Sustainability strategies in the Indian leather industry: an empirical analysis

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Abstract

Purpose – Burgeoning challenges of climate change and poverty alleviation across many parts of the world have enforced the policy makers and researchers to develop an alternate system for performance assessment of an individual, a country, and a corporate. The purpose of this paper is to analyze the sustainability strategies of three leading states in the Indian leather industry – Tamil Nadu (TN), West Bengal (WB) and Uttar Pradesh (UP) – to gain insights into their efforts and progress in generating economic, social, and environmental values.
Design/methodology/approach – This study used case study approach for investigative analysis, and triangulation method – interviews and field visits, for data verification. The study examines the various sustainability strategies by applying economic value creation (evaluation of growth in total turnover, evaluation of the growth in profitability, evaluation of leverage), social value creation (evaluation of the growth in wages, evaluation of the growth in employee welfare expenses), and environmental value creation (conservation in raw material consumption, conservation in energy consumption, evaluation of waste management practices).
Findings – The findings reveal that the three states differ significantly from each other both in terms of efforts made and progress achieved during the period of study, 1998-2013. UP seems to be making the most consistent progress in achieving economic value, while WB shows the most progress in creating social value, and TN leads the pack in terms of creating environmental value. Thus, the three leading states in the Indian leather industry have been allowing trade-offs to get competitive advantage over others.
Research limitations/implications – The opaqueness with which the Indian leather Industry conducts social and environmental practices clearly limits the sources of accurate and reliable data, and the ability of researchers to precisely identify the problems and suggest solutions.
Practical implications – The opaqueness with which the Indian leather Industry conducts social and environmental practices clearly impacts the policy makers, practitioners, and researchers to continue such initiatives and improve the lives of people in India for whom continuing this profession is a big challenge and a hurdle to accomplish their livelihood.
Originality/value – The paper gives a theoretical explanation of the sustainability in the leather industry with respect to its strategies in terms of economic value, social value, and environmental value.

Keywords Sustainability, Social value, Indian leather industry, Economic value, Environmental value
Paper type Research paper

1. Introduction

Burgeoning challenges of climate change and poverty alleviation across many parts of the world have enforced the policy makers and researchers to develop an alternate system for performance assessment of an individual, a country, and a corporate (Allen, 1980; Rees and Wackernagel, 1996; Wackernagel and Rees, 1996; UN, 2002; Horta *et al.*, 2012; Park and Kremer, 2015). With lot of discussion and brainstorming, they came up with a concept of sustainable development, which was formally defined as "Sustainable development

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is economic growth that meets the needs of present without compromising the ability of future generations to meet their own needs" in a report titled as "Our common future", published by World Commission on Environment and Development, a body constituted under UN (WCED, 1987). Since then many matrices or frameworks for sustainability assessment have been proposed; among them Triple Bottom Line (TBL) (Elkington, 1997) and (Global Reporting Initiative, 2006) are very common. A few studies used balanced scorecard as a measure to predict sustainability assessment framework while considering the social and environmental performance of the firms (Figge *et al.*, 2002; Yongvanich and Guthrie, 2006; Hubbard, 2009; Panayiotou *et al.*, 2009; Sureeyatanapas *et al.*, 2015). Another study suggests the sector-specific assessment for sustainability assessment for more precise results (Salzmann *et al.*, 2005). The concepts of sustainability have been applied across a range of industries and regions to assess their relative performance and survival strategy (Morse and Fraser, 2005; Sarkis, 2006; Schmidt and Taylor, 2006; Kloepffer, 2008; Nourry, 2008; NRC, 2011; Luthra *et al.*, 2015; Gopal and Thakkar, 2016; Irani *et al.*, 2017). However, it is more relevant for industries with high ecological footprint (Rees and Wackernagel, 1994; Wackernagel and Rees, 1996) in terms of resource consumption and pollution intensiveness with present technology, such as leather, textile, and other chemical-based industries.

The leather tanning industry has created a negative public image by being identified closely with the generation of air, liquid and solid waste pollution with conventional production technology, as the report titled "2012 World's Worst Pollution Problems" released by Blacksmith Institute and Green Cross Switzerland highlights. Due to very strict environmental standard guidelines in many developed country like USA, Germany, UK, most of the low and medium end leather processing units have been shifting to other parts of the world (Savino *et al.*, 2015). India is one of the developing countries which has grabbed this opportunity and demonstrated impressive growth in the leather sector. India's leather industry is spread over many states across the country. However, the three states namely Tamil Nadu (TN), West Bengal (WB) and Uttar Pradesh (UP) are the top players among all the states. According to the Council of Leather Exports, 89 percent of the tanneries in India are located in these three states, i.e. 45 percent in TN, 26 percent in WB, 18 percent in UP, and they produce over two billion square feet of leather per annum.

Due to the water intensive nature of conventional leather processing, most of the tanneries in UP, WB, and TN are located along the Ganges river basin in North and the Palar River in South. Further, 99 percent of the leather firms in these states are micro, small and medium enterprises. Of those, less than 1 percent of the firms are publicly listed. Thus, even today, 75-80 percent of the Indian leather industry is part of the unorganized sector. The major strength of the Indian leather industry is that it ranks among the highest in livestock population in the world with cattle (12 percent), buffalo (22 percent), goat (77 percent), and sheep (62 percent). As per Annual Survey of Industries (ASI), Government of India (GoI), the revenues of the Indian leather industry grew at a CAGR of 13 percent during 1998-2013, and crossed 412.7 billion rupees in 2012-2013. Further, according to the Council of Leather Exports (CLE), India's export of leather and leather products reached 257.26 billion rupees in 2013-2014, posting an annual growth of 17.81 percent over the period 2012-2013.

Not surprisingly, the Indian leather industry has been facing turbulence since 1990s, where the issues related to environmental compliance have taken center stage. During last few decades, many studies have reported the adverse impact of tanneries activities on the livelihood of tannery workers, people living in nearby community, and on quality of soil and surface and ground water in India (Khwaja *et al.*, 2001; Mondal *et al.*, 2005; Gowda *et al.*, 2010; Gnanasekaran *et al.*, 2010; Katiyar, 2011; CPCB, 2014). Many social activists and NGOs have filed law suits (Sahu, 2010) against leather industries in India[1],[2]. Previous studies conducted on the Indian leather industry found that though the

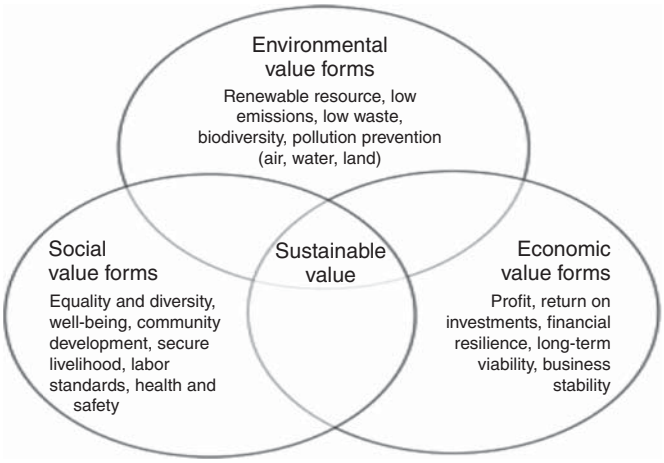
environmental standards are clear, regulatory compliance is extremely poor due to lack of self-patrolling, corrupt law enforcement mechanisms, and insignificant penalties for violations (Dasgupta, 2000; Schjolden, 2000; Priyadarshini and Gupta, 2003). Further, Roy (2012, 2013) found in his study that compliance has been driven by improvement in export performance of Indian leather industry. Tewari and Pillai (2005) suggested that policy framework set by different ministries of government play a very vital role in environmental compliance.

Many researchers advocate that sustainable growth (Matthews, 2003; Rothenberg *et al.*, 2005; Schneider *et al.*, 2010; Colicchia *et al.*, 2011; Shamma and Hassan, 2013; Deng, 2015; Hosseinpour *et al.*, 2015) for the leather industry will not be possible unless it embraces innovative approaches to prevent and mitigate the challenges of pollution (Porters and Linde, 1995; Berry and Rondinelli, 1998; Sarkis, 2001; Vachon and Klassen, 2006; Walker *et al.*, 2014; Mejías *et al.*, 2016; Abdul-Rashid *et al.*, 2017). Following this view, GoI has envisioned and implemented many landmark initiatives. The objectives of the Indian Government initiatives are R&D support, leather export promotion, human resource and capacity building, and superior environmental compliance guidelines (DIPP, 2012; GoI, 2012a). Schaltegger *et al.* (2011) opined that to create value from a sustainability perspective, a firm must comprehensively integrate the economic, social, and environmental goals. The combination of social and economic value is extremely important to achieve the environmental value (Schaltegger and Wagner, 2011; Acs *et al.*, 2013). On a similar note Ueda *et al.* (2009) explained that sustainability value is a mix of economic, social, and environmental value (see Figure 1).

Thus, the sustainability of the Indian leather industry is still enigmatic. Nevertheless, the states of TN, WB, and UP have been instrumental in shaping the future of this industry in India. Accordingly, this study decided to evaluate and benchmark the economic, social, and environmental value generated by the leather industries in TN, WB, and UP.

2. Research methodology

The concept of TBL was coined by John Elkington (1999, 2002, 2004, 2006) with respect to different corporations for value creation and deletion toward economic, social, and environmental domains. Although the concept is widely used for the private undertakings for small activities, but it is equally applicable for public organizations for their performance



Source: Evans *et al.* (2017)

Figure 1.
Sustainable value: combination of economic, social, and environmental value

assessment (Allen *et al.*, 2012). The reason behind using this approach is to highlight all associated outliers and to attain sustainability (Dubey *et al.*, 2015, 2017; Dubey and Gunasekaran, 2015, 2016; Mani *et al.*, 2016; Shibin *et al.*, 2016; Tayal *et al.*, 2017) through proper planning and development activities (Fredline *et al.*, 2005). This study applied the TBL approach (Elkington, 1997) to assess the progress of the leather industry in TN, WB, and UP states, in terms of the economic, social, and environmental value created, over a 15-year window, 1998-2013. The methodology employed is a case study method, based on quantitative as well as qualitative techniques. Aggregate data on a variety of parameters has been obtained from the ASI database for leather and leather products. In addition, data on effluent treatment and waste disposal for each state was obtained from two sources: the reports of the Central Pollution Control Board of India, and the State Pollution Control Boards. This information was augmented and verified by data from two other independent sources (triangulation approach), namely, personal interviews with business executives/ leather industry experts and secondary literature reports.

3. Results and discussion

3.1 Economic value creation

The most accepted definition of economic value creation shared by Brandenburger and Stuart (1996) states that it is the generated difference between the willingness of the customers' to pay in response to the opportunity cost paid by its suppliers (Peteraf and Barney, 2003; Lepak *et al.*, 2007). It has been further discussed under three sub-heads, i.e. evaluation of growth in total turnover, evaluation of the growth in profitability, and evaluation of leverage.

3.1.1 Evaluation of growth in total turnover. A comparison of the growth in the total turnover of TN, UP, and WB, which includes both domestic and export turnovers, indicates that UP has grown at the fastest CAGR (22.5 percent), followed by WB (12.8 percent) and TN (10.4 percent), respectively (see Figure 2). In addition, the results show that the UP posted the most stable growth in total turnover over the entire 15-year window (1998-2013). On the other hand, TN showed erratic growth pattern during 2009-2011, though it recorded the strongest turnover growth among the three states during 1998-2008.

The consistency observed in the growth of UP compared to TN and WB could be attributed to its steady progression in domestic performance coupled with outstanding results in exports. The latter fact is attested by the fact that key large players in UP such as Mirza International, Super House, and Rahman have been winning the Largest Exporter Awards in one or more categories of leather products. These companies have also been strongly pushing their own brands (Ex. Red Tape, Allen and others) in the Indian market.

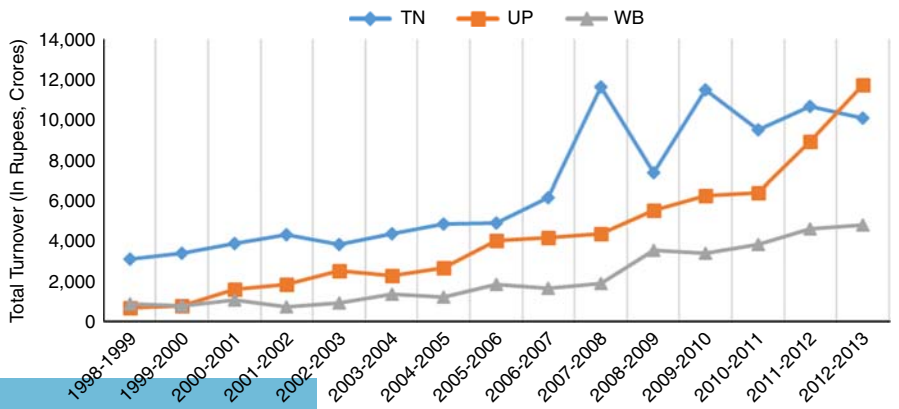


Figure 2.
Comparison of growth in total turnover in TN, UP and WB

The field work done as part of this study revealed that this variation in turnover is prominently due to severe shortages in raw material supplies and higher labor costs. To understand the raw materials problems faced by these states, this study analyzed the corresponding supply chain (namely, growth in shares of livestock population). The growth in shares of livestock population has been shown in Table I. The analysis of the Indian livestock population data (GoI, 2012b) over a five-year window 2007-2012 revealed the competitive advantages/disadvantages of TN, WB, and UP. Thus, while remarkable increases are evident in UP's share of livestock population in India across all the categories including cattle (8 percent), buffalo (24.6 percent), sheep (25.3 percent) and goat (9.5 percent), TN and WB have recorded spectacular losses:

(1) TN: cattle (−17.8 percent), buffalo (−62.4 percent), sheep (−34.1 percent), and goat (−8.6 percent).

(2) WB: cattle (−10.3 percent), buffalo (−16.67 percent), Sheep (−25.0 percent), and goat (−20.6 percent).

This data show that both TN and WB have been experiencing relatively severe shortages in raw material supplies. It also rationalizes why UP shows a significantly higher CAGR in the total turnover compared to TN and WB.

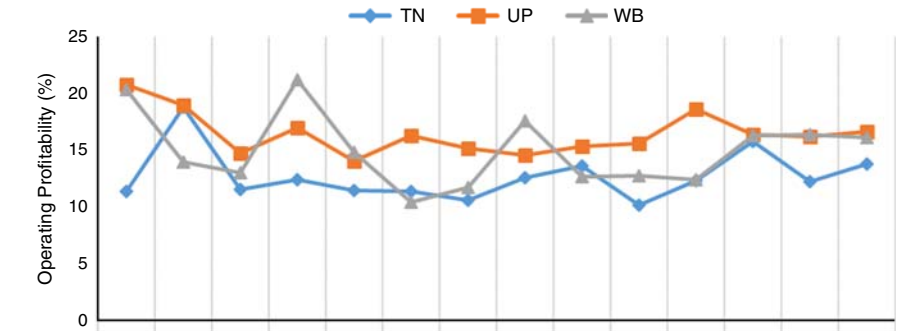
3.1.2 Evaluation of the growth in profitability. The growth in operating profitability (OP) has been given in Figure 3. First, it is important to note that all the states, i.e. TN, WB, and UP, are net positive in OP over the entire period of study, 1998-2013. However, UP and WB also showed a steady erosion in OPs during the same period (UP = −5.31 percent CAGR; WB = −1.19 percent CAGR), while the OP of TN showed improvement from 11.4 percent to 13.8 percent (2.79 percent CAGR). Further, the median OP of UP (16.3 percent) is higher than that of either WB (14.9 percent) or TN (12.3 percent).

It is important to note that the OP of the leather industry depends upon the combined operating costs for both domestic and export markets. Thus, UP may be posting higher median OP due to its significantly lower operating costs in the domestic market (lower raw material costs and cheaper labor). The field visit interviews confirmed that the environmental compliance costs of the firms in TN are higher due to higher export quality requirements and regulatory pressure. The comparison of growth in share of TN, UP, and WB in India's net profit has been shown in Figure 4. TN showed the most spectacular losses in its share of India's net profit, and touched −14 percent (1999), −27 percent (2009), −35 percent (2011) and −10 percent (2012). WB also showed losses in its share of India's net profit for a couple of years, −15 percent (2003), and −11 percent (2004). But more importantly, WB lost its share in the net profit of India from 25 percent in 1999 to

	UP			TN			WB		
	2007	2012	% change	2007	2012	% change	2007	2012	% change
Cattle	18.88	19.55	3.57	11.2	8.82	−21.2	19.18	16.51	−13.94
Share (%)	9.48	10.24	8.02	5.62	4.62	−17.80	9.64	8.65	−10.3
Buffalo	23.81	30.62	28.60	13.99	5.43	−61.12	0.7	0.6	−14.29
Share (%)	22.60	28.17	24.64	13.28	5.00	−62.40	0.66	0.55	−16.67
Sheep	1.19	1.35	13.45	8.00	4.79	−40.16	1.57	1.07	−31.77
Share (%)	1.66	2.08	25.30	11.17	7.36	−34.11	2.20	1.65	−25.00
Goat	14.79	15.59	5.36	9.27	8.14	−12.20	15.07	11.50	−23.65
Share (%)	10.53	11.53	9.50	6.59	6.02	−8.65	10.72	8.51	−20.61
Total	58.66	67.11	14.39	42.45	27.18	−35.97	36.52	29.69	−18.72

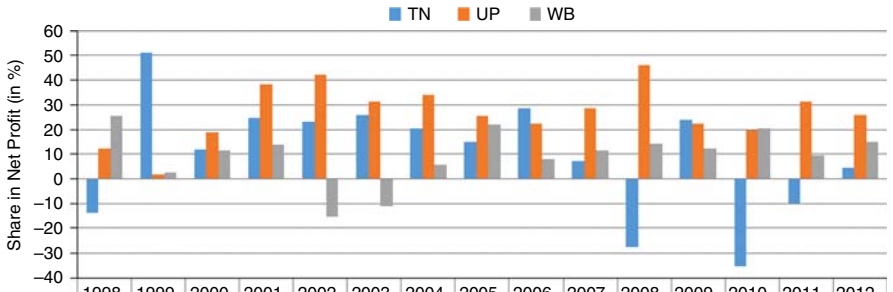
Note: [a]Livestock numbers are in millions

Table I. Livestock census[a] across the selected states in India



	1998-1999	1999-2000	2000-2001	2001-2002	2002-2003	2003-2004	2004-2005	2005-2006	2006-2007	2007-2008	2008-2009	2009-2010	2010-2011	2011-2012
TN	11.42	18.89	11.60	12.48	11.51	11.37	10.66	12.66	13.70	10.21	12.32	15.85	12.30	13.84
UP	20.83	19.06	14.76	17.05	14.11	16.34	15.23	14.60	15.44	15.62	18.71	16.42	16.31	16.68
WB	20.40	14.03	13.06	21.27	14.86	10.42	11.79	17.63	12.74	12.81	12.45	16.32	16.45	16.15

Figure 3.
Comparison of operating profitabilities of TN, UP and WB



	1998-1999	1999-2000	2000-2001	2001-2002	2002-2003	2003-2004	2004-2005	2005-2006	2006-2007	2007-2008	2008-2009	2009-2010	2010-2011	2011-2012	2012-2013
TN	−13.9	51.01	11.67	24.73	23.20	26.04	20.32	15.11	28.53	7.11	−27.4	23.84	−35.2	−9.98	4.34
UP	12.21	1.89	18.83	38.20	42.08	31.42	34.21	25.34	22.32	28.50	45.95	22.15	19.79	31.15	25.75
WB	25.44	2.39	11.29	13.91	−15.5	−11.0	5.71	21.91	7.75	11.40	14.03	12.08	20.21	9.48	15.01

Figure 4.
Comparison of TN, UP and WB's shares of Indian leather industry's net profit

15 percent in 2013, a drop of 10 percentage points. The performance of UP is truly outstanding among the three states. UP consistently posted a positive share of the India's net profit, and doubled its share from 12.2 percent in 1999 to 25.7 percent in 2013, an increase of 13 percentage points.

As discussed before, TN's declining performance on many dimensions, namely growth in total turnover, growth in OP and share in India's net profit, is probably due to a combination of factors including mounting raw material costs, greater compliance requirements, and relatively more expensive labor. Though modernization led to improvements in quality, firms in TN have been subjected to higher environmental costs, such as effluent treatment cost[3], and solid waste economic management cost. In addition, exporting firms in TN have higher compliance costs due to their overseas customers' requirements. For instance, such firms in TN need to apply and get certification from Leather Working Group[4] in EU to enhance their sales in the export market. This certification costs them around eight to ten lakhs of rupees annually. On the contrary, UP's huge gains in the share of India's net profit (13 percent) can be rationalized in terms of its significantly lower operating costs within the domestic market.

A comparison of the growth in returns on investment (ROI) for TN, UP, and WB during 1998-2013shows that WB is the most volatile of them all. While TN showed reasonably steady ROI during 2000-2007, there has been erratic ROI recorded during 2008-2013. On the contrary, UP is the only state to show consistently positive ROI during the entire period, 1998-2013.

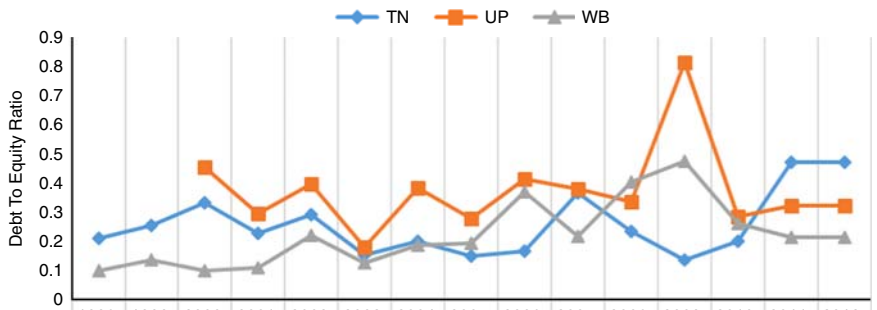
Further, UP marked the highest median ROI (14.56 percent), with the lowest standard deviation (2.96), whereas TN has posted the lowest median ROI (7.92 percent) with the second highest standard deviation (6.29). Finally, WB showed a median ROI of 12.67 with the highest standard deviation (9.53). Once again, field visits and interviews clarified the data. In WB, the volatility of the leather industry (CAGR = −6.65) demonstrated during 2002-2004 (ROI = −6.8, −5.5) can be linked to the shifting of production base from unorganized sector to state-of-art Calcutta Leather Complex. In the case of TN, the negative ROI during 2008-2009 and 2010-2011 may be possibly due to higher environmental compliance and global recession. In the case of UP, ROI was quite consistent throughout the selected period with CAGR as 2.76 percent.

3.1.3 Evaluation of leverage. The Debt Service Coverage Ratio analysis of the median values does not raise any long-term liquidity concerns for the three states. The comparison of debt to equity (D/E) ratio for TN, WB, and UP has been shown in Figure 5. It is clear that the leather industries in these states show D/E ratios well below 0.5 during 1998-2013. In most industries that are capital intensive, such as the automotive industry, this ratio is closer to 2. However, in industries that are not capital intensive this ratio may be close 0.5. The fact that D/E ratios for TN, WB, and UP are consistently well below 0.5 (see red dotted line in Figure 5) indicates that the leather industry is labor intensive and not capital intensive. This clearly indicates that the Indian leather industry is severely under-leveraged.

Field studies revealed that the cost of capital is very high for the leather industry in India. This situation leads to a capital structure that is very low in debt and significantly high in equity investments. In addition, the domination of micro- and small-size firms across the selected states, lacking strong financial track records, may also be contributing to under leverage.

3.2 Social value creation

The social value creation is a process that adds or creates some value to the societal issues or causes (Auerswald, 2009; Muethel *et al.*, 2011; Dietz and Porter, 2012; Seraj, 2012). The social value created by a company is measured in terms of a variety of factors including its commitment to the well-being and progress of its own workers, society in which it is



	1998-1999	1999-2000	2000-2001	2001-2002	2002-2003	2003-2004	2004-2005	2005-2006	2006-2007	2007-2008	2008-2009	2009-2010	2010-2011	2011-2012	2012-2013
TN	0.21	0.25	0.33	0.23	0.29	0.15	0.20	0.15	0.17	0.37	0.23	0.14	0.20	0.47	0.47
UP			0.453	0.297	0.395	0.181	0.384	0.28	0.415	0.38	0.336	0.814	0.284	0.323	0.323
WB	0.101	0.135	0.101	0.111	0.221	0.125	0.186	0.194	0.369	0.217	0.403	0.476	0.263	0.215	0.215

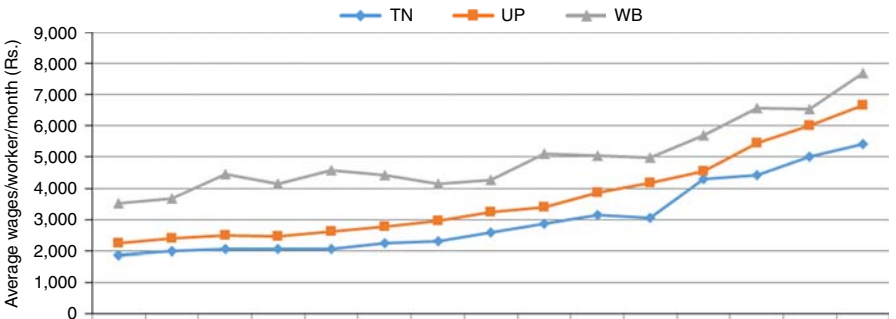
Figure 5.
Comparison of debt to equity ratios of leather industries in TN, UP and WB

situated, society it is directly serving, and the larger society it is part of. These include verifiable variables such as hiring policies, male to female ratio in employment, salaries/wages for male vs female, working conditions, overtime pay for extended working hours, medical and health benefits, holiday and leave policies, disability and death benefits, life insurance, retirement savings, and pension benefits, corporate social responsibility and customer relationship management practices (Pratap Singh *et al.*, 2011; Whitehead, 2011; HRW, 2012; Biswas and Rahman, 2013; Rani and Hooda, 2013). Unfortunately, aggregate data for the leather industries in TN, UP, and WB are simply unavailable for many of such important variables to thoroughly evaluate the social value created. Consequently, this study limits social value assessment to just the available aggregate data.

3.2.1 Evaluation of the growth in wages. Analysis of the wages paid in the Indian manufacturing industries revealed that the nominal average wages per worker per month in the Indian leather industry (Rs4,961) are 20 percent lower than that of the Indian industry average (Rs6,196) (ASI, 2015). This being the case, relative differences in the nominal average wages in the leather industries of TN, UP, and WB have been further examined (see Figure 6). Interestingly, it was found that the leather industry in WB paid its workers the highest average wages (Rs4,991) during the period 1998-2013, while UP is the second best (Rs3,688) and TN is the last (Rs3,030). Field studies further revealed that the basis for higher wages in WB is twofold: strong labor unions and constraints in the availability of labor due to locational differences.

3.2.2 Evaluation of the growth in employee welfare expenses. The Indian leather industry pays welfare expenses of Rs1,184.65/employee/month, which is less than half of the Indian manufacturing industry[5] average (Rs2378.76/employee/month). Among the three states, WB maintained its lead over the others in terms of average welfare expenses/worker/month during 1999-2008. However, WB began to decrease welfare expenses during the years, 2009-2013. During the same period, TN stayed in second position and UP continued in the third position. UP has been the bottom player in welfare expenses/worker/month most of the time. These trends will be explained below.

During 2007-2013, WB witnessed a rise of 484 percent in the number of workers it hired. This nicely coincides with the rise in the total number of factories in WB from 231 to 501. Surprisingly, however, the welfare expenses/employee/month also saw a dramatic downward trend during the same period. This may be due to a many reasons of which two may be prominent: first, leather industries in WB needed to spend significantly more on the salaries of new workers. The field studies also corroborated that WB hired a lot of contract workers



	1998-1999	1999-2000	2000-2001	2001-2002	2002-2003	2003-2004	2004-2005	2005-2006	2006-2007	2007-2008	2008-2009	2009-2010	2010-2011	2011-2012	2012-2013
TN	1,891	2,015	2,058	2,055	2,051	2,258	2,326	2,584	2,857	3,141	3,071	4,297	4,415	5,017	5,412
UP	2,242	2,397	2,490	2,455	2,614	2,766	2,979	3,243	3,408	3,871	4,176	4,559	5,441	6,006	6,666
WB	3,520	3,697	4,469	4,146	4,591	4,426	4,150	4,257	5,110	5,036	4,995	5,684	6,554	6,543	7,686

Figure 6.
Comparison of growth in nominal average wages/worker in TN, UP and WB

without benefits during this period; second, to meet the increasing demand large firms also expanded their capacities by outsourcing work to small firms who fulfilled the variable demands with contract workers. Contrary to WB, both TN and UP have consistently paid more welfare expenses (and competitive salaries) to meet the increasing demand in domestic and international markets and build their brands with better quality products.

3.3 Environmental value creation

The term environmental value creation refers to the elimination of unwanted environmental externalities that create side effects and questions societal welfare (Bithas, 2011). In a similar vein Maxwell and Van der Vorst (2003) discussed the advantages of removal of environmental externalities in the form of recycle of reusable waste, effective disposal of waste and a few others. In this study, this aspect has been discussed with respect to conservation in raw material consumption, conservation in energy consumption, and evaluation of waste management practices.

3.3.1 Conservation in raw material consumption. This study assessed conservation in raw material consumption achieved by the leather industries in TN, WB, and UP by quantifying material intensity (MI)[6]during 1998-2012. There are some reports that claim that Indian leather firms discharge 35-60 percent of the chromium in hazardous oxidized form as solid or liquid waste (Kolomaznick, 2008). Hence, MI is of great environmental concern and is calculated as follows:

$$\text{MI} = \left(\text{Total raw material cost}/\text{Total turnover}\right) \times 100.$$

Excluding the data for 2012-2013[7], and comparing the computed data on the growth in MI during 1998-2012, revealed that the MI of the leather industry is consistently high (60-70 percent). Therefore, raw material handling and waste disposal practices are of serious concern to the public as well as the government[16]. During this period, WB has shown the highest growth in MI (6.7 percent), followed by UP (4.2 percent). On the other hand, TN recorded a marginal decrease in MI (2.7 percent) over the same period. These trends can be rationalized as follows. Field studies revealed that a major reason for WB's highest growth in MI may be due to poorer quality of raw materials used in WB compared to either UP or TN. Yet another reason for this could be the significant increases in the demand for raw materials, due to 130 percent increase in the total number of factories in WB. UP also showed 4.2 percent increase in MI during 1998-2012. This is rational in terms of the 190 percent increase in the total numbers of factories (largely due to the entry of many small players into the market) in UP and lag in modernization of factories. The decreasing MI (−2.7 percent) in spite of a 64 percent increase in the total number of factories in TN is perhaps a sign of technology improvements. Field studies revealed that TN had shut down many inefficient small factories, and also modernized some of the existing factories.

3.3.2 Conservation in energy consumption. This study assessed conservation in energy consumption achieved by the leather industries in TN, WB, and UP by quantifying energy intensity (EI) during 1998-2012. The formula used to the compute EI is as follows:

$$\text{EI} = \left(\text{Total energy cost}/\text{Total turnover}\right) \times 100$$

Thus, quantified data on EI for the three states during 1998-2012 revealed that the EI for the leather industry is not very high (only 2-4 percent). Comparison of the EIs for the three states during 1998-2012 has shown that UP posted the most significant reduction of EI (−17.7 percent), followed by WB (−3.9 percent) and TN (−2.5 percent). This may due to

strategic implementation of continual and positive improvements in the leather production since 1998. Unfortunately, field studies done in UP indicate that illegal consumption of electricity is at least partially accountable for the remarkable reduction in EI observed.

3.3.3 Evaluation of waste management practices. The waste management practices in the leather industry involve effluent treatment and disposal, as well as solid waste economic management/disposal. The complexity of the evaluation of waste management practices became clear as the study probed into existing ground realities in TN, WB, and UP. As discussed earlier, the effluent treatment and disposal in leather firms in India fall into two categories, i.e. registered and unregistered. Every registered firm is supposed to have an on-site Primary Effluent Treatment Plant (PETP) and be connected to a Common Effluent Treatment Plants (CETPs), if not possess an Individual Effluent Treatment Plant.

The effluent management is handled in two stages: Primary Effluent Treatment and Common Effluent Treatment. There are at present a total of 19 CETPs in the Indian leather industry, with 17 of them operating in the states of TN, UP, and WB. The distribution of CETPs among the three states of interest is as follows: TN, 13 (77 percent), UP, 3 (18 percent) and WB, 1 (5 percent). The field work done as part of this study revealed many alarming facts: unregistered firms (many but unknown in numbers) run on crude technologies (pit and paddle), and operate without even properly lined pits to avoid seepage of toxic materials into ground water. Further, they run their businesses with no regulatory oversight. Though the registered firms show PETPs on paper, many of them either do not operate PETPs at all or operate them most inefficiently. Thus, this study found it impossible to precisely estimate the quantities/quality of the effluents generated by these firms. (While the number and names of firms associated with a particular CETP is well known (see Table I), either unit level data on the exact quantities of effluent contributed by each of the member firms or aggregate level data on the total quantity of effluent that a CETP manages on a per day basis are unavailable. The efficiency of effluent management by a CETP has also been a point of concern to public and government for many years[8]. Therefore, the "Effluent Treatment Cost per Million Liters per Day" (ETC/MLD) has been computed (see Table II), to probe into the efficiencies of effluent management by CETPs (CPCB, 2005, 2014).

Table II.
Derived effluent treatment data on CETPs in the selected states

SNo.	State	CETP name and location	Capacity million liters per day(MLD)	ETC[a]/MLD (lakhs)
1	TN	TALCO Vaniyambadi, Valayampet, Vellore	2.8	119.64
2		TALCO Vaniyambadi, Udayendiram, Vellore	0.2	350
3		TALCO Perinambut	0.9	222.22
4		TALCO AmburThuthipet, Vellore	2	267.5
5		Visharam, Melvisharam, Vellore	3.4	107.51
6		TALCO Ranipet CETP, Vellore	4	n/a
7		Melpudupet, Ambur, Vellore	n/a	n/a
8		Ambur Mallgalthope, Vellore	1.1	245.45
9		SIDCO Ranipet, Vellore	2.5	128
10		SIDCO phase II Ranipet, Vellore	n/a	n/a
11		TALCO Dindigul	2.5	202.8
12		TALCO Madhavaram CETP, Chennai	0.4	700
13		Pallavaram, Chennai	3	245.6
14	UP	Kanpur CETP	36	61.36
15		Unnao CETP	2.15	90.7
16		Banther CETP	4.5	133.33
17	WB	Calcutta Leather Complex CETP	30[b]	273.64

Notes: [a]Effluent treatment cost per million liters per day; [b]targeted capacity

Based on this data, it is clear that there are huge variations in the ETC/MLD among the CETPs. Field studies revealed that many factors contribute to this, such as the differences in technologies (CPCB, 2005, 2014), sizes of the plants, cost overruns, structure, and costs of capital. Unfortunately, crucial information on many aspects of CETPs, such as the reasons for differences in capital costs, utilized vs actual capacity, the Effluent Treatment Pricing structure of a CETP, the actual technology differences in CETPs, and the environmental fate of solid waste in CETP's landfill sites is simply unavailable. Not surprisingly, therefore, a strong suspicion is evident on the waste management practices in UP (DT, 2015a), TN (FT, 2015; HD, 2015a, b) and WB (DT, 2015b), as well as the waste monitoring protocols employed by state PCBs and central PCBs (Schjolden, 2000; Prasad, 2006; Singh, 2006). Recently, the National Green Tribunal of India issued letters to almost all the tanneries of UP to ensure compliance under Section 18 1(b) of Water Act, 1974 and also issued confirmed directions for closure to some of them under Section 5 of E(P) Act, 1986 (NGT, 2014). Indeed, these highly publicized episodes of non-compliance and factory closures highlight their poor performance in environmental sustainability.

Further concern from solid waste economic management vs treatment and disposal with respect to economic/environmental value from tanneries includes raw hide/skin trimmings, green fleshing, limed fleshing, pelt trimmings, wet-blue trimmings, vegetable tan trimmings, shavings (organic wastes), dusted salt, buffing's and sludge (inorganic wastes). It is what tanneries chose to do that decides whether further economic value is generated or neglected. Indeed, when the solid wastes are mismanaged, they can cause serious environmental damage.

Research revealed that the solid waste management practices in India have a huge untapped potential for economic, social, and environmental value generation. Presently, UP and WB have no organized industry structure to convert solid waste into value-added products, whereas in TN only portions (40-45 percent) of the organic wastes from tanneries are sold to organized ventures to extract further economic value.

To evaluate the leather value chain management practices in TN, UP, and WB, the study conducted field surveys and semi-structured interviews. Here are the findings:

(1) Fleshing and pelt trimmings: in TN, they are used for different value-added products: 30-35 percent tallows, 20-25 percent biogas, 10-15 percent glue, 5-7 percent biofuel. In UP, these solid wastes are mostly sold to unorganized glue (90-95 percent) and gelatin makers (5-10 percent). Unfortunately, the makers of glue collect fleshings from tanners and mostly process it along the side of the river Ganga without the permission of local authorities. In the case of WB, 70-75 percent is sold as fish meal, 15-20 percent for tallow, and 10-15 percent for gelatin.

(2) Raw hide/skin trimming: broadly, they are used for a variety of end applications such as animal feed, biogas, gelatin, and bio-fertilizer. However, TN is the only state that uses these solid wastes comprehensively for all end uses: 15-20 percent animal feed, 20-25 percent biogas, 40-45 percent gelatin, and 20-25 percent bio-fertilizer. In contrast, UP uses its raw hide/skin trimmings more selectively: 30-35 percent for animal feed, 40-45 percent for gelatin, and 30-35 percent for bio-fertilizer. Finally, WB uses these solid wastes similar to UP: 10-15 percent for animal feed, 35-40 percent for gelatin, and 40-45 percent for bio-fertilizer.

(3) Hair: in general, tanneries in TN, UP, and WB do not recover hair for useful end applications.

(4) Lime sludge: lime sludge is utilized as filling material to the extent of 40-45 percent in UP, and 50-60 percent in WB. Neither of the states use lime sludge to generate biogas. On the contrary, TN uses 10-15 percent lime sludge for biogas and 85-90 percent lime sludge for filling material.

(5) Chrome shavings/wet-blue trimmings: the wet-blue trimmings can be used for two important end applications: biogas and leather boards. In TN, these sold wastes are utilized 30-35 percent for biogas and 60-65 percent for leather boards. In UP, the wet-blue trimmings are used 0 percent for biogas and 80-90 percent for leather boards, while in WB they are used 0 percent for biogas and 80-85 percent for leather boards.

(6) Finished leather trimmings: there are differences among TN, UP, and WB in the end applications of the finished leather trimmings. For instance, TN uses this solid waste, 30-35 percent for biogas and 60-65 percent for leather boards. Both UP and WB use this form of solid waste only for leather boards (80-90 percent) and no biogas.

(7) PETP sludge: PETP sludge is the end product of the leather value chain. It has just one end application as soil conditioner. Otherwise, it must be sent to secure landfill. TN as well as UP get rid of sludge through landfills. Only WB uses 10-15 percent of sludge as soil conditioner, and sends the rest to landfill.

4. Key findings and implications

This study examines the sustainability of the Indian leather industry in TN, WB, and UP states, in terms of economic, social, and environmental value creation over a 15-year window (1998-2013). Indeed, the results are mixed for the three states, with each state leading in different categories. Thus, none of the three leading states in the Indian leather industry has complete domination over the others in all three dimensions of sustainability. In economic value creation, the results of this study show that UP leads over WB and TN. Thus, a comparison of the growth in total turnover – which includes both domestic and export turnovers – indicates that UP has grown at the fastest rate (CAGR = 22.5 percent), followed by WB (12.8 percent) and TN (10.4 percent), respectively. The relatively slow growth rate observed with TN may to be due to the expansion of the existing players rather than entry of new players, whereas in WB and UP, the growth rate may be attributable to the entry of large numbers of small players into the market. During 2008-2013, TN has shown huge losses in domestic market share (−21.5 percent), while WB has posted smaller losses (−2.4 percent). On the contrary, UP has shown the largest gains in market share (26.6 percent) over the same period, at the expense of other key dometic players. In social value creation, WB is the leader, followed by UP and TN. Thus, WB paid the highest average wages/worker/month (Rs4,991) during the period 1998-2013, while UP is the second best (Rs3,688) and TN is the last (Rs3,030). The field studies further revealed that the basis for higher wages in WB is twofold: strong labor unions and constraints in the availability of labor due to locational differences. Among the three states, WB maintained its lead over the others in terms of average welfare expenses/worker/month during 1999-2008. However, WB began to decrease welfare expenses during the years, 2009-2013. During the same period, TN stayed in second position and UP continued as the bottom player in welfare expenses/worker/month. In environmental value creation, TN leads over UP and WB. Thus, while WB has shown the highest growth in MI (6.7 percent), followed by UP (4.2 percent), TN recorded a marginal decrease in MI (2.7 percent) over the same period. Indeed, it appears that TN is the environmental leader with its zero liquid discharge policy and superior leather value chain management practices. However, it is nonetheless pertinent to mention that leather industry contributes to environmental pollution/degradation to a great extent which requires an intervention by the government. Further, care must be taken while allocation of resources to these industries. The policy makers are advised to think over for the practices which can help to reduce the uses of leather to the extent possible while giving due consideration to global competition.

5. Limitations and scope for future research

The opaqueness with which the Indian leather industry conducts social and environmental practices clearly limits the sources of accurate and reliable data, and the ability of researchers to precisely identify the problems and suggest solutions. For instance, many crucial performance indicators such as Effluent Treatment Index, Solid Waste Disposal Index, Emission Index, and Percent Community Welfare Expense were dropped, due to unavailability of data. In future, to understand the role of various kinds of leather production technology on three dimensions of sustainability, there is an imperative need to conduct in-depth case studies over the selected leading states. Moreover, the functioning of CETPs, which is quite mysterious in terms of fixed investments, operating costs, has to be investigated in great details to ensure sustainability of the CETP projects and the industry as well. The conceptual framework of sustainability can be used in other similar industries having high ecological footprint such as textile, sugar refinery, pharmaceutical, etc.

Notes

1. *M.C. Mehta v. Union of India*, AIR 1988 SC 1115.
2. *Vellore Citizens' Welfare Forum v. Union of India*, AIR 1996 SC 2715.
3. The effluent treatment cost in TN is Rs70-80/kilo-liter, as opposed to UP: Rs17-25/kilo-liter.
4. The objective of this multi-stakeholder group is to develop and maintain a protocol that assesses the environmental compliance and performance capabilities of tanners and promotes sustainable and appropriate environmental business practices within the leather industry (see: www.leatherworkinggroup.com/).
5. Calculated based on the latest data available from ASI (2015).
6. It is important to monitor material intensity due to the use of hazardous and toxic chemicals like chromium and ammonium compounds, lime, acids, dye, fat liquors and more, which in turn necessitates the use of large volumes of water.
7. For reasons unclear, all of them showed a significant downward movement in material intensity in 2012-2013.
8. Central Pollution Control Board (CPCB) has reported that a large number of CETPs are under performing, largely due to inefficient operation and improper maintenance (CPCB, 2005, 2014).

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