

## 6.1 Introduction

Any organization with operational excellence can continuously improve itself in all aspect of performance such as profitability, decision-making, customer and partner services, ongoing investment, and human resources competences. The operational performance (OP) refers to a manufacturing plant's ability to create and deliver goods to consumers more quickly and cost-effectively (Zhu Sarkis, and Lai, 2008). One of the most common criteria used to gauge the effectiveness of OP is the cost. Later, the development and frequency of the new product introductions were also included (Ahmad and Schroeder, 2003). LEAN, Six Sigma, Kaizen are the major tools of waste reduction and are being increasingly used across all types of industries. LEAN as a medium of reducing costs and enhancing the quality of the products and services that enterprises provide to customers. Six Sigma emphasizes customer demands, employee empowerment, optimising current processes, and also emphasizing leadership, teamwork, and problem resolution. Regardless of the industry or sector in which a company operates, Kaizen (A Japanese method) is a fundamental technique of organisational success and an important aspect of the continuous development path. Businesses of all sizes may attain robust performance by committing to a never-ending cycle of continuous improvement. To boost productivity, every organisation should strive for operational excellence.

***"Operational excellence is achieving and sustaining results that meet and exceed the expectations of all stakeholders." Richard Morris, VP product integration, BMW***

Lean manufacturing has been applicable mostly to discrete manufacturing (The products are distinct like mobile, toys, etc., and differ from the process industry) industry. The discrete production system in manufacturing leads to remarkable results so it is considered that LEAN manufacturing should be extended to the textile industries. Some LEAN techniques are useful in the textile industry with flexible machine and good design.

The main attention of OE in any business is to mitigate throughput time in manufacturing. Haryana state possesses enough capability to grow its textile manufacturing units because of its sound infrastructure and availability of raw material (cotton) (Haryana Textile Policy, 2019). Haryana's textile industry employs more than 10 lakh people with an export worth US\$ 3 billion every year (Haryana Textile Policy, 2019). The present chapter analyses the operational performance of textile manufacturing units in Haryana, situated in north India. Input-oriented CCR and BCC of DEA & RTS analysis has been followed to compute the operational efficiency of textile manufacturing units in Haryana for five years from 2015-16 to 2019-20. It is found that no study has been carried out so far on the operational performance of the Haryana's textile industry in India based on the DEA technique. The present chapter will be helpful in making investment decisions by exploring efficient and inefficient textile units. The rest of this chapter is structured in three sections: Section 6.2 contains the research methodology part of this specific chapter. Section 6.3 summarises and discusses the findings. The conclusion and policy implications are presented in Section 6.4.

## **6.2 Methodology**

### **6.2.1 Data and Sample selection**

The variables' data of textile manufacturing companies of Haryana was accessed from the two different websites; MCA, New Delhi, and Prowess database maintained by the CMIE. Prowess database provides the data related to Profit & Loss and the balance sheet of all those textile companies which are listed on the Bombay Stock Exchange (BSE) (Rajeev and Mazumdar, 2009). The rest data were accessed through MCA. The data relating to operational variables for Haryana's textile manufacturing companies was gathered by reviewing their annual reports (Profit & Loss and Balance sheet) for five years i.e. 2015-16 to 2019-20. Initially, a report of 192 textile manufacturing companies consisting of only Name, CIN and addresses has been extracted from the website of the MCA. However, 139 of these

companies have been striking-off, and six were under liquidation. Therefore, the complete data (Profit & Loss and Balance sheet) of the rest of the 47 companies were extracted (one by one) by the researcher from the website of the MCA. On the other hand, data of 35 DMUs (Profit & Loss and Balance sheet) was accessed through Prowess. Thus, after compiling both the resultant quantity, 82 DMUs were left for analysis. At the last stage, the researcher has removed outliers, and the final sample is left with 61 Textile Manufacturing Companies (DMUs) in Haryana.

### **6.2.2 Selection of Variable**

To examine the technical efficiency of each firm through DEA, this is vital to choose the optimal input and output variables of various DMUs (Darji and Dahiya, 2021). Major cost-effective input variables are Labour (Gupta *et al.*, 2019; Kumar and Arora, 2012; Kumar and Gulati, 2009; Mukherjee, 2007; Sahoo and Tone, 2009; Wu, 2016), raw material (Leung and To, 1999; Rajeev and Mazumdar, 2009; Gambhir and Sharma, 2015b; Propa, Banwet and Goswami, 2018), and operating expenses (Driessen, Lijesen and Mulder, 2006; Rajeev and Mazumdar, 2009; Ogayon, 2014; Gambhir and Sharma, 2015b, 2015a). Net sales (Barros and Santos, 2006; Barros, 2004; Bhaskaran, 2013; Chandra *et al.*, 1998; Joshi and Singh, 2010; Leung and To, 1999; Mani, 2007; Orzes *et al.*, 2017) and revenue (Kapelko and Lansink, 2014; Nagaraju, 2014; Ogayon, 2014) considered as output variables by most of the studies.

In line with the above-mentioned studies, input variables that used in the current study are: (1) Raw material (2) Labour and (3) Operating Expenses which are considered as cost effective in today's contemporary business environment for the textile industry. Similarly, Total sales have been selected as an output variable (Table 6.1). It is required to satisfy at least one rule of thumb viz.  $N > (m*s)$  and/or  $N \geq \{3(m+s)\}$  while applying the DEA technique (Cooper *et al.*, 1990).

Where,

N = Number of DMUs

m=Number of input variables

s= Number of output variables

<b>Sr. n.</b>	<b>Variables</b>	<b>Authors</b>	<b>Variable type/Indicator</b>
1	Raw materials	Rajeev and Mazumdar (2009), Propa, Banwet and Goswami (2018)	Input (m)
2	Labour	Barros and Santos (2006), Battese <i>et al.</i> (2004), Bhandari and Maiti (2007), Kumar and Arora (2012)	Input (m)
3	Other operational expenses	Ogayon (2014), Rajeev and Mazumdar (2009), Driessen, Lijesen and Mulder (2006)	Input (m)
4	Net sales	Barros and Santos (2006), Bhaskaran (2013), Joshi and Singh (2010), Orzes <i>et al.</i> (2017)	Output (s)

The present study used three input variables and one output variable, which meet the first and second condition as  $(3 \times 1 = 3 < 61)$  and  $[(3+1) \times 3 < 61]$  respectively. Hence, results from both the conditions of rule of thumbs are satisfying that present research can apply DEA technique on the selected variable and DMUs. The DEA and RTS model orientation and equations has already been discussed in Research methodology chapter of this thesis.

**Table 6.2: Descriptive statistics of the variables (Amount in Lakhs) (DMU =61)**

Years	Descriptive Statistics	Raw materials	Labour	Other operational expenses	Sales/Net sales
<b>2015-16</b>	Mean	5215.88	1384.79	437.86	11407.79
	Min	0.01	0.01	0.01	3.4
	Max	111895	45769	4552	199578
	SD	16079.18	5914.47	855.85	31579.94
	Skewness	5.43	7.13	3.24	4.57
	Kurtosis	32.92	53.39	11.15	23.05
	Median	733.12	44.2	124.9	1183.54
<b>2016-17</b>	Mean	5346.19	1566.44	493.86	11870.88
	Min	0.01	0.01	0.01	2.6
	Max	91686	49408	4981	211193
	SD	15693.39	6411.92	970.97	33498.77
	Skewness	4.63	7.01	3.32	4.62
	Kurtosis	22.17	52.12	11.63	23.36
	Median	711	78.44	153	1567
<b>2017-18</b>	Mean	5266.49	1681.61	526.35	12318.08
	Min	0.01	0.01	0.01	1.8
	Max	82137	50258	4793	191270
	SD	14476.27	6562.63	951.81	33580.65
	Skewness	4.47	6.86	3.05	4.25
	Kurtosis	20.54	50.4	9.78	18.93
	Median	650.94	77	190.16	1562
<b>2018-19</b>	Mean	6090.31	1700.22	561.58	13724.49
	Min	0.01	0.01	0.01	0.1
	Max	114600	52131	5473	223755
	SD	18413.64	6805.13	1036.13	40576.81
	Skewness	4.91	6.89	3.2	4.59
	Kurtosis	25.04	50.68	11.19	21.55
	Median	772	96	166.89	1678
<b>2019-20</b>	Mean	4660.93	875.75	439.76	10256.88
	Min	0.01	0.01	0.01	0.1
	Max	145906	16358	4867	264409
	SD	18822.27	2636.91	894.92	35845.44
	Skewness	7.14	4.59	3.79	6.2
	Kurtosis	53.41	22.63	15.82	42.3
	Median	324.98	52.08	127.62	973

**Source:** Calculated by author using raw data of each company

### **6.3 Results and Discussion**

Table 6.2 depicts the descriptive statistics of input and output variables considered for the present study. The average values; 6090.31, 1700.22, 561.58 and 13724.49 lakhs of all input and output variables viz. raw material, labour, other operational expenses and sales has been observed highest respectively in 2018-19 whereas the lowest mean values are 4660.93 (Labour), 875.75 (Raw material) and 10256.88 (Sales) found in 2019-20 except for operational expense. The most unpredictable raw material data has been observed in 2019-20 as its SD is highest; 18822.27 in this year and lowest in 2017-18 i.e. 14476.27. Further, the net sales is fluctuating in 2018-19 and were stable in 2015-16 with a SD of 40576.81 and 31579.94 lakh respectively. It is also seen that sales figure is maximum but not competitive in 2019-20 because it has a high value of SD.

#### **6.3.1 Operational performance of Textile Manufacturing Companies in Haryana for the year 2015-16**

Table 6.3 gives the OTE, PTE, SE, and RTS scores of 61 DMUs in Haryana for the year 2015-16 while Table 6.4 outlines the frequency distribution of OTE, PTE, and SE of the same year. The mean OTE score is 0.20, which indicates that the OTIE is 80%. The 80 percent reduction in input size indicates that the Textile units are capable of growing their outputs simultaneously. The primary reason for such inefficiency could be that an insufficient scale size or input/output configuration was chosen, along with the size of operations. Only three companies are efficient at OTE which are Aggarsain Spinners Ltd., J.D.R.D. Embroidery Pvt. Ltd., Peacock Fabrics Pvt. Ltd. This group of companies is in favour of the CRS conical hull. The same set of companies operates at PTE and SE, which comes under the VRS assumption. The VRS conical hull encloses data points more closely than the CRS conical hull. These findings indicate that a particular company that operates at OTE also operates at PTE and SE with CRS. According to table 6.4, only one company (Shiv Sharan Handlooms Pvt. Ltd.)

achieved a score of 0.8 to 1, indicating that a 20% revision of inputs and operations can move this company toward efficiency. The maximum forty-four companies (72.13 percent) are operating below the 0.20 scores, require a significant change in operations, or advancement in technology. One company between 0.4 and 0.6 (1.64%) and two companies (3.28 percent) are moderately efficient (0.6 to 0.8), while 16.39% of companies (10 companies) have a low efficiency (0.2 to 0.4), which also requires a significant increase in the input size.

More specifically, out of the 61 textile manufacturing companies that are considered in the study, 13 (i.e. 21.31%) have achieved a PTE score of 1 and so have obtained the designation of locally technical efficient and managerially efficient. PTE scores, which estimate the degree of Pure Technical Inefficiency (PTIE) in DMUs, show that PTE mean value is 0.43, which indicates that the amount of PTIE in these companies is 57 percent ( $1-0.43=0.57$ ). The findings reveal that approximately 57% of OTIE (80 percent) is associated with the underperformance of the management only (Kumar and Gulati, 2008) rest degree of OTIE may be due to inappropriate input scale size. In table 6.4, there are 61 DMUs out of which 3 are locally as well as globally technical efficient corresponding to PTE scores. The remaining 10 units are efficient at domestic level but inefficient at global level. The OTIE in these ten companies is a result of their inability to function at their most productive scale size (MPSS). Additionally, 45 DMUs (i.e. 73.77 percent) have a PTIE greater than 20%, while only three DMUs (4.91 percent) have a PTIE less than or equal to 20%.

Further, the SE score equal to 1 indicates MPSS - that is, the ideal scale size of a unit is in effect. Conversely, a SE score  $\neq 1$  means that the company is functioning at its sub-optimal scale size. The mean SE score in the current analysis is 0.54, indicating that the average level of SIE in DMUs is approximately 46% of companies that are technically efficient on a global scale (OTE score = 1) are also technically efficient on a local scale (PTE score = 1), and so

the ratio of both efficiencies is one (1) is efficient at SE. As a result, there is no need for further improvement for DMUs with SE scores of 1 and enterprises functioning at MPSS.

**Table 6.3: Operational Efficiency scores and RTS Analysis of Textile manufacturing Units in Haryana in 2015-16 (DMU = 61)**

Name of the Company	DMUs	OTE	PTE	SE	RTS	$\sum \lambda$
Aggarsain Spinners Ltd.	C1	1	1	1	CRS	1
Ashnoor Textile Mills Ltd.	C2	0.2389	0.8483	0.2816	DRS	409.84
Benetton India Pvt. Ltd.	C3	0.1021	1	0.1021	DRS	183.16
Meyer Apparel Ltd.	C4	0.0201	0.0209	0.9631	DRS	32.04
Gupta Exim (India) Pvt. Ltd.	C5	0.0296	0.2508	0.1182	DRS	477.12
H P Cotton Textile Mills Ltd.	C6	0.032	0.1693	0.189	DRS	399.39
Haryana Texprints (Overseas) Ltd.	C7	0.059	0.2199	0.2683	DRS	500.72
Hisar Spinning Mills Ltd.	C8	0.1126	0.4496	0.2504	DRS	461.54
Indo Cotspin Ltd.	C9	0.1662	0.2053	0.8096	DRS	43.3
Jasch Industries Ltd.	C10	0.1016	0.4577	0.2221	DRS	397.96
Orient Craft Ltd.	C11	0.0328	1	0.0328	DRS	1526.39
Partap Spintex Pvt. Ltd.	C12	0.239	1	0.239	DRS	5734.81
Shivani Textiles Ltd.	C13	0.056	0.0825	0.6792	DRS	143.07
Pasupati Spinning &Wvg. Mills Ltd.	C14	0.0615	0.4337	0.1419	DRS	1214.27
Voith Paper Fabrics India Ltd.	C15	0.056	0.2609	0.2146	DRS	215.2
R L F Ltd.	C16	0.0255	0.0259	0.9877	DRS	1.55
Richa Industries Ltd.	C17	0.1712	1	0.1712	DRS	1121.65
Sanganeriya Spinning Mills Ltd.	C18	0.114	0.2858	0.3988	DRS	917.74
Uniroyal Industries Ltd.	C19	0.03	0.0342	0.8758	DRS	77.93
United Leasing &Inds. Ltd.	C20	0.0351	0.0371	0.9439	DRS	2.11
United Textiles Ltd.	C21	0.1397	0.5513	0.2534	DRS	265.38
Tex Corp Pvt. Ltd.	C22	0.0418	0.1323	0.3159	DRS	102.64
Biba Apparels Pvt. Ltd.	C23	0.064	0.5694	0.1124	DRS	378.39
Numero Uno Clothing Ltd.	C24	0.0666	0.4822	0.1381	DRS	189.2
Unicharm India Pvt. Ltd.	C25	0.1285	1	0.1285	DRS	4105.98
Jindal Spinning Mills Ltd.	C26	0.1068	0.1743	0.6123	DRS	307.74
Gautam Apparel & Sourcing Pvt. Ltd.	C27	0.1193	0.3719	0.3207	DRS	125.23
Chaos design Private Ltd.	C28	0.0155	0.0168	0.9222	DRS	9.13
Click Clothing Company Private Ltd.	C29	0.0741	0.1118	0.6629	DRS	119.38



DAG Design Concept Fashion Private Ltd.	C30	0.0956	0.1143	0.8364	DRS	8.47
Drips Apparels Private Ltd.	C31	0.0329	0.0421	0.7804	DRS	41.11
Delphique Fabrics Private Ltd.	C32	0.0501	0.1132	0.4422	DRS	13.8
Dida Brothers Company Private Ltd.	C33	0.1285	0.2023	0.6352	DRS	115.34
J.D. Textiles Private Ltd.	C34	0.093	0.1252	0.7425	DRS	18.14
Jai Handloom Private Ltd.	C35	0.3976	0.6696	0.5938	DRS	296.2
Jindal Cotspin Private Ltd.	C36	0.1466	0.2777	0.5277	DRS	170.96
Panipat Texo Fabs Private Ltd.	C37	0.0725	0.2161	0.3356	DRS	168.4
Radico Fashions Private Limited	C38	0.2004	0.3967	0.5051	DRS	28.1
RGL Fashion Private Ltd.	C39	0.0483	0.055	0.8785	DRS	43.28
Santosh Woolen Pvt. Ltd.	C40	0.0877	0.1404	0.6251	DRS	57.66
Sarla Handicrafts Pvt. Ltd.	C41	0.1247	0.5011	0.2489	DRS	732.78
Shivansh Textile Private Ltd.	C42	0.354	0.709	0.4994	DRS	95.41
Shree Shiv Shakti Synthetics Pvt. Ltd.	C43	0.4478	0.9259	0.4837	DRS	159.76
Shubh&SanchayTexofab Pvt. Ltd.	C44	0.2336	0.2488	0.9388	DRS	8.37
Sufiana Design Pvt. Ltd.	C45	0.1287	0.3079	0.4179	DRS	48.15
TypioYfm Design Pvt. Ltd.	C46	0.031	0.0337	0.9195	DRS	20.11
Angel Fabrics Pvt. Ltd.	C47	0.0491	0.0708	0.6933	DRS	65.33
Anika Syncotex Pvt. Ltd.	C48	0.1583	0.1815	0.8724	DRS	9.58
Shiv Sharan Handlooms Pvt. Ltd.	C49	0.9675	1	0.9675	IRS	0.97
Vee Fabrics Pvt. Ltd.	C50	0.116	1	0.116	IRS	0.11
J.D.R.D. Embroidery Pvt. Ltd.	C51	1	1	1	CRS	1
Maharaja Texo Fab Pvt. Ltd.	C52	0.1321	0.1799	0.7339	DRS	178.99
Nik Fasteners Pvt. Ltd.	C53	0.6538	1	0.6538	IRS	0.65
Prosource Textstyles Pvt. Ltd.	C54	0.0167	0.0261	0.6392	DRS	11.27
UNMA Textiles Pvt. Ltd.	C55	0.0205	0.0429	0.4776	IRS	0.48
Peacock Fabrics Pvt. Ltd.	C56	1	1	1	CRS	1
PCC Interlinings Pvt. Ltd.	C57	0.294	1	0.294	IRS	0.29
Kanta fabrics Pvt. Ltd.	C58	0.2445	0.473	0.5169	DRS	124.41
Govind Textiles Pvt. Ltd.	C59	0.3648	1	0.3648	IRS	0.36
Aan Handloom Pvt. Ltd.	C60	0.7116	0.9247	0.7695	DRS	55.32
Neelmani Textile Pvt. Ltd.	C61	0.2752	0.2927	0.9401	DRS	9.11
<b>Average</b>		<b>0.20</b>	<b>0.43</b>	<b>0.54</b>		

**Source:** Author's calculation

The same set of DMUs that are efficient in the CCR model with OTE equal to one must be efficient in the BCC model with SE score equal to one. Additionally, as shown in Table 6.4, just three (4.91 percent) of the 61 companies have a SE score of 1 and are functioning at MPSS. Thus, it demonstrates that the remaining 58 (95.08 percent) companies have some degree of SIE. Thereby, it was discovered that thirteen (21.31 percent) of 61 companies have a SE score greater than 0.8 and operate near MPSS, while twelve companies (19.67 percent) have a score between 0.60 and 0.80. If these enterprises lessen their inputs by approximately 10% to 20%, the majority of them can approach MPSS (40.98 percent). As shown in Table 6.3, if a company has an OTE score of 1, it must also be efficient in terms of PTE and SE, with a  $\lambda$  score of 1

Sr.N.	Different ranges of efficiency scores	OTE		PTE		SE	
		DMU's	Percentage	DMU's	Percentage	DMU's	Percentage
1	0.00<= Score <0.2	44	72.13%	22	36.07%	10	16.39%
2	0.2<= Score <0.4	10	16.39%	13	21.31%	14	22.95%
3	0.4<= Score <0.6	1	1.64%	8	13.11%	9	14.75%
4	0.6<= Score <0.8	2	3.28%	2	3.28%	12	19.67%
5	0.8<= Score <1	1	1.64%	3	4.92%	13	21.31%
6	Score =1	3	4.92%	13	21.31%	3	4.92%
	<b>Total</b>	<b>61</b>	<b>100.00%</b>	<b>61</b>	<b>100.00%</b>	<b>61</b>	<b>100.00%</b>

Source: Author's calculation

### **6.3.2 Operational performance of Textile Manufacturing Companies in Haryana for the year 2016-17**

Table 6.5 shows the OTE, PTE, SE scores, and RTS analysis of 61 DMUs in Haryana for the year 2016-17 while Table 6.6 summarises the OTE, PTE, and SE frequency distribution in the same year. The average OTE score is 0.18, which indicates that the OTIE is 82%. The 82 percent diminution in input size indicates that the Textile units are capable of growing their

outputs simultaneously in the year 2016-17. Three out of 61 companies are efficient at OTE this year which are Aggarsain Spinners Ltd., Shiv Sharan Handlooms Pvt. Ltd., J.D.R.D. Embroidery Pvt. Ltd., Nik Fasteners Pvt. Ltd., Peacock Fabrics Pvt. Ltd. According to the above argument each company must operate at the all-efficiency parameters viz. OTE, PTE, and SE. No company could achieve a score of 0.8 to 1, indicating that either companies are operating at below moderate efficiency/low efficiency or fully efficient at score one. The maximum forty-nine companies (80.33 percent) are operating below the 0.20 score, require a significant change in operations, or require the introduction of advanced technology. Two companies between 0.4 and 0.6 (3.28%) and one company between 0.6 to 0.8 are moderately efficient, while 6.56% of the companies (4 companies) have low efficiency (0.2 to 0.4) scores, which also requires a significant optimization in the input size.

Fourteen companies (i.e.22.95%) have achieved a PTE score of 1 and hence these are locally technical efficient and managerially efficient. PTE mean value is 0.43 (Same in the year 2015-16) which indicates that the amount of PTIE in these companies is 57 percent. In table 6.5, five companies are relatively efficient about local technical efficiency with an OTE score of 1. It means they are technically efficient at local as well as globally level. The remaining 9 units are efficient at local level and inefficient at global level. The OTIE in these nine units is the result of their inability to function at their most productive scale size (MPSS). Additionally, 46 DMUs (75.46 percent) have a PTIE greater than 20%, while only one DMUs (1.64 percent) have a PTIE less than or equal to 20%.

Further, the mean SE score in 2016-17 is 0.44, shows that the average level of SIE in DMUs is approximately 56%. It indicates that companies that are technically efficient on a global scale (OTE score = 1) are also efficient on a local scale (PTE score = 1), and so the ratio of both efficiency is one (1), and efficient at SE. As a result, there is no need for further improvement for DMUs with SE scores of 1 because in this scenario enterprises operate at

MPSS. Additionally, as shown in Table 6.6, only five (8.20 percent) of the 61 companies have a SE score of 1 and are functioning at MPSS.

**Table 6.5: Operational Efficiency scores and RTS Analysis of Textile manufacturing Units in Haryana in 2016-17 (DMU = 61)**

Name of the Company	DMUs	O TE	P TE	SE	RTS	$\sum \lambda$
Aggarsain Spinners Ltd.	C1	1	1	1	CRS	1
Ashnoor Textile Mills Ltd.	C2	0.1504	0.7835	0.192	DRS	2301.48
Benetton India Pvt. Ltd.	C3	0.1051	1	0.1051	DRS	1818.05
Meyer Apparel Ltd.	C4	0.0147	0.0176	0.8353	DRS	243.8
Gupta Exim (India) Pvt. Ltd.	C5	0.0268	0.2742	0.0979	DRS	4365.17
H P Cotton Textile Mills Ltd.	C6	0.0249	0.2475	0.1004	DRS	2933.67
Haryana Texprints (Overseas) Ltd.	C7	0.0361	0.3345	0.108	DRS	3230.77
Hisar Spinning Mills Ltd.	C8	0.0657	0.2832	0.232	DRS	525.58
Indo Cotspin Ltd.	C9	0.0815	0.1543	0.5279	DRS	276.94
Jasch Industries Ltd.	C10	0.0743	0.5306	0.14	DRS	3208.46
Orient Craft Ltd.	C11	0.0354	1	0.0354	DRS	15844.88
Partap Spintex Pvt. Ltd.	C12	0.0523	0.6813	0.0767	DRS	12448.99
Shivani Textiles Ltd.	C13	0.0267	0.063	0.4245	DRS	566.99
Pasupati Spinning &Wvg. Mills Ltd.	C14	0.0306	0.4053	0.0754	DRS	5756.41
Voith Paper Fabrics India Ltd.	C15	0.052	0.422	0.1232	DRS	1949.05
R L F Ltd.	C16	0.0339	1	0.0339	IRS	0.04
Richa Industries Ltd.	C17	0.1538	1	0.1538	DRS	11334.72
Sanganeriya Spinning Mills Ltd.	C18	0.0645	0.6477	0.0996	DRS	1994.12
Uniroyal Industries Ltd.	C19	0.0235	0.0372	0.6317	DRS	650.63
United Leasing &Inds. Ltd.	C20	0.0423	0.052	0.8138	DRS	67.65
United Textiles Ltd.	C21	0.0899	0.3258	0.2759	DRS	224.73
Tex Corp Pvt. Ltd.	C22	0.0349	0.223	0.1566	DRS	1186.87
Biba Apparels Pvt. Ltd.	C23	0.0597	0.5356	0.1115	DRS	4680.67
Numero Uno Clothing Ltd.	C24	0.0566	0.4484	0.1263	DRS	1246.13
Unicharm India Pvt. Ltd.	C25	0.0833	1	0.0833	DRS	41488.09
Jindal Spinning Mills Ltd.	C26	0.0663	0.181	0.3662	DRS	1086.88
Gautam Apparel & Sourcing Pvt. Ltd.	C27	0.0001	0.0001	0.9741	IRS	0.97
Chaos design Private Ltd.	C28	0.0183	0.0217	0.8412	DRS	11.93
Click Clothing Company Private Ltd.	C29	0.0357	0.0507	0.7053	DRS	199.15

DAG Design Concept Fashion Private Ltd.	C30	0.0835	0.1601	0.5216	DRS	73.06
Drips Apparels Private Ltd.	C31	0.0298	0.1293	0.2308	DRS	84.41
Delphine Fabrics Private Ltd.	C32	0.0841	0.1721	0.4886	DRS	462.45
Dida Brothers Company Private Ltd.	C33	0.009	0.0159	0.5649	DRS	84.82
J.D. Textiles Private Ltd.	C34	0.0751	0.1794	0.4187	DRS	36.95
Jai Handloom Private Ltd.	C35	0.063	0.1186	0.5312	DRS	79.34
Jindal Cotspin Private Ltd.	C36	0.3433	0.9599	0.3576	DRS	824.86
Panipat Texo Fabs Private Ltd.	C37	0.1017	0.2742	0.3708	DRS	433.69
Radico Fashions Private Limited	C38	0.0491	0.1939	0.2532	DRS	385.11
RGL Fashion Private Ltd.	C39	0.0245	0.0417	0.588	DRS	151.29
Santosh Woolen Pvt. Ltd.	C40	0.0461	0.113	0.4075	DRS	138.4
Sarla Handicrafts Pvt. Ltd.	C41	0.0551	0.3852	0.1429	DRS	528.65
Shivansh Textile Private Ltd.	C42	0.0836	0.2818	0.2968	DRS	635.36
Shree Shiv Shakti Synthetics Pvt. Ltd.	C43	0.4534	1	0.4534	DRS	439.77
Shubh&SanchayTexofab Pvt. Ltd.	C44	0.3107	0.3927	0.7912	DRS	102.22
Sufiana Design Pvt. Ltd.	C45	0.0702	0.301	0.2333	DRS	54.98
TypioYfm Design Pvt. Ltd.	C46	0.0266	0.0393	0.6762	DRS	169.77
Angel Fabrics Pvt. Ltd.	C47	0.0463	0.1729	0.2676	DRS	76.79
Anika Syncotex Pvt. Ltd.	C48	0.0897	0.1785	0.5029	DRS	82.48
Shiv Sharan Handlooms Pvt. Ltd.	C49	1	1	1	CRS	1
Vee Fabrics Pvt. Ltd.	C50	0.1054	1	0.1054	IRS	0.11
J.D.R.D. Embroidery Pvt. Ltd.	C51	1	1	1	CRS	1
Maharaja Texo Fab Pvt. Ltd.	C52	0.245	0.2896	0.8459	DRS	326.82
Nik Fasteners Pvt. Ltd.	C53	1	1	1	CRS	1
Prosource Textstyles Pvt. Ltd.	C54	0.0122	0.0245	0.4991	DRS	91.89
UNMA Textiles Pvt. Ltd.	C55	0.0182	0.0202	0.8974	DRS	1.36
Peacock Fabrics Pvt. Ltd.	C56	1	1	1	CRS	1
PCC Interlinings Pvt. Ltd.	C57	0.4523	1	0.4523	IRS	0.46
Kanta fabrics Pvt. Ltd.	C58	0.186	0.4046	0.4597	DRS	392.85
Govind Textiles Pvt. Ltd.	C59	0.6256	1	0.6256	IRS	0.62
Aan Handloom Pvt. Ltd.	C60	0.3254	0.4882	0.6666	DRS	236.59
Neelmani Textile Pvt. Ltd.	C61	0.1434	0.2963	0.4838	DRS	94.61
<b>Average</b>		<b>0.18</b>	<b>0.43</b>	<b>0.44</b>		

**Source:** Author's calculation

Thus, it demonstrates that the remaining 56 (91.80 percent) companies have some degree of SIE, though of varying degrees. Henceforth, it was discovered that six (9.83 percent) of 61 companies have a SE score greater than 0.8 and operate near MPSS, and the same number of companies (Six DMUs) have a score between 0.60 and 0.80. If these enterprises lessen their inputs by approximately 10% to 20%, the majority of them can approach MPSS. As shown in Table 6.5, the company has an OTE score of 1, it is also efficient in terms of PTE and SE, with a  $\lambda$  score of 1.

Sr.N.	Different ranges of efficiency scores	OTE		PTE		SE	
		DMU's	Percentage	DMU's	Percentage	DMU's	Percentage
1	0.00<= Score <0.2	49	80.33%	23	37.70%	19	31.15%
2	0.2<= Score <0.4	4	6.56%	13	21.31%	10	16.39%
3	0.4<= Score <0.6	2	3.28%	7	11.48%	15	24.59%
4	0.6<= Score <0.8	1	1.64%	3	4.92%	6	9.84%
5	0.8<= Score <1	0	0.00%	1	1.64%	6	9.84%
6	Score =1	5	8.20%	14	22.95%	5	8.20%
	<b>Total</b>	<b>61</b>	<b>100.00%</b>	<b>61</b>	<b>100.00%</b>	<b>61</b>	<b>100.00%</b>

Source: Author's calculation

### **6.3.3 Operational performance of Textile Manufacturing Companies in Haryana for the year 2017-18**

Tables 6.7 demonstrate the OTE, PTE, SE scores, and RTS analysis of 61 DMUs in Haryana for the year 2017-18 while Table 6.8 outlines the frequency distribution of OTE, PTE, and SE of the same year. The average OTE score is 0.18 (Same in 2016-17), which indicates that the OTIE is 82%. The 82 percent reduction in input size indicates that the Textile units are capable of growing their outputs simultaneously in 2017-18. Only three companies are efficient at OTE: Neelmani Textile Pvt. Ltd., Peacock Fabrics Pvt. Ltd., Shiv Sharan Handlooms Pvt. Ltd., Aggarsain Spinners Ltd. These companies are also efficient at PTE and SE. Further,

no company achieved a score of 0.8 to 1 in the year 2017-18 as achieved in the year 2016-17, indicating that either companies are operating at below moderate efficiency/low efficiency or fully efficient. The maximum forty-nine companies (80.33% - same as 2016-17) are operating below the 0.20 score, require a significant change in operations, or require the introduction of advanced technology. Four companies (6.56%) between 0.4 and 0.6 and one company between 0.6 to 0.8 is moderately efficient, while 4.92% of companies have a low efficiency (0.2 to 0.4), which also requires a significant increase in the input size.

Seventeen companies (i.e.27.87%) have achieved a PTE score of 1 and hence these are locally technical efficient and managerially efficient. PTE mean value is 0.55, which indicates that the amount of PTIE in these companies is 45 percent. In table 6.7, out of 61 DMUs, 4 are relatively efficient about local technical efficiency with an OTE score of 1. It means they are domestically as well as globally technical efficient. The rest 14 units are efficient at local level but inefficient at global level. The OTIE in these fourteen units is a result of their inability to function at their MPSS. Additionally, 42 DMUs (68.85 percent) have a PTIE greater than 20%, while two DMUs (3.28 percent) have a PTIE less than or equal to 20%.

Further, the mean SE score in 2017-18 is 0.29, describing that the average SIE in DMUs is approximately 71% companies that are technically efficient on a global scale (OTE score = 1) are also technically efficient on the local scale (PTE score = 1). As a result, there is no need for further improvement for DMUs with SE scores of 1 and enterprises functioning at MPSS. The same set of DMUs is efficient at OTE, PTE, and SE all. In addition to this Table 6.8, shows only four companies (6.55 percent) of the 61 companies have a SE score of 1 and are functioning at MPSS. Thus, it demonstrates that the remaining 57 (93.44 percent) companies have some degree of SIE.

**Table 6.7: Operational Efficiency scores and RTS Analysis of Textile manufacturing****Units in Haryana in 2017-18 (DMU = 61)**

Name of the Company	DMUs	OTE	PTE	SE	CRS	$\Sigma \lambda$
Aggarsain Spinners Ltd.	C1	1	1	1	CRS	1
Ashnoor Textile Mills Ltd.	C2	0.1102	1	0.1102	DRS	2115.92
Benetton India Pvt. Ltd.	C3	0.1879	1	0.1879	DRS	3851.61
Meyer Apparel Ltd.	C4	0.0189	0.053	0.3571	DRS	291.22
Gupta Exim (India) Pvt. Ltd.	C5	0.0266	0.288	0.0924	DRS	4778.19
H P Cotton Textile Mills Ltd.	C6	0.0177	0.3292	0.0537	DRS	2582.44
Haryana Texprints (Overseas) Ltd.	C7	0.0252	0.4709	0.0535	DRS	2278.72
Hisar Spinning Mills Ltd.	C8	0.052	0.4168	0.1247	DRS	738.21
Indo Cotspin Ltd.	C9	0.0689	0.3265	0.2111	DRS	282.56
Jasch Industries Ltd.	C10	0.0519	0.6034	0.086	DRS	3148.54
Orient Craft Ltd.	C11	0.0515	1	0.0515	DRS	21361.47
Partap Spintex Pvt. Ltd.	C12	0.0318	0.6413	0.0496	DRS	12107.95
Shivani Textiles Ltd.	C13	0.1487	0.4996	0.2976	DRS	14.87
Pasupati Spinning &Wvg. Mills Ltd.	C14	0.0157	0.3898	0.0403	DRS	3144.73
Voith Paper Fabrics India Ltd.	C15	0.0481	0.5606	0.0859	DRS	1978.61
R L F Ltd.	C16	0.0499	0.0919	0.5434	DRS	19.97
Richa Industries Ltd.	C17	0.0597	0.5909	0.101	DRS	4714.5
Sanganeriya Spinning Mills Ltd.	C18	0.0584	0.7637	0.0765	DRS	1910
Uniroyal Industries Ltd.	C19	0.0211	0.218	0.0968	DRS	645.52
United Leasing &Inds. Ltd.	C20	0.0328	0.0913	0.3591	DRS	65.57
United Textiles Ltd.	C21	0.0897	0.2827	0.3175	DRS	305.13
Tex Corp Pvt. Ltd.	C22	0.0485	0.3713	0.1306	DRS	1464.19
Biba Apparels Pvt. Ltd.	C23	0.112	0.8671	0.1291	DRS	10078.35
Numero Uno Clothing Ltd.	C24	0.1041	0.6975	0.1492	DRS	2060.48
Unicharm India Pvt. Ltd.	C25	0.1009	1	0.1009	DRS	35651.19
Jindal Spinning Mills Ltd.	C26	0.0455	0.4446	0.1024	DRS	719.49
Gautam Apparel & Sourcing Pvt. Ltd.	C27	0.1108	0.7107	0.1559	DRS	853.08
Chaos design Private Ltd.	C28	0.0305	0.0574	0.5307	DRS	17.82
Click Clothing Company Private Ltd.	C29	0.015	0.1049	0.1433	DRS	312.3
DAG Design Concept Fashion Private Ltd.	C30	0.0954	0.3173	0.3005	DRS	80.01
Drips Apparels Private Ltd.	C31	0.0405	0.2768	0.1464	DRS	287.14



Delphique Fabrics Private Ltd.	C32	0.0454	0.2069	0.2193	DRS	291.68
Dida Brothers Company Private Ltd.	C33	0.0175	0.0553	0.3172	DRS	41.48
J.D. Textiles Private Ltd.	C34	0.065	0.2376	0.2734	DRS	112.61
Jai Handloom Private Ltd.	C35	0.5758	1	0.5758	DRS	875.26
Jindal Cotspin Private Ltd.	C36	0.0769	0.3466	0.222	DRS	550.77
Panipat Texo Fabs Private Ltd.	C37	0.0965	0.6385	0.1512	DRS	936.73
Radico Fashions Private Limited	C38	0.0555	0.1729	0.3211	DRS	11.27
RGL Fashion Private Ltd.	C39	0.0131	0.0492	0.2656	DRS	29.95
Santosh Woolen Pvt. Ltd.	C40	0.0366	0.1615	0.2267	DRS	127.25
Sarla Handicrafts Pvt. Ltd.	C41	0.1164	1	0.1164	DRS	1479.34
Shivansh Textile Private Ltd.	C42	0.1315	0.7524	0.1747	DRS	853.12
Shree Shiv Shakti Synthetics Pvt. Ltd.	C43	0.5433	1	0.5433	DRS	515.64
Shubh&SanchayTexofab Pvt. Ltd.	C44	0.225	0.5996	0.3753	DRS	116.11
Sufiana Design Pvt. Ltd.	C45	0.1266	0.3235	0.3914	DRS	117.23
TypioYfm Design Pvt. Ltd.	C46	0.0189	0.1176	0.1611	DRS	161.13
Angel Fabrics Pvt. Ltd.	C47	0.0485	0.163	0.2975	DRS	34.43
Anika Syncotex Pvt. Ltd.	C48	0.0492	0.16	0.3077	DRS	45.74
Shiv Sharan Handlooms Pvt. Ltd.	C49	1	1	1	CRS	1
Vee Fabrics Pvt. Ltd.	C50	0.1053	1	0.1053	IRS	0.11
J.D.R.D. Embroidery Pvt. Ltd.	C51	0.5385	1	0.5385	IRS	0.54
Maharaja Texo Fab Pvt. Ltd.	C52	0.0883	0.8382	0.1054	DRS	1210.75
Nik Fasteners Pvt. Ltd.	C53	0.4615	1	0.4615	IRS	0.46
Prosource Textstyles Pvt. Ltd.	C54	0.0082	0.0306	0.268	DRS	68.81
UNMA Textiles Pvt. Ltd.	C55	0.0858	1	0.0858	IRS	0.08
Peacock Fabrics Pvt. Ltd.	C56	1	1	1	CRS	1
PCC Interlinings Pvt. Ltd.	C57	0.6944	1	0.6944	IRS	0.7
Kanta fabrics Pvt. Ltd.	C58	0.1805	0.3954	0.4564	DRS	386.58
Govind Textiles Pvt. Ltd.	C59	0.3325	1	0.3325	IRS	0.33
Aan Handloom Pvt. Ltd.	C60	0.2147	0.5705	0.3763	IRS	220.68
Neelmani Textile Pvt. Ltd.	C61	1	1	1	CRS	1
<b>Average</b>		<b>0.18</b>	<b>0.55</b>	<b>0.29</b>		

**Source:** Author's calculation

Henceforth, it was discovered that no company is nearby of MPSS because none of 61 companies have a SE score greater than 0.8 and only one company have a score between 0.60

and 0.80. If this company lessens its inputs by approximately 20%, it can approach MPSS. Table 6.7 shows that, if any particular company has an OTE score of 1, it is necessarily efficient at PTE and SE, with a  $\lambda$  score of 1.

Sr.N.	Different ranges of efficiency scores	OTE		PTE		SE	
		DMU's	Percentage	DMU's	Percentage	DMU's	Percentage
1	0.00<= Score <0.2	49	80.33%	13	21.31%	29	47.54%
2	0.2<= Score <0.4	3	4.92%	14	22.95%	20	32.79%
3	0.4<= Score <0.6	4	6.56%	8	13.11%	7	11.48%
4	0.6<= Score <0.8	1	1.64%	7	11.48%	1	1.64%
5	0.8<= Score <1	0	0.00%	2	3.28%	0	0.00%
6	Score =1	4	6.56%	17	27.87%	4	6.56%
	Total	61	100.00%	61	100.00%	61	100.00%

Source: Author's calculation

### **6.3.4 Operational performance of Textile Manufacturing Companies in Haryana for the year 2018-19**

Tables 6.9 demonstrate the OTE, PTE, SE scores, and RTS analysis of 61 DMUs in Haryana for the year 2018-19 while Table 6.10 outlines the frequency distribution of OTE, PTE, and SE of the same year. The average OTE score in 2018-19 is 0.40, which is the best efficiency of the textile industry out of the five-year study period indicating that the OTIE is 60%. The 60 percent reduction in input size indicates that the textile units are capable of growing their outputs simultaneously in 2015-16. Nine companies operate at OTE score one: Aan Handloom Pvt. Ltd., Govind Textiles Pvt. Ltd., Shiv Sharan Handlooms Pvt. Ltd., Shree Shiv Shakti Synthetics Pvt. Ltd., Jai Handloom Private Ltd., Aggarsain Spinners Ltd., Benetton India Pvt. Ltd., Shivani Textiles Ltd., R L F Ltd., and these companies are also efficient at PTE and SE. Only one company has achieved a score of 0.8 to 1 in 2018-19 indicating the proximity of efficiency score one. A maximum of nineteen companies (31.15%) are operating

below the 0.20 score and the same number (Nineteen) of companies are operating at a low score of 0.20 to 0.40, needs a significant change in operations, or requiring the innovation of technology. Eight companies (13.11%) between 0.4 and 0.6 and five companies (8.20 percent) are moderately efficient (0.6 to 0.8).

Twenty companies (27.87% - The maximum number of companies out of five years except for 2019-20) have achieved a PTE score of 1 and hence these are locally technical efficient and managerially efficient. PTE mean value is 0.60, that shows the amount of PTIE in these units is 40 percent. In table 6.9, out of 61 DMUs, 9 are relatively efficient about local technical efficiency with an OTE score of 1. It means they are technically efficient at local as well as global level. The rest 11 units are efficient locally but inefficient globally. The OTIE in these eleven companies is a result of their inability to operate at the MPSS. Additionally, 38 DMUs (62.29 percent) have a PTIE greater than 20%, while three DMUs (4.92 percent) have a PTIE less than or equal to 20%.

Henceforth, the mean SE score in 2018-19 is 0.71 (The highest SE score out of five years of the study period), indicating that the average level of SIE in DMUs is approximately 29 percent. Companies that are technically efficient on a global scale (OTE score = 1) are also technically efficient on a local scale (PTE score = 1). As a result, there is no need for further improvement for DMUs with SE scores of 1 and enterprises functioning at MPSS. The same set of DMUs is efficient at OTE, PTE, and SE all. In addition to this Table 6.10, shows nine companies (14.74 percent) have a SE score of 1 and are functioning at MPSS. Thus, it demonstrates that the remaining 52 (85.25 percent) companies have some degree of SIE.

**Table 6.9: Operational Efficiency scores and RTS Analysis of Textile manufacturing  
Units in Haryana in 2018-19 (DMU = 61)**

Name of the Company	DMUs	OTE	PTE	SE	RTS	$\sum \lambda$
Aggarsain Spinners Ltd.	C1	1	1	1	CRS	1
Ashnoor Textile Mills Ltd.	C2	0.6954	1	0.6954	IRS	17.58
Benetton India Pvt. Ltd.	C3	1	1	1	CRS	1
Meyer Apparel Ltd.	C4	0.093	0.0931	0.9988	DRS	1.51
Gupta Exim (India) Pvt. Ltd.	C5	0.1351	0.2418	0.5589	DRS	35.29
H P Cotton Textile Mills Ltd.	C6	0.1186	0.2482	0.4781	DRS	35.09
Haryana Texprints (Overseas) Ltd.	C7	0.2073	0.4189	0.4948	DRS	29.36
Hisar Spinning Mills Ltd.	C8	0.2133	0.3819	0.5585	DRS	3.99
Indo Cotspin Ltd.	C9	0.4211	0.5022	0.8386	DRS	2.19
Jasch Industries Ltd.	C10	0.3468	0.5195	0.6675	DRS	58.39
Orient Craft Ltd.	C11	0.2889	1	0.2889	DRS	615.44
Partap Spintex Pvt. Ltd.	C12	0.2046	0.6134	0.3335	DRS	127.07
Shivani Textiles Ltd.	C13	1	1	1	CRS	1
Pasupati Spinning &Wvg. Mills Ltd.	C14	0.1199	0.2906	0.4126	DRS	38.08
Voith Paper Fabrics India Ltd.	C15	0.3329	0.523	0.6365	DRS	47.58
R L F Ltd.	C16	1	1	1	CRS	1
Richa Industries Ltd.	C17	0.2899	0.4657	0.6225	DRS	50.38
Sanganeriya Spinning Mills Ltd.	C18	0.2918	0.5802	0.5029	DRS	7.75
Uniroyal Industries Ltd.	C19	0.1501	0.2793	0.5374	DRS	4.53
United Leasing &Inds. Ltd.	C20	0.1728	0.174	0.9933	IRS	0.49
United Textiles Ltd.	C21	0.2455	0.2457	0.9995	IRS	0.73
Tex Corp Pvt. Ltd.	C22	0.2463	0.2875	0.8568	DRS	50
Biba Apparels Pvt. Ltd.	C23	0.5007	0.8132	0.6157	DRS	230.88
Numero Uno Clothing Ltd.	C24	0.5614	0.5931	0.9465	DRS	76.42
Unicharm India Pvt. Ltd.	C25	0.8154	1	0.8154	DRS	1044.11
Jindal Spinning Mills Ltd.	C26	0.3424	0.5582	0.6134	DRS	6.53
Gautam Apparel & Sourcing Pvt. Ltd.	C27	0.5479	0.7089	0.7728	DRS	4.89
Chaos design Private Ltd.	C28	0.22	1	0.22	IRS	0.22
Click Clothing Company Private Ltd.	C29	0.0809	0.1702	0.4756	DRS	4.36
DAG Design Concept Fashion Private Ltd.	C30	0.4046	0.4065	0.9952	IRS	0.54
Drips Apparels Private Ltd.	C31	0.4261	0.431	0.9887	DRS	5.93
Delphique Fabrics Private Ltd.	C32	0.2775	0.3926	0.7068	DRS	2.88

Dida Brothers Company Private Ltd.	C33	0.0967	0.0995	0.9719	IRS	0.24
J.D. Textiles Private Ltd.	C34	0.2222	0.2259	0.9837	IRS	0.33
Jai Handloom Private Ltd.	C35	1	1	1	CRS	1
Jindal Cotspin Private Ltd.	C36	0.278	0.4367	0.6367	DRS	3.67
Panipat Texo Fabs Private Ltd.	C37	0.5157	0.8329	0.6192	DRS	3.51
Radico Fashions Private Limited	C38	0.197	0.1981	0.9946	IRS	0.25
RGL Fashion Private Ltd.	C39	0.0468	0.0503	0.9308	IRS	0.02
Santosh Woolen Pvt. Ltd.	C40	0.1656	0.1657	0.9998	IRS	0.83
Sarla Handicrafts Pvt. Ltd.	C41	0.361	0.7032	0.5134	DRS	4.16
Shivansh Textile Private Ltd.	C42	0.6083	0.9213	0.6603	DRS	2.85
Shree Shiv Shakti Synthetics Pvt. Ltd.	C43	1	1	1	CRS	1
Shubh&SanchayTexofab Pvt. Ltd.	C44	0.7723	0.7724	0.9999	IRS	0.87
Sufiana Design Pvt. Ltd.	C45	0.3695	0.3698	0.9991	IRS	0.4
TypioYfm Design Pvt. Ltd.	C46	0.1653	0.2973	0.5561	DRS	2.1
Angel Fabrics Pvt. Ltd.	C47	0.1488	1	0.1488	IRS	0.04
Anika Syncotex Pvt. Ltd.	C48	0.1823	0.1876	0.9717	IRS	0.02
Shiv Sharan Handlooms Pvt. Ltd.	C49	1	1	1	CRS	1
Vee Fabrics Pvt. Ltd.	C50	0.2427	1	0.2427	IRS	0.25
J.D.R.D. Embroidery Pvt. Ltd.	C51	0.123	1	0.123	IRS	0
Maharaja Texo Fab Pvt. Ltd.	C52	0.4072	0.6114	0.6661	DRS	14.74
Nik Fasteners Pvt. Ltd.	C53	0.0102	0.014	0.728	IRS	0.01
Prosource Textstyles Pvt. Ltd.	C54	0.0557	0.0573	0.973	IRS	0.22
UNMA Textiles Pvt. Ltd.	C55	0.0668	1	0.0668	IRS	0.01
Peacock Fabrics Pvt. Ltd.	C56	0.2469	1	0.2469	IRS	0.06
PCC Interlinings Pvt. Ltd.	C57	0.7324	1	0.7324	IRS	0.73
Kanta fabrics Pvt. Ltd.	C58	0.6905	0.7064	0.9776	DRS	1.05
Govind Textiles Pvt. Ltd.	C59	1	1	1	CRS	1
Aan Handloom Pvt. Ltd.	C60	1	1	1	CRS	1
Neelmani Textile Pvt. Ltd.	C61	0.123	1	0.123	IRS	0
<b>Average</b>		<b>0.40</b>	<b>0.60</b>	<b>0.71</b>		

**Source:** Author's calculation

Henceforth, it is worth noting that the maximum number of companies (19 DMUs) is nearby to MPSS have a SE score greater than 0.8, and fourteen companies (Second highest) have a score between 0.60 and 0.80. If this company lessens its inputs by approximately 20%, it can

approach MPSS. Table 6.9 shows that, if any company has an OTE score of 1, it is also efficient in terms of PTE and SE, with a  $\lambda$  score of 1.

Sr.N.	Different ranges of efficiency scores	OTE		PTE		SE	
		DMU's	Percentage	DMU's	Percentage	DMU's	Percentage
1	0.00<= Score <0.2	19	31.15%	10	16.39%	4	6.56%
2	0.2<= Score <0.4	19	31.15%	11	18.03%	5	8.20%
3	0.4<= Score <0.6	8	13.11%	11	18.03%	10	16.39%
4	0.6<= Score <0.8	5	8.20%	6	9.84%	14	22.95%
5	0.8<= Score <1	1	1.64%	3	4.92%	19	31.15%
6	Score =1	9	14.75%	20	32.79%	9	14.75%
	<b>Total</b>	<b>61</b>	<b>100.00%</b>	<b>61</b>	<b>100.00%</b>	<b>61</b>	<b>100.00%</b>

Source: Author's calculation

### **6.3.5 Operational performance of Textile Manufacturing Companies in Haryana for the year 2019-20**

Tables 6.11 demonstrate the OTE, PTE, SE and RTS scores, of 61 DMUs in Haryana for the year 2019-20 while Table 6.12 outlines the frequency distribution of OTE, PTE, and SE of the same year. The average OTE score in 2018-19 is 0.28, indicating that the OTIE is 72 percent. The 72 percent reduction in input size signifies that the textile units are competent in growing their outputs simultaneously in 2019-20. Eight companies efficient at OTE: Kanta fabrics Pvt. Ltd., Neelmani Textile Pvt. Ltd., UNMA Textiles Pvt. Ltd., Anika Syncotex Pvt. Ltd., Angel Fabrics Pvt. Ltd., Aggarsain Spinners Ltd., Benetton India Pvt. Ltd., R L F Ltd., and these companies are also efficient at PTE and SE. Only two companies have achieved a score of 0.8 to 1 in 2019-20 indicating the proximity of efficiency score one. A maximum of thirty-seven companies (60.66%) are operating below the 0.20 score and eleven companies (18.03 percent) are operating at a low score of 0.20 to 0.40, requiring a significant change in operations or modernisation of technology. Three companies (4.92%) are operating between

0.4 and 0.6 and no company is moderately efficient (0.6 to 0.8). Twenty-four companies (39.34 % - The maximum number of companies out of five years) have achieved a PTE score of 1 and hence these are locally technical efficient and managerially efficient. PTE mean value is 0.62 (the highest average PTE score out of the five years), which indicates that the amount of PTIE in these companies is 38 percent. In table 6.11, out of 61 DMUs, 8 companies are relatively efficient about local technical efficiency with an OTE score of 1. It means those companies are technically efficient at both the level local as well as global. The rest 16 DMUs are globally inefficient but locally efficient. The OTIE in these sixteen companies is the result of their inability to operate at their MPSS. Additionally, 36 DMUs (62.29 percent) have a PTIE greater than 20%, while only one DMU (1.64 percent) has a PTIE less than or equal to 20%. Further, the mean SE score in 2019-20 is 0.38, indicates that the average SIE in DMUs is approximately 62 percent. Companies that are technically efficient on a global scale (OTE score = 1) are also technically efficient on a local scale (PTE score = 1). As a result, there is no need for further improvement for DMUs with SE scores of 1 and enterprises functioning at MPSS. The same set of DMUs is efficient at OTE, PTE, and SE all. In addition to this table 6.12, shows eight companies (13.11 percent) have SE score of 1 and are functioning at MPSS and the remaining 53 (86.89 percent) companies have some degree of SIE. Henceforth, it is also found that two companies are nearby of MPSS have a SE score greater than 0.8, and no company has a score between 0.60 and 0.80. If these enterprises lessen their inputs by approximately 10% to 20%, the majority of them can approach MPSS. As shown in Table 6.11, the company has an OTE score one (1) it is certainly efficient at PTE and SE, with a  $\lambda$  score of 1.

**Table 6.11: Operational Efficiency scores and RTS Analysis of Textile manufacturing  
Units in Haryana in 2019-20 (DMU = 61)**

Name of the Company	DMUs	OTE	PTE	SE	RTS	$\sum \lambda$
Aggarsain Spinners Ltd.	C1	1	1	1	CRS	1
Ashnoor Textile Mills Ltd.	C2	0.3913	1	0.3913	DRS	6221.08
Benetton India Pvt. Ltd.	C3	1	1	1	CRS	1
Meyer Apparel Ltd.	C4	0.0356	0.1475	0.2412	DRS	217.33
Gupta Exim (India) Pvt. Ltd.	C5	0.035	1	0.035	IRS	0.03
H P Cotton Textile Mills Ltd.	C6	0.0301	0.2293	0.1314	DRS	3737.19
Haryana Texprints (Overseas) Ltd.	C7	0.0563	0.434	0.1297	DRS	5117.19
Hisar Spinning Mills Ltd.	C8	0.074	0.3228	0.2291	DRS	1382.99
Indo Cotspin Ltd.	C9	0.106	0.2706	0.3916	DRS	445.04
Jasch Industries Ltd.	C10	0.0813	0.4808	0.169	DRS	5587.35
Orient Craft Ltd.	C11	0.035	1	0.035	IRS	0.03
Partap Spintex Pvt. Ltd.	C12	0.0631	0.7486	0.0842	DRS	19867.19
Shivani Textiles Ltd.	C13	0.035	1	0.035	IRS	0.03
Pasupati Spinning &Wvg. Mills Ltd.	C14	0.0263	0.2954	0.089	DRS	5387.41
Voith Paper Fabrics India Ltd.	C15	0.0904	0.5095	0.1774	DRS	5081.15
R L F Ltd.	C16	1	1	1	CRS	1
Richa Industries Ltd.	C17	0.0291	0.2662	0.1094	DRS	2017.83
Sanganeriya Spinning Mills Ltd.	C18	0.035	1	0.035	IRS	0.03
Uniroyal Industries Ltd.	C19	0.0446	0.2897	0.154	DRS	1315.01
United Leasing &Inds. Ltd.	C20	0.0346	0.2815	0.1229	DRS	95.9
United Textiles Ltd.	C21	0.1301	0.3258	0.3992	DRS	377.2
Tex Corp Pvt. Ltd.	C22	0.035	1	0.035	IRS	0.03
Biba Apparels Pvt. Ltd.	C23	0.2421	0.5712	0.4238	DRS	21323.57
Numero Uno Clothing Ltd.	C24	0.3355	0.6194	0.5417	DRS	4591.86
Unicharm India Pvt. Ltd.	C25	0.2083	1	0.2083	DRS	97585.38
Jindal Spinning Mills Ltd.	C26	0.0934	0.3993	0.2339	DRS	1560.01
Gautam Apparel & Sourcing Pvt. Ltd.	C27	0.2488	0.6648	0.3743	DRS	1916.07
Chaos design Private Ltd.	C28	0.2518	1	0.2518	IRS	0.25
Click Clothing Company Private Ltd.	C29	0.0257	0.1694	0.1519	DRS	1365.77
DAG Design Concept Fashion Private Ltd.	C30	0.1118	0.261	0.4282	DRS	109.44
Drips Apparels Private Ltd.	C31	0.1072	0.2513	0.4267	DRS	374.15
Delphique Fabrics Private Ltd.	C32	0.0785	0.2311	0.3394	DRS	976.26



Dida Brothers Company Private Ltd.	C33	0.0273	0.0866	0.3155	DRS	5.78
J.D. Textiles Private Ltd.	C34	0.1344	0.329	0.4086	DRS	104.45
Jai Handloom Private Ltd.	C35	0.5749	1	0.5749	DRS	1344.72
Jindal Cotspin Private Ltd.	C36	0.0906	0.3468	0.2613	DRS	1352.01
Panipat Texo Fabs Private Ltd.	C37	0.1567	0.5469	0.2865	DRS	1686.63
Radico Fashions Private Limited	C38	0.0524	0.1472	0.3561	DRS	53.98
RGL Fashion Private Ltd.	C39	0.0208	0.0976	0.2127	DRS	4.61
Santosh Woolen Pvt. Ltd.	C40	0.0493	0.1934	0.255	DRS	238.92
Sarla Handicrafts Pvt. Ltd.	C41	0.0862	0.4552	0.1893	DRS	1839.16
Shivansh Textile Private Ltd.	C42	0.289	0.8817	0.3278	DRS	1505.01
Shree Shiv Shakti Synthetics Pvt. Ltd.	C43	0.3877	1	0.3877	DRS	322.21
Shubh&SanchayTexofab Pvt. Ltd.	C44	0.3764	1	0.3764	DRS	839.71
Sufiana Design Pvt. Ltd.	C45	0.1189	0.3377	0.3522	DRS	190.55
TypioYfm Design Pvt. Ltd.	C46	0.0579	0.3938	0.1469	DRS	430.57
Angel Fabrics Pvt. Ltd.	C47	1	1	1	CRS	1
Anika Syncotex Pvt. Ltd.	C48	1	1	1	CRS	1
Shiv Sharan Handlooms Pvt. Ltd.	C49	0.4779	1	0.4779	IRS	0.47
Vee Fabrics Pvt. Ltd.	C50	0.9103	1	0.9103	IRS	0.91
J.D.R.D. Embroidery Pvt. Ltd.	C51	0.0822	0.5876	0.1399	DRS	3607.15
Maharaja Texo Fab Pvt. Ltd.	C52	0.0373	0.2007	0.1856	DRS	166.81
Nik Fasteners Pvt. Ltd.	C53	0.0132	0.114	0.1161	DRS	27.16
Prosource Texstyles Pvt. Ltd.	C54	0.2574	1	0.2574	IRS	0.26
UNMA Textiles Pvt. Ltd.	C55	1	1	1	CRS	1
Peacock Fabrics Pvt. Ltd.	C56	0.8579	1	0.8579	IRS	0.86
PCC Interlinings Pvt. Ltd.	C57	0.2842	0.6982	0.4071	DRS	675.61
Kanta fabrics Pvt. Ltd.	C58	1	1	1	CRS	1
Govind Textiles Pvt. Ltd.	C59	0.1773	0.3525	0.503	DRS	324.84
Aan Handloom Pvt. Ltd.	C60	0.5238	1	0.5238	IRS	0.52
Neelmani Textile Pvt. Ltd.	C61	1	1	1	CRS	1
<b>Average</b>		<b>0.28</b>	<b>0.62</b>	<b>0.38</b>		

**Source:** Author's calculation

Sr.N.	Different ranges of efficiency scores	OTE		PTE		SE	
		DMU's	Percentage	DMU's	Percentage	DMU's	Percentage
1	0.00<= Score <0.2	37	60.66%	7	11.48%	20	32.79%
2	0.2<= Score <0.4	11	18.03%	18	29.51%	21	34.43%
3	0.4<= Score <0.6	3	4.92%	7	11.48%	10	16.39%
4	0.6<= Score <0.8	0	0.00%	4	6.56%	0	0.00%
5	0.8<= Score <1	2	3.28%	1	1.64%	2	3.28%
6	Score =1	8	13.11%	24	39.34%	8	13.11%
	Total	61	100.00%	61	100.00%	61	100.00%

**Source:** Author's calculation

### **6.3.6 RTS Analysis Textile manufacturing companies in Haryana for five years (2015-16 to 2019-20)**

Table 6.13 shows the year-wise RTS analysis of selected 61 DMUs from 2015-16 to 2019-20. In 2015-16 three companies (4.91 percent) operate at CRS, because these DMUs have a summation ( $\sum$ ) of  $\lambda = 1$  (Table 6.3), and six DMUs (9.84 percent) operate at IRS, where the  $\sum\lambda$  is less than one (Table 6.3), additional inputs are required to achieve the efficiency level of one. The remaining 52 companies (85.25 percent) are operating at DRS, because the  $\sum\lambda$  is greater than 1 (Table 6.3), implying a need to reduce inputs by an optimal quantity to achieve efficiency level = 1.

In 2016-17, five companies (8.20 percent) operate at CRS because these DMUs have  $\sum\lambda=1$  (Table 6.5), and 6 DMUs (9.84 percent) operate at IRS, where the  $\sum\lambda < 1$  (Table 6.5), additional inputs are required to achieve the efficiency level of one. The remaining 51 companies (83.61 percent) are operating at a DRS level due to the  $\sum\lambda > 1$  (Table 6.5), implying a need to reduce inputs by an optimal quantity to achieve efficiency level = 1.

In 2017-18, four companies (6.56 percent) operate at CRS, and because these DMUs have a  $\sum\lambda=1$  (Table 6.7), and 7 DMUs (11.48 percent) operate at IRS, where the  $\sum\lambda<1$  (Table 6.7), additional inputs are required to achieve the efficiency level of one. The remaining 50 companies (81.97 percent) are operating at DRS due to  $\sum\lambda>1$  (Table 6.7), implying reducing inputs by an optimal quantity to achieve efficiency level = 1.

In 2018-19, nine companies (14.75 percent) are operating at CRS, because these DMUs have a  $\sum\lambda=1$  (Table 6.9), and 22 DMUs (36.07 percent) operate at IRS, where the  $\sum\lambda<1$  (Table 6.9). Hence, additional inputs are required to obtain the efficiency score of one in the above case. The remaining 30 companies (49.18 percent) are operating at DRS due to the  $\sum\lambda>1$  (Table 6.9), implying to reduce inputs by an optimal quantity to achieve efficiency level = 1

In 2019-20 eight companies (13.11 percent) operate at CRS because these DMUs have  $\sum\lambda=1$  (Table 6.11). Eleven DMUs (18.03 percent) operate at IRS, due to  $\sum\lambda<1$  (Table 6.11), it needs additional inputs to achieve the efficiency level of one. The remaining 30 companies (78.67 percent) are operating at a DRS due to  $\sum\lambda>1$  (Table 6.11), it needs to reduce inputs by an optimal quantity to achieve efficiency level = 1

**Table 6.13: Average score of RTS Analysis in all the years of 61 Textile manufacturing Units in Haryana**

<b>RTS</b>	<b>2015-16</b>	<b>2016-17</b>	<b>2017-18</b>	<b>2018-19</b>	<b>2019-20</b>	<b>Overall Avg.</b>
<b>CRS</b>	3	5	4	9	8	5.8
<b>IRS</b>	6	5	7	22	11	10.2
<b>DRS</b>	52	51	50	30	42	45
<b>Total</b>	61	61	61	61	61	61

**Source:** Author's calculation

It can be concluded that DMUs operating at CRS are efficient at OTE and also at PTE and SE, whereas DMUs operating at IRS or DRS are inefficient to some extent and require increasing or decreasing their input size to achieve the desired level of efficiency.

### **6.3.7 Comparison of efficiency-based performance of Textile manufacturing companies in Haryana for five year (2015-16 to 2019-20)**

Table 6.14 shows the overall comparison of efficiency across the five years (2015-16 to 2019-20). In 2015-16 the OTE and PTE range from 0.02 to 1 (Min. to Max.), and the value of SD of OTE and PTE is 0.25 and 0.36 respectively. It indicates a higher level of deviation which leads to a low level of efficiency. It can be optimised by minimising the inputs. SE scores range from 0.03 to 1 and the standard deviation is 0.30 (less than PTE and more than OTE). Hence, it can be concluded that there is less fluctuation in SE than PTE in operations and more fluctuation than OTE. In 2016-17, both OTE and PTE range from 0.00 to 1, and the value of SD of OTE and PTE is 0.27 and 0.36 (same as 2015-16), respectively. It depicts the much unfavorable efficiency in PTE as compared to OTE. This indicates that the managerial efficiency fluctuates more than input operations as PTE represents managerial efficiency. SE scores range from 0.03 to 1 and its standard deviation is 0.30, which is less than the PTE standard deviation (0.30).

In 2017-18, the range of OTE is 0.99 (0.01 to 1) which shows that unfavourable efficiency is higher than the PTE (0.97) and SD of OTE is 0.26. The SD is at its highest level with a score of 0.35 and again the managerial efficiency fluctuates more than input operations like 2016-17. The range of SE (0.96) and value of SD (0.24) both are lower than PTE and OTE respectively. It can be understood that there is less fluctuation in SE and comparatively more stable operations. In 2018-19 the OTE and PTE range from 0.01 to 1 (Min. to Max.), which shows the lower level efficiency. SE scores range from 0.07 to 1 and the standard deviation is 0.28, which is less than the PTE standard deviation (0.34).

In 2019-20, the range of OTE is 0.99 (0.01 to 1) and the value of SD of OTE is 0.33. The range of PTE is 0.91 (lowest in all five years), indicating the favorable sign of efficiency out of the five years and the SD is at the highest level with a score of 0.34. This shows that managerial efficiency fluctuates more than input operations. SE scores range from 0.04 to 1 and the standard deviation is 0.30, which is less than the PTE standard deviation (0.34).

<b>Table 6.14: Overall comparison of efficiency scores of Textile Manufacturing Units in Haryana each year</b>								
<b>Year</b>	<b>Efficiency type</b>	<b>Minimum</b>	<b>1st Quartile</b>	<b>Mean</b>	<b>Median</b>	<b>3rd Quartile</b>	<b>Maximum</b>	<b>SD</b>
<b>2015-16</b>	OTE	0.02	0.05	0.2	0.11	0.23	1	0.25
	PTE	0.02	0.13	0.43	0.29	0.85	1	0.36
	SE	0.03	0.25	0.54	0.52	0.81	1	0.3
<b>2016-17</b>	OTE	0	0.03	0.18	0.07	0.14	1	0.27
	PTE	0	0.15	0.43	0.3	0.78	1	0.36
	SE	0.03	0.14	0.44	0.42	0.63	1	0.3
<b>2017-18</b>	OTE	0.01	0.04	0.18	0.07	0.13	1	0.26
	PTE	0.03	0.24	0.55	0.5	1	1	0.35
	SE	0.04	0.11	0.29	0.22	0.36	1	0.24
<b>2018-19</b>	OTE	0.01	0.17	0.4	0.29	0.56	1	0.31
	PTE	0.01	0.29	0.6	0.58	1	1	0.34
	SE	0.07	0.54	0.71	0.73	0.99	1	0.28
<b>2019-20</b>	OTE	0.01	0.04	0.28	0.11	0.38	1	0.33
	PTE	0.09	0.29	0.62	0.57	1	1	0.34
	SE	0.04	0.15	0.38	0.32	0.43	1	0.3

**Source:** Author's calculation

It can be concluded from Table 6.14 that data range is found more than 0.91 (Minimum values of all the OTE, PTE and SE scores are less than 0.09 and maximum values are equal to one (1) in all the years is not a good sign if the highest value of efficiency is one (1). This is why the average level of efficiency in each year is very less. On the other hand, a higher value of SD shows that some companies are getting good scores near to one but some are at very low efficiency. This is again an unfavorable condition for the textile industry in

Haryana. Although maximum efficiency in each year is one (1) but very few companies are efficient in the study period viz. 3 companies are efficient in 2015-16, five companies are efficient in 2016-17, four companies in 2017-18, nine companies are efficient in 2018-19 and eight companies are efficient in 2019-20 out of the sample of 61.

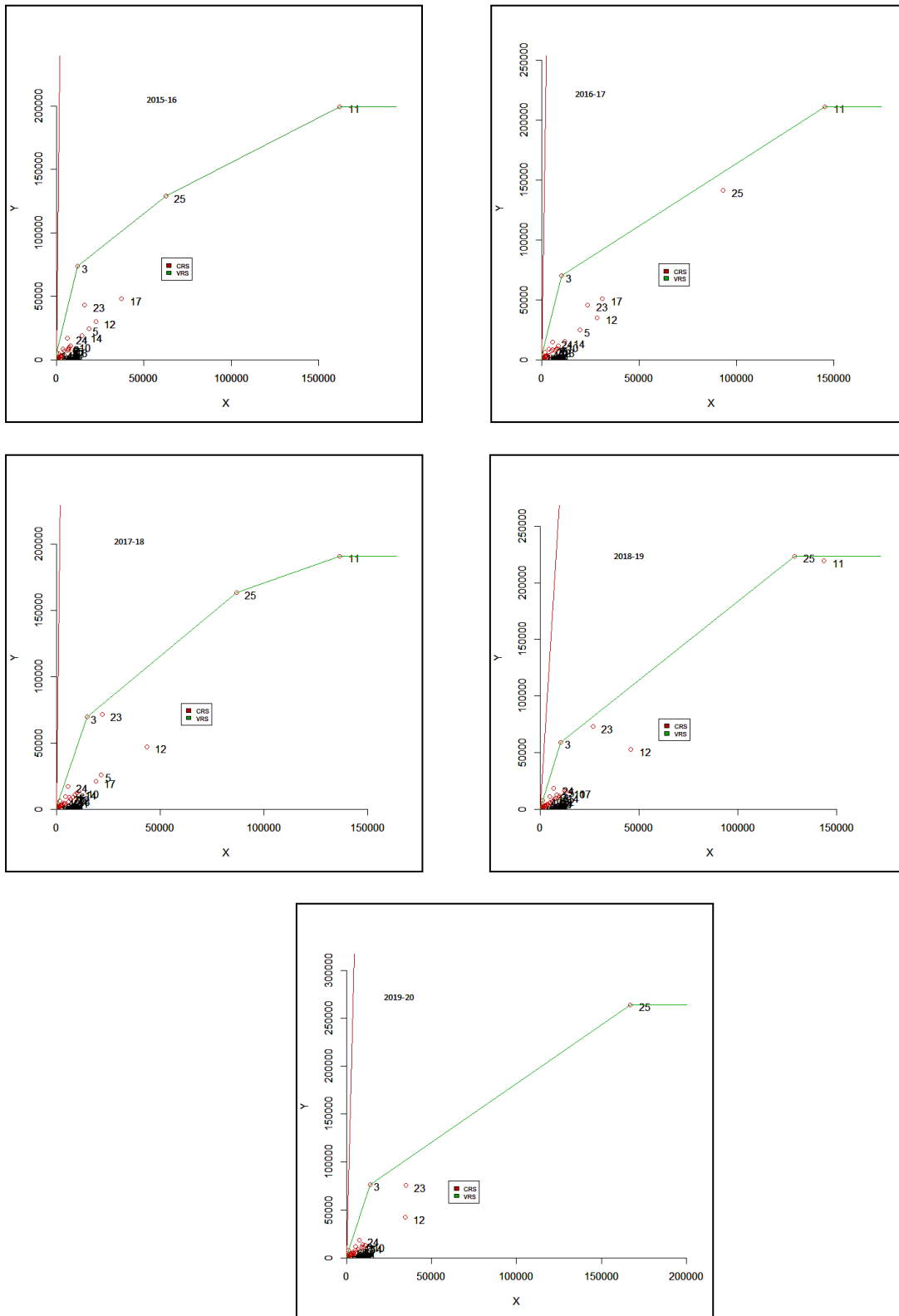
<b>Table 6.15: Average overall and average year-wise operational performance of textile manufacturing units in Haryana (DMU = 61)</b>			
<b>Years</b>	<b>OTE</b>	<b>PTE</b>	<b>SE</b>
<b>2015-16</b>	0.2	0.43	0.54
<b>2016-17</b>	0.18	0.43	0.44
<b>2017-18</b>	0.18	0.55	0.29
<b>2018-19</b>	0.4	0.6	0.71
<b>2019-20</b>	0.28	0.62	0.38
<b>Overall Average</b>	<b>0.25</b>	<b>0.53</b>	<b>0.47</b>

**Source:** Author's calculation

From the above results, it can be concluded that there is a huge scope for improvement in the managerial efficiency of the companies because of the highest SD in PTE which is directly related to the managerial performance of an organisation. It is worth noting that, although efficiency level of OTE PTE and SE was found highest viz. 0.40, 0.60, and 0.71 respectively in 2018-19 but not satisfactory and there is a much chance for improvement in input level and managerial efficiency in the operations of the textile industry of Haryana. As per table 6.14, the improved efficiency has been observed in the operations over the five years (2015-16 to 2019-20) but there is a need to minimise the input scale and underperformance of management to get the optimum level of efficiency in each DMU of the textile industry in Haryana.

Figure 6.1 depicts the variation of VRS (green line in PPC) to CRS (red line in PPC). Here VRS line shows the intersection of sum of the total weightage of inputs to sum of the total weightage of outputs of each DMU for each year.

**Figure 6.1: Production possibility curve (PPC)**



**Source:** Author's compilation

The upper line in production frontier shows the best possible combination of input and output

variables, also called as CRS and there is no need to improve the input size or process. This line shows the maximum area of production on which ratio of input and output of all the companies will either fall on this line if these are efficient or below the line if the companies are inefficient and operating at Variable Return to Scale i.e. IRS or DRS.

#### **6.4 Conclusion**

It can be concluded that operational performance may vary according to the different variables, industry, country, and years. Seventy-five percent of the operational inefficiency observed in Haryana's textile industry can be eliminated through company-level input optimization combined with increased managerial efficiency. The results demonstrate a very low performance of the textile industry in Haryana with an average consolidated score of technical efficiency i.e. 0.25 for five years. Selected textile companies with respective scores 0.2, 0.18, 0.18, 0.4, and 0.28 are technically efficient from 2015-16 to 2019-20 respectively. Only, 5.8 companies (average of five years) are operating at CRS, 10.2 companies (average of five years) are operating at IRS, and the rest 45 companies (average of five years) are operating at DRS. There is a need to increase the input scale by those companies which are functioning at an increasing return to scale whereas those units which are functioning at decreasing return to scale have to keep their input scale low to increase their efficiency. According to descriptive statistics in Table 6.2, a huge fluctuation has been observed in the number of ranges of different variables. It shows that some companies are so big and some are very small, so the small companies are always fighting in the market in terms of finance, technology, and other important sources. Mselmi, Lahiani, and Hamza (2017) have supported this finding that smaller companies have higher levels of debt, are less profitable and have lower repayment capacity, so they reflect lesser efficiency. In practical, scenario, capital structure theory doesn't seem to fit for small businesses. The capital structure theories are best suited to established or large enterprises because debt is typically available for them at a



lesser cost. Thus, large businesses always preserve the quantity of debt higher to a certain amount, and this also happens to be more profitable compared to funds held by the company. An additional important conclusion is that the majority of the companies are operating at the DRS (As per table 6.13) which means they have to lower their input size to reach the level of efficiency equal to one (1). Hence, small companies need to improve internal sustainability (Shahi *et al.*, 2020) like financial matters, and management efficiency to enhance their performance. Conversely, large-scale companies can easily raise sufficient funds and hence it is easier for them to employ quality material and skilled labour.