RESEARCH REVIEW JOURNALS
Volume-04
Issue-01
January-2019

ISSN: 2455-3085 (Online)
RESEARCH REVIEW International Journal of Multidisciplinary
www.rrjournals.com[UGC Listed Journal]

Technical Efficiency of Apparel Industry in India at Firm Level

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ARTICLE DETAILS

Article History
Published Online: 10January 2019

Keywords
Competitiveness, WTO, Data Envelopment Analysis, Apparel Firm, Partnership

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ABSTRACT

The current paper analyzed the technical efficiency of Indian textile in Wearing and Apparel firms using Data Envelopment Analysis Model. Data Envelopment Analysis (DEA) is a post ante analysis based on the past performance cross-sectional view of several organizational units in a given single period, as measured by their multiple inputs and outputs. We classify the units into two groups, efficient and inefficient, in the pareto sense. The study finds Individual Proprietorship has higher (grand) technical efficiency (rank-1). In the remaining organization type Partnership (rank-2) had the highest grand efficiency. Then public limited companies and Private Limited Company have a rank of 3 and 4 respectively. Among the selected Indian states firms from the state of Andhra Pradesh performed at higher average levels of technical efficiency with respect to both their state frontier and a grand frontier applicable to firms from all states.

1. Introduction

There has been change in the world order after 1995 when WTO came into existence. Most of the WTO members who are competitive player in international trade markets have changed their macro-economic policy to make their industry significantly competitive in the changing environment. Since then the market oriented growth has been pursued by most of the countries. Against this back drop Indian industries are also trying to operate in the changing environment. Under the regime of new economic order in contrast to the old policy regime, new economic policy mostly rely on market forces and aiming to be cohesive and integrative with the international market. In the last over eighteen years Indian industries have made a successful attempt to face the greater competition in the domestic as well as in international market.

Trade restrictions and preferences in developed markets have shaped this process. The boom in exports from developing countries led to protectionist pressures in developed countries, notably the Multifibre Arrangement (MFA) concluded in 1974, a global system of quotas. It therefore had the unintended benign consequence of spurring global diversification of production, as buyers sought out countries that were not restricted by the quotas. The expiry of the MFA in January 2005 has, conversely, led to fears that a few dominant producers, notably China, will rapidly dominate the world market and cut off this route to development for LDCs. China's exports boomed in 2005 and some new exporters, notably in Africa and Latin America, experienced a corresponding sharp drop in exports. US imports of clothing from sub-Saharan Africa fell sharply from $1.8 billion in 2004 to $1.3 billion in 2006 (US ITC, 2006); in Maldives, the clothing industry has collapsed (Maldives DTIS, 2006).

In addition to quotas, clothing is subject to relatively high tariffs in the United States and Europe. Both have Generalized System of Preferences schemes that exempt eligible LDCs from customs duties, but clothing, because of its sensitive nature, are largely excluded. In Europe, clothing imports from LDCs qualify for preferences under the Everything but Arms preferential duties, but restrictive rules of origin apply to fabric sourcing, limiting the effective generosity of those provisions. The United States' African Growth and Opportunity Act (AGOA) relaxes rules of origin for African LDCs on a temporary basis. In combination with the MFA, AGOA has been very successful in jump-starting clothing production in a number of southern and eastern African countries, but the sustainability of their fledgling industries is in doubt owing to the temporary nature of AGOA, relentless competition from Asia and the end of the MFA.

Another issue in developed countries emanates from human rights groups, which have decried low wages and labour standards in LDCs despite clear evidence that wages in exporting firms, while low, are uniformly superior to the alternatives available to most workers in agriculture and the informal sector (Moran, 2002). US preferences and bilateral trade agreements are increasingly contingent on LDCs' satisfying labour and environmental standards.

Internationally, markets proved to have fierce completion led by China, South East Asian Nation and South Asian countries like Sri Lanka, Pakistan and Bangladesh. There has been change in the spatial pattern of the competitiveness at the global level, though there has been dominance of the developed region till now but in the manufacturing sector competitiveness has shifted from west to east at global level.

Global opportunities are extremely varied and sectors with high potential differ across countries, these differences reflecting differences in factor endowments, locational advantages, and scale or agglomeration effects. The linkages of exports to growth and competitiveness of firm also differ, in some cases operating mainly through employment and learning effects at the firm and industry level, in others through expanded financing for public infrastructure or imported capital equipment,

India has initiated, since August 1991, a far-reaching structural adjustment programme (SAP) to reduce policy induced rigidities in the functioning of the economy and to achieve competitiveness in the international market. The SAP involves reducing state intervention in product and factor markets and correcting the import substitution bias that characterized India's industrial development strategy and policy. The policy reforms include industrial deregulation, reduction of tariffs and quantitative restrictions on imports, access to disembodied foreign technology, liberalization of exchange rate and foreign direct investment policies. The primary objective of policy changes has been to improve the efficiency of the manufacturing sector through increased competitive pressure and access to imported inputs at international prices. The assessment of the impact of the first five years of reform on industrial and trade performance has shown the impact to be largely positive (see World Bank 1997). Between 1991 and 1994, India's exports have grown in dollar terms, at the annual average rate of 12.4 per cent (Economic Survey 1997). However, India's penetration of world export markets was very low, at 0.60 per cent in 1994, relative to many other Asian developing countries. Consequently, the emphasis of government policy continued on achieving export growth and integration with the world economy.

Labor intensive manufactured exports, particularly clothing, to developed countries has been a vital stepping stone in the export growth of many labour abundant developing economies, starting with the East Asian tigers (Republic of Korea, Taiwan Province of China, Hong Kong and Singapore in the 1960s). A highly sophisticated international division of labour has developed over the last few decades, with the most unskilled, labour-intensive operations moving to developing countries with very low wages. Over time, the production of apparel for export has spread to South-East Asia, China, South Asia, Latin America and North Africa, and most recently even some countries in sub-Saharan Africa. Three interrelated forces have contributed to this diffusion of production to LDCs: the rise of global buyer chains, the evolution of labour costs and productivity, and the policies of developed countries.

Fiercely competitive global buyers have come to dominate the clothing market, and scour the globe for the cheapest sourcing. Global buyers include discount chain stores (e.g. Walmart, Target), branded marketers (Nike, Liz Claiborne), apparel specialty stores (The Limited, The Gap) and private label programmes of mass merchandisers (Sears, JC Penney). Large retailers do little of their own manufacturing, and instead subcontract with firms in developing countries, thereby fragmenting and diffusing production around the world (Gereffi, 1999). Buyers have exacting quality standards and delivery schedules.

Ideally, measures of competitiveness should satisfy three basic criteria: first, they should cover all the sectors exposed to competition, i.e. represent all goods traded or trade-able that are subject to competition and only those goods; second, they should encompass all the markets open to competition; and, third, they should be constructed from data that are fully comparable internationally. In practice, none of the indicators that are available fulfill these three criteria. Data and other limitations mean that compromises have to be made at every stage, so that any measure of competitiveness is in fact only a rough approximation of the ideal.

Competitiveness can be defined at the firm level, the industry level, the national level and at international level. At the firm level, competitiveness is the ability to produce goods and services more effectively and efficiently than competitors (Nurbel, 2007). This signifies continuous success of firm in domestic market. competitiveness at the firm level can be computed through firm profitability and declining cost and high quality, the exports or foreign sales divided by output, and regional or global market share (Porter, 1992).

The apparel industry has been chosen for study for two reasons. Firstly, among the top major export earner. Secondly, its export performance is said to have been affected adversely by the rising costs and the pull of the domestic market.

The garment manufacturing units have been set-up at various locations, suiting to the needs of the entrepreneur. Such units in-fact are also competing. This study, therefore has attempted to find-out locational advantage to manufacturing units by using Data Envelopment Analysis.

2. Overview of Technical Efficiency of Apparel Industry in India at Firm Level

Evaluation of the any firm or industry is today's most important task for the survival or to run business smoothly in this competitive nature of the world. Especially, in developing countries like India, it is more competitive because of huge population, high resources and government's new polices. Nevertheless, many foreign companies are showing interest in doing business in India due to this reason. This makes the companies to undergo evaluation on their own in the regular interval of the time to sustain themselves in the competition and also around the world. The Textile is the one of the largest and leading Sector in India. It is the vital role in the development of the country.

Also the Indian Textiles and clothing industry plays a crucial role in the Indian economy, and contributes about 14% of industrial production and 4% of GDP of the country. The industry also creates an employment opportunities for about 45 million people and accounts 12% of the export of the country with a share of 6.16% in textiles and 4.31% in clothing in the global market during 2014. While export contributes significantly to the overall growth of the textile industries of the country, the domestic demand of textiles both in household sector also plays an equally important role. The increase in disposable income in the recent years accompanied by accelerated growth in Gross Domestic Product (GDP) of the country has further enhanced the contribution of the domestic demand for the overall growth of the sector. One of the important factors for growing demand of textiles is population growth, which has increased to 1.25 billion in 2014.

Further, the domestic demand of the household sector has increased to $ 73.70 Bn during 2014 as against $63.51 Bn in 2012. The market size of the Textile and Clothing including exports has increased from $121 Bn in 2012 to $142 Bn in 2014 and the share of the household has declined from 52.33

percent to 51.85 percent during the same period. The decline in the share of the household sector in the overall demand may be attributed to the growth in non-household sector and export of T&C to the rest of the World. While the export of T & C has moved positively from US $ 33.31 billion in 2012 to US$ 38.60 billion in 2014. The demand of the non-household sector has increased from $24.54 Bn in 2012 to $29.85 Bn (Source: National Household Survey 2015- Textile Committee).

3. Description of data and variables used

The present study is based on the secondary data. Each observation in our data set includes the information on a number of variables for different individual industrial units covered by the Central Statistical Organization (CSO), Government of India through its Annual Survey of Industries (ASI). The data used are for the years 2008-09, 2009-10, 2010-11, 2011-12, 2012-13 for firms drawn from the entire textile industry (NIC-2008: Division-14: 14101 to 14309). Thus , we conceptualize a **1-output**, **3-input** technology. The output is measured by the total ex-factory value of products and by-products produced by the firm during the production year. The inputs are labor (measured by the total no. of employee), capital (measured by the net value of fixed assets of the firm at the beginning of a year) and intermediate inputs (measured by the nominal value of material inputs (both indigenous and imported) and energy (power, fuels etc.).

4. Methodology

As, Mentioned above this paper establishes to identified the technical efficiency of Indian textile in Wearing and Apparel firms for selected years using Data Envelopment Analysis.

Data Envelopment Analysis (DEA) is a post ante analysis based on the past performance cross-sectional view of several organizational units in a given single period, as measured by their multiple inputs and outputs. We classify the units into two groups, efficient and inefficient, in the pareto sense. DEA does not use common weights, as do Multiple Criteria Decision Theory models, which usually rank the elements based on the multiple criteria (inputs and outputs), and usually provide common weights. In DEA, the weights vary among the units: this variability is the essence of DEA. As a performance measurement and analysis technique, DEA is a nonparametric frontier estimation methodology based on linear programming for evaluating relative efficiency of a set of comparable DMU that share common functional goals.

Assume that there are:

KDecision Making Units (DMU), where each DMU_k, (k= 1,..., n)
j Different inputs,(r =1,...,r)
i Different outputs,(i =1,...,m) We assume that the data set are positive.

Efficiency in DEA is defined as the ratio of the weighted sum of outputs to its weighted sum of inputs. That is

Technical Efficiency = $\frac{\sum \text{weights outputs}}{\sum \text{weights inputss}}$

As the above approach of DEA has several strength, it is the best tool for deciding relative efficiency. The efficiency score lies between 0 and 1. Ifthe score is equal to 1, then the DMU is termed as *efficiency*, otherwise *inefficiency*. The relative efficient score for q^{th} DMU can be obtained using the mathematical programming model discussed below (1). The model (1) can be reduced to linear programming problem as (2).

Max $Z_Q = \frac{\sum_{i=1}^{m} ViYiq}{\sum_{j=1}^{r} UjXjq}$

Subject to Constraints

$\frac{\sum_{i=1}^{m} ViYiq}{\sum_{j=1}^{r} UjXjq} \leq$ 1¥$K$$v_i$,u_j ≥ 0 ¥ i , j .... (1)

The model (1) can be reduced to **linear programming problem** as (2).

Max $Z_Q = \sum_{i=1}^{m} viyiq$

Subject to Constraints

$$\sum_{j=1}^{r} ujxjq = 1$$

$\sum_{i=1}^{m} vjyik$- $\sum_{j=1}^{r} ujxjk \leq$ 0¥$K$$v_i$, u_j ≥ 0 ¥ i , j .... (2)

i =1 to m (number of outputs), j = 1 to r (number of inputs), k=1 to n (number of DMU's), v_i ,u_j

are weight given to j inputs and i outputs v_{ik}=amount of output i produced by DMUs k.

Input Oriented Method (For group)

φ_g= Min φ

Min φ

$\sum_{k=1}^{n} \boldsymbol{\lambda}_k x_k \leq \varphi x_q$

$\sum_{k=1}^{n} \boldsymbol{\lambda}_k y_k \geq \varphi y_q$

$\sum_{k=1}^{n} \boldsymbol{\lambda}_k = 1$

$\boldsymbol{\lambda}_k \geq 0$, (i =1,2,3...,n)

Where, φ = Efficiency score,
K=1 to n (Number of DMU's),
x_k = amount of input j utilized by DMU k,
y_k = amount of output i produced by DMU k,

Input Oriented Method (For Grant)

φ_G = Min φ

Min φ

$\sum_{k=1}^{N} \boldsymbol{\lambda}_k x_k \leq \varphi x_q$

$\sum_{k=1}^{N} \boldsymbol{\lambda}_k y_k \geq \varphi y_q$

$\sum_{k=1}^{N} \boldsymbol{\lambda}_k = 1$

$\boldsymbol{\lambda}_k \geq 0$, (i =1,2,3...,N)

In the model where objective is to minimize the inputs while producing at least the given output levels so it is called as **input oriented**. The DEA model can be classified as constant return to scale (CRS) or variable returns to scale (VRS) based on the assumptions relating the changes in inputs as a result of the outputs. The DEA models, the outputs are not affected by the size of the DMU, rather they change in the direction proportion to the change in inputs assuming that the scale of operation does not influence efficiency whereas, in VRS model changes in inputs are not necessarily proportional to the changes in the inputs. VRS model differs from CRS by adding the constraint to ensure the total weight does not exceed 1 ($\boldsymbol{\lambda}_i$ adds up to 1). In CRS model, efficiency scores for both input and output oriented will be same but efficient score for inefficient DMU's vary in VRS model.

The (group) technical efficiency of the firm k within group,

$$TE_g = \frac{1}{\varphi g}$$

The (Grant) technical efficiency of the firm k from out of the entire firm is measured as

$$TE_G = \frac{1}{\varphi G}$$

Technology Closeness Ratio

When, for any firm *k* in group*g*, the *group* efficiency and the *grand* efficiency measures are close, we may argue that evaluated at the input bundle, the relevant *group frontier* is close to the *meta-frontier.* Instead of evaluating the proximity of the *group frontier* to the *meta-frontier* at individual points, it is useful to get an overall measure of proximity for the group as a whole. For this, we first define an average technical efficiency of the firms in the group (i.e., relative to the *group frontier*) by the taking a average of such individual technical efficiencies. For the group *g* this will be given by

$$TE_g = [\sum_{g=1}^{n} \frac{1}{\varphi g}] \text{ / Number of DMUs within group.}$$

$$TE_G = [\sum_{G=1}^{N} \frac{1}{\varphi G}] \text{ / Total number of DMUs.}$$

TCR increases if the *group frontier* shifts towards the *meta-frontier*, ceteris paribus, and is bounded above by unity which would be realized if and only if *group frontier* coincides with the *meta-frontier*.

5. Result and Discussion

Grand efficiency

In order to perform *meta-frontier* analysis for studying the effects of difference in location, we focus on eleven major textile-producing states namely Andhra Pradesh, Delhi, Gujarat, Haryana, Karnataka, Maharashtra, Punjab, Rajasthan, Tamil Nadu, Uttar Pradesh and West Bengal.Observations from the rest of the country contribute to the construction of the *meta-frontier* but are not analyzed as a single group for measuring TCR.

Average technical efficiency measured relative to either *frontier* as well as TCR for different states are shown in Table 1.In 4 out of the 5 years analyzed, Delhi had the highest level of average *grand* efficiency (rank-1) i.e., technical efficiency measured relative to the *meta-frontier*.In the remaining year Maharashtra(rank-2) had the highest grand efficiency.Then Andhra Pradesh, Karnataka, Punjab, Uttar Pradesh, Haryana, West Bengal, Gujarat, Rajasthan and Tamil Naduhave a rank of 3, 4, 5, 6, 7, 8, 9, 10 and 11respectively.

As per organization type, **Individual Proprietorship**(identified in Table 2) has higher (grand) technical efficiency (rank-1). In the remaining organization type Partnership (rank-2) had the highest grand efficiency. Then public limited companies and Private Limited Company have a rank of 3 and 4 respectively.

Group efficiency

Coming to the *group efficiency* i.e., technical efficiency measured against the *group* frontier of each state, **Andhra Pradesh**is found to be best performing with averages ranging from 0.99 (in 2012-13) and 1.00 (in 2008-09& 2009-10).

Moreover, judging by the coefficient of variation (CV) in the year-wise group efficiency levels, Andhra Pradesh (Average percentage is 1.80) and Gujarat (7.05%) had the lowest yearly average degrees of variability in technical efficiency across firms with the state.

By contrast, Tamil Nadu(27.22%), Karnataka(19.51%), Maharashtra(14.13%), Haryana (13.93%), Uttar Pradesh(12.99%), Rajasthan(10.82%), West Bengal(10.70 %),Delhi(10.56%) and Panjab(7.57%) showed much greater variability in efficiency within the group.

Thus, with highest mean and lowest variability in the levels of efficiency, the Andhra Pradesh firms appear to have performed in a superior fashion in most of the years. Then Gujarat appear in the second place.

A high level of TCR *does not* imply that firms in a specific state are, on an average, more efficient. The TCR of any group is an index of the proximity of the *group* frontier to the *grand* or *meta-frontier* over the relevant range of variation in the input bundles. Bounded naturally between 0 and 1, a high value of the TCR for any state implies that, on an average, the maximum output producible from an input bundle by a firm required to produce within the state would be almost as high as what could be produced if the firm could choose to locate anywhere else in the country.

This, in its turn, implies only that there are no significant production infrastructural constraints (e.g., physical, legal, cultural, etc.) that hinder productivity in that state relative to the nation as a whole.

This is best illustrated by the examples of Tamil Nadu in the year 2008-09 and Rajasthan in 2008-09.In the case of

Tamil Nadu, in the relevant year the TCR was as high as 86% showing that the *group* frontier for the state was quite close to the *grand* frontier. However, relative to either frontier, the average technical efficiency was particularly low – only 0.44 and 0.51. Thus, even though, the state faced no particular disadvantage, the firms performed poorly.

The case of Rajasthanwas the opposite. The average level of group efficiency in 2008-09 was a respectable 95%. But the grand efficiency was as low as 47%. The corresponding TCR of 0.49 shows that from an average input bundle a firm in Rajasthancould at most produce only 49% of what would be feasible elsewhere in India. The Rajasthanfirms were doing reasonable well relative to a state benchmark but infrastructural constraints hindered efficient production.

In the case of Private Limited Company, in the year 2009-10the TCR was as high as 98% showing that the *group* frontier for the organization was quite close to the *grand* frontier. However, relative to either frontier, the average technical efficiency was particularly low – only 0.70 and 0.72.

6. The main findings of our empirical analysis can be summarized as follows.

1. Firms from the state of Andhra Pradesh performed at higher average levels of technical efficiency with respect to both their state frontier and a grand frontier applicable to firms from all states.
2. There were significant technological differences across states. However, firms from states with more productive technologies often ended up performing at low levels of efficiency as is evident from the case of Tamil Nadu in the year 2008-09.
3. Firms organized as Individual Proprietorship companies performed better than firms of other organizational types.
4. Technical efficiency tends to increase with firm size.

Hence the paper tried to measure the levels of technical efficiency of firms from the Indian textiles industry (Wearing Apparel) in different years. This study allows identifying the contribution of technological differences across groups of firms towards the overall measure of technical efficiency.

Superior performance of Individual Proprietorship companies suggests that this should be encouraged as a preferred organizational form. Also, consolidation of smaller firms into larger entities would enhance efficiency. These measures of technical efficiency suggest considerable room for increasing output without requiring any additional inputs.

Table: 1

Mean Technical Efficiency and TCR for Different States

State	Criterion	2008-09	2009-10	2010-11	2011-12	2012-13	Mean	Rank (Grant)	Rank (Group)
Andhra Pradesh	% of Firms	0.8	1	1	0.8	1.39			
	Grand (TE)	0.57	0.79	0.65	0.66	0.75	0.68	3	
	Group (TE)	1	1	0.96	1	0.99	0.99		1
	CV (in %)	0	0	6	0	3.02	1.8		
	TCR	0.57	0.79	0.68	0.66	0.76			
Delhi	% of Firms	11.35	9.56	6.77	7.17	6.97			
	Grand (TE)	0.63	0.77	0.7	0.78	0.76	0.73	1	
	Group (TE)	0.8	0.95	0.91	0.93	0.88	0.9		7
	CV (in %)	18.3	5.25	10.34	7.13	11.76	10.56		
	TCR	0.78	0.81	0.77	0.83	0.86			
Gujarat	% of Firms	4.18	3.39	2.79	2.99	3.98			
	Grand (TE)	0.54	0.7	0.65	0.61	0.64	0.63	9	
	Group (TE)	0.96	0.94	0.97	0.96	0.96	0.96		2
	CV (in %)	5.78	8.94	6.32	7.18	7.04	7.05		
	TCR	0.56	0.75	0.67	0.64	0.67			
Haryana	% ofFirms	15.14	13.94	9.16	9.56	8.96			
	Grand (TE)	0.53	0.7	0.63	0.63	0.62	0.62	7	
	Group (TE)	0.87	0.77	0.85	0.88	0.87	0.85		9
	CV (in %)	11.21	23.86	11.4	12.39	10.79	13.93		
	TCR	0.61	0.92	0.74	0.72	0.71			

Karnataka	% of Firms	9.36	7.37	9.76	9.36	11.75			
	Grand (TE)	0.49	0.77	0.68	0.66	0.65	0.65	4	
	Group (TE)	0.77	0.84	0.81	0.82	0.82	0.81		10
	CV (in %)	25.42	15.6	21.04	18.31	17.2	19.51		
	TCR	0.64	0.91	0.84	0.8	0.8			
Maharashtra	% of Firms	8.37	7.57	10.16	10.36	7.97			
	Grand (TE)	0.63	0.76	0.66	0.68	0.7	0.69	2	
	Group (TE)	0.83	0.88	0.89	0.92	0.93	0.89		6
	CV (in %)	21.31	15.3	14.8	9.8	9.41	14.13		
	TCR	0.77	0.87	0.74	0.75	0.75			
Punjab	% of Firms	9.76	7.77	9.16	7.57	6.77			
	Grand (TE)	0.54	0.73	0.66	0.64	0.64	0.64	5	
	Group (TE)	0.94	0.94	0.9	0.97	0.94	0.94		3
	CV (in %)	7.39	7.06	10.6	3.69	9.09	7.57		
	TCR	0.57	0.78	0.74	0.66	0.68			
Rajasthan	% of Firms	4.58	5.18	4.18	4.38	3.78			
	Grand (TE)	0.47	0.66	0.64	0.61	0.59	0.59	10	
	Group (TE)	0.95	0.93	0.94	0.85	0.91	0.91		5
	CV (in %)	7.54	8.28	8.96	17.29	12.01	10.82		
	TCR	0.49	0.71	0.68	0.72	0.64			
Tamil Nadu	% of Firms	23.31	30.48	30.08	33.07	28.29			
	Grand (TE)	0.44	0.64	0.6	0.58	0.58	0.57	11	
	Group (TE)	0.51	0.84	0.71	0.67	0.72	0.69		11
	CV (in %)	49.23	15.16	20.87	30.37	20.49	27.22		
	TCR	0.86	0.77	0.84	0.86	0.8			
Uttar Pradesh	% of Firms	11.95	11.35	14.74	12.55	17.73			
	Grand (TE)	0.54	0.73	0.65	0.64	0.63	0.64	6	
	Group (TE)	0.85	0.88	0.88	0.86	0.86	0.86		8
	CV (in %)	15.21	13.71	11.69	12.16	12.2	12.99		
	TCR	0.64	0.83	0.74	0.74	0.74			
West Bengal	% of Firms	1.2	2.39	2.19	2.19	2.39			
	Grand (TE)	0.63	0.61	0.71	0.61	0.6	0.63	8	
	Group (TE)	0.95	0.96	0.98	0.85	0.91	0.93		4
	CV (in %)	13.48	6.55	3.7	17.09	12.67	10.7		
	TCR	0.66	0.64	0.72	0.72	0.66			
Over All	% of Firms	100	100	100	100	100			
	Grand (TE)	0.53	0.66	0.64	0.62	0.68	0.63		
	TCR	1	1	1	1	1	1		

Grand TE - Grand Technical Efficiency (TE), Group TE - Grand Technical Efficiency (TE), CV - Co-efficient of Variation, TCR - Technology Closeness Ratio.

Table-2
Mean Technical Efficiency and TCR for Different Organisation

State	Criterion	2008-09	2009-10	2010-11	2011-12	2012-13	Mean	Rank- (Grant)	Rank - (Group)	Rank - (CV)
Individual Proprietorship	% of Firms	22.51	23.51	23.11	19.72	18.53				
	Grand (TE)	0.55	0.70	0.64	0.64	0.70	0.65	1		
	Group (TE)	0.75	0.87	0.83	0.84	0.84	0.83		1	
	CV (in %)	21.80	13.70	20.14	14.79	15.87	17.26			4
	TCR	0.74	0.81	0.77	0.76	0.83				
Partnership	% of Firms	31.08	34.86	34.86	33.67	36.25				
	Grand (TE)	0.54	0.71	0.64	0.65	0.67	0.641	2		
	Group (TE)	0.75	0.82	0.71	0.79	0.77	0.77		3	
	CV (in %)	18.59	14.65	19.58	16.51	17.73	17.41			3
	TCR	0.72	0.87	0.89	0.82	0.87				
Private Limited Company	% of Firms	37.05	35.46	34.06	39.04	40.64				
	Grand (TE)	0.51	0.70	0.64	0.61	0.68	0.63	4		
	Group (TE)	0.66	0.72	0.77	0.65	0.74	0.71		4	
	CV (in %)	30.16	24.53	18.88	32.60	19.13	25.06			1
	TCR	0.77	0.98	0.83	0.94	0.91				
Public Limited Company	% of Firms	8.96	5.98	7.37	7.17	3.78				
	Grand (TE)	0.51	0.67	0.69	0.63	0.69	0.639	3		
	Group (TE)	0.62	0.91	0.81	0.81	0.90	0.81		2	
	CV (in %)	42.09	8.47	18.88	18.68	15.22	20.67			2
	TCR	0.82	0.74	0.86	0.78	0.77				
Grand TE - Grand Technical Efficiency (TE), Group TE - Grand Technical Efficiency (TE), CV - Co-efficient of Variation, TCR - Technology Closeness Ratio.										

Source: Authors calculation based on primary survey

7. Conclusion and Recommendations

It is suggested that ASI data for the recent years is tested, by using Data Envelopment Analysis to perform meta-frontier analysis for the measurement of Average technical efficiency as well as Group efficiency.

It is recommended that State Governments of India, who are coming out with various incentive schemes for the promotion of manufacturing industry particularly for apparel sector, refer the findings of this study and do in depth analysis of gaps from grand efficiency. This may be helpful in better allocation of financial resources in apparel sector.

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