CHAPTER 2
REVIEW OF LITERATURE

In this chapter, a brief review of literature is discussed. It includes literature on the context of Solid Waste Management (SWM), present status of SWM industry in India, SWM industry as a part of EGS industry and regulatory framework for this industry. At the end, a discussion on the concepts and theories related to the regulations for SWM industry is given. On the basis of this review, the research gaps are identified and the conceptual framework and the objectives are discussed.

SWM - CONTEXT AND BACKGROUND

Waste is created by human activities and this waste needs to be collected, stored and finally disposed in a manner, which is not detrimental to the environment or to public health. The manner of handling and disposing solid waste that tries to minimize health and environmental impact is known as SWM. Human activities can create waste and the mishandling of this waste in terms of its collection, storage or disposal can create pollution and environmental degradation (Zhu et al., 2008). The most common generators of solid waste are households, commercial establishments, industries, and hospitals. Management of this waste, including its treatment is usually considered as the responsibility of the municipal and other local authorities.

Municipal corporations in developed economies have moved away from the ‘end of pipe’ problems such as waste management and have started to focus on innovating cleaner production technologies. Developing countries however, are still grappling with waste management as the primary focus in environmental management (Barton, 1997).
In this context, improper handling of the gases released during the biodegradation process in these sites can even contribute to the increase in greenhouse gases, thus hastening the global warming process. Different fractions of waste take different amount of time to decompose. While organic waste can take from one week to one month, plastic waste can take centuries to decompose.

In order to tackle these problems, Integrated Waste Management Systems (IWMS) that combine different waste streams (solid, water, air, etc.) and control the collection, treatment and disposal of this waste have been developed. These systems involve waste reduction at source, resource recovery and recycling, thus converting waste back into a resource. The objective is to achieve environmental benefits, economic optimization and societal acceptance, thus fulfilling the norms for sustainable growth (McDougall et al., 2001).

**Characteristics of a SWM system**

The features of a typical waste management system in a developing country could include waste generation and storage, waste segregation and its reuse/recycling, primary waste collection and transportation, sweeping of streets, management of transfer station, secondary collection and transfer and finally, disposal of waste (Zhu et al., 2008).

Troschinetz and Mihelcic (2009) conducted a survey to identify and rank the most important factors influencing a sustainable SWM system in developing countries. The identified and ranked factors included the education of municipal solid waste management (MSWM) personnel, waste collection and segregation, government finances, household education, waste characterization, government policy, technological and human resources, MSWM plan and administration, existence of a local recycling market, household economics and land availability.
Guerrero et al. (2012) have summarized some of the important factors affecting an effective waste management system. Waste management involves a large number of different stakeholders and the citizens along with the municipality are considered co-responsible for the task. An effective system combines technology with environmental, socio-cultural, legal, institutional and economic linkages to enable the overall system to function (ibid.). From a resource perspective, SWM requires resources in the form of skilled personnel, appropriate equipment, right infrastructure, proper maintenance and operation. There is a need for the financial support of the central government, the interest of the municipal leaders in waste management issues, the participation of the service users and the proper administration of the funds for a modernized sustainable system (Joshi and Ahmed, 2016).

The system needs to produce reliable data and to create proper information channels amongst the government bodies and enable decision-makers to make positive changes and develop integrated waste management practices. Education and research have played an important role in creating and analyzing data that can help strategy making in waste management (Guerrero et al., 2012).

**Techniques of waste disposal**

Ineffective disposal of solid waste is a major source of bottleneck for most economies. Some of the existing techniques for waste disposal have been identified by Bundela et al. (2010) and Asnani (2006). Open dumping is the most common method even though it is considered illegal and poses problems to residents and passers-by. In developing countries, the extent of waste disposed by open dumping is estimated between 60-90 percent (Khajuria et al., 2010). Composting is another technique which helps create an end product that is useful for enriching the soil quality and also reduces the amount of open waste in the vicinity. This
method creates opportunities for business solutions in managing organic waste and also creating a revenue stream from the sale of compost.

Landfilling is one of the most commonly used techniques in developing countries. If practiced unscientifically, this method can lead to contamination of the soil as well as groundwater. The harmful gases released can also cause an environmental hazard. In India, around 15 percent of the waste is land-filled. Sanitary landfills, commonly used in developed countries take care of the leachate release as well as harness the gases emanating from the landfill (Khajuria et al., 2010; Sharholy et al. 2008).

Incineration is also called ‘thermal treatment’. This method involves the burning of organic material and other substances and converts the waste into ash, particles and heat. There is a business opportunity in it as well. This heat can be used to generate electric power and the ash is used for productive purposes or simply landfilled. It is a contentious method mainly due to the release of harmful gaseous pollutants during the process. It is high in capital cost and maintenance cost and also needs proper segregation (Kaushal et al., 2012). However, newer technologies in this area are helping rename this technique as ‘Waste to Energy’ where the energy fraction is captured with minimal to no pollution (Brunner, 2002)

Recyclable materials such as paper, plastic, glass and metals are segregated from the waste and sent to recycling factories. While this is a desirable technique of waste management, only about 10-15 percent of waste in developing countries is recycled due to poor segregation techniques (Khajuria et al., 2010, Leverenz et al., 2002).

In gasification, the solid waste is incinerated in the absence of oxygen, thus producing fuel gas, part of which is diverted back to process and the remaining part is used to generate
electricity or sold as such. Segregation of waste is necessary in this process to remove certain types of waste to generate the optimum output. There are very few such incinerators in India (Kaushal et al., 2012).

Another technique is the bioreactor landfill which is a sanitary landfill that uses enhanced microbiological processes. These processes transform and stabilize the readily and moderately decomposable organic waste constituents within a relatively short period of bioreactor process implementation. The bioreactor landfill significantly increases the extent of organic waste decomposition, conversion rates and process effectiveness over what would occur in a regular sanitized landfill (Pacey et al., 1999). The solid waste can also be segregated and compressed into pellets and which can be used along with conventional fuel for industrial and domestic purposes (Sharholy et al. 2008).

**PRESENT STATE OF SWM INDUSTRY IN INDIA**

In India, solid waste in the city is managed by the Municipal Corporations. It is found that the growth in municipal solid waste in India is expected to go hand in hand with the increase in the GDP. It is reported in the MSW annual report of the CPCB for the year 2016-17 that MSW generated in India is about 49 million tons per annum or 135,000 tons per day (TPD) (CBCP, 2017). This figure is expected to reach 160.5 million tons per annum or 440,000 TPD by 2041.

Almost 90 percent of the MSWM budget in India is spent on waste collection and transport activities. Disposal of waste is still a problem for most municipalities and most of these activities happen through depositing of the waste in low lying areas outside the cities. This waste needs to be compacted and leveled and finally, the site needs to be covered with earth (Sharholy et al.,
In practice, the waste disposal activities are quite unscientific and potentially harmful to residents around the dumping area (Gupta et al., 1998).

Studies conducted by Sharholy et al. (2008); Zhu et al. (2008); Asnani (2006); Gupta et al. (1998) have revealed that starting with the first step of collection and storage, most urban areas either do not have adequate bins or else they are common for decomposable and non-decomposable waste. This leads to indiscriminate dumping of waste in a manner that is hazardous to the people as well as to the environment. Transfer and transport too suffer from similar inefficiencies. For example, the vehicles that collect the waste carry it directly to the dumping areas instead of taking it to the transfer stations, where segregation could be done. Further, the waste is transported in open trucks, leading to spillage of some of the waste onto the roads.

Joshi and Ahmed (2016) and Zhu et al. (2008), suggested that there is an immense scope for private sector participation in the field of solid waste management, which was so far believed to be the domain of agencies and bodies such as the municipal corporations. The study mentioned the advantages of having private sector participation as: (a) higher flexibility in terms of hiring and paying staff and faster decision-making, (b) increased efficiency in all areas including acquisition of equipment, spare parts and new technology backed by the ability to absorb all the cost involved in the activity, and (c) full accountability of performance and customer satisfaction which could also lead to performance incentives.

**Barriers to SWM in India**

Sharholy et al. (2008) pointed out the barriers in efficient SWM in India and suggested ways to improve the same, which mainly pointed at better efficiency and policy support. For example, the habit of segregating certain MSW at source and dispose it directly through the
informal network needs to be encouraged. There is a need for increased public awareness about the health hazards of waste and how to dispose it properly. The role of municipal authorities in collecting, storing, transporting and disposal of the waste needs to be improved. The study concluded that the lack of finance, infrastructure, data, planning and leadership needed to be improved substantially. Present municipalities are strained for all these resources leading to the inference that private sector participation could help in this area.

SWM is a complex task that needs to be backed by information about changes in the consumption and the waste production patterns. It also requires technological support, organizational skills and leadership, and cooperation among the different stakeholders. Urban bodies face challenges of collection, transportation, treatment and disposal at the operational level. It leads to the question of whether private sector participation could be a welcome addition to the scenario (Unnisa 2014).

Asnani (2008) found the apathy of municipal authorities and lack of community participation to be the most important causes for the issues plaguing SWM. There was a lack of attention and also the delegation of responsibility from municipalities leading to the downgrading of the activity of SWM itself. Lack of awareness and information among the public compounded the problem at the ground level leading to an increased burden on the already strained system.

A study conducted in Lebanon concluded that municipalities were ill-equipped to handle SWM due to lack of finances and adequate and suitable human resources (Massoud and El-Fadel, 2002). The introduction of the private sector in this area leads to increased performance efficiency and environmental benefits. The main reason for this was the ability of the private sector to reduce collection costs.
SWM INDUSTRY AS A PART OF THE EGS INDUSTRY

The SWM industry falls under the broad umbrella of the Environmental Goods and Services (EGS) industry. It provides goods and services to abate pollution or manage environmental resources and it has slowly become the core business of specialized private firms. Policymakers and governments are paying attention to it for, among other things, a significant number of jobs. The direct employment job creation of the EGS industry in the European Union is estimated at about 2.8 million and 3.4 million, respectively in 2004 and 2008. The EGS industry is also seen as a key ingredient of industrial competitiveness, trade advantage and social stability in the context of protection of environmental resources (Sinclair-Desgagne, 2008).

Bilsen et al., (2009) have mentioned that due to its potential impact on production processes throughout the entire economy, the EGS industry can have a strong potential leverage effect on other sectors of the economy as well. While the EGS industry does seem to have a major role in attaining policy objectives, studies in this area have been relatively less. Sinclair-Desgagne (2008) feels that there is an enhanced need to study this industry further for critical reasons. Studying the EGS industry can lead to a better understanding of compliance costs, which are complementary to enforcement costs. These compliance costs are determined by not only the cost of technology, but also on organizational design and capabilities. One can relate these costs to the prices polluters have to pay when they outsource abatement products and services, whose prices depend upon the structure of the EGS markets.

Secondly, it is needed to help advance environmental regulation and policy. Environmental regulation is one of the main drivers of demand for environmental goods and services. Each policy instrument, through its individual impact on demand for EGS, determines the size and number of competing environment firms. By this, it also influences the market prices of
environmental measures and the abatement efforts ensued by the polluters. In order to achieve the objectives of the environmental policy, regulatory designs would now require taking this into account (Sinclair-Desgagne, 2008).

Lastly, the EGS industry would help understand the concept of environmental innovation. Lanjouw and Mody (1996) observed that of all the global patents for abatement of pollution, a mere 20 percent came from polluters themselves. This indicated that the polluters may not be interested in researching into the abatement technology and that environmental innovation could become the domain of the EGS industry. For environmental innovation or eco-innovation to be widespread and transformational, it would have to be guided by the EGS industry backed by public support. This transition would be potentially threatening to the existence of many established traditional industries in their present forms and hence, would be strongly opposed by them. For this transition to take place, equally strong policy support would need to be provided to the EGS industry (Ekins, 2010).

**Factors determining growth of SWM Industry**

Different environmental products and services may be prioritized by economies, depending on the stage of development or the environmental pressures faced. Barton (1997) suggested that developed countries may prioritize energy efficiency, renewable energy and reduction of carbon dioxide emissions. Developing and particularly least developed countries will probably place a higher priority on investments in waste and wastewater management due to the pressures of increased urbanization and industrialization. As the economy records progress on the industrial development index, there may be a concomitant tightening in the environmental regulation and enforcement. These two factors drive the early market development of environmental goods and services. In most of the developed countries,
governments frequently employ further and more complicated economic incentives to drive green innovation (e.g.: tax incentives for industries to employ cleaner technologies and renewable energy) (Bucher et al., 2014).

In response to increasing regulations, the environment industry has grown rapidly since the 1980s. While the SWM industry was primarily burdened with the job of dealing with waste management and reduction strategies, it has also evolved into leading the way to innovation of cleaner production technologies. This move away from the ‘end-of-pipe’ solutions has created a North/South divide amongst the economies. The developed economies (the North) are more focused on creating better production techniques and the developing economies (the South) are tackling basic issues such as waste management. This has also created a market for developed economies to export technologies to the developing economies. In exchange, the developing economies export environmental services to the developed economies (Barton, 1997). For example, a developed economy could export SWM technology to a developing economy which would also process the solid waste of the developed economies.

**Demand as a driver for growth**

There exists a gap between the need for these SWM services and their actual market demand and profit potential in developing countries. This is mainly evident in the lack of environmental regulation or the lack of its implementation (Bucher et al., 2014).

Environmental regulation is a major driver of demand for environmental goods and services (Sinclair-Desgagne, 2008). This regulation could manifest in the form of a generic solar energy policy or a focused but critical intervention by the government to regulate a particular product that may be considered to be hazardous to the environment. For example, the movement of hazardous waste in the interests of protecting the health and the environment is
regulated by the Basel Convention\(^7\). It has also guided the development of associated environmental services to assist the process of movement of hazardous waste (Bucher et al., 2014).

Infrastructure environmental services, such as SWM, are commonly associated with governmental services. Municipal bodies are the main service providers for the two mentioned services. Nonetheless, there are examples of various modes of private sector participation through some schemes or partnerships such as Build-operate-transfer (BOT) schemes or public private partnerships\(^8\). Non-infrastructure environmental services, such as environmental consultancy services or eco-tourism, have seen the active presence of the private sector, mainly in the form of small and medium enterprises (SMEs). These enterprises frequently service other businesses providing related services, or deal with consumers directly as in the case of eco-tourism. The drive towards accepting and furthering innovation in SWM is dependent on the incentives such as tax benefits and subsidies in place for the private sector. These measures encourage the private sector firms to apply technologies to adjust production processes and for suppliers to produce relevant and affordable technologies and services (Bucher et al., 2014).

For the SWM industry, growth, competitiveness and performance are strongly linked to the policy agendas (including the environmental policy agenda). Regulations, that aim to reduce the negative environmental and social impacts, create business opportunities that allow for development of a whole new industry. Besides regulations, the SWM industry is driven by

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\(^7\) The Basel convention is an international treaty to regulate the movement of hazardous waste between countries. It focuses on reducing transfer of hazardous waste from developed nations to developing nations.

\(^8\) In Morocco, for instance, landfilling and waste management services are mostly provided by private companies, many of which are foreign-owned subsidiaries (Boucharab 2010)
technology, which can allow the above mentioned business opportunities to be exploited (Dervojeda et al., 2013).

**Green Strategy for growth**

There exists complexity of interactions within and across the value chain of eco industries. This is so due to the blurring of boundaries between traditional industries and the SWM industry and also, due to the emergence of a strong interdependence between the two. Regulation, where available and implemented, forces traditional industries to increasingly move towards green business strategies and adopt environmental technologies to improve resource efficiency and reduce pollution. This interdependence and convergence of the SWM industries and traditional industries is expected to increase even more in the future (Dervojeda et al., 2013).

To encourage the growth of the SWM Industry Dervojeda et al., (2013) have argued that the presence of a strong lead firm or a small group of such firms in the supply chain of the industry can retain control over the processes within it. If strong enough, they can be leaders in driving innovation as well. Lanjouw and Mody (2006) also suggest that there is a huge scope for environmental innovation for the SWM industry.

Lanjouw and Mody (1996) further argued that removal of barriers in the process of technology transfer can help develop the market for SWM Industry. This needs to be supported by the development of capital markets for these industries. There is also the need to bring in the scope for transfer of technology not only between firms but also between countries. In this respect, the heterogeneous implementation of the various regulations at a country level could become a potential hurdle. Even where countries have voluntarily agreed
on certain standards and procedures, the lack of a uniform implementation and enforcement can create a barrier.

Availability of adequate labour force is vital in this context. The technological progress and eco-innovations have led to the need for newer skills and skill levels. There is a need for an open global market for the free movement of such labour to enable the exploitation of the opportunities created by the new scenario. Increased global competition among the developed and developing economies can lead to an increased demand for the products, smoother and faster flow of technology as well as a value addition to existing products. Cost competition is another of the positive fallouts of increased competition. Strategic partnerships between traditional and eco industries can be aimed at tackling environmental issues. Greater awareness about evolving policies and legislation on the part of core EGS industries such as SWM industries can enable them to advise traditional industries on strategies to prepare for upcoming regulations. Technological stability can lead to SWM industries satisfying customers’ needs - for example, energy intensive traditional industries need stable energy supply and prices. Awareness about the SWM industries, their technologies and applications could help increase the competitiveness of both, the traditional as well as the SWM industries (Lanjouw and Mody, 1996).

Michael Porter (1991), in ‘Porter’s hypothesis’, argued that by providing incentives for environmentally friendly innovation, environmental regulations could result in international competitiveness of the economies as well as the firms. This can become possible with environmental regulations in place.

In the short run, stringent environmental regulations can negatively affect employment and productivity, particularly in pollution and energy intensive sectors (Jaffe et al., 1995).
However, in the longer run, government policies such as labour markets regulations can help reduce or offset these transitory impacts. Moreover, the social benefits of environmental regulations, in particular in terms of improved health, may present a beneficial cost-benefit outcome. Environmental regulations can promote innovation in clean technologies and discourage research and development in polluting technologies. This is also due to the fact that low-carbon innovations induce larger economic benefits than the ‘dirty’ technologies that they replace. Directed technological change can help offset the costs of environmental regulations and even encourage economic growth in some cases (Dechezlepretre and Sato, 2009). However, environmental regulation may not always be able to encourage the demand for EGS through the incentives route. In case of certain services, there may not be any existing demand. For example, sewage or waste water treatment may not be done out of sheer altruism. These are markets that would need to be created out of environmental regulations (Adlung, 2009).

**REGULATORY FRAMEWORK**

Environmental regulation needs to ensure that firms and households internalize the environmental impacts of their decisions, and indirectly, the social impacts. For this, policymakers have to choose the best regulatory instruments available to them and present them in the optimal mix. The regulatory instruments include ‘non-tax measures’ such as emission standards, ambient standards, technology requirements, liability rules, information-disclosure measures, emission trade permits and ‘tax measures’ such as green taxes, subsidies and investments. These instruments can also be classified into ‘command-and-control’ which are
prescriptive in nature, and ‘market-based’ (also called economic incentives) that allow for
greater flexibility in the way private actors can abate pollution (Sauvage, 2005).

While each of these measures has some drawbacks, together they can form a potent force in
combating the effects of pollution. Kosoden and Nicodeme (2009), Bradbaart (2007), Ligthart
(1998) and Wilson (1996) have stated that the ideal environmental policy consists of a
combination of command and control techniques along with economic incentives. Combining a
green tax policy with tax incentives would mean that the taxes collected could be used to help
provide an alternative to the polluting product, or at least reducing the polluting effect of the
polluting product by helping it in recycling or in converting it into another usable product (Gago
and Labandiera, 2000).

The current environmental regulation system may be inferior to a more market driven approach
to regulation in being able to reduce pollution in the future. Firstly, there is a loss of faith in the
government efficacy in this area and secondly, there have been great technological advances in
the SWM industry. It is also hoped that the technological innovations that the market is expected
to bring would lead to dynamic efficiency, which would be evident in cheaper SWM practices
and lower emissions (Ellerman, 1999).

As an emerging exporter of EGS, India has not been able to realize its full export potential in this
area. The growth of India’s exports of EGS was found to be negatively affected by the so-called
‘behind the border’ constraints, such as weak infrastructure and regulations. The effect of
explicit ‘beyond the border’ constraints, such as partner-countries’ tariff and exchange rate on
the exports of EGS was relatively less (Kalirajan and Nguyen, 2013).
Heyes (2000) highlighted the need for effective and strong enforcement of regulations. Enforcement is where “the rubber hits the road” and was a necessary prerequisite of well-designed regulations. For this, better understanding of the relationship between the enforcement agent and the firm would be considered imperative. Well-designed regulations can serve the purposes which can interest both society as well as businesses (Porter and van der Linde, 1995). The authors further argue that these regulations can help identify a potential resource inefficiency and scope for technological innovations. Regulations that focus on information gathering can lead to heightened corporate awareness about the extent of pollution and danger to the environment. They can create a sense of certainty about the area for which regulation exists. This can encourage investment in this area. They could build up positive pressure to encourage innovation and progress. This would be in addition to the traditional sources of pressure from strong competitors, alert customers and price of raw material. These regulations can help level the playing field for businesses during the transition to innovation-based solutions. They can provide a buffer until the innovations are accepted and become more economical. Since innovation cannot completely offset the cost of compliance, regulations can help plug the gap and improve the environmental quality.

Porter and van der Linde (1995) have also identified principles of regulatory design which can promote innovation, resource productivity and competitiveness. According to them, regulations need to focus on the processes and not the outcomes to encourage innovation. They need to be strict enough to promote process innovation rather than encourage end-of-pipe solutions. This would help improve resource productivity and competitiveness. They also need to be harmonized with the existing regulations in related fields. Also, the regulations need to convey a sense of stability and predictability by ensuring that they would be in place for a longer period. Market
incentives can be used to highlight resource inefficiencies. Incentives such as pollution charges, deposit-refund schemes and tradeable permits can serve this purpose. Developing regulations ahead of those in other economies can help improve the competitive advantage of local firms vis-à-vis foreign firms. Industry’s participation should be sought in matters such as designing phase-in periods, the content of regulations, and the most effective regulatory process. Finally, on the procedural front, regulation design needs to reduce time delay in granting permits, encourage self-regulation with periodic inspections and have rigid arbitration steps to discourage litigation.

Mani and Wheeler (1998) tested the proposition that heavy regulation in developed countries only helped in creating ‘pollution havens’ in those economies. They observed that the desirable alternative to imposing heavy and restrictive policies was to encourage activities that: (a) finance pollution control training, (b) help in transfer of cost effective pollution control technologies, and (c) help in transfer of information systems that regulate and disseminate information about the environment.

In India, the Solid Waste Management Rules have been issued in 2016 by the Ministry of Environment and Forests. Prior to that, the Municipal Solid Waste Management Rules, 2000 were in force. These rules lay down the procedure to handle solid waste but do not specify any particular method nor do they place the ultimate responsibility on municipal corporations to choose the best possible method. As a result, in spite of the available technology, municipal corporations prefer to use landfills to dispose solid waste. There are rules for disposal of solid waste at the bulk consumer level too, which are not strictly followed.
RESEARCH GAP

There exists literature on the EGS industry and on the SWM industry in particular. The literature has analyzed the requirement of a good SWM system, the factors affecting the success of such a system as well as the eco-system and stakeholders needed to make a SWM system effective. There are studies that critically examine the state of SWM in India regarding the composition of SWM, the state of the present system and barriers to its effectiveness. From a regulatory perspective, there is a branch of literature on the components that would encourage SWM including models such as the five-point model for Environmental Protection using regulatory instruments. These have been debated and discussed from a Pigovian perspective, where the roles of the market as well as the regulatory interventions have been advocated in differing measures. On the other hand, the Coasian school of thought has proposed the ‘market only’ approach, where transaction costs would not have a great impact on the overall activity of pollution reduction.

The role of SWM firms in improving the condition of SWM in an economy has been discussed in much lesser detail, and where done so, as a peripheral variable to the main aspects of the SWM system and its regulation. The business strategy perspective of such firms needs more exploration. In addition, there is a need to link the impact of environmental regulation and the policy to the working of these firms. This is important since these firms are instrumental in effecting the provisions of the policy. A large part of the success of best-intentioned policies depends on the way they are implemented and the SWM firms play a critical role in this implementation. This research has tried to fill this gap and attempts to explore the role of the environmental policy on the working of SWM firms and in turn, the effect on the overall environment. It tries to understand how the SWM industry perceives the existing policy and
looks for suggestions for improving the policy. The literature on sustainable businesses and technological aspect of SWM has not been focused upon in detail as the aim was to look at the policy aspect of these businesses. The review of literature has concentrated upon the activity of management of solid waste and the environmental policy as a whole, with emphasis on the policy related to SWM.

**CONCEPTUAL FRAMEWORK**

The conceptual framework for this study is drawn from established work such as that of Kosoden and Nicodeme (2009), Bradbaart (2007), Kolstad (2000), Blackman and Harrington (2000), Ligthart (1998) and Wilson (1996). The focus of most of these works has been that there is no single way to tackle the environmental problem but instead it needs a coordinated effort. The multiple measures to tackle the problem have been identified in the literature review and are diagrammatically represented as under:

![Conceptual Framework Diagram]

The nature of environmental taxation and emission fees that can be applied in different scenarios would be different (Pigou, 1920; Sandmo, 1975). In India, the application of environmental taxation is limited. While it is present in case of usage of plastic bags, it may shift the usage to
bags of other material, which may create a different environmental problem (Rebeiz and Craft, 1995; Scarlett, 1991).

Pollution permits have been studied under the concept of marketable instruments as an incentive to reduce pollution. Voluntary negotiation was the base of the Coase theorem (Coase, 1960), which states that initial distribution of polluting rights is of no consequence. Market mechanism would ultimately lead to the optimal option. Currently, there is no agreement in force to take care of the solid waste problem at the producer’s level. Incentives and subsidies have also been studied and were generally found to be inefficient. However, there are studies that acknowledge an undeniable place for these measures as part of a composite package [Kolstad, 2000; Blackman and Harrington, 2000]. For example, there are income tax incentives for a large number of other activities such as setting up infrastructure (roads, highways, ports, etc.), donations to educational institutions, and for managing bio-degradable waste. However, there are no specific incentives for solid waste management. Two major sub-components of environmental policy viz. non-tax policy measures and green tax policies are discussed below:-

**Non-Tax Policy Measures**

Traditionally, the approach to environmental protection through policy has been through market centric measures such as pollution permits or through command and control methods such as regulations and standards. The governments also intervene frequently by imposing green taxes on polluters and using these collections to provide a benefit to certain sections of the society by reducing taxes on salaries or, for poverty reduction [Goulder, 2013; Bento and Jacobsen, 2007; Williams, 2002; Blackman and Harrington, 2000; Ligthart, 1998; Sandmo, 1975]. The different policy measures are outlined as under:
• **Regulations and Standards:** Also called ‘command and control’ measures, regulations and standards include bans and restrictions. Regulations could be counterproductive due to their compulsory and restrictive nature, which may induce polluters to circumvent the regulations (Ishikawa et al., 2012). With direct regulation, a polluting company has no incentive to pollute lesser than the permissible limit. Informational costs being high, can make the command and control system more expensive and the polluter also has an incentive to misreport information. These also significantly reduce the incentive to innovate and find other ways of reducing pollution (Blackman and Harrington, 2000; Kolstad, 2000). The extent of hidden environmental regulation compliance costs can be almost eight to nine times the reported costs. The reasons for these costs staying invisible are mainly systemic and the difficulty in estimation of these costs (Joshi et al., 2001). Moreover, public sentiment generally leans more towards economic development than environmental protection by using these measures (Blackman and Harrington, 2000).

• **Pollution permits:** These are part of a set of economic instruments to help control pollution and allow the polluter to buy and sell the right to pollute. However, the challenge with pollution permits is to achieve environmental transformation without being too complex and impractical. The actual trading may not take place unless polluters have faith in the monitoring system (Blackman and Harrington, 2000). This instrument also encounters political roadblocks as the level of the fee needs to be changed over time, which is usually resisted by industry (Kolstad, 2000).

• **Voluntary Negotiations:** Moral pressure from the governments or society on industry has increased, leading to some change in the polluting patterns. However, this method is largely voluntary and depends to a great extent on the individual polluter. The Coase
theorem states that the initial distribution of polluting rights does not matter and market mechanism would ultimately lead to a pareto optimal\(^9\) condition. It is seen that bilateral negotiations are motivated by this principle (Coase, 1960). However, the theorem assumes that among other things, there is perfect information, the legal system for enforcing agreements is costless and there are no transaction costs. Owing to the non-realistic nature of these assumptions, the negotiations are difficult to conclude or implement. Looking at the theorem from another angle, it implies that governments need to limit or reduce transaction costs so that market forces can take over (Todarova, 2007). This perspective also makes it difficult to view negotiations from an implementable viewpoint. Pollution abatement through this measure may also incentivize free riders and may affect the very stability of the coalition (Nagashima et al., 2011).

Green Taxes

Green Tax policies can be broadly viewed in two ways: 1) the imposition of taxes on the polluting activities to ensure the reduction or stoppage of those activities and, 2) the tax incentivizing the non-polluting activities (negative taxation) to make them financially more attractive than the polluting ones.

- **Green Taxes**: The primary role of any taxation system is to raise revenue to fund the general functions of the government. A related important policy objective is also to enhance the overall economic well-being while promoting fairness at the same time. Taxes can broadly be categorized as direct and indirect\(^{10}\).

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9 Pareto optimality or Pareto efficiency is that state of allocation of resources where it is not possible to make an individual better off without worsening the economic situation of another individual.

10 Direct taxes are those which are paid directly to the government by the persons on whom they are imposed. Examples of these are Income tax and Wealth tax. Indirect taxes are taxes such as VAT and Central Excise which
On the role that can be played by taxes in environmental protection, A.C. Pigou (1920) stated that pollution creates negative externalities and the same could be internalized into the market by imposing a tax on the polluters equal to the marginal social cost of the pollution. The focus was entirely on the ‘polluter pays’ principle. Taxes that attempt to internalize the negative externalities caused by pollution have come to be known as the Pigouvian taxes or the environmental taxes or the ‘green taxes’\textsuperscript{11}. These are mainly indirect taxes, occurring at the stages of production and/or sales. Taxes on production and sale of petroleum products and plastic products are examples of such taxes.

Goulder (2013), Markandya et al. (2013), Bento and Jacobsen (2007), Williams (2002), Bovenberg (1999), Schob (1996), Parry (1995), Goulder (1995) among others have emphasized that one of the major advantages of the green tax theory is the ‘double dividend’ hypothesis\textsuperscript{12}, which implies that the tax policies can be revenue neutral in form. This happens by taxing polluting activities and using the increased revenues to offset a reduction in taxes on salaries under specific conditions.

The concept of double dividend can be critically analyzed in such a manner so that the cost and benefit of this concept can be understood. While governments can collect taxes from the polluting producers, these taxes still need to be ploughed back into the economy in a beneficial way. If the collected taxes are channelized back by way of reduced salary

\begin{footnotesize}
\textsuperscript{11}Here, this concept also includes emission fees where the producer pays a fee to the government on the basis of carbon or other harmful emissions arising from the production activity.

\textsuperscript{12}The double dividend hypothesis suggests that increasing taxes on polluting activities provides two kinds of benefits or dividends. One is in the form of raising more revenue for the government which can help reduce other taxes such as income tax on salaries (green dividend) and the other is an increase in environmental quality (efficiency dividend).
\end{footnotesize}
or wage taxes, there would be a compensation or relief for the consumer for having paid a higher green tax (Schob, 1996; Sandmo, 1975). This move of reducing salary taxes would put more money into the hands of the consumer, thus encouraging the search for better and more environmental friendly alternatives. The taxes could also be collected explicitly as environmental taxes to help improve the environment and not be diverted to other uses such as the one above (Gago and Labandeira, 2000).

Green taxes have its shortcomings too. These taxes would be ultimately borne by the consumer, irrespective of the level of income. As a result, the poor tend to pay more taxes as a percentage of their total income. If lower income groups spend a greater portion of their income on products with external social costs, such as electricity, tax is perceived as regressive (Eskeland and Kong, 1998). Secondly, like all indirect taxes, green taxes can also encourage smuggling and black market activities, especially if there are large differences in product prices with those in nearby areas (Okoye and Akenbor, 2010; Blackman and Harrington, 2000). Thirdly, in a developing country such as India, less than three percent of the population pay income tax and a portion of these taxpayers are salaried tax payers. Most of these tax payers do not belong to the 'poorest of the poor' section of the population. So there is a contradictory implication of this tax on the poor. While they are paying the green taxes, they are not able to receive any benefit of this tax redistribution.

From an implementation perspective, there is a public resistance to increase in green/carbon taxes in most countries that make this step politically unpopular as compared to some of the other measures discussed in the study (Jagers and Hammar, 2009). A green
tax may reduce emissions in total but not necessarily emissions per unit of production (Blackman and Harrington, 2000).

- **Incentives and Subsidies**: Incentives such as subsidy schemes for reducing emissions, soft loans to buy capital equipment, etc. have proved equally effective in reducing pollution (Ligthart, 1998). These incentives or benefits could also be in the form of specific deductions, which directly relate to conservationist activities, as opposed to general deductions, which could be taken advantage of by all industries (Douglas, 2002). Traditionally, tax incentives have mostly been to encourage supply, as mentioned above. They could also be used to encourage demand for environment friendly machines, products, energy\(^{13}\), etc. (Mann and Hymel, 2006). A large number of economically and socially desirable policies in India are implemented by way of tax incentives to invest in them\(^{14}\).

Levi and Nault (2004) found that in certain cases, a uniform lump-sum incentive is preferable to output-based variable incentives. This is mainly because it is easier and economical to collect information about the conversion of the plant’s technology instead of constantly monitoring the output of the plant.

Each of these regulatory instruments has a specific impact on the price elasticity of the polluters’ demand for abatement services. This price elasticity in turn, affects the market power of the SWM industry and the cost of abatement. Hence, the environmental policy needs to take into

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\(^{13}\)For example, a household investing in solar water heaters could well be given rebates in their regular electricity bills, as is being done in some parts of India.

\(^{14}\)For example, businesses are encouraged to buy new machinery instead of old ones and drive the indigenous machine production industry. They are offered additional depreciation under section 32 of the Income Tax Act to compensate them for their decision to buy new machinery (Income Tax Act, 1961).
consideration the role of the SWM industry in leading the innovation in abatement services (David and Sinclair-Desgagne, 2005).

Due to the paucity of literature in this area, this study tries to explore the specific components required in the environmental policy framework to tackle the issue of SWM in India by studying the linkage between policy and firms in the SWM area.

**OBJECTIVES**

Based on the literature review and the conceptual framework, the objectives of this exploratory study are as under:

1. To understand the background and context of the SWM and SWM firms in India
   - How is SWM perceived in India?
   - What are the features of the ecosystem of SWM in India?
   - How are SWM firms managing their operation in the current scenario?

2. To understand the process technique issues related to the SWM firms in India
   - What are the process and Research and Development (R&D) related challenges faced by the firms in this industry?
   - How are new inventions and developments helping firms overcome these challenges?
   - What are the features of a good eco system in SWM that can help in advancing technology in this area?

3. To understand the linkage between environmental policy and SWM industry
   - What are the existing policies applicable to SWM Industry?
• How do current policies affect the working of the industry?
• What are the challenges of environmental policies faced by the industry?
• What are the policy related suggestions of these firms that can help the SWM industry as well as help create positive externalities?