Chapter 7

Cross Case Analysis

7.1 Introduction

This chapter presents the Cross Case analysis for Gujarat and Rajasthan along with the findings. In this chapter, similarities and dissimilarities between two case studies are presented. The findings from two case studies are compared on identified Barrier and Challenges. The table and figures presents the conclusive findings on State's response to the role of identified Barriers and Challenges found in Chapter 3.

7.2 Similarities and dissimilarities between cases

Table 7-1 presents the comparison of two States on the basis of their fact file.

Table 7-1 Cross Case findings on fact file of Gujarat and Rajasthan

S.No.	Parameters	Gujarat	Rajasthan
1	State Capital	Gandhinagar	Jaipur
2	Area (Sq. km)	1,96,024	3,42,239
3	Population(2011 Census)	6.04 Crores	6.86 Crores
4	Population Density(per Sq.Km)	308 persons	201persons
5	Districts	26	33
6	Average GSDP growth rate (%)	16 %	17.9 %
7	Sex Ratio (2011 Census)	917 females per '000 males	926 females per '000 males
8	Key Industries	Textiles, Engineering, Petrochemicals, Drugs &	Mineral Based Industries, Textiles, Tourism, Gem

		Pharmaceuticals, Dairy and Jewelry, Dimensional Stones.	and Jewelry, Dimensional stones, Agro Processing
9	**Fiscal Deficit to GSDP (2012-13)**	-2.61 %	-2.81 %
10	**Literacy Rate**	79.3 %	67.07 %

The State capital for Gujarat and Rajasthan are Gandhinagar and Jaipur respectively. The total area covered by Rajasthan is almost 1.5 times of Gujarat, but they have similar population size.

According to Census of 2011, Gujarat had larger population density per square kilometer as compared to Rajasthan whereas, the gender ratio show similar patterns. Also it is revealed that Gujarat as a State has a higher literacy rate in comparison to Rajasthan. The key industries are different in both States. Rajasthan has higher GDSP growth rate as well as fiscal deficit than that of Gujarat.

Table 7-2 shows different companies in power sector in two states, it is seen that Gujarat has a holding company called GUVNL under which there is one Generation and Transmission Company, along with it there are four Distribution Companies. Rajasthan also has one Generation and Transmission Company but three Distribution companies but no holding company as such.

Table 7-2 Power Sector Structure in Gujarat and Rajasthan

Functions	Gujarat	Rajasthan
Holding Company	GUVNL - Gujarat Urja Vikas Nigam Ltd.	-
Generation Company	GSECL - Gujarat State Electricity Corporation. Ltd	RVUN - Rajasthan Rajya Vidyut Utpadan Nigam Ltd.
Transmission Company	GETCO - Gujarat Energy Transmission Corporation. Ltd	RVPN - Rajasthan Rajya Vidyut Prasaran Nigam Ltd
Distribution	UGVCL - Uttar Gujarat Vij	JVVNL - Jaipur Vidyut

Company	Company Ltd.	Vitran Nigam Ltd.,
	DGVCL - Dakshin Gujarat Vij Company Ltd.	AVVNL - Ajmer Vidyut Vitran Nigam Ltd.
	MGVCL - Madhya Gujarat Vij Company Ltd.	JdVVNL - Jodhpur Vidyut Vitran Nigam Ltd.
	PGVCL - Paschim Gujarat Vij Company Ltd.	

Table 7-3 shows the different sources for electricity generation in two States. It is evident that Gujarat has higher generation capacity through all sources, except Biomass, whereas Rajasthan lack electricity generation through Mini Hydel. It is noticed that Gujarat has almost twice the installed capacity than Rajasthan in solar power generation. The important difference is that, in Gujarat, total capacity for solar power has been installed under Gujarat Solar Policy whereas in Rajasthan, the total capacity has been installed under JNNSM, which is a Central Government Policy.

Table 7-3 Sources of electricity generation in Gujarat and Rajasthan

Fuel	**Gujarat**		**Rajasthan**	
	Capacity MW	**Share %**	**Capacity MW**	**Share %**
Hydro	779	3.50	1548	11
Lignite	1040	4.65	251	1.79
Coal	11720	52.34	7687	54.62
Atomic	559	2.50	573	4.1
Gas	4172	18.62	775	5.51
Wind	3231	14.42	2683	19.1
Biomass	31	0.14	106	0.8
Mini Hydel	7	0.03	-	-
Solar	857	3.82	443 (Under JNNSM)	3.2
Total	**22396**	**100**	**14059**	**100%**

Table7-4 shows the comparison of State specific Solar Policy for Gujarat and Rajasthan. It is evident from the information that Gujarat has more robust policy than Rajasthan (as discussed in chapter 5 and 6), as a result of which Gujarat has maximum installed capacity in its region whereas Rajasthan lacks the merit to attract developers.

Table 7-4 Details of State Solar Policy of Gujarat and Rajasthan

S.No	Parameters	Gujarat	Rajasthan
1	**Policy Name**	Solar Power Policy 2009	Rajasthan Solar Energy Policy 2011
2	**Operative Period**	2009-2015	2011-Till further announcement
3	**Capacity Planned**	500 MW	200 MW- Phase 1 (till 2013)
			400 MW -Phase 2 (till 2017)
4a	**Tariff from 2009-12 (₹)**	15.00 (1st to 12th years) (from the COD) 5.00 (13th to 25th year)	Plant commissioned by 31 Mar 2014 9.63 without AD 8.42 (with AD)
4b	**Tariff from 2012-15 (₹)**	For MW Scale Plants**:** **Jan 2012-March 2013:** 10.37 (Without AD*), 09.28 (With AD), **FY 2013-14:** 9.64 (Without AD), 8.63 (With AD), **FY 2014-15**: 8.97 (Without AD), 8.03 (With AD)	
5	**Category / Types of Projects**	Category 1 - Competitive bidding	Category 1 - Competitive Bidding
		Category 2 - Feed in Tariff	Category 2 - Captive /Open Access
		Category 3 - Open Access	Category 3 - REC
		-	Category 4 - JNNSM
			Category 5 - RPSSGP

6	**Installed Capacity as of 2013**	865 MW	443 MW (JNNSM)
7	**Off Taker**	GUVNL	Rajasthan DISCOM
8	**Radiation kWh/m^2 / day**	6.5-7	6.5-7
9	**Nodal Agency**	GEDA	RRECL
10	**Other Incentives**	Exemption from Demand cut upto 50%	Eligible for incentives under Industrial policy
		Electricity Duty Exemption	Electricity Duty Exemption
		Cross subsidy surcharge not applicable	

*AD – Accelerated Depreciation

Table 7-5 presents the RPO to be fulfilled by States through solar.

Table 7-5 Solar RPO for Gujarat and Rajasthan

Year	**RPO Solar Obligation**	
	Gujarat	**Rajasthan**
2010-11	0.25%	-
2011 - 12	0.5%	0.5%
2012 -13	1%	0.75%
2013 - 14	-	1%

Table 7-6 shows the comparison of tariff announced by two SERC's for grid connected solar PV power plants to be commissioned on or before 31-3-2015. The significant difference in tariff announced by two SERC's is that Gujarat is offering Feed in Tariff [37] whereas Rajasthan ask for competitive bids from bidders upon the Tariff announced.

[37] *A renewable energy policy that offers a guarantee of payment to renewable energy developers for the electricity they produce. Also called fixed-price policies, minimum price policies, feed laws, feed-in laws, renewable and energy dividends*

Table 7-6 Details of Solar PV Tariff in two States

Category	Gujarat		Rajasthan	
	Tariff without AD* benefit	**Tariff with AD benefit**	**Tariff without AD benefit**	**Tariff with AD benefit**
Solar (PV) commissioned by 31.3.2012	Feed in Tariff (FiT) (₹ / kWh) (*AD not applicable*)		Competitive Bidding (₹ /kWh)	
	15.00 (1^{st} to 12^{th} years) (from the COD)	5.00 (13^{th} to 25^{th} year)	15.32	13.19
Solar (PV) commissioned by 31.3.2014	9.64	8.63	9.63	8.42
Solar (PV) commissioned by 31.3.2015	8.97	8.03	-	-

*AD – Accelerated Depreciation

7.3 Cross Case analysis on Identified Barriers and Challenges

The following section presents similarity and dissimilarity among Gujarat and Rajasthan on identified Barrier and Challenges. The basis for Cross Case analysis has be drawn from the responses given in each State and Within Case analysis done for both case studies. The comparisons have been shown through a Venn diagram, the intersection of diagram represents common responses whereas different opinions are presented on left and right side of diagram presenting Gujarat and Rajasthan respectively.

7.3.1 Cross Case Findings on Financial Barrier

The following figure 7-1 shows the comparisons between two States on Financial Barrier. It is evident from the Venn diagram that both States had

similar responses to Financial Barrier. The developers faced similar kind challenges for getting their projects funded from banks or financial institutes. The most common features of financing project adopted by developers across States were through Self-financing or they looked for Equity investors to fund their project. The banks provided short term loan to developers, but heisted in funding project. Some developers did get their projects funded by the banks but money was loaned largely after projects had started its operations, as it assured them of payment security through revenue inflow for the project.

The banks mostly preferred to lend money at higher rate of interest at which it became difficult for developers to attain project feasibility. The developers tried to cut cost on various like human resource, engineering and modules, even the developers used self-manufactured PV modules to attain early break even.

According to responses it was clear that banks were funding the manufacturing industries in solar sector but refrained from financing grid connected solar PV power plants. The banks did their Due Diligence to assess the feasibility of project, which normally takes 6-12 months processing time, which is apparently more than the gestation period for execution of grid connected solar PV power plants. Few projects were commissioned before a bank could complete its due diligence process.

Hence from the experiences shared by different respondents from both States, it is evident that, Gujarat and Rajasthan had no significant response to the role of Financial Barrier.

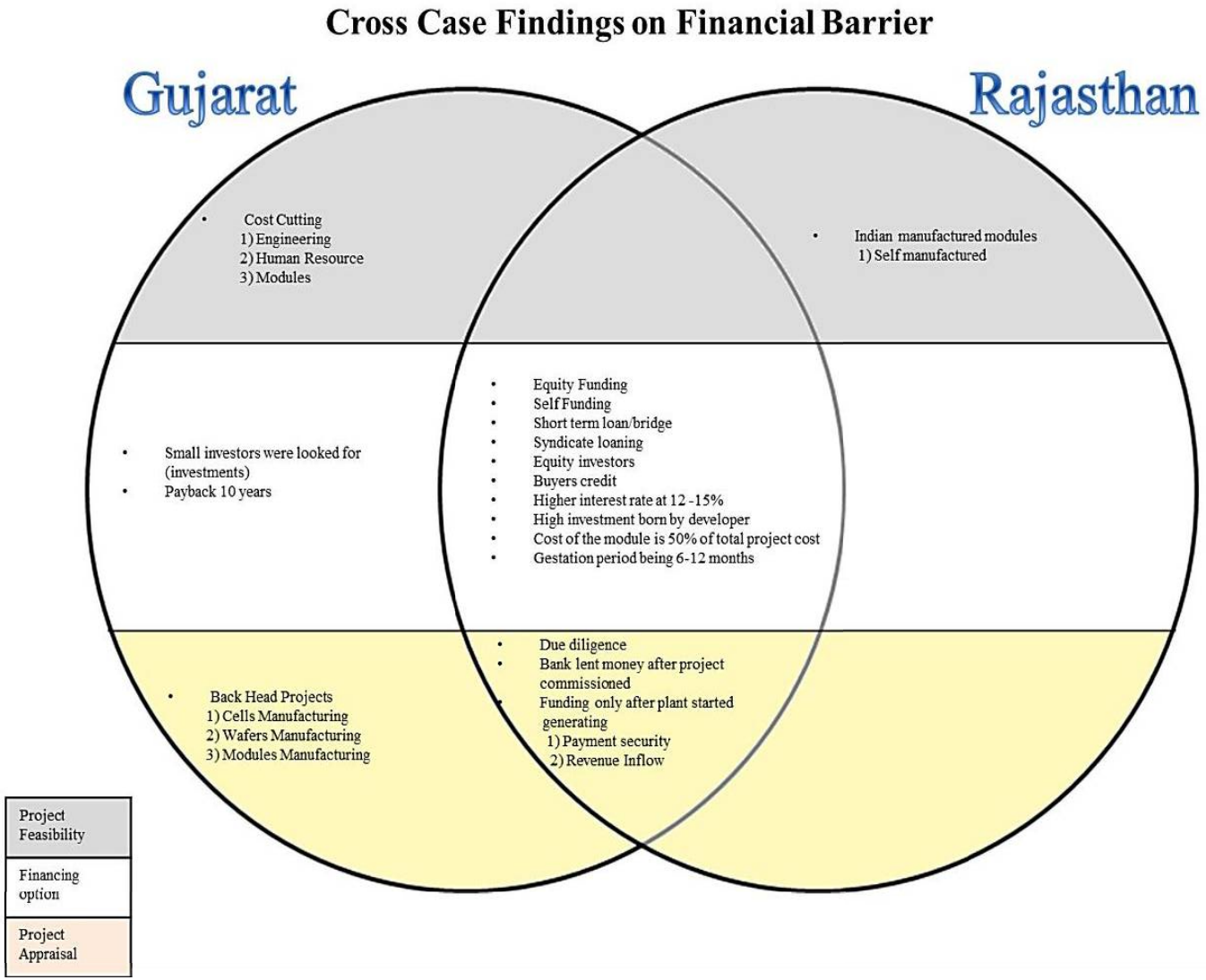

Figure 7-1 Cross Case Findings on Financial Barrier

7.3.2 Cross Case Findings on Policy and Political Barrier

The following figure 7-2 shows the comparisons between two States on Policy and Political Barrier. It is evident from the Venn diagram that Gujarat was proactive in promoting the solar sector in its region. It was the first State to announce it solar policy named as Gujarat Solar Policy 2009 which was incidentally earlier than Central government policy named Jawaharlal Nehru National Solar Mission 2010. Later, Rajasthan declared its policy named as Rajasthan Solar Energy Policy 2011.

The respondents pointed out that Gujarat solar policy had much clarity in comparison to Central or Rajasthan solar policy. The local governance and administration in Gujarat was efficient and effective in nature which assisted the developers in timely execution of projects in the State.

Gujarat government showed strong political will to promote sector in its region. They took strong step to convince different stakeholder to win their trust. They promoted the policy at different platforms through conferences and meets. They even went on to set a meticulous example by developing Asia's 1st Solar Park. This Solar Park was promoted with strong supporting infrastructure like road connectivity water supply and grid connectivity.

Gujarat government backed up the Tariff with payment security mechanism, moreover, respondents shared through their experience that the authorities were efficient enough to make timely payments

In Rajasthan, developers had installed solar PV power plants under JNNSM and signed the PPA with NVVN. The nodal agency, RRECL facilitated developer on behalf of Central Government in the State.

Therefore they were no significant installations under Rajasthan Solar Policy.

The Central government chose and promoted Rajasthan to develop solar energy sector in country, though the national policy stood for whole country. The developers went for high DNI as result of which maximum installation came in Rajasthan. Moreover the State government had large barren land holdings and assisted developers with identification of government land at much economical prices as compared to Gujarat.

Central government strongly backed the Tariff through payment security mechanism named as Solar Payment Security Account (SPSA).

Hence it can be derived from the experiences shared by different respondents from both States that, Gujarat had significant response to the role of Policy and Political Barrier as compared to Rajasthan which had moderately significant response to the role of Policy and Political Barrier (The State Government helped in identification of government land).

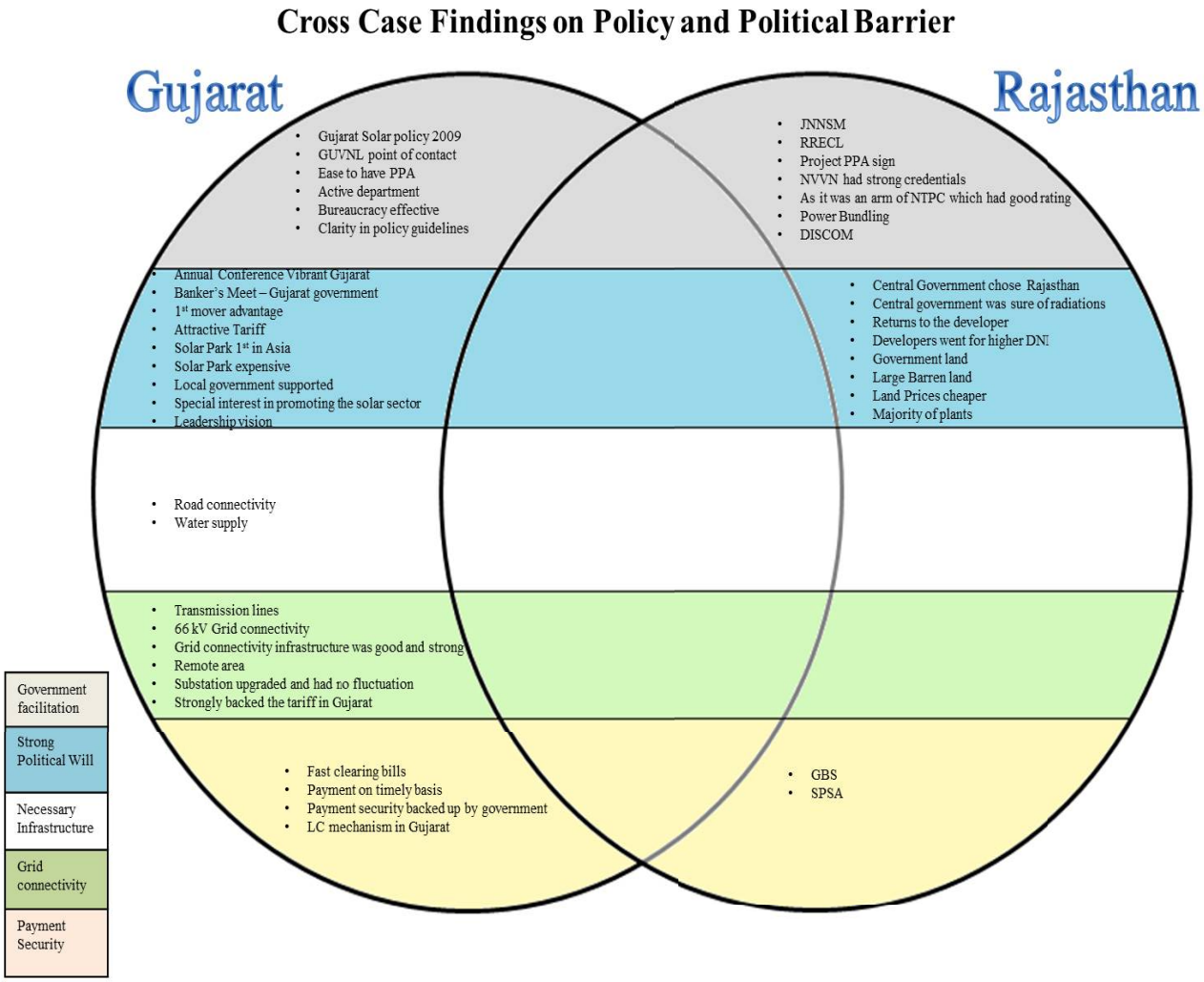

Figure 7-2 Cross Case Findings on Policy and Political Barrier

7.3.3 Cross Case Findings on Institutional Barrier

The following figure 7-3 shows the comparisons between two States on Institutional Barrier. It is evident from the Venn diagram that both States had similar experience to Institutional Barrier. The respondents stated that they faced issues related to availability of reliable and accurate solar radiation data for a specific location. This situation persisted across the States. The DNI data available was not dependable, as a consequence of which developers had to be dependent on different software to assess the radiations for a specific location. The software was designed by international agencies like Homer, PVsyst, and Meteonorm. Further the developers referred the data provided by NREL, NASA and IMD, but as they were not accurate they had to be double checked.

Most respondents expressed that, there is lack of skilled workforce, but that was manageable through on site and self-training. The average duration to train human resource was approximately 2-3 months.

Further respondents expressed that, there was limited R&D activities in country and they agreed that because of low level of R&D in country, it has not assisted them in any manner.

Few respondents in Gujarat stated that, their organization had signed MoU with some reputed academic institutes but it is in very nascent stage.

Hence it can be derived from the experiences shared by different respondents that, Gujarat and Rajasthan had no significant response to the role of Institutional Barrier in their respective regions.

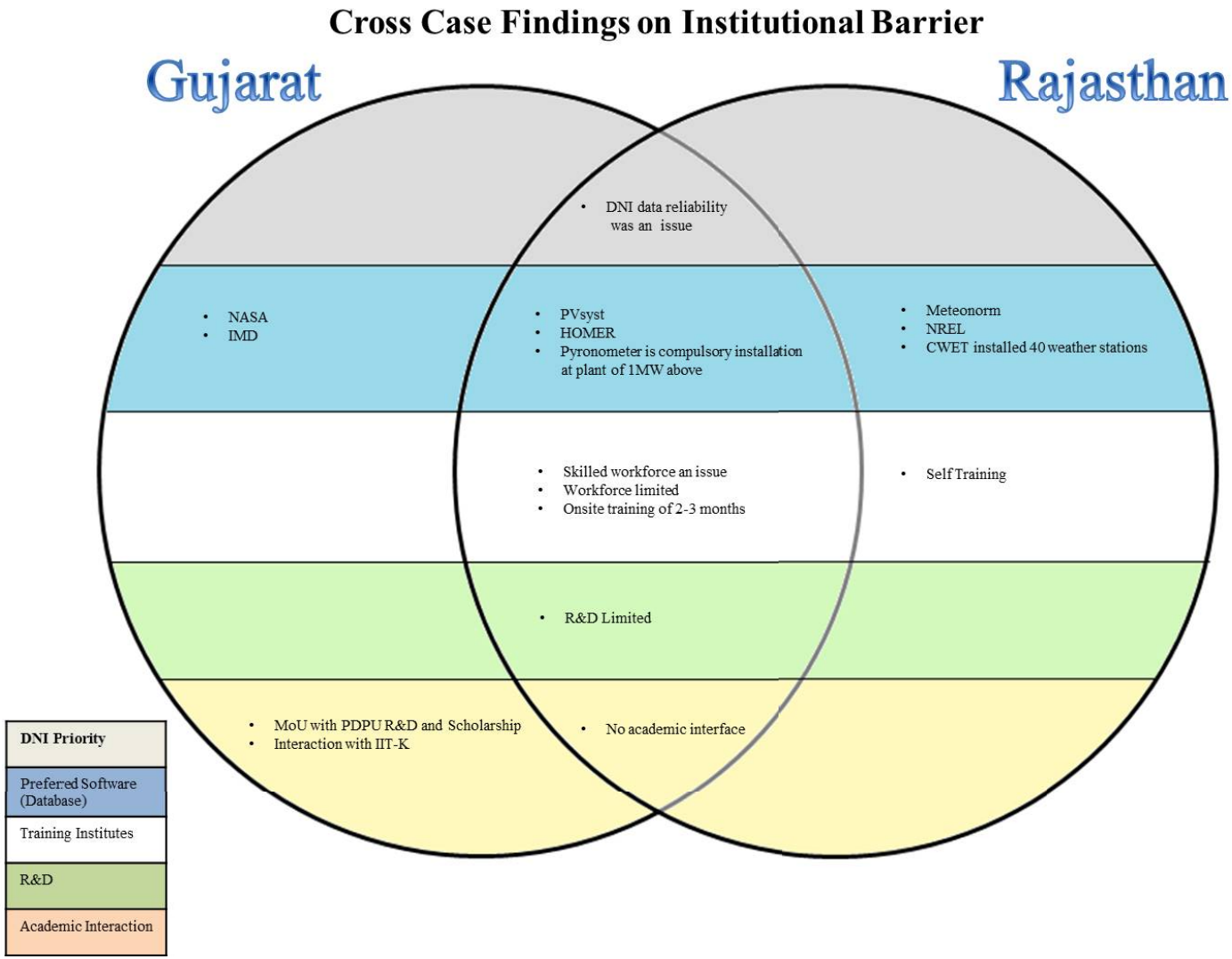

Figure 7-3 Cross Case Findings on Institutional Barrier

7.3.4 Cross Case Findings on Land Information Challenges

The following figure 7-4 shows the comparisons between two States on Land Information Challenges. Both the governments facilitated the developers with land banks which were under government holdings. It was learnt from respondents that local departments were active in providing necessary information on identified piece of land. The registrar was supportive and assisted the developers in their respective States.

Further it was learnt that Village Accountant plays a very important role on identification of potential land for grid connected solar PV power plants. Hence the experience shared by respective respondent in two States was positive.

In Gujarat 70% of grid connected solar PV installations have come up on private land whereas in Rajasthan maximum installations have come up on government land. Rajasthan had cheaper land which was available on 30 years lease. The information sort on the potential land was available with much help of Village Accountant and local departments which were efficient and effective.

Hence it can be derived from the experiences shared by different respondents from both that, Gujarat and Rajasthan had significant response to the role of Land Information Challenges in their respective regions.

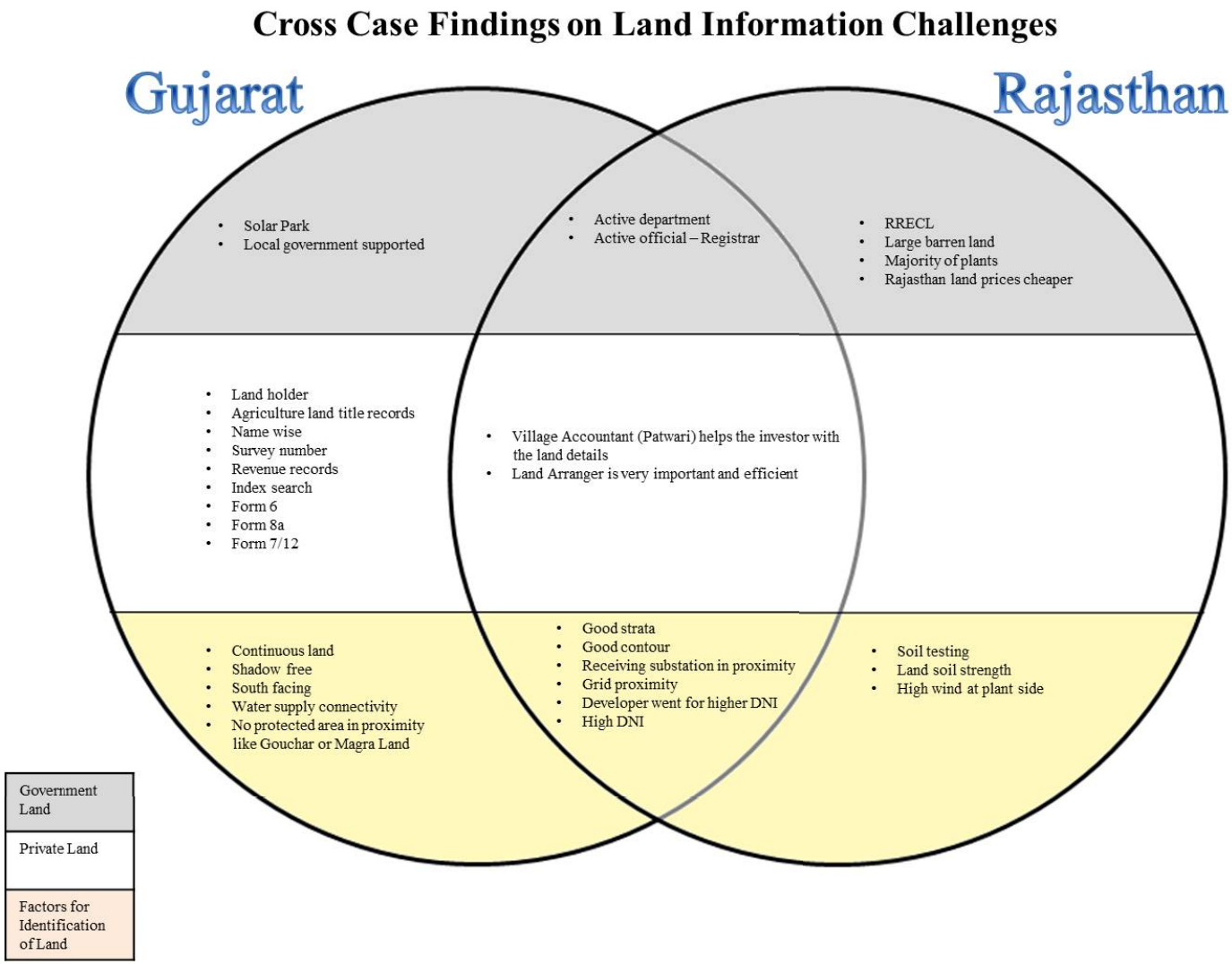

Figure 7-4 Cross Case Findings on Land Information Challenges

7.3.5 Cross Case Findings on Land Acquisition Challenges

The following figure 7-5 shows the comparisons between two States on Land Acquisition Challenges. According to responses gathered on Gujarat and through available secondary data, it was apparent that most of the grid connected solar PV power plants have come up on private land. Moreover, Gujarat government developed a Solar Park to assist developers. The ratio of grid connected solar PV installed capacity on government land as compared to private land was in the ration 1:3[38].

In the case of Rajasthan, government had identified land banks for developers. The nodal agency RRECL had a database which it shared with potential developers for executing grid connected solar PV projects. The government provided land on lease basis for 30 years + 10 years. This lease was very nominal in value, which helped developer to reduce the overall cost of project.

Village Accountant (Patwari) and land arranger played important role acquisition of private land as well as government land in both States.

Hence from the experiences shared by different respondents from both States, it is evident that, Gujarat and Rajasthan had significant response to the role of Land Acquisition Challenges in the respective States.

[38] *Solar Park has a total installed capacity of 224 MW whereas total installed capacity on private land is close to 650 MW.*

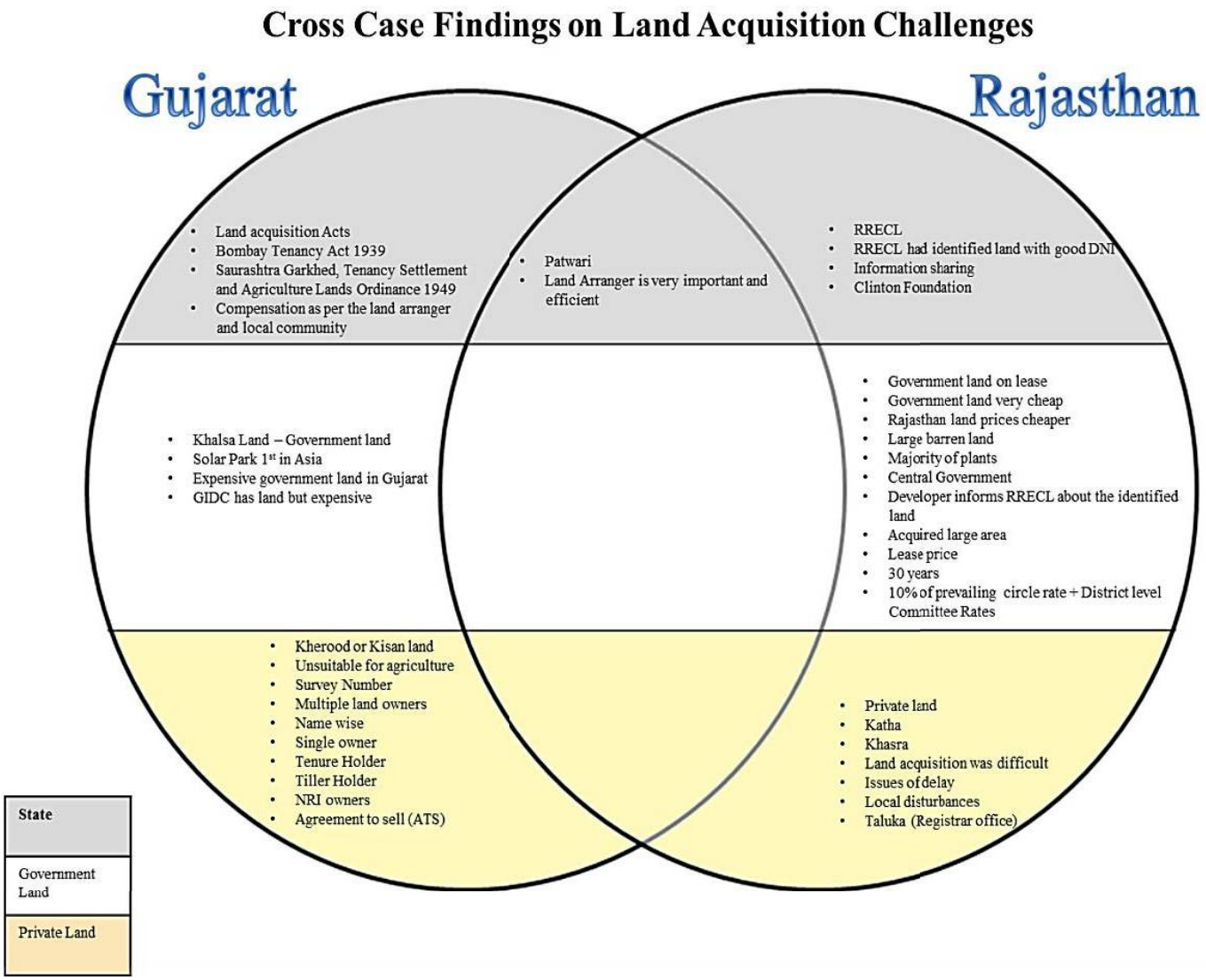

Figure 7-5 Cross Case Findings on Land Acquisition Challenges

7.3.6 Cross Case Findings on Administrative Challenges

The following figure 7-6 shows the comparisons between two States on Administrative Challenges. Respondents shared a positive experience on the administrative challenges in Gujarat. It was learnt from their responses that Gujarat had comparatively effective Single Window Clearance Mechanism (SWC). The government assisted the developer at all levels. The support provided by government to developers was very high and proactive.

The respondents expressed that bureaucracy and administration in Gujarat was strong. The clearances were provided on timely basis which helped developer to execute its project without much delay.

The Power Purchase Agreements (PPA) was successfully signed with Gujarat Urja Vikas Nigam Ltd (GUVNL). It made sure that developers were made payments on timely basis as per PPA signed.

The Registrar was proactive and supportive in processes of acquisition of private land in the State. Further, Industrial Commissioner played an important role in execution of projects.

According to experiences shared by respondents on Rajasthan on administrative challenges in State, it was learnt the State had provision of Single Window Clearance Mechanism (SWC), but it was time consuming as it was not fully implemented. The respondents further mentioned that RRECL had to seek clearances from Central Government on certain matters which apparently caused delays.

Further, respondents stated that, bureaucracy and administration was weak and time consuming. The clearances took time as a result of which the developers had to experience delays in execution of their project.

The Power Purchase Agreements (PPA) was successfully signed with NVVN. It made sure that developers were made payments on timely basis as per PPA signed.

Hence from the experiences shared by different respondents from both States, it is evident that, Gujarat had significant response to the role of Administrative Challenges, whereas Rajasthan had no significant response to the role of Administrative Challenges.

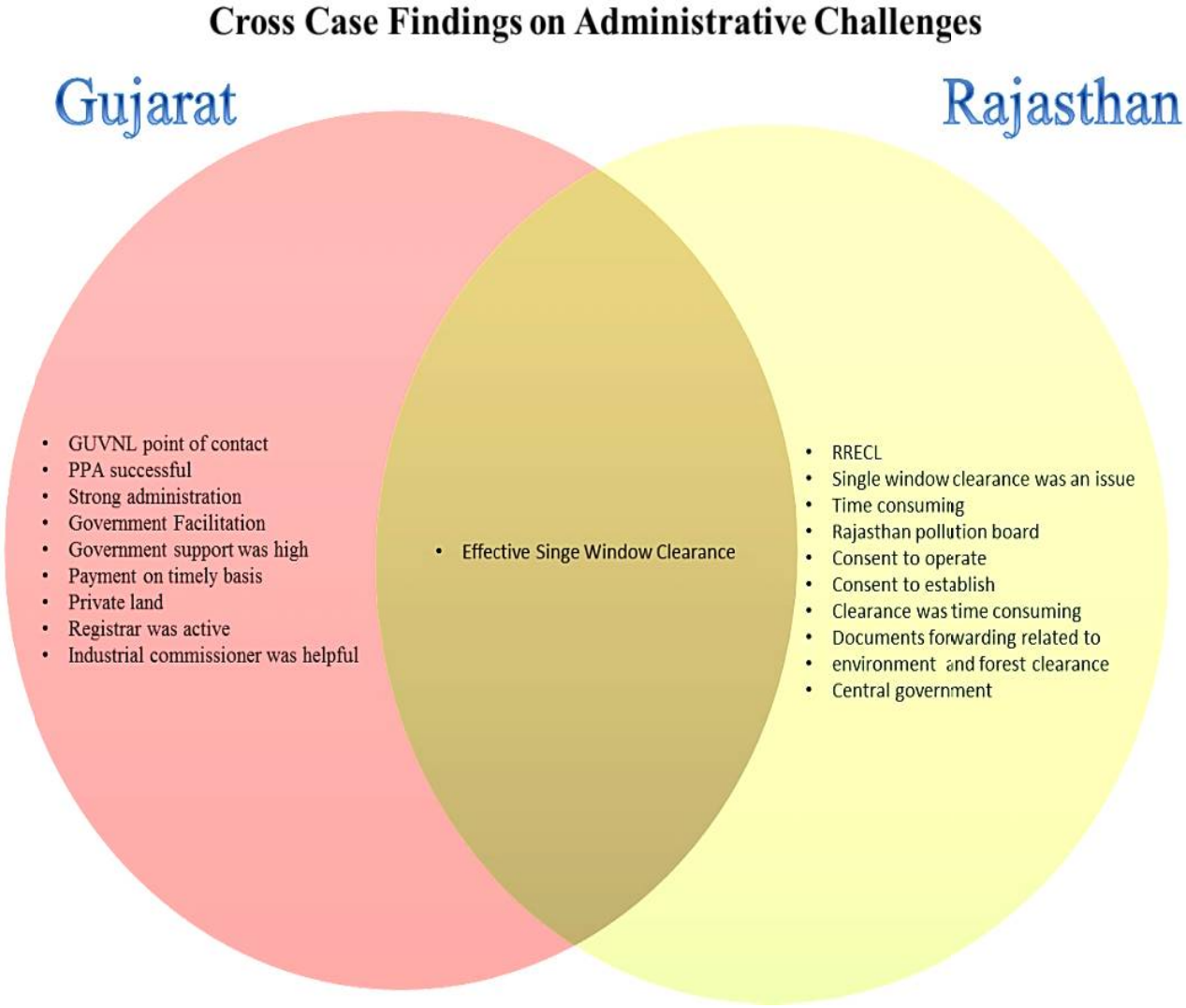

Figure 7-6 Cross Case Findings on Administrative Challenges

7.3.7 Cross Case Findings on Regulatory Barrier

The following figure 7-7 shows the comparisons between two States on Regulatory Barrier. The respondents showed positive response on Tariff offered by GERC which was higher as compared to any other policy. Moreover, Gujarat provided Feed in Tariff as compared to competitive tariff in Rajasthan under JNNSM.

Gujarat solar policy provided a front loaded tariff of ₹ 15 / kWh for first twelve years from commercial date of operation and rest thirteen years they will provided with ₹ 5 / kWh.

The grid connected solar PV power plants under JNNSM were selected after competitive bidding in Rajasthan. The respondents had expressed that the tariff which was discovered through competitive process had no negative impact on the sector, further it helped in price discovery and creating a competitive market.

Further, respondents added that competitive bidding made sure that serious players entered the market, new and efficient technologies were incubated.

Rajasthan as State had no role in regulation of sector as majority of grid connected solar PV power plants came under JNNSM through a competitive based tariff decided by CERC.

According to information on RRECL website a total number of seven solar projects have been allocated permission to install a total capacity of 75 MW under Rajasthan Solar policy. The lowest price discovered was ₹ 6.45 / kWh. According to the information available most of the bidders

have not taken up the projects so far due to low tariff discovered (RE Solve, 2013) which according to them is not feasible.

Hence it is learnt from the experiences shared by different respondents from both States that, Gujarat had significant response to the role of Regulatory Barrier, whereas Rajasthan had no significant response to the role of Regulatory Barrier.

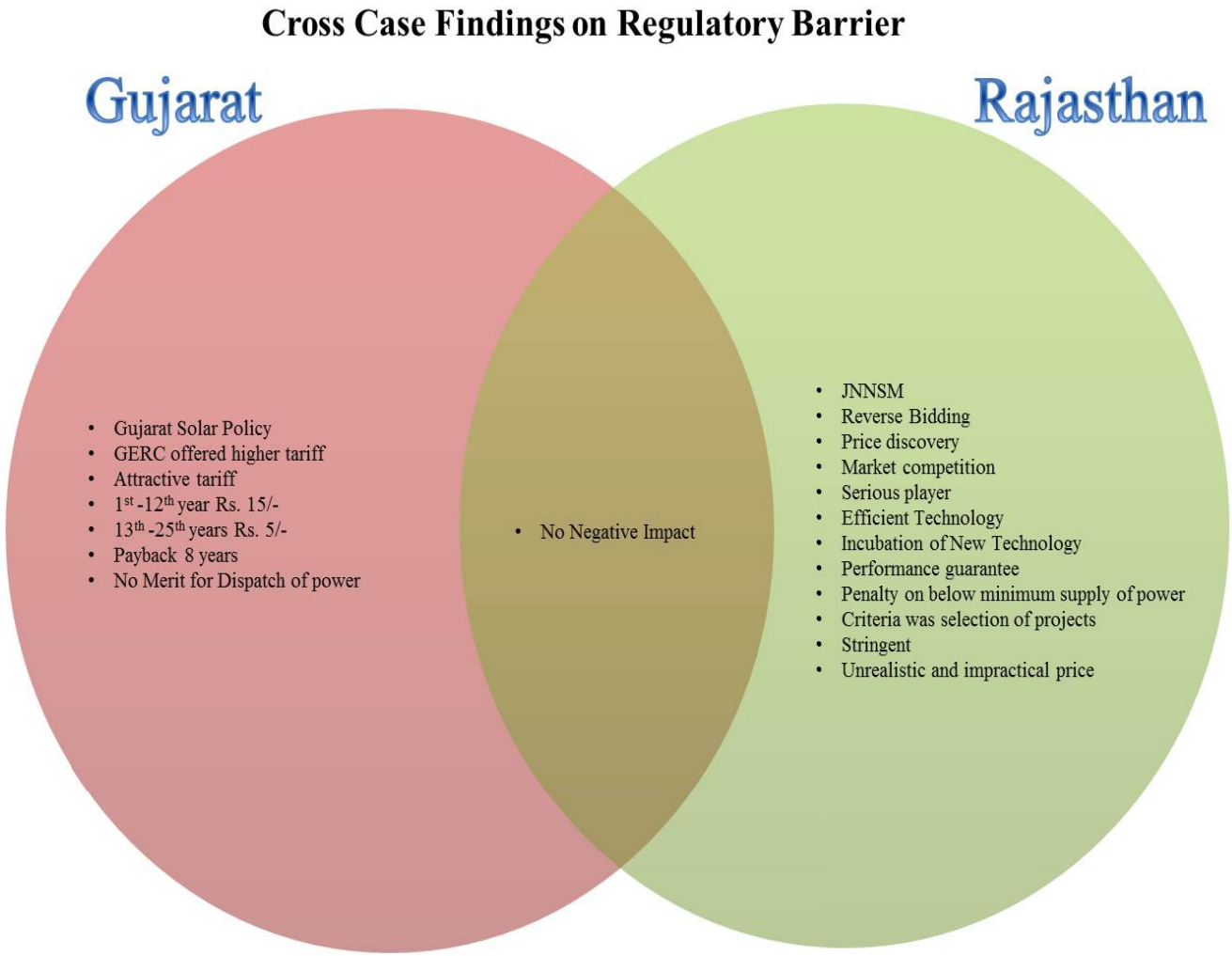

Figure 7-7 Cross Case Findings on Regulatory Barrier

7.3.8 Cross Case Findings on Market and Technology Barrier

The following figure 7-8 shows the comparisons between two States on Market and Technology Barrier. The respondents faced similar situation across the States. Respondents communicated that solar market in India is not matured enough to compete with international market. The developers imported Crystalline and Thinfilm PV modules from different countries, as they did not find Indian manufactured modules to be feasible.

Further, respondent cleared that, they had very little choice to make among Indian PV manufacturers along with it, there were issues related to low efficiency of PV modules as compared to imported modules.

The respondents explained that developers were interested in importing modules as well as related equipment (such as inverters, cables) from different countries. Crystalline PV modules were mostly imported from China followed by Japan and Canada whereas Thinfilm PV modules were imported from USA.

Gujarat has the advantage of having ports which helped the developers to reduce the overall cost of project. The respondents stated that executing a grid connected solar PV power plant is more of logistics management than construction. The logistics contributes to 1% - 2% of total project cost. In case of Rajasthan the logistic cost increased by 10% - 15% as compared to Gujarat.

The respondent stated that companies have their quality assessment teams with a set of internal parameters to rate the modules and equipment which are imported. The buyer takes a feedback from other companies who have already bought the same modules and equipment from same manufacturer.

This helps them to have a quality check for the technology. The manufacturing companies mostly provide 25 years of guarantee to buyer.

Hence it is understood from the experiences of different respondents from both States that, Gujarat and Rajasthan had no significant response to the role of Market and Technology Barrier.

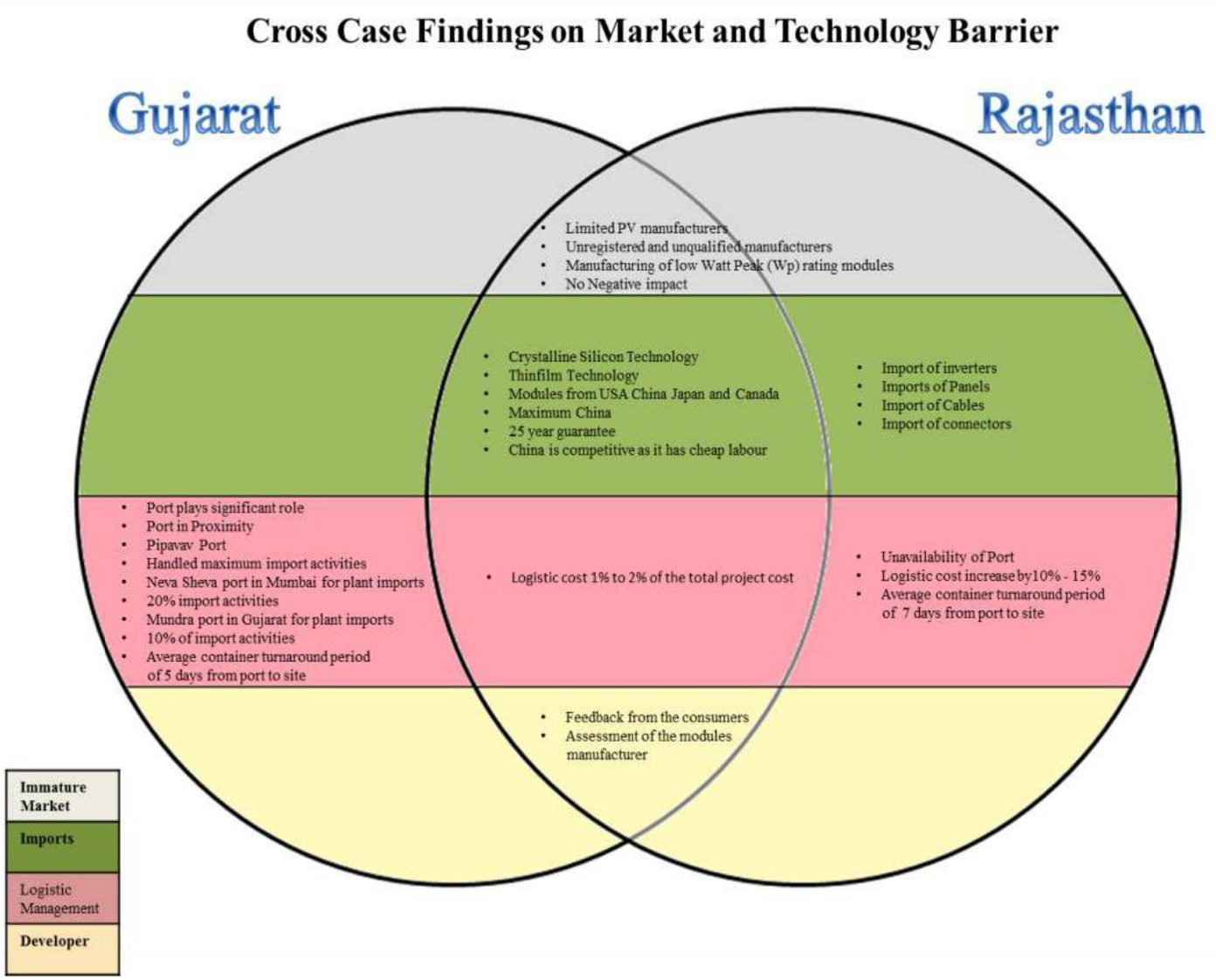

Figure 7-8 Cross Case Findings on Market and Technology Barrier

7.3.9 Cross Case Findings on Development Cost Barrier

The following figure 7-9 shows the comparisons between two States on Development Cost Barrier. The respondents informed that development cost are a very small part of total project cost hence, it had no negative impact on execution or operation of the project.

It is evident from the experiences shared by different respondents in both States that, Gujarat and Rajasthan had no significant response to the role of Development Cost Barrier.

Hence it was negated by the respondents in these respective States.

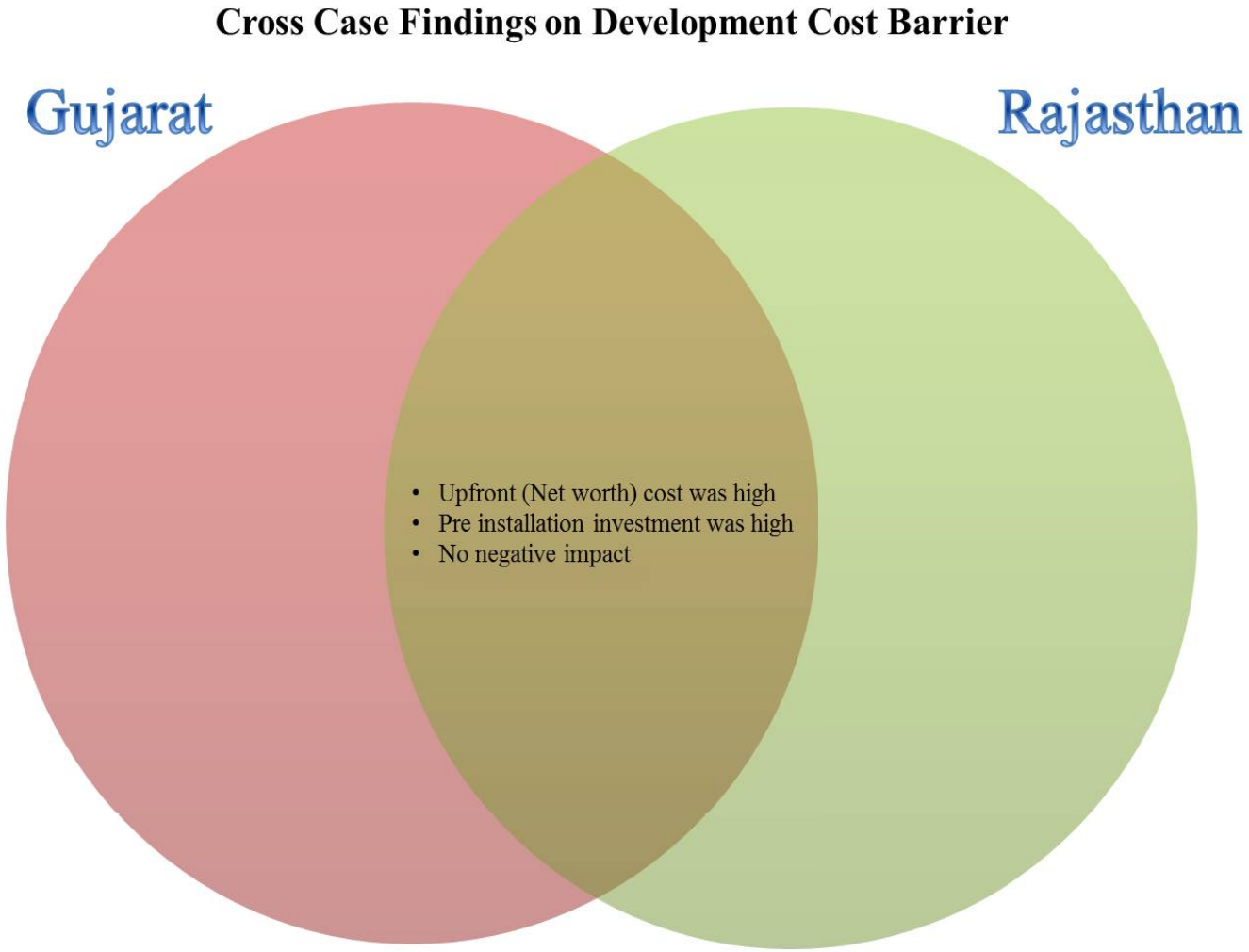

Figure 7-9 Cross Case Findings on Development Cost Barrier

7.4 Epilogue

This chapter presented the cross case analysis for two case studies namely Gujarat and Rajasthan. It is evident from the analysis that Gujarat had significantly responded to the roles of Policy and Political Barrier, Land Information Challenges, Land Acquisition Challenges, Administrative Barrier and Regulatory Barrier. Whereas, Gujarat failed to significantly respond to the roles of Financial Barrier, Institutional Barrier and Market and Technology Barrier.

In case of Rajasthan it is found that it had significant response to the role of Land Information and Land Acquisition Challenges, moreover, it had moderately significant response to the role of Policy and Political Barrier as it had helped the developers in identification of government land for executing their projects. Whereas, Rajasthan failed to significantly respond to the role of Financial Barrier, Institutional Barrier, Administrative Barrier, Regulatory Barrier and Market and Technology Barrier.

The Development Cost Barrier was negated by the respondent in these two States as discussed in Chapter 3.

This completes the cross analysis for two case studies. The next Chapter discusses the Conclusion and Recommendation.