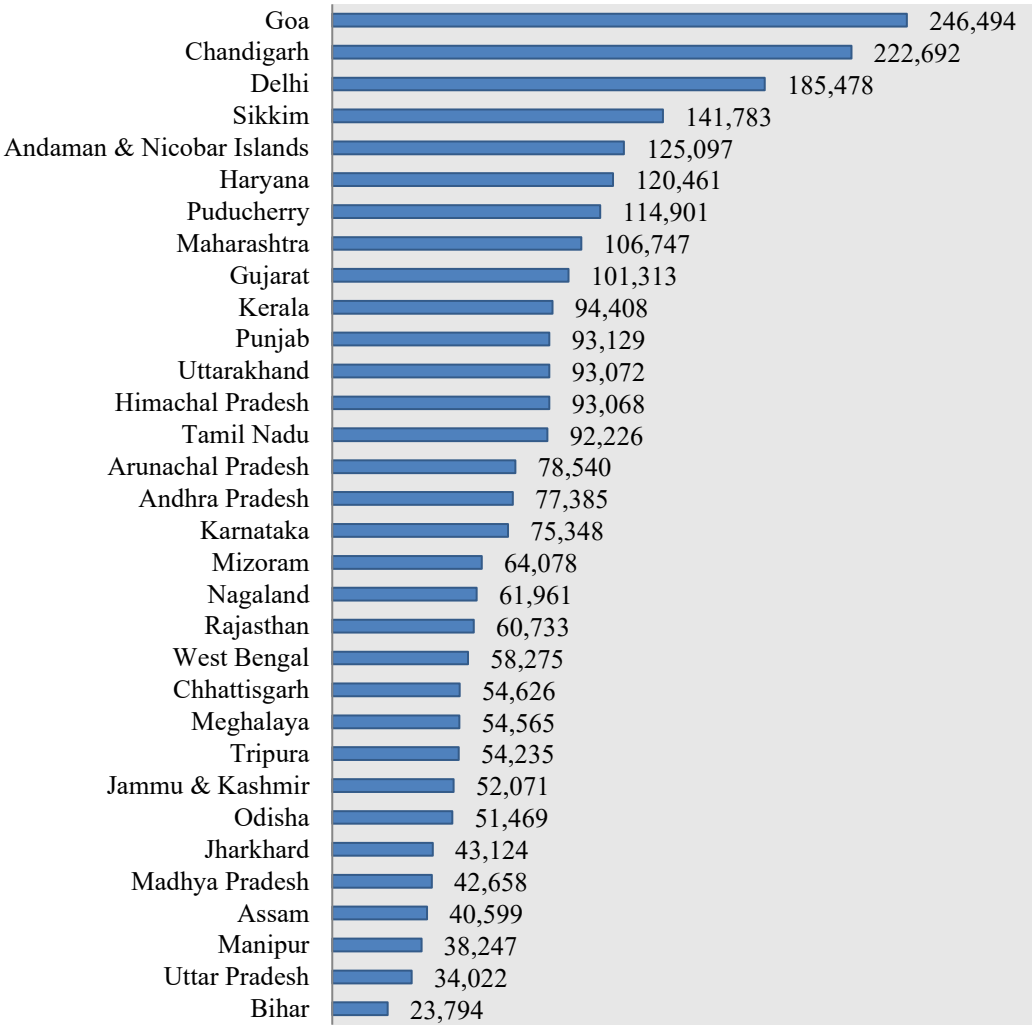
Religions	Population (million)	Share of total population (%)
Hindus	966.3	79.8
Muslims	172.2	14.2
Christians	27.8	2.3
Sikhs	20.8	1.7
Buddhists	8.4	0.7
Jains	4.5	0.4
Others	10.8	0.9

Source: Government of India (2011).

India's diverse culture is essentially reflected by the number of languages spoken in the country, because language 'does not exist apart from culture, that is, from the socially inherited assemblage of practices and beliefs that determines the texture of our lives' (Edward 1949). According to the latest consensus data, there are more than 1,000 languages used in the country. Of these, 29 languages have more than a million speakers (Government of India 2001). Major languages used in India include: Bengali, English, Hindi, Marathi, Tamili, Telugu and Urdu (Tenhunen & Saavala 2012).

India also has significant regional diversity in terms of economic and social development. For example, India's high economic performers are the western state of Goa, and northern union territories of Chandigarh and Delhi. These states have more than Rs. 150,000 per capita GDP in 2011-12. This is more than 5 times higher than that of the poorest states in

the country, such as, Bihar, Uttar Pradesh and Manipur (see Figure B-1). Socially, the western union territories of Dadra and Nagar Haveli are the poorest states in the country with around 40 per cent of the population living under the poverty line. This is much higher than average poverty level in the country (about 20 per cent). The wealthiest states include, for example, Goa, Kerala, and Lakshadweep. Less than 6 per cent of the population in these states live under poverty (Reserve Bank of India 2015).



Source: Government of India (2014): State Wise Data

Figure B-1: Per capita GDP by state in 2011-12 (Rs. current prices)

Appendix C: List of existing studies on the performance of electricity industry

1. Aghdam (2006)
2. Aghdam et al. (2013)
3. Bacon and Besant-Jones (2001)
4. Cambini and Rondi (2010)
5. Erdogdu (2011; 2013; 2014)
6. Fiorio et al. (2007)
7. Fiorio and Florio (2013)
8. Gugler et al. (2011)
9. Hattori & Tsutsui (2004)
10. Henisz et al. (2004)
11. Nagayama (2007; 2008; 2010)
12. Nepal and Jamasb (2012)
13. Pompei (2013)
14. Ruffin (2003)
15. Steiner (2001)
16. Zhang et al. (2002; 2005; 2008)

Appendix D: Data sets for assessing the performance of electricity industry in India

This appendix presents the data used in this research to assess the performance of the Indian electricity industry. It contains the following tables:

Table D-1: Energy deficits (%)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Andhra Pradesh	6.5	6.7	9.8	12.9	15.9	19.0	22.1	14.4	8.7	6.6	7.8	8.5	6.8	4.3	0.7	1.3	4.4	4.1	6.8	6.6	3.2	7.2	17.6	6.9	4.9	0.1
Assam	7.5	6.9	7.6	8.2	8.9	9.5	10.2	8.7	2.7	0.0	0.0	0.7	3.2	5.8	5.4	6.7	7.3	8.4	10.6	8.5	6.3	5.6	6.9	6.4	7.0	5.6
Bihar	29.7	29.7	29.3	28.8	28.4	27.9	27.5	19.9	8.1	6.3	7.0	5.1	8.3	22.5	10.1	9.3	8.1	13.4	16.4	14.4	13.0	21.3	16.7	4.1	2.8	1.3
Gujarat	4.0	4.3	5.1	5.8	6.6	7.3	8.1	5.3	6.2	8.2	9.7	11.5	11.4	12.0	11.7	8.2	13.4	16.2	9.8	4.5	5.8	0.4	0.2	0.0	0.0	0.0
Haryana	3.3	2.0	2.8	3.6	4.3	5.1	5.9	1.6	2.1	2.3	2.8	1.7	3.0	4.7	5.7	9.1	11.9	12.6	8.5	4.2	5.6	3.6	7.7	0.6	0.4	0.1
Himachal Pradesh	1.6	0.7	0.7	0.8	0.8	0.9	0.9	0.1	0.2	0.3	3.2	2.6	2.5	0.1	2.1	1.0	2.7	3.0	0.3	3.9	3.4	0.7	2.8	2.3	0.9	0.7
Jammu & Kashmir	10.1	10.8	10.6	10.5	10.3	10.2	10.0	2.7	6.0	19.2	16.4	11.1	12.7	4.6	9.2	17.2	31.9	29.0	24.2	24.8	25.0	23.6	25.0	21.9	19.1	15.3
Karnataka	24.5	23.6	24.3	25.0	25.7	26.4	27.1	20.3	13.2	8.3	9.1	12.5	9.8	13.9	4.2	0.7	2.1	2.7	6.0	7.7	7.6	11.2	13.9	9.5	4.3	5.2
Kerala	3.2	3.3	7.2	11.1	14.9	18.8	22.7	19.0	9.7	7.3	6.6	7.4	6.9	3.8	1.2	0.7	2.0	2.4	11.8	2.4	1.4	2.1	4.0	2.4	1.5	0.5
Madhya Pradesh	5.7	5.6	6.9	8.2	9.4	10.7	12.0	6.7	5.8	7.1	12.4	15.4	16.4	13.2	13.5	14.2	15.2	14.1	17.2	19.0	20.2	16.9	9.6	0.1	0.5	0.0
Maharashtra	5.6	4.5	4.7	4.9	5.2	5.4	5.6	2.9	3.9	6.1	10.5	8.8	13.4	10.2	12.1	18.2	19.0	18.3	21.4	18.8	16.6	16.7	3.2	2.1	1.3	0.3
Orissa	6.8	7.0	6.2	5.4	4.6	3.8	3.0	1.8	3.3	0.0	0.0	0.1	2.3	0.9	0.8	1.3	1.8	1.8	1.5	0.9	0.3	1.5	3.3	1.7	1.6	0.6
Punjab	7.3	6.2	5.3	4.4	3.4	2.5	1.6	0.8	2.2	0.7	2.7	4.2	5.9	2.9	9.0	8.7	9.8	8.4	10.6	13.8	6.0	3.1	5.4	1.5	1.0	0.0
Rajasthan	2.2	1.4	2.6	3.8	5.0	6.2	7.4	1.8	2.5	4.5	3.6	1.0	2.1	0.5	0.8	3.7	4.6	3.1	1.1	2.4	0.9	3.9	3.0	0.3	0.6	0.3
Tamil Nadu	5.1	4.8	6.6	8.4	10.2	12.0	13.8	14.1	11.9	7.9	7.6	7.1	6.0	0.6	0.6	0.6	1.7	2.8	7.8	6.2	6.5	10.5	17.5	5.9	3.1	0.7
Uttar Pradesh	11.8	10.3	11.0	11.7	12.5	13.2	13.9	12.3	9.8	12.9	14.6	9.9	17.8	13.2	20.1	20.9	15.8	18.0	21.5	21.6	15.0	11.3	16.6	14.0	15.6	12.5
West Bengal	9.9	9.0	7.8	6.6	5.3	4.1	2.9	0.7	2.8	0.0	0.0	0.5	1.0	2.2	1.6	1.7	2.2	3.9	3.2	2.8	1.7	1.0	0.7	0.3	0.6	0.3

Sources: Planning Commission, Annual Report (various years).

Table D-2: Peak deficits (%)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Andhra Pradesh	13.1	15.8	17.4	18.9	20.5	22.0	23.6	11.3	9.3	11.7	14.6	19.9	19.2	3.6	2.4	5.1	15.4	8.8	9.8	10.6	6.3	14.8	20.2	6.5	5.0	0.1
Assam	7.8	9.5	7.6	5.7	3.8	1.9	0.0	5.7	3.2	1.6	0.9	10.2	11.8	12.4	5.8	7.4	10.8	9.7	16.8	5.0	3.5	5.3	4.1	8.2	13.3	7.6
Bihar	36.1	43.7	44.6	45.6	46.5	47.5	48.4	41.2	15.4	16.0	14.1	8.6	4.6	13.4	0.0	15.1	16.9	34.0	27.6	32.9	22.5	14.4	22.3	6.2	4.0	6.7
Gujarat	15.1	18.3	17.8	17.2	16.7	16.1	15.6	6.4	16.3	21.1	11.5	16.3	15.1	26.6	25.4	22.2	30.2	26.7	24.3	8.6	7.8	1.8	0.3	0.0	0.8	0.3
Haryana	16.7	20.2	19.3	18.5	17.6	16.8	15.9	0.0	-8.3	0.0	3.3	3.3	2.5	1.6	10.3	9.3	13.2	2.7	13.1	7.4	9.3	4.2	9.5	0.0	0.0	0.0
Himachal Pradesh	18.1	21.9	17.5	13.1	8.8	4.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	5.0	0.0	4.8	3.9	-3.6	7.1	7.1	21.0	10.8	0.0	0.0
Jammu & Kashmir	25.9	31.3	28.5	25.6	22.8	19.9	17.1	3.7	18.2	17.0	16.8	17.4	15.2	8.0	11.4	23.4	14.4	26.2	34.9	33.8	33.7	25.0	25.0	20.1	20.0	15.2
Karnataka	23.5	28.5	28.5	28.5	28.5	28.5	28.5	27.5	15.5	15.5	13.2	17.1	10.0	6.4	5.3	6.6	7.1	15.4	5.0	13.2	7.3	18.9	13.5	7.2	4.5	6.8
Kerala	15.1	18.3	19.4	20.6	21.7	22.9	24.0	26.4	11.6	9.1	5.1	16.9	16.5	9.8	1.3	1.7	2.1	6.4	13.7	4.1	5.8	5.1	8.8	2.7	4.4	3.1
Madhya Pradesh	17.6	21.3	22.9	24.4	26.0	27.5	29.1	17.2	25.2	29.7	25.3	21.6	27.6	29.8	18.5	21.7	20.8	10.6	10.0	14.4	8.7	7.1	6.1	0.0	0.4	0.0
Maharashtra	7.2	8.7	8.7	8.7	8.7	8.7	8.7	9.4	18.7	19.3	15.5	12.6	19.8	18.2	16.8	23.1	27.4	26.4	23.7	24.4	18.1	22.1	6.5	8.6	1.7	1.8
Orissa	19.7	23.9	21.9	19.9	17.8	15.8	13.8	8.4	2.0	5.2	-2.2	7.3	6.5	8.0	0.0	1.7	3.2	7.5	2.6	2.1	2.1	1.8	6.9	0.1	0.7	0.0
Punjab	9.2	11.1	10.5	9.9	9.3	8.7	8.1	0.0	0.0	0.0	2.0	8.9	6.7	0.0	22.0	20.4	26.9	15.4	15.9	24.3	15.5	16.9	24.0	13.4	13.0	0.0
Rajasthan	4.8	5.8	5.8	5.7	5.7	5.6	5.6	0.9	4.2	0.0	2.5	1.2	1.7	0.0	7.8	13.2	14.6	12.7	3.2	0.0	3.7	7.1	4.8	0.1	0.0	0.0
Tamil Nadu	13.8	16.7	16.5	16.4	16.2	16.1	15.9	19.7	12.8	12.5	15.3	13.1	6.3	3.0	1.2	11.5	2.7	15.9	6.0	11.8	11.0	17.5	13.2	7.6	1.5	0.1
Uttar Pradesh	14.7	17.8	18.2	18.7	19.1	19.6	20.0	24.6	19.8	23.1	15.0	9.2	14.8	16.1	20.4	19.4	18.0	22.8	22.1	21.1	3.7	3.5	13.6	5.8	17.0	14.6
West Bengal	25.8	31.2	27.2	23.2	19.1	15.1	11.1	7.0	5.8	6.4	4.7	5.5	0.0	9.0	3.7	3.0	2.4	5.6	0.2	2.2	0.8	0.9	1.0	0.4	0.3	0.3

Sources: Planning Commission, Annual Report (various years).

Table D-3: Forced outage rates (%)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Andhra Pradesh	10.2	11.3	7.5	8.2	6.0	6.4	5.9	4.3	10.0	5.9	3.0	3.1	3.2	3.2	3.3	3.4	3.5	3.6	3.7	2.4	9.3	4.2	7.0	7.8	8.7	9.5
Assam	31.0	34.4	46.5	33.6	21.3	10.5	35.4	48.5	49.4	52.0	51.4	49.7	48.0	46.3	44.6	43.0	41.3	39.6	37.9	36.1	42.1	46.7	48.9	52.1	55.4	58.6
Bihar	24.8	27.6	41.9	31.1	21.9	28.4	36.0	48.3	40.8	40.6	42.5	44.2	46.0	47.7	49.5	51.2	52.9	54.7	56.4	47.8	42.4	48.8	41.7	38.9	36.1	33.2
Gujarat	9.6	10.6	7.2	7.6	6.6	7.9	7.4	7.8	10.4	12.9	12.4	11.8	11.1	10.5	9.9	9.2	8.6	7.9	7.3	9.2	15.2	12.0	15.9	17.9	19.9	21.9
Haryana	27.8	30.9	16.4	26.7	35.7	29.7	24.1	22.7	25.1	26.3	19.1	18.2	17.2	16.3	15.3	14.4	13.5	12.5	11.6	9.9	11.7	16.0	16.1	17.6	19.1	20.6
Himachal Pradesh	13.7	15.2	16.2	13.2	12.4	12.0	12.8	12.1	14.5	13.1	12.6	12.2	11.8	11.4	10.9	10.5	10.1	9.7	9.3	8.9	10.3	11.5	12.0	12.8	13.6	14.4
Jammu & Kashmir	13.7	15.2	16.2	13.2	12.4	12.0	12.8	12.1	14.5	13.1	12.6	12.2	11.8	11.4	10.9	10.5	10.1	9.7	9.3	8.9	10.3	11.5	12.0	12.8	13.6	14.4
Karnataka	7.9	8.8	26.6	8.9	6.7	7.0	2.9	5.3	5.5	2.8	5.7	6.9	8.2	9.4	10.6	11.9	13.1	14.3	15.5	11.0	11.3	10.6	8.5	7.0	5.5	4.1
Kerala	13.7	15.2	16.2	13.2	12.4	12.0	12.8	12.1	14.5	13.1	12.6	12.2	11.8	11.4	10.9	10.5	10.1	9.7	9.3	8.9	10.3	11.5	12.0	12.8	13.6	14.4
Madhya Pradesh	14.9	16.5	14.6	19.3	12.2	11.0	9.0	10.4	9.9	10.6	11.2	10.9	10.5	10.2	9.9	9.5	9.2	8.9	8.5	7.3	10.5	12.3	13.3	14.8	16.3	17.7
Maharashtra	12.3	13.7	14.1	10.0	7.8	10.2	10.0	9.4	10.9	9.2	8.9	8.8	8.7	8.5	8.4	8.3	8.2	8.0	7.9	7.0	15.5	13.9	17.7	20.4	23.1	25.7
Orissa	24.3	27.0	25.9	19.8	33.5	19.0	5.3	5.2	4.3	1.6	5.9	5.4	4.9	4.5	4.0	3.5	3.0	2.5	2.1	4.5	3.0	5.1	5.6	6.4	7.1	7.9
Punjab	6.4	7.1	8.2	13.1	10.2	7.1	12.8	4.7	12.2	9.5	10.7	10.2	9.6	9.1	8.5	8.0	7.4	6.9	6.3	4.0	10.1	7.0	8.9	9.7	10.5	11.3
Rajasthan	13.3	14.8	7.2	4.9	9.2	10.3	9.4	5.0	14.7	3.7	4.2	4.2	4.2	4.2	4.2	4.2	4.1	4.1	4.1	5.3	9.4	11.3	13.9	16.5	19.1	21.6
Tamil Nadu	10.2	11.3	7.5	8.2	6.0	6.4	5.9	4.3	16.6	10.9	4.5	4.7	4.9	5.2	5.4	5.6	5.8	6.1	6.3	8.4	11.0	12.8	15.1	17.3	19.6	21.8
Uttar Pradesh	24.9	27.7	27.6	22.7	15.9	26.1	29.7	23.2	32.1	25.6	24.7	23.0	21.4	19.7	18.1	16.4	14.8	13.1	11.5	10.2	11.6	11.3	11.3	11.4	11.5	11.6
West Bengal	12.5	13.9	40.4	24.2	17.9	16.7	14.8	22.0	30.4	31.6	33.1	32.0	30.8	29.7	28.6	27.5	26.3	25.2	24.1	21.5	21.7	19.9	18.8	17.5	16.3	15.1

Sources: Planning Commission, Annual Report (various years).

Table D-4: Network losses (%)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Andhra Pradesh	22.9	20.3	20.7	20.2	18.1	19.6	33.1	32.3	33.6	37.7	36.6	26.8	30.1	28.1	26.2	24.2	22.3	20.3	19.2	18.1	16.3	16.0	16.0	15.4	14.0	13.2
Assam	24.1	22.7	21.4	22.4	25.3	27.6	26.0	27.3	38.7	39.0	40.7	42.8	38.3	36.2	34.2	32.1	30.0	28.0	29.6	28.1	24.2	29.1	26.7	23.4	24.4	23.7
Bihar	16.5	18.3	17.2	15.1	15.3	12.6	18.2	11.0	16.5	15.5	17.9	51.7	38.0	38.2	38.4	38.6	38.8	39.1	38.0	38.3	43.6	44.1	42.0	38.0	41.9	42.3
Gujarat	23.4	23.6	22.2	20.8	20.9	21.0	21.4	24.4	25.3	25.3	28.1	26.9	28.5	27.6	26.6	25.7	24.7	23.8	22.8	17.1	18.2	18.3	18.4	17.9	15.9	15.0
Haryana	27.5	26.8	26.8	25.0	30.8	32.4	32.8	34.0	35.3	38.3	39.8	39.2	37.7	35.7	33.8	31.9	30.0	28.1	25.7	26.4	24.3	22.9	23.7	20.4	20.1	19.0
Himachal Pradesh	21.0	19.8	20.0	18.8	19.2	16.4	18.4	20.2	26.4	22.8	23.4	25.6	21.2	19.6	18.1	16.5	15.0	13.5	13.2	14.7	11.1	13.4	12.4	12.1	11.9	11.6
Jammu & Kashmir	43.0	50.1	48.1	46.4	50.1	49.0	50.0	51.3	48.0	45.0	45.4	48.9	45.6	48.8	52.1	55.4	58.6	61.9	61.3	63.0	62.0	61.4	46.7	46.4	46.5	43.7
Karnataka	20.2	19.9	19.6	19.5	19.4	19.2	18.9	19.1	30.6	37.3	34.9	33.8	24.6	24.7	24.9	25.0	25.1	25.3	23.3	21.4	21.7	20.0	19.1	18.3	16.9	15.8
Kerala	22.4	22.5	22.8	20.5	20.8	21.5	21.4	19.1	17.7	17.8	18.4	32.2	27.5	25.9	24.4	22.9	21.4	19.9	19.9	19.2	17.9	18.3	16.8	16.5	15.9	15.3
Madhya Pradesh	18.0	25.8	22.5	21.8	20.8	19.3	20.6	20.9	21.1	33.7	46.1	44.6	43.3	42.7	42.0	41.4	40.7	40.1	39.0	36.6	34.6	33.7	31.0	25.9	25.6	23.5
Maharashtra	18.3	18.6	18.5	17.8	17.5	18.2	17.7	18.0	17.8	29.2	33.8	37.3	34.0	33.0	32.1	31.1	30.1	29.1	26.5	25.2	21.1	18.8	17.6	18.8	14.5	12.6
Orissa	25.8	25.3	25.9	23.1	23.7	25.6	50.4	49.8	43.2	44.3	44.9	47.3	45.4	37.9	30.4	22.9	15.5	8.0	7.5	7.3	7.0	6.7	6.4	6.1	5.8	5.5
Punjab	19.3	21.8	15.3	15.8	15.0	16.5	17.4	13.6	18.0	18.3	7.9	27.7	24.4	23.8	23.3	22.7	22.1	21.5	18.5	19.7	18.2	17.1	16.8	16.4	15.3	14.5
Rajasthan	25.8	23.1	22.7	24.9	24.7	29.3	25.9	26.4	29.4	30.3	29.8	43.1	42.6	41.2	39.8	38.4	36.9	35.5	31.9	29.4	26.7	24.4	23.0	21.6	18.3	16.0
Tamil Nadu	18.0	18.4	17.3	17.0	17.1	16.1	17.2	17.1	16.8	17.0	15.7	16.1	17.3	17.4	17.6	17.7	17.9	18.0	18.0	18.0	20.8	16.9	20.0	19.6	19.8	20.1
Uttar Pradesh	27.1	26.1	24.7	24.4	21.9	22.8	25.1	26.5	30.3	40.4	36.9	37.6	34.2	33.8	33.5	33.2	32.9	32.6	28.6	31.1	31.0	31.6	28.8	27.0	27.8	27.3
West Bengal	17.7	19.7	17.5	16.0	19.5	20.0	20.6	20.4	22.9	26.3	29.4	31.7	25.9	25.6	25.3	25.0	24.7	24.3	23.3	23.8	25.0	25.3	21.1	22.0	22.1	21.8

Sources: Planning Commission, Annual Report (various years).

Table D-5: Electricity prices for industry (paise/kWh)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Andhra Pradesh	159.8	177.5	214.7	221.8	236.0	287.9	330.3	330.3	394.9	439.5	441.5	428.8	416.2	403.5	390.8	378.1	365.5	374.0	397.8	457.3	425.0	546.5	535.9	591.5	639.4	687.4
Assam	89.2	99.1	132.8	129.7	195.3	210.3	209.4	233.0	380.9	429.7	447.6	456.0	464.4	472.8	481.2	489.6	498.0	522.0	534.0	447.0	521.0	537.0	537.0	547.7	555.7	563.7
Bihar	157.1	174.6	205.0	220.5	247.4	246.8	275.9	275.9	334.3	362.3	362.3	376.2	390.2	404.2	418.1	432.1	446.1	435.5	430.5	504.5	674.5	583.6	671.1	639.7	638.0	636.3
Gujarat	169.2	188.0	220.2	220.0	235.0	284.7	336.8	396.5	391.1	439.6	476.7	473.6	470.4	467.3	464.2	461.1	458.0	537.7	527.5	514.8	566.2	591.6	607.9	630.3	651.1	672.0
Haryana	153.9	171.0	195.7	222.3	266.6	319.9	338.0	341.0	411.1	428.0	477.9	470.2	462.4	454.6	446.9	439.1	431.3	429.7	424.7	474.1	498.3	574.1	573.0	623.2	660.5	697.9
Himachal Pradesh	87.3	97.0	105.0	125.0	135.0	161.2	182.8	194.0	235.9	265.0	275.0	284.0	292.9	301.9	310.9	319.8	328.8	355.2	345.7	369.1	414.0	422.3	430.8	439.1	447.5	455.9
Jammu & Kashmir	41.9	46.6	39.6	40.3	41.0	40.0	47.3	59.0	135.0	135.0	135.0	148.2	161.3	174.5	187.7	200.8	214.0	245.7	256.5	283.8	317.0	340.9	340.9	356.9	368.8	380.8
Karnataka	166.9	185.4	221.6	231.0	262.2	227.2	302.9	325.0	410.0	409.9	480.7	478.5	476.2	474.0	471.7	469.5	467.2	469.3	492.6	524.5	556.3	585.4	610.2	637.9	664.8	691.8
Kerala	74.3	82.5	92.8	101.1	104.2	116.8	150.6	165.9	225.2	225.2	226.7	256.3	285.9	315.6	345.2	374.8	404.5	474.7	413.2	427.5	418.6	537.1	567.9	657.1	731.7	806.4
Madhya Pradesh	165.5	183.9	211.0	238.0	268.3	357.0	401.8	385.1	435.8	437.8	437.8	437.7	437.6	437.5	437.4	437.2	437.1	448.8	444.5	488.9	525.6	563.5	580.6	611.5	639.0	666.5
Maharashtra	190.0	211.1	232.9	270.5	271.8	330.8	345.3	351.2	353.7	419.9	208.8	247.9	287.0	326.1	365.2	404.3	443.4	446.0	482.0	602.4	630.5	716.4	771.8	847.6	918.2	988.9
Orissa	80.2	89.1	111.3	170.8	193.6	237.5	256.2	277.5	319.1	323.0	0.0	52.2	104.4	156.5	208.7	260.9	313.1	331.4	342.3	411.8	527.4	612.4	642.3	708.9	766.4	823.8
Punjab	113.2	125.8	153.5	165.1	187.1	219.2	241.2	243.2	279.2	300.3	306.5	316.1	325.7	335.3	344.9	354.5	364.1	386.4	425.1	434.0	486.2	580.6	586.7	651.7	701.9	752.2
Rajasthan	141.2	156.9	178.0	204.1	234.6	280.2	304.7	311.8	379.4	392.9	395.1	409.5	423.8	438.2	452.5	466.9	481.2	487.0	493.4	415.4	458.1	474.2	582.3	629.0	691.1	753.2
Tamil Nadu	150.5	167.2	202.4	245.1	270.5	281.5	321.4	365.9	342.1	379.6	395.4	405.3	415.2	425.2	435.1	445.1	455.0	457.9	473.5	486.2	478.2	702.9	735.4	896.0	1024.5	1153.1
Uttar Pradesh	189.8	210.9	225.2	240.8	272.1	276.0	335.5	341.6	412.9	464.4	482.0	473.8	465.5	457.3	449.1	440.9	432.6	431.8	485.2	496.3	509.9	653.7	736.4	859.7	972.9	1086.1
West Bengal	113.3	125.9	149.5	183.0	209.3	202.1	246.7	283.7	321.3	320.0	352.8	362.8	372.8	382.7	392.7	402.6	412.6	416.7	460.3	557.5	589.6	641.5	650.5	688.0	718.4	748.9

Sources: Planning Commission, Annual Report (various years).

Table D-6: Electricity prices for agriculture (paise/kWh)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Andhra Pradesh	7.7	8.6	6.4	5.3	2.8	12.0	17.4	16.1	15.4	15.0	14.0	13.0	12.1	11.1	10.1	9.1	8.2	8.6	9.2	10.7	12.0	18.7	44.3	57.2	62.8	68.3
Assam	161.1	179.0	93.3	88.0	158.9	271.6	166.8	156.6	227.6	272.4	287.2	313.4	339.7	365.9	392.2	418.5	444.7	490.2	374.3	389.8	430.8	446.7	446.7	457.4	465.3	473.3
Bihar	9.5	10.5	14.8	15.2	16.2	14.0	14.0	14.0	13.4	13.4	13.4	21.8	30.3	38.7	47.1	55.6	64.0	64.0	64.0	223.6	169.1	357.0	410.6	553.6	674.4	795.1
Gujarat	9.9	11.0	19.0	22.0	19.0	20.0	18.0	17.0	15.0	39.0	63.6	72.9	82.2	91.6	100.9	110.2	119.5	197.5	176.9	167.0	207.2	214.9	217.6	223.6	228.7	233.9
Haryana	23.0	25.5	29.0	45.5	51.9	52.4	55.0	55.0	35.5	37.0	47.7	46.0	44.4	42.7	41.1	39.4	37.7	40.2	35.8	41.5	43.6	48.0	46.5	48.9	50.3	51.8
Himachal Pradesh	29.7	33.0	33.0	50.0	50.0	50.0	50.0	60.0	50.0	50.0	50.0	66.3	82.5	98.8	115.1	131.4	147.6	256.6	554.1	513.1	0.0	0.0	0.0	0.0	0.0	0.0
Jammu & Kashmir	10.6	11.8	9.1	9.3	10.3	10.0	12.5	15.8	220.0	220.0	220.0	221.0	222.0	223.0	224.0	225.0	226.0	151.4	129.0	142.0	160.0	168.5	168.5	174.2	178.4	182.6
Karnataka	3.8	4.2	2.8	1.8	1.7	62.6	87.1	86.0	31.5	30.5	38.8	44.5	50.2	55.8	61.5	67.2	72.9	82.3	145.3	304.7	107.5	152.6	172.9	209.8	242.5	275.2
Kerala	22.6	25.1	29.4	23.9	23.7	27.0	50.0	55.1	67.2	67.2	67.2	73.6	80.0	86.3	92.7	99.1	105.4	135.3	109.9	115.1	107.5	152.6	172.9	209.8	242.5	275.2
Madhya Pradesh	22.1	24.5	19.7	3.7	4.2	8.0	10.0	9.1	7.2	7.2	7.2	24.5	41.8	59.1	76.4	93.7	111.0	206.0	261.2	299.0	317.7	340.5	350.7	369.3	385.8	402.3
Maharashtra	13.7	15.2	22.7	18.2	16.5	22.7	25.5	25.4	45.7	82.3	82.3	97.4	112.5	127.6	142.8	157.9	173.0	194.1	201.9	205.9	214.7	239.8	258.3	281.2	303.0	324.8
Orissa	27.8	30.9	21.2	53.1	54.2	54.6	65.8	72.0	102.0	107.7	0.0	19.1	38.2	57.3	76.3	95.4	114.5	131.0	185.4	112.4	110.4	61.1	67.6	75.1	82.4	89.7
Punjab	9.7	10.8	19.5	34.5	38.5	28.6	0.0	0.0	0.0	0.0	0.0	0.3	0.6	0.9	1.2	1.5	1.8	0.0	0.0	51.3	0.2	0.4	0.0	0.0	0.0	0.0
Rajasthan	27.9	31.0	30.8	30.1	27.2	26.7	38.0	38.0	33.6	46.3	46.3	61.9	77.6	93.2	108.8	124.4	140.0	133.7	123.1	127.1	129.4	147.1	180.6	203.5	229.1	254.7
Tamil Nadu	0.0	0.0	0.0	0.0	0.0	1.5	1.6	1.2	1.2	1.3	1.3	1.1	0.9	0.7	0.5	0.3	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0
Uttar Pradesh	28.4	31.6	31.9	43.1	49.5	42.5	44.7	46.6	64.3	107.8	119.0	126.3	133.7	141.0	148.3	155.6	163.0	153.1	159.6	195.9	191.9	236.8	224.2	249.9	266.1	282.2
West Bengal	17.3	19.2	25.3	19.9	21.8	21.4	29.7	34.1	36.0	57.9	91.9	96.7	101.5	106.3	111.1	115.9	120.7	168.8	138.9	145.6	263.6	413.6	415.2	515.8	591.6	667.4

Sources: Planning Commission, Annual Report (various years).

Table D-7: Costs of electricity supply (paise/kWh)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Andhra Pradesh	78.7	89.2	100.1	109.0	128.9	156.1	213.8	239.7	287.6	313.8	343.4	360.7	356.6	352.6	348.5	344.5	340.4	336.3	423.4	401.2	387.0	332.1	385.6	425.6	474.6	521.4
Assam	249.6	281.2	255.2	252.7	299.3	356.1	337.3	457.2	450.6	432.9	556.8	589.1	575.6	562.0	548.5	534.9	521.4	507.9	549.4	596.2	616.3	375.9	374.3	363.8	359.3	353.2
Bihar	169.0	176.5	185.7	200.1	232.8	252.4	290.6	316.0	346.2	365.1	391.8	377.1	425.3	473.5	521.7	569.9	618.2	666.4	691.9	720.5	721.9	373.8	341.9	388.1	382.3	389.5
Gujarat	110.1	132.3	146.6	158.4	171.6	181.5	207.4	247.6	277.2	313.1	354.5	365.4	369.8	374.2	378.6	382.9	387.3	391.7	464.3	441.2	425.5	338.2	360.2	371.7	390.2	407.0
Haryana	103.7	115.5	134.4	165.4	179.5	208.7	240.6	293.4	299.2	349.5	403.7	411.9	420.4	428.9	437.5	446.0	454.5	463.0	543.1	578.5	533.6	394.5	397.6	399.5	402.2	404.8
Himachal Pradesh	94.8	118.2	114.3	142.8	126.6	111.5	143.0	166.0	192.9	254.4	238.4	235.4	259.8	284.2	308.6	333.0	357.4	381.9	421.6	451.0	472.8	270.0	302.7	309.5	333.6	353.4
Jammu & Kashmir	125.6	172.3	165.5	209.1	230.8	242.5	286.2	293.0	325.3	379.8	432.3	412.3	451.8	491.3	530.8	570.3	609.8	649.3	677.7	644.4	719.1	271.1	319.6	384.0	437.8	494.3
Karnataka	82.6	92.0	96.8	112.1	121.1	152.3	187.3	179.4	242.6	279.6	324.6	374.6	374.9	375.2	375.4	375.7	376.0	376.3	417.5	408.8	462.8	309.5	333.5	341.6	360.3	376.3
Kerala	68.2	81.3	87.3	98.3	108.8	134.5	161.3	196.0	179.2	240.4	303.0	347.3	351.7	356.2	360.6	365.1	369.5	374.0	456.7	477.2	451.5	238.1	383.5	320.9	396.9	438.3
Madhya Pradesh	116.4	121.5	141.4	157.8	167.2	181.6	216.2	231.5	251.1	314.4	314.4	324.9	345.4	365.9	386.4	406.9	427.4	447.9	492.5	557.7	561.3	275.6	290.9	288.2	297.6	303.9
Maharashtra	107.4	124.5	139.0	152.2	162.0	185.3	206.9	215.6	223.3	298.8	318.7	357.5	366.3	375.1	384.0	392.8	401.6	410.4	450.0	466.2	462.0	356.0	377.2	388.0	405.8	421.8
Orissa	71.4	71.8	98.8	133.5	185.7	227.5	322.6	351.7	374.1	162.0	177.2	184.9	207.7	230.4	253.2	275.9	298.7	321.4	366.2	329.9	292.0	254.1	216.1	222.3	232.5	241.6
Punjab	106.8	98.8	122.0	145.2	165.1	179.7	187.3	217.2	236.2	260.1	274.5	285.2	305.3	325.5	345.6	365.8	385.9	406.0	405.4	414.5	499.8	230.7	276.3	303.4	342.9	379.2
Rajasthan	114.6	113.3	138.2	163.8	196.5	213.2	234.5	258.6	284.3	336.1	341.3	368.2	392.1	415.9	439.8	463.6	487.5	511.3	637.7	679.8	629.8	335.9	375.8	380.1	408.1	430.2
Tamil Nadu	114.3	103.3	124.5	144.7	152.0	170.9	185.0	208.1	230.6	255.2	270.8	309.8	324.5	339.2	353.8	368.5	383.2	397.9	478.9	493.8	511.7	377.0	429.1	387.8	408.8	414.2
Uttar Pradesh	110.0	119.5	153.4	169.4	177.5	192.0	222.3	253.3	253.3	359.0	361.1	383.6	387.9	392.3	396.6	401.0	405.3	409.7	438.8	506.5	501.3	369.9	389.6	409.2	428.8	448.5
West Bengal	157.2	163.7	161.9	170.1	185.2	189.4	205.4	252.5	300.4	332.7	344.3	376.8	372.8	368.8	364.9	360.9	356.9	352.9	490.8	443.5	471.6	377.7	382.9	382.3	385.6	387.9

Sources: Planning Commission, Annual Report (various years).

Table D-8: Electricity generation (GWh)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Andhra Pradesh	18,249	18,655	18,371	19,959	21,141	22,499	25,499	29,182	57,384	61,141	61,968	62,671	62,959	63,121	68,238	68,200	70,108	75,452	77,024	89,005	92,025	97,180	103,785	110,312	117,030	123,640
Assam	1,206	1,080	1,068	940	1,255	1,423	1,332	1,033	1,066	1,027	1,000	986	817	942	931	1,709	1,677	2,016	2,950	3,376	3,560	3,788	4,376	4,590	4,908	5,306
Bihar	2,964	2,599	2,967	2,987	2,700	2,301	2,742	3,570	4,225	3,623	3,613	2,088	1,894	1,739	1,512	1,329	1,141	1,797	4,011	5,797	3,441	3,160	4,305	3,528	2,928	3,252
Gujarat	19,875	20,801	23,045	24,121	24,934	25,993	27,075	30,247	34,357	36,401	36,506	34,336	39,167	41,555	45,476	70,354	70,394	80,607	91,238	104,884	122,054	135,910	152,065	167,034	182,979	198,027
Haryana	6,938	7,765	7,973	6,677	7,418	7,262	7,627	7,332	7,676	8,021	15,604	17,165	18,839	20,266	19,600	23,259	23,643	24,905	29,571	33,462	31,490	33,431	36,283	36,866	37,781	39,979
Himachal Pradesh	1,262	1,050	1,087	977	1,132	1,285	1,252	1,306	1,484	1,201	1,216	1,418	1,578	2,715	2,743	2,825	2,908	3,073	3,744	4,019	4,820	6,720	7,647	8,542	9,548	10,804
Jammu & Kashmir	875	878	801	790	879	798	796	951	713	608	646	683	1,102	1,678	1,507	1,644	1,847	2,411	2,735	3,530	4,721	5,068	5,883	6,738	7,461	8,120
Karnataka	12,430	12,907	12,758	14,344	16,830	15,503	12,927	17,109	17,203	21,141	25,262	29,107	29,783	34,326	37,404	41,229	45,001	55,179	56,339	59,998	64,148	63,309	67,936	70,298	72,607	75,090
Kerala	5,491	5,326	6,193	5,822	6,571	6,620	5,471	5,183	7,602	7,650	8,057	8,499	8,696	9,790	9,043	9,343	9,643	8,152	9,776	7,282	7,231	7,186	6,988	6,467	6,633	6,222
Madhya Pradesh	12,937	12,525	13,260	14,383	16,597	17,599	18,416	19,449	20,562	21,836	21,782	21,722	21,666	21,574	21,583	38,013	37,975	40,339	45,889	51,132	54,405	59,280	64,117	68,346	72,676	77,419
Maharashtra	36,439	39,200	38,607	41,417	46,561	50,699	53,561	54,187	56,639	62,557	61,844	61,526	63,321	64,690	66,114	118,380	120,161	135,374	153,883	167,606	184,913	224,335	241,824	264,296	288,020	311,318
Orissa	5,792	8,760	9,012	5,373	5,765	9,808	10,592	9,862	11,057	13,291	13,853	15,993	13,286	17,200	19,871	19,397	23,093	25,435	27,407	27,123	26,528	29,252	29,176	29,597	30,614	31,588
Punjab	14,618	14,677	15,718	16,322	17,175	16,899	18,455	17,900	20,880	22,563	23,183	23,804	24,428	25,046	25,670	26,345	27,020	24,273	26,294	27,799	23,702	22,820	23,350	21,533	19,985	19,657
Rajasthan	6,717	8,130	8,592	8,529	8,773	9,929	10,386	10,853	11,964	12,639	13,781	29,085	33,221	35,801	39,310	42,635	45,623	49,437	54,279	57,200	57,445	63,803	66,748	69,357	72,586	76,431
Tamil Nadu	13,202	13,833	16,958	17,627	19,917	21,975	22,954	23,827	23,279	26,155	26,675	29,233	31,375	32,374	32,557	36,595	39,958	45,033	44,406	46,679	47,178	46,765	48,506	49,193	49,545	50,392
Uttar Pradesh	19,688	18,692	18,167	19,847	21,675	22,827	23,637	23,790	24,938	23,598	23,516	46,067	25,729	46,106	44,263	44,120	53,469	58,879	64,203	71,422	79,605	86,738	94,341	101,939	108,957	116,345
West Bengal	9,001	6,075	6,427	13,585	14,296	7,148	7,643	14,755	15,883	16,650	19,836	25,800	29,610	32,547	35,294	37,236	40,065	45,171	47,623	50,200	55,605	56,649	60,524	63,795	66,902	69,688

Sources: Planning Commission, Annual Report (various years), Central Electricity Authority, General Review (various years).

Table D-9: State generation (GWh)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Andhra Pradesh	17,397	17,563	17,217	18,750	20,045	21,235	24,074	25,853	26,579	27,304	28,030	28,756	29,481	30,207	30,933	31,658	32,384	33,110	33,079	33,033	32,389	37,451	36,210	37,636	39,252	40,761
Assam	1,206	1,080	1,068	940	1,255	1,423	1,332	1,033	926	867	850	834	817	801	784	768	751	868	1,549	1,755	1,709	1,703	2,066	2,051	2,141	2,298
Bihar	2,964	2,599	2,967	2,975	2,683	2,277	2,008	2,039	2,708	2,423	2,230	2,036	1,843	1,649	1,456	1,262	1,069	1,045	3,229	4,986	2,647	2,204	3,343	2,516	1,866	2,141
Gujarat	17,432	18,120	20,304	21,233	21,987	23,053	22,899	23,811	23,144	23,178	23,754	24,329	24,905	25,481	26,057	26,633	27,208	29,569	32,741	30,912	33,454	33,524	34,627	34,967	36,281	36,700
Haryana	6,938	7,765	7,973	6,677	7,418	7,262	7,627	7,332	7,676	8,021	8,366	8,711	9,056	9,401	9,746	10,091	10,436	10,781	14,540	17,505	14,559	15,561	17,463	17,096	17,062	18,310
Himachal Pradesh	1,262	1,050	1,087	977	1,132	1,285	1,252	1,306	1,484	1,201	1,216	1,231	1,246	1,261	1,276	1,291	1,306	1,456	2,092	2,413	1,526	1,739	1,845	1,573	1,410	1,499
Jammu & Kashmir	875	878	801	790	879	798	796	951	713	608	646	683	721	758	796	834	871	1,327	1,543	2,230	3,312	3,552	4,259	5,006	5,621	6,171
Karnataka	709	707	804	919	1,150	1,160	932	1,099	1,089	1,096	3,654	6,213	8,771	11,330	13,888	16,447	19,005	26,683	26,642	26,419	26,019	22,721	23,132	21,771	20,358	19,119
Kerala	5,491	5,326	6,193	5,822	6,571	6,620	5,471	5,155	7,558	7,614	7,873	8,132	8,390	8,649	8,908	9,167	9,426	7,744	8,833	6,633	7,008	7,137	6,559	6,021	6,170	5,741
Madhya Pradesh	12,937	12,525	13,260	14,383	16,597	17,599	18,410	19,441	20,552	21,812	21,753	21,693	21,634	21,574	21,515	21,455	21,396	18,846	19,260	19,465	17,740	17,396	17,215	16,368	15,621	15,288
Maharashtra	28,764	31,373	31,062	34,113	38,212	39,470	41,056	41,607	44,363	45,287	46,275	47,264	48,253	49,242	50,230	51,219	52,208	51,495	54,523	51,321	50,624	47,504	47,529	44,959	43,642	41,899
Orissa	3,839	4,252	3,739	3,580	3,574	2,670	3,346	4,022	4,699	5,375	6,052	6,728	7,404	8,081	8,757	9,433	10,110	10,786	11,092	9,142	6,881	7,939	6,197	4,952	4,303	3,611
Punjab	14,618	14,677	15,718	16,322	17,175	16,899	18,455	17,900	20,880	22,563	23,183	23,804	24,425	25,046	25,666	26,287	26,908	24,107	26,149	27,566	23,458	22,516	22,997	21,131	19,534	19,157
Rajasthan	6,717	8,130	8,592	8,529	8,773	9,929	10,386	10,853	11,964	12,638	13,775	14,912	16,050	17,187	18,324	19,461	20,599	22,225	24,885	25,324	22,673	23,832	24,088	23,235	23,002	23,384
Tamil Nadu	13,202	13,833	16,958	17,627	19,917	21,975	22,954	23,066	22,142	23,550	24,194	24,838	25,483	26,127	26,771	27,416	28,060	29,510	28,576	29,121	27,720	25,479	25,406	24,265	22,790	21,810
Uttar Pradesh	19,484	18,133	18,167	19,847	21,675	22,827	23,637	23,790	24,938	23,598	23,516	23,434	23,352	23,270	23,188	23,106	23,024	22,969	22,054	23,596	23,824	22,257	23,044	23,147	22,670	22,562
West Bengal	2,858	2,853	2,870	3,703	3,750	3,208	3,761	3,850	3,635	3,948	5,345	6,743	8,141	9,539	10,937	12,335	13,733	17,829	19,470	21,276	25,047	25,139	27,811	29,913	31,849	33,465

Sources: Planning Commission, Annual Report (various years), Central Electricity Authority, General Review (various years).

Table D-10: Private generation (GWh)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Andhra Pradesh								2,043	2,909	3,317	4,009	5,093	6,261	6,285	6,437	5,794	5,151	8,286	8,406	18,949	21,131	19,741	26,103	29,722	33,340	36,959
Assam									140	160	150	152		141	147	131	115	94	104	80	67	58	40	25	10	8
Bihar															5	10	14	19	24	29	29	47	49	56	63	69
Gujarat	2,443	2,668	2,724	2,869	2,927	2,930	4,168	6,431	11,205	13,221	12,752	6,587	9,038	11,774	15,025	14,905	14,784	15,551	15,922	24,310	31,851	38,550	46,515	54,057	61,600	69,143
Haryana															7	14	22	29	26	42	107	137	178	218	258	297
Himachal Pradesh												187	332	1,454	1,467	1,534	1,602	1,617	1,652	1,605	3,293	4,981	5,802	6,970	8,137	9,305
Jammu & Kashmir																										
Karnataka				64	89	54	67	81	124	505	2,114	4,071	2,870	3,818	3,693	4,066	4,439	6,101	6,466	9,512	13,225	14,846	18,225	21,111	23,996	26,882
Kerala								28	44	36	184	368	306	1,141	135	176	217	408	943	649	223	49	428	446	463	481
Madhya Pradesh							6	7	11	23	29	28	33	-	69	89	110	83	279	376	434	712	790	926	1,062	1,197
Maharashtra	7,676	7,827	7,545	7,304	8,350	11,229	12,505	12,575	12,269	16,911	15,569	14,262	15,069	15,448	15,884	16,676	17,468	18,248	18,584	20,363	23,221	50,617	52,936	62,832	72,728	82,623
Orissa															806	1,613	2,419	3,225	4,032	4,838	5,645	6,451	7,257	8,064	8,870	9,676
Punjab													3		4	58	112	166	145	233	244	304	353	402	451	500
Rajasthan												11	25	15	318	407	497	791	1,081	1,669	2,673	5,978	6,774	8,343	9,913	11,482
Tamil Nadu								761	1,138	2,606	2,481	4,395	5,893	6,247	5,786	8,505	11,224	14,646	14,751	16,277	17,974	19,601	21,213	22,838	24,463	26,088
Uttar Pradesh															164	328	492	656	1,594	1,971	4,626	8,026	9,541	11,736	13,931	16,126
West Bengal	2,828	3,222	3,557	3,617	3,831	3,940	3,882	4,228	4,965	5,618	6,389	5,429	6,574	6,937	7,277	7,616	7,954	8,146	8,139	8,092	8,907	9,041	9,425	9,777	10,129	10,482

Sources: Planning Commission, Annual Report (various years), Central Electricity Authority, General Review (various years).

Table D-11: Introduction periods of various components for reforms

	Structure[1]	Regulation[1]
Andhra Pradesh	2000	1999
Assam	2004	2002
Bihar	-	2005
Gujarat	2005	2003
Haryana	1998	1998
Himachal Pradesh	2010	2002
Jammu & Kashmir	-	2013
Karnataka	1999	1999
Kerala	-	2003
Madhya Pradesh	2005	2001
Maharashtra	2005	1999
Orissa	1996	1997
Punjab	2010	1999
Rajasthan	2000	2000
Tamil Nadu	2010	1999
Uttar Pradesh	2000	1999
West Bengal	2007	1999

Note 1: Year when the reform component was implemented

Sources: various

Table D-12: Rural population (% of total population)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Andhra Pradesh	73.4	73.1	73.0	73.0	73.0	72.9	72.9	72.8	72.8	72.8	72.7	72.7	72.0	71.4	70.7	70.1	69.5	68.9	68.3	67.8	67.2	66.6	66.1	65.6	65.0	64.5
Assam	89.7	88.9	88.4	88.0	87.6	87.2	86.8	86.4	86.0	85.7	85.3	85.0	85.1	85.2	85.3	85.4	85.5	85.6	85.7	85.7	85.8	85.9	86.0	86.1	86.1	86.2
Bihar	86.5	86.2	86.6	87.0	87.4	87.7	88.1	88.4	88.7	89.0	89.3	89.5	89.4	89.3	89.2	89.2	89.1	89.0	88.9	88.8	88.8	88.7	88.6	88.6	88.5	88.5
Gujarat	65.8	65.5	65.1	64.7	64.3	64.0	63.6	63.3	63.0	62.7	62.4	62.1	61.6	61.0	60.5	60.0	59.5	59.1	58.6	58.2	57.8	57.4	57.0	56.6	56.3	55.9
Haryana	75.6	75.4	74.8	74.2	73.6	73.1	72.6	72.1	71.7	71.2	70.8	70.4	69.8	69.2	68.6	68.1	67.5	67.0	66.5	66.0	65.6	65.1	64.7	64.3	63.9	63.5
Himachal Pradesh	91.5	91.3	91.0	90.7	90.4	90.2	89.9	89.7	89.4	89.2	88.9	88.7	88.9	89.0	89.1	89.3	89.4	89.5	89.6	89.7	89.9	90.0	90.1	90.2	90.3	90.4
Jammu & Kashmir	75.3	75.0	74.7	74.4	74.1	73.8	73.5	73.3	73.0	72.8	72.6	72.4	72.4	72.4	72.5	72.5	72.5	72.5	72.6	72.6	72.6	72.6	72.6	72.7	72.7	72.7
Karnataka	69.2	69.1	68.7	68.3	67.9	67.6	67.2	66.9	66.6	66.3	65.9	65.7	65.2	64.7	64.2	63.8	63.3	62.9	62.5	62.1	61.7	61.3	61.0	60.6	60.3	59.9
Kerala	74.3	73.6	73.1	72.6	72.2	71.7	71.2	70.8	70.4	69.9	69.5	69.1	67.3	65.6	63.9	62.2	60.5	58.8	57.2	55.5	53.9	52.3	50.7	49.1	47.6	46.0
Madhya Pradesh	77.2	76.8	76.3	75.8	75.2	74.6	74.1	73.5	72.9	72.3	71.7	71.1	71.2	71.4	71.5	71.6	71.8	71.9	72.0	72.1	72.3	72.4	72.5	72.6	72.7	72.8
Maharashtra	61.6	61.3	60.8	60.3	59.8	59.3	58.9	58.5	58.1	57.7	57.3	56.9	56.7	56.4	56.2	56.0	55.8	55.6	55.4	55.2	55.0	54.8	54.6	54.4	54.2	54.1
Orissa	86.8	86.6	86.3	86.0	85.7	85.4	85.1	84.8	84.6	84.3	84.1	83.8	83.7	83.7	83.6	83.6	83.5	83.5	83.4	83.4	83.4	83.3	83.3	83.2	83.2	83.2
Punjab	70.6	70.5	69.9	69.3	68.8	68.3	67.8	67.4	66.9	66.5	66.1	65.6	65.3	65.0	64.6	64.3	64.0	63.7	63.4	63.1	62.8	62.5	62.2	62.0	61.7	61.5
Rajasthan	77.3	77.1	76.7	76.3	76.0	75.6	75.3	75.0	74.6	74.4	74.1	73.8	74.0	74.1	74.3	74.4	74.5	74.7	74.8	74.9	75.0	75.1	75.2	75.3	75.4	75.5
Tamil Nadu	66.0	65.8	64.7	63.6	62.6	61.5	60.5	59.5	58.5	57.6	56.6	55.7	55.3	54.8	54.4	53.9	53.5	53.1	52.7	52.3	52.0	51.6	51.3	50.9	50.6	50.3
Uttar Pradesh	84.6	84.4	83.5	82.6	81.7	80.9	80.1	79.3	78.6	77.9	77.3	76.6	76.8	76.9	77.0	77.1	77.2	77.3	77.4	77.5	77.6	77.7	77.8	77.9	78.0	78.1
West Bengal	72.6	72.5	72.4	72.3	72.2	72.1	72.0	71.9	71.8	71.7	71.7	71.6	71.2	70.8	70.5	70.1	69.7	69.4	69.1	68.7	68.4	68.1	67.8	67.5	67.2	67.0

Sources: Census data (various years).

Table D-13: Industry value added (% of gross state domestic product)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Andhra Pradesh	0.31	0.34	0.35	0.36	0.37	0.37	0.37	0.40	0.38	0.40	0.39	0.41	0.43	0.42	0.46	0.47	0.48	0.48	0.49	0.47	0.47	0.52	0.48	0.47	0.46	0.46
Assam	0.27	0.27	0.27	0.28	0.26	0.26	0.26	0.28	0.27	0.28	0.28	0.29	0.33	0.34	0.42	0.39	0.39	0.38	0.38	0.38	0.40	0.48	0.46	0.47	0.46	0.46
Bihar	0.17	0.17	0.17	0.18	0.17	0.19	0.17	0.21	0.17	0.25	0.23	0.24	0.23	0.23	0.29	0.31	0.30	0.33	0.33	0.34	0.36	0.40	0.37	0.37	0.35	0.32
Gujarat	0.68	0.61	0.57	0.55	0.52	0.56	0.52	0.51	0.51	0.57	0.56	0.53	0.56	0.54	0.64	0.63	0.62	0.62	0.63	0.65	0.60	0.59	0.63	0.60	0.61	0.61
Haryana	0.23	0.31	0.35	0.37	0.39	0.43	0.40	0.43	0.42	0.42	0.42	0.45	0.47	0.55	0.58	0.59	0.57	0.56	0.54	0.56	0.54	0.56	0.57	0.58	0.58	0.59
Himachal Pradesh	0.28	0.36	0.39	0.38	0.42	0.43	0.43	0.42	0.42	0.46	0.45	0.45	0.46	0.46	0.53	0.53	0.55	0.53	0.55	0.57	0.56	0.61	0.61	0.61	0.61	0.61
Jammu & Kashmir	0.28	0.28	0.28	0.30	0.26	0.29	0.27	0.27	0.30	0.33	0.34	0.35	0.34	0.34	0.43	0.44	0.45	0.45	0.44	0.44	0.42	0.48	0.46	0.46	0.47	0.46
Karnataka	0.28	0.35	0.37	0.39	0.40	0.40	0.40	0.42	0.42	0.42	0.43	0.47	0.50	0.53	0.60	0.59	0.63	0.62	0.63	0.62	0.60	0.67	0.67	0.66	0.66	0.66
Kerala	0.25	0.31	0.34	0.36	0.36	0.37	0.37	0.38	0.39	0.40	0.43	0.44	0.45	0.46	0.51	0.51	0.52	0.53	0.52	0.52	0.54	0.67	0.67	0.66	0.66	0.66
Madhya Pradesh	0.34	0.35	0.35	0.34	0.37	0.37	0.36	0.37	0.36	0.37	0.39	0.38	0.40	0.37	0.47	0.47	0.50	0.51	0.52	0.51	0.50	0.46	0.39	0.40	0.39	0.37
Maharashtra	0.60	0.59	0.58	0.58	0.58	0.59	0.54	0.57	0.58	0.55	0.55	0.55	0.55	0.57	0.66	0.68	0.68	0.68	0.69	0.68	0.67	0.67	0.67	0.66	0.68	0.67
Orissa	0.40	0.38	0.36	0.35	0.36	0.34	0.34	0.32	0.34	0.38	0.39	0.38	0.40	0.39	0.52	0.51	0.53	0.52	0.54	0.48	0.50	0.59	0.55	0.55	0.53	0.55
Punjab	0.21	0.26	0.28	0.30	0.31	0.33	0.32	0.33	0.34	0.33	0.33	0.33	0.34	0.34	0.46	0.47	0.49	0.50	0.48	0.49	0.49	0.43	0.43	0.42	0.42	0.42
Rajasthan	0.47	0.42	0.40	0.39	0.39	0.40	0.36	0.38	0.38	0.39	0.40	0.39	0.44	0.39	0.51	0.52	0.53	0.52	0.52	0.52	0.46	0.50	0.49	0.49	0.48	0.48
Tamil Nadu	0.59	0.55	0.53	0.50	0.51	0.53	0.52	0.50	0.49	0.50	0.50	0.49	0.53	0.54	0.63	0.62	0.62	0.62	0.61	0.61	0.61	0.64	0.65	0.62	0.61	0.60
Uttar Pradesh	0.32	0.33	0.34	0.33	0.34	0.35	0.34	0.35	0.34	0.36	0.36	0.36	0.37	0.37	0.47	0.48	0.50	0.50	0.47	0.48	0.48	0.50	0.50	0.50	0.51	0.51
West Bengal	0.52	0.45	0.42	0.41	0.40	0.41	0.39	0.39	0.39	0.37	0.39	0.39	0.40	0.42	0.47	0.46	0.47	0.47	0.46	0.44	0.43	0.44	0.42	0.41	0.41	0.40

Notes: Industry includes mining, manufacturing, infrastructure, construction and banking.

Sources: Reserve Bank of India, Handbook of Statistics on the Indian Economy (various years).

Table D-14: Centre-state relationship

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Central	JD	INC					BJP								INC										BJP	
Andhra Pradesh	INC				TDP					TDP					INC				INC						TDP	
Arunachal Pradesh	INC					INC				INC					INC					INC					INC	
Assam	AGP	INC					AGP				INC					INC						INC				
Bihar	JD					JD					RJD					JD					JD					JD
Dehli	BJP+JNP	BJP					BJP			BJP					INC					INC					BJP	
Goa	INC				INC						BJP						INC							BJP		
Gujarat	JD					BJP			BJP				BJP					BJP					BJP			
Haryana	JD	INC					BJP			BJP				INC					INC					BJP		
Himachal Pradesh	BJP			INC					BJP					INC				BJP						INC		
Jammu & Kashmir	JKN						JKN						INC+PDP						JKN						JKPDP	
Karnataka	INC				JD					INC					INC+JD+BJP				BJP					INC		
Kerala	CPM	INC					CPM					INC					CPM					INC				
Madhya Pradesh	BJP			INC					INC					BJP					BJP					BJP		
Maharashtra	INC					SHS				INC					INC					INC					BJP	
Manipur	INC						MPP				MSCP			INC					INC					INC		
Meghalaya	INC+HPU			INC					UDP					INC					INC					INC		
Mizoram	INC			INC					MNF					MNF					INC					INC		
Nagaland	INC			INC					INC					NPF					NPF					NPF		
Orissa	JD					INC					BJD				BJD					BJD					BJD	
Punjab	SAD		INC					SAD					INC					SAD						SAD		
Rajasthan	BJP				BJP					INC				BJP					INC					BJP		
Tamil Nadu	DMK	ADK					DMK					ADK					DMK					ADK				
Tripura	INC				CPM				CPM				CPM						CPM					CPM		
Uttar Pradesh	JD	BJP		BJP			BJP						SP					BSP						SP		
West Bengal	CPM	CPM					CPM					CPM					CPM					AITC				

Notes: AITC=All India Trinamool Congress; ADK=All India Anna Dravida Munnetra Kazhagam; AGP=Asom Gana Parishad; BAC=Bangla Congress; BJD=Biju Janata Dal; BJP=Bharatiya Janata Party; BSP=Bahujan Samaj Party; CPI=Communist Party of India; DMK=Dravida Munitra Kazhagam; HPU=Hill People Union; INC=Indian National Congress; JD=Janata Dal; JKN=Jammu&Kashmir National Conference; JKPDP=Jammu & Kashmir People's Democratic Party; JNP=Janata Party; MPP=Manipur People's Party; MSCP=Manipur State Congress Party; MNF=Mizo National Front; NPF=Nagaland People's Front; PDP=People's Democratic Party; RJD=Rashtriya Janata Dal; SAD=Shiromani Akali Dal; SHS=Shiv Sena; SP=Samajwadi Party; TDP=Telugu Desam; UDP=United Democratic Party

Sources: Election Commission of India

Appendix E: Results of the analysis for assessing the industry performance

This appendix presents the results of the analysis conducted in the research to assess the performance of electricity industry in India. It contains the following tables:

Table E-1: Correlation matrix of selected variables

Table E-2: Akaike information criterion (AIC)

Table E-3: Estimation results of Granger causality models

Table E-4: Impact of industry governance structure (GS) on industry performance (IP)

Table E-5: Impacts of wider influencing factors (WIF) on electricity institutions (EI)

Table E-6: Impacts of WIF on the relationship between EI and IP

Table E-1: Correlation matrix of selected variables

Correlations

		ED	PD	NL	FoR	PCI	PCA	S	P	R	RI	DBI	EP	CSR
ED	Pearson Correlation	1	.749**	.282**	.041	-.126**	-.082	-.165**	-.263**	-.224**	.022	-.189**	.013	.097*
	Sig. (2-tailed)		.000	.000	.392	.008	.085	.000	.000	.000	.644	.000	.789	.042
	N	442	442	442	442	442	442	442	442	442	442	442	442	442
PD	Pearson Correlation	.749**	1	.173**	.057	-.140**	-.252**	-.320**	-.215**	-.356**	.034	-.262**	.180**	.178**
	Sig. (2-tailed)	.000		.000	.228	.003	.000	.000	.000	.000	.476	.000	.000	.000
	N	442	442	442	442	442	442	442	442	442	442	442	442	442
NL	Pearson Correlation	.282**	.173**	1	.149**	-.501**	.105*	-.057	-.366**	-.040	.191**	-.285**	.042	-.090
	Sig. (2-tailed)	.000	.000		.002	.000	.027	.235	.000	.399	.000	.000	.379	.060
	N	442	442	442	442	442	442	442	442	442	442	442	442	442
FoR	Pearson Correlation	.041	.057	.149**	1	-.134**	.311**	-.147**	-.071	-.091	.465**	-.417**	.039	-.025
	Sig. (2-tailed)	.392	.228	.002		.005	.000	.002	.138	.055	.000	.000	.408	.604
	N	442	442	442	442	442	442	442	442	442	442	442	442	442
PCI	Pearson Correlation	-.126**	-.140**	-.501**	-.134**	1	.149**	.233**	.194**	.132**	-.270**	.326**	-.073	-.031
	Sig. (2-tailed)	.008	.003	.000	.005		.002	.000	.000	.005	.000	.000	.123	.522
	N	442	442	442	442	442	442	442	442	442	442	442	442	442
PCA	Pearson Correlation	-.082	-.252**	.105*	.311**	.149**	1	.228**	.036	.264**	.193**	.054	-.302**	-.056
	Sig. (2-tailed)	.085	.000	.027	.000	.002		.000	.445	.000	.000	.260	.000	.237
	N	442	442	442	442	442	442	442	442	442	442	442	442	442
S	Pearson Correlation	-.165**	-.320**	-.057	-.147**	.233**	.228**	1	.176**	.684**	-.106*	.424**	-.541**	-.064
	Sig. (2-tailed)	.000	.000	.235	.002	.000	.000		.000	.000	.026	.000	.000	.180
	N	442	442	442	442	442	442	442	442	442	442	442	442	442
P	Pearson Correlation	-.263**	-.215**	-.366**	-.071	.194**	.036	.176**	1	.300**	-.142**	.501**	-.256**	-.060
	Sig. (2-tailed)	.000	.000	.000	.138	.000	.445	.000		.000	.003	.000	.000	.208
	N	442	442	442	442	442	442	442	442	442	442	442	442	442
R	Pearson Correlation	-.224**	-.356**	-.040	-.091	.132**	.264**	.684**	.300**	1	-.226**	.510**	-.669**	-.101*
	Sig. (2-tailed)	.000	.000	.399	.055	.005	.000	.000	.000		.000	.000	.000	.034
	N	442	442	442	442	442	442	442	442	442	442	442	442	442
RI	Pearson Correlation	.022	.034	.191**	.465**	-.270**	.193**	-.106*	-.142**	-.226**	1	-.617**	.162**	.031
	Sig. (2-tailed)	.644	.476	.000	.000	.000	.000	.026	.003	.000		.000	.001	.510
	N	442	442	442	442	442	442	442	442	442	442	442	442	442
DBI	Pearson Correlation	-.189**	-.262**	-.285**	-.417**	.326**	.054	.424**	.501**	.510**	-.617**	1	-.509**	.072
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.260	.000	.000	.000	.000		.000	.129
	N	442	442	442	442	442	442	442	442	442	442	442	442	442
EP	Pearson Correlation	.013	.180**	.042	.039	-.073	-.302**	-.541**	-.256**	-.669**	.162**	-.509**	1	-.141**
	Sig. (2-tailed)	.789	.000	.379	.408	.123	.000	.000	.000	.000	.001	.000		.003
	N	442	442	442	442	442	442	442	442	442	442	442	442	442
CSR	Pearson Correlation	.097*	.178**	-.090	-.025	-.031	-.056	-.064	-.060	-.101*	.031	.072	-.141**	1
	Sig. (2-tailed)	.042	.000	.060	.604	.522	.237	.180	.208	.034	.510	.129	.003	
	N	442	442	442	442	442	442	442	442	442	442	442	442	442

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Table E-2: Akaike information criterion (AIC)

		no lag	1 lag	2 lags	3 lags	4 lags	5 lags
Electricity Governance Structure (GS) ↔ Industry Performance (IP)							
Structure (S)	ED	8.107	4.874	4.886	4.882	4.896	4.913
	PD	8.665	5.852	5.840	5.844	5.862	5.881
	FoR	9.324	4.787	4.780	4.776	4.778	4.796
	NL	9.087	5.112	5.124	5.142	5.154	5.172
	PCI	2.810	-0.375	-0.380	-0.377	-0.355	-0.370
	PCA	2.093	-1.563	-1.552	-1.533	1.518	-1.507
Privatisation (P)	ED	5.733	1.863	1.869	1.834	1.855	1.841
	PD	6.369	2.854	2.840	2.798	2.810	2.801
	FoR	7.022	1.781	1.800	1.762	1.763	1.757
	NL	6.581	2.146	2.167	2.129	2.130	2.124
	PCI	0.518	-3.348	-3.346	-3.398	-3.379	-3.399
	PCA	-0.195	-4.569	-4.562	-4.594	-4.582	-4.612
Regulation (R)	ED	7.870	4.982	4.992	5.013	5.028	5.049
	PD	8.461	5.962	5.956	5.965	5.985	6.002
	FoR	9.137	4.895	4.914	4.926	4.946	4.956
	NL	8.874	5.193	5.201	5.206	5.221	5.210
	PCI	2.658	-0.240	-0.259	-0.253	-0.270	-0.267
	PCA	1.881	-1.436	-1.415	-1.397	-1.391	-1.379
National Governance Paradigm (NGP) ↔ Electricity Governance Structure (GS)							
RI	S	-0.123	-9.146	-11.172	-11.155	-11.136	-11.119
	P	-2.447	-12.091	-14.175	-14.222	-14.198	-14.203
	R	-0.356	-8.972	-11.076	-11.080	-11.059	-11.040
DBI	S	-0.280	-4.756	-4.784	-4.780	-4.759	-4.754
	P	-2.704	-7.763	-7.776	-7.818	-7.805	-7.819
	R	-0.574	-4.654	-4.660	-4.650	-4.629	-4.613
EP	S	2.428	-0.042	-0.324	-0.328	-0.379	-0.498
	P	0.303	-2.998	-3.299	-3.387	-3.440	-3.562
	R	2.020	-0.019	-0.278	-0.295	-0.342	-0.449
CSR	S	2.750	0.270	0.289	0.309	0.320	0.337
	P	0.442	-2.739	-2.724	-2.758	-2.747	-2.754
	R	2.562	0.387	0.403	0.408	0.409	0.425

Table E-3: Estimation results of Granger causality models

		1 lag	2 lags	3 lags	4 lags	5 lags
Electricity Governance Structure (GS) ↔ Industry Performance (IP)						
Structure (S)	ED	0.0050 0.9825	0.0173 0.8866	0.0007 0.9397	0.0026 0.8699	0.0035 0.7960
	PD	0.0385 0.6780	0.0190 0.4490	0.0083 0.7613	0.0138 0.8169	0.0389 0.9266
	FoR	0.2301 0.0712	0.1619 0.0253	0.1380 0.0819	0.2982 0.0698	0.3763 0.0151
	NL	0.0000 0.2906	0.0000 0.2724	0.0000 0.4291	0.0000 0.6895	0.0002 0.7529
	PCI	0.0000 0.9506	0.0000 0.7122	0.0000 0.8907	0.0000 0.7856	0.0000 0.5862
	PCA	0.0704 0.2985	0.1301 0.4915	0.3745 0.7015	0.2785 0.7926	0.2253 0.8819
Privatisation (P)	ED	0.0038 0.8411	0.0021 0.7066	0.0061 0.8692	0.0278 0.7613	0.0364 0.6222
	PD	0.2521 0.4837	0.0985 0.1506	0.1484 0.1599	0.2844 0.3799	0.3630 0.4979
	FoR	0.0156 0.1535	0.0080 0.0525	0.0286 0.0693	0.0539 0.1168	0.1054 0.1376
	NL	0.0024 0.1105	0.0085 0.2524	0.0090 0.3645	0.0144 0.3896	0.0162 0.4236
	PCI	0.0064 0.3415	0.0130 0.4873	0.0396 0.5136	0.0869 0.3361	0.1476 0.1875
	PCA	0.2733 0.4996	0.5291 0.6475	0.7886 0.8242	0.8867 0.7924	0.9169 0.7341
Regulation (R)	ED	0.0514 0.3111	0.0904 0.5541	0.2755 0.6542	0.4262 0.6988	0.5920 0.7427
	PD	0.2365 0.0206	0.2365 0.0206	0.2342 0.0781	0.3596 0.1158	0.5658 0.2891
	FoR	0.1529 0.5309	0.1529 0.5309	0.0212 0.6576	0.1289 0.7288	0.1893 0.8628
	NL	0.0000 0.0359	0.0000 0.0234	0.0000 0.0371	0.0000 0.0227	0.0000 0.0136
	PCI	0.0000 0.6200	0.0002 0.5256	0.0006 0.6483	0.0007 0.5833	0.0005 0.3773
	PCA	0.0267 0.8191	0.0905 0.9331	0.3036 0.9820	0.2965 0.6820	0.2008 0.4045
National Governance Paradigm (NGP) ↔ Electricity Governance Structure (GS)						
RI	S	0.0578 0.1985	0.1387 0.2395	0.2583 0.5375	0.2988 0.6781	0.3680 0.7576
	P	0.9985 0.6988	0.7924 0.5321	0.2356 0.1697	0.1569 0.4872	0.0708 0.6277
	R	0.0211 0.3781	0.0300 0.4170	0.1697 0.2356	0.1029 0.3369	0.0554 0.4473
DBI	S	0.0008 0.3985	0.0017 0.5945	0.0029 0.4841	0.0159 0.3369	0.0259 0.2307
	P	0.1356 0.9961	0.0607 0.8650	0.0174 0.6146	0.0986 0.7468	0.2681 0.8727
	R	0.2684 0.0009	0.3984 0.0029	0.6867 0.1251	0.7358 0.1369	0.8572 0.1634

Notes: The first values indicate the causal relationship from right to left; the second values indicate the causal relationship from left to right.

Table E-4: Impacts of electricity institutions on industry performance

	ED		PD		FoR		NL		PCI		PCA	
	FE	RE	FE	RE	FE	RE	FE	RE	FE	RE	FE	RE
Structure (S)	-1.40**	**-1.46****	-5.46***	**-5.56*****	-1.68***	**-1.71*****	-0.17	-0.22	**0.11****	0.13***	-	-
Adj. R^2	0.42	0.01	0.33	0.08	0.77	0.01	0.51	0.00	0.30	0.01	-	-
Hausman test (Prob.)		0.42		0.50		0.48		0.60		0.04	-	-
Privatisation (P)	-7.50***	**-7.93*****	-	-	-	-	-	-	-	-	-	-
Adj. R^2	0.43	0.03	-	-	-	-	-	-	-	-	-	-
Hausman test (Prob.)		0.36	-	-	-	-	-	-	-	-	-	-
Regulation (R)	**-1.97*****	-2.05***	-	-	-	-	**2.42*****	2.21***	0.00	0.03	0.21***	**0.20*****
Adj. R^2	0.43	0.03	-	-	-	-	0.52	0.02	0.29	0.00	0.36	0.13
Hausman test (Prob.)		0.04	-	-	-	-		0.00		0.00		0.10

Notes: 1. '***', '**', and '*' mean statistical significance at 1%, 5% and 10% levels.

2. '-' means that no coefficients are estimated due to the non-existence of causal relationship between the variables

Table E-5: Impacts of WIF on EI

	Structure	
	FE	RE
DBI	**3.11*** **	2.90***
Adj. R^2	0.47	0.30
Hausman test (Prob.)		0.00
EP	-0.62***	**-0.62*** **
Adj. R^2	0.52	0.38
Hausman test (Prob.)		1.00

Notes: '***' means statistical significance at 1% level

Table E-6: Impacts of WIF on the relationship between EI and IP

	ED	PD	FoR	NL	PCI	PCA
S	-23.44	-12.30	16.35	2.56	-0.81	-0.21
S×RI	21.16	5.67	-25.47	-2.71	0.88	0.15
S×DBI	13.50	6.90	5.93	-2.17	0.81	0.79**
S×EP	-	-	-	-	-	-
S×CSR	2.79	-1.20	-4.96	0.56	-0.25	-0.25
P	-219.35***	-244.87***	6.77	107.75	-5.25	9.35***
P×RI	195.70***	209.88***	-22.88	-105.35	5.43	-7.74***
P×DBI	140.91***	170.05***	38.36	-102.15	3.56	8.47***
P×EP	-	-	-	-	-	-
P×CSR	-16.06**	-41.46***	-2.82	44.63*	1.49	3.63***
R	-17.08***	-6.07	-6.81	-12.93	-1.18**	-0.66
R×RI	13.68*	-2.28	-10.03	-11.49	1.49***	0.90
R×DBI	11.67**	-5.12	-0.27	-7.90	0.19	0.44
R×EP	-	-	-	-	-	-
R×CSR	1.31	0.15	0.52	4.34*	-0.08	0.08

Notes: '***', '**', and '*' mean statistical significance at 1%, 5% and 10% levels.

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