Eco-Designing for Sustainability

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Abstract

Concept of sustainable development (SD) has forced the society and many industries to rethink about the way of development as environmental degradation is the global problem. Higher environmental degradation leads to depletion of resources, causes environmental pollutions, reduces the corporate social responsibility (CSR) and overall has its impact on sustainability. In every sector green approach is the requirement for sustenance of human civilization. Green designing, eco-labelling, green marketing, green consumerism are the essential requirement for addressing sustainability through eco-designing. Adopting eco-designing would generate CSR, green consumerism, energy intensive behaviour, green growth and would lead to formulation of suitable policies for SD. It would also help to reduce environmental footprint, address social and economical aspects of sustainability, promote sustainable management policies in various developmental sectors as well as combat the mega event of climate change.

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Keywords

Ecological sustainability · Eco-design · Green technology · Sustainability · Natural resource management

Abbreviation

CSR	Corporate social responsibility
GHG	Greenhouse gases
GT	Green technology
R&D	Research and development
SD	Sustainable development
SM	Sustainable manufacturing

16.1 Introduction

Eco-design or environmentally sustainable designs are made to reduce the negative impact on environment. The main principle of the design is ecological sustainability. Eco-design also includes the sustainable architect, eco-friendly products, growing green marketing for natural resource sustainability, as well as reducing the overuse and destruction of resources. In eco-design life cycle assessment of product is done for environmental protection over product service. Concept of sustainable development (SD) has forced the society and many industries to rethink about the way of development as environmental degradation is the global problem. To attain the SD, many new eco-friendly technologies have emerged. For maintaining and improving the environment with resource efficient approaches, various green initiatives are being taken for sustainable society (Yilmaz et al. 2019; Jhariya et al. 2019a, 2019b).

For concerning the environment and to overcome the current environment problem, applications of science and technology with green technologies (GT) have assessed and have great role in responding to mitigate the environmental threats. Environment and sustainability are important consideration in making and adapting new technologies (Raj et al. 2020; Banerjee et al. 2020). For enhancing the designing and manufacturing process, there is need of utilizing suitable tools and technique and focuses on sustainability, life cycle assessment and other practices that are aware of the entire life cycle which does not affect the environment (Shafiei and Abadi 2017).

Agricultural industries and other industrial sector are becoming one of the central issues for environmental problem including many other aspects. For this, green space are not only way to reduce the impact but also green production process and eco-friendly products, green marketing are applied in marketing methods (Dzulkarnain et al. 2019).

Understanding of human and nature interaction causing severe damage to environment by scientific communities which uses non-renewable source of energy.

Development in industrial sectors consumes more raw material and energy unsustainably which leads to degradation of resources and energy through deep transformations (Marques and Loureiro 2013). To overcome the negative effects on environment construction sector is working to make their work more sustainable by using eco-design and trying to use materials which have less effect on environment. Construction and demolition of building due to urbanization cause many difficulties and generate high amount of waste material causing bad impact on environment. Due to high cost of raw material, humans go for cost-effective resources and use the resource without concerning about its management and have always taken advantage of free resources. Population expansion also increases the need of raw material, with knowledge about the resource management and life cycle assessment of resources leads to decline in environment which inversely affects the environment. Many environmental impacts occur due to production process and products such as water pollution, air pollution, carbon and amount of energy during life cycle of product. Eco-friendly products and material should be considered for promoting the sustainability and maintaining environment sustainability (Allione et al. 2012). Over extraction of resources leads to damage to the planet earth which severely reduces the biodiversity and landscape alteration occurs due to mining process and many other anthropogenic activities (Khan et al. 2020a, 2020b; Raj et al. 2018).

In age of globalization it is difficult to fulfil the need as well as keeping our environment safe has become the major challenge to manufacturers and producer nowadays (Reddy 2017). Sustainability is a challenge for consumers and it is linked with the consumption of material which causes environmental stress (Hojnik et al. 2019). To maintain the social responsibility and SD companies are practicing green marketing, which include the marketing of eco-friendly products which causes less harm to the environment (Green Business Bureau 2020).

Improvement of new technologies and eco-friendly products are focused on eco-design with sustainability of products and for economy development concept. The motto behind the eco-designing is to reduce the environmental risk without altering or compromising with commodity quality and other parameters and consumer satisfaction (Haase et al. 2017; Stal and Corvellec 2018).

Using eco-design for sustainability can reduce the impact of urbanization, climate change and other factors on environment and natural resources. Sustainable architecture, green marketing, using eco-friendly product from different sector and in day today life can reduce the impact on environment and resources and this can also improve human health and natural environment. This chapter discusses the concept of eco-designing for sustainability of natural resources and reducing the impact of anthropogenic activities and impact of over use of resources by human beings.

16.2 Eco-Design and Sustainability

In the corporate sector proper designing of products is a crucial step for effective marketing process. In this context, incorporation of environmental aspects leads to eco-designing which focuses on reducing environmental impact and eco-friendly

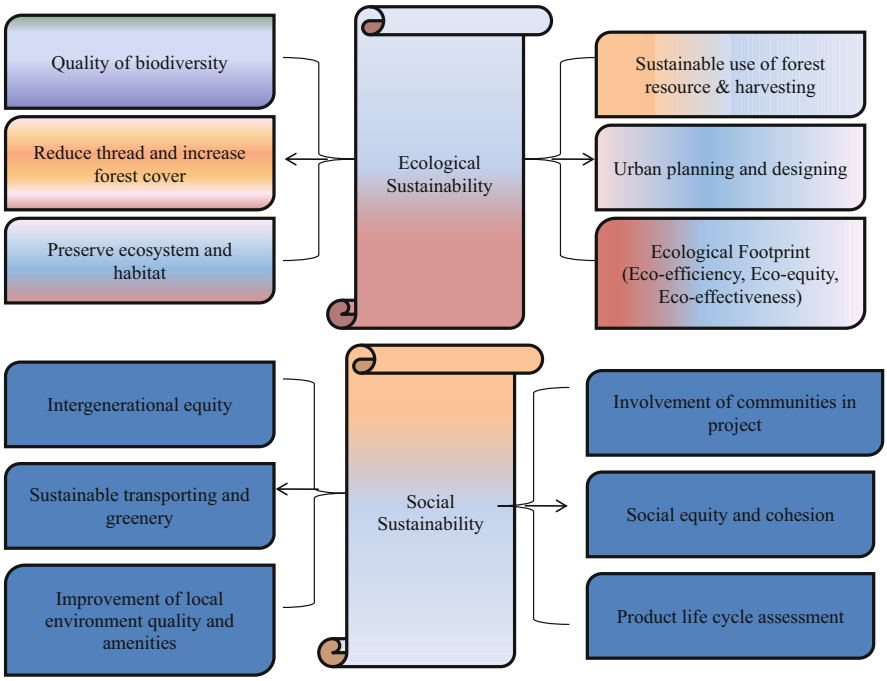

Fig. 16.1 Dimensions of sustainability (Modified: Pereira et al. 2018; Degato 2017)

process formulations. From sustainability perspectives eco-friendly product designing is the key concept for various countries across the world (Pigosso et al. 2013).

Sustainability is a big issue which requires a comprehensive approach for attaining the ecological and social sustainability (Fig. 16.1). From social perspective equity in terms of resource utilization, distribution followed by green designing to bring aesthetic pleasure is a major issue. Further, to generate environmental consciousness both in consumers as well as in the production cell, green consumerism through purchasing eco-friendly product is the main stay. Further, schemes such as eco-labelling, maintaining environmental standards at the societal level are very important to promote social and ecological sustainability. In ecological sustainability point of view various processes and marketing mechanism should have green approaches in order to promote conservation as well as maintain ecological integrity.

Developing eco-friendly products has also lead to the development of life cycle assessment approach which reduces the impact on environment. Eco-designing has a compliance with SD. Sustainability is big issue for human society which includes better life, healthy environment and overall improvement of human civilization (Ortiz et al. 2009). Every eco-designing project should aim towards efficiency in resource and energy sector, reduction of GHGs emission, and prevention of pollution, maintain the quality of life and harmony with the environment (Ortiz et al. 2010).

16.3 Natural Resource, Sustainability and Eco-Designing under Climate Change

Natural resources are global treasure that sustains lives of diverse flora and fauna by providing uncountable and multifarious ecosystem services. These are categorized into renewable (agriculture, forest and animals) and non-renewable resources (soil and minerals). These resources are quite important due to variety of ecosystem services that not only sustain human lives but also maintain environmental sustainability and ecological stability at global scale. Agriculture sustains lives of billions of peoples by providing quality foods and fruits. Forests are the largest natural resource, having greater potential of C sink and hold diversified plants, animals and provide timber and non-timber forest products for sustaining lives of forest fringe peoples. Animals are integral parts of both agriculture and forestry which provides milk, meat, wood and recreations, etc. Similarly, soil is the pillar of life that holds forest, agriculture, animals and other resources. Anchoring root system of plants provides essential nutrients for proper growth and development of crop plants along with climate change mitigation through soil C sequestration. Whereas minerals are source of life and maintain efficient mineral cycling. Thus, conservation and management of these resources are utmost important that contributes in making foundation for SD (Fig. 16.2) (Wellmer et al. 2019).

From sustainability perspective natural resource is a big issue as it challenges the supportive and assimilative capacity of the earth under changing climate. Climatic perturbations have increased the dependency on natural resource across the globe. Under changing climate humans are going for more production, adopting consumptive lifestyle and maximum utilization of natural resource. Therefore, for various sectors such as agriculture, corporate, business, marketing, ecology, environment requires proper planning and designing to achieve the goal of SD.

16.3.1 Sustainable Design for Natural Resource Management

Degradation of natural resources due to bad management practices, unsustainable and unscientific technology is major concern today and its management is utmost important. The goal of sustainability can be achieved by managing natural resources through application of eco-designing such as green designing, eco-labelling, eco-marketing and green consumerism. These will not only manage natural treasure but also maintain environmental sustainability and ecological stability at global scale. In this context, a figure is drawn that represents "how can we achieve the goal of sustainability through eco-designing for natural resource management?" Thus, we can say a great nexus exist among natural resource management, eco-designing and SD (Fig. 16.3).

SD involves social, ecological and economical objectives and improves the sustainability of resource exploitation, technological development and change in institutional development (Fig. 16.4). SD is said to help in developing social, environmental and economic goals (Koltun 2010). For sustainable designing, it is

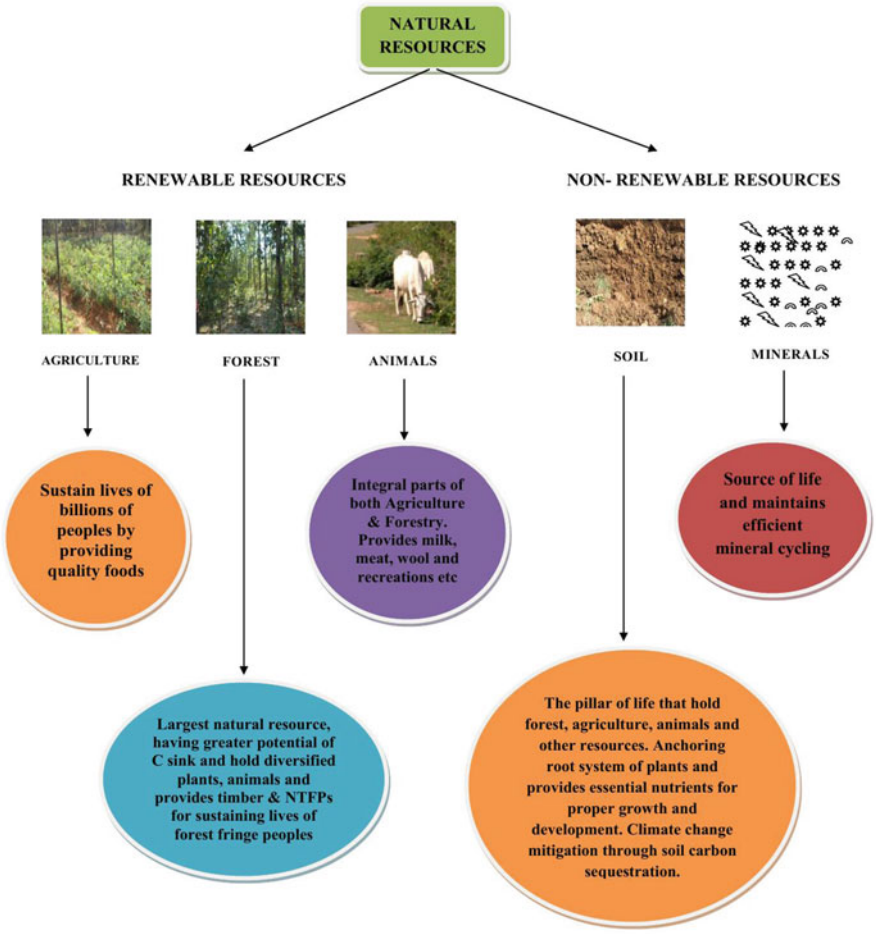

Fig. 16.2 Natural resource classification and its performance (Modified: Wellmer et al. 2019)

very difficult to design the product and systems. Sustainable design is the instrument for the SD and for protecting the environment (Skerlos 2015). SD should contribute to meet the need of today without affecting the ability of future generation. SD defines the problem and choses the approaches and makes solution toward environmental problem (Tomasowa 2018).

Comprehensive goal of education and implementing the sustainable design in field of architecture, engineering, construction and facility management is very important and necessary for making sustainable environment with less damage to the environment. Excessive extraction and use of natural resources are the reason for the degradation of natural resources and causing environmental problem across the world (Tomasowa 2018; Meena et al. 2018).

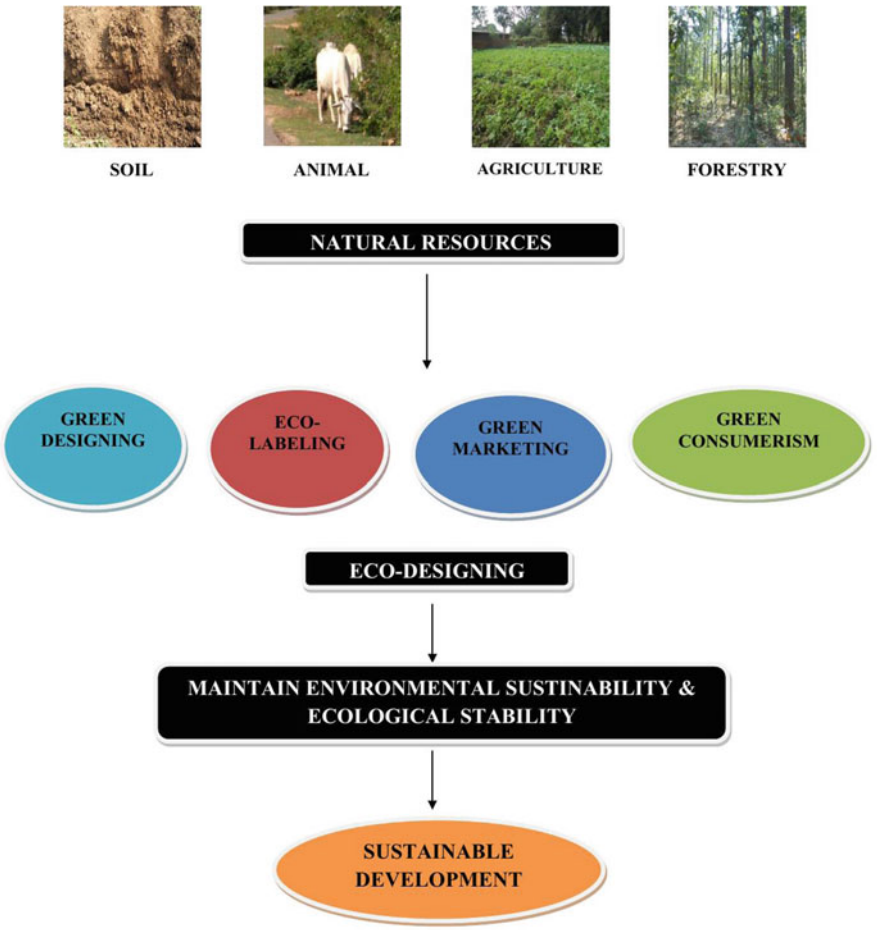

Fig. 16.3 Nexus among natural resource management, eco-designing and sustainable development

Integration of sustainability with manufacturing is termed as sustainable manufacturing (SM) and it deals with design objectives, function, profits and productivity of the system. It influences the advances and priorities for manufacturing technologies and operations. There is need to practice the sustainability in industries also, manufacturers and decision maker have to practice to establish the sustainable culture for fulfilling the need and demand of today and future (Yadav and Pathak 2017; Meena and Lal 2018). SM deals with all three component of sustainability such as environment, economy and society. It is broader than eco-manufacturing, eco-machining and clean production. Material toxicity, GHG emission and pollution all the environmental concern are covered by SM. It uses both non-technological and technological solution, from material selection to organizational mission and performance of reports.

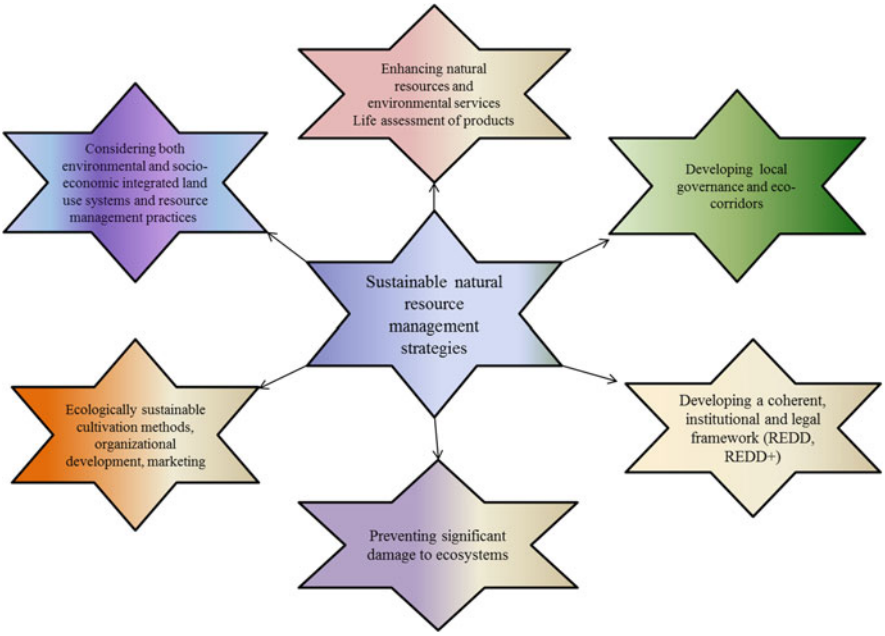

Fig. 16.4 Sustainable natural resource management strategies (FAO 2020)

Eco-design moves toward the sustainable future for developing environment by systematic integration and designing the process across assessing the product lifecycle (Simon et al. 2000). Eco-design aims to reduce impact of products on environment, concerning the life cycle of products and using the recycling and disposal of products (Despeisse et al. 2012).

A dichotomy exists between intensive practices and sustainable intensifications in land use systems such as agriculture, forestry, agroforestry, horticulture and other farming practices. Both are contrary just like a two faces of one coin. Intensive practices need high synthetic inputs with heavy mechanizations that will affect land quality and cause resource depletions (Meena et al. 2020; Kumar et al. 2020). In this context, an eco-designing must be practiced for managing land and other resources. For example, the practices of eco- and sustainable based intensifications (that are assuming to be as eco-designing) would be helpful in managing resources, land quality, soil fertility and enhance biodiversity that intensify ecosystem services. The characteristics, principles and practices for sustainability are very clear which can be utilized for resource conservation along with maintaining environmental sustainability and ecological stability. Thus, a sustainable design including sustainable intensification is used in different land management practices for betterment of environment and would be helpful in achieving the goal of SD (Table 16.1).

Table 16.1 Sustainable design in different land use practices for resource conservation

Feature	Sustainable intensification in different land use practices	Source
Characteristics	Maximize yield and productivity along with natural resource conservation	Pretty (1997)
	Improve nutrient availability, its efficient utilizations and maintain overall soil fertility and SOC pools that promote return from different land use practices such as agriculture, horticulture, forestry, agroforestry, etc.	Ruerd and Lee (2000)
	Maintain a better tree–crop interaction with less competitions among them for resources and improve overall productions without destroying our natural ecosystem and environment	Baulcombe et al. (2009), Pretty and Bharucha (2014)
	Enhance resource use efficiency and judicious utilization of resources and less synthetic inputs are other important characteristics of sustainable intensification that maintains environmental sustainability and ecological stability at global scale	Pretty (2008)
	Strengthen the productivity along with input-output balance and sustainable livestock's productions without resource and environmental degradations are other peculiar features that signify the ecosystem services	Gibon et al. (1999)
Principles	This is based on the principle of less inputs and proper utilizations of renewable resources like land, water, light, space, etc. for maintaining efficient productions at farm level	Godfray et al. (2010), Firbank et al. (2013)
	Efficient utility of tree-crops varieties along with essential breeds of cattle and animals	Ruerd and Lee (2000), Pretty (2008)
	Optimization of outside inputs, better resource use efficiency, improves food production systems and reduces its impact on our environment	Pretty (1997), Matson et al. (1997)
	Reducing food wastage with higher productivity is important principle on which sustainable intensification will depend	Garnett et al. (2013)
Practices	Conservation tillage and mulching practices are very important for better land quality, soil fertility and overall conservation of natural resources	Wezel et al. (2015)
	IPM (integrated pest management) practices which is very viable for managing emergence of insect pest and related diseases	Pretty (1997)
	Practices of crop rotations system along with integration of cash and cover crops including beans and their proper harvesting maintained existing resources by minimizing its depletion	Tilman et al. (2011a)

(continued)

Table 16.1 (continued)

Feature	Sustainable intensification in different land use practices	Source
	Incorporation of improved varieties of woody perennial trees, agricultural crops and livestock's along with protection and conservation of important plant genetic resources that are economically and ecologically viable	FAO (2004)
	Applying of soil and water resource based conservations practices that improve the resource availability and utilization	FAO (2004), Wezel et al. (2015)
	Fertigation and irrigation based water management practices are involved	FAO (2004)

16.3.2 Climate Change and Natural Resource

Globally, changing climate as well as degradation of natural resources is severe problems that people experiencing to a great extent. The changing climatic condition also puts pressure on the food availability, quality, food security and poverty for achieving the global SD. Natural resource conservation and management along with changing climate adaptation and mitigation are key sustainability issues in the sector of food, economic growth and good governance globally (Singh and Jhariya 2016; Jhariya et al. 2018a, 2018b). Eco-friendly product development, promotion and utilization can meet out the environmental resilience and can improve the local and national economy. Climatic perturbations have influenced the human and natural ecosystem worldwide. The continuous rise in the global temperature leads various major changes in various ecosystems (Raj et al. 2020; Banerjee et al. 2020; Jhariya et al. 2019a). Thus, conserving natural resources, it's efficient and sustainable utilization is the need of the hour to meet increasing global needs.

As per prediction, the world's food and water requirement is expected to rise twice in coming three decades. Moreover, the changing climate imposes the problems directly and indirectly on the productivity in agricultural sectors through climatic irregularities. The reduction in the natural resource base also creates conflicts and competition at local, national and international level if the proper conservation, management and sustainable utilization of resources are not given proper consideration (Raj et al. 2019a, 2019b). Increasing human population in addition to changing climates puts the pressure on natural resources. Further the over use of natural resources has multiple issues like mass extinction of species in the one hand and threatens the environment and ecosystem on the other. This affects the energy and food supply system in third world nations and challenging the social, economic and environmental development (Meena et al. 2020a, b). Therefore, judicious utilization of these resources is pre-requisite for human health and environment sustainability. Climatic alteration influence on the natural resource is very complex and regulated by direct and indirect ways. SD is the key to balance bridge between environment and economic developments of community at present

and future context. It infers the equitable management of resources at sectoral level to satisfy the people needs as per space and time (Cruz et al. 2007).

16.3.3 Social and Economic Perspective on Sustainability

As we know, social, economic and environment are the three pillars for the sustainability. Society welfare, social cohesion, gender discrimination, maintenance of people capital, etc. are studied under social aspects whereas the value of production/consumption, economic growth, efficiency and competitiveness, foreign trade system, stability/flexibility and employment generations are recognized under economic aspects. The maintenance of these two pillars decides our environmental quality and base for the SD.

It has been found that consumeric lifestyle is the root cause of modern day problems. It is causing pollution, depletion of natural resource and loss of environmental balance. Adopting green practices and behavioural approach one can change from consumeric to conservative lifestyle (Culiberg and Elgaaied-Gambier 2016). This is very much important for the finite resources of the earth such as fossil fuels (Maidment 2015). It is therefore urgent need to adopt such mechanism of green practices very quickly otherwise we would be devoid of our essential resources for existence of life on the earth.

16.4 Green Technologies and Sustainable Development

The changing climate, earth's warming, resource depletion and other environmental concern have triggered the scientific communities towards GT for sustainable development. It is noted by scientific research that increment in the SD level creates sustainable society and economy (Klimova et al. 2016). From sustainability point of view, technological transformation and upgradation through innovation, research and creativeness are the need of modern society from the one hand and it should be eco-friendly on the other. The technologies have negatives consequences on environment and ecology from regional to global scale. In this context, GT seems to be promising to avail the economic sustainability with bridging the balance between society and the environment. Moreover, the technological effectiveness, efficiency, economical and environmental impact must be tested and evaluated prior to its implementation (Shaikh 2018). GT protects and conserves the environment and therefore causes least harm to the ecosystem by biotic interference (Huesemann and Huesemann 2011). The GT gives environmentally safe produce and cuts the GHGs production, waste generation and ensures the human's live better today and tomorrow (Williams and Helm 2011). Thus, SD is comprised of all round social, economic and environment development (Ahmed et al. 2016).

16.5 Marketing and Environmental Issues

Marketing is a major aspect in terms of customer satisfaction for particular firms. It is the responsibility of the firm to properly communicate and generate value for its customers. Better performance and economic output become a firm capital and develop competency in market mechanisms. In this mechanism after competency development proper use of resources helps the firms to achieve the aims and objectives of SD. This is the area of success for a firm to effectively produce own resources through market competency (Arnett and Wittmann 2014). Development process is going on in the direction of developing interest in environmental issue related to eco-design and marketing (Polonsky 2011).

According to Fisk (1974) marketing tends to have detrimental effects upon the environment due to consumeric lifestyle of the consumers. However the opinion varies on case to case basis. The social and environmental aspects can also be addressed under marketing mechanism (Sheth and Sisodia 2015). However, this particular aspect needs to be scientifically explored properly for policy framing in the corporate sector towards SD. Environmental issues would be an aided advantage in the marketing mechanism to increase the competitiveness (Arnett and Wittmann 2014).

Besides their benefits GT implementation is a hard task and is associated with some challenges. The first and foremost challenge includes adequate funding for research and development (R&D) activities. For development of new innovative technologies sufficient funds should be available for R&D activities. Environmental impact assessment study is often prove to be non-fruitful for adoption of GT. Lack of extensive support system often hampers to maximize the potential of GT. Due to the costing GT sometimes becomes a luxury approach. Conservative approach in our culture often hampers the implementation of GT.

16.6 Green Market and Marketing

In modernized world, it is challenging task to keep user aware about the environment and its related concern. The awareness and human interactions with surrounding environment in safe manner are the key factors governing the success of green marketing. In the present context, green marketing become important phenomenon in India and other developing countries of the world to address the SD because in these regions the environmental pollution is the biggest issues (Sasikala 2017). Therefore, by the firms it is needed to create the environmental friendly products with communicating the people to adopt eco-friendly approaches.

Incorporation of environmental issues in marketing develops the concept of green marketing. Under this concept marketing strategies are oriented towards eco-friendly direction to get positive results towards sustainability.

From the marketing mechanism it is evident that unsustainable consumption pattern causes environmental degradation (Christensen et al. 2007). Therefore, adopting sustainable practices in the marketing process would create a positive

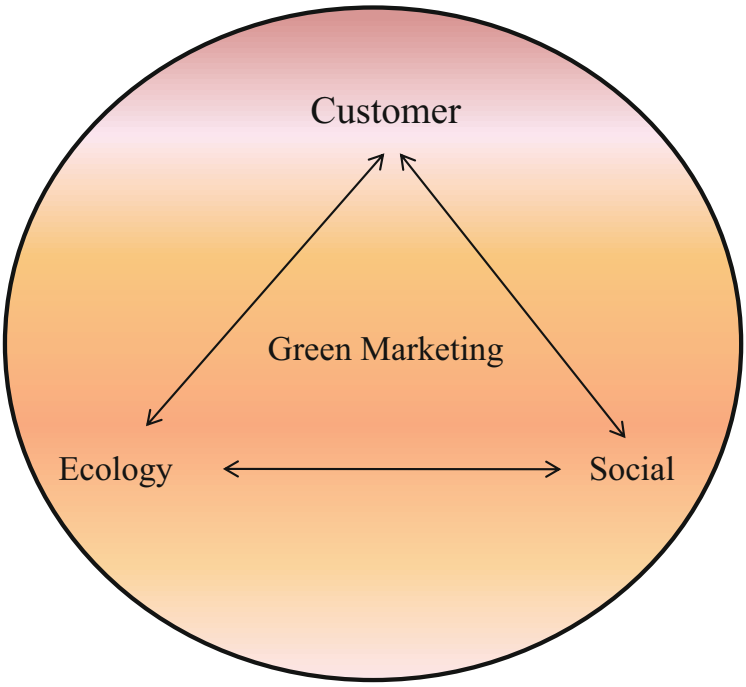

Fig. 16.5 Sphere of green marketing towards sustainability (Folasayo 2019)

image in the society and development of eco-friendly products (Fig. 16.5). It may lead to bring the products under green category but not at the cost of expectations of the stakeholder stand points. For effective implementation of green marketing, one needs to understand the concept of SD, alter the behavioural attitude of the consumers to become green consumer. Changing consumption pattern is a part of green marketing mechanism which indicates the corporate responsibilities towards the society in reducing environmental degradation. Thus, green marketing has become the thrust area of research in the present century (Alhamad et al. 2019).

In the present time the marketing trend has changed to a considerable extent focusing on development of eco-friendly products for effective use of consumers and safety of the environment (Schiffman and Wisenblit 2019). Climate change and global warming are posing significant threat to humankind as well as marketing sector. Therefore, production of eco-friendly products is the need of the hour to make the environment hostile and sustainable (Alnoor et al. 2018; Abdulsahib et al. 2019).

From global context, several countries are approaching towards motivation process among the consumer to become environmentally conscious in terms of purchasing decision. This may lead to change in behavioural attitude. As a consequence green labelling and eco-labelling have become prevalent for eco-friendly product in the market. This also motivates the consumer to purchase green products other than the products which are not eco-friendly. This is essential in order to

achieve success in green marketing whose success depends upon change in consumer perception (Sukri et al. 2015). Another major aspect of green marketing is to satisfy the need of the consumer as well as believe in sustainability by adopting green consumption pattern. Green marketing also produces competitiveness in the market for producing high quality eco-friendly products that satisfies the need of the consumers (Laroche et al. 2001).

Gradually there is a rapid growth in green marketing mechanism followed by green consumption patterns. This is only possible for some countries due to stringent legal framework, government policy, pressure of various NGOs, and the liability of business sector named as CSR. Thus, green marketing has both competitive approach and low cost policy to achieve sustainability (Yılmaz et al. 2019).

Green marketing simply implies the inclusion of environmental agenda into the marketing mechanism (Chan et al. 2012). Green marketing can be divided into three components: (1) increase environmental efficiency through proper marketing policy, (2) satisfying the consumer demand through eco-friendly products and (3) to develop competitiveness in the market towards sustainability (Liu et al. 2012).

Green marketing should include challenging attitude to use the market effectively, proper management of supply-demand chain and ultimately towards development of eco-friendly products. The main motto of adopting green marketing is to produce, distribute eco-friendly products with less harmful residue in the environment (Sharma et al. 2010).

One of the main objectives of green marketing includes inventorization and identification of consumer demand and its successful fulfilment for societal well-being in a sustainable way (Chan 2014). With gradual growth of green marketing researches were focussed on identifying the impact of green marketing over a firm performance. Various assessments were done for the firms through their performance in producing various products with various qualities (Robins 2006). From the results it was observed that despite the variable approaches of green marketing focussing on environmental improvement most of the cases results were unsatisfactory in terms of its outputs (Crane 2000). Green marketing expands the dimension of the business sector by incorporating the environmental factors into marketing strategies. For instance, under green marketing, one needs to consider the societal and environmental value along with the economic value. This would help to understand the interaction between human-environment and marketing process (Robins 2006).

Suitable strategies for effective implementation of green marketing have two basic components which include the basic component and on the other applied component. Basic component strives for improvement in the performance irrespective of organization, individual as well as maximum benefit for people. The applied aspect includes green positioning, green designing and green pricing which would work in an integrated manner for sustainability. Further the component of green logistic and disposal is the supplementary part which would reflect the effectivity of the process (Fig. 16.6).

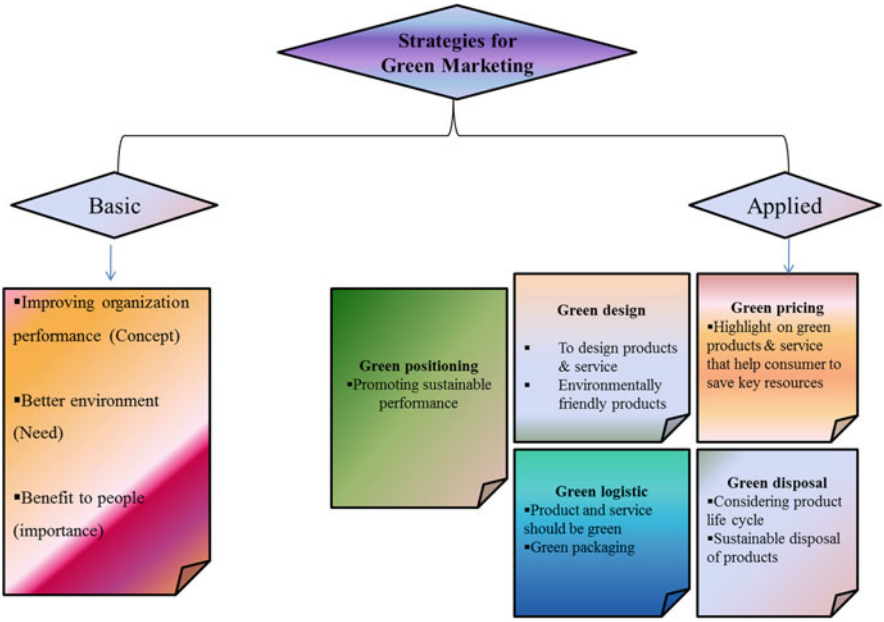

Fig. 16.6 Strategies for green marketing (Alhamad et al. 2019)

16.7 Eco-Friendly Product and Sustainable Architecture

Green designing is the need of the hour in order to avoid the negative consequences of global warming and climate change. Various countries across the globe are practicing green architecture in building constructions which is very much important for reducing GHGs emission in the atmosphere (Ghaffarian Hoseini et al. 2013). Due to such positive outputs the concept of green designing, green building is gaining worldwide acceptance and recognition (Aithal and Aithal 2016). Such approaches are gaining more importance in the industrial sector with gradual development of latest and new technology of building constructions. The major output takes place in the form of environmental sustainability through adapting green building practice (Jagarajan et al. 2017).

In the developing countries the green building practice is a suitable strategy for SD. It is little bit costlier than the normal and conventional building constructions due to modelling and designing approach but in long term it would surpass the benefits of normal buildings. Initially green constructions seem to be little bit costly but however by using green materials and technologies one can reduce the environmental cost and externalities for a better health of human civilization. GT leads to produce eco-friendly products which increase the property values, societal value and above all environmental values (Ghaffarian Hoseini et al. 2013; Paritosh et al. 2017). Such technologies focus on sustainable use of water and energy resources, lesser

production of waste, lesser pollution, increase employment opportunities and maintain the health and productivity of human ecosystem with least environmental footprints (Bhowmik and Dahekar 2014).

GT is a newer concept which aims to serve the purpose of human beings and explore new ideas to fulfil the demand and comfort of human civilization. Using energy efficient materials would lead to produce energy source for future use. Using eco-friendly products would help to minimize the consumption pattern as well as least damage to the environment. GT therefore identifies renewable energy resources, promotes recycling of water resource and waste water treatment practices to promote SD (Jagarajan et al. 2017).

In the sector of building construction and infrastructure development sustainability is a big issue as improper practices may alter the land use pattern. Implementing green building or green designing concept is a suitable option in which proper management in the concern sector can be achieved. Implementation of green approaches in such sector is associated with some constraints. Lack of awareness, policies, non-involvement of environment sectors as well as inadequate funding often become the bigger hurdles for sustainable architecture in developing countries (Fig. 16.7).

16.8 Eco-Labelling

Sustainability approach in corporate sector is including environmental issues with gradual growth of science and technology. Production process is very much important for both the industries as well as the corporate world. Therefore, eco-friendly technologies, products are the need of the hour in order to improve competitiveness and economic output. It was observed that some of the firms tend to be green in their message and not in activity. Under the current time they would be obliterated from the market due to poor quality and lack of environmental consciousness. So, firms need to be innovative in their approach, go more towards designing eco-friendly products and environment friendly practices (Janßen and Langen 2016; Del Rio et al. 2016).

In these connections eco-labelling is a management policy to promote eco-friendly products into the market. This is also good for consumers from their health perspective as well as their awareness related to environmental issues in the corporate world. Therefore, for proper marketing of a product eco-labelling concept is being used by the companies both in developed and developing world. It also helps the consumer for screening of products and their quality within the market mechanisms (Rex and Baumann 2007).

For effective implementation of eco-labelling one needs to reduce the gap of understanding between consumers and sellers regarding various eco-labels. Consumers need to understand the various eco-labels to gain quality as well as fulfilling their own aspirations. In this way they would be reflecting their environmental responsiveness for safety and well-being (Nik Abdul Rashid 2009). On the other hand, eco-labelling is directly associated with consumer consciousness and

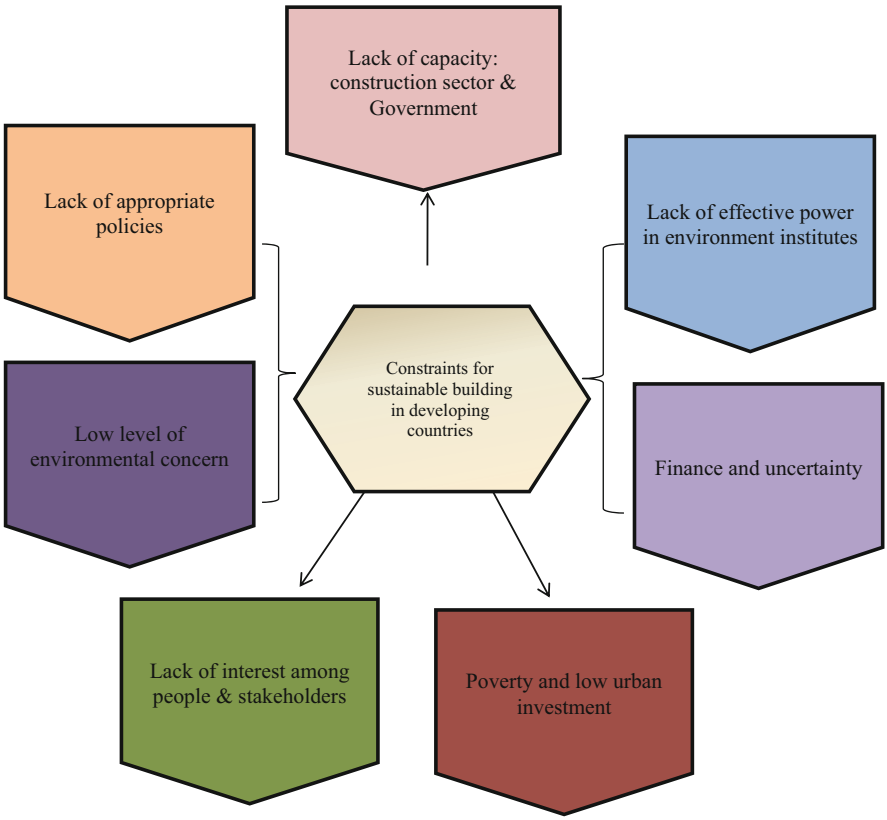

Fig. 16.7 Constraints for sustainable building in developing countries

green marketing. Therefore, consumer awareness should be promoted regarding adopting and purchasing of eco-friendly products and proper decision making (Alhamad et al. 2019).

Eco-labels are the most significant aspect in terms of environmental issues associated with a particular product or services. It performs to generate environmental consciousness among the consumers in relation to environmental quality. Eco-labelled product usually does not harm the environment and are eco-friendly (Buckley 2002). According to Lupu et al. (2013) it is an approach which stimulates environmentally responsive behaviour among the corporate sector to market such products and services which causes least damage to the environment. The associated problems in the life cycle of a product are usually not visible to a consumer but through proper eco-labelling consumer can be made well aware about the negative consequences of a product. Eco-labels highlight the purchase preference of a consumer for a particular product or service considering the environmental issues (Burgin and Hardiman 2010). Corporate firm and companies nowadays are under tremendous pressure due to CSR to maintain the eco-friendly practices and

production of green products. Such approach ensures minimization of negative impact on environment. Eco-labels provide necessary information to the consumers about the type of product to be purchased by them which will be good in quality and health perspectives (Ho and Lin 2011). Some describes it as a certification process regarding environmental friendliness offered by an organization to its consumers or customers. Eco-labels indirectly generate responsible behaviour of the consumers towards environment by changing their attitude for purchasing eco-friendly products (Thorgersen et al. 2010). Eco-labelling emphasizes production of goods maintaining environmental standards under the strict supervision of government, producers and suppliers. Eco-label has another important function of overcoming the barriers against green trade at the international level. The characteristic feature that a particular product or service needs to meet up should be according to global eco-labelling network. The conditions include participation in the process from all ends, must be compatible with the laws and there should be suitable criteria for specific category of products. The criteria set for the said purpose should be flexible and accountable in nature (Yilmaz et al. 2019).

16.9 Strategic Approaches for Eco-Designing

Environmental issues such as pollution stress, waste accumulation and resource use are the major challenges which need to be taken care of while implementing eco-designing process (Witt 2011). In eco-designing companies need to maintain the stringency in environmental regulation in their operation and manufacturing process which would lead to SD (Randelli and Rocchi 2017). Consumers will play their active part by altering their purchasing behaviour towards eco-friendly products. Therefore, environmental component should be a key aspect of product development (De Medeiros and Ribeiro 2017). To achieve SD major emphasis should be given on green consumerism that would lead to environmental sustainability.

Under green marketing strategies the associated value of product may be increased by improving its quality followed by reducing the environmental risks. It would act as a fruitful strategy for the firm to win the competition in the market. The policies of green marketing tend to be effective by the firms approach to produce eco-friendly products along with consumer education for purchasing environmentally friendly products. As a marketing strategies firm may promote product development, proper pricing, improve services, and all other green practices to achieve the target of SD. Marketing policy and strategies also depend upon building up of an appropriate image of the firm for gaining confidence of consumers. This is very important for effective implementation of green marketing (Chen and Chang 2013).

Implementing green marketing helps the firm to explore new green opportunities, boost up the corporate sector, increase the value of products, and elevate the comparative benefits along with following environmental trends (Chen and Chang 2013).

16.10 Environmental Footprint and Eco-Design

Eco-design is flexible mechanisms which incorporated under the design of the product and reduce the environmental impact. However, it does not alter the basic structure and fundamentals of the production process but modifies them by including the environmental criteria in order to reduce various types of footprints and improve the quality and safety. Inclusion of environmental criteria for a product design should be planned at the time of designing of the product. This is very much important as once the product has be produced and sent to the market they therefore provides least opportunities for effective designing to reduce environmental impacts.

C footprint is a significant factor during production cycle of a particular product. It simply refers to amount of GHG emitted as a whole during the entire lifecycle of a product starting from production to end use, i.e., from cradle to grave approach. In order to reduce the C footprint the amount of GHG emission at various stages of the life cycle needs to be monitored. After having the detailed inventories and sound data base suitable designing considerations including the environmental aspects can be implemented in order to reduce the footprint.

In agricultural sector footprint is a serious issue due to emission of GHG in a significant amount. It also promotes the climate change event which is a serious issue nowadays for both developed and developing nations. In this sector, there are various processes associated in the production activity. Animal husbandry, aquaculture is the various activities which contribute at the significant level in GHG emission. Therefore, the footprint is increasing day by day (Vergé et al. 2012). Agro-products have variable amount of C footprint which is increasing day by day with increase in the production process. Therefore, minimizing the GHG emission and thereby reducing the C footprint through eco-friendly practices such as organic farming, eco-intensification, eco-designing and practices need to be implemented to fulfil the food requirement and reducing the C footprint (Tilman et al. 2011b).

Scientific investigation and explorations towards environmental footprint reduction and eco-designing are the need of the hour. The scientific findings should provide transparent database and also provide suitable policy formulation for GHG emission reduction and hence footprints.

16.11 Urban Green Space for Environment Protection

Urban greening is gaining importance nowadays at the event of climate change. For proper designing and structure of cities urban green spaces act as eco-friendly approach that performs multidimensional functions. For instance, it provides fresh oxygen to the ambient atmosphere improving the air quality of cities. It also acts as a site of aesthetic pleasure and recreation of the local people. It also tends to reduce the pollution load to a certain extent. However, the positive outcomes of urban green space seem to be under doubt due to faulty practices, improper land use, population explosion in cities, and over-exploitation of natural resources (Ebrahimpour et al. 2013).

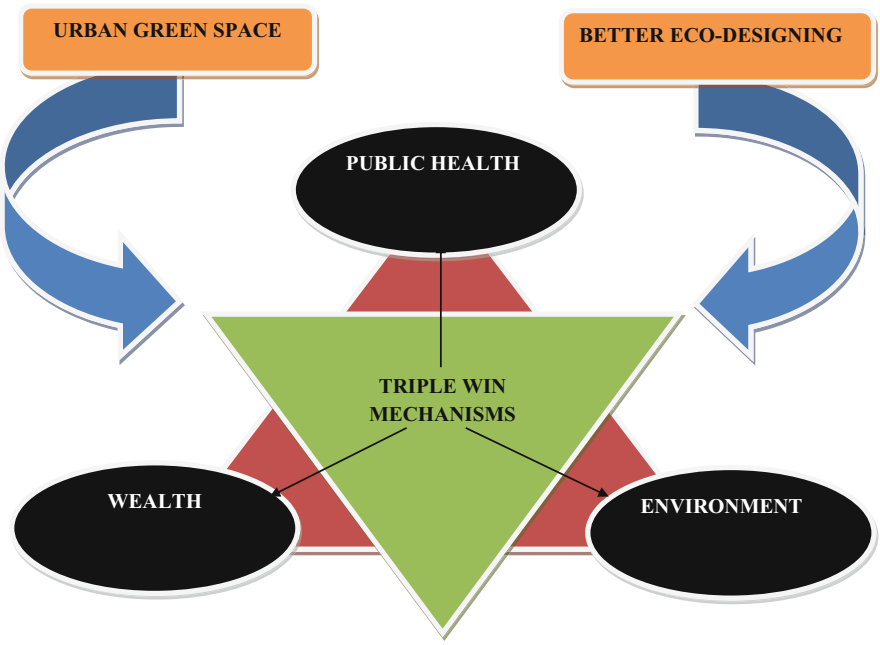

Fig. 16.8 Triple win mechanism through urban green space by adoption of eco-designing (Vargas-Hernández et al. 2018; Kruize et al. 2019)

Public health, neighbourhood stability and environmental sustainability are recognized significant through the proper designing of urban green space. Obviously, a proper designing of green space in urban areas would be highly significant in delivery of uncountable and multifarious ecosystem services. For example, adult work training, childhood educations, taxonomical practices and building social cohesion are certified services which can be delivered through proper designing of green space. Similarly, physical exercise, psychological treatment, clean air breathing and disease reduction (asthma curing) are significant from public health perspective. Pollution reductions, minimizing extreme noise and sound, environmental ameliorations and wildlife management and its protections are included in environmental remediation. Therefore, urban green space regulates the triple win mechanisms by promoting public health, wealth and environment. "How can eco-designing work for urban green space to achieve the triple wins?" However, this question is absolutely justified by above assumptions. Also, a figure represents promising of triple win mechanism through urban green space by adoption of a better eco-designing (Fig. 16.8). Thus, urban green spacing is a component of ecosystem that must be operationalized in such a way to keep better health and environment at sustainable basis (Vargas-Hernández et al. 2018; Kruize et al. 2019).

16.12 Business Strategies for Sustainable Management

In the modern world all the firms are promoting environmental friendly practices and products to minimize the degradation of environment and provide maximum consumer benefits. Some have transformed their technologies towards cleaner production fulfilling the demand of the consumers. It also improves their resource use efficiency of the products, process and other benefits and reduces the negative impacts on public health and environment (Bai et al. 2015).

16.13 Green Growth in Developing Countries

Sustainability is a big issue which integrates various aspects such as health safety and pollution free environment. Overall there should be integration between human beings with the nature. This requires a conservative approach to promote conservation of natural resources. Technologies reformation or reorientation needs to be done to achieve sustainable strategies for future. The concept of sustainable cities is based on harmonized growth and development which includes proper reuse and recycling, green designing of buildings in the form of roof top rainwater harvesting and zero energy buildings are the basic requirements. Further from infrastructure point of view proper drainage system, micro-irrigation facilities, use of renewable energy resource such as solar energy, wind power, hydrothermal energy systems may be adopted as GT. In the transportation sectors use of electric vehicles, compressed natural gas buses along with presence of bio-toilets can be implemented as GT to improve the overall performance on environmental issues (Aithal and Aithal 2016).

For promoting green growth three-dimensional approach of environment, economic and social perspective is necessary to address SD (Fig. 16.9). Green growth demands low C economy, resource efficiency, economically viable alternatives as well as connectivity with the society.

16.14 Eco-friendly Product and Sustainable Management in Different Sector

Eco-designing and eco-friendly technologies need to be implemented properly in the various sectors of agriculture, food production units and other sectors (Table 16.2). Agriculture is such an issue which involves both developing and developed nation. In order to maintain the production unit cleaner production activities are required for having resource saving approach as well as convert them into eco-efficient and feasible alternatives (Zhang et al. 2018).

For sustainable management of the agriculture sector, the problems need to be addressed on sectoral basis. The policies should be aimed to address the sustainability issues in terms of maintaining the sustainable yield and production under various biotic and abiotic stress conditions. Income generating agricultural practices should be identified in the agricultural sector in the form of agro-ecology,

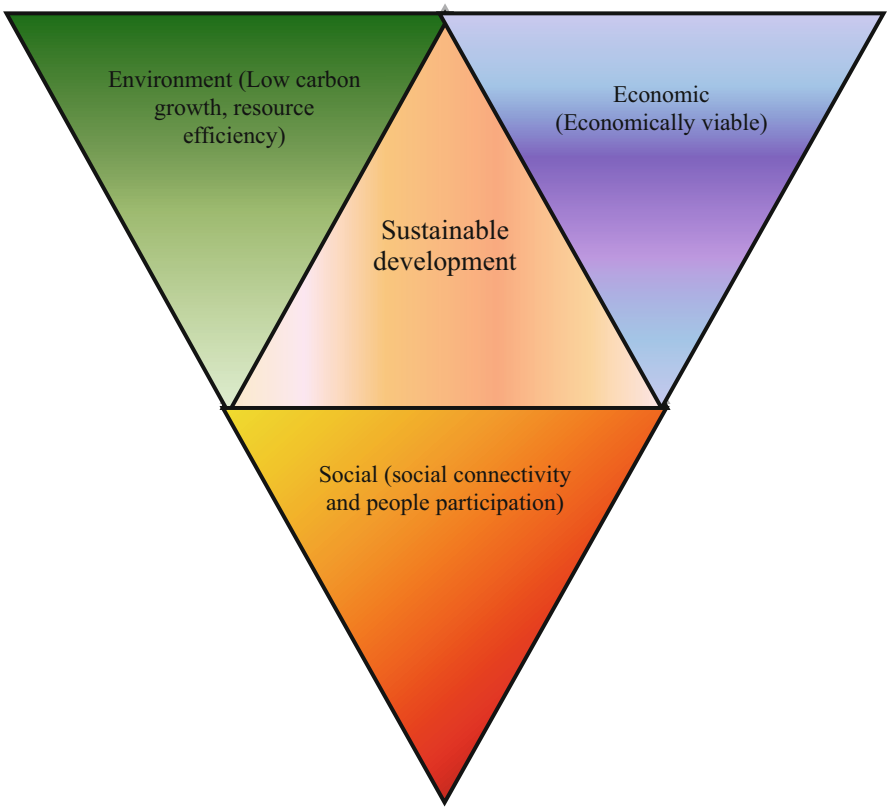

Fig. 16.9 Sustainable development approach (Jhariya et al. 2019a, 2019b; Raj et al. 2020; Banerjee et al. 2020)

ecology based agriculture, renewable energy production in rural sector, etc. Further, the national policies and its impact should be properly studied and on the basis of that extension activities of particular technologies should be implemented. The concept of sustainable agriculture addressed the issues of health, economy and social well-being in an integrated manner. This can also be considering as green agro-technology and designing for effective production of food. After production proper management and marketing are essential.

Water resource is a scarce resource due to its over use and abuse. As a consequence, it has been reported that approximately 1.1 billion people is devoid of safe access to drinking water, 2.4 billion people is without proper sanitation facilities, more than two/third of the developing world suffer from the water borne diseases (Aithal and Aithal 2016). Therefore, the demand for safe and clean water is increasing day by day. Green designing and process build up is necessary in this perspective in order to reduce water pollution and promote conservation of water. Nanotechnology is the most suitable example of that. It is such a technology which undergoes

Table 16.2 Green alternative for various sectors (Modified: Aithal and Aithal 2016)

S. N.	Sectors	Green Technological Perspective
1	Agriculture/farming/ cultivation	Adopt eco-friendly technology for reducing environmental degradation
2	Food processing and packaging	Elimination of contamination and hazardous impact of food to human health
3	Water	Water purification and filtration through bioremediation and nano-technological applications and other eco-friendly processes
4	Sustainable energy	Harvesting and assessment of non-conventional energy resources through green processes
5	Firm produce and green designing	Use of eco-labelling, development of green technology having least damage on environment. Green designing for building construction for energy efficiency and environment friendly structures
6	Automobiles, air navigation and industrial sectors	Energy efficient technologies in automobile sector having zero pollution, adoption of green materials and energy sources in air navigation. Development of industrial process having zero greenhouse emission, using recyclable items
7	Education, health and information technology	Go for green education, adoption of traditional medicinal treatment having no side effect, use of renewable energy sources for sustainable management of energy resource

filtration at molecular level followed by water conserving activities such as recycling of rainwater, desalinization of sea water, etc. It has been found that utilization of nanotechnology in purification of water can generate large amount of portable water by using wind and solar power.

Energy sector is also another important one which is suffering from the crisis situation due to over use and abuse of human beings. With the motto of comfortable lifestyle the energy consumption has increased considerably across the globe. As a consequence of that it is estimated that more than 1.3 billion people has no excess to electricity, 2.2 billion people depends on electricity from organic source. On the other hand, it is predicted that fossil fuel consumption would be double up to year 2025 (Aithal and Aithal 2016).

Green designing in the form of implementation of nanotechnology would address the energy crisis situation to a considerable extent. It may take place in the form of designing of solar photovoltaic cell, silicon cell, hydrogen fuel cell for energy production. Nanotechnology also promotes the solar and wind power as green technology.

In the infrastructure and building construction sectors GT has much role to play by using eco-friendly materials for infrastructure development. For example, construction materials such as cement can be modified up to nanometre scale leading to formation of novel super plasticizers which would help in cement bindings, improve the concrete stability and overall performance of building (Aithal and Aithal 2016).

Food and food processing industries is another big issue in order to feed the growing human population. Due to rising population of human beings GT needs to be implemented at the food production and processing sector (Boye and Arcand 2013). Various forms of technologies in the form of bio-preservation, adoption of electromagnetic forces for decontaminating food materials are the suitable example of GT in food processing sector.

16.15 Policy and Legal Framework Towards Eco-Designing and Sustainability

Sustainability has become a major issue from global context in recent century. Every sphere of human society such as economic, political, social, psychological aspects is going through transformations to achieve sustainability (Patterson et al. 2017). Policy formulation in this aspect is very important to evaluate the effectivity on green designing. For instance, community awareness towards purchasing eco-friendly products can be a key policy for effective implementation of green designing. Further various sectors of the society including the government, corporate organizations, local community stakeholders and policy makers should play their part of effective implementation of green designing policies. Policy should aim toward proper certification, environmental friendliness, green production, packaging, and green consumerism in order to maintain corporate social responsibility (Hojnik et al. 2019).

In this process proper communication between society and the corporate sector is the essential key process for moving towards sustainability (Fig. 16.10). In this, community participation and perception are very important to develop a conservative attitude for fulfilment of needs of future generation. This would ultimately bring a psychological change among the community people and lead to environmentally responsive behaviour (Hojnik et al. 2019). One example of green consumerism includes use of cotton cloth bags instead of plastic bags can be effectively implemented among the consumer during their purchasing activity. In this, consumers have to realize the benefit of using eco-friendly product and exhibit environmentally responsive behaviour. Mass media can serve the purpose of awareness generation in this direction to a considerable extent (Hojnik et al. 2019).

Policy should also be framed towards community awareness for better use of green designing, GT, eco-labelled products and therefore improving the motivation from consumer point of view (Liu et al. 2017). Researches revealed that with gradual improvement of consumer perception the inclination to purchase eco-friendly product gradually increases. In this perspectives consumer should be updated with latest information about eco-friendly products, their benefits that would lead to sustainable lifestyle (Hojnik et al. 2019).

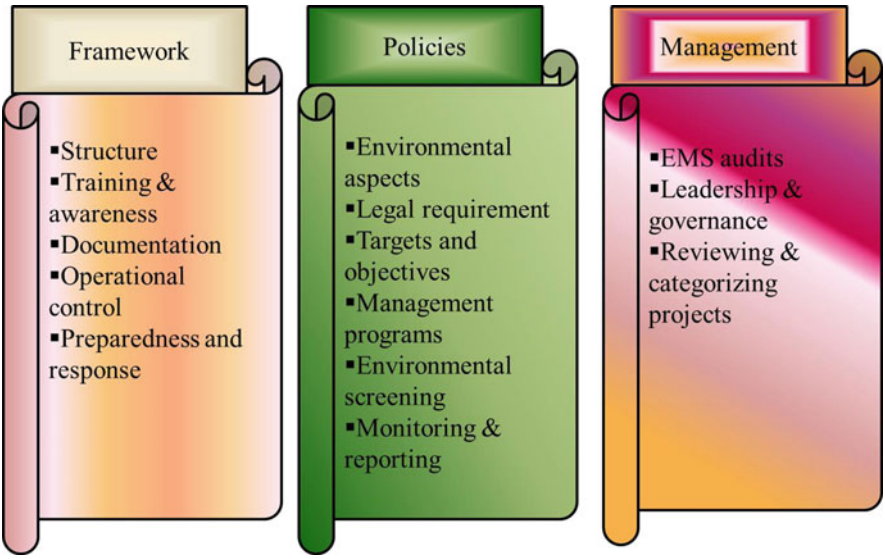

Fig. 16.10 Policies and legal framework towards sustainable management (Modified: Jabareen 2008; Baumgartner 2014)

16.16 Conclusion

Researches should be focussed on new developments in the issues of green marketing as well as developing community perception in these aspects. Positive outcomes should be assessed in terms of various green marketing strategies such as green consumerism, green mechanism, green economy, eco-labelling, etc. Contextual aspects also need to be considered in order to assess the firm performance in implementing green designing technologies. All such aspects need to be explored properly. On the other hand, various factors such as government policies, policies of corporate sectors for adopting green marketing and promotion of sustainable green practices should be the future perspective of green designing technologies. GT seems to have a promising future ahead in terms of social-economic-environmental benefits. Further, technological advancement is required in these aspects to implement the GT from local to regional to global platform towards SD.

16.17 Future of Eco-Design

In the production process for future perspective proper designing and planning are required in order to maintain the environmental sustainability. It is evident that due to technological growth and ever increasing human population one needs to arrest various forms of environmental degradation. For achieving this green designing and

green product promotion is required to mitigate the big issue of climate change, conservation of natural resources, reuse and recycling and adoption of eco-friendly technologies. In the marketing sector the success would be dependent upon the marketing strategy for inclusion of environmental issues. It may be in the form of eco-labelling, eco-branding and eco-packaging. Therefore, if we consider the future of eco-designing proper strategies and policies should be promoted for more production of green products and their consumption by the end users. The marketing strategy is such that they should promote production of green products followed by changes in the attitude of consumer to purchase green products.

Future perspective of eco-designing implies promotion of various eco-friendly practices and eco-friendly attitude development among the corporate sectors. This includes clean development mechanism, life cycle assessment, eco-designing and formulation of green marketing policies. It also involves consideration of social costs that needs to be explored. Any approach that is damaging to the environment and well-being of people should be discouraged under the green marketing policies. Another major aspect includes consideration of eco-friendly technologies, safety of technologies should be given priority in decision making. Developmental market, technological, financial, regulatory challenges need to be managed through proper R&D activities followed by supportive and compatible policies for betterment of eco-designing and overall sustainability.

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