CHAPTER 5

MAJOR FINDINGS

AND

RECOMMENDATIONS
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5.1. Major Findings

The major findings of the primary surveys are as follows:

1. The study and the data collected revealed that the awareness of green supply chain management practices is very much present in the medium and the large sized chemical industries in Gujarat but only a small proportion of them are unaware about the GSCM concept. From the initial survey done and the pilot study it was found that the small and micro chemical industries are not aware of the concept. (Refer table 4.2) (Bhateja et al, 2011)

2. The data shows that most of the Chemical industries surveyed are at the Beginning Stage of Green Supply Chain Activities followed by the few large scale Chemical Industries which are at Intermediate stage of Green Activities Implementation. It is found that only very few players are implementing Green activities entirely along the every activity and are at Advanced Stage of green activities implementation and there are almost practically no medium sized and large scaled chemical industries without green activities strategy. (Refer Table 4.3) (Kumar and Chandrakar, 2012)

3. It also shows that there is an association between the state of Green Supply Chain Management process ISO 14000 certification achieved by an organization. The stages of green management activities differ among organizations having ISO 14000 certification and not having ISO 14000 certification. (Refer Table 4.5) (Arimura et al, 2011; Chan et al., 2010; Deif 2011; Heidrich and Tiwary, 2013))

4. There is also an association between the state of green supply chain management process and adoption of Environmental Management System. The stages of green management activities differ among organizations having adopted EMS and not adopted EMS. (Refer Table 4.6) (Arimura et al, (2008); Arimura et al, 2011)

5. There is an association between the state of green supply chain management process and the size of an organization. The stages of green management activities differ among medium and large size of organizations. (Refer Table 4.7) (Skachkova, 2011)
6. The data that most of chemical industries in Gujarat have implemented GSCM activities like Eliminate/reduce hazardous/toxic chemicals from manufacturing processes, Eliminate, reduce, or repurpose manufacturing waste etc which are majorly pertaining to green manufacturing practice. (Refer Table 4.8) (Bhateja et al, 2011)

7. The most influencing motivating factors for implementing GSCM practices for most of chemical industries in Gujarat according to their ranks. The top three Influencing factors are Environmental commitment of Top management followed by Gain legitimacy and at the third rank is Employee’s values. (Refer Table 4.9) (Dashore and Sohani, 2013; Diabat and Govindan, 2011)

8. The preferences of organizations to work with various external parties/stakeholders namely Competitors, Suppliers, Consultants, 3PL providers, Governmental Agencies and Customers differ. (Refer 4.11) (Kocabasoglu et al 2007; Wolf and Seuring, 2010)

9. The result shows the impacts of ecological approach towards SCM in chemical industries in Gujarat. The most important three impacts are Potential competitive advantage: enhance the competitiveness of your organization, Enhance corporate image and Management of environmental risks. (Refer 4.12) (Rao and Holt, 2005; Bhateja et al, 2011)

10. The result shows the barriers for GSCM Implementation in chemical industries of Gujarat. The most commonly faced Barriers for the GSCM implementation are Skepticism in regards to the potential benefits, the high costs of environmental programs and the complexity of ecological approach in supply chain. (Refer 4.13) (Luthra et al, 2011; Dashore and Sohani, 2013; Mudgal et al, 2010)

11. An exploratory factor analysis was conducted to derive groupings of Green Supply Chain Management (GSCM) Drivers/Pressures, were extracted using maximum likelihood method, followed by varimax rotation. The eight factors on GSCM Drivers/Pressures are labeled as Vertical Channel Partners, Environmental Regulations, Society, Expected Business Benefits, Top Management Support and Corporate Values, Competitors’ Practices, Organizational Factors and International Environmental Agreements. (Refer 4.14) (Pandya and Mavani, 2012; Nimmawat and Namdev, 2012; Diabat and Govindan, 2011; Ravi and Shankar, 2005; Bhateja et al, 2011)

12. An exploratory factor analysis was conducted to derive groupings of Green Supply Chain Management (GSCM) Practices. Seven factors of GSCM

13. A similar factor analysis of the GSCM Performance items of also grouped the scale items as predicted. The five factors on Green Supply Chain Management (GSCM) performance are labeled as Environmental Performance, Financial Performance, Operational Performance, Competitive Performance and Reduction in Penalties. (Refer 4.18) (Digalwar and Metri, 2004; Pandya and Mavani, 2012; Nimmawat and Namdev, 2012; Bhateja et al, 2011).

14. The regression analysis of GSCM Drivers on Green Manufacturing reveals that Domestic and Government Environmental Regulations, Society, Expected Business Benefits, Top Management Support and Corporate Values, Competitive Environment, Organizational Factors, International Environmental Agreements are having significant impact on Green Manufacturing. (Refer 4.22.1) (Singh et al, 2012; Sarkis and Geng, 2005;)

15. The regression analysis of GSCM Drivers on Green Procurement reveals that Vertical Channel Partners, Domestic and Government Environmental Regulations, Society, Top Management Support and Corporate Values, Competitive Environment, Organizational Factors are having significant impact on Green Procurement. (Refer 4.22.2) (M Björklund, 2010; Min and Galle, 1997).

16. The regression analysis of GSCM Drivers on Green Designing reveals that Domestic and Government Environmental Regulations, Expected Business Benefits, Top Management Support and Corporate Values, Organizational Factors are having significant impact on Green Designing. (Refer 4.22.3) (Diabat and Govindan 2011; Chen et al., 2006).

17. The regression analysis of GSCM Drivers on Green Supplier Development reveals that Vertical Channel Partners, Society, Expected Business Benefits, Top Management Support and Corporate Values, Organizational Factors are having significant impact on Green Supplier Development. (Refer 4.22.4) (Bhool and Narwal, (2013).

18. GSCM drivers like Expected Business Benefits, Top Management Support and Corporate values, Organizational factors exerts significant positive impact on
Green Management, while Vertical Channel Partners Environmental Regulations, Society, International Environmental Agreements and Competitive Environment aspect exerts significant negative relationship with Green Management. (Refer 4.22.5) (Walker, 2008; Lee 2008)

19. GSCM drivers like Top Management Support and Corporate values, Organizational Factors, Expected Business Benefits, International Environmental Agreements exerts significant positive impact on Green Logistics, while Vertical Channel Partners, Environmental Regulations, Society, Competitive Environment aspect exerts significant negative relationship with Green Logistics. (Refer 4.22.6) (Zhu et al, 2008; Bhool and Narwal, 2013)


21. Regression analysis is done to find important variables as Green Supply Chain Management practices and their relationships with the environmental performance criteria shows that the GSCM practices like Green Manufacturing, Green Procurement, Green Logistics, Green Marketing and Green Management are all in significant relationship with the Environmental Performance. (Refer 4.22.8) (Chien and Shih, 2007; Eltayeb and Zailani, 2011; Zailani et al, 2012)

22. Regression analysis is done to find important variables as Green Supply Chain Management practices and their relationships with the financial performance criteria shows that the GSCM practices like Green Manufacturing, Green Procurement, Green Logistics, Green Marketing and Green Management are all in significant relationship with the Financial Performance. (Refer 4.22.9) (Zhu et al, 2010’; Chen, 2008; Ninlawan et al, 2011; Eltayeb and Zailani, 2011)

23. Regression analysis is done to find important variables as Green Supply Chain Management practices and their relationships with the operational performance criteria shows that the GSCM practices like Green Manufacturing, Green Procurement, Green Logistics, Green Management and Green Designing are all in significant relationship with the Operational Performance. (Refer 4.22.10) (Zhu et al, 2005, 2008, 2011; Eltayeb and Zailani, 2011)
24. Regression analysis is done to find important variables as Green Supply Chain Management practices and their relationships with the Competitive Advantage performance criteria shows that the GSCM practices like Green Manufacturing, Green Procurement, Green Logistics, and Green Marketing are all in significant relationship with the Competitive Advantage. (Refer 4.22.11) (Chen, 2008; Ninlawan et al, 2011)

25. Regression analysis is done to find important variables as Green Supply Chain Management practices and their relationships with the Reducing Penalties performance criteria shows that the GSCM practices like Green Manufacturing, Green Procurement and Green Marketing are all in significant relationship with the Reducing penalties. (Refer 4.22.12) (Zhu et al, 2005, 2008, 2011; Chopra and Meindl, 2004; Eltayeb and Zailani, 2011)

26. The regression analysis of GSCM Drivers on GSCM Practices shows that GSCM driver has positive relationship with GSCM Practices. This means GSCM drivers exerts significant influence over GSCM practices. An increase in GSCM drivers will bring about a significant increase in GSCM practices. (Refer 4.21) (Rehman et al, (2013), Zhu and Sarkis (2004), Zhu et al., (2005), Zhu et al., (2010); Xu et al, (2013).

27. The regression analysis of GSCM Practices on GSCM Performance shows that GSCM driver has positive relationship with GSCM Performances. This means GSCM Practices exerts significant influence over GSCM Performance. An increase in GSCM Practices will bring about a significant increase in GSCM Performance. (Refer 4.21) (Rehman et al, (2013), Zhu and Sarkis (2004), Zhu et al., (2005), Zhu et al., (2010)).

28. The data collected according to the majority of the respondents think that the importance of the GSCM practices will become more important or a priority issue in the future days. The majority of respondents also believe that the future legislative landscapes regarding climate change will lead to increase in regulations on green supply chain management.(Refer 4.30 and Refer 4.31) Chien et al.,2007
5.2. Recommendations

1. Government should do campaigns to create awareness of green issues as customers are one of the major drivers of GSCM implementation.

2. Governments should make some laws for GSCM implementation so as to motivate them as the one of the main drivers for GSCM implementation is to gain legitimacy. Further efforts by governments and industries are needed to promote GSCM implementation, from within manufacturer boundaries to broader product supply chain boundaries.

3. Government of India agencies (Ministry of Environment and Forest, Central Pollution Control Board, Department of Chemicals and Petrochemicals) must work with state governments to ensure more rigorous and transparent enforcement of pollution and environment related regulations in chemical units.

4. Government can give subsidies to motivate GSCM implementation in Chemical Industries. Government should aid the industrial association like chemical industry association of India to address barriers they may face internally or throughout the supply chains.

5. Providing greater autonomy to Pollution Control Boards (PCBs) for stricter enforcement could be considered as the regulations and enforcements from the pollution control board act a major driving force to for chemical Industries to implement GSCM Practices. Public will also be involved by introducing of ‘whistle-blower schemes’ with incentives to identify the defaulters.

6. For the interest of development of chemical industry Government of India should consolidate multiple legislations governing the chemical industry into one Integrated Chemical Legislation. This legislation should cover the entire life cycle of chemicals.

7. At least 20 reputable and active educational / research institutes be identified and supported by Government of India (GOI), to set up initiatives with industry, to develop GSCM processes, that are less water intensive,
environmentally compliant, and safe; and to train specialists, process developers and managers.

8. These institutes, like the Indian Institute of Technology (IITs), Council of Scientific and Industrial Research (CSIR) labs, and university departments, can each focus on sectors and areas of key interest, tasked to develop within 5 years into centers of excellence and consultancy; and industry experts may be asked to join these institutes as GSCM advisors/research panel members.

9. Seminars/Workshop on Green Supply Chain Management (GSCM) best practices in the Chemical Industries and other Industries should be organized with national level premier technical institutions/ RandD organizations.

10. Credible Environmental Audit and Certification, viz Responsible Care Certification (Sales: over 250 cr) and ISO 14000 Compliance (Sales: 10-250 cr), should be made mandatory and reportable, for all chemical companies. Reputable auditors must be empanelled. (Arimura et al, 2011)

11. There has to be a system of positive incentives for compliant industries. The star rating system used by commerce ministry to encourage exports has worked wonders over the last 20 years. The best way could be to use the internationally recognized measures of excellence for chemical company performance in environment, safety, health, community perception: viz “Responsible Care Certification”; and encourage companies with such certification through star rating and fast track clearance for expansions, product diversification etc. These key non-fiscal incentives will encourage the growth of compliant companies and will act as a catalyst to motivate non-compliant companies towards better environmental compliance.

12. Government could provide incentives for bio-based raw materials to reduce dependence on crude oil, encourage companies to seek “Responsible Care Certification” and facilitate priority loans to those who meet environment norms. A great amount of work has already been done worldwide in this direction. Establish chemical sector council for innovation having representatives from the government, chemical companies, industry associations and reputed research/ educational institutes e.g., National
Chemical Laboratory (NCL), Institute of Chemical Technology (ICT). Such Council can help and support the Chemical Industries in Gujarat to implement the GSCM and helps them to achieve them to perform at various dimensions of organizational performances.

13. A system needs to be developed for obtaining production related information, particularly for toxic chemicals. This along with life cycle analysis would help to assess exposure potential of such chemicals to humans. The need for such information has prompted Environmental authorities in developed countries to generate such database.

14. The Environmental Audit procedure has to be strengthened to obtain complete data on installed/licensed capacities and actual production figures in respect of toxic organic chemicals manufactured in the country.

15. It is recommended to take up Life Cycle Analysis of toxic chemicals to help understand exposure potential to humans and identify population at risk. Life Cycle Assessment is a decision cum management tool which provides information on the environmental effects of various products and processes so as to arrive at necessary corrective measures to make the entire process efficient with optimal utilization of resources and minimal wastes generation.

16. Industry needs to develop and upgrade technologies and processes to produce chemicals starting from agro-wastes and non-edible agricultural products such as ethanol, glycerin, cellulosic materials, non edible oils, etc. to surfactants, polymers, specialty and fine chemicals, through fermentation, genetic engineering and bio-tech based processes and intermediates.

17. Industries can work on enhancement of cooperation within the supply chain stakeholders by encouraging the knowledge and information sharing among the supply chain stakeholders. Training should be given to the employee of the Industries for enhancement of overall performance of supply chain and green practices in it.
18. Industries are required to provide appropriate sampling chamber/point in the frontal premises of the industries before connecting to the underground drainage under implementation.

19. Upgrade air pollution control system by installing/ modifying suitable APCM like Cyclone, Multi-cyclone, and bag filters etc. Upgrading of Air Pollution Control Measures (APCM)

20. Constant vigilance requires to be kept on illegal. Checking of illegal transportation and dumping of Hazardous waste. Industries should adopt 4 - R’s (Reduce, Recover, Reuse, and Recycle) for better management of Hazardous waste.

21. There are many ways in which Chemical Industries can reduce carbon footprint in manufacturing plant. A closer look at the power source is an excellent start. Looking beyond the source of energy, there are ample opportunities to reduce consumption. How water is consumed as a resource throughout the production stages? How efficient are your plant layout and production plans? Streamlining production steps and reducing toxic materials and harmful emissions can each have a significant impact on how green your supply chain.

22. Green initiatives are tied to the larger issue of corporate social responsibility (CSR), the idea that companies have obligations not just to their investors but also to their stakeholders, society, and the environment. Industries should consider these GSCM practices as an CSR activity and should work upon them as their responsibility towards the society and environment.