

CHAPTER 3

GLOBAL ELECTRICITY MARKET

In the previous chapter, the structural and regulatory reforms in the Indian Power Sector were discussed. The competition in Indian electricity markets has come up as an impact of restructuring in the Indian Power Sector. This chapter outlines the competition in the global electricity market and its connection with the developments in Indian Electricity market. For this, the first part of the chapter takes account of global retail competition scenario covering United States of America, Argentina, Australia, United Kingdom and New Zealand. The second part of the chapter elaborates on Market Arrangement Models. The retail competition model of market arrangement brings together more than one supplier leading to oligopoly market structure. This indicates that underpinning theory for present work is market structure competition. The theory of oligopoly is discussed in the latter part of this chapter.

3.1 INTRODUCTION

The generation, transmission, distribution, and supply were traditionally handled by the vertically integrated utilities (IEA, 2005). Wherever the restructuring and reforms were progressed they resulted in competitive electricity industry (Larsen et al, 1999). Each country needs to design their reform programs in order to move from vertically integrated monopoly model to competitive models of wholesale market arrangement and finally to retail market arrangement (Bacon et al. 2001). These developments introduced competitive models in the market arrangement (Wang et al. 2005). The retail model of electricity market arrangements shifts the electricity market structure from monopoly to oligopoly, wherein more than two players compete with each other (Boroumand, 2014).

Many countries in the past two decades have liberalized their electricity markets. According to Bacon et al. 2011 deregulation, privatization and restructuring started as a political ideology in New Zealand, United Kingdom, Chile which is furthered subsequently in the European Union. Though, the main reason and motivation of restructuring of the electricity industry in various

countries are not essentially the same (Hattori et al., 2004). Countries like Australia, United Kingdom, New Zealand, Latin America did the restructuring for corporatization, privatization and functional separation of distribution utilities while the countries of Eastern and Central Europe opted restructuring to decentralize the government control (Shiohansi et al., 2006). In USA and such other countries where most part of the electricity industry is owned by private sector already, the objective of restructuring was to increase the competition in the sector (Srivastava et al., 2011). A successful liberalization usually requires- restructuring, the establishment of the wholesale market, implementation of retail competition, independent regulation, incentivized grid regulations and privatization (Jamash et al., 2005). In India liberalization was introduced in 1991. The reforms in Indian Power Sector and their impact are exhaustively discussed in Chapter 2. In alignment with the purpose of present work i.e. to develop a framework for Indian Power Sector, the researcher will now take up the restructuring in the global electricity market, the market arrangement models and market structure competition in detail.

3.2 GLOBAL ELECTRICITY MARKET

Electricity markets around the world are in various stages of liberalization (Weigt, 2009). The transformation to free markets is based on various economic and policy motivation which varies from country to country (Shiohansi, 2006). Developed countries chose liberalization to overcome the inefficiencies vested in large and regulated companies while developing countries often do it because the government lacks money for investments (Grades, 2009). A brief look at the prominent electricity markets is as follows:

WHOLESALE ELECTRICITY MARKET

Pioneers of these reforms have been operating now with significant success delivering substantial benefits to economies (IEA, 2005). MacGill (2010) enlisted mature electricity markets in the world. These are as follows:

- a) New Energy Trading Arrangement (NETA)
- b) British Electricity Trading Transmission Arrangements (BETTA)
- c) New Zealand Electricity Market (NZEM)

- d) Pennsylvania-New-Jersey-Maryland Interconnect (PJM)
- e) Nordic Power Exchange (NPE)
- f) National Electricity Market (NEM)

New Energy Trading Arrangement (NETA) and British Electricity Trading Transmission Arrangements (BETTA) - The electricity industry in the United Kingdom pioneered the liberalization with the objective of promoting competition in the power market through electricity pool. As a result, “New Electricity Trading Arrangements” was created in 2001 and it was applied to England and Wales only (Giulietti et al. 2010). In 2005 for Scotland, NETA was extended to form **BETTA** i.e “British Electricity Transmission and Trading Arrangements”. The operating provisions under NETA and BETTA consist bilateral wholesale trade arrangement. Under these arrangements only generators and suppliers can sell and buy the electricity in forward and future markets. National grid acts as a system operator and performs the duty to match supply and demand on second to the second basis as per the defined balance mechanism (Yiakoumi et al. 2016)

New Zealand Electricity Market (NZEM): In 1995, New Zealand Government made announcements to take the necessary steps for opening up of the wholesale electricity market. In 1996, the New Zealand Electricity Market (NZEM) was commenced as a competitive wholesale market under a multilateral contract. The Transpower took the role of scheduler and dispatcher while M-Co acted as a market administrator for clearing and pricing provisions (ERB, 2015). The NZEM introduces competition within the wholesale electricity sector through the formation of national electricity pool and spot market. NZEM provides platform for centralized clearing of electricity generation and demand and to determine respective prices (Alvey et al. 1998)

Pennsylvania-New-Jersey-Maryland Interconnect (PJM), USA: In early days (before the formal introduction of PJM wholesale market), market operations and its reliability were based on the capacity calculations. Prior to the retail introduction, the original members of PJM used to determine their loads and capacity obligations on annual basis. Each member was given the task to have installed generation capacity equals to load and reserve margin. A non-transparent bilateral market was there which permitted members to buy the power for members short on capacity from members long on capacity. In 1998, a transparent PJM marketplace was introduced formally in

response to the need for retail restructuring. Retail restructuring allowed new players to compete for serving load. The new players are required meet the PJM criteria of reliability (Bowring et al., 2000). Customer response to price and reduction in consumption during the time of system shortage is a critical component of PJM marketplace (Walawalkar et al. 2010)

Nordic Power Exchange (NPE), Nord Pool for Nordic Countries: Norway is one of the first countries in the world, which introduced power exchange (Skytte, 1999). A major restructuring was seen in the Nordic countries during the 1990s. A wholesale marketplace with significant competition was established in 1993 as Norwegian electricity exchange and extended in 1996 to Norway and Sweden as a Nord Pool. The Nord Pool became first multi-national exchange in the world and presently is taken as the true international electricity market. There is no cross-border tariff in Nord Pool and a common framework of trading for all countries make it most liquid electricity market of the world. The Finnish and Danish utilities are active buyers and sellers in Nord Pool as well.). The Nordic market closes at noon to clear the supply and demand bids against each other. Subsequently, commitments are communicated for the delivery on following day (Flatabø et al., 2003)

National Electricity Market (NEM), Australia: Australia has been an enthusiastic and early adopter of electricity industry restructuring (MacGill, 2010). After 1991, States of Australia started restructuring although the pace of restructuring was different across the different states. Victoria was the first state to introduce wholesale electricity market and introduced Victorian Power Exchange in 1994. Subsequently, in 1996, a wholesale market ‘Transgrid’ started working in New South Wales. In 1998, these two markets were joined to form the National Electricity Market (NEM). The NEM is a country level wholesale market to sell and purchase electricity and is combined with open access provisions for the use of transmission and distribution system ((Abbott, 2005). Spot and derivative markets are the heart of National Electricity Market (Outhred, 2004)

The common goal of worldwide electricity markets is to generate significant benefits through the introduction of incentives to achieve higher efficiency (Joskow, 2008). Few relevant studies tabled below presents the reforms and developments in Global Electricity Market:

Table 3.1 Relevant Studies Undertaken on Global Electricity Markets

S. No.	Author	Year	Dimensions
1	Weight	2009	Transformation of United Kingdom power market from monopoly to competitive segments.
2	Erlangung	2009	The change to free markets is based on economic and policy motivations.
3	Erdogdu	2010	Unbundling of vertically integrated utilities into generation, wholesale and retail segments through reforms.
4	Squicciarini et al.	2010	1996 Electricity Directive in EU for the reforms at Member States level, and at European level
5	Kessides et al.	2012	Standard reform models - privatization, unbundling, lead to significant improvements in operating performance.
6	Figueiredo et al.	2013	Adequate integration of national electricity transmission grids and the associated increase of electricity cross-border transfers.
7	Tashpulatov	2015	Liberalization in OECD countries, creating a wholesale market to exchange electricity between producers and retail suppliers.

Source: Compiled by the Researcher

Reforms in the electricity sector have become the leading restructuring strategy for the development of power sector (Mizrahi et al., 2014). The evidence from international market suggests that if the reforms are implemented correctly, they lead to considerable improvements in operating performance (Kessides et al., 2012). Introduction of wholesale market and establishment of the capacity market are the common objectives of reforms (Erdogdu, 2010). Many electricity markets around the world have been restructured and transformed into partially competitive markets but the international experience suggests that the process of reforms is neither straightforward nor riskless (Weight, 2009).

Initial reforms were followed by “reform of reforms” to deal with the initial shortcomings of liberalized markets ((Joskow, 2006). But overall it is better off for introducing reforms in electricity markets. In Britain, the reform benefits outweighed the cost. Not all benefits of reforms were passed to consumers. Sometimes they enriched the generators and distributors also (Sioshansi, 2006).

Implementation of market reforms has been more manageable in small and isolated markets such as New Zealand and Singapore. Issues were observed in large interconnected markets of Europe and USA. There, separation of generation from grid and supply has not been completed hence opportunities to subsidies competitive functions were created (Haas et al., 2006). In markets, like Australia, some players have been privatized while some remained in the hand of State Government hence a fair level playing field does not exist (Moran, 2006). Overall Market reforms gave mixed results. The California disaster dampened the interest of reforms in USA and other countries. On the other hand, the success of Nordic market reforms reinforced everyone's faith in such reforms (Amundsen et al., 2006).

The above discussion specifies that there is a requirement to execute more review of the literature on the global power markets. Therefore, the researcher can now safely assert that his third research theme is- **“Competition in Global Power Markets”**.

GLOBAL RETAIL ELECTRICITY MARKET

Globally, electricity market reforms involved various forms of unbundling of previously state-owned vertically integrated utilities. To some extent, the retail competition exists now in such all countries who introduced competition in electricity generation. Many countries are allowing large and industrial consumers to choose the supplier of electricity which some countries are also giving the same freedom to medium and residential consumers also. New Zealand, United Kingdom, Norway, Sweden, Germany and some States of USA and Australia have implemented full retail competition by 2000. European directive, 2001 mandates the implementation of retail competition in all nations of European Union. The centralized objective of the retail competition is to the removal of monopoly in distribution business by introducing competition in electricity supply (Littlechild, 2002). This section undertakes the quick overview of retail scenario around the few cases of the world to give the brief idea about the international retail experience.

NEW ZEALAND

Wholesale market in New Zealand was introduced in 1996 and subsequently, retail competition was introduced in 1998 (Abbott, 2014). New Zealand is the only country in the world who has implemented forced ownership unbundling of electricity distribution from rest of the supply

activities in order to introduce retail competition. The forced unbundling was mandated by the Electricity Industry Reform Act 1998 which strictly prohibited the distribution companies to involve in the generation and retail activities (Gunn et al, 1999). The objective of introducing retail reforms in New Zealand through separation was to introduce competition and prevent cross-subsidization. The choice for selecting the supplier was also introduced to all consumers (Abbott, 2014). The government of New Zealand claimed that aim of reform is to lower power prices, lower cost of business, enhanced local and international competition; leading to higher economic growth (Gunn, 1997). New Zealand also has the concept of Gentailers – where some retailers are involved in production activities (Talosaga et al. 2012). The impact of ownership separation and retail introduction is mixed in New Zealand (Nillesen, 2011). Consumer participation plays an important role in the success of retail market competition in New Zealand (Daglish, 2016). Presently the separation rules in New Zealand are revised by Electricity Industry Act 2010 and distribution is allowed back into retailing and generation through certain threshold limit is there for cross involvement (ERB, 2015)

Table 3.2 Relevant Studies on Retail Markets in New Zealand

S. No	Author	Year	Discussion
1	C Gunn	1997	The aim of reform was lower electricity prices, further leading to enhanced international and local competitiveness, resulting in jobs and economic growth.
2	L Nillesen	2011	The forced ownership separation of the distribution network from retail activities in New Zealand in 1998 and the resulting economic consequences have received little attention.
3	T Talosaga et al.	2012	For the physical electricity network to become operationalized as a commercial entity– retail is required. Retailers bill individual consumers for the electricity they consume.
4	M Abbott	2014	Ownership separation of line and energy businesses was mandated. Now, line businesses could not own or undertake electricity generation and retailing businesses, and vice versa.
5	T Daglish	2016	Customers play an important role in the risk-management strategies of gentailer (vertically integrated generator/retailer) electricity companies.

Source: Compiled by the Researcher

UNITED KINGDOM

The restructuring and privatization of United Kingdom industry resulted in the separation of generation, transmission and distribution activities. Thus the United Kingdom became the first country to introduce the greatest degree of competition in electricity industry (Woolf, 1994). Competition in the country was introduced in a phased manner. Until 1990, regional monopolies were there and degree of competition was zero. Government formulated a strategy to introduce the retail competition in three phases. Large consumers (Connected load > 1 MW) were given the choice in 1990. Midsize users (Connected load > 100 kW) were given the choice in 1994 whereas the market for all category of consumers was opened up in 1998 (Littlechild, 2010). Some serious practical problems arose after opening up of the market. These problems were majorly from metering and billing domain. All the problem handled well and solved quickly (Thomas, 2002). The response of opening up of the market was dramatic and about half of the consumers changed their suppliers. Active retailers in the United Kingdom reduced cost at all stages of the supply chain. Reduction in generation cost and risk was seen. Transmission and distribution cost was also reduced. Retail competition leads to several social benefits. In addition to the reduction in costs at various points, efficiency level got increased ((Littlechild, 2010). Though it has been suggested that welfare gains in the UK from retail competition can be increased by reducing switching cost (Giulietti et al., 2005)

Table 3.3 Relevant Studies on Retail Markets in United Kingdom

S.No.	Author	Year	Discussion
1	Tim Woolf	1994	The financial benefits of retail competition may instead remain with utility shareholders, and that some important public policy objectives may be sacrificed.
2	S Thomas	2002	The introduction of retail competition for small electricity consumers has been an economic disaster for small consumers.
3	S Littlechild	2002	More importantly, a key function of retail competition is precisely carried out the process of price formation in the market. That process has been suppressed or distorted by government.
4	M Giulietti et al.	2005	Welfare gains from the competitive process could be increased either by reducing perceived search and switching costs, The benefits of opening the market have yet to exceed the costs.
5	S Littlechild	2010	Is the British approach to creating a retail market a model for others? Maybe not, even though the concept of a timetable has set a precedent followed by many governments worldwide.

Source: Compiled by the Researcher

UNITED STATES OF AMERICA

In USA, with the entire turmoil if electric power industry during last years, the retail market did not receive significant attention (Rose, 2004). Just after the creation of the wholesale market, some States in USA started to restructure their power sector for the introduction of retail competition. By the end of 2011, the retail competition was introduced in 13 States for residential consumers. While the retail competition was introduced in 13 States for commercial. It has been a decade now since some states of USA implemented retail competition in their electricity market and only residential consumers can be taken as the benefitted consumer category (Xuejuan Su, 2014). Most of the retail markets in the USA remains relatively inactive, especially for residential consumers. The activity of retail competition is correlated with the relatively high price areas where consumer willingly pays more for generated electricity than the distribution company. There are some high price areas with little activities but presently there is no low price area with high level of activity (Rose, 2004). In the USA, it is difficult to make the retail market vibrant overnight. States may take necessary steps to remove all the barriers to entry of competitive supplier (Goulding et al. 1999). In the USA, many states are allowing open access where consumers are free to choose the electricity supplier. States who have not implemented the open access are moving in the direction to implement. The outcome in price reduction depends on the consumer behavior and rate to switch the supplier (Goett et al, 2000).

Table 3.4 Relevant Studies on Retail Markets in USA

S.No.	Author	Year	Discussion
1	Bernard S. Black	1994	There are two competing models of how retail competition should be implemented. The first is a standard direct trade model. The second approach is "central pool" model.
2	A. Goulding et al.	1999	Because the electricity market is being reformed from a regulated monopolistic model to a competitive model, a vibrant retail market will not appear overnight.
3	A. Goett et al.	2000	Under "open access" for retail energy, customers are free to choose among suppliers of the energy commodity, with the traditional utility providing transmission and distribution.
4	K Rose	2004	In the USA, with all the turmoil in the electric power industry in the last few years, retail markets have not received the attention they once did.
5	Xuejuan Su	2014	It has been over a decade since some states in the U.S. implemented retail competition in their electricity markets. only residential customers can be said to have benefited.

Source: Compiled by the Researcher

AUSTRALIA

Australia is an early and enthusiastic adopter of electricity industry restructuring (MacGill, 2000). Australian electricity industry had vertically integrated structure until the 1990s. The industry was predominantly owned by State Government. On the recommendation of a report published by Industry Commission, the respective State Government disintegrated the industry into generation, transmission, distribution and retail sector and implemented the competition in the wholesale and retail marketplace. As of now, Australia has 15 Generation Companies, 5 Transmission Companies, 15 Distribution Companies and 25 Retail Companies (Outhred, 2000).

The restructuring process involved functional separation, privatization, corporatization of Government utilities with the subsequent development of National Electricity Market (NEM) and Retail Market (Outhred, 1998). State of Victoria and South Australia have introduced full retail competition by deregulating the retail market and allows the choice to the consumer through necessary investments and innovations (Simshauser et al., 2013). In the country, demand is not fulfilled directly by electricity generation companies. It is fulfilled by retail companies that purchase electricity from generation houses or from sellers and then distribute to consumers. The

electricity purchase is packaged with the transportation service and can be made on regular/medium term/irregular basis (Rasjidin et al, 2012).

Table 3.5 Relevant Studies on Retail Markets in Australia

S.No.	Author	Year	Discussion
1	H Outhred	1998	The Australian electricity industry restructuring process involves functional separation, corporatization and, in some cases, privatization and formation of NEM.
2	H Outhred	2000	Governments agreed to disaggregate the industry into generation, transmission, distribution and retail sectors, and to implement competition at wholesale and retail levels.
3	L. Bird et al	2002	Most consumers have a retail choice although some states have delayed restructuring. Incumbent retail energy suppliers offer green power options in Australian Capital Territory.
4	I MacGill	2010	There has been some movement towards large generators and retailers joining together to form ‘gentailers’ who then have a partial physical hedge against price variability and volatility.
5	R Rasjidin et al.	2012	In eastern Australia's electricity market, the retailers have to purchase a certain amount of power to fulfill their customers’ demand.
6	P Simshauser	2013	Retail prices are generally competitive, but price regulation remains a policy constraint in New South Wales, Queensland, and Western Australia

Source: Compiled by the Researcher

Benefits of retail competition can be achieved only if there will be a true competition in the market. Electricity consumers are needed to face a genuine choice among the available retail supply companies. Policymakers need to ensure the competition in generation market to lead the competition in the retail market (Bohi et al., 1996). The above discussion specifies that there is a requirement to execute more review of the literature on the global retail power markets. Therefore, the researcher can now safely state that his fourth research theme is- “**Global Experience in Retail Competition**”.

3.2.1 GLOBAL ELECTRICITY RETAIL MARKET RELEVANT FOR PRESENT STUDY

1. Center for the Advancement of Energy Markets (CAEM) in 2003 prepared a competitive metrics to measure the performance of global retail markets. The competitive metric was prepared based on the competitiveness of the electricity market. Sioshani in 2005 came up with the metric entitled “Who has the most competitive retail market?” The competitive metrics is as follows:

Table 3.6: Global Competitive Metrics for Retail Markets
(Ranking of selected retail electricity markets)

Country, province, state or territory	RED index score 2003	World rank 2003
England, UK	88	1
New Zealand	75	2
Texas, USA	69	3
Pennsylvania, USA	67	4
Maine, USA	64	5
Alberta, Canada	61	6
New York, USA	60	7
Columbia, USA	54	8
Michigan, USA	52	9
Maryland, USA	52	9
Victoria, Australia	50	11
New Jersey, USA	50	11

Source: Sioshansi, 2005

United Kingdom and New Zealand retail markets rank higher than other countries as shown in competitive metrics. While USA and Australia retail markets rank lowest as shown above.

2. The first country to introduce competition in electricity industry was United Kingdom (Woolf, 1994). New Zealand market design provides fundamental design elements, which ensure competition (Hogan, 2001). The California crisis in USA stuck the process of further retail reforms (Rose, 2004).

3. Consumer switching rates are highest in the United Kingdom followed by the New Zealand (Daglish, 2016). New Zealand is the only country in the world, which has implemented forced ownership unbundling of electricity distribution from rest of the supply activities in order to introduce retail competition (Gunn et al, 1999). While, Retail competition in USA and Australia is limited to some states only (Goulding, 1999; Simshauser et al., 2013)
4. Thus, researcher selected United Kingdom and New Zealand for developing the concept through familiarisation for developing the framework for introducing retail competition in India.

3.3 MODELS OF ELECTRICITY MARKET ARRANGEMENT

Sally Hunt (2002) suggested four models of power industry structure which were differentiated through the degree of monopoly retained by them. These four models of power industry structure progressively reduced the degree of monopoly and progressively increased the degree of competition. Although all the models considered transmission, carriage business and system operation as the natural monopoly. These models with their associated characteristics are shown in Figure 3.1 below:

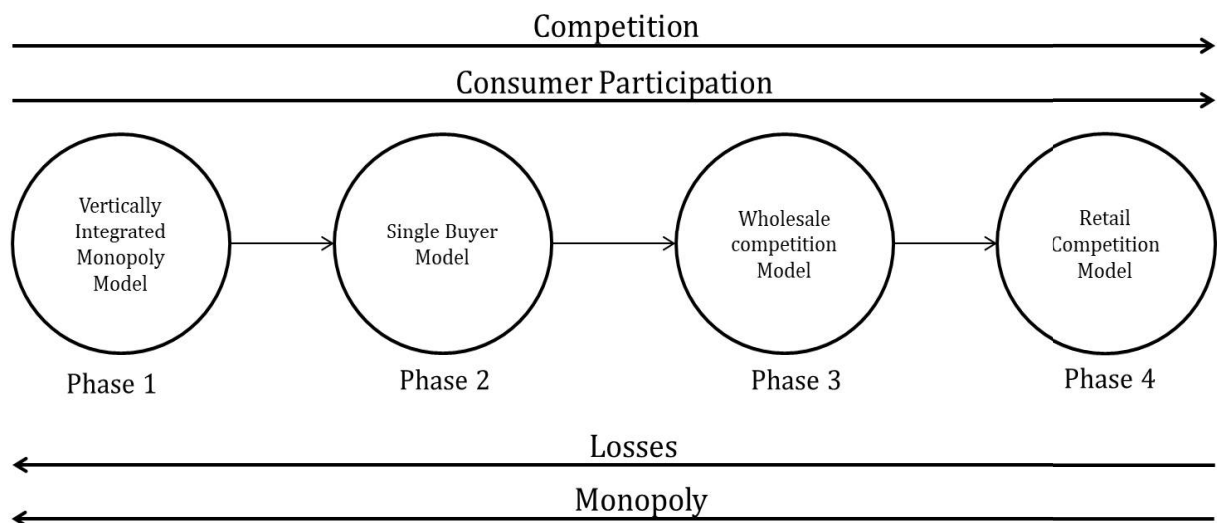


Figure 3.1: Four Models of Power Industry Structure¹³

Source: Agrawal et al., 2017

¹³ Based on the Theory of Restructuring by Sally Hunt

Table 3.7: Relevant Studies Undertaken on Models of Power Industry Structure

S. No.	Author	Year	Discussion
1	Bacon et al.	2001	Model 1 (monopoly) has no competition, Model 2 allows a single buyer or purchasing agency to encourage competition, Model 3 (wholesale competition) allows distribution companies to purchase electricity directly from generators. Model 4 (retail competition) allows all customers to choose their electricity supplier, which implies full retail competition.
2	S Hunt	2002	Four models are differentiated by how much monopoly is retained. All of the models assume continued monopoly over transmission, distribution wires, and system operations. The four models provide progressively more choice, and progressively reduce the scope of monopoly.
3	Edward Vine et al.	2003	The four generic models of power sector structure are: Model 1—vertically integrated, regulated monopoly; Model 2—unbundled monopoly; Model 3—unbundled, limited competition; Model 4—unbundled, full competition.
4	Hiroaki Nagayama	2008	Four steps in the liberalization model:1) Monopoly model – before competition/ no competition 2) Single Buyer model – mid/ long-term competitive bid for generation business 3) Wholesale market model – when the wholesale market is liberalized 4) Retail market model – If the wholesale and retail markets are liberalized
5	A Agrawal et al	2017	Power Market Structure consists four models: Model 1: Vertically Integrated Monopoly; Model 2: Single Buyer; Model 3: Wholesale Market; Model 4: Retail Competition. If the industry moves from Model 1 to Model 4, competition increases and monopoly decreases.

Source: Compiled by the Researcher

As shown in the above Figure 3.1, there are four models in a power industry – Vertically Integrated Monopoly Model, Single Buyer Model, Wholesale Competition Model and Retail Competition Model. Model 1 is the least competitive model while Model 4 provides full competition into the industry. If power industry moves from Model 1 to Model 4, the degree of competition and consumer participation increases. In opposite direction of model movement, losses increase as the degree of competition becomes low. A brief overview of these models is as follows:

3.3.1 Vertically Integrated Monopoly Model - This model had been followed since the inception of the power sector. Vertically Integrated State Electricity Boards are an example of this model.

Figure 3.2 below presents the structure of power industry under Vertically Integrated Monopoly Model:

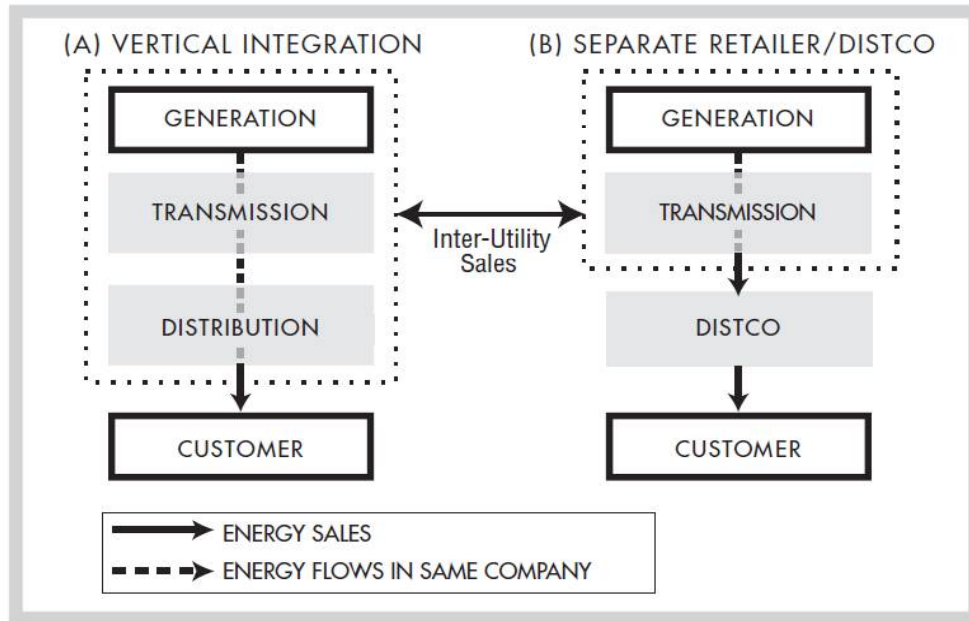


Figure 3.2: Vertically Integrated Model Structure of Power Industry
(Source: Sally Hunt, 2002, p. 42)

Model 1 is vertically integrated monopoly model. In this model, buying power directly from generators is not permitted hence competitiveness in the generation and other segments is not present. All the functions of power industry i.e. generation, transmission and distribution are highly regulated and bundled together. This model existed in power industry for 100 years and still is in practice at few places.

3.3.2 Single Buyer Model - In this model, Generators sell their electricity through Single Buyer. Distributors cannot purchase electricity directly from Generator. Figure 3.3 below presents the structure of power industry under Single Buyer Model:

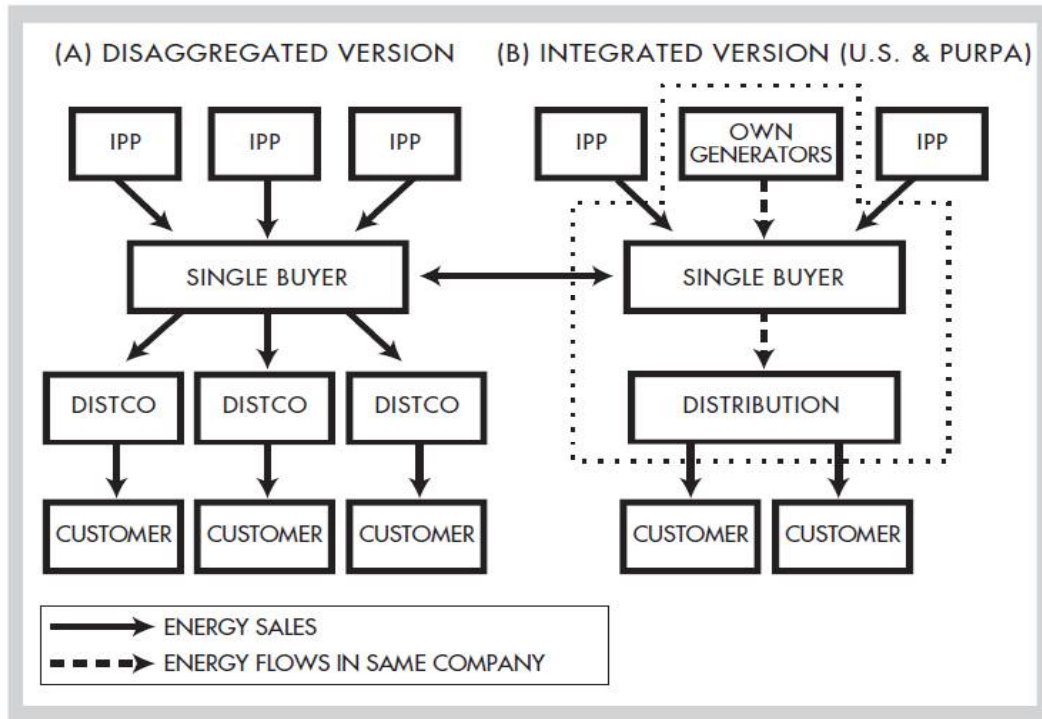


Figure 3.3: Single Buyer Model Structure of Power Industry

(Source: Sally Hunt, 2002, p. 43)

The single buyer model was first adopted inadvertently by the United States in 1978. The model has two versions – 1) Disaggregated Version – in which all generators are independent power producers. 2) Integrated Version – in which independent power producers are there in the market but the integrated company also has its own generation unit. In this single buyer model, power is purchased based on the long-term contract arrangements. This model introduced competition in generation segment. Many countries, especially Asian countries took this model as the first step of liberalization.

3.3.3 Wholesale competition Model - This model introduces the concept of both Power Trading and Open Access. Large consumers have the freedom to buy power from competitive generators or through power exchanges. Figure 3.4 below presents the structure of power industry under Wholesale Competition Model:

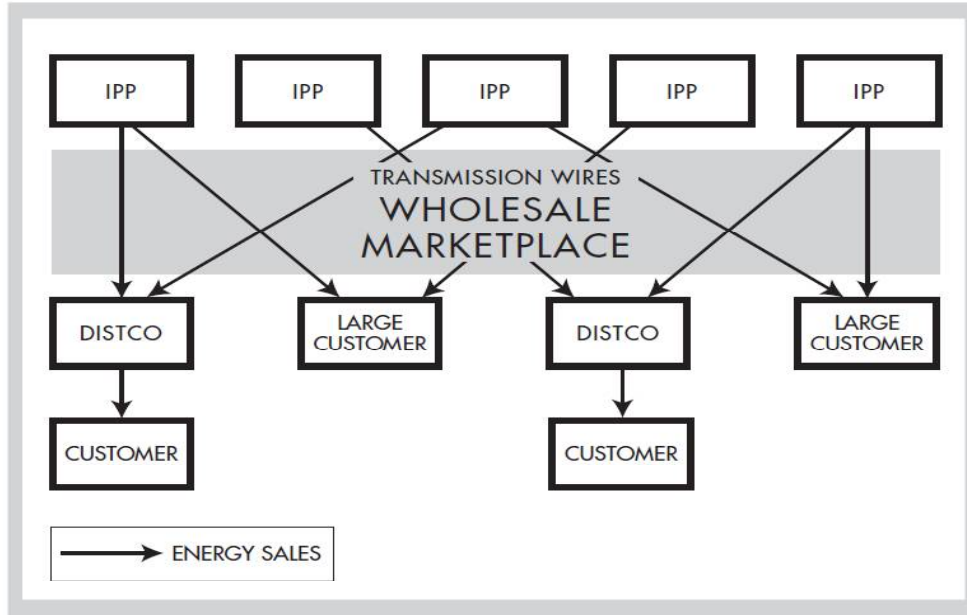


Figure 3.4: Wholesale Competition Model Structure of Power Industry
(Source: Sally Hunt, 2002, p. 45)

The wholesale competition model has full competition in generation segment. Generators are fully deregulated and they can sell their power in the competitive wholesale market. The model provides freedom to all distribution companies and large consumers to buy power from any generator or from a wholesale marketplace or from trader although in this model distribution segment still behaves like a monopoly for smaller consumers. Tariff for small consumers has both fixed and variable components.

3.3.4 Retail Competition Model - This model gives freedom to all class of consumers to choose the supplier. The model introduces full competition by introducing multiple supply licensees in an area. Figure 3.5 below presents the structure of power industry under Retail Competition Model:

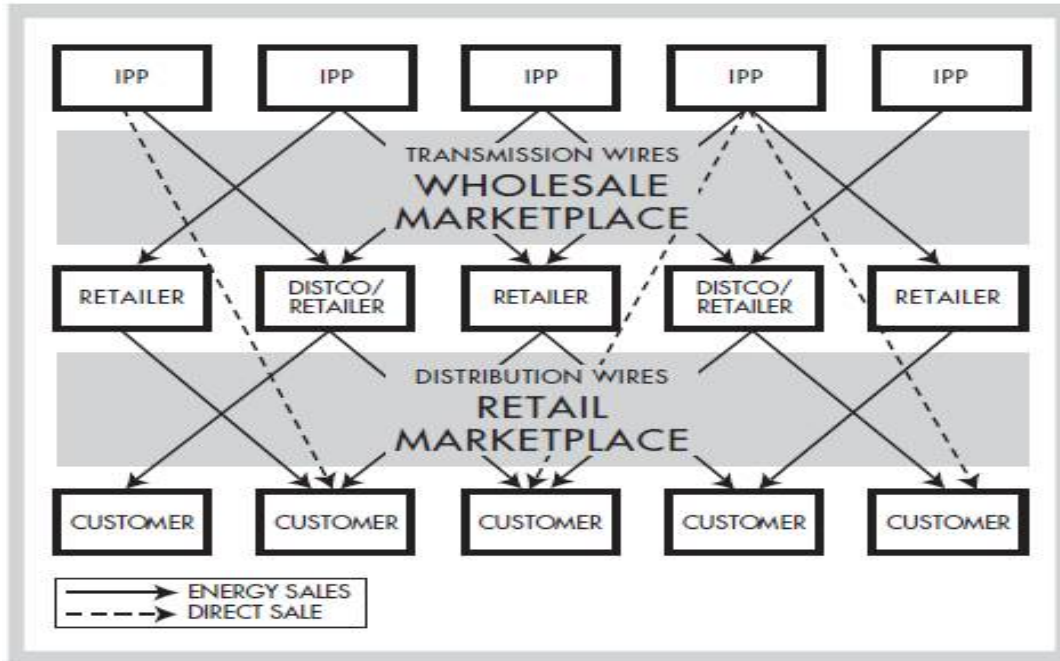


Figure 3.5: Retail Competition Model Structure of Power Industry
(Source: Sally Hunt, 2002, p. 54)

Retail competition model permits competing power generators to sell their power to anyone. Small consumers buy their power from retail suppliers and they have the facility to switch the supplier with pre-decided switching frequency. Retail competition pulls benefits from a competitive wholesale power market by enabling retailers to pressurize generators for better prices. This model needs proper arrangements for the wholesale trading place, meter reading and billing, settlement process and awareness in consumers.

3.4 JUSTIFICATION OF SELECTING RETAIL MARKET ARRANGEMENT MODEL FOR PRESENT STUDY

Standing Committee on Energy found that there is an imperative need for third generation reforms in Indian Power Sector to deal with the existing inefficiencies. Retail competition needs to be introduced to implement third generation reforms. The committee had already suggested certain amendments in existing Electricity Act, 2003 to facilitate the introduction of retail competition in

India (SCOE, 2014). These amendments are expected to change the business dynamics of existing power distribution companies in India (Business Standard, 2014)

Presently, Indian power industry is in the transition stage from Vertically Integrated Single Buyer Model to Wholesale Competition Model. Though as per the suggestions of policymakers, Indian power industry needs an immediate shift to Retail Competition Model (Agrawal et al, 2017).

Under retail competition, integrated distribution (wire or network or carriage) and retail (supply or content) functions are unbundled and the customers are allowed to choose their electricity supply from independent retail suppliers of electricity (Kurdgelashvili, 2008). If implemented, retail competition model will introduce full competition by removing existing monopolies of power distribution sector (Singh, 2010). Retail Competition Model is the awaited phase of electricity market restructuring. All the requirements, preparations to introduce retail competition in India shall require the retail model arrangements as suggested by the Sally Hunt, 2002. The study aims to identify all such preparatory arrangements which are necessary to introduce retail competition in India.

3.4.1 CARRIAGE AND CONTENT IN ELECTRICITY DISTRIBUTION

In India, the present structure of power distribution consists two main functions (The Hindu, 2015):

1. Network Function: Build, Operate and Maintain the Network for required capacity
2. Supply Function: Procuring power from generators/traders and transfer to delivery points for end use

These two functions are termed as the ‘Carriage’ and ‘Content’ functions respectively. Electricity Amendment Bill, 2014 proposes the segregation of carriage and content functions from existing distribution. Segregation of carriage and content businesses also implies the separation of natural monopoly from competitive activity (Dasgupta, 2014). After the separation of carriage and content businesses, competition shall be introduced in supply business by introducing parallel player in the market while network business will remain as the regulated activity. Owner of Network Business will not be able to indulge in Supply Business (Bhaskar, 2013). The successful separation of Carriage and Content Businesses shall lead into the introduction of retail competition in Indian power sector (Agrawal et al., 2017).

3.5 MARKET STRUCTURE AND COMPETITION

Market structure is also taken as the number of firms producing similar products or delivering identical services. Market conditions under which firms sell goods and services is known as the market structure. The market structure usually describes key traits of the market which includes: number of firms, the similarity of products or services, ease of entry and exit, regulatory and pricing conditions etc. The market structure affects the nature of competition and thus pricing of product or services. (Stopford,1991) There are certain forms of market structure exists which are defined as below:

- 1) **Perfect Competition:** Perfect Competition is an ideal market structure that is equipped with unlimited contestability, unlimited number of producers and consumers. In this type of market structure, a large number of sellers and buyers operate freely and sell a homogenous product at a uniform price. (Stigler, 1957)
- 2) **Pure Monopoly:** Monopoly is the form of market structure, where a single seller is there for a particular commodity and no close substitute exists in the market. Monopoly is also taken as the opposite extreme of perfect competition. In a monopoly market, there are high barriers to entry in the market for that particular product. (Chamberlin, 1954)
- 3) **Monopolistic Competition:** Monopolistic Competition is the form of competitive market structure, that has some elements of a monopoly. In this form of market competition, closely differentiated products are sold by the many available firms of the market. The barrier of entry in this type of competition is low for the new entrants. (Chamberlin, 1948)
- 4) **Oligopoly Competition:** Oligopoly Competition is the market structure where few firms compete with each other. Since the industry comprises few firms, any change in pricing or output decision by an individual firm likely to influence the profits and output of rivalry firms. In an oligopoly, it is difficult for a new firm to enter the market. (Wilcox, 1950)

Since the retail competition in the electricity industry is an example of a market structure where few firms compete with each other, the theory of oligopoly can be linked with it. A brief discussion around the theory of oligopoly shall help us to understand the linkage of this work with the theory of oligopoly.

3.5.1 THEORY OF OLIGOPOLY

Oligopoly Competition is the market structure where few firms compete with each other. Since the industry comprises few firms, any change in pricing or output decision by an individual firm likely to influence the profits and output of rivalry firms. In an oligopoly, it is difficult for a new firm to enter the market (Wilcox, 1950). In an oligopoly, the market price can be highest at the competitive price level and cannot be higher than the price of monopoly market (Bresnahan, 1982). There are various theories and models of oligopoly. The model suggested by Cournot is on quantity based and compete on sales volumes while Bertrand model competes on price. As per Bertrand, if the price is used as the strategic variable amongst rivalry firms, one firm get an incentive to cut other's price in order to capture the higher market share. Price formation strategy in Cournot model is mysterious. As per Cournot, increase in the output of one firm may have a negative effect on the profit of competitive firm (Shapiro, 1989).

Though the Cournot and Bertrand models are most considered models in the theory of oligopoly, a question is still unanswered - which model is best fit for various conditions of oligopolistic markets (Delbono et al., 2016). Even after the 150+ years of the Cournot model, a benchmark set by Cournot is as it is. With the factors of demand and supply etc., the price is also determined by the rivalry of oligopoly market. Equilibrium in the market is achieved when the firm maximizes its production in response to other firm's production. Usually firm does not come together to fix a market price like in monopoly because of the probability of cheating and earn. Perfect competition is the limit of oligopoly model in which market prices are not defined by the individual products (Vives, 1989). Recent developments in oligopoly theory are seen particularly if the issue of entry is involved. If post entry oligopoly is not relevant, in such market environment, all products have access to similar technology whereas technology may have fixed cost but not the sunk cost. Consumer reacts with change in price instantly hence incumbents do not change their price or tariff instantly (Dixit, 1982)

Formal assumptions of oligopoly theory may be applied to all type of market structures as those assumptions were universal. However, later assumptions can be applied to the smaller segment only. Literature suggests that oligopoly theory should deal with the potential competition instead of actual competition. In the situation of perfect competition, a firm should not be worried about the reactions of present rivals hence any question of potential rivals does not come into the picture.

Existing firms may have the advantage of cost over the new entrants and this may remain true in future also (Bhagwati, 1970). In Cournot Oligopoly, a firm expects that the production level will be higher than the equilibrium so that prices can be below of the equilibrium price. If a firm wants prices to be higher than equilibrium price than production should be below of equilibrium (Desgranges et al., 2015).

Static models sometimes miss the central theme of an action whereas dynamic models are helpful to use the central theme. Hence if static models of an oligopoly theory are not able to provide sensible answers, dynamic models provide though it is typical to solve a dynamic model in comparison to static hence a combination of the numerical and analytical method is used generally. Patterns repeated by the numerical expressions generate the various possibilities to analyze the results (Cabral, 2012). Many oligopoly solutions offer more close predictions but it is hard to say that which solution is better for the real-time market situations. Different oligopoly solutions can be identified econometrically. One may also use standard econometric methods, even if data is not available for the demand and supply functions (Bresnahan, 1982).

In an oligopoly, price competition and advertising have a certain relationship. In the market, consumers pursue only local price information hence sellers of other location do the advertisements about their competitive prices in order to attract the customers of that location. Such advertising promotes competition hence consumers get benefitted (Bester, 1995). Welfare implications of the informative marketing/ advertising in oligopoly market for differential products are also examined. Advertisements can be undersupplied if products are homogeneous while they may be oversupplied if products have a small degree of differentiation (Hamilton, 2009) In the oligopoly structure, sales can be promoted through the distribution of coupons and rebates. Sales promotion strategy and other more powerful strategies like media advertising sometimes are necessary to increase the sales and market share. Giving coupon to customers of a competing brand can be helpful to increase the market share as the coupons can compensate the cost of the movement of a customer to another brand because consumer switching cost get reduced by the benefits offered through discount coupons (Bester et al., 1996)

In a duopolistic setting, companies may pre-announce the competitive decisions of future even if they have not implemented the same. Companies try to over-state the future decisions of each other through pre-announcing if demand uncertainty is low. However, under Cournot oligopoly market,

the pre-announcing may lower down the profits of a company. So firm may remain silent if they do not want to lower down the profits. Pre-announcements may be done in the industries where competition is harsh (Carlos Corona et al., 2013)

Oligopoly is infinitely repeated if, in the spot market, companies compete based on the quantities or price or if they are doing future or forward trading. Trade of forward contracts generates pro-competitive results which allow the company to generate collusive profits. On the other hand, commodity markets are made more competitive if companies do forward trading in order to behave aggressively in spot markets (Liski et al., 2006). Non-competitive producers may use forward transactions as an effective strategic tool under certain conditions. The producer may practice forward transactions to recover their position in the spot market (Allaz, 1992).

Oligopolists may plan the maximum joint profit. Mutual profit of a domain of a particular industry gets maximized when they mutually act like a monopolist. Although this collusion can be a failure in some firms (Stigler, 1964). In the oligopoly, two types of firms are supposed to compete with each other in downstream and upstream markets under two pricing games: 1. Purchasing to Stock: in which a company chooses input price before finalizing the consumer price. 2: Purchasing to Order: in which a company sells out the future and forward contracts before selecting the input price. Pre-settlement of prices leads to the low competition in market and soften the rivalry in market and the same behavior generates anti-competitive belongings in the market (Hamilton et al., 2015)

Oligopoly models for electricity markets are also discussed. Till now, several oligopoly models had been recommended to represent the strategies of power markets in which Supply Function Equilibrium, Cournot Model, and Bertrand Model are the main. Few of the models are deterministic in nature, however, the model of Supply Function Equilibrium is not. This model does not consider the uncertainties of the supply side. Supply-side uncertainties of oligopoly models are the cause of unpredictable failures of generation units (Wang et al., 2007)

Oligopolistic behaviors in electricity markets also need attention. UK and Norway electricity markets and their reforms are considered as the benchmark. Suppliers in the market are encouraged to have oligopolistic behavior in a multimarket setting like retail competition. An example is Britain, where suppliers have mutual competition within their related area of service. Though there is a lack of solution if the competitive scenario does not catch enough pace. (Boroumand, 2014).

Generic oligopoly theory can be applied in wholesale electricity markets. For wholesale markets, economies have a rich amount of data and thus need to pursue low assumptions. Wholesale markets have clear-cut policies to function as well as the regulatory environment which governs the whole process. Although there is no surety that promised results of restructuring are always seen. Lessons may be materialized from the wholesale power markets to monitor market and design for other oligopoly firms (Wolak, 2010).

Japanese electricity market has transmission constrained oligopoly. The power system in Japan is being operated at two different frequency levels – 50 Hz (Eastern Region), 60 Hz (Western Region). Frequency converters are able to provide limited connectivity between these regions hence transmission congestion happens. The increment in transmission capacity may lead to lower prices and gain in social welfare but it may not be substantial from the angle of high investment. On the other hand, unbundling of the largest power company in Japan may yield to lower prices and may cut the existing losses significantly (Tanaka, 2009).

Oligopoly equilibria has a relationship with environmental concerns of nonrenewable resource markets. Most natural resource industries have not been described whether they are competitive industry or pure monopolies. Industries want to understand the oligopolistic trends for the non-competitive natural resource market specially to reduce the CO₂ emission under Kyoto protocol as it is assumed that oil is controlled by the monopoly. The oligopoly theory for non-renewables is based on the concept of Nash open-loop equilibrium (Salo et al., 2001).

Literature also discusses the domestic merger policy in an international oligopoly (Scrgard, 1997; Nilsson, 2005). Domestic markets are being integrated by the mergers on an international level. The merger which does not have cost-saving effects are detrimental towards the domestic welfare in a country if that country imports goods. However, if a country exports goods then merger may be beneficial to increase the social welfare with the initial condition of low price and cost margin. Mergers which do not have any cost savings may be banned with immediate effect (Scrgard, 1997). Some mergers in Swedish electricity markets decreased the social welfare while some increased the social welfare. Further concentration on electricity market should be based on the degree of restrictive requirements if firms argue that the merger shall lower down the cost of production. Reduction in cost shall benefit the customers, especially the household customers. Nilsson (2005).

3.5.2 THEORY OF MIXED OLIGOPOLY FOR PRESENT STUDY

- 1) Oligopoly refers to such market conditions where more than one firms compete with each other (Kotler, 2016). After the transition of Indian electricity industry to Retail Competition Model, such market structure shall be formed where electricity retail supplier will be more than one (FOR, 2013).
- 2) Globally, both private and public firms serve in some sectors of the market. Transportation, **electricity**, telecommunication, education, banking, and healthcare sectors are one of them (Bennett et al. 2012; Donder et al. 2009; Matsumura et al. 2005) Mixed oligopoly is an oligopoly market which contains at least one public and one private firm (Net, 1999). In Indian Scenario among the available companies for retail supply, there shall be a mandate of the presence of one government company, others will be private companies (EAB, 2014). In view of this researcher is considering Theory of Mixed Oligopoly as underpinning theory for the present study.

3.6 SUMMARY

1. Liberalization in global electricity markets are the buzzword for last three decades. Electricity markets around the world have been restructured and transformed into partially competitive markets. With this backdrop, the third research theme is: “Competition in Global Power Markets”
2. Implementation of Retail competition model is now most adoptable practice by policymakers to introduce third generation reforms in the inefficient power markets. With this backdrop, the fourth research theme is “Global Experience in Retail Competition”.
3. On the basis of Global Retail Competition Metrics, the relevant countries which undertook retail competition were New Zealand and United Kingdom. The said data would be used for conceptualization purpose in Chapter 6.
4. The relevant market structure model for the present study is the ‘Retail Competition Model’.

5. The underpinning theory of present study is ‘Theory of Mixed Oligopoly’ as in Indian Scenario among the available companies for retail supply, there shall be a mandate of the presence of one government company, others will be private companies (EAB, 2014).
6. Chapter 4 presents the Structured Literature Review on the themes identified by the researcher in Chapter 2 and Chapter 3.