

# Performance Evaluation of Administrative Parameters of Real Estate Regulations in India by using Data Envelopment Analysis Model

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**Abstract:** The real estate sector is one of the most universally recognized sectors which contribute a lot in economic growth of any country. In India, it is expected to grow and reach around USD 1 trillion by 2030. Immediately after implementation of the Real Estate (Regulation and Development) Act, 2016 [RERA] it has been become essential to find out the behavior and performance of various administrative parameters employed across different states of India. The study is related to the performance evaluation of administrative parameters engaged in the states of Maharashtra and Gujarat of India. The basic approach carried out to collect the data through primary resources including questionnaires. Here the Data Envelopment Analysis model is used to perform system research on the performance of real estate regulations and accordingly developed a Charnes Cooper Rhodes (CCR) Model and a Banker Charnes Cooper (BCC) Model to evaluate the efficiency of administration. The CCR model predicts the efficiency range of key indicators that shows differential results on variables considered in the study. The BCC model shows significant comparison between efficiencies. The difference in the efficiency level allows the stakeholders to think further on these findings and question the appropriateness of key parameters of this new reform as it is more impacting promoters and real estate agents during the initial stage.

**Keywords:** Performance Evaluation, Efficiency, RERA 2016, Administrative Parameters, Data Envelopment Analysis Model.

## 1. Introduction

The real estate sector is one of the most worldwide acknowledged sectors. Indian real estate is a huge and multifarious sector with a great demand for housing & commercial properties due to rapid urbanization. It is a sector directly or indirectly associated with around 270 allied industries particularly with the core sectors such as cement, steel, paint, glass and other building materials. The Indian real estate sector plays a significant role in the country's economy. The government of India has enacted numerous laws and regulations to control & standardize the real estate sector during past few years. The sector corroborated a milestone legislative reform in

March 2016 with the enactment of Real Estate (Regulation and Development) Act, 2016 [RERA]. Prior to initiation of the reforms, Real Estate Sector was facing various issues and irregularities such as duping of homebuyers by builders through various malpractices, rampant use of black money, diversion of funds and lack of accountability. On the other hand, developers had to seek umpteen numbers of sanctions and approvals through complex processes before commencement of project construction. For example - even a simple task of getting the project layout map approved would take years, resulting in delays and cost escalation. There was no recourse to any speedy grievance redressal mechanism in case of any

genuine problem faced by either the homebuyers or developers.

Major peculiarities of RERA consists of registration of projects (above 500 sq. meters and above 8 apartments) with specific details like sanctioned plan, layout plan, agreement letter, specification details etc, agents registration, separate bank account for each project, penalty clauses, refund on delay and Appellate Tribunals for speedy dispute resolution if any. RERA came into full force in May 2017, 35 States / Union Territories of the Nation have notified these reforms including the state of Maharashtra and Gujarat. The real estate regulatory authorities have been set up. GujRERA (Gujarat Real Estate Regulation and Development) Rules, 2017 and MahaRERA (Maharashtra Real Estate (Regulation and Development) Rules, 2017 are such authorities setup to govern the real estate activities in the state of Maharashtra and Gujarat respectively.

Immediately after implementation of the act RERA it became essential to find out the behavior and performance of various administrative parameters employed in various states. Chinese government has strengthened controls on the real estate market. However, the academic circle has controversy on the policy effectiveness of real estate regulation (Xiaojun Liu and Zhang Hongli, 2009). Trustworthiness of various parameters cum decision making units including registration process for promoters and real estate agents, dispute cases filed by the stakeholders particularly customers, appeals and average time taken for registration sanction etc were the most prime requirements to be evaluated. While the satisfaction and empowerment to the homebuyers was the one of the prime objective of the Act but to ensure the confidence & interest of promoters and agents was too important for the growth of real estate sector. China's housing policy has entered into an adjustment period. The central government tries to take macro measures to regulate the urban housing market, with the purpose of enhancing long-term housing development (Ye Jian-Ping and Zheng-Hong Wu, 2008). Henceforth to get an idea over the feedback regarding suitability of different administrative parameters became essential.

There has been some debate on merits and demerits of real estate regulation and licensing. It was concluded by a Turkish study (Coskun & Yener, 2011) that consumers may benefit while decreasing the potential value of opportunities for the real estate market players due to introduction and implementation of the RERSAT (Real Estate Regulation and Supervision Agency of Turkey).

The real estate sector has shown promising growth since last two decades. Extensive research has been done in the field of management and engineering aspects directly or indirectly focusing on real estate business and operations but no conclusive study have been done focusing on the real estate stakeholders - the real estate developers; their opinions and the impact of RERA, 2016.

In this study an attempt is made to evaluate the performance efficiency of few major administrative parameters employed in the regulations. How to objectively evaluate the performance of real estate policies is not only helpful to achieving consensus of views but also helpful for using the instruments of real estate policy. While policy implementation no longer frames the core question of public management and public policy, some scholars have debated appropriate steps for revitalization. And the practical world stands just as much in need now of valid knowledge about policy implementation as ever (O'Toole Jr and Laurence J, 2005). The impact of real estate regulations in the country was taken out through case studies particularly for state of Maharashtra & Gujarat to illustrate the effectiveness of administration by using Data Envelopment Analysis model. Further it was also validated with the Simplex Method of Linear Programming to compare the performance efficiency of those administrative parameters. It also analyzes parameters for performance rating of real estate regulatory authority, the appropriateness of implemented clauses and challenges faced by the stakeholders. Any transformation in business of such magnitude can have multiple effects on its derived value (Pfnur & Wagner, 2020).

**2. Materials and Methods**

**2.1 Objectives and Area of Study**

The primary objective of the study is to evaluate the performance of various administrative parameters employed amongst various states of the country just after implementation of RERA. How these parameters affecting the mode of operations in the real estate sector particularly in the administration affecting the real estate developers and the real estate agents are analyzed by using Data Envelopment Analysis model. Further it has also been validated with the Simplex Method of Linear Programming to compare the performance efficiency of those identified administrative parameters.

The area of study chosen for the said study was the state of Maharashtra and Gujarat in India. Maharashtra is the second-most populous state in India and the third-largest state by area. The state provides a diverse real estate business opportunity spreaded across various districts, with young, new and experienced real estate developers practicing with a very high percentage of large real estate developers and real estate companies. Gujarat is widely considered one of the most industrially developed states of India and a manufacturing hub. It also provides a great opening and door to the real estate sector.

Including both the states, with a panel data for 2017–2018 has been taken through the authorized

internet resources which enlightens study test on the performance of administrative parameters. Real estate regulation system is a complex system contained a number of input and output indexes, the interaction between these input and output indexes is difficult to be indicated accurately. When the DEA method is evaluating the relative effectiveness of every decision-making unit, it emphasizes mainly on the optimization of the decision-making unit and the maximal value and optimal weight of the relative efficiency, while no need to set up the specific output and input function beforehand.

**2.2 Variables in Study**

The parameters identified for the study has been selected after careful evaluation of the Act, RERA 2016 and unique modifications of the terms in MahaRERA, 2017 and GujRERA, 2017 through an expert survey. These parameters are assumed as decision-making units including registration process for promoters and real estate agents, dispute cases filed by the stakeholders particularly customers, appeals and average time taken for registration sanction etc. In this similar administrative parameters are taken out from Maharashtra real state regulatory authority and Gujarat state regulatory authority are taken out with relevant statistics are as shown in table 1.

**Table 1: Indicator System (DMU'S) for RERA, 2016**

Sr. No.	MahaRERA	GujRERA
1	Project Registration	Project Registration
2	Agent Registration	Agent Registration
3	Dispute Cases Filed	Dispute Cases Filed
4	Appeals	NA
5	Average Time for Registration	Average Time For Registration

It is given that only a limited amount of research has been conducted on the performance evaluation of real estate regulations, this study attempts to extend to find out the performance evaluation of administrative parameters of the real estate regulatory authority into the business. As mentioned earlier, the basic approach has been to collect relevant data through online portals of real estate regulations in the states of Maharashtra and Gujarat. It has been collected

through the official websites of Maharashtra real estate regulatory authority and Gujarat real estate regulatory authority. Here the Data Envelopment Analysis model is used to carry out system research on the performance of real estate regulations during 2017-2018.

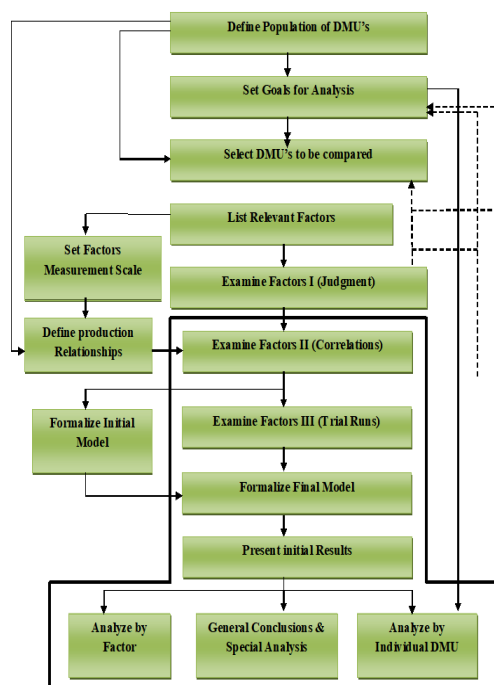
Data Envelopment Analysis (DEA) is a non-parametric linear programming technique used to compare decision making units (DMUs), with input and output data of other similar DMUs. Whereas

linear programming is a simple technique where we depict complex relationships through linear functions and then find the optimum points. Since real estate regulation system is a complex system contained a number of input and output indexes, the interaction between these input and output indexes is difficult to be indicated accurately by function relation formula. When the DEA method is evaluating the relative effectiveness of every decision-making unit, it emphasizes mainly on the optimization of the decision-making unit and the maximal value and optimal weight of the relative efficiency, while no need to set up the specific output and input function beforehand. Thus, DEA method is particularly suitable for studying the

policy performance of real estate regulation. The three main phases in carrying out an efficiency study by means of DEA are highlighted as below -

- a) Definition and selection of DMUs to enter the analysis.
- b) Determination of input and output factors which are relevant and suitable for assessing the relative efficiency of the selected DMUs.
- c) Application of the DEA models and analysis of outcomes.

The general procedure for the adopted DEA model is as shown in figure 1 as below.



Hence performance efficiency of few administrative parameters of real estate regulations of Maharashtra and Gujarat states are been determined by DEA method. Later results have been validated by Linear Programming method.

**3.0 Results**

In this data is collected through the experts and authorized official websites of real estate regulatory authority. Here details of Maharashtra

and Gujarat states has been taken out through their annual reports published by respective state authorities during the year 2017-18, just after immediate implementation of RERA, 2016. The various indicators of real estate management are sorted with relevant statistics to respond.

**3.1 Charnes Cooper Rhodes (CCR) Model for MahaRERA**

Here Data Envelopment Analysis method is applied with the help of data as shown in table 2.

Table 2: DMU's for MahaRERA

Sr. No.	Project Registration	Agent Registration	Dispute Cases Filed	Appeals	Average Time for Registration
Input	16565	14235	2229	106	30
Output	16188	14044	1273	70	16

(Source: Maharashtra Real Estate Regulatory Authority, Annual Report – 2017-18)

After applying DEA solver following results have been drawn including performance efficiency is as shown in table 3 and optimum efficiency (input – output graph) are as shown in figure 2.

Table 3 Performance Efficiency of MahaRERA

DMU No	DMU Name	Input Oriented CRS Efficiency	Sum of Lambdas	RTS	Optimal Lambdas with Benchmark	
1	Project Registration	0.99053	1.153	Decreasing	1.153	Agent Registration
2	Agent Registration	1.00000	1.000	Constant	1.000	Agent Registration
3	Dispute Cases Filed	0.57888	0.091	Increasing	0.091	Agent Registration
4	Appeals	0.66936	0.005	Increasing	0.005	Agent Registration
5	Average Time For Registration	0.54059	0.001	Increasing	0.001	Agent Registration

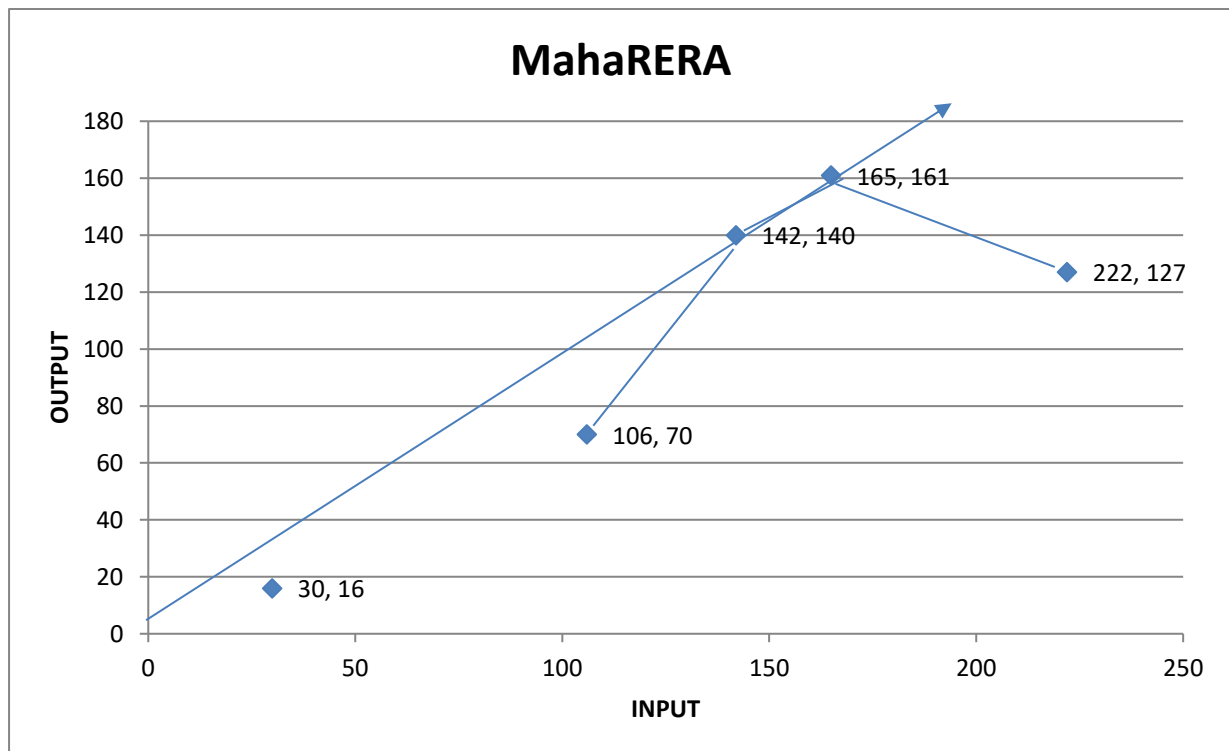


Figure 2: Optimum Efficiency of MahaRERA

### 3.2 Charnes Cooper Rhodes (CCR) Model for GujRERA

The Data Envelopment Analysis method is applied with the help of following data is as shown in table

4. After applying DEA solver following results have been drawn including performance efficiency are as shown in table 5 and optimum efficiency (input – output graph) is as shown in figure 3.

**Table 4: Data for GujRERA**

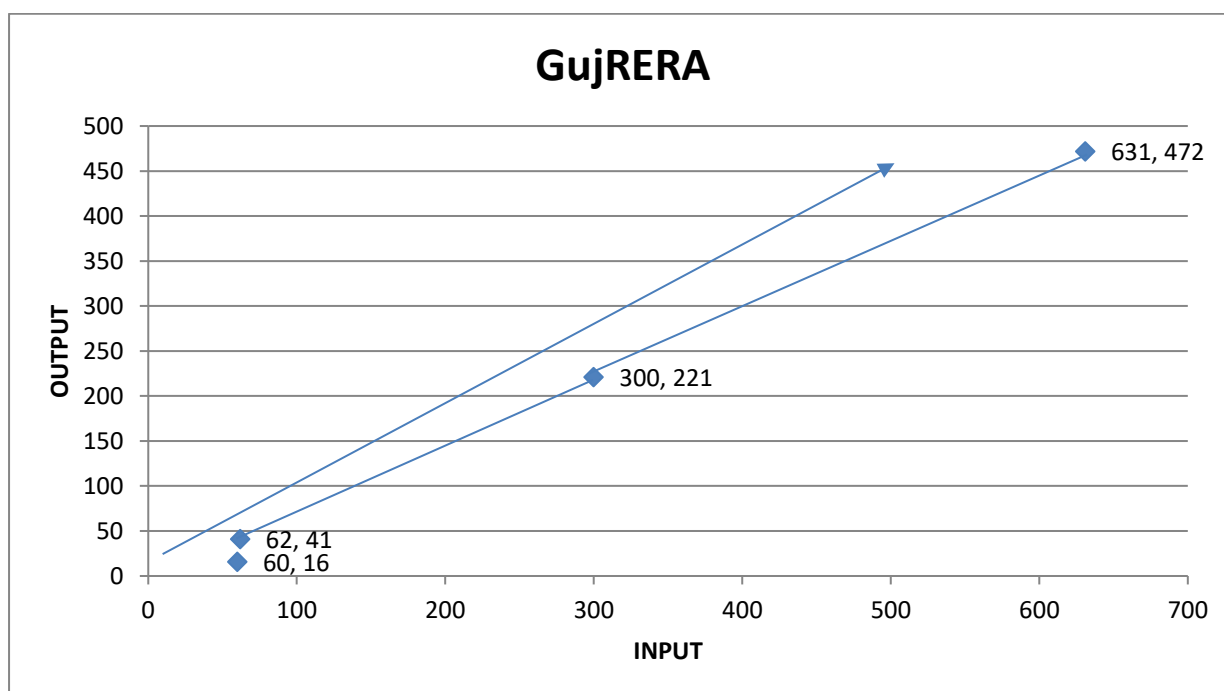
Sr. No.	Project Registration	Agent Registration	Dispute Cases Filed	Average Time for Registration
<b>Input</b>	<b>3000</b>	<b>631</b>	<b>62</b>	<b>60</b>
<b>Output</b>	<b>2215</b>	<b>472</b>	<b>41</b>	<b>16</b>

(Source: Gujarat Real Estate Regulatory Authority, Annual Report – 2017-18)

After applying DEA solver following results have been drawn including performance efficiency in table 5 and optimum efficiency (input – output graph) as in figure 3.

**Table 5: Performance Efficiency of GujRERA**

DMU No.	DMU Name	Input-Oriented CRS Efficiency	Sum of lambdas	RTS	Optimal Lambdas with Benchmarks	
1	Project Registration	0.98705	4.693	Decreasing	4.69	Agent Registration
2	Agent Registration	1.00000	1.000	Constant	1.00	Agent Registration
3	Dispute Cases Filed	0.88406	0.087	Increasing	0.08	Agent Registration
4	Average Time for Registration	0.35650	0.034	Increasing	0.03	Agent Registration



**Figure 3: Optimum Efficiency of GujRERA**

**3.3 Banker Charnes Cooper Model (Combined for MahaRERA & GujRERA)**

Here Data Envelopment Analysis method is applied with the help of data as shown in table 6

**Table 6: Combined for MahaRERA & GujRERA**

Sr.No.	Parameters	Input MH	Input GUJ	Output MH	Output GUJ
1	Project Registration	16565	3000	16188	2215
2	Agent Registration	14235	631	14044	472
3	Dispute Cases Filed	2229	62	1273	41
4	Average Time for Registration	30	60	16	16

After applying DEA solvers following results have been drawn including performance efficiency in table 7.

**Table 7: Performance Efficiency of MahaRERA & GujRERA**

DMU No.	DMU Name	Input-Oriented CRS Efficiency	Sum of lambdas	RTS	Optimal Lambdas with Benchmarks	
1	Project Registration	1.00000	1.000	Constant	1.000	Project Registration
2	Agent Registration	1.00000	1.000	Constant	1.000	Agent Registration
3	Dispute Cases Filed	0.92252	0.091	Increasing	0.091	Agent Registration
4	Average Time for Registration	1.00000	1.000	Constant	1.000	Average Time for Registration

**3.4 Linear Programming**

A linear program can have an objective of either minimization or maximization, while its constraints can have any combination of linear inequalities and equalities. When using CCR model to analyze

the policy performance of real estate regulation, the first thing that should be solved is how to make a decision-making unit.

**3.4.1 Linear Programming to MahaRERA DMU's -**

Sr. No.	Project Registration	Agent Registration	Dispute Cases Filed	Appeals	Average Time for Registration
Input	16565	14235	2229	106	30
Output	16188	14044	1273	70	16

(Source: Maharashtra Real Estate Regulatory Authority, Annual Report 2017-18)

**Solving by Simplex Method**

$$\text{Max } Z = x_1 + x_2 + x_3 + x_4 + x_5$$

$$\text{S.t. } 16565 x_1 \leq 16188$$

$$14235 x_2 \leq 14044$$

$$2229 x_3 \leq 1273$$

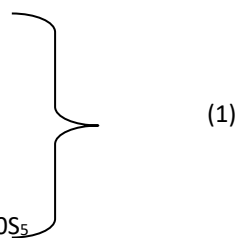
$$106 x_4 \leq 70$$

$$30 x_5 \leq 16$$

$$\text{Max } Z = x_1 + x_2 + x_3 + x_4 + x_5 + 0S_1 + 0S_2 + 0S_3 + 0S_4 + 0S_5$$

$$\text{S.t. } 16565 x_1 + S_1 = 16188$$

$$14235 x_2 + S_2 = 14044$$



$$2229 x_3 + S_3 = 1273$$

$$106 x_4 + S_4 = 70$$

$$30 x_5 + S_5 = 16$$

Solving above we get,

$$X_1 = 0.9772$$

$$X_2 = 0.9864$$

$$X_3 = 0.5716$$

$$X_4 = 0.6604$$

$$X_5 = 0.5337$$

### 3.4.2 Linear Programming to GujRERA DMU's -

Sr. No.	Project Registration	Agent Registration	Dispute Cases Filed	Average Time for Registration
Input	3000	631	62	60
Output	2215	472	41	16

(Source: Gujarat Real Estate Regulatory Authority, Annual Report – 2017-18)

#### Solving by Simplex Method

$$\text{Max } Z = x_1 + x_2 + x_3 + x_4$$

$$\text{S.t. } 3000 x_1 \leq 2215$$

$$631 x_2 \leq 472$$

$$62 x_3 \leq 41$$

$$60 x_4 \leq 16$$

$$\text{Max } Z = X_1 + X_2 + X_3 + X_4 + 0S_1 + 0S_2 + 0S_3 + 0S_4$$

$$\text{S.t. } 3000 x_1 + S_1 = 2215$$

$$631 x_2 + S_2 = 472$$

$$62 x_3 + S_3 = 41$$

$$60 x_4 + S_4 = 16$$

Solving above we get,

$$X_1 = 0.7383$$

$$X_2 = 0.7480$$

$$X_3 = 0.6613$$

$$X_4 = 0.2667$$

Performance efficiency of various administrative parameters have been evaluated for the state of Maharashtra & Gujarat and further compared with each other irrespective of their real estate regulatory authorities is as shown in table 8. In this case the real estate regulation is neither with any affects as some public opinions in the early time, nor that with great success as claimed by some officials?

**Table 8: Comparison of Performance Efficiency of MahaRERA & GujRERA**

Sr. No	Indicators/DMUs	Performance Efficiency	
		MahaRERA	GujRERA
1	Project Registration	0.99053	0.98705
2	Agent Registration	1.00000	1.00000
3	Dispute Cases Filed	0.57888	0.88406
4	Appeals	0.66936	--
5	Average Time for Registration	0.54059	0.35650

Further the performance efficiency of said administrative parameters of real estate regulations in the states of Maharashtra and Gujarat have been again evaluated by using linear programming - Simplex method. Later it was compared to validate as shown in table 9. It is clear from above the results that DEA method has been validated through Simplex method of Linear Programming.

**Table 9: Performance Efficiency by DEA Solver & Simplex Method**

Sr. No	Regulatory Authority	Indicators/DMUs	Performance Efficiency	
			DEA Model	Simplex Method
1	MahaRERA	Project Registration	0.9905	0.9772
2		Agent Registration	1.0000	0.9864
3		Dispute Cases Filed	0.5788	0.5716
4		Appeals	0.6693	0.6604
5		Average Time for Registration	0.5405	0.5337
1	GujRERA	Project Registration	0.9870	0.7383
2		Agent Registration	1.0000	0.7480
3		Dispute Cases Filed	0.8840	0.6613
4		Appeals	--	--
5		Average Time for Registration	0.3565	0.2667

**4.0 Discussions**

The study have been developed a Charnes Cooper Rhodes (CCR) Model for various key administrative parameters employed by MahaRERA and GujRERA authorities. Also a Banker Charnes Cooper (BCC) Model has been developed which shows the combined efficiency of various administrative parameters employed by MahaRERA and GujRERA authorities respectively. It has been found that the performance efficiency of Project Registration with a positive value of 0.99053 for MahaRERA where as 0.98705 for GujRERA. Similarly Agent Registration values were found to be 1.00 for both the state authorities. Dispute cases filed were found to be 0.57888 for MahaRERA where as 0.88406 for GujRERA. Appeals were raised and resolved with an efficiency of 0.66936 in case of MahaRERA faster than GujRERA. Average time for the registration was found to be 0.54059 for MahaRERA where as 0.35650 for GujRERA. The CCR model predicts the efficiency range of key indicators in the form of parameters that shows differential results on variables considered in the study. The difference in the efficiency level allows us to think further on these findings and question the appropriateness of key parameters of this new reform as it is impacting promoters and real estate agents.

However, it would be interesting to investigate further with more & more statistics not only of the same states but of different states in the country. This highlights the fact that the impacts of administrative parameters of the respective states are very crucial to impart the effectiveness of reforms.

**5.0 Conclusions**

The study on the evaluation of performance efficiency of various key administrative parameters in the state of Maharashtra and Gujarat determined that inclusion of MahaRERA, 2017 & GujRERA, 2017 under the act RERA, 2016 has impacted the real estate promoters & agents live business operations. It has been investigated that the real estate regulation is neither with any affect as some public opinions in the early time, nor that with great success as claimed by some officials. As professional and cultural business practices are likely to vary in different regions; regional impact of the RERA, 2016 in other states of the country needs further study to support the conclusive evidences presented in this study. The role of administration particularly in case of government becomes very important to facilitate the implementation of reforms to get smooth functioning and growth of real estate sector.

**Declaration of interest statement**

This study was carried out as a part of independent unfunded Ph.D research work and does not have any vested political or business interest in the operations of the real estate industry of the states of Maharashtra or Gujarat or any other cities of India.

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