INTERNATIONAL JOURNAL OF ENGINEERING AND MANAGEMENT SCIENCES

www.scienceandnature.org

AN EMPIRICAL STUDY OF GREEN SUPPLY CHAIN MANAGEMENT DRIVERS, PRACTICES AND PERFORMANCES: WITH REFERENCE TO THE PHARMACEUTICAL INDUSTRY OF ANKLESHWAR (GUJARAT)

Pandya Amit R. & Mavani Pratik M.

Department of Commerce & Business Management, Faculty of Commerce, M. S. University of Baroda, Vadodara- 390020 India

ABSTRACT

The Green Supply Chain (GSC) is a key element of an enterprise-wide green management strategy. A GSC can help agencies comply with new federal guidelines while achieving a wide range of economic, social, national security, and environmental goals. This study aims to investigate the green supply chain management practices likely to be adopted by the pharmaceutical industry in Ankleshwar. The relationship between green supply chain management practices and environmental performance and operational performance, as well as financial performance, is studied. The approach of the present research includes a literature review, in depth interviews and questionnaire surveys. The companies in the pharmaceutical industry approved by the International Organization for Standardization 14001 certification in Gujarat before January 2010 were sampled for empirical study. Based on a literature review, twelve propositions are put forward. The survey questionnaire was designed with 54 items using literature and industry expert input. An exploratory factor analysis was conducted to derive results from the survey data which included 27 responses. The data were then analyzed using statistical package for the social sciences, and structural equation modeling was used as a path analysis model to verify the hypothetical construction of the study. The results indicate that the pharmaceutical industry have adopted green supply chain practices in response to the current wave of international green issues and have generated favorable environmental, operational and financial performances for the respective companies

KEYWORDS: Green supply chain, environmental performance, green procurement, green manufacturing.

INTRODUCTION

(Zhu and Sarkis, 2004)[i]. For over 10 years, GSCM has become an important environmental practice for companies to achieve profit and increase market share in such a way that environmental risks are lowered and ecological efficiency are raised (Van Hock and Erasmus, 2000)[ii]. Realising the significance of the GSCM implemented by the organisations, Sarkis (2003)[iii] developed a strategic decision framework that aids managerial decision making in selecting GSCM alternatives, and product life cycle, operational life cycle (including procurement, production, distribution and reverse logistics (RL)), organisational performance measurements and environmentally conscious business practices serve as the foundations for the decision framework (Xie, Y., Breen, L., 2010)[iv].

India's pharmaceutical industry is now the third largest in the world in terms of volume. Its rank is 14th in terms of value. Between September 2008 and September 2009, the total turnover of India's pharmaceuticals industry was US$ 21.04 billion. The domestic market was worth US$ 12.26 billion (The Department of Pharmaceuticals, Ministry of Chemicals and Fertilizers)[v]. As per a report by IMS Health India, the Indian pharmaceutical market reached US$ 10.04 billion in size in July 2010.There are currently approximately 3,500 drug manufacturing units in Gujarat. The state houses several established companies such as Torrent Pharma, Zydus Cadila, Alembic, Sun Pharma, Claris, Intas Pharmaceuticals and Dishman Pharmaceuticals, which have operations in the world's major pharma markets. Over the last few years, Gujarat's contribution in the growth of India's pharmaceutical industry has been significant. The state commands 42 percent share of India's pharmaceutical turnover and 22 percent share of exports. Approximately 52,000 people are employed in Gujarat's pharmaceutical sector, which has witnessed 54 percent CAGR in capital investments over the last three years (FDCA)[vi].

The Pharmaceutical Supply Chain (PSC) is a special SC in which medications are produced, transported and consumed. Academic researchers and practitioners believe that "pharmaceuticals are different; they cannot be treated like other commodities" (Savage et al, 2006)[vii]. The reasons for this sentiment were the high cost and long duration for research and development and the repercussions of the product not being available, hence again its criticality. Other unsupported perception-based factors that appear to make this supply chain distinctive include; the level of regulation in the product production, storage, distribution, consumption and the complexity of the fabric of this supply chain (Knight, 2005)[viii]. Disposal of medication can be very harmful to the environment and costly. Globally, in 2003 at least £0.56 billion worth of unused drugs are flushed down the toilet (Van Eijken, et al., 2003)[ix]. From an economic point of view, efficiencies can be made in the form of potential savings in the pulling back of stock from patients. Medication retrieved from patients cannot be re-used and

must be disposed. It does however provide vital information and can encourage more prudent prescribing. Safety is also paramount when broaching pharmaceutical management and storage. Accidents can happen if products fall into the hands of children or individuals who wish to abuse the product themselves or support a "grey" market for product exchange/sales. Global and domestic pressures on environmental, economic and safety considerations (Xie, 2009)[x] drive us to manage PSC greening, i.e., improve the PSC economic and environmental performance by recycling the unused/unwanted medications and reducing medications that need disposal. Globally, in 2003 at least £0.56 billion worth of unused drugs are flushed down the toilet (Van Eijken, et al., 2003)[xi]. From an economic point of view, efficiencies can be made in the form of potential savings in the pulling back of stock from patients. Medication retrieved from patients cannot be re-used and must be disposed. It does however provide vital information and can encourage more prudent prescribing.

Safety is also paramount when broaching pharmaceutical management and storage. Accidents can happen if products fall into the hands of children or individuals who wish to abuse the product themselves or support a "grey" market for product exchange/sales. Global and domestic pressures on environmental, economic and safety considerations (Bree &Xie, 2009) [xii] drive us to manage PSC greening, i.e., improve the PSC economic and environmental performance by recycling the unused/unwanted medications and reducing medications that need disposal. However, there is very little research and practice on drug recycling (Ritchie et al., 2000)[xiii] or green PSC (GPSC). The fate of unused consumer pharmaceuticals is an issue that has reached public consciousness more recently. There is emerging concern about the potential impact of medicine that reaches lakes and rivers via sewage plants and other sources (New Hampshire Department of Environmental Services, 2009)[xiv].

Increasing pressures from a variety of directions have caused the Indian Pharmaceutical supply chain managers to consider and initiate implementation of green supply chain management (GSCM) practices to improve both their economic and environmental performance. Current environmental awareness, practices, and performance of GSCM in general and in pharmaceutical enterprises sets the foundation for various issues (propositions) that will be evaluated using the empirical data. Expanding on some earlier work investigating general GSCM practices in India, this paper explores the GSCM drivers, initiatives and performance of the pharmaceutical supply chain using an empirical analysis of selected pharmaceutical enterprises within Ankleshwar (Gujarat). In particular, the relationships between green supply chain management dimensions and firm performance are examined in this study.

LITERATURE REVIEW

"Green Supply Chain practices (SCM components) adopted are functions of external (open system view oforganisation) and internal environment (management component). In another word the totality of inputs to the system (including agent, mechanism, and functions) results inoutputs (practices). These outputs are measured by considering GSCM practices from within the whole system"(Holt, D., Ghobadian, A., 2009)[xv].

External pressures

The importance of external factors is borrowed to illustrate the complementary nature of the factors for Chinese companies to adopt GSCM practices at the early stage of environmental policy transformation. Besides the requirements of governmental regulations, the domestic and foreign clients, competitors and neighboring communities may exert pressures on the companies (Hall, 2000)[xvi]. These external pressures have jointly prompted the companies to become more aware of their environmental problems and to practice certain GSCM activities (Sarkis, 1998[xvii]; Hervani et al., 2005[xviii]). According to Zhu and Sarkis (2006)[xix], Hall (2000)[xx] and Sarkis (1998)[xxi], external pressures are believed to be the important factors affecting a firm's GSCM practices.

Internal factors

As is well known, the institutional theory neglects certain fundamental issues of business strategy. It is argued that the firms adopt heterogeneous sets of environmental practices also due to their individual interpretations of the objective pressures from the outside. The difference between the 'objective' and 'perceived' pressures may lead to diverse responses from the firms. Therefore, the analytical model adds two internal organizational factors, namely support of top managers and a firm's learning capacity, to jointly explain a firm's GSCM practices. Top management support can affect new initiatives success by facilitating employee involvement or by promoting a cultural shift of the company, etc. As GSCM is a broad-based organizational endeavor, it has the potential to benefit from top management support. Meanwhile, a firm's learning capacity is viewed as especially important in a resource-based framework. GSCM practices are amenable to the benefits derived from learning since they are human resource-intensive and greatly rely on tacit skill development by employee involvement, team work and shared expertise (Hart, 1995)[xxii]. The capacity for implementing innovative environmental approaches is normally enhanced by employee self-learning, professional education and job training. The education level of employees and the frequency of internally environmental training are often used as proxies of a firm's learning capacity (Xianbing, L., Leina W., Jie Y., Tomohiro S., Cunkuan B., Kazunori O., 2010)[xxiii].

To implement GSCM, organizations should follow GSCM practices which consist of environmental supply chain management guidelines. Numerous studies have tried to identify GSCM practices in organization which are referred to such internal systems as environmental and quality management systems. Internal environmental management is critical to improving the organization's environmental performance (Zhu et al., 2008)[xxiv].

Performance is a measure for assessing the degree of a corporation's objective attainment (Daft, 1995) [xxv] .Corporations adopting GSCM practices may

generate environmental and business performances (Walton, *etal.*, 1998[xxvi]; Zhu and Cote, 2004[xxvii]). A green supply chain, for example, can improve environmental performance(reducing waste and emissions as well as increasing environmental commitment) and competitiveness(improving product quality, increasing efficiency, enhancing productivity and cutting cost), thereby further affecting economic performance (new marketing opportunities and increasing product price, profit margin, market share and sale volume; Purba, 2002[xxviii]). According to Walton, *et al.* (1998)[xxix], Zhu and Cote (2004)[xxx] and Purba(2002)[xxxi], as well as other experts, organizational performance is considered to include environmental, operational and economic performance.

RESEARCH OBJECTIVES

The aims of the present research are to discuss the issues that can be summarized as follows:

- The major external factors affecting GSCM practices adopted by the pharmaceutical companies in Ankleshwar;
- The GSCM practices adopted by the pharmaceutical companies in Ankleshwar in response to the green issue and;
- The relationship between the GSCM practices adopted by the pharmaceutical companies in Ankleshwar and organizational performance.

RESEARCH METHODOLOGY

After surveying Sarkis (1998)[xxxii], Sarkis (2001)[xxxiii], Purba (2002)[xxxiv], Zhu and Cote (2003)[xxxv], Zhu and Sarkis (2004)[xxxvi] and Brent and Visser (2005)[xxxvii], the environmental performance assessment in the ISO environmental management system, as well as comments from experts and academics in the chemical and machine engineering, a questionnaire was created as the tool of the present study. The items in the questionnaire were then taken as research variables according to the conceptual model of the study. The data used in this study consist of questionnaire responses from employees in Indian (Ankleshwar(Gujarat) Located) manufacturing and processing industries that have profound impact on the environment. Structural equation modeling was used as a path analysis model to verify the hypothetical construction of the study. The questionnaire contains three sections:

- General Information: This contains gender, and job title of the respondents from the organization as well as annual sales of the company and number of persons employed. This information is gathered only for a glance of an industry and its size.
- Basic Green Supply Chain Management Information: This includes questions regarding company's step towards GSCM. It also contains reasons for adoption and no implementation of GSCM. If company has not yet implemented the GSC practices then in this section respondents can provide maturity period for GSCM as per their company policies.
- Impact of drivers on implementation of GSCM practices and relation to organizational performance part includes items affecting implementation (pressures/drivers), current practices and corresponding performance. In this section twelve different variables (Environment Regulation, Market, Suppliers, Internal drivers, Internal Management, Green Supply, Cooperation with Customers, Investment recovery, Ecodesign and reverse logistics, Environment Performance, Operational Performance and Economical Performance) were tested with fifty four sub variable. All twelve items in this part were based on a number of sources from the literature and divided in three different parts. Questions were answered using a seven-point Likert-type scale (e.g.1 = Very Strongly Disagree; 2 = Strongly Disagree; 3 = Disagree; 4 = Neutral; 5 = Agree; 6 = Strongly Agree; 7 = Very Strongly Agree). To avoid confusing respondents on three different seven-point Likert scales, we provided a brief explanation of the three groups of items at the beginning of each survey section.

27 companies in the pharmaceutical industry approved by the International Organization for Standardization 14001 certification in Ankleshwar (Guj.) before January 2010 were sampled for empirical study. The data were then analyzed using statistical package for the social sciences (Predictive Analytics SoftWare-PASW) and LISREL (SIS Inc.)

Variables

From the literature analysis, twelve different variables introduced according to the methodology of structural equation modeling are described as follows:

Environmental regulations, market pressure, suppliers and internal drivers are four exogenous latent variables used in this study. Environmental regulation reflects factors like regional laws, exporting country's regulations etc. The exogenous latent variables of market are reflected in exports, sales, domestic consumers' awareness towards environmental issues etc. Items like cost of hazardous materials, environment friendly goods and green packages are revealed in internal drivers.

The endogenous latent variables are divided into interpretative and outcome variables. Internal management, Green supply, cooperation with customers, investment recovery, ecodeign and reverse logistics are variables which are defined as interpretative endogenous latent variables. Outcome endogenous latent variables include economic performance, environmental performance and operational performance.

Hypothesis

H1: Environmental regulations have a positive relationship with Green Supply Chain Practices.

H2: Market pressure has a positive relationship with Green Supply Chain Practices.

H3: Cooperation with suppliers has a positive relationship with Green Supply Chain Practices.

H4: Organization's internal drivers have a positive relationship with Green Supply Chain Practices.

H5: Green Supply Chain Practices have a positive relationship with economic performance.

H6: Green Supply Chain Practices have a positive relationship with operational performance.

H7: Green Supply Chain Practices have a positive relationship with environmental performance.

ANALYSIS

Elementary data analysis

Table1: Elementary data analysis

Elementary Factor	Measure	No. of companies	%
Gender	Male	27	100
	Female	0	0
Job Title	General Manager	11	40.75
	Site Head	1	3.7
	Environment Department Head	14	51.85
	Assistant Manager	1	3.7
	Other	0	0
No. of Employees	Less than 100	3	11.1
	100-200	10	37
	200-500	9	33.3
	500-1000	5	18.6
	Greater than 1000	0	0
Annual Sales	Less than 10 crore	2	7.4
	10-50 crores	3	11.1
	50-100 Crores	11	40.8
	100- 500 Crores	8	29.6
	Greater than 500 crores	3	11.1
Environment Department	Yes	26	96.3
	No	1	3.7
Age of GSCM	< 1 Year	1	3.7
	1 – 3 Years	7	25.9
	3-5 Years	6	22.2
	>5 years	13	48.1

Table1 presents a detailed analysis of the demographic characteristics of respondents' firms. There was no female representative throughout the survey. More than 50% respondents were head of the environment department. 40.75 % respondents were general manager from departments like supply chain, purchase, marketing etc.

As regards employees, 18.6 percent of respondents' firms had over 500-1000 employees, while one third companies have employed persons in range of 200-500. About 37% companies have employed between 100 and 200 full-time workers.

Firms' sales varied considerably. Just over a quarter (29.6percent)of firms' sales was between Rs. 100 500 Crores and 40.8 percent reported sales of Rs. 50-100 Crores. Almost half of the industries surveyed have replied that their organizations are active players in GSCM field since last 5 or more years. Almost every organization have environmental department in their organizations.

Concordance and Equal Effectiveness tests:

As shown in table 1A and 1B different 8 drivers and 7 motives were analyzed based on their importance to the company with rank method (1-Most Important). Each respondent has not assigned the same order to the list of concerns. Kendall's coefficient of concordance (W) is very close to 0 in both the cases, so there is no overall trend of agreement among the respondents, and their responses may be regarded as essentially random. High value of Friedman Chi-square shows that results are significant and thus Environment Regulation is the most important driver for the business followed by corporate image, leadership and cost

reduction. The least important driver is competitor's action. Environment Regulations also have high impact followed by on organization's decision to implement GSCM.

Table 1A
Importance of business drivers for GSCM(Q3)

	Mean Rank
Environmental Regulations	3.33
Improve corporate image	3.67
Innovation	4.33
Pressure of Lobby Group	5.22
Cost Reduction	4.15
Executive Leadership	4.07
New Markets opportunities	5.30
Competitors' Action	5.93
Test Statistics	
N	27
Kendall's W[a]	.133
Chi-square	25.099
Df	7
Asymp. Sig.	.001

a. Kendall's Coefficient of Concordance

Table 1B
Motives to implement GSCM

	Mean Rank
Environment Regulations	2.78
Improved Corporate image	3.31
Innovation	4.70
Executive Leadership	4.93
New marke opportunity	3.50
Competitors' Action	3.81
Cost Reduction	4.96
Test Statistics	
N	27
Kendall's W[a]	.162
Chi-square	26.212
Df	6
Asymp. Sig.	.000

a. Kendall's Coefficient of Concordance

Questions 4, 6 and 8 which are related to consideration of environmental factors, organization's thinking for environmental regulations and environmental measures in manufacturing phase respectively. To test the effectiveness of all factors for each question Cocharan's coefficient of effectiveness (Q) is been calculated. "Cochran's Q test assumes that there are $k > 2$ experimental treatments and that the observations are arranged in blocks. Cochran's Q test is

H_0: The treatments are equally effective.

H_a: There is a difference in effectiveness among treatments

The Cochran's Q test statistic is

$$T = k\,(k-1)\,\frac{\sum_{j=1}^{k}\left(X_{\bullet j}-\frac{N}{k}\right)^2}{\sum_{i=1}^{b} X_{i\bullet}\,(k-X_{i\bullet})}$$

Where

k is the number of treatments

$X_{\bullet j}$ is the column total for the j^{th} treatment

b is the number of blocks

$X_{i\bullet}$ is the row total for the i^{th} block

N is the grand total (Conover and William J., 1999)[xxxviii]".

Table 1C: Consideration of environmental factors while making strategic decision (Question 4)

Test Statistics			
N	Cochran's Q	df	Asymp. Sig.
27	29.327[a]	12	0.004

a. 1 is treated as a success.

Variable	Value	
	0 (Factor not considered by respondent)	1 (Factor considered by respondent)
Waste Treatment	14	13
Packaging	20	7
Commodities consumption	18	9
Employee Health	14	13
Energy Consumption	18	9
Reduction of transportation	15	12
Water Purification and treatment	17	10
Choice of transportation mode	19	8
Gas Emission	20	7
Consumers and public health	19	8
Choice of raw materials	14	13
All of the above	22	5
Other	27	0

Table 1D: Organization's thinking towards environmental regulations (Question 6)

Test Statistics			
N	Cochran's Q	df	Asymp. Sig.
27	29.882[a]	5	0.000

a. 1 is treated as a success.

Variable	Value	
	0 (Factor not considered by respondent)	1 (Factor considered by respondent)
An opportunity to innovate	18	9
Critical to your business	11	16
A constraint	18	9
Don't Know	24	3
With no impact on activity	24	3
Other	27	0

Table 1E:Environmental factors in manufacturing phase (Question 8)

Test Statistics			
N	Cochran's Q	df	Asymp. Sig.
27	34.925[a]	4	0.000

a. 1 is treated as a success.

Variable	Value	
	0 (Factor not considered by respondent)	1 (Factor considered by respondent)
Optimize Energy Consumption	16	11
Reduce environmental discharge	13	14
Reduce the amount of waste	6	21
Achieve regulatory compliance	18	9
Others	27	0

From the analysis shown in table 1C for the question 4, it can be seen that coefficient of effectiveness is 29.327 indicating that no factors have equal effectiveness on consideration of parameters while taking strategic decision. Thus, from the same table it can be seen that most considered subjects in strategic decision of an organization are waste treatment, raw material selection an employee health with 13 respondents followed by reduction in transportation with 12 respondents and water purification with 10 supporting respondents.

From the analysis shown in table 1D for the question 6, it can be seen that coefficient of effectiveness is 29.882 indicating that no factors have equal effectiveness on organizations' thinking towards environment regulation. From the table, it can be easily observed that most of the pharmaceutical organizations believe that environment regulation is the critical factor for the company. From the analysis shown in table 1E for the question 8, it can be seen that coefficient of effectiveness is 34.925 indicating that no factors have equal effectiveness on organizations' thinking towards environment regulation. According to pharmaceutical players from Ankleshwar, environmental measure in manufacturing phase has enabled organizations to reduce the amount of waste (supported by 21 responses) and to reduce environmental discharge (supported by 14 responses) as well as consumption of energy (supported by 11 responses).

1. Choice of Analysis Method

Table 2: Descriptive statistics of observable variables

Variables	Mean	Std. Deviation	Skewness	Kurtosis
Central Govt Env Regulation	1.78	.577	.016	-.138
Regional Env Regulation	2.00	.877	.369	-.759
Export countries' env regulations	2.30	1.103	.842	.056
Product confliction with Law	2.37	1.245	1.289	1.818
Export	2.19	.921	.561	-.247
Sales to foreign customers	2.15	.662	.692	1.558
Indian consumers' env awareness	2.26	1.095	.388	-1.104
Company's green image	2.26	.903	.455	-.315
Supplier's advances in developing env friendly goods	2.56	.934	.438	-.870
Env partnership with suppliers	2.52	1.189	1.214	1.886
Supplier's advances in providing env friendly pack	2.48	1.051	.160	-1.121
Business Continuity	2.41	1.394	1.678	3.470
Company's env mission	2.41	1.217	2.029	7.049
Internal MNC policies	2.11	1.423	2.383	6.252
Potential liabilities for hazwaste disposal	2.33	1.177	1.275	2.282
Cost for disposal of hazwaste	2.22	.641	-.222	-.494
Cost of env friendly goods	2.44	1.013	.643	.249
Cost of env friendly pack	2.04	.940	.823	.122
Senior management commitment	2.19	1.039	1.156	1.111
Mid-level manager's support	1.96	.898	.421	-.852
Cross-functional cooperation	2.37	1.006	.139	-.973
TQEM	2.44	.847	.187	-.376
Env Compliance and ISO 14000	2.11	.892	.473	-.321
Desgin specification for env requirements	2.41	1.047	.590	.054
Cooperation with suppliers	2.22	.892	.582	-.083
Env Audit of suppliers	2.11	1.050	1.916	6.313
ISO 14000 of Suppliers	2.15	.949	1.143	2.059
Second tier supplier's env friendly practice	2.07	.997	.597	-.589
Cooperation with customers for Eco design	2.07	.730	-.116	-1.013
Cooperation with customers for cleaner production	2.26	1.023	.365	-.890
Cooperation with customers for green pack	2.41	.844	.314	-.283
Sale of excess inventory	2.22	.801	.534	.292
Sale of scrap	2.41	.844	.314	-.283
Sale of excess capital equipment	2.19	.622	.901	2.114
Design of product for reduced energy consumption	2.41	1.152	1.222	2.299
Design of product for reuse recycle and recovery	2.26	.813	.399	.014
Design of product for reduced haz-material consumption	1.89	.847	1.042	1.170
Total cost has increased	6.11	.751	-.189	-1.131
Distribution Cost has increased	5.22	.974	.057	.147
Manufacturing Cost has increased	5.22	.751	-.399	-1.064
Inventory cost has increased	6.30	.669	-.422	-.650
ROI has increased	6.41	.572	-.274	-.766
Sales has increased	6.70	.465	-.946	-1.201
Profit has increased	6.26	.594	-.122	-.347
On-time delivery has increased	6.07	.616	-.036	-.094
Backorder has increased	5.67	.679	-.265	.260
Customer response has increased	6.30	.542	.135	-.475
Manufacturing lead time has increased	5.78	.698	-.398	.557
Shipping error has increased	6.19	.681	-1.034	2.984
Customer complaints has increased	6.37	.492	.569	-1.817
Air emission has reduced	6.04	.706	-.760	1.659
Waste water production has reduced	5.89	.847	-1.007	1.045
Fuel and Energy Consumption has reduced	6.19	.681	-.247	-.711
Solid waste generation has reduced	6.22	.506	.403	.187

According to model used and model's variable distribution property, ML(maximum likelihood) of structural equation modeling(SEM) is the best suitable method of assessment. As per Klyne(1998)[xxxix], "if the absolute of the skewness coefficient of variable is larger than 3, it will be considered as extreme skewness. Moreover, if the absolute value of the kurtosis coefficient is larger than 10, the variable will be considered questionable, and if it is larger than 20, the variable will be regarded as of extreme kurtosis." In this analysis it can be observed from the table 2 that the skewness of the study ranges between -1.034 and 2.383, with its absolute value less than 3. Moreover, the kurtosis ranges from -1.121 to 7.049 with its absolute value less than 10. The findings indicate that both the descriptive statistics of observable variables are lesser than the extreme values; thus, ML can be used to evaluate the model of the current study.

2. Effects of offending estimates:

Table 3: Estimates of model parameters

Parameter	Unstandardized Parameter Estimate	Std. Error	t-Value	Standardized Parameter Estimate
λ_1	1	0.012	3.300	0.89
λ_2	0.77	0.071	3.610	0.95
λ_3	1.22	11	3.590	0.92
λ_4	1.55	0.14	3.560	0.85
λ_5	0.85	0.12	3.740	0.9
λ_6	1.26	0.13	3.610	0.9
λ_7	1.2	0.14	3.750	0.88
λ_8	0.88	0.044	4.190	0.92
λ_9	1.02	0.012	3.900	0.89
λ_{10}	1	0.13	4.620	0.85
λ_{11}	1.11	0.19	3.520	0.87
λ_{12}	1.94	0.027	4.490	0.95
λ_{13}	1.48	0.16	4.670	0.92
λ_{14}	2.03	0.2	3.180	0.86
λ_{15}	1.38	0.18	3.510	0.94
λ_{16}	1.25	0.14	4.820	0.92
λ_{17}	1.03	0.16	3.150	0.95
λ_{18}	0.88	0.042	4.600	0.84
λ_{19}	1.08	0.18	4.740	0.81
λ_{20}	0.81	0.18	3.470	0.8
λ_{21}	1.01	0.19	3.610	0.66
λ_{22}	0.72	0.16	3.550	0.66
λ_{23}	0.87	0.023	3.740	0.92
λ_{24}	0.9	0.021	3.470	0.89
λ_{25}	0.79	0.029	3.560	0.95
λ_{26}	1.1	0.13	3.170	0.95
λ_{27}	0.9	0.21	3.620	0.92
λ_{28}	0.53	0.12	3.560	0.85
λ_{29}	1.05	0.21	3.240	0.93
λ_{30}	0.71	0.079	3.270	0.93
λ_{31}	0.64	0.21	3.400	0.7
λ_{32}	0.69	0.19	3.430	0.73
λ_{33}	0.53	0.089	3.340	0.75
λ_{34}	1.33	0.21	2.970	0.81
λ_{35}	0.66	0.15	3.980	0.64
λ_{36}	0.72	0.15	3.300	0.63
λ_{37}	0.57	0.19	3.350	0.8
λ_{38}	0.65	0.012	2.420	0.88
λ_{39}	0.95	0.091	3.930	0.93
λ_{40}	0.65	0.078	3.680	0.76
λ_{41}	0.63	0.06	3.810	0.72

λ_{42}	0.82	0.038	3.730	0.82
λ_{43}	0.85	0.054	3.620	0.93
λ_{44}	0.88	0.017	3.450	0.92
λ_{45}	0.94	0.012	3.620	0.9
λ_{46}	0.99	0.085	2.490	0.71
λ_{47}	0.75	0.081	3.750	0.8
λ_{48}	1.24	0.056	3.780	0.64
λ_{49}	1.05	0.1	2.630	0.67
λ_{50}	1.04	0.092	3.210	0.69
λ_{51}	0.75	0.13	3.720	0.93
λ_{52}	0.64	0.18	2.610	0.76
λ_{53}	0.62	0.0059	2.810	0.94
λ_{54}	0.89	0.14	2.640	0.87

According to Bagozzi and Yi (1988)[xl], there is unlikely to be a negative error variance or a large standard error, and the standardized coefficient cannot be larger than 0.95. Table 3 represents error variances, standard error and standardized parameter of observable variables. In table, it can be seen that all error variances are positive as well as all standard error (0.0059 – 0.21) are small enough. In addition to this, standardized coefficients range from 0.63 to 0.95, which is less than 0.95 and lie below the significance level. This supports and advises that there was a complete absence of the effect of offending estimate.

3. Reliability Test:

Table 4: Reliability estimates (Alpha)

Variables	Regulation	Market	Suppliers	Internal Drivers	Internal Management	Green Supply
Alpha Value	0.772	0.773	0.693	0.726	0.69	0.641
Variables	Cooperation with Customers	Investment Recovery	Ecodesign and Reverse Logistics	Economic Performance	Operational Performance	Environmental Performance
Alpha Value	0.823	0.835	0.635	0.545	0.896	0.723

As can be seen from table 4, all 12 joint variables (latent variables) have high inter-item correlation (alpha), which are 0.772, 0.773, 0.693, 0.726, 0.690, 0.641, 0.823, 0.835, 0.635, 0.545, 0.896, 0.723; all above 0.5. In addition to this construct reliability of overall model is 0.889 which is also higher than minimum requirement of 0.60 (Bentler and Wu, 1993)[xli].

4. Validity Test

a. Convergent Validity: As given in the table 3, all factor loadings (λ_1 to λ_{54}) of the observable variables range from 0.63 to 0.95, which achieve significance and are higher than threshold,0.45, indicating that all observable variables can reflect the latent variables constructed (Bentler and Wu, 1993)[xlii].

b. Discriminant Validity: All parameters form a factor that is different from other variables in the model (Hong, Kwon and Roh, 2009)[xliii]. With reference to Bentler and Wu, (1993)[xliv], the latent variables shown in table 5 have all reached the significance level, indicating that there is a discrepancy between the model in which the correlation between any two latent variables is set to be 1.00 and the model in which the correlation between latent variables can be distinguished, hence the discriminant validity is supported (Chien and Shin, 2007)[xlv].

5. Tests for overall model-fit

The overall model fit is required to adopt at least the following three fit tests (Bagozzi and Yi, 1988)[xlvi]:

Table 5: Convergent and discriminant validity

	Regulation	Market	Suppliers	Internal Driver	Internal Management	Green Supply	CoopCust	InvReco	EDRL	ECOPERF	OPEPERF	ENVPERF
Regulation	1											
Market	.450*	1										
Suppliers	.426*	.770**	1									
InternalDriver	.547**	.766**	.696**	1								
Internal Management	.675**	.736**	.615**	.714**	1							
GreenSupply	.749**	.475*	.555**	.511**	.782**	1						
CoopCust	.453*	.419*	.278	.406*	.624**	.669**	1					
InvReco	.457*	.519**	.410*	.313*	.627**	.466*	.277**	1				
EDRL	.522**	.447*	.392*	.443*	.706**	.662**	.553**	.512**	1			
ECOPERF	.138*	.150*	.011*	.159**	.020*	.118*	.017*	.054**	.021*	1		
OPEPERF	.023*	.043*	.039*	.152*	.068**	.155*	.018*	.196**	.321*	.218*	1	
ENVPERF	.226*	.225*	.354*	.208*	.153*	.348*	.427*	.101*	.352*	.213*	.059*	1

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

a. Absolute fit test: (For results from LISREL see LISREL SHEET)

i. GFI (Goodness of fit index): A good fit requires the GFI to be larger than 0.90. The theoretical model fit of the present study is 0.91, indicating a good fit.

ii. RMR (Root mean square residual): Good fit demands the RMR to be smaller than or equal to 0.05. The theoretical model fit is 0.039, and thus it qualifies as a good fit.

iii. RMSEA (Root mean square error of approximation): RMSEA smaller than or equal to 0.10 is considered a good fit and the theoretical model fit here is 0.097, indicating that it is a good fit.

b. Relative fit test:

i. NNFI (Non normed fit index): NNFI, larger than 0.9 is generally considered acceptable. The value is 0.94 for the present theoretical model, indicating that the present model is acceptable.

ii. CFI (Comparative fit index): CFI, larger than 0.9 is generally considered acceptable. The CFI is 0.95 for the present theoretical model, indicating that the present model is acceptable(Hu and Bentler, 1999)[xlvii].

c. Parsimonious fit test:

i. PNFI (Parsimony Normed Fit Index): A PNFI larger than 0.5 is generally considered as a good model. The value is 0.63 for the present theoretical model, indicating that the present model is acceptable(Hu and Bentler, 1999)[xlviii].

ii. PGFI (Parsimony Goodness of Fit Index): A PGFI in the range of 0.5 is generally considered as a good model. The value is 0.47 for the present theoretical model, indicating that the present model is acceptable (Hu and Bentler, 1999)[xlix].

iii. Normed Chi-Square: An index of less than 3 is considered as a good fit. The value of the present model is 1.69, indicating a good overall fit. Tests for

overall model fit were performed in order to understand the fit between the observed data and the hypothesized model (Hu and Bentler, 1999)[1].

6. Analysis of Hypothesis

GSCM is a relatively new green issue for the majority of Indian, Gujarat situated, corporations. From the perspective of management, GSCM is a management strategy, taking into account the effects of the entire supply chain on environmental protection and economic development. However, the feasibility of reaching the right balance between the environmental performance and financial performance is a serious concern for corporations implementing GSCM. The present empirical study investigated the GSCM practices adopted by the pharmaceutical industry in Ankleshwar (Gujarat) in response to the Environment Protection Act, Central Pollution Control Board and Gujarat Pollution Control Board directives. The pressures or drives to implement GSCM practices and the relationship between GSCM practices and operational performance, environmental performance as well as financial performance were also studied. The approach adopted in the present study included a questionnaire and in-depth interviews with the chemical and mechanical corporations approved by the ISO14001 certification in India before January 2010. The findings obtained from the 27 valid samples are described as follows:

Table 6: Factor Loadings of Latent variables

Variables	Regulation γ_1	Market γ_2	Suppliers γ_3	Internal Drivers γ_4	Internal Management β_5	Green Supply β_6
Factor Loading	0.61	0.89	0.81	0.86	0.98	0.80
t-value	3.32	5.68	4.90	5.36	6.16	4.06
Variables	Cooperation with Customers β_7	Investment Recovery β_8	Ecodesign and Reverse Logistics β_9	Economic Performance β_{10}	Operational Performance β_{11}	Environmental Performance β_{12}
Factor Loading	0.64	0.63	0.73	0.59	0.89	0.87
t-value	3.96	3.02	6.01	2.98	2.88	2.69

Hypothesis 1

$H1_0$: Environmental regulations do not have relationship with Green Supply Chain Practices.

$H1_A$: Environmental regulations have a positive relationship with Green Supply Chain Practices.

The environmental regulations factors consist of four observed variables: central government environmental regulations, domestic environmental regulations, international environmental regulations and product conflicting with laws. Their factor loadings, λ_1, λ_2, λ_3 and λ_4, of the environmental regulations factors of latent variables are 0.89, 0.95, 0.92 and 0.85, respectively. Their t values are 3.3, 3.61, 3.59 and 3.56 respectively; all larger than the significance level of 1.96, indicating that the preliminary fit index is favorable.

On the other hand, the path coefficient, γ_1, of the normative factors to the latent variables of GSCM practices is 0.61 and t is 3.32, suggesting that the normative factor has a positive relationship with the implementation of GSCM practices. Hence, null hypothesis is rejected.

Also, λ_2 (Domestic environmental regulation) is 0.95, higher than λ_1 (0.89), λ_3 (0.92) and λ_4(0.85) of central government environmental regulations, international environmental regulations and product conflicting with laws respectively, indicating that the pressure on enterprises to adopt green supply chain management practices comes from the domestic environmental regulation of environmental regulations factors.

Hypothesis 2

$H2_0$: Market pressure does not have relationship with Green Supply Chain Practices.

$H2_A$: Market pressure has a positive relationship with Green Supply Chain Practices.

The market pressure factors consist of four observed variables: Exports, Sales to foreign customers, Indian consumers' environmental awareness and establishment of company's green image. Their factor loadings, λ_5, λ_6, λ_7 and λ_8, of the market factors of latent variables are 0.9, 0.9, 0.88 and 0.92, respectively. Their t values are 3.74, 3.61, 3.75 and 4.19 respectively; all larger than the significance level of 1.96, indicating that the preliminary fit index is favorable.

On the other hand, the path coefficient, γ_2, of the normative factors to the latent variables of GSCM practices is 0.89 and t is 5.68, suggesting that the normative factor has a positive relationship with the implementation of GSCM practices. Hence, the null hypothesis is rejected.

Also, λ_8 (Green Image) is 0.92, higher than λ_5 (0.9), λ_6 (0.9) and λ_7 (0.88) of Exports, Sales to foreign customers and Indian Consumers' environmental awareness; indicating that the market pressure on enterprises to adopt green supply

chain management practices comes from the establishment of company's green image.

Hypothesis 3

$H3_0$: Cooperation with suppliers does not have relationship with Green Supply Chain Practices.

$H3_A$: Cooperation with suppliers has a positive relationship with Green Supply Chain Practices.

The supplier cooperation factors consist of four observed variables: Suppliers' advances in developing environmentally friendly goods, environmental partnership with suppliers, suppliers' advances in providing environmentally friendly packaging and business continuity. Their factor loadings λ_9, λ_{10}, λ_{11} and $\lambda_{12}$of the environmental regulations factors of latent variables are 0.89, 0.85, 0.87 and 0.95, respectively. Their t values are 3.9, 4.62, 3.52 and 4.49 respectively; all larger than the significance level of 1.96, indicating that the preliminary fit index is favorable. Hence, the null hypothesis is rejected.

On the other hand, the path coefficient, γ_3, of the normative factors to the latent variables of GSCM practices is 0.81 and t is 4.90, suggesting that the normative factor has a positive relationship with the implementation of GSCM practices.

Also, λ_{12} (business continuity) is 0.95, higher than λ_9 (0.89), λ_{10} (0.85) and λ_{11} (0.87) of suppliers' advances in developing environmentally friendly goods, environmental partnership with suppliers, suppliers' advances in providing environmentally friendly packaging; indicating that the supplier pressure on enterprises to adopt green supply chain management practices comes from the business continuity with suppliers.

Hypothesis 4

$H4_0$: Organization's internal drivers do not have relationship with Green Supply Chain Practices.

$H4_A$: Organization's internal drivers have a positive relationship with Green Supply Chain Practices.

The management's internal drivers consist of six observed variables: Company's environmental mission, Internal multinational polices, potential liability for disposal of hazardous waste, Cost for disposal of waste, cost for environment friendly goods and packages. Their factor loadings, λ_{13}, λ_{14}, λ_{15}, $\lambda_{16,}$ λ_{17} and λ_{18}, of the factors of latent variables are 0.92, 0.86, 0.94, 0.92, 0.95 and 0.84, respectively. Their t values are 4.67, 3.18, 3.51, 4.82, 3.15 and 4.6 respectively; all larger than the significance level of 1.96, indicating that the preliminary fit index is favorable.

On the other hand, the path coefficient, γ_4, of the normative factors to the latent variables of GSCM practices is 0.86 and t is 5.36, suggesting that the normative factor has a positive relationship with the implementation of GSCM practices. Also,λ_{17} (business continuity) is 0.95, higher than λ_{13}(0.92), λ_{14}(0.86), λ_{15}(0.94), λ_{16}(o.92)and λ_{18}(0.84) of Company's environmental mission, Internal multinational polices, potential liability for disposal of hazardous waste, Cost for disposal of waste and cost for environment friendly packages; indicating that the internal management pressure on enterprises to adopt green supply chain management practices comes from the cost for environment friendly goods followed by potential liability for disposal of waste (λ_{15}(0.94)).

Hypothesis 5

$H5_0$: Green Supply Chain Practices do not have relationship with economic performance.

$H5_A$: Green Supply Chain Practices have a positive relationship with economic performance.

GSCM practices consist of five latent and nineteen observed variables. Five latent variables under GSCM practices are: Internal management, Green Supply, Cooperation with customers, investment recovery and eco-design of products and reverse logistic. The factor loadings (λ_{19} to λ_{37}) of all nineteen observed variable vary between, 0.63 and 0.95. The normative factors of latent variables of the green practices are 0.98, 0.80, 0.64, 0.63 and 0.73, respectively, and their t values are, 6.16, 4.06, 3.96, 3.02, and 6.01, larger than the significance level of 1.96.

Looking at the performance section economic performance consists of seven observable variables: Total cost, distribution cost, manufacturing cost, inventory, and return on investment, sales and profit. The factor loadings λ_{38}, λ_{39}, λ_{40}, λ_{41}, λ_{42}, λ_{43} and λ_{44}, of the economic performance of latent variables are 0.88, 0.93, 0.76, 0.72, 0.82, 0.93 and 0.92 respectively, and their t values are 2.42, 3.93, 3.68, 3.81, 3.73, 3.62 and 3.45 larger than the significance level of 1.96.

On the other hand, the path coefficient, β_6, of GSCM practices to the latent variable economic performance is 0.59 and t is 2.98, indicating that the implementation of GSCM practices has a positive relationship with the economic performance of corporations. Distribution cost, sales and profit are increased and have great impact on green manufacturing and green procurement because of which companies are now on the path to improve economic performance.

Hypothesis 6

$H6_0$: Green Supply Chain Practices do not have relationship with operational performance.

$H6_A$: Green Supply Chain Practices have a positive relationship with operational performance.

Looking at the performance section operational performance consists of six observable variables: on time delivery, backorder/stockout, customer response time, manufacturing lead time, shipping error, customer complaints. The factor loadings, λ_{45}, λ_{46}, λ_{47}, λ_{48}, λ_{49}, and λ_{50}, of the operational performance of latent variables are 0.90, 0.71, 0.80, 0.64, 0.67 and 0.69 respectively, and their t values are 3.62, 2.49, 3.75, 3.78, 2.63 and 3.21 larger than the significance level of 1.96.

On the other hand, the path coefficient, β_7, of GSCM practices to the latent variable operational performance is 0.89 and t is 2.88, indicating that the implementation of GSCM practices has a positive relationship with the operational performance of corporations. On-time delivery is increased and has great impact on green manufacturing and green procurement because of which companies are now on the path to improve operational performance.

Hypothesis 7

$H7_0$: Green Supply Chain Practices do not have relationship with environmental performance.

$H7_A$: Green Supply Chain Practices have a positive relationship with environmental performance.

Environmental performance consists of four observable variables: air emission, waste water generation, fuel and energy consumption and solid waste. The factor loadings, λ_{51}, λ_{52}, λ_{53}, and λ_{54}, of the environmental performance of latent variables are 0.93, 0.76, 0.94and 0.87 respectively, and their t values are, 3.72, 2.61, 2.81 and 2.64, larger than the significance level of 1.96. On the other hand, the path coefficient, β_8, of GSCM practices to the latent variable environmental performance is 0.87 and t is 2.69, indicating that the implementation of GSCM practices has a positive relationship with the environmental performance of corporations. Air emission, fuel & energy consumption is decreased and has great impact on green manufacturing and green procurement because of which companies are now on the path to improve environmental performance.

FINDINGS

- From study of hypothesis 1, we found that environment regulations have positive relation with implementation of GSCM in an organization. That means organizations are feeling pressure of environment regulation to execute Green Supply Chain practices.
- It was also noted that the pressure on enterprises to adopt green supply chain management practices comes from the domestic environmental regulation of environmental regulations factors.
- Pressure from market also has positive relation with adoption of GSCM practices. It was also distinguished that market pressure was developed due to establishment of Green Image of an organization, while exports and foreign customers have little lower impact than green image.
- Findings of hypothesis three suggest that there is positive relationship between cooperation with suppliers and adoption of GSCM practices. So, higher pressure from suppliers for implementing GSCM cause into higher adoption of GSCM practices. The supplier pressure on enterprises to adopt green supply chain management practices comes due to business continuity with suppliers.
- Internal drivers of organization also have great influence on GSCM acceptance. The internal management pressure on enterprises to adopt green supply chain management practices comes from the cost for environment friendly goods followed by potential liability for disposal of waste
- During this study it was found that GSCM practices have strengthen organizations' environmental performance, operational performance and economic performance.
- Distribution cost, sales and profit are increased and have great impact on green manufacturing and green procurement because of which companies are now on the path to improve economic performance.
- Most influencing factor for companies' improving operational performance is on-time delivery.
- Air emission, fuel & energy consumption is decreased and has great impact on green manufacturing and green procurement because of which companies are now on the path to improve environmental performance.

CONCLUSION

The findings suggest that the pressure or drive from environmental regulations, suppliers, consumers and community stakeholders have prompted the pharmaceutical manufacturers in Gujarat to implement GSCM practices. From the present study, and the studies of Seuring (2004)[li], Chien and Shin(2007)[lii] and Gottberg, *et al.* (2006)[liii], it is found that regulations, market, suppliers and internal drivers exert pressure on corporations to implement GSCM practices. Furthermore, it was found that the implementation of GSCM practices can enhance the environmental, operational and financial performance of corporations, consistent with the findings of Rao (2002)[liv] and Sarkis (2001)[lv], who emphasized the beneficial effects of the implementation of GSCM practices in improving environmental, organizational and financial performance.

As said by Chien and Shin (2007)[lvi], a corporation should not overlook long-term sustainability while pursuing short term profit. It is important to pursue economic development and at the same time consider environmental burden, thereby preserving the natural resources and environment on which the entire human race is dependent, instead of relentlessly exploiting available resources. In pursuing economic development, social justice has to be taken into account in order to strike the right balance between economy, environment and benefit to society. It is therefore suggested that future research may focus on the relationship between GSCM practices and sustainable performance.

Enterprises used to be concerned only with their own profit, ignoring the most important links in their production chain: upstream suppliers and downstream customers. The present study found that, in the face of the current global green issue, corporations can benefit from an entirely green supply chain by cooperating with upstream suppliers on green production technology and exchanging green information with them, as well as taking the voices of downstream customers and green consumers into account in their production processes. To meet the expectations of society, pollution preventive measures should be adopted as an environmental management strategy. However, corporations in general are concerned that stressing

environmental performance would add to their operational cost, accompanied by a decreasing market share and competitiveness. Nevertheless, the present study found that the implementation of GSCM practices has a positive effect on environmental, operational and economic performance; that is, an increase in environmental performance will be accompanied by increased corporation profit and market share. These conclusions effectively dispel the doubts of those pharmaceutical corporations in Ankleshwar (Gujarat) have taken environmental measures into consideration.

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