CHAPTER 2
LITERATURE REVIEW

2.1 INTRODUCTION

A comprehensive and judicious review of literature is a structured account of related published work by accredited scholars, researchers and professional bodies – national and international. The extensive survey of available literature in the selected field fulfils the information requirement for identifying the problem or the ‘gap area’ for pursuing research as well as selection of tools for the study. It helps in organising the field work and assists the researcher in enhancing critical reasoning skills. Thus, a good review is a synthesized, well organised body of knowledge that is related to the area of study, and helps in identifying areas of agreement and disagreement as well as supports the formulation of objectives.

The guiding concept in writing the literature review has been a holistic handling of the subject. An effort has been made to include the most recent global thought and research on the subject. All aspects of the problem that have been established over the years as well as the ones that have most recently been propounded have been covered. The research work and reports studied have been classified under common areas pertaining to the problem under discussion. These are:

- Studies related to Sustainable Development
- Studies related to Consumer Behaviour and Environment
- Studies related to Corporate Strategies for integration of Environmental Concerns through the Value Chain
- Studies pertaining to Environment Management System (EMS) & Value Chain Analysis In Automobile Industry
2.2 STUDIES RELATED TO SUSTAINABLE DEVELOPMENT

The 190 odd countries of the world share an interdependent biotic system that cuts across national boundaries; although the effect of climate change is global, the causes thereof have been an open and many times an acrimonious debate. The increasing awareness regarding climate change has moulded the term sustainable development from a context-driven concept to a global imperative. The high level of global interdependence and consequent vulnerabilities have developed a set of representative values, needs and expectations around the term, yet there have been disagreements on selection of interventions and the ‘right’ path(s) to take.

The protection of environment was enshrined in the Article 51A of the Indian Constitution, “It shall be the duty of every citizen… (g) to protect the forests and improve the natural environment, forests, lakes, rivers and wild life and to have compassion for living creatures.” Thus the Constitution has directed all Indians to demonstrate environment consciousness which was in consonance with the rich Indian heritage of peaceful coexistence in natural surroundings.

The publication of Silent Spring in 1962 by Rachel Carson in the United States was a turning point in the understanding of the interconnections among the environment, the economy and social well-being. A decade later, Simon (1973) made an impassioned plea for technology as a solution for environmental concerns, placing the responsibility for its use or abuse squarely on the social institutions involved in its introduction and management. "Environmental problems will not be solved by slogans; they will not be solved by romantic visions of returning to a simpler pre-technological past. In the absence of viable technological alternatives, they will not be solved by legislation and regulation. They may be solved by a more vigorous pursuit of basic science, imaginative engineering and sophisticated management science." The exploitation of a particular new technology as a business decision has been driven by profitability concerns, giving rise to the term ‘techno-commercial’ decisions. Sometimes, introduction of new products was
a political decision to spend public funds to exploit a particular technological opportunity. Most often, it was found to be a whole host of decisions made through all of these institutional structures, e.g. most communities do not have access to a viable mass transit, a consequence of series of decisions by consumers, business concerns and investors, and governments. The application or non-application resulted from the same apparatus that has made the other decisions in our society. Thus, the considered opinion was to improve the decision-making institutions, and make a continually wiser use of the growing body of technological knowledge.

The suboptimal outcomes of unregulated private decisions regarding environment was discussed by Lerner (1977). A detailed study was presented supporting ‘extended protection’ of the environment as a whole (which belongs to the people as a whole), not only in the case of public goods or what economists have called externalities, but for any activity that affects none but the person or persons undertaking it.

Cairncross (1993) wrote about the tendency to blame business for environmental problems, overlooking the root causes which lie in the nature of the economic system and the policy decisions made by government. He said that the decisions about process, products and investments are commercial decisions guided by market forces. Thus, market signals need to be changed to encourage conservation instead of exploitation. Ultimately the responsibility for protecting the environment rests with society as a whole and this implies setting new ground rules (environmental legislation) and creating financial incentives (taxes and subsidies) to conserve rather than destroy the environment. And as market ‘values’ reflect society’s preferences, the general public will have to campaign, both in their role as consumers and citizens, for a ‘greener’ economy. A ‘stick and carrot’ approach consisting of stricter environmental legislation and financial incentives (e.g. tax concessions) could persuade more companies to go green.

However, Hawken (1993) categorically stated that companies are responsible for the environmental effects of their products; from raw materials through the ultimate disposal of the products. Subsequently, Gowdy (1996)
declared that humans are ethically obliged to preserve ecosystems and protect other life-forms. Thus, environment should be perceived as a stakeholder and its protection should be viewed as a core value for any business.

Anderson (1998) presented a discussion on the nature of environmentalism and the nature of enterprise arguing that both have commonalities as both are social processes based on the notion of value. In environmentalism the value of economic growth per se was open to debate; challenging ideas about what society should consider being valuable; about whether quality of life is more important than standard of living. Entrepreneurship was argued to be about the creation of value, first at a social level in terms of new products or services, and second, at an individual level in terms of the production of idiosyncratic values, such as self-satisfaction and gratification. He said that changes in social evaluations, brought about by ‘greening’, mean that new entrepreneurial opportunities have arisen to develop new businesses embedded in, and valorised by, the emergent social values. Considering that they are also energised and motivated at a personal level they are seen to be both viable and environmentally sustainable.

The integrated approach was further supported by Chen (2001) who said that the success of green product development and its actual benefit to the environment depended heavily on the joint effort by both the private and public sectors. The industry should recognize that the call for green products from the public was actually a marketing or economic opportunity rather than an annoying burden or an inevitable threat; the government should create a regulatory environment benign to green product innovation and strict enough to ensure the overall environmental quality.

The International Environmental Technology Centre Division of Technology, Industry and Economics, United Nations Environment Programme (Environmentally Sound Technologies for Sustainable Development, 2003) advocated that for the survival of society the highest priority must be given to maintaining the integrity of the ecosystem as a whole,
as ecology was at the centre of all interactive natural, social and technological forces. Further the report maintained that the very reason that human capacity understood the workings of the ecosystem conferred upon a responsibility to adopt a combination of new technologies and new lifestyle choices that could help reduce the environmental ‘footprint’ imposed on the world. The report stated that new and emerging technologies offered enormous opportunities for raising productivity and living standards and for improving health, while at the same time reducing consumption and conserving the earth’s natural resources. The report also stated that before accepting and implementing a particular technology, its scale, the complete technological system, the intensity and dynamics of its application and its interaction with society all had to be taken into account.

Though ecological concerns have long been on the periphery, in the past decade they have evolved into those that merit considerable attention and structured response. The need to respect and enhance communities including those that supply materials and consume the final product is well understood by businesses. Hart (2005) in his research quoted Dr H Fisk Johnson, CEO of S C Johnson & Son, who said, "Improving the lives of workers in one country, while degrading the environment in another, is an unacceptable demonstration of civic responsibility. Short term quarterly profits cannot trump long-term sustainability."

The Lowell Centre for Sustainable Development in its training material advocated a systems approach to explore comprehensive strategies to address the sustainability of products and services at all stages of their life cycle. The Centre stated that production consumed resources and energy: to produce something required that something must be consumed, thus each node in a product chain is both a production and a consumption node, rather than discrete stages in a product’s life cycle chain, with production (an industrial activity) preceding consumption (a domestic activity) (Lowell Centre for Sustainable Production, 2007).
The rights of every nation to take measures to safeguard its biodiversity were also considered and provisioned for by World Trade Organisation (WTO). Thus environment and international trade have shared a dual relationship consisting of both the impact of environmental policies on trade, as well as the impact of trade on the environment, recognized as early as 1970. The Appellate Body of WTO had made it clear that under the rules, countries have the right to take trade action to protect the environment (in particular, human, animal or plant life and health) and endangered species and exhaustible resources). Thus environmental policies have an increasing impact on trade, and with increasing trade flows, the effect of trade on the environment is also increasingly evident (WTO, 2007).

The study, Global Gaps in Clean Energy Research, Development, and Demonstration (International Energy Agency, 2009) reported that the trends in energy supply and use were unsustainable – economically, environmentally, and socially. It called for decisive action for energy revolution, wherein every major country and sector of the economy had to be involved. The report cautioned that it had to be ensured that investment decisions would not result in suboptimal technologies in the long run. The analysis revealed an annual spending gap in funding of Major Economies Forum (MEF) nations to the tune of USD 15.0–31.7 billion. However, the report stated that it had not accounted for the private sector, which was believed to be the largest source of funds for advanced vehicles RD&D. Further, it did not capture advanced vehicles research investment in China, which was considered to be expanding its capacities rapidly in that technology area. The IEA also reported that the decarbonisation of the transport sector required a significant move towards more efficient vehicles, advanced propulsion systems, improved vehicle energy storage, and low-carbon alternative fuel production and compatibility with vehicles.

The Trade and Environment Review – Promoting poles of clean growth to foster the transition to a more sustainable economy, (UNCTAD, 2009/2010) discussed the “green” economic stimulus packages referred to as “Green New Deal” (GND) or “Green Fiscal Stimulus” (GFS) approaches by many
governments. The report suggested that there was a paradigm shift that may be emerging leading to a conceptual transcendence of the long-accepted false dichotomy between economic health and environmental protection. The study also stated that though the national investments in climate mitigation offered global benefits but they may not pay off without sufficient international cooperation. However, the study assured that the transition to a low-carbon and more material/resource-efficient economy would increase annual GDP growth in many countries. The World Resources Institute (WRI), (2010) have found large variations in carbon emission between different industrial activities and between different technologies, necessitating a prudent choice in selecting the right pattern of industrialization that can actually pave the way for sustainable development.

The researchers, Waeraas & Ihlen (2009) carried out a qualitative analysis of documents that described the environmental focus and policies of GE, Toyota, and Starbucks. Their study revealed a constructed organizational ethos that was combined with strong environmental focus to appear trustworthy in environmental matters in the eyes of consumers and stakeholders. The companies as per the researchers practised a form of ‘green legitimation’, termed as ‘manipulative legitimation’. Drucker quoted by Insead Business School (2010) differentiated between two types of social responsibilities: those to do with social impacts or what business does to society and those to do with social problems or what business can do for society. Drucker considered that social impacts could be unintended, inescapable by-products of business; however once identified social impacts were best eliminated. He further stated that the principle of corporate responsibility was clear: identify and address, if not eliminate, undesirable social impacts of business activities and, if they cannot be turned into profitable business opportunities, seek a regulatory solution (industry self-regulation or government regulation) that creates an optimal trade-off for all involved.

It is evident from the review of research papers and specialists that environment concerns wield an ever increasing influence on the way business is being done. The relationship between the firm and the environment is
receiving increasing attention in both professional and academic literature with research work that is immense in its depth and breadth of coverage. The imperative for inclusive sustainable development could be achieved only through comprehensive and collective social efforts.

2.3 STUDIES RELATED TO CONSUMER BEHAVIOUR AND ENVIRONMENT

It is a well established fact that the right and prudent consumer choices give an impetus to manufacturers to focus on producing goods with an ecologically beneficial footprint. While the ‘R’s of Environment, i.e., ‘Reduce, Reuse, Recycle’ are a result of modern thought; ethical consumption of one sort or another have been around for centuries. Sustainable consumption and production have become important, as they concretise the overall principle of sustainable development. Of the two, dealing with consumption has been less emphasised in policy making so far. Sustainable consumption means not only consuming more environmentally friendly products, but also changing consumption patterns.

There is extensive discussion in literature on consumption as a means to help construct a person’s identity and lifestyle. The research has focused upon green consumption values, attitudes and behaviours, as well as ways to segment and target green consumers. Bennett & Mandell (1969) researched the information seeking behaviour of car users. They opined that the search for information before purchase was a function of consumers’ prior experiences with that make. Thus experience of buying and using a particular product brand reduces the need to seek information.

According to Mayer (1976), by consuming with an eye to environmental quality, conservation of scarce resources, and social justice, the middle-class liberal found a new outlet for his/her progressive and humanitarian proclivities. There are researchers who have studied the causal relationships between behaviours and attitudes. “An attitude may be viewed as an association between a given item and corresponding evaluation, with possible variations
in the strength of this relationship”, Fazio, Powell, & Herr (1983). Thus attitudes can be employed as predictor variables to better understand various dimensions of consumer behaviour.

The relationship between the degree of intergenerational altruism and the consumption of private goods was presented as a model by Jouvet, Michel, & Vidal (2000). The more a community cared about future generations' welfare, the less it may consume. This stemmed from the intergenerational trade-off between today's satisfaction derived from consumption, and the altruistic satisfaction derived from enhancing future generations' standard of living through a cleaner environment. However, the researchers added that private individuals are price takers and fail to take into account the consequences of capital accumulation on pollution. Thus, concluded that there was a case for public environmental policies in spite of altruism towards offspring.

The nature of environment and a consumer was deliberated extensively by Auld (2001). The researcher said that the original benefits of automobiles were thought to be convenience, freedom of mobility and comfort. "The first two things vanished entirely under the regime of compulsory commuting. What is left of comfort amounts to little more than air conditioned imprisonment (due to the road congestion, and heavy traffic). Moreover, the consequences of mass commuting by private automobiles have rendered the quality of outside air a health hazard." He opined that it is necessary to eliminate the dominance of the consumer/producer model from while developing policy dealing with the problems of human settlement and mobility. He added that there is a requirement of citizens-in-the-community, not consumers-in-the-market.

Laroche, Bergeron, & Barbaro-Forleo (2001) presented results of a research regarding a consumer's willingness to pay more for a 'green product'. They found that a consumer willing to pay more for green products did not perceive it inconvenient to behave in an ecologically favourable manner. The opposite was found for the unwilling respondents. Therefore they surmised
that it was of primary importance for marketers to advertise why it was convenient to purchase green products and to change consumer perceptions in a positive way. They concluded that the increase in media coverage of ecological deterioration, the recent influx of environmentally compatible products in the marketplace and the integration of ecological issues in both our educational and political systems point to the need for more research on the environmentally conscious consumer.

Carrigan et al (2004) carried out an interpretive study for ethical consumption within the older market. The results showed that there was no consensus among consumers on what constituted a responsible company, although there were number of clear issues that were required to be addressed by companies.

The environmentally-friendly behaviour as influenced by various attitudes and personality characteristics was examined by Cleveland, Kalamas, & Laroche (2005). The researchers found that it was important to consider the specificity of pro-environmental behaviours, when assessing the roles of pro-environmental attitudes/dispositions. They suggested that the research should be directed less at whether attitudes are predictive of behaviour, more on the question of when and how they are predictive of behaviour. Fraj & Martinez (2006) researched and identified values and lifestyles that best explained environmentally friendly behaviours.

Kronenberg (2007) discussed the Integrated Product Policy of the European Union in his paper and wrote that if consumption patterns were guided by reason, taking into consideration long-term interests of the economy, less material products would be consumed and to a larger extent function would become the subject of market transactions. This would have to be complemented by "reasonable" production strategies, such as organising proper end-of-life management of products and eco-design. Studies show that the socially conscious consumer satisfies his own innate desire for doing the 'right' thing.
The companies under pressure from environmental groups and consumer lobbies must now consider their role as members of the wider community and become good citizens. Increasingly studies are highlighting the importance accorded by consumers to various Corporations efforts at environmental and social responsibility. Bharat Petroleum and Maruti Udyog jointly topped the inaugural TNS Global Corporate Social Responsibility Study 2006 for India (Autonews, 2007). The study showed that consumers across the world are very likely to accept or reject a corporation based on its reputation for social and environmental responsibility.

The Division of Technology Industry and Environment under UNEP has listed some industry initiatives that included eco-labels and other types of environmental and social information, information dissemination on – use, care for, recycle or discard of products (UNEPDTIE, 2007).

Steve Miller (2008) wrote in MediaWeek that given the design and power requirement of consumers, it's hard to fault the automobile industry for hypocrisy when it's following the whims of hypocritical customers, many of whom seem pleasantly untroubled by the fact they want what's technologically impossible. A study conducted by Chitturi, Raghunathan, & Mahajan (2008) demonstrated a correspondence among hedonic benefits, delight, and loyalty, as also a correspondence among utilitarian benefits, satisfaction, and loyalty. They found evidence that though delight and satisfaction are positively correlated, they are significantly different in terms of their antecedent emotions – promotion and prevention emotions, respectively – and the consequences for customer loyalty, as measured by word of mouth and repurchase intentions. They showed that delighting customers improves word of mouth and repurchase intentions more than merely satisfying them. Thus, the automobile manufacturers have to bring together a bouquet of product elements in an environment friendly vehicle that will delight the consumers.

The IBM Study (2008) presented the current and future scenarios in the automobile industry and market, as depicted in Figure 2.1. The authors presented that a new definition of mobility was being scripted, represented with an innovative ownership profile – one in which the purchase or lease of a
vehicle provides access to a diverse “garage” of vehicles. The auto executives interviewed by the think-tank, saw a major change in vehicle buying criteria, a significant change with regard to fuel efficiency and eco-friendliness of vehicles. Further, they have stated that alternate modes of transport along with lifetime cost of ownership will result in only a moderate change. Surprisingly, they find that the values of the company and brand will have a limited change potential.

Figure 2.1: Expected Change in Vehicle Buying Criteria (2008-2020)

![Change in Vehicle Buying Criteria](image)

Source: Source: Automotive 2020 (2008), Clarity beyond the chaos, IBM Global Services (Fig 3, Page 7).

The University of Oxford and the Smith School of Enterprise and the Environment (Future of Mobility Roadmap - Ways to Reduce Emissions While Keeping Mobile, 2009) reported that behavioural change was imperative to encourage low carbon transport. The report suggested top-down or bottom-up polices: (1) Top-down methods included (i) command and control polices e.g. regulation and (ii) incentive based polices e.g. taxes and charges; and (2) Bottom up methods or complementary polices further categorised as (i) physical polices e.g. public transport, land use, walking and cycling, road construction and freight transport, (ii) soft polices e.g. policies informing consumers and producers about the consequences of their transport choices, and potentially persuading them to change their behaviour (through advertising, for instance) regarding car-sharing and car-pooling, tele-working...
and teleshopping, eco-driving, as well as general information and advertising campaigns and (iii) knowledge polices emphasising the important role of investment in research and development. The report further stated that top-down methods were not efficient from an economical perspective but were essential for drastic changes in activity; on the other hand bottom-up methods were economically efficient but did not always achieve their full potential for change. Finally the report suggested that a combination of all policy levers in an integrated framework was required to reduce CO₂ emissions.

J.D. Power Associates (2009) in their ‘2008 Power Auto Offline Media Report - Spring Edition’ shared their findings that although many new-vehicle buyers may wanted to purchase an environmentally friendly vehicle, just 11 percent were ‘very willing’ to pay more to do so. Further, they found that those who purchase hybrid vehicles tend to have much higher levels of education and report much higher household income; they are also about four years older than the average new vehicle buyer (54 years vs. 50 years), the study found. “Hybrid owners tend to be proud advocates of their vehicles, and they typically provide many more positive recommendations about their ownership experience than do other new vehicle buyers”, said JD Power. New-vehicle buyers who said that they were willing to pay more for a vehicle that is environmentally friendly were more likely to purchase compact vehicles than the average new vehicle buyer.

Separately, a psychographic profile of hybrid-car owners in the United States, developed by Mindset Media (2009), compiling responses from 44,931 principal drivers of new cars and trucks found that people who drive hybrid cars are 78 percent more likely than the general population to be highly creative and are inventive and imaginative and also tend to be emotionally sensitive and intellectually curious.

The World Trade Organisation and United Nations Environment Programme (WTO-UNEP Report, 2009) listed ‘labelling’ as one of the technical requirements to promote the use of climate-friendly goods and technologies. The report has acknowledged the role of ‘Labelling schemes’ for providing information to consumers, allowing them to make rational decisions
which take into account the environmental consequences of specific products, and thus to stimulate manufacturers to design products that achieve higher ratings than the minimum standard.

The consultants AT Kearney in their expert perspective on passenger cars viz. Auto 2020 (AT Kearney, 2009), conceded that customer behaviour had become a ‘mystery’: therefore the segments and diverse expectations made forecasts for the industry almost impossible. The report identified various customer segments and demands as: Emerging market buyers who generate ultra low-cost cars (ULCCs) segment; Senior citizens who play increasingly important role in mature markets; the ‘Me generation’ who ask for more tailored products even at higher price as also the emergence of ‘New mobility concepts’ – non-buyers, car sharing and new rental formats.

Gupta & Ogden (2009) studied the consumer attitude-behaviour gap to identify the reasons that despite concern towards the environment (attitude), consumers fail to purchase environmentally friendly or green products (behaviour). The researchers described the attitude-behaviour gap as a social dilemma and drew upon reference group theory to identify individual factors to help understand the gap and suggest ways in which to bridge it. The study revealed that several characteristics of the individual – trust, in-group identity, expectation of others’ cooperation and perceived efficacy – were significant in differentiating between ‘non-green’ and ‘green’ buyers.

Choy & Prizzia (2010) researched the relationship between consumer behaviour and environmental quality in Hawaii with the purpose to gauge the predisposition of residents to purchase a hybrid auto and their level of agreement to support legislation that improves and protects environmental quality. The researchers carried out an exploratory study using a non-random sample of 350 Hawaii residents identified as owners of non-hybrid cars; and it was found that regardless of age and gender, respondents agreed that they would purchase a hybrid car if the cost was the same as a traditional gas fueled car. The researchers also found significant correlations between agreement to purchase a hybrid car and agreement to support legislation that provides tax credits to consumers who purchased a hybrid car and other
environmentally safe products, tax credits to companies that produce environmentally safe products, and penalties for government agencies, private organizations, and individuals who polluted the environment.

Creusen (2010) studied the relative importance of product aspects for different consumer groups, and identified relationship between gender, age, education and income, and the importance of certain product aspects like aesthetic aspects, symbolic aspects, functionalities, ease of use and quality in buying a product. The researcher found that there were relationships of several demographic variables with more specific product aspects – namely aesthetic, symbolic, functionalities, ease of use and quality and opined that the knowledge of these relations would help companies to better adjust their products and marketing efforts to fit consumer preferences.

The review of various papers on consumer behaviour and environmental concerns highlighted the need for responsible choices that could be influenced through proper product information and awareness campaigns. Moreover, in certain cases the regulatory or top-down methods like taxes would show greater effectiveness in moulding consumer behaviour.

2.4 STUDIES RELATED TO CORPORATE STRATEGIES FOR INTEGRATION OF ENVIRONMENTAL CONCERNS THROUGH THE VALUE CHAIN

There are two mainstream schools on strategy – the positioning school and the resource based school. The most famous proponent of the positioning school, Michael Porter talks of ‘FIT’, a long term perspective in delineating the fundamental elements impacting sustainability of competitive advantage, the relationship between organisation & its competitive environment, allocation of resources among competing investment opportunities. The resource based school, especially the writings of Gary Hamel & CK Prahalad emphasize ‘STRETCH and LEVERAGE’; Leverage – how the organisation marshals its resources & Stretch – extending the capabilities of the organisation & its competitiveness.
There is consensus amongst researchers that irrespective of the strategy, environmental concerns need to be addressed by integrating responsiveness across the process as well as reflect in the product offered in the market. This has been variously viewed both as a challenge and as an opportunity; and how the companies' address environmental concerns has been considered material to the long term survival success of an organisation.

Johnson (1988) researched the role of organisational culture as a major deterrent or motivator for taking up a proactive role towards environmental stewardship (as opposed to a mere compliance mode). A number of elements were listed that impacted on organisational culture - the paradigm: the mission and values of the organisation; control systems: the management system which defines the procedures and protocols in place and the internal mechanisms for monitoring performance; organisational structures; reporting mechanisms and responsibilities; power structures: the decision-making process and identifying where the responsibilities for decision making exist in practice; symbols: organisational identity including logos, and symbols of power within the organisation; rituals and routines: meeting and reporting structure; and stories and myths: internal business actions and deeds.

Dechant & Altman (1994) addressed the question of how companies should manage environmental considerations. The authors reported that there was no single set of rules that these companies follow but that they frequently engaged in the five common practices - a mission statement and corporate values that promote environmental advocacy, a framework for managing environmental initiatives, Green process/product design, environmentally focused stakeholder partnership, internal and external education initiatives. They further reported that contemporary environmentalism had become an integral part of organisational strategy, affecting decisions on product development, future procurement, technology and total quality program.

Walley & Whitehead (1994) have argued that win-win solutions were rare in the area of environmental programs. Such investments mostly yielded a negative financial return to shareholders. Hence, they viewed the
minimization of shareholder value destruction as the main goal to be pursued in environmental strategies.

A number of forces, as per James & Bennett (1994), were driving organizations to measure their environmental performance. These included demonstrating progress towards targets, ensuring better data for decision making as well as supplying information to regulators and all major stakeholders. Their detailed model in the form of a continuous loop consisted of eight sequential steps for effective environmental performance appraisal:

1. define the environmental context and objectives;
2. identify potential measures;
3. select appropriate measures;
4. set targets;
5. implement measures;
6. monitor and communicate results;
7. act on results;
8. review.

The evolution of corporate environmental strategies has been discussed by Shrivastava & Hart (1995). They stated that in the 1970s, environmental management was regarded by companies with little enthusiasm; however, the 1990s saw a shift with companies regarding environmental management as a strategic tool for gaining competitive advantage. They shared that there were diverse options available to mitigate the environmental impact of companies' activities; and it was for a company to decide on the options to exercise, the mode and extent of integrating environmental concerns into strategy. Further, they stated that in the context of environmental regulations, the firm's key competencies and capabilities (which are viewed traditionally as the sources of industrial performance) may actually hinder the leveraging of environmental competencies. They found that resources were committed to environmental performance only if it was expected that they will also improve industrial performance (in this case profits). The firms most likely to commit resources beyond compliance were those with more contact with final consumers (as measured by advertising
expenditures) and greater R&D expenditures. The former case reflected a stronger expected public recognition of environmental efforts, and thus a higher probability of final customer value. The latter case implied a higher expected probability of successful innovation when increasing R&D expenditures to benefit industrial performance.

Finally, the researchers identified the sources which contributed to environmental performance and could have simultaneously improved industrial performance. They included quality management systems for pollution prevention which lead to overall cost reduction and savings in resources due to technological improvements. For product differentiation and increasing customer value, they listed life cycle analysis carried out at the product design stage and supplier selection systems to pre-empt competition.

Levy (1995) also reviewed the empirical evidence on the impact of environmental performance on industrial performance and found mixed results. Pollution-reducing investments were neither consistently profitable nor unprofitable, suggesting that it depends on a number of contingent factors at the firm level. He finds that a higher degree of multi-nationality is associated with superior environmental performance, probably because external pressures from international environmental regulations increase more rapidly than the firm's bargaining power.

Similarly, Mosley (1996) suggested ways of overcoming practical barriers to implementing performance measures in an organisation. The researcher proposed that the idea of a performance cycle could be perceived as a dialogue and a focal point across the organizational divide, between the specialist measurers and the functional managers. It was the latter who would have the ultimate responsibility for formulation, implementation and improvement once the measures were ascertained.

The researchers Westley & Vredenburg (1996) spotlighted organizational activities which supported the concepts of ecosystems as cycles, the inherent balance of ecosystems, the interconnectedness of parts of ecosystems and the mutually adaptive nature of ecosystems.
Roarty (1997) studied the greening of business in a market economy found that earlier there was a tendency for business to ignore environmental costs in order to reduce production costs and stay competitive. However, the growing trend towards "green" consumerism reflected the increasing number of consumers who preferred to buy products that satisfied high standards of environmental protection. Consequently, it was becoming profitable to sell "green" products in both the domestic and international markets. The "pull" of the market was reinforced by the "push" resulting from environmental legislation which set higher standards of environmental quality.

McIntyre, Henham, & Pretlove (1998) detailed how the environmental bias was developed and how it could be used to provide both a measure of environmental performance for the whole supply chain, each functional element within the chain and for different product delivery scenarios. Rugman & Verbeke (1998) examined the prevailing managerial thought on the impact of environmental regulations on the firm, further assessed the development of firm-level green capabilities, and finally analyzed the impact of environmental regulations on their strategies. They expounded that appropriate market-based incentives would allow a firm to reach a stage wherein environmental excellence could be integrated into business strategy. They opined that - the impact of environmental regulations is such that long-run survival requires a major managerial shift in understanding the forces driving industry competition and a change in most companies' strategies, secondly, the complementary nature of industrial and environmental performance does not naturally exist but can be crafted by introducing new performance measures, and finally, the inclusion of an environmental agenda into strategic planning should be congruent with the development of new relationships with a variety of stakeholders, including employees, environmental groups, customers, etc.

Beamon (1999) investigated the environmental factors leading to the development of an extended environmental supply chain. Further, the researcher described the additional challenges presented by the extension of the supply chain, and suggested appropriate performance measures and a general procedure towards achieving and maintaining the extended green
supply chain. Hoek (1999) looked at challenges for research on green steps to be taken and green practices in supply chains for lowering the ecological footprint of supply chains.

Miles and Covin (2000) in their study emphasised environmental performance and consequent marketing as a source of reputational, competitive, and financial advantage resulting from "innovations", or adopting a "strategic model" for environmental management. They defined two mutually-exclusive philosophies towards environmental management: the "compliance model" of environmental management; and the "strategic model" of environmental management. The compliance model suggested that corporations simply complied with all applicable regulations and laws. This was referred to as a typical traditional "defensive" environmental management approach. The strategic approach to environmental performance suggested that firms attempted to maximise stockholder returns by utilising an environmental strategy "proactively" to create a sustainable competitive advantage. They argued that firms primarily marketing commodity products and competing primarily on the basis of price would tend to adopt the compliance model of environmental management, whereas firms that primarily market highly differentiated products would tend to adopt the strategic model of environmental management.

The means to achieve operational and environmental improvement have also been subject of research. Hanna, Newman, & Johnson (2000) identified the growing importance of employees in translating environmental goals into operational performance and the need for adequate training. Their study linked employee involvement, to better organisational environmental improvement.

Sroufe, Curkovic, Montabon, & Melnyk (2000) examined the role played by environmental issues during the new product design process and categorized the firms studied into one of five major groups: innovators, early adopters, early majority, late majority and laggards. They found that the factors that accounted for acceptance of environmentally responsible
manufacturing in the innovators and early adopters were significantly different from those factors observed in the early majority, late majority, and laggards.

Theyel (2000) maintained that continued improvement in environmental performance was more likely when environmental management practices such as TQM for implementing pollution prevention, environmental training for employees, environmental requirements imposed on suppliers, and employee incentive programs for environmental improvement were adopted because, by their nature, these practices become imbedded in the firms' production systems.

The Lowell Center for Sustainable Production (2001) has developed a five-level indicator hierarchy on the basic principles of sustainability from Level 1 that pertain to ‘Compliance Indicators’ to Level 5 that refer to ‘Sustainable System Indicators’. The first two levels are internally focused while the third level looks just over the fence of the facility. The hierarchy (Figure 2.2) is descriptive of the evolution of corporate consciousness relative to broader societal issues. At the first level, companies were concerned about meeting a minimum standard or requirement to comply with regulations and standard procedures (e.g. ISO 14000). At the second level, companies’ were concerned about how efficiently or effectively their processes and people were operating. At the third level, companies were concerned about the effects of their processes and operations on the local surroundings. The standards and methods for defining and measuring Level 3 indicators – environmental impacts (ozone-depleting potential, global warming potential, acidification potential) – have only recently been developed or are still under development (Veleva & Ellenbecker, 2001). At the fourth level, companies see how they fit into a larger economic, social, and environmental system – what are the upstream and downstream effects of their operations. It was found that lack of data was a major barrier to calculating Level 4 indicators (supply-chain and product life-cycle). The companies were not tracking pounds of packaging, miles travelled for delivery of raw materials and products, employee commuting, etc. In many cases there are no data on conversion
factors, limits and thresholds (e.g. embodied energy in key raw materials and packaging).

Finally, at the fifth level (the fully developed social consciousness level) companies acknowledged that they were partners in the larger system and that they need to work with other entities in the system to determine how best to fit within the carrying capacity of supporting eco-systems. The sustainable systems/carrying capacity indicators required collaboration with entities outside a corporation. Although there were some efforts to determine system capacities (e.g. Kyoto Protocol work on CO2 emissions), there were still many unanswered questions.

**Figure 2.2: The Lowell Center for Sustainable Production Indicator Framework**

![Image of the Lowell Center for Sustainable Production Indicator Framework](http://www.sustainableproduction.org/proj.sind.thel.shtml, 31 Jan 2007)

The Centre for Science and Environment (CSE, 2001), carried out an environmental study of the Indian Automobile Industry, rating it at 31.4 percent giving it two green leaves. The study had identified the overall top three companies in the industry as Daewoo Motors India Ltd., followed by Hyundai Motors India Ltd and General Motors India. The various aspects assessed were, Corporate Environmental Policy & Environment Management System, Corporate Leadership & Proactive Environmental Initiatives, Corporate Governance & Proactive Initiatives, Procurement Policy & Supply Chain Management, Process & Consumption Efficiency, Pollution, Pollution Control & Prevention, and Environmental Performance during Production.
Phase, Environmental Performance during Product Use Phase, and Environmental Performance during Product Disposal Phase. The companies that received the top overall ranking did not top all the heads that were researched by CSE.

Lin, Jones, & Hsieh (2001) described the process of environmentally conscious business practice as a multi-dimensional issue, with an analytical dimension of strategy and decision procedure, a behavioural dimension addressing corporate culture, perceptions and motivation, and an organizational dimension concerned with regulatory environment and supply chain management.

In a research carried out by Hui et al (2001) it was identified that different trades have different anticipations and approaches in the implementation of Green Manufacturing (GM) or EMS programs. The role of manufacturing companies was to convert materials into finished products, so to satisfy the environmental issue; they emphasized waste and energy reduction. They considered that, to be successful in business, a company must be able to reduce the process cost, to use resources effectively and to provide satisfaction to customers.

Pun, Hui, Henry, Law, & Lewis (2002) developed an EMS planning framework for environment management practices. They stated that the policy and evaluation concerns, environmental goals and targets have to be aligned with corporate objectives and be systematically deployed and transformed into operative plans.

The LCSP framework formed the basis for a study by, Veleva, Hart, Greiner, & Crumbley (2003) who analyzed the environmental sustainability indicators voluntarily-reported by six pharmaceutical companies, half of which are Global Reporting Initiative pilots. The research results demonstrated that most indicators publicly reported addressed only performance or eco-efficiency (Level 2), a few indicators looked at environmental effects (Level 3), only the Global Reporting Initiative pilots were finihgvto address and...
report on supply-chain and product life-cycle effects (Level 4), and no companies were addressing carrying capacity issues (Level 5).

In a study conducted in Europe, Karna, Hansen, & Justlin (2003) found that “Proactive green marketers” (companies emphasising pursuing sustainability and believing in free market system) emphasise environmental issues in their marketing planning clearly more than traditional “consumption marketers”, and more than “reactive green marketers” (companies emphasising pursuing sustainability under governmental balancing). Further they opined that proactive marketers are the most genuine group in implementing environmental marketing voluntarily and seeking competitive advantage through environmental friendliness.

Bansal (2003) assessed the scope, scale, and speed of organizational response and differentiated between the companies studied on the basis of their response to environmental issues Using an ethnographic, longitudinal research design, the researcher tracked the development of environmental issues within two major organizations in the United Kingdom. It was found that the congruence of organizational values and individual concerns were positively related to the speed of response to organizational change. Individual discretion was found to moderate the relationship, so that the speed was faster with greater individual discretion. Another moderator identified was excess resource slack, so that the speed was faster with greater excess resource slack. Individual concern and organizational values were found to be essential conditions; either one had to be present for an organization to respond. Thus, organizations with closely aligned organizational and individual agendas were more likely to respond to issues than are organizations with very disparate agendas. The researcher presented that the concern for issues could be activated through education and training e.g. informing people of the link between poverty and environmentally unsustainable practices was found to ignite their concern for environmental issues. Another finding was regarding hiring of people who were passionately concerned about an issue, such as "environmentalists," who were also competent issue sellers facilitating organizational responsiveness. “As
individuals embrace organizational values and organizations reflect individual concerns, a responsive and adaptive organizational environment will thrive.”

The South East Asian experience in greening of production and its relevance was studied by Rao (2004), who investigated the various initiatives taken by the companies of this region and thereby identified the factors that were critical to the process of greening production. The significance of the factors were ascertained and validated through an empirical research conducted across five countries of the region employing the structural equation-modelling framework.

Watson & Anthony (2004) researched the development of EMS in Europe and the USA, particularly the development of, and differences between, ISO14001 and EMAS; and propounded that both schemes were threatened by inadequate policing by controlling bodies. They expressed concern that the processes were adopted more for business marketing purposes rather than depicting a serious concern for environmental effect abatement.

Zutshi & Sohal (2004), summarised benefits of an EMS as: Cost reductions and savings resulting from waste minimisation, recycling, and savings from reduction in usage of electricity, water, gas and raw materials; improvement in operational processes resulting in both savings made from usage of raw materials and increased safety. These also resulted in multiple benefits, like increased motivation amongst the employees; improved communication across the organisation due to the usage of the same EMS related terminology; improved corporate image resulting from ‘environmental-friendly organisation’ image, leading to improved and better relations with customers, community and other stakeholders. They also listed some external benefits of implementing EMS that included increased insurance from the financial institutions, improved long-term relationship with the suppliers/contractors and sub-contractors and reduction in fines due to compliance with legislation, regulations and guidelines.
Simpson & Power (2005) investigated the relationship between a supplier and firm's level of environmental management activity and the structure of the customer-supplier manufacturing relationship. They revealed that efforts to improve or influence a supplier's environmental management practice raised critical issues of transaction costs and efficacy of approach for the buyer.

Hervani, Helms, & Sarkis (2005) sought to integrate works in supply chain management, environmental management, and performance management into one framework. A systems framework forms the discussion outline with a focus on controls/pressures, inputs, tools, and outputs as major categories for evaluation and review. They provide some of the very first insights into development of a green supply chain management performance measurement system. Typically performance measurement systems are internally and business focused, they expand on these issues by considering inter-organizational and environmental issues within a business context.

The environmental perspective in the strategic management field as voiced by Michael Porter was that an appropriately designed environmental policy may lead to first mover advantages at the firm level. Early adoption of strict environmental standards may lead to 'innovation offsets' that lower costs or improve quality and ultimately lead to net benefits for the firm. However, researchers have also found that the reaction of companies to environmental issues was ill-planned, and hastily introduced. In their paper, Peattie & Crane (2005) explored 'green marketing' with reference to it being a legend, a myth, a farce or a prophecy. They stated that much of what had been commonly referred to as “green marketing” was underpinned by neither a marketing, nor an environmental philosophy.

The corporate motivations for environmental transformation were studied by Gonzalez-Benito (2005), who suggested that the ‘green strategies’ of companies were influenced by commercial considerations, and lead to the prioritization of more superficial and externally perceivable transformations. The competitive business strategy for global efficiency improvement through matching of both quality and environmental performance was examined by
Giancarlo (2005). The research focused on various manufacturing activities, and it was found that the enterprises were used to managing quality together with productivity, thus incorporating environmental aspects that helped the aforementioned goals.

Pflieger, Fischer, Kupfer & Eyerer (2005) concluded that the corporate performance on environment was best where there was a clear internal and external communication to the employees comprising of the strategic and operational goals, the corporate performance data on inventory level, the translation of the inventory data to sustainability core indicators as well as the performance evaluation in terms of sustainability.

Bateman (2005) identified ten “enablers” for sustaining process improvement (PI) activities derived from analysing 40 activities. The enablers are designed to assist people who conduct PI activities, cell leaders whose areas are involved in PI activities and change agents and change champions who are co-ordinating PI programmes. The practical nature of the enablers means that they are based on processes that cell leaders, change agents and change champions can affect.

Porter (2006) in his article ‘Making a Real Difference’ published in Harvard Business Review built on his two models of value chain and diamond framework and addressed a range of CSR activities including environment. He referred to these as: ‘Looking Inside Out: Mapping the Environmental Impact of the Value Chain’; ‘Looking Outside In: Social Influences on Competitiveness’. As the value chain depicted all the activities a company engaged in while doing business, Porter said that the framework can help identify the positive and negative impacts of those activities.

Fassoula (2006) wrote on transforming the supply chain, and presented a modular structured management tool for planning, implementing and measuring the effectiveness of supply chain transformation process (SCTP), in relation to overall organizational performance and business strategy. Vachon & Klassen (2006) found that technological integration with primary suppliers and major customers was positively linked to environmental
monitoring and collaboration. Stonebraker & Jianwen (2006) argued that for efficiency and success, a strategic fit must exist between environmental, strategic and operations variables and this fit would ease out any bullwhip inefficiencies.

The researchers, Gernuks et al (2007) considered the systematic determination of environmental targets as a primary area progress with regard to efficient environmental improvement. The determination of environmental targets as a procedure included not only the decision-makers, but also the environmental department, technical experts, and representatives of all relevant departments of the production site.

Pun (2006) identified 15 environmentally responsible operations (ERO) factors and grouped them under three heads, namely policy, product/process, and performance evaluation. The researcher further discussed the relevance of these factors to six typical ERO tools/methods. It was stated that the policy and evaluation concerns, environmental goals and targets must align with corporate objectives and be systematically deployed and transformed into operative plans.

This comprehensive approach for addressing environment concerns was revalidated by a study conducted in Malaysia by Sambasivan & Fei (2008). They found that processes, structure, and attitude of the organization towards the environment have to be geared to reap maximum benefits from the implementation. Proper equipment to monitor the systems and technical expertise must be available within an organization to ensure continuous improvement in the management of environment. It was found that the pressure from customers, stakeholders, and government regulatory bodies quickened the pace of implementation. The benefits reaped from the implementation were many, including: improvement in the company’s image and reputation, improvement in efficiency of processes and profits, improvement in customer loyalty and trust, and improvement in staff morale and employer-employee relations.
Jorgensen (2008) researched the life cycle management and its integration to achieve more sustainable management systems. The researcher said that a prerequisite for integration was an understanding of generic processes and tasks in the management cycle - the plan-do-check-act. Further, he listed the potential benefits of such integration as more focus on interrelations and synergies, as well as better understanding of tradeoffs between quality, environment, occupational health and safety, and social accountability; with an accent on setting up objectives and targets that are well coordinated and balanced, with a proper definition of organisation and responsibilities. The advice proffered to realise this ambition - focus of the management system has to be on the synergy between customer-based quality, product-oriented environmental management as well as corporate social responsibility.

Hacking & Guthrie (2008) asserted that by bringing in an environmental assessment of processes within an organisation by itself influenced decision-making, even though it may not be always readily apparent at the time. Consequently, the companies by introducing and applying the best assessment, measurement and monitoring systems like EMS, used it as a stepping stone to improved processes benefiting the environment. A number of forces like demonstrating progress towards targets, ensuring better data for decision making as well as supplying information to regulators and all major stakeholders were driving organizations to measure their environmental performance. Moreover, by measuring the right indicators, an organisation could identify where to improve and how the limited resources could be used more effectively and bring positive synergies to bear upon environmental performance goals and improvement targets. The researchers pointed out complexities in performance measurement across supply chains with multiple vendors, manufacturers, distributors and retailers, whether regionally or globally dispersed. There were difficulties in measuring performance within organizations and even more difficulties arose in inter-organizational environmental performance measurement.
The Global Reporting Initiative (GRI) Reporting Framework recognized as the de facto global standard in sustainability reporting enumerates thirty indicators for measuring environmental performance – to be included by companies as part of its sustainability report. Nearly 1000 organizations from over 60 countries, from business, civil society, labour, accounting, investors, academics, governments, and others, disclose their sustainability performance with reference to the GRI Guidelines.

Polonsky & Jevons (2009) researched what it meant to be socially responsible and how companies leveraged their actions to meet these challenges. The paper proposed consideration of three distinct areas: the range of social responsibility issues, what the organisations actually did and the way these actions were leveraged. The authors reviewed and synthesised the academic, practitioner and industry literature and addressed the three areas of complexity – issue, organisational and communication. They found that there was a corporate requirement for improved comprehension, integration and assessment of many sub-issues associated with social issue complexity (identification, heterogeneity, measurement, and interpretation); organizational complexity (overall corporate brand, multiple products and brands, functional activities, and supply chain); and communication complexity (intensity of action/positioning, communicating action, types of programs utilised, and integration issues.)

Shukla, Deshmukh, & Kanda (2009) researched the various challenges and barriers to the adoption of green supply chain management (GSCM) practices; statistical analysis of various drivers, practices and performance of environmentally and socially conscious supply chain in the case of an automobile cluster in central India. The researchers found that environmentally and socially responsive supply chains were in the early adoption stages in India. They found that though the awareness and inclination to adopt green measures in supply chain had been on the rise the actual implementation lacked a holistic approach.

The researchers Voola & O'Cass (2010) investigated the relationships among competitive strategies (i.e. differentiation and cost-leadership),

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responsive market orientation (RMO), proactive market orientation (PMO) and firm performance. They found that differentiation strategy had a stronger influence on RMO and PMO than cost-leadership strategy, and that PMO had a stronger influence on performance than RMO; thus supporting the hypothesis that strategy implementation was a valid route to firm performance.

The corporate strategies regarding environmental issues were found to be a widely researched area with a consensus for a complete vision to value chain and closed loop inclusion of environment responsiveness. The researchers have written regarding the seriousness of incorporating environment concerns in product and process planning. The various research works cited above evidenced that for successfully dealing with environmental concerns the companies need to weave the impact mitigation initiatives into the overall strategy, from vision, to involving employees and in allocating resources. The studies related to environment indicators used by companies’ showed that it was easier for them to quantify and address the facility level indicators that resulted in efficient resource use helping in improving their balance sheets. The review signified that companies have a long way to go in reaching the fully developed social consciousness level, wherein the companies would acknowledge their role as partners in the larger system. It was also found that the adoption of EMS did help the companies to identify measures for environment impact abatement and helped in streamlining the value chain activities.

2.5 STUDIES PERTAINING TO ENVIRONMENT MANAGEMENT SYSTEM (EMS) & VALUE CHAIN ANALYSIS IN AUTOMOBILE INDUSTRY

Mobility is considered a strategic issue in both developed and emerging economies, and globally the automotive industry is transforming itself. The period of uncertainty and discontinuity was responsible for the emergence of entirely new ways of doing business.
Muffatto (1999) in evolution of production paradigms adopted an evolutionary perspective to analyse the similarities and the possibility of converging various types of production systems and in particular the lean production models specifically in the case of Toyota and Volvo. He mentioned that the elements that appeared to be particularly important in the search for new solutions were namely, assembly design, work organization and the automation of assembly. Further the researcher identified two aspects of assembly design which required consideration viz. the structure or configuration of assembly and the organization of production flows. The evolution of the Toyota production system was studied from the point of view of assembly design, work organization and automation. Then the evolution of the Swedish model of production, and its influence on the lean model was considered. Subsequently, the question of similarities and differences between the systems was studied in light of unique aspects of the social and cultural contexts where the production systems have been developed. The researcher concluded that there was a greater uniformity and stability in production methods, thus proposing research of innovations in other stages of the value chain, such as design, supplier relationship and distribution.

Thorpe (1999) wrote about the major challenge faced by the car industry in implementing an effective reverse (also called closed loop) supply chain design while manufacturing environmental friendly cars from limited available resources. The term increasingly used is Extended Producer Responsibility (EPR) for holding manufacturing companies accountable for the products throughout the life cycle. The closed loop logistics model for remanufacturing was discussed by Jayaraman, Guide, & Srivastava (1999) in a recoverable product environment. They stated that a closed-loop system could be created by incorporating traditional logistics forward flows with logistics channels reversed. In a closed-loop system new material was needed to replace only materials which were not recovered by the system and the end-users were the source of input materials as well as customers of the system. A major part of the recoverable product environment was the recoverable manufacturing system that focused on systems designed to extend product life cycles via remanufacturing and repair.
The used vehicle business was studied by Urban, Hoffer, & Pratt (2000), who stated that in the early 1990s, several new entrants extended “category-killer, big-box” retailing concepts to the marketing of used vehicles. However, despite promise, each entrant either exited the market or changed its business plan. Based on both primary and secondary data, the authors found that, although the superstore maintains some advantages over traditional used-vehicle retailers, it had cost disadvantages over the traditional retailer. These findings on both the demand and the supply side of the business explained the observed market failures.

The sourcing trends in the car industry including strategies and relationships were studied by Corswant & Fredricksson (2002) who surveyed car manufacturers and first tier suppliers. They presented that intense competition and structural changes characterized the car industry and identified several trends including reduced product development time and increased supplier involvement in product development and the share of inbound JIT-deliveries. They found that reducing the reliance on natural resources was the driver that led to greater collaboration between competing industries.

The study by Benko & McFarlan (2003) on the metamorphosis in the auto industry, found three outstanding trends representing a convergence of progressive thinking from the major players. The manufacturer’s changing relationship with its customers had resulted in shrinking the “order to delivery” cycle. Another dimension was the fact that cars were evolving into electric appliances. It was researched that the electronic content of a car would increase from 22 percent to 40 percent by 2013. Finally, they found that the new partnerships with suppliers were leading to radically new infrastructure to support design, procurement and logistical processes. Thus, by connecting with suppliers and sharing demand data, quality and responsiveness were improving and costs were reduced.

The Changing Drivers report (2003) prepared by World Resources Institute (WRI) and Sustainable Assets Management, explored how carbon constraints in global automotive markets would affect value creation in 10
leading automotive companies between 2003 and 2015. This was considered a long enough timeframe in which major technological and policy changes were possible. The Original Equipment Manufacturers (OEMs) assessed were BMW, DaimlerChrysler (DC), Ford, GM, Honda, Nissan, PSA, Renault, Toyota and VW – the world’s largest independent automotive companies. The report was explicitly forward-looking, focused on the main factors affecting OEMs’ exposure to carbon constraints. The authors discussed the contributions of lower carbon technologies that were primed to address the increasing emissions from vehicular traffic. The enduring competitive advantage (Figure 2.3) for leading OEMs was evaluated to arise from three reasons: (1) Brand differentiation - leadership in a key lower-carbon technology could enhance brand equity, thereby lifting pricing power and margins; (2) De facto standards - first movers in lower-carbon technologies could define industry standards and be in a strong position to capitalize on this advantage through technology licensing, early profits and a proprietary learning curve, and (3) Disruptive potential - some lower-carbon technologies held the potential to alter fundamentally the competitive balance in the automotive industry.

Figure 2.3: Contributions of Lower Carbon technologies: CO₂ Reductions & Competitive Advantage through 2015

Source: Changing Drivers: The Impact of Climate Change on Competitiveness and Value Creation in the Automotive Industry, WRI & SAM, 2003 (Fig 2.1 pg 15 & Table 2.1 pg 17)

The report categorically stated that all else being equal, OEMs that earned a relatively large proportion of their profits from carbon-intensive
segments would find carbon constraints most challenging. However, differing consumer preferences and regulatory attitudes to carbon constraints across major markets created differing scenarios that were to be accounted for separately. The study found that PSA, Renault and VW stood out as deriving over 90 percent of profits from vehicles of low or medium carbon intensity, while GM and Ford earned over 70 percent of total profits from vehicles that emitted more than 270g CO$_2$/km (less than 20.5 mpg). Further they found that emissions rates for midsized cars vary by 50 percent across OEMs and by 40 percent for SUVs. They report further categorised the various influences across the company affecting both the tangible and intangible value drives in an automobile company (Figure 2.4). The impact of carbon constraints was considered as a major influencing factor on the cost structure, the new models and product segmentation under the ‘tangible value drivers’ and on brand and innovation under the ‘intangible value drivers’.

**Figure 2.4: The Influence of Carbon Constraints on Value Drivers in a Typical Automotive Sector Valuation Model**

![Figure 2.4](image.png)

Source: Changing Drivers: The Impact of Climate Change on Competitiveness and Value Creation in the Automotive Industry, WRI &SAM, 2003 (Figure 2.2 pg 16)

The report concluded that though the key source for reduction of CO$_2$ in the next few years was incremental improvement in the current engines, the competitive advantage of automobile companies was dependent upon their ability to invest and fructify alternate technologies like Fuel Cells. It was also
establishes that during the transition, diesel based investments, and hybrid electric cars would also add value to the companies' bottom-line.

The Global Reporting Initiative (GRI) in its Automotive Sector Supplement (2004) reported the significant and/or unique attributes of the automobile industry: its global role as an economic barometer in most national economies, the auto sector’s complex and multi-tiered value chain, and finally that unlike most industries where the most significant sustainability impacts are usually associated with the manufacturing of the product, in the auto sector, product use has major significant impacts.

Saad & Patel (2006) in their research paper on supply chain performance measurement in the Indian automotive sector identified and discussed the main motives and determinants for the adoption and implementation of supply chain management concepts. They found that there was an increasing awareness about the need to collaborate with world-class players and enhance performance through the use of new management concepts. Further, their research established that the Indian companies were increasingly improving the coordination and integration with their suppliers both within and outside the national boundaries. However, the innovations most influenced were the most tangible factors which were easy to measure such as cost and productivity. Similarly, there was reluctance to adopt flatter and less hierarchical organizational structures, and learning was essentially aimed at the technical capabilities, which was perceived as tangible and easily measurable. Thus they concluded that the awareness about the need to measure and continuously improve performance was essentially carried out through traditional models of performance measurement based on tangible factors.

The Wharton faculty and analysts (2007) in an article on environmentalism wrote that an environmental strategy to be successful had to be deeply integrated into a corporation’s underlying culture and values. They quoted a case from the automobile industry that of Ford, where the company launched a visible campaign to introduce environmentalism which included installing an environmentally friendly grass roof on a showplace plant.
However, the benefits of such initiatives were quite limited as the company's product line-up continued to rely on heavy trucks and sport utility vehicles that fell out of favour among consumers when oil prices -- and concern about a sustainable energy policy -- began to rise. At the same time, Toyota and Honda stood ready to profit from years of investment in vehicles with high fuel economy. Kumar & Yamaoka (2007) studied the Japanese ELV regulation and its impact on the automobile industry, and stated that without additional tax on used car export, manufacturers in Japan tended to export used cars. They mentioned that to make a passenger car, about 3,000 modular parts were needed of which in Japan, 81-83 percent (by car weight of cars) were recycled. The car recycling process in Japan comprised of four-steps: the oil, engine, tires, and seats were removed and recycled, the remaining auto body was compressed and shipped to appropriate facilities, in the facilities, the compressed body was shredded and divided into steel, non-steel and other material, called automobile shredder residue (ASR) and dumped into the sea to create artificial islands. They concluded that issues pertaining to recycling, reuse, or remanufacture should be factored in the product design phase to reduce the cost of products and raw materials.

Gonzalez, Sarkis, & Adenso-Diaz (2008) studied the relationship between the possession of certified EMS (ISO 14001) and eco-management and audit scheme, and the environmental demands imposed by the organizations on their suppliers in the automobile sector in Spain. The researchers opined that environmental concern spread upstream in the supply chain, and the environmental demands on suppliers increased with customer organization size. However, they found that the degree of internationalization, measured by the rates of imports and exports, did not show a significant relationship to these pressures.

The Institute of Public Policy Research, UK (Bird, 2008) in a study on using mandatory targets to improve vehicle efficiency for reducing CO\textsubscript{2} emissions, reported that there were a number of technologies at differing stages of development that could help to bring improvements in vehicle efficiency, and hence cut emissions. In the short term, a reduction in carbon
emissions was likely to come mostly from incremental improvements to existing technologies, such as improved engine efficiency, regenerative braking (whereby energy is captured that would otherwise be lost as heat) and improved aerodynamics. In the medium term, hybrid technologies could play a greater role in reducing emissions e.g. the Toyota Prius and Honda Civic – and a greater uptake by consumers in the future would decrease total emissions. Finally, for the long term, radical new technologies, such as full electric vehicles and hydrogen powered vehicles, were the solution to reduce tailpipe emissions of CO₂ to zero.

The IBM Global Services (2008) comprehensive study on the shifting industry landscape articulated certain priorities that will define success by 2020. The team identified differentiation as the major strategy, successfully manifested through five key dimensions brought together by an emergence of a sophisticated consumer, intelligent vehicle, dynamic operations, integrated enterprise and an interdependent ecosystem (Figure 2.5). The leverage areas for the industry were in partnering extensively to execute globally towards simplifying the complexities of the intelligent vehicle of the future. Moreover, the companies had to advance mobility solutions to encompass all consumer needs and transform their retailing. As per IBM it was time for the global enterprises to build on strategies that:

- Respond to the redefined reality of personal mobility;
- Connect with the sophisticated consumer of the next decade;
- Harness the strength in standardization and commonality;
- Build new cohesive enterprise ecosystems; and
- Architect an optimal global presence and a unique socially responsible culture.

A comprehensive approach that cohesively brought together these elements would differentiate the outperformers from the rest of the automotive world of 2020. The study also found an increase in collaborations both intra and inter- industry, prompted by green concerns and the pressure on development of alternative power sources for vehicles, such as batteries. There were cases of collaboration amongst competing
segments – consumer electronics for battery innovation, utilities for power and the energy industry for alternatives to fossil fuels – because the answer was unclear as to the power of choice for the future.

Figure 2.5: Five Imperatives for the Automobile Industry

The consultants, Ernst & Young (2009) researched and published an exclusive Asia special regarding the automotive industry in the era of climate change and sustainability. The report delineated a comprehensive approach for meeting the environment change challenges, covering all life cycle activities starting from the drawing board – R&D, through recycling and disposal. Therefore, the literature review regarding the automobile industry highlighted its unique characteristics and the multiple challenges being faced. The industry by itself was considered an economic barometer for measuring countries performance on development indices. However, it was well established that vehicles polluted through their life cycle and the industry, always a complex network of stakeholders, was facing its toughest challenge yet – that of restructuring its production and re-engineering its product - in an uncertain business environment.

Alaez-Aller & Longas-Garcia (2010) examined changes over time in outsourcing decisions in the automotive industry by incorporating the viewpoint of individual plants. The researchers studied the evolution from sole
sourcing to split sourcing and stressed the need to analyse procurement strategies in evolutionary terms, with experience leading to reconfiguration of sourcing decisions.

2.6 IMPLICATIONS OF THE REVIEW OF LITERATURE FOR THE DEVELOPMENT OF THE FRAMEWORK FOR THE STUDY

The review of literature highlighted the fragile nature of our environment and the monumental challenges posed by major climate change concerns to the automobile industry. The industry was found to be under tremendous pressure to balance the short term measures while chalking out a long term strategy for survival.

The automobile industry's strengths of established processes and systems have been benchmarked and emulated by other manufacturing industries. However, the current business environment was questioning its very premise. The impact of governmental regulations for the industry have become a major factor, influencing the cost structure, the new models and product segmentation, as well as the marketing initiatives of companies incorporating emissions information. The automobile industry has reached 'maturity' especially in the European and American markets. The Indian economic and social environment however has provided an opportunity for the automobile companies to gain volume growth, and help them to retool for the low-carbon future. India, home to the second largest population in the world, has become a lucrative consumer market as well as an attractive manufacturing base for automobiles. There is heated debate on the car technology, choice of fuels and fuel quality, and the need for stringent regulations raised by various stakeholders. Although it is in the domain of car manufacturer's to introduce alternate fuel vehicles or develop more efficient cars, a lot can be achieved at the consumer level. UNEP, in conjunction with partners from the automotive industry, has put together a campaign to promote greener driving, with videos and comics to encourage a change in behaviour, the themes include choosing the right form of transport, checking
tyre pressure, changing tyres, and driving styles. It is estimated, that following this advice should reduce fuel consumption by 25 percent. The Petroleum Conservation Research Association (PCRA) has as one of its objectives “to create awareness among masses about the importance, benefits and methods of conserving petroleum products & clean environment by enhancing information and capacity building”.

In India, due to various economic considerations there is greater demand for small vehicles that are high on mileage. The identified need is for convenient mobility at least cost. This has ensured that the various automobile companies have focused on this segment. Moreover, the high cost of fuel and the recent Government decision on de-control of fuel prices, does necessitate an investment in mobility that maximizes mileage. However, there is hardly any focus on the car user’s role in conservation. Do customers hold an attitude that shows concern for environment? And does this concern translate into environment friendly behaviour?

Thus, the research study looking at the integration of EMS through the Value Chain of Select Automobile Companies with an emphasis on the marketing chain, and the attitudes and behaviour choices of the Indian consumers. The study examined the environmental impact mitigation and growth strategies of select companies in a highly regulated operating and marketing environment that places major carbon constraints on vehicles. An established fact is that the major environmental impact of a vehicle happens during the product use stage. This makes the consumer an important player whose involvement is essential in reducing the environmental impact of a vehicle. He/She has a responsible and constructive role in exercising his/her choice in selection, maintenance and use of a vehicle. Therefore, the study takes into account: the Automobile Marketing Companies (Original Equipment Manufacturers) and the Consumers.