Developing Integrated Solid Waste Management Plan

Training Manual

Volume 4: ISWM Plan

United Nations Environment Programme

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Volume 4

ISWM Plan

Compiled by

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Preface

Rapid increase in volume and types of solid and hazardous waste as a result of continuous economic growth, urbanization and industrialization, is becoming a burgeoning problem for national and local governments to ensure effective and sustainable management of waste. It is estimated that in 2006 the total amount of ***municipal solid waste*** **(MSW)** generated globally reached 2.02 billion tones, representing a 7% annual increase since 2003 (Global Waste Management Market Report 2007). It is further estimated that between 2007 and 2011, global generation of municipal waste will rise by 37.3%, equivalent to roughly 8% increase per year. Based on incomplete reports from its participants, The Basel Convention estimated that about 318 and 338 million tons of ***hazardous and other waste*** were generated in 2000 and 2001 respectively. ***Healthcare waste*** is classified as a sub-category of hazardous wastes in many countries. As per WHO estimations, the total health-care waste per person per year in most low-income countries, is anywhere from 0.5 kg to 3 kg. There is no estimate about *global industrial wastes generation*. The US EPA estimates that, American industrial facilities generate and dispose off approximately 7.6 billion tons of non-hazardous industrial solid waste each year. The EU estimated that its 25 member states produce 700 million tons of ***agricultural waste*** annually. **Waste Electrical and Electronic Equipment (WEEE) or *E-waste*** is also one of the fastest growing waste streams and it equals to 1% of total solid waste on an average in developing countries. It is expected to grow to 2% by 2010.

Although considerable efforts are being made by many Governments and other entities in tackling waste-related problems, there are still major gaps to be filled in this area. The World Bank estimates that in developing countries, it is common for municipalities to spend 20-50 percent of their available budget on solid waste management (open dumping with open burning is the norm), even though 30-60 percent of all the urban solid wastes remain uncollected and less than 50 percent of the population is served. . In low-income countries, collection alone drains up 80-90 percent of municipal solid waste management budget. In mid-income countries, collection costs 50-80 percent of total budget. In high-income countries, collection only accounts for less than 10 percent of the budget, which allows large funds to be allocated to waste treatment facilities. Upfront community participation in these advanced countries reduces the collection cost and facilitates waste recycling and recovery.

Hence, developing countries face uphill challenges to properly manage their waste with most efforts being made to reduce the final volumes and to generate sufficient funds for waste management. If most of the waste could be diverted for material and resource recovery, then a substantial reduction in final volumes of waste could be achieved and the recovered material and resources could be utilized to generate revenue to fund waste management. This forms the premise for **Integrated Solid Waste Management (ISWM) system based on 3R (reduce, reuse and recycle) principle.** ISWM system has been pilot tested in a few locations (Wuxi, PR China; Pune, India; Maseru, Lesotho) and has been well received by local authorities. It has been shown that with appropriate segregation and recycling system significant quantity of waste can be diverted from landfills and converted into resource.

Developing and implementing ISWM requires comprehensive data on present and anticipated waste situations, supportive policy frameworks, knowledge and capacity to develop plans/systems, proper use of environmentally sound technologies, and appropriate financial instruments to support its implementation.

Many national governments, therefore, have approached UNEP, [as reflected in the decision taken by the UNEP Governing Council/Global Ministerial Environment Forum during its 25th Session in February 2009 (UNEP/GC.25/CW/L.3)] to get further support for their national and local efforts in implementation of the Integrated Solid Waste Management (ISWM) programme.

In response to this decision and in line with the Bali Strategic Plan for Capacity Building and Technology Transfer, UNEP has developed a programme on integrated solid waste management. This programme includes support for capacity building and technology transfer for ISWM through a number of actions:

1. Guidelines to develop ISWM System: The four sets of guidelines on ISWM covering waste characterization and quantification, assessment of current waste management system, target setting and identification of stakeholders' issues of concern for ISWM, and how to develop ISWM Plan.
2. Pilot projects on ISWM and emerging waste streams including E-waste, waste agricultural biomass, waste plastics and so on
3. Regional and sub-regional training for policy makers and experts on ISWM and emerging waste streams
4. Interactive advisory support on ISWM and emerging waste streams

This document is the *fourth* and last of the four sets of guidelines on ISWM. It focuses on how to develop an ISWM Plan by utilizing the information collected and generated with the help of the previous three sets of the guidelines. This document could also be used as a stand alone document to build the capacity of experts and policy makers on planning for ISWM.

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ACRONYMS

AHP	Analytical Hierarchy Process
ASL	Automated Side Loaders
APC	Air Pollution Control
BEI CHP & RS	The bei cellulose hydrolysis process and reactor system
BMT	Biological and Mechanical Treatment
BMW	Bio-Medical Waste
BOT	Build-operate-transfer
C&D	Construction and Demolition
CDM	Clean Development Mechanism
CD-ROM	Compact Disc Read-Only Memory
CIWMB	California Integrated Waste Management Board
C.L	Confidence Level
CO2	Carbon Dioxide
CRT	Cathode Ray Tube
CRV	California Redemption Value
CV	Calorific Value
DEPA	Danish Environmental Projection Agency
DKK	Danish Krone
DPSIR	Driving force - Pressure - State - Impact - Response
DTIE	Division of Technology, Industry and Economics
EIA	Environmental Impact Assessment
EMC	Environmental Management Centre
EnRA	Environmental Risk Assessment
EPA	United States Environmental Protection Agency
EPR	Extended Producer Responsibility
ESTs	Environmentally Sound Technologies
E-Waste	Electronic Waste
EWC	European Waste Catalogue
FOB	Free on Board
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GIS	Geographic Information System
GPS	Global Positioning System
HCl	Hydrogen Chloride
HDPE	High Density Polyethylene
HW	Hazardous Waste
IETC	International Environmental Technology Centre
ISWM	Integrated Solid Waste Management
ISWMP	Integrated Solid Waste Management Plan
IT	Information Technology
IWPM	Integrated Waste Management Plan
KPIs	Key Performance Indicators
LPB	Liquid Paper Board
LR	Landfill Rate
LWAC	Landfill Waste Acceptance Criteria
MB	Megabytes

MBT	Mechanical and Biological Treatment
MC	Moisture Content
MCDM	Multi Criteria Decision Making
MEAs	Multilateral Environmental Agreements
MF	Multi Family residence
MRF	Materials Recovery Facility
MSW	Municipal Solid Waste
MSWM	Municipal Solid Waste Management
NGOs	Non-governmental Organizations
NIMBY	Not-in-my-backyard
O&M	Operations and Maintenance
ODS	Ozone Depleting Substances
OECD	Organisation for Economic Co-operation and Development
PAYT	Pay as You Throw
PE	Polyethylene
PET	Polyethylene Terephthalate
PIC	Project Implementation Committee
PMC	Pune Municipal Corporation
PP	Polypropylene
PPE	Personal Protective Equipment
PRC	People's Republic of China
PS	Polystyrene
PS	Private Sector
PSP	Private Sector Participation
PVC	Polyvinyl Chloride
RAM	Random Access Memory
RDF	Refuse Derived Fuel
RPPC	Rigid Plastic Packaging Containers
SAT	Sustainability Assessment of Technologies
SF	Single Family residence
SP	Strategic Planning
SWAP	Solid Waste Analysis Protocol
SWM	Solid Waste Management
SWOT	Strengths, Weaknesses, Opportunities and Threats
3R	Reduce, Reuse and Recycle
UNEP	United Nations Environment Programme
USD	The United States Dollar
WCV	Waste Collection Vehicle
WGF	Waste Generation Factors
WND	Wuxi New District, People's Republic of China
WTE	Waste-to-Energy
WWTP	Wastewater Treatment Plant

Glossary

- ✓ **Aerobic composting** - a method of composting organic wastes using bacteria that needs oxygen (aerobic bacteria). This requires that the waste be exposed to air, either via turning or by forcing air through perforated pipes that pass through the material.
- ✓ **Anaerobic digestion** - a method of composting that does not require oxygen. This composting method produces methane. Also known as anaerobic composting.
- ✓ **Ash** - the non-combustible, solid by-product of incineration or other combustion process.
- ✓ **Autoclaving** - sterilisation via a pressurized, high-temperature steam process.
- ✓ **Baghouse** - a combustion plant emission control device that consists of an array of fabric filters through which flue gases pass in an incinerator flue. Particles are trapped and thus prevented from passing into the atmosphere.
- ✓ **Basel Convention** - an international agreement on the control of trans-boundary movements of hazardous wastes and their disposal, drawn up in March 1989 in Basel, Switzerland, with over 100 countries as signatories.
- ✓ **Biodegradable material** - any organic material that can be broken down by micro-organisms into simpler, more stable compounds. Most organic wastes (e.g., food, paper, etc.) are biodegradable.
- ✓ **Bio-Medical Waste (BMW)** - also known as Medical or Clinical Waste and normally refers to waste products produced from healthcare premises such as hospitals, dispensaries etc. It is also known as Health Care Waste; however in this report it is referred to as Bio-Medical Waste.
- ✓ **Bottom ash** - generally, a toxic residue of incineration that accumulates on the grate of the furnace and is relatively coarse and non-combustible.
- ✓ **Bulky waste** - large wastes (such as appliances, furniture, trees and branches, etc.) that cannot be handled by normal MSW processing methods.
- ✓ **Capacity Building** - refers to activities that strengthen an organization or an individual and helps fulfil its mission better. Capacity building is often regarded as the assistance provided to the entities which have a need to develop certain skills or competence, or for general upgrading of performance ability. These activities include, among others, strategic planning, technology upgrades, operational improvements, and board development.
- ✓ **Cell** - the basic unit by which a landfill is developed. It is the general area where incoming waste is tipped, spread, compacted, and covered.
- ✓ **Cleaner production** - processes designed to reduce the wastes generated by production.
- ✓ **Co-disposal** - the disposal of different types of waste together in one area of a landfill or dump. For instance, sewage sludge may be disposed off with regular solid wastes.
- ✓ **Cogeneration** - production of both electricity and steam from one facility, from the same fuel source.

- ✓ **Collection** - the process of picking up wastes from residences, businesses, or a collection point, loading them into a vehicle, and transporting them to a processing, transfer, or disposal site.
- ✓ **Combustibles** - inflammable materials in the waste stream, including paper, plastics, wood, food and garden wastes.
- ✓ **Combustion** - in MSWM, the burning of materials in an incinerator.
- ✓ **Commingled** - mixed recyclables that are collected together after having been separated from mixed MSW.
- ✓ **Communal collection** - a system wherein individuals bring their waste directly to a central point for collection.
- ✓ **Communication** - a task of getting specific information or ideas across the people not as learners but as a target audience.
- ✓ **Compactor vehicle** - a collection vehicle using high-power mechanical or hydraulic equipment to reduce the volume of solid waste.
- ✓ **Composite liner** - a liner system for a landfill consisting of an engineered soil layer and a synthetic sheet of material.
- ✓ **Compost** - the material resulting from composting. Also called humus, it is a soil conditioner.
- ✓ **Composting** - biological decomposition of solid organic materials by bacteria, fungi, and other organisms into a soil-like product.
- ✓ **Construction and Demolition (C&D)** - C&D waste includes all wastes arising from construction/building industry and demolition/destruction activities (either by man or the environment)
- ✓ **Construction and demolition debris** -waste generated by construction and demolition of buildings, such as bricks, concrete, drywall, lumber, miscellaneous metal parts and sheets, packaging materials, etc.
- ✓ **Controlled dump** - a planned landfill that incorporates, to some extent, some of the features of a sanitary landfill: siting with respect to hydro-geological suitability, grading, compaction in some cases, leachate control, partial gas management, regular (not usually daily) cover, access control, basic recordkeeping, and controlled scavenging.
- ✓ **Curing** - allowing partially composted materials to reside in a pile for a specified period of time as part of the maturing process in composting.
- ✓ **Disposal** - the final handling of solid waste, following collection, processing, or incineration. Disposal most often means placement of wastes in a dump or a landfill.
- ✓ **Diversion rate** - the proportion of waste material diverted for recycling, composting, or reuse and away from landfilling.
- ✓ **Drop-off centre** - an area or facility for receiving compostables or recyclables that are dropped off by waste generators.
- ✓ **Dump** - see *Controlled dump* and *Open dump.*

- ✓ **Electronic Waste (E-Waste)** - a waste type consisting of any broken or unwanted electrical or electronic appliance. It is a point of concern, considering that many components of such equipment are considered toxic, and are not biodegradable.
- ✓ **Emissions** - gases released into the atmosphere.
- ✓ **Energy recovery** - the process of extracting useful energy from waste, typically from the heat produced by incineration or via methane gas from landfills.
- ✓ **Environmental impact assessment (EIA)** -an evaluation designed to identify and predict the impact of an action or a project on the environment, human health and well being. It can include risk assessment as a component, along with economic and land use assessment.
- ✓ **Environmental risk assessment (EnRA)** - an evaluation of the interactions between agents, humans, and ecological resources. It comprises of human health risk assessment and ecological risk assessment, typically evaluating the probabilities and magnitude of harm that could come from environmental contaminants.
- ✓ **Fabric filter** - see *Baghouse.*
- ✓ **Flaring** - the burning of landfill gas/methane captured and emitted from collection pipes at a landfill.
- ✓ **Fluidized-bed incinerator** - a type of incinerator in which the stoker grate is replaced by a bed of limestone or sand that can withstand high temperatures. The heating of the bed and the high air velocities used, cause the bed to bubble, which gives rise to the term “fluidized”.
- ✓ **Fly ash** - a highly toxic particulate matter captured from the flue gas of an incinerator by the air pollution control system.
- ✓ **Garbage** - also called refuse in everyday usage. Although not common, some MSWM manuals use garbage to mean “food wastes”.
- ✓ **Groundwater** - water beneath the earth’s surface that fills underground pockets (known as aquifers), supplying wells and springs.
- ✓ **Goals** - Specific, discrete aims that define accomplishment of the vision and mission.
- ✓ **Hazardous Waste (HW)** - a waste that poses substantial or potential threats to public health or the environment generally exhibiting one or more of these characteristics: ignitable, oxidizing, corrosive, eco-toxic, radioactive, etc. Such wastes arising from industries are called as Industrial Hazardous Waste.
- ✓ **Heavy metals** - metals of high atomic weight and density that are toxic to living organisms, such as mercury, lead, and cadmium.
- ✓ **Household hazardous waste** - products used in residences that are toxic to living organisms and/or the environment, such as paints and some cleaning compounds.
- ✓ **Humus** - the end product of composting. Also called compost.
- ✓ **Incineration** - the process of combusting solid waste under controlled, approximately stoichiometric conditions to reduce its weight and volume, and often to produce energy. In combustion chemistry, the condition whereupon the quantity of oxygen provided to the

combustion process is exactly that needed to completely oxidise all carbon in the fuel to carbon dioxide.

- ✓ **Informal sector** - the part of an economy that is characterized by private, usually small-scale, labour-intensive, largely unregulated, and unregistered manufacturing or provision of services.
- ✓ **Inorganic waste** - waste composed of material other than plant or animal matter, such as sand, dust, glass, and many synthetics.
- ✓ **Integrated Solid Waste Management (ISWM)** - ISWM refers to a strategic initiative for the sustained management of solid waste through the use of a comprehensive integrated format generated through sustained preventive & consultative approach to the complementary use of a variety of practices to handle solid waste in a safe and effective manner.
- ✓ **International NGO** - an organisation that has an international headquarters and branches in major world regions, often with the purpose of undertaking development assistance.
- ✓ **In-vessel composting** - composting in an enclosed vessel or drum with a controlled internal environment, mechanical mixing, and aeration.
- ✓ **Itinerant waste buyer** - a person who moves around the streets buying (or bartering for) reusable and recyclable materials.
- ✓ **Kerbside collection** - collection of compostables, recyclables, or trash at the edge of a sidewalk in front of a residence or a shop.
- ✓ **Key Performance Indicators (KPIs)** - parameters that provide a meaningful, concise, overall picture of an organization's performance or that of the project/programme, used to report progress that is chosen to reflect the critical success factors of a program or plan. The KPI's reflect long-term considerations.
- ✓ **Landfill gases** - gases arising from the decomposition of organic wastes; principally methane, carbon dioxide, and hydrogen sulphide. Such gases may cause explosions at landfills.
- ✓ **Landfilling** - the final disposal of solid waste by placing it in a controlled fashion in a place intended to be permanent. The term is applied to both controlled dumps and sanitary landfills.
- ✓ **Leachate** - liquid (which may be partly produced by decomposition of organic matter) that has seeped through a landfill or a compost pile and has accumulated bacteria and other possibly harmful dissolved or suspended materials. If uncontrolled, leachate can contaminate both groundwater and surface water.
- ✓ **Leachate pond** - a pond or tank constructed at a landfill to receive the leachate from the area. Usually the pond is designed to provide some treatment of the leachate, by allowing settlement of solids or by aeration to promote biological processes.
- ✓ **Lift** - the completed layer of compacted waste in a cell at a landfill.
- ✓ **Liner** - a protective layer, made of soil and/or synthetic materials, installed along the bottom and sides of a landfill to prevent or reduce the flow of leachate into the environment.
- ✓ **Manual landfill** - a landfill in which most operations are carried out without the use of mechanized equipment.

- ✓ **Market waste** - primarily organic waste, such as leaves, skins, and unsold food, discarded at or near food markets.
- ✓ **Massburn incinerator** - a type of incinerator in which solid waste is burned without prior sorting or processing.
- ✓ **Materials recovery** - obtaining materials that can be reused or recycled.
- ✓ **Materials recovery facility (MRF)** - a facility for separating commingled recyclables by manual or mechanical means. Some MRFs are designed to separate recyclables from mixed MSW. They then bale and market the recovered materials.
- ✓ **Methane** - an odourless, colourless, flammable, explosive gas, CH4, produced by anaerobically decomposing MSW at landfills.
- ✓ **Microenterprise** - a synonym for small-scale enterprise: a business, often family-based or a cooperative that usually employs fewer than ten people and may operate "informally".
- ✓ **Mission** - defines where the organisation is headed now, the purpose and the reason for its existence. It concentrates on the present, defines the stakeholders, critical processes and it informs you about the desired level of performance.
- ✓ **Mixed waste** - unsorted materials that have been discarded into the waste stream.
- ✓ **Modular incinerator** - a relatively small type of pre-fabricated solid waste combustion unit.
- ✓ **Monofill** - a landfill intended for one type of waste only.
- ✓ **Municipal Solid Waste** (**MSW**) - a waste type that predominantly includes household waste (domestic waste), except industrial and agricultural wastes, with sometimes the addition of commercial wastes collected by a municipality within a given area. The C & D debris and special wastes like hazardous wastes – usually not categorized under MSW - may also enter the municipal waste stream to an extent. It is sometimes also defined to mean all solid wastes that a city authority accepts responsibility for managing in some way.
- ✓ **Municipal solid waste management (MSWM)** - planning and implementation of systems to handle MSW.
- ✓ **NGO** – non-governmental organisation. May be used to refer to a range of organizations, from small community groups to national and international organizations. Frequently these are not-for-profit organizations.
- ✓ **Nightsoil** - human excreta.
- ✓ **NIMBY** - "Not In My Back Yard". An expression of resident opposition to the siting of a solid waste facility based on the particular location proposed.
- ✓ **Objectives** - specific, concrete, quantifiable, realistic statements that measure the accomplishment of a goal over a specified period of time (2 to 3 year time frame).
- ✓ **Open dump** - an unplanned "landfill" that incorporates few, if any, of the characteristics of a controlled landfill. There is typically no leachate control, no access control, no cover, no management, and many scavengers.

- ✓ **Organic waste** - technically, waste containing carbon, including paper, plastics, wood, food wastes, and yard wastes. In practice, the term is often used in a more restricted sense to mean material that is more directly derived from plant or animal sources, and which can generally be decomposed by micro-organisms.
- ✓ **Pathogen** - an organism capable of causing a disease.
- ✓ **Pollution** - the contamination of soil, water, or the atmosphere by the discharge of waste or other polluting materials.
- ✓ **Post-consumer materials** - materials that a consumer has finished using, and which may be sold, given away, or be discarded as wastes.
- ✓ **Primary material** - a commercial material produced from virgin materials used for the manufacture of basic products. Examples include wood pulp, iron ore, and silica sand.
- ✓ **Privatization** - a general term referring to a range of contracts and other agreements that transfer the provision of some services or production from the public sector to private firms or organizations.
- ✓ **Processing** - preparing MSW materials for subsequent use or management, using processes such as baling, magnetic separation, crushing, and shredding. The term is also sometimes used to mean separation of recyclables from mixed MSW.
- ✓ **Producer responsibility** - a system in which a producer of products or services takes responsibility for the waste that results from the products or services marketed, by reducing materials used in production, making repairable or recyclable goods, and/or reducing packaging.
- ✓ **Putrescible** - subject to decomposition or decay. Usually used in reference to food wastes and other organic wastes that decay quickly.
- ✓ **Pyrolysis** - chemical decomposition of a substance by heat in the absence of oxygen, resulting in the production of various hydrocarbon gases and carbon-like residue.
- ✓ **Recyclables** - items that can be reprocessed into feedstock for new products. Common examples are paper, glass, aluminium, corrugated cardboard and plastic containers.
- ✓ **Recycling** - the process of transforming materials into raw materials for manufacturing new products, which may or may not be similar to the original product.
- ✓ **Refuse** - a term often used interchangeably with solid waste.
- ✓ **Refuse-derived fuel (RDF)** – solid fuel produced from MSW that has undergone processing. Processing can include separation of recyclables and non-combustible materials, shredding, size reduction, and palletising.
- ✓ **Resource recovery** - the extraction and utilisation of materials and energy from wastes.
- ✓ **Reuse** - the use of a product more than once in its original form, for the same or a new purpose.
- ✓ **Rubbish** - a general term for solid waste. Sometimes used to exclude food wastes and ashes.

- ✓ **Sanitary landfill** - an engineered method of disposing off solid waste on land, in a manner that meets most of the standard specifications, including sound siting, extensive site preparation, proper leachate and gas management and monitoring, compaction, daily and final cover, complete access control, and recordkeeping.
- ✓ **SAT methodology** - a tiered approach to assess the feasibility of a technology with respect to economic, environmental and social aspects. The technique used for assessment is participatory and requires inputs from the users. However the data requirements gradually increase for a select few technologies which do not get eliminated during the initial stages of assessment.
- ✓ **Scavenger** - a person who picks out recyclables from mixed waste wherever it may be temporarily accessible or disposed off.
- ✓ **Scheme** - is an elaborate and systematic plan of action, it is an internal representation of the world; an organisation of concepts and actions that can be revised by new information about the world.
- ✓ **Scrubber** - emission control device in an incinerator, used primarily to control acid gases, but also to remove some heavy metals.
- ✓ **Secondary material** - a material recovered from post-consumer wastes for use in place of a primary material in manufacturing a product.
- ✓ **Secure landfill** - a disposal facility designed to permanently isolate wastes from the environment. This entails burial of the wastes in a landfill that includes clay and/or synthetic liners, leachate collection, gas collection (in cases where gas is generated), and an impermeable cover.
- ✓ **Septage** - sludge removed from a septic tank (a chamber that holds human excreta).
- ✓ **Setout container** - a box or bucket used for residential waste that is placed outside for collection.
- ✓ **Sewage sludge** - a semi-liquid residue that settles at the bottom of canals and pipes carrying sewage or industrial wastewaters, or at the bottom of tanks used for treating wastewaters.
- ✓ **Site remediation** - treatment of a contaminated site by removing the contaminated solids/liquids or treating them onsite.
- ✓ **Situation Analysis** - includes conducting a brief scan or review of the organization and its environment. It presents the EXACT situation of the organisation.
- ✓ **Source reduction** - the design, manufacture, acquisition, and reuse of materials so as to minimize the quantity and/or toxicity of waste produced.
- ✓ **Source separation** - setting aside of compostable and recyclable materials from the waste stream before they are collected with other MSW, to facilitate reuse, recycling, and composting.
- ✓ **Special wastes** - wastes that are ideally considered to be outside the MSW stream, but sometimes enter it and must often be dealt with by municipal authorities. These include household hazardous waste, medical waste, construction and demolition debris, war and

earthquake debris, tires, oils, wet batteries, sewage sludge, human excreta, stoichiometric condition slaughterhouse waste, and industrial waste.

- ✓ **Strategic planning** - an organization's process of defining its strategy, or direction, and taking decisions on allocating its resources, including its capital and people, to pursue this strategy. Various business analysis techniques can be used in strategic planning, such as SWOT analysis. The outcome is normally a strategic plan which is used as guidance to define functional and divisional plans, including Technology, Marketing, etc.
- ✓ **Strategies** - broad activities required to achieve an objective, control a critical success factor, or overcome a barrier.
- ✓ **Subsidy** - direct or indirect payment from the government to businesses, citizens, or institutions to encourage a desired activity.
- ✓ **SWOT Analysis** - a strategic planning tool used to evaluate the *S*trengths, *W*eaknesses, *O*pportunities, and *T*hreats involved in a project or in a business venture. It involves specifying the objectives of the business venture or project and identifying the internal and external factors that are favourable and unfavourable to achieving that objective. This technique is credited to Albert Humphrey.
- ✓ **Tactics** - defined as the activities to be carried out to implement the strategy i.e., "how will it be done?"
- ✓ **Tasks** - actual actions performed to implement the required tactic/strategy. Tasks may be defined as "what will be done, and by whom?"
- ✓ **Tipping fee** - a fee for unloading or dumping waste at a landfill, transfer station, incinerator, or recycling facility.
- ✓ **Tipping floor** - unloading area for vehicles delivering MSW to a transfer station, processing facility, or incinerator.
- ✓ **Transfer** - the task of moving waste from a collection vehicle to a larger transport vehicle.
- ✓ **Transfer point** - a designated point, often at the edge of a neighbourhood, where small collection vehicles transfer waste to larger vehicles for transport to disposal sites.
- ✓ **Transfer station** - a major facility where MSW from collection vehicles is consolidated into loads that are transported by larger trucks or other means to more distant final disposal facilities, typically landfills.
- ✓ **Transition countries** - the countries of Eastern Europe and the former Soviet Union that are in various stages of restructuring their economies. The changes involve a transition from being substantially state-run towards a variety of new configurations, ranging from moderate economic liberalization to a significant dismantling of the state's role in the economy.
- ✓ **Vectors** - organisms that carry disease-causing pathogens. At landfills, rodents, flies, and birds are the main vectors that spread pathogens beyond the landfill site.
- ✓ **Vermiculture** - see *Worm culture*.

- ✓ **Virgin materials** - any basic material for industrial processes that has not previously been used, for example, wood pulp trees, iron ore, crude oil, and bauxite.
- ✓ **Vision** - defines where the organisation wants to be in the future. It reflects the optimistic view of the organisation's future, a guiding image of the success achievable in terms of contribution to society. It provides clear decision-making criteria.
- ✓ **Waste characterisation study** - an analysis of samples from a waste stream to determine its composition.
- ✓ **Waste collector** - a person employed by a local authority or a private firm to collect waste from residences, businesses, and community bins.
- ✓ **Waste dealer** - an intermediary who buys recyclable materials from waste generators and itinerant buyers to sell them, after sorting and some processing, to wholesale brokers or recycling industries.
- ✓ **Waste Hierarchy** - refers to the "3Rs" (Reduce, Reuse and Recycle), that classifies waste management strategies according to their desirability. The 3Rs are meant to be a hierarchy, in order of importance - a ranking of waste management operations according to their environmental or energy benefits. The purpose of the waste management hierarchy is to make waste management practices as environmentally sound as possible.
- ✓ **Waste picker** – see *Scavenger. (also known as Rag picker)*
- ✓ **Waste reduction** - all means of reducing the amount of waste that is produced initially and collected by solid waste authorities. This ranges from legislation and product design to local programs designed to keep recyclables and compostables out of the final waste stream.
- ✓ **Waste stream** - the total flow of waste from a community, region, or facility.
- ✓ **Waste-to-energy (WTE) plant** - a facility that uses solid waste materials (processed or raw) to produce energy. WTE plants include incinerators that produce steam (for district heating or industrial use), or generate electricity and also include facilities that convert landfill gas to electricity.
- ✓ **Water table** - level below the earth's surface at which the ground becomes saturated with water.
- ✓ **Wetland** - an area that is regularly wet or flooded and has a water table that stands at or above the land surface for at least a part of the year.
- ✓ **Windrow** - an elongated pile of aerobically composting materials that are turned periodically to expose the materials to oxygen and to control the temperature to promote biodegradation.
- ✓ **Working face** - the length and width of the area where waste is being deposited at a landfill. Also known as the tipping face.
- ✓ **Worm castings** - the material produced from the digestive tracts of worms as they live in earth or compost piles. The castings are rich in nitrates, potassium, phosphorus, calcium, and magnesium.

- ✓ **Worm culture** - a relatively cool, aerobic composting process that uses worms and micro-organisms. Also known as vermiculture.
- ✓ **Yard waste** - leaves, grass clippings, prunings, and other natural organic matter discarded from yards and gardens.

Concept and Organization of the ISWM Manual

Concept

This manual is intended to provide a practical and step-by-step guidance to city/civic authorities in developing urban areas, for the formulation and implementation of an Integrated Solid Waste Management (ISWM) Plan for a city. It also provides the municipal managers and decision-makers a set of tools for managing the waste problem in their cities. It is a framework for understanding the problems, and then looking for their solutions. This is important because many of the collapses in solid waste management are related to an inadequate analysis of the problem, which leads to emergencies and, poor crisis-driven decision making.

Specifically, the manual provides guidance on:

- What is ISWM, its relevance and the process of developing an ISWM Plan?
- How to prepare for and conduct participatory approach involving multiple stakeholders towards realizing the ISWM process
- How to conduct Inventorization of wastes, assess existing situation (Situation Analysis) and identify gaps
- How to structure the ISWM Plan, ensure enabling mechanism and conduct capacity building for implementing the plan
- How to continually monitor and improve the plan for prolonged sustenance.

This manual is not waste-stream specific; rather it is intended to present a generic ISWM plan methodology that can be applied along various waste streams at various locations. The annexes to this manual contain resources of the ISWM plans around the world.

Who should read this manual?

These tools are written for municipal managers, decision-makers and members of city councils (primarily) who:

- Have noticed that the current approaches to waste management do not usually succeed.
- Would like to use public funds responsibly.
- Are concerned about the environment and public health of their citizens.
- Are concerned with improving waste management services.
- Are interested in the long-term health and well-being of their cities.
- Are searching for a more coherent way to analyse the situation, understand the problems and engage citizens in formulating solutions.

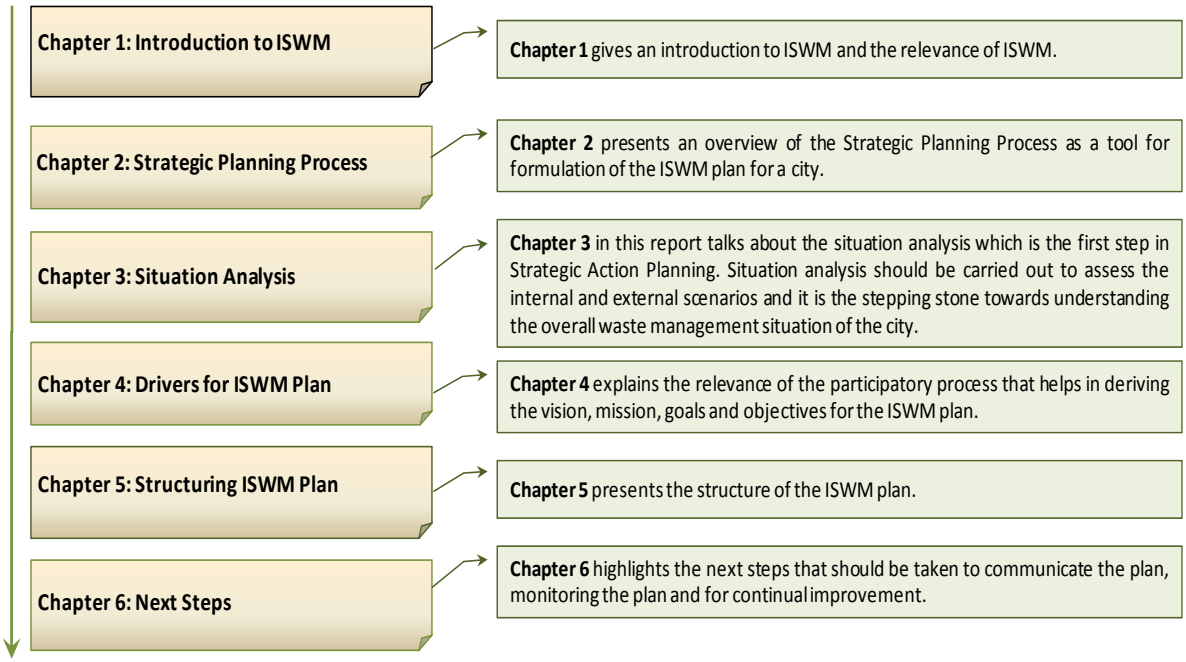
This document can also be of interest to other interested parties/organisations that aim at supporting municipal managers and decision-makers. They may be:

- consultants working on urban services, recycling, or waste management;
- representatives or staff of other local stakeholders including community groups, NGOs, and the private sector;
- entrepreneurs wishing to expand or strengthen their solid waste portfolios;
- academicians and scholars in urban environmental management;
- the press, especially when seeking background materials;
- donors interested in supporting future waste management activities;
- local experts interested in using or replicating the results;

This manual is accompanied by a **Set of Guidelines for Practitioners**. This set of guidelines can be used by both Policy makers, Field Staff and Practitioners for Solid Waste Data collection and Management.

Organization of the Guidance Manual

The following chapters of this report are as follows:



All of the above chapters have been supported by illustrations of ISWM plans around the world.

Icons used in the Manual

The following icons have been used in the training material to draw attention to certain parts of the text.

Icon	Description
	**Overview**: This icon is used to highlight the outline of each of the chapters in this guidance manual
	**Illustrative Example**: This icon indicates the position in the text where examples have been used to illustrate a particular step or tool.
	**Key Points**: This icon depicts the position where key concepts are explained.
	**Solved Examples**: This icon indicates the position of the solved examples used to explain certain issues.
	**Lessons learnt**: This icon lists out the lessons learnt at the end of each chapter in this guidance manual

ISWM like Examples around the World

1. Introduction to Integrated Solid Waste Management (ISWM)

 **Overview**	**What will you learn**	Why should we focus on Integrated Solid Waste Management (ISWM), what is ISWM and how can we develop the ISWM plan (methodology). Various illustrative examples of ISWM and its related experiences around the world have been listed.
	Target addressees	• **City Authorities** • **Civic Authorities** • Professional service providers and organizations • Small and medium enterprises • Representatives or staff of other local stakeholders including community groups, NGOs, and the private sector • Consultants
	Attached Document	ISWM Manuals 1, 2 and 3

1.1. Why Focus on Integrated Solid Waste Management (ISWM)

The growth of a city is characterized by an increase in its economic and developmental activities that are typically driven by the production and consumption patterns. Over the years, these activities have been mapped with the manufacturing and construction activities. The improved standards of living and the extent of commercialization in the cities have significantly changed the consumption patterns and thereby the waste composition. The inability to fully grasp the problems of waste generation and characterization have resulted in transforming Solid Waste Management as one of the most compelling problem of urban environmental degradation.

From the solid waste generation perspective, waste generation can be typically classified as:

- Municipal Solid Waste *including* Plastic waste (MSW)
- Construction and Demolition waste (C&D)
- Hazardous solid wastes (HW)
- Bio-medical waste (BMW)
- Electronic waste (E-waste)

The quantity of solid waste generated, as well as its ever changing characteristics, is at an alarmingly increasing proposition. The household waste contains biodegradable waste (such as vegetables, leftover foods), non biodegradable materials (such as plastics), and hazardous material (like used batteries); thereby rendering it to be a complicated situation to handle.

Municipal Solid Waste(MSW): MSW is a waste type that includes predominantly household waste (domestic waste) with sometimes the addition of commercial wastes collected by a municipality within a given area.

Construction and Demolition (C&D) wastes are many times considered as part of MSW and such mixed waste is usually disposed off at landfills, thereby reducing the life of such landfills. In addition to this, wastes generated from commercial establishments and industries add a different dimension to the waste generation scenario. The industrial hazardous wastes, if mixed with Municipal Solid Waste (MSW), create unsafe conditions.

Construction and Demolition (C&D): C&D waste includes all wastes arising from construction/building industries, demolition or directly, to man or the environment

Hazardous Waste (HW): HW is waste that poses substantial or potential threats to public health or the environment and generally exhibits one or more of these charateristics: ignitable, oxidizing, corosivity, toxic, radioactive, eco-toxic. Such wastes arising from industries is called as Industrial Hazardous Waste.

Furthermore, the generation and problems of bio-medical and electronic waste (E-waste) lead to complicated waste generation and management scenario.

Bio-Medical Waste (BMW): BMW also known as medical waste or clinical waste normally refers to waste products that are produced from healthcare premises such as hospitals, dispensaries etc.

Electronic Waste (E-Waste): E-Waste is a waste type consisting of any broken or unwanted electrical or electronic appliance. It is a point of concern considering that many components of such equipment are considered toxic and are not biodegradable.

Figure 1.1 and 1.2 shows the increasing solid waste problem in two developing cities - Maseru in Lesotho and Pune in India respectively.

Figure 1.1:

Official Dump site - Tšosane (for domestic waste) in Maseru, Lesotho

Figure 1.2:

Dumping of Mixed Waste (mostly MSW and C&D) in Pune

The heightened awareness and the governing regulatory regime has resulted in the involvement of various agencies like government, private and non-government organizations; to undertake pilots and projects in partnership for SWM. However, an integrated and strategic approach is still missing and in most cases, the projects and initiatives have remained either isolated or not up-scaled or replicated. Individual or fragmented approach is bound to become unsustainable in view of the increasing complexity of the waste streams. Unless the approach is strategic and cross-sectional, ad-hoc waste management will always remain a challenge.

There is also a dire necessity to integrate the informal sector (comprising of rag pickers, illegal or unauthorized recyclers) into the mainstream waste management process as they handle a substantial amount of waste generated, without the requisite environmental safeguards.

A plausible solution to waste management would be an integrated approach which would include collective management of all types of wastes and implementation of the

3R (***Reduce, Reuse and Recycle***) policies and strategies. *Figure 1.3* highlights the need for ISWM.

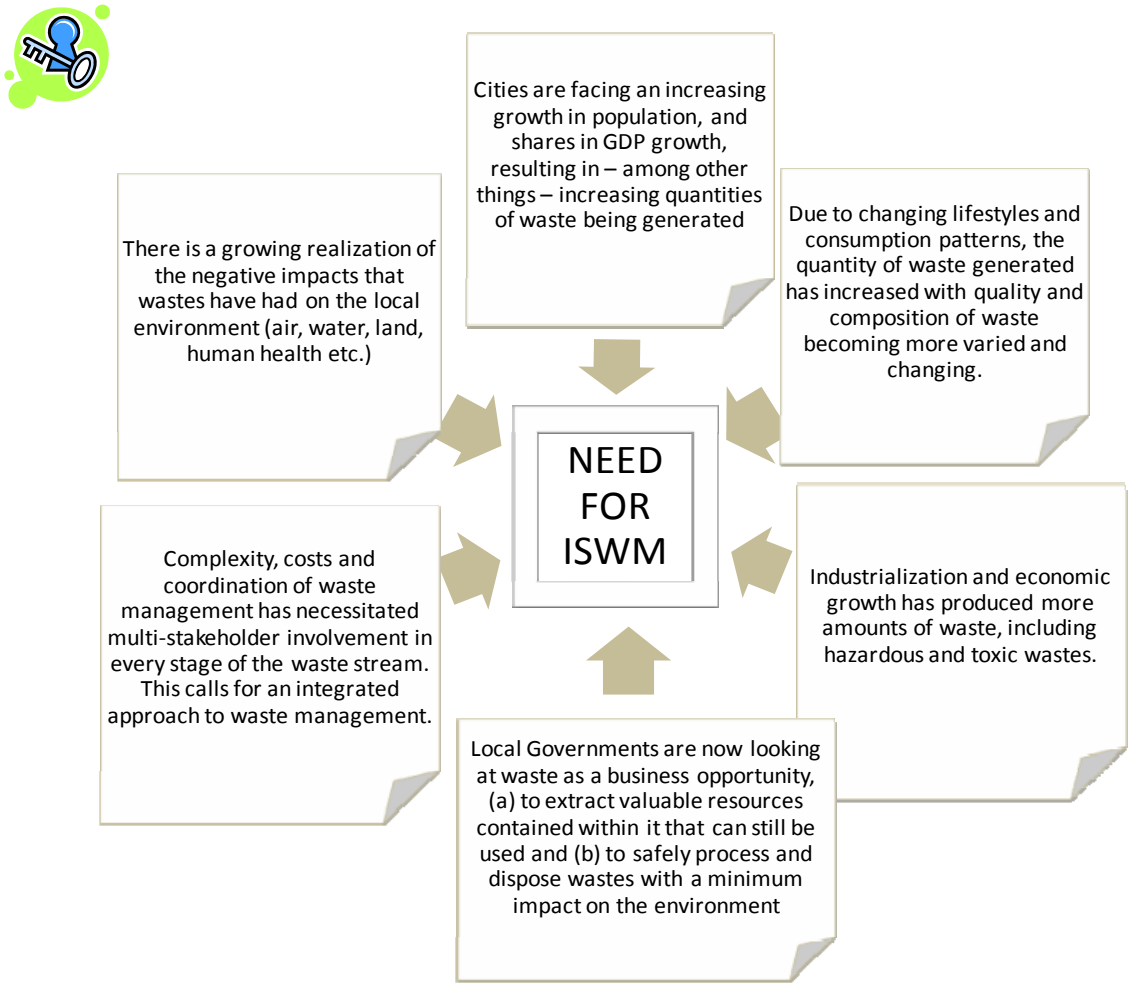


Figure 1.3: Need for ISWM[1]

Several SWM Plans have been developed around the world. Many of them have been used as illustrations in this as well as the following chapters. However, there being no standard methodology for ISWM planning, most of these plans highlight only the problems of MSW and are therefore incapable to handle the total waste management problem in an integrated manner. This could have also resulted due to lack of standard methodology for ISWM planning.

In order to cope with the problems of SWM, The United Nations Environmental Programme (UNEP) through International Environmental Technology Centre (IETC),

1 As referred to http://www.institutoventuri.com.br/img_forum/palestras/Palestras%2018%20de%20maio%20%20Tarde/Surya%20Chandak.pdf

Division of Technology, Industry, and Economics (DTIE) have been instrumental in developing and implementing Integrated Solid Waste Management Plans for three cities, namely:

1. Pune city, India
2. Wuxi, Peoples Republic of China
3. Lesotho, South Africa

The objective of the projects was to develop the Integrated Solid Waste Management (ISWM) plan covering MSW, Biomedical, Industrial hazardous, Construction & Demolition (C&D) and Electronic-waste. The plans would cover all the aspects of ISWM chain including collection, segregation, transportation, recycling, treatment and disposal.

The implementation of these three projects, set-up in varied locations and under different circumstances, has led to an increase in the knowledge-pool of UNEP. In order to share the experiences during these projects and thereby further aid other city's municipals and authorities for implementing ISWM plans, a *Guidance Manual* has been attempted. This Guidance Manual, targeted at the urban management authorities, provides a set of distilled guidelines that can be practiced to enhance the ISWM implementation process.

The UNEP-DTIE-IETC is utilizing the services of Mr.Rahul Datar, together with the support from the Environmental Management Centre for assisting them to carry out the project and tasks identified to achieve the project objective.

1.2. What is Integrated Solid Waste Management (ISWM)

Integrated Solid Waste Management (ISWM): ISWM refers to a strategic initiative for the sustained management of solid waste through the use of a comprehensive integrated format generated through sustained preventive & consultative approach to the complementary use of a variety of practices to handle solid waste in a safe and effective manner.

ISWM is a frame of eference for designing and implementing new waste management systems and for analysing and optimising existing systems.

Integrated waste management is based on the concept that all aspects of a waste management system (technical and non-technical) should be analysed together, since they are in fact interrelated and developments in one area frequently affect practices or activities in another area.

ISWM proposes to take a comprehensive approach across all types of solid waste streams and involves the use of a range of different options. It is a system developed from generation to disposal and builds around the other management steps encompassing all types of solid wastes. The selection of the most appropriate waste management systems and sustainable technologies are also needed to deliver an optimum and sustainable ISWM system. In combination with economic and social considerations, this approach would help waste managers to design more sustainable solid waste management systems.

Thus, for the management of solid waste, the following is the preferred hierarchy of approaches

- Reduction at source - meaning incorporation of the tenets of waste management at every stage of consumption from design, manufacture, purchase, or use of materials to reduce the amount or toxicity of waste generated.
- Environmentally suitable reuse and recycling - to conserve natural resources and energy through systematic segregation, collection and reprocessing.

The various interpretations of ISWM can be seen in *Figure 1.4***.**

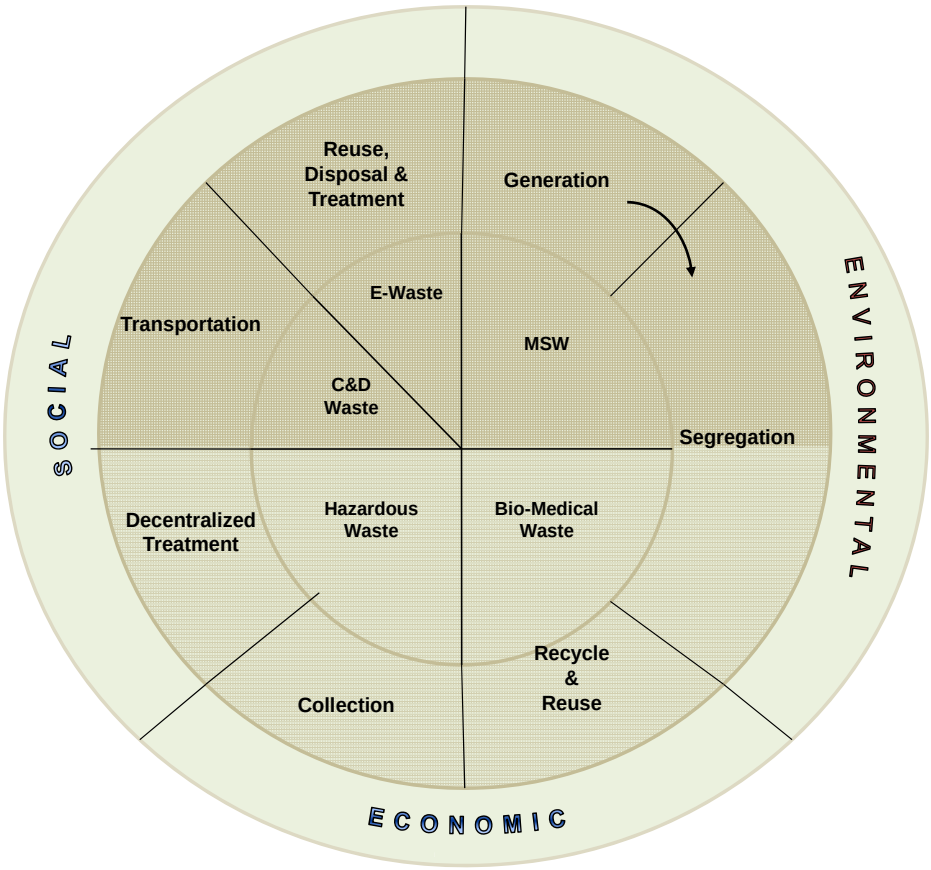


Figure 1.4: Concept of Integrated Solid Waste Management

The ISWM concept has to be adapted with a view that effective management schemes need the flexibility of design, adaptation, and systems which can best meet current social, economic, and environmental conditions. These are likely to change over time and vary by location. The need for consistency in quality and quantity of recycled and recovered materials (compost, energy); the need to support a range of disposal options; and the benefit of economies of scale, suggest that the ISWM systems should be organized on a large-scale.

Some of the major features of ISWM can be listed as follows:

- Holistic approach to all waste streams thus maximizing synergetic benefits in collection, recycling, treatment & disposal
- Maximize the opportunities for resource recovery at all stages - from generation to final disposal
- Accommodate aspirations of all stakeholders – from waste generators to waste management and service providers
- Facilitate life cycle view of products and materials; thus, promoting greater resource use efficiency
- Integrate different response functions such as technical, managerial, financial, policy etc.
- Greater local ownership & responsibilities/participation through a consultative approach

1.3. Illustrative examples of ISWM like experiences around the World

Several plans for integrated waste management initiatives have been taken up around the world. A few of them are listed below (**Box 1.1 to 1.5**) highlighting the process of ISWM adapted.

Box 1.1: California (Cal) EPA – Integrated Waste Management Board Strategic Plan

The Integrated Waste Management (IWM) Act (AB 939, Sher, Chapter 1095, Statutes of 1989, as amended [AB 939]) created the California Integrated Waste Management Board (CIWMB). The CIWMB continued its formal strategic planning efforts with the publication of this plan in 2001. Data gathering was done by inputs from a broad representation of internal and external stakeholders, which was solicited and received throughout the development of this plan. Public forums were conducted so that the Board could obtain broad policy inputs on key waste management issues of the future. The following was the Vision, Mission, Values and Strategic Goals of this IWM Strategic Plan.

Following are the Board's seven strategic goals:

1. Increase participation in: resource conservation, integrated waste management, waste prevention, and product stewardship to reduce waste and create a sustainable infrastructure.
2. Assist in the creation and expansion of sustainable markets to support diversion efforts and ensure that diverted materials return to the economic mainstream.
3. Educate the public to better understand and participate in resource conservation and integrated waste management strategies.
4. Manage and mitigate the impacts of solid waste on public health and safety, and the

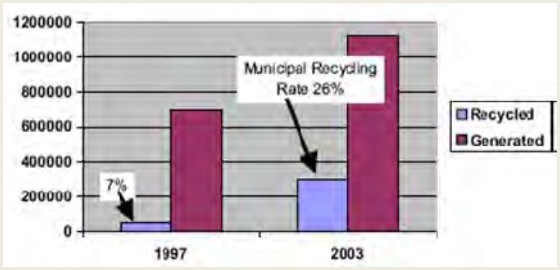
environment, and promote integrated and consistent permitting, inspection, and enforcement efforts.

5. Improve the efficiency and effectiveness of the IWM Board in pursuit of its mission.
6. Continuously integrate environmental justice concerns into all of the Board's programs and activities, including administrative and budgetary decisions.
7. Promote a "zero-waste California" where the public, industry, and government strive to reduce, reuse, or recycle all MSW materials back into nature or the marketplace in a manner that protects human health and the environment and honours the principles of California's Integrated Waste Management Act.

Box 1.2: Waste Management Plan 2005 – 2010 – for the Dublin Region

The Waste Management Plan for the Dublin Region has been developed jointly by Dublin City Council, South Dublin County Council, Fingal County Council and Dun Laoghaire-Rathdown County Council. The Dublin Region adopted a *Regional Waste Management Strategy* in 1997, which set out to replace a system that over-relied on landfill disposal with a new approach based on integrated waste management over a 20 year period. The first Regional Waste Management Plan became effective in 2001 and the first formal Review of the Plan has recently taken place during 2004-2005, culminating in this replacement Plan.

Key Achievements from 1998 – 2004: Through concerted efforts by the Local Authorities, the waste management industry and the voluntary and community sector, Dublin has made significant strides in implementing its waste management strategy. While it has taken longer than expected to reach certain targets, there has been substantial progress during the period. For example:



- 22, 500 home compost bins and information packs provided since 2001
- 313 schools registered with the An Taisce Green Schools Programme – 54 Green Flags awarded
- 32 waste related projects sponsored under the Local Agenda 21 Initiative
- Involvement of voluntary groups, umbrella bodies and private companies in waste awareness activities

Review of the Waste Management Plan 1998-2004: A formal review of the Waste Management Plan was commissioned in 2004 and completed in 2005. This examined the progress made till date and involved a significant amount of consultation with the public and sectoral interests.

Waste Management Policy from 2005 – 2010: Responding to the consultation feedback, the findings of the Review, and the need to meet National and EU Objectives, the waste management policy for the Region has been revised and updated. Some of the key issues and objectives include Prevention and Minimisation Policy, Reuse and Repair, Objectives for Household Recycling, Commercial/Industrial Recycling, Energy Recovery Policy, Landfill Policy, Regional Co-operation & Movement of Waste, Directing Waste, Construction and Demolition Waste and Hazardous and Priority Wastes.

Implementing the Plan: Reflecting on the challenge of plan implementation, four subsets of waste management services in the region have been set out (as shown in the opposite figure). Though the Local Authorities are responsible for leading the implementation initially, the success of the Plan, however, will largely depend on the actions of the entire society.

The **General Public** has a responsibility to prevent and minimise waste wherever possible, and to use the facilities made available for safe collection and disposal of waste. They need to participate in source separation and recycling services provided, and remove household hazardous waste for safe disposal.

The **business and Industrial** sectors need to implement best practice in relation to waste prevention, minimisation, recycling and disposal, and also to implement greener policies in-house. They will ensure that all waste leaving their premises has appropriate documentation and is handled by legal operators.

The **Packaging Industry (including re-pack),** is responsible for improving packaging waste reduction, reusability and recyclability, as well as funding recycling and recovery of packaging.

The **private waste sector** will continue to expand collection and recycling services, provide innovative technologies and assist in the promotion of awareness on waste management. They are required to follow the waste hierarchy and waste plan objectives with improvements in data reporting and compliance.

Voluntary NGO & Community Groups are encouraged to undertake waste projects at local level. Increased responsibility will be taken for waste management through community schemes with support from Local Authorities.

Box 1.3: ISWM plan for Raichur Municipal Council (India)

Raichur Municipal Council received funds under the Indo Norwegian Environmental Program (INEP) for preparing the ISWM plan. It is based on Municipal Solid Waste Management Rules-2000

The salient features of the ISWM plan are:

- Promote segregation of waste at source.
- Avoid multiple handling of waste.
- Conduct awareness programs.
- Public/NGO participation.

Box 1.4: ISWM Plan for Guam - Environmental Protection Agency (EPA)

Guam EPA with assistance from Guam Department of Public Works (DPW) prepared the ISWM plan in 2005 with the provision for update and revision of the plan. The key elements identified in the plan were:

- Collection and transport of solid waste
- Recycling and waste reduction
- Disposal of solid waste
- Public education
- Management of Guam's solid waste operation

It is mandatory on the Guam EPA to revise the ISWM plan at least once in five years or sooner as needed.

Box 1.5: The Integrated Waste Management Plan (IWMP) for Cape Town

IWMP for Cape Town was developed with a focus on municipal waste, including hazardous waste. The main objectives of IWMP included the following:

- Developing strategies to address methods of waste management in order to achieve compliance with the requirements of waste management hierarchy
- Increase waste minimization by promoting prevention, reduction, reuse and recycling of waste
- Draft by-laws on solid waste for enforcements
- Adopting strategies for optimization of landfill site and steadily reduce the amount of waste going to landfill
- Adopting integrated approach to all waste management projects so as to prevent

adverse social and environmental impacts

- To identify and develop plans for future waste management needs in terms of short, medium and long term strategies.
- Ensure adequate capacity building for the city is made available and long term political support is given to meet the targets set within IWMP
- Present the IWMP for public and stakeholders consultation

The methodology adopted for this IWMP included the findings of the Assessment Report, which were confirmed by the Gap Analysis Report. Key findings served as a guide for the formulation of strategies for the Draft IWMP which described the main objectives of the IWMP and outlined the proposed layout of the document. The Public Participation Process (PPP) is being carried out to canvas comments on the IWMP documentation compiled to date.

1.4. How can we develop the ISWM Plan: Methodology

The ISWM concept, as per definition, involves the entire life-cycle process from generation to disposal, of varied waste streams. This issue not only involves different sources of waste generation but also includes diversities in terms of waste characteristics, involved stake-holders and the required technological know-how. In order to deal with this complex issue and to arrive at an optimal solution, a number of difficult choices shall have to be made. Prediction of waste generation and characterization is crucial for developing a robust waste management plan. However, these parameters being a function of several factors, the prediction has to be done following the scenario building approach. A plan for managing diverse streams needs a flexible approach involving varied organizations and stake-holders and generating alternatives based on participatory approach.

The scenario based approach; participatory framework, and analysis of alternatives to come up with a robust alternative, are some of the key principles enshrined in the Strategic Planning (SP) Process. Hence this process can be adopted as the basis for developing the ISWM Plan as it focuses more on adaptability to change, flexibility and importance of strategic thinking and organizational learning. Further, SP is a continuous process and not a one-time or quantum activity. The process should begin with a situation analysis, i.e., an assessment of the internal as well as the external environment. During this process, the existing situation has to be carefully evaluated to find out if the organization is on the right path towards meeting its goal/vision[2] and the SP process has to be geared towards achieving targets under each objective.

This should be followed by developing an action plan on how to meet targets which has to be then monitored to check if targets have been attained or not. In case

[2] if no goals/objectives have previously been set then new ones should be set

targets are not achieved, the process should be repeated till the desired targets are met. The detailed process of SP is discussed in *Chapter 2*.

What did you learn?

- ✓ The inability to fully grasp the problems of waste generation and characterization have resulted in transforming **Solid Waste Management as one of the most compelling problem of urban environmental degradation.**
- ✓ A **plausible solution to waste management would be an integrated approach** which would include collective management of all types of wastes and implementation of the 3R (*Reduce, Reuse and Recycle*) policies and strategies.
- ✓ The **Integrated Solid Waste Management concept as per definition involves the entire life-cycle process from generation to disposal of varied waste streams**.
- ✓ The scenario based approach; participatory frame-work and analysis of alternatives to come up with a robust alternative are some of the key principles enshrined in the **Strategic Planning (SP) Process**. Hence this process can be adopted as the basis for developing the ISWM Plan.

2. Strategic Planning Process (SP): A Tool and its Relevance in ISWM

 **Overview**	**What will you learn**	What is Strategic Planning and its basic concepts? A SP Model has been described which can be used in Strategic Planning. How is the SP process incorporated in ISWM and its benefits in ISWM? Various illustrative examples which highlight the experience of SP in ISWM.
	Target addressees	• **City Authorities** • **Civic Authorities** • Professional service providers and organizations • Small and medium enterprises • Representatives or staff of other local stakeholders including community groups, NGOs, and the private sector • Consultants
	Attached Document	ISWM Manuals 1, 2 and 3

2.1. What is Strategic Planning (SP): Basic Concepts

Strategic Planning (SP) is a management tool that helps an organization to achieve its goals. The term *strategic* is used for the process because it prepares the organization to respond to circumstances related to the organization's dynamic environment. Strategic planning is about:

- The choice that is made out of a number of alternatives that can be done or need to be done;
- Prioritisation of these choices;
- Timing of the action associated with these choices

Strategic planning is an organization's process of defining its strategy, or direction, and making decisions on allocating its resources to pursue this strategy, including its capital and people. Various business analysis techniques can be used in strategic planning, such as SWOT analysis. The outcome is normally a strategic plan which is used as guidance to define functional and divisional plans, including Technology, Marketing, etc.

Strategy is essentially a bridge between the past and the future. The past and present are viewed when an "as is" study is done while the future is visualized through the "to be" study of the overall management structure. Here, strategic planning helps in providing ways of maximizing opportunities, developing a far-sighted approach for managing the solid wastes in a region.

Strategy is thus a process of:

- Targeting the key things that needs to be done to move in the desired direction (priority issues, key influences on these issues, and the most effective ways of dealing with them); and
- Engaging everyone concerned to carry them out

The main components of a strategy are:

- Assessment including diagnosis (at the start of a strategy);
- Designing the actions (planning);
- Taking the actions (implementation).
- Monitoring and evaluation (during a strategy);

These components must continue together and reinforce one another. The best strategies have been based on participation, building on good existing plans and processes, with clear attention to an integrated approach. However, strategies are not panaceas, indeed they break new grounds in the way societies and governments tackle complex issues related to solid waste management.

Strategic planning for waste management should be a participatory process because:

- Solid waste management is not possible by one or two institutions. It is a shared responsibility;
- Participation means shared responsibility for the strategy and its joint undertaking;
- Participation by stakeholder groups is critical for decision making. The result will be a realistic strategy with a broad base of knowledge, understanding and commitment from the groups involved;
- Participants bring information for the strategy, ensuring that it is based on a common understanding of purpose, problems and solutions;
- Participation is the most effective way of communicating information on which the strategy is based, its goals and tasks to be undertaken;
- Participation should be expanded as the strategy develops.

In the present context, strategic planning could assist in:

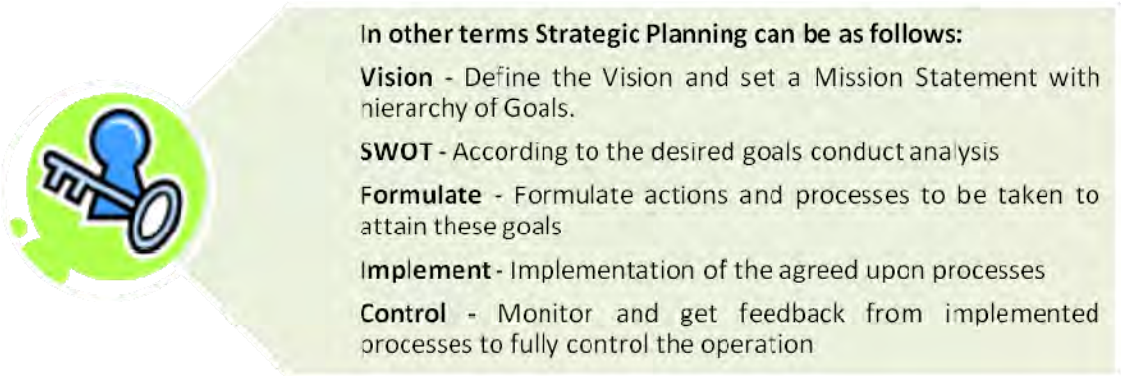
- Developing institutions and organisational arrangements that are better equipped to cope with uncertainty, rapid change and the need for more integrated decisions;

- Developing institutional and technological skills in solid waste management;
- Developing multi-agency networks: Incorporating the public, private and the informal sector;
- Setting in motion analysis of the main constraints for more integrated management.

With a goal as broad as ISWM, it is tempting to try to do everything. Planning must ensure that the strategy concentrates on a few priority issues while retaining a broad purview. Such a strategy is more likely to be implemented successfully.

Strategic planning seeks to answer questions such as:

- "What is our vision?"
- "How should we be organized?"
- "How should we allocate resources to our programs and services?"



2.2. What are the Types of SP Models

A number of SP models exist, all of which differ from one another in some degree. Some models provide a way to identify strategies, while others define the logic to identify strategies as well as actions. No one model can be said to suit all users. The following three models are generally used in SP[1]:

- **SWOT model:** This model is based on identifying the organization's internal strengths and weaknesses with respect to the threats and opportunities of the external environment, and consequentially identifying the organization's distinctive competencies and key success factors.
- **Ansoff's model:** In this model, developed by Igor Ansoff, "strategy" is designed to transform the organization from its present position to the desired position as described by the objectives, subject to the constraints of the capabilities and the potential of the organization.

1 Adapted from *Strategic Planning: Basic Models*. Available at: http://www.des.calstate.edu/basicmodels.html.

- **Porter's model:** This model is also called the *"five forces model"*. The five forces include: (a) the risk of new competitors entering the industry; (b) threat of potential substitutes; (c) the bargaining power of buyers; (d) the bargaining power of suppliers and; (e) the degree of rivalry between the existing competitors.

Most of these models were created for the business world and need adaptation if intended to be used for regulatory purposes. One of the most important benefits of these models is the flexibility and adaptability. They can be used in a variety of ways, using approaches specific to a particular setting, to create a unique picture of the institution's distinctive environment.

However, the Ansoff's model specifically stresses on two concepts: (a) evaluate the "difference" (gap) between the current position of the firm and its objectives and; (b) the idea that the organizations must seek a "product-market posture with a combined performance that is greater than the sum of its parts". Application of Ansoff's model may be limited to such contexts.

Like Ansoff's model, Porter's model is also mostly suited for strategic planning in dynamically changing business organizations.

2.2.1. Sub-models

Apart from the models that identify strategy, there are also *sub-models* that outline different approaches to the SP process. These include:

- **Basic SP approach:** Basic SP is typically followed by organizations that are extremely small or busy, and have not gone through the process of SP before. This type of planning is usually carried out by the top-level management. Goals-based SP is the most common model and starts by turning the focus on the organization's mission (and vision and/or values), goals to work towards the mission, strategies to achieve these goals, and action planning.
- **Issue-based SP approach:** Issue-based SP often starts by examining the issues facing the organization, strategies to address those issues, and drawing action plans accordingly.
- **Alignment sub-model:** This model ensures strong alignment amongst the organization's mission and its resources for an effective operation of the organization. This model is applied to organizations that have already gone through the process of SP but need to fine-tune or to find out the reason for failure of their strategies. Thus this approach could be best used for monitoring and adoption of SAP.
- **Scenario planning approach:** This approach can be used in conjunction with other models. It involves strategic thinking of various scenarios and outcomes. And usually takes place in a workshop setting where the planners imagine possible scenarios for a critical issue. Strategies are developed for the most likely scenario.

In practice a combination of the sub-models is often used to best address the interest of the organization and the situation.

2.3. What is the SWOT Model

SWOT Analysis is a strategic planning tool used to evaluate the ***S**trengths*, ***W**eaknesses*, ***O**pportunities*, and ***T**hreats* involved in a project or in a business venture. It involves specifying the objective of the business venture or project and identifying the internal and external factors that are favorable and unfavorable to achieving that objective. The technique is credited to Albert Humphrey.

The SWOT model's objective is to recommend strategies that ensure the best alignment between the external environment and internal situation. Organization's can develop a competitive advantage by identifying a fit between its strengths and upcoming opportunities.

A SWOT analysis may be incorporated into the SP model. The United States Environmental Protection Agency (USEPA) employs the SWOT model towards its SP process. It is believed that this model is most relevant and hence most suited for government organizations.

2.3.1 Internal and External Factors:

The aim of any SWOT analysis is to identify the key internal and external factors that are important to achieve the objective. SWOT analysis groups key pieces of information into two main categories:

Internal Factors: The strengths and weaknesses internal to the organization

- **Strengths** are the attributes of the organization that are helpful to achieve the objective.
- **Weaknesses** are the attributes of the organization that are hindrances in achieving the objective.

External factors: The opportunities and threats presented by the external environment

- **Opportunities** are the external conditions which are helpful to achieve the objective.
- **Threats** are the external conditions which are hindrances in achieving the objective

Figure 2.1 shows the SWOT Analysis:

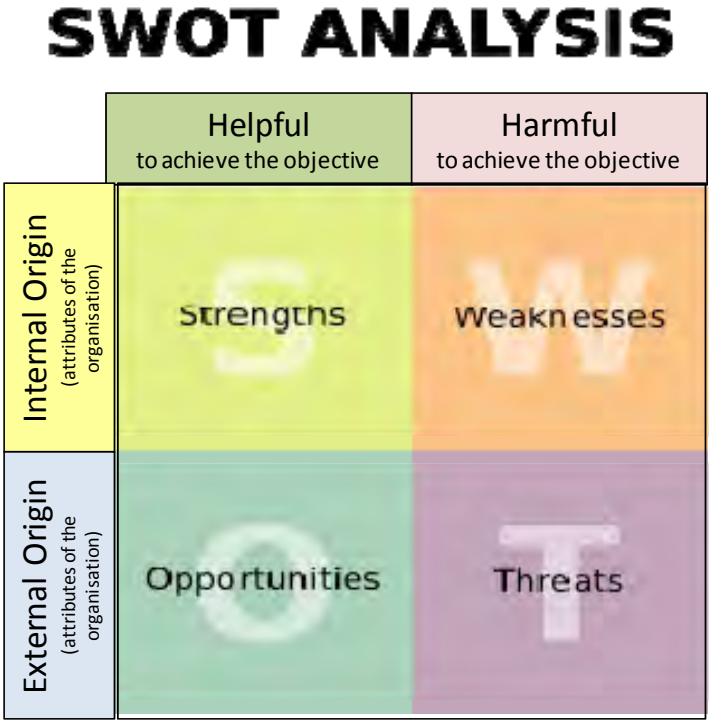


Figure 2.1: Illustrative Diagram of SWOT Analysis

SWOT are used as inputs for the creative generation of possible strategies, by asking and answering each of the following four questions, many times:

1. How can we USE each Strength?
2. How can we STOP each Weakness?
3. How can we EXPLOIT each Opportunity?
4. How can we DEFEND against each Threat?

A cross-functional team or a task force who represent a broad range of perspectives should carry out the SWOT analysis.

2.4. What is the meaning of Use of Strategic Planning (SP) in ISWM

SP process is about *planning* because it involves setting of targets or goals and developing a framework to achieve them. In other words, it can be explained as a vehicle for a journey, from the present situation to a better future. It is about the choices that are made from a number of alternatives, the prioritization of those choices, and the timing of the action associated with them. Thus, it is a proactive and target-oriented process-cum-methodology.

The objective of SP is to allocate organizational resources and to establish priorities of actions. SP can thus be beneficial to the economic efficiency of the organization as well, by guiding a more efficient use of personnel and a more productive application of the available financial resources[2].

Lastly, SP is essential towards the achievement of long-term objective of developmental activities as it encourages a simultaneous consideration of social, environmental and economic factors. *Figure 2.2* explains the basic steps in SP.

Figure 2.2: Strategic Planning Process

By answering these questions (and many others), SP assists in creating a desired future. The process as explained in *Figure 2.2* begins with a situation analysis or "strategic analysis", i.e. an assessment of the existing status of the organization. Here, the key areas of concern are identified based on "values" to set the strategic directions. The action plan is then monitored to check its effectiveness.

2 *How to Prepare an Economic Development Action Plan for Your Community* by The Centre for Economic Development Research, College of Business Administration, University of South Florida. Available at: cedr.coba.usf.edu/projects/Module1EDActionPlan/Case%20Study%201.pdf

The benefits of the strategic planning process have been summarized in **Box 2.1**[3].

Box 2.1: Benefits of Strategic Planning

- Provides a clear definition of the organization's purpose (vision/mission) and helps to establish and achieve realistic goals and objectives in a defined time-frame within the organization's capacity.
- Helps in communicating the vision/mission, goals and objectives to the constituents of the organization.
- Ensuring an efficient use of the organization's resources by focusing on key priorities and issues.
- Provides a monitoring base for measuring the progress, and establishes a mechanism for informing about changes when needed.
- Brings together everyone's best and most reasoned efforts: this has an important value in building a consensus about where the organization is going.
- Helps in developing a sense of ownership of the plan when implemented in a participatory manner

2.5. Illustrative examples of Strategic Plans for Solid Waste Management around the World

The process of SP has been applied at several instances for Solid Waste Management purposes around the world. The following section tries to share those experiences. The relevance and benefits of SP have been illustrated through these examples.

Box 2.2 - 2.4 describes the experience of SP in the context of Solid Waste Management around the World.

Box 2.2: Strategic Plan for Waste Management and Reduction in Metropolitan Melbourne[4]

In order to achieve the targets outlined in the *Towards Zero Waste* strategy, the State Government is currently developing the **Metropolitan Waste and Resource Recovery Strategic Plan**. This Plan will cover all aspects of solid waste disposal from commercial, industrial and municipal sources within Metropolitan Melbourne. Key components include the analysis of population, consumption and climate change patterns, new technology investment and links to statutory planning systems. The Plan will provide a

3 Strategic Planning: Available at: http://www.mapnp.org/library/plan_dec/str_plan/str_plan.htm

4 As referred to http://www.sustainability.vic.gov.au/www/html/2408-metropolitan-waste-and-resource-recovery-strategic-plan.asp

long term vision for waste management and reduction in metropolitan Melbourne. It will also identify short and long term waste infrastructure needs and devise a schedule for the utilisation of landfill sites.

The Strategic Plan covers three areas. The stated objectives for each area, as outlined in the *Environment Protection Act 1970*, are as follows:

The Metropolitan Plan	•Sets the strategic framework for all solid waste management in metropolitan Melbourne. Sustainability Victoria has been appointed by John Thwaites, the former Minister for Environment, Climate Change and Water, to develop the Metropolitan Plan.
The Municipal Solid Waste Infrastructure Schedule	•Devises a schedule of existing and mandatory infrastructure for municipal solid waste, to be developed by the Metropolitan Waste Management Group.
The Metropolitan Landfill Schedule	•A timetable that identifies the locations and sequence for the filling and operation of landfill sites, to be developed by the Metropolitan Waste Management Group.

- To ensure that a unified approach by the government is adopted for the development of the Strategic Plan, a Strategic Plan Steering Group, comprising of representatives from Department of Sustainability and Environment, Sustainability Victoria, the Metropolitan Waste Management Group and the Environment Protection Authority, will manage the Project and make sure all key deliverables are achieved.
- The process followed by the Government to develop the Strategic Plan will occur over one year. It includes consultation with industry, local government, NGOs and the community.
- Workshops organized by the Strategic Plan Steering Group and involving a wide variety of stakeholders were held on 11 and 12 July.
- The Environment Protection Act 1970 sets out the following legislative requirements for the Strategic Plan, including key outcomes and compliance:

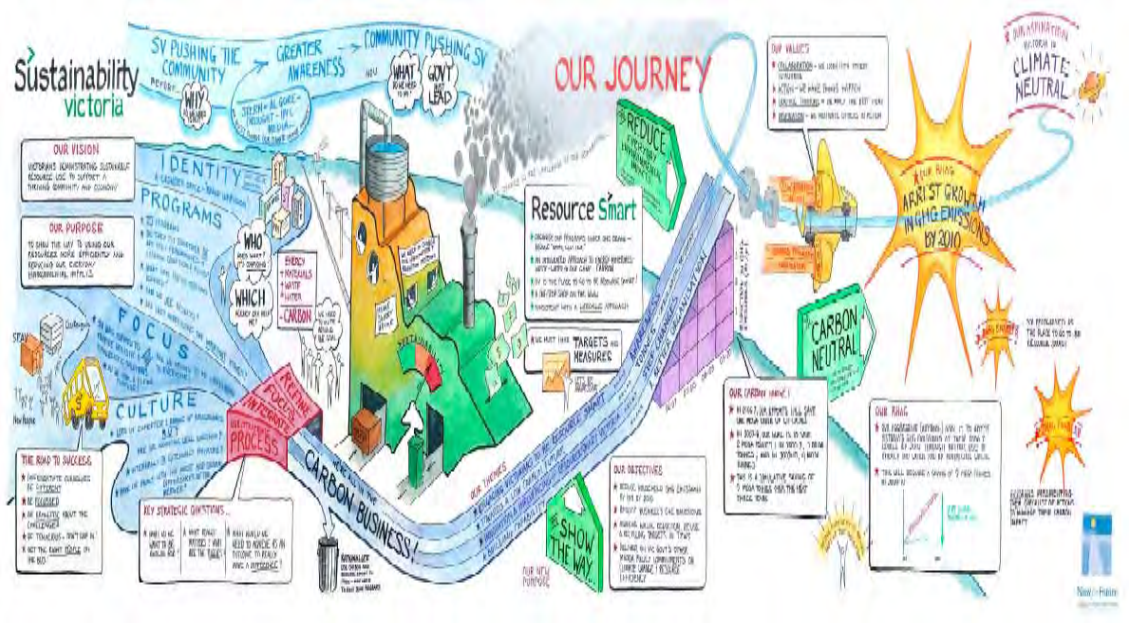
Metropolitan Plan

- Long term trend analysis on the generation, management and reduction of MSW as well as commercial and industrial waste (including construction and demolition waste)
- Identify future waste volumes and processing needs
- A strategic analysis of the current waste management infrastructure and service provision, as well as resource recovery (materials and energy)
- Identify waste minimisation, resource recovery, waste collection, transport and disposal options, including a social and economic assessment of each option
- Develop programs for infrastructure and service provision, so that key objectives for waste management, resource recovery and resource efficiency

are met
- Specify measures for litter prevention and control within metropolitan Melbourne

The Municipal Solid Waste Infrastructure Schedule
- An assessment of the needs, priorities and preferred locations for municipal waste management facilities (other than landfill) within metropolitan Melbourne
- A detailed description of existing municipal waste and resource recovery infrastructure within metropolitan Melbourne
- Identify new municipal waste and resource recovery locations within metropolitan Melbourne, and co-ordinate the implementation with key stakeholders

The Metropolitan Landfill Schedule
- Devise a 10 year schedule for the filling of available landfill
- Include a program for replacing and rehabilitating existing landfill sites
- Estimate the intended/likely date of closure of each landfill site
- Identify options for future landfill capacity



Box 2.3: Use of Strategic Planning Tool in Bangalore for Municipal Solid Waste Management[5]

- It was noted that stakeholders in this location often found it difficult to step outside their specific roles and responsibilities both (a) to work with people from other stakeholder groups and; (b) to conduct an objective analysis of Municipal SWM problems.
- It became clear that in order for the Steering Committee to arrive at a consensus of the existing Municipal SWM problems and to start thinking strategically about how these problems could be solved in practice, it was necessary to remove stakeholders from their everyday environment and encourage them to work together in the analysis of the system.
- Applying this tool provided stakeholders with a unique overview of the existing Municipal SWM system and a visual baseline, from which the strategic vision, strategy and action plan could be developed. This helped the group to develop a shared purpose and strategic direction.

Box 2.4: Solid Strategic Plan City of Santa Barbara, 5th March, 2007[6]

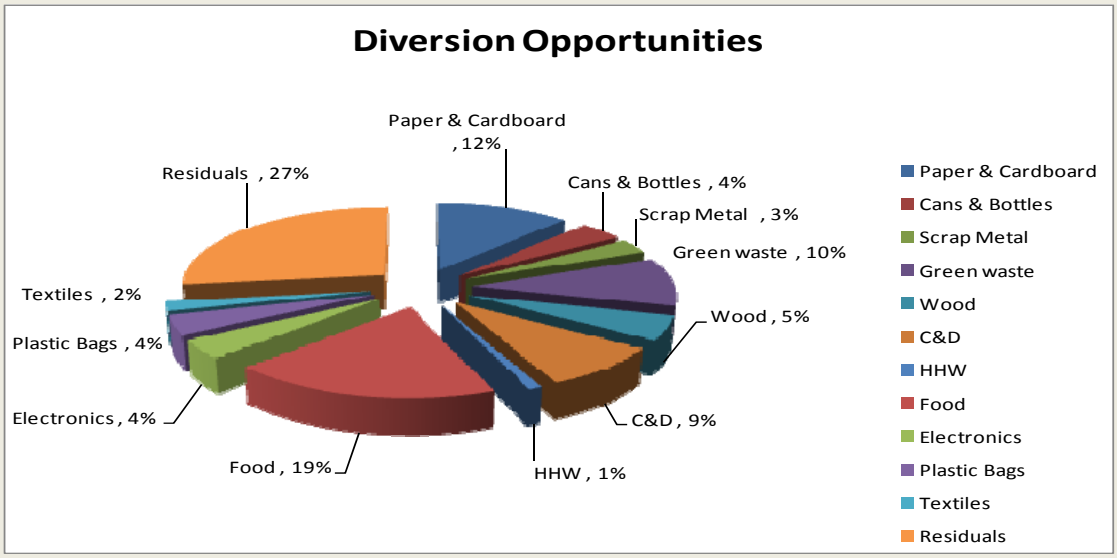
It's a five year Strategic Plan:

- Progress to be made by diverting City's MSW from landfills
- Characteristics of City's waste stream
- Recommended action plan to achieve diversion goals

The 2002 Solid Waste Policy was to make Santa Barbara the recycling leader of the State and target 70% diversion of waste by 2010.

5 http://www.wastekeysheets.net/pdf/ks2_02_tot_eng_copy.pdf

6 As referred to www.bren.ucsb.edu/academics/courses/282/Lectures/13-IE-5March-07-MacIntosh.ppt



The **Principles & Goals** were :

- Cost-effective diversion programs
- Secure, reliable service
- Minimal exposure to liability
- Long-term disposal options
- Ultimate control of waste stream

Long-term Strategies:

- Construction and demolition (C&D) recycling
- Enhanced commercial recycling
- Regional material recovery facility (MRF)
- Conversion technology (CT) as alternative to landfilling
- Long-term disposal options for biosolids

Current Programmes in Progress

- School Recycling (Diversion: 1%, Cost: $40,000)
- City Facilities Recycling (Diversion: 0.25%, Cost: $20,000)
- Public Education & Outreach (Cost: $75,000)
- Uniform Colour Containers
- Space Requirements for Recycling
- Recycling in Public Spaces (Diversion: 0.5%, Cost: $130,000)

Implementation – short term (fiscal year 2006-2007)

- C&D Recycling Ordinance
- Mandatory Commercial Recycling
- Food scrap Recovery and Composting
- Waste Generation Rate

- Additional Green waste Unscheduled Hauling Permits
- C&D Recycling Facility Support
- Rate Incentives
- Waste Stream Optimization
- Green Purchasing Policy
- Regional Discussions

Implementation – medium term (within five years)

- Local Material Recovery Facility (Diversion: 3.0%, Cost: $60,000)
- Being studied through MJSWTG
- Siting is primary challenge
- Hazardous Waste Management (Diversion: 1.25%)
- Consider siting new hazardous waste collection centre

Implementation – long term (beyond five years): Conversion Technology

- Explores feasibility of conversion technology
- Beyond five-year time frame of Plan
- Would not compete for recoverable materials
- MJSWTG requesting approval of CT principles

However, for many of the ISWM Plans around the world; the methodology adopted does not use the Strategic Planning (SP) approach. Even if that was adopted, clear justification for adopting this approach has not been properly explained. Some of the significant lessons learnt after reviewing the application of the various projects applying Strategic Planning Process for Solid Waste Management are as follows:

- Most of the ISWM Plans are more focused towards Municipal Solid Waste Management
- Though many of the Strategic Plans had defined a vision and mission, the implementation was complicated due to the individual objectives and actions getting mixed together with the planned objectives
- The targets with respect to time that were set by the plans, needed to be updated in order to achieve all the goals with some of the plans still being implemented
- Reduce, Reuse and Recycle Waste Management methods were a common feature among most of the ISWM Plans

Therefore, UNEP-DTIE-IETC has encouraged the use of Strategic Planning for the development of the ISWM plans for the cities of Pune, Wuxi and Lesotho. These plans were developed:

- To overcome the pitfalls in ISWM planning,
- To make use of the Strategic Planning approach for the ISWM plans for a city
- To standardize a methodology for ISWM planning around the world,
- To cover all the Solid Waste streams as well as all the aspects of ISWM

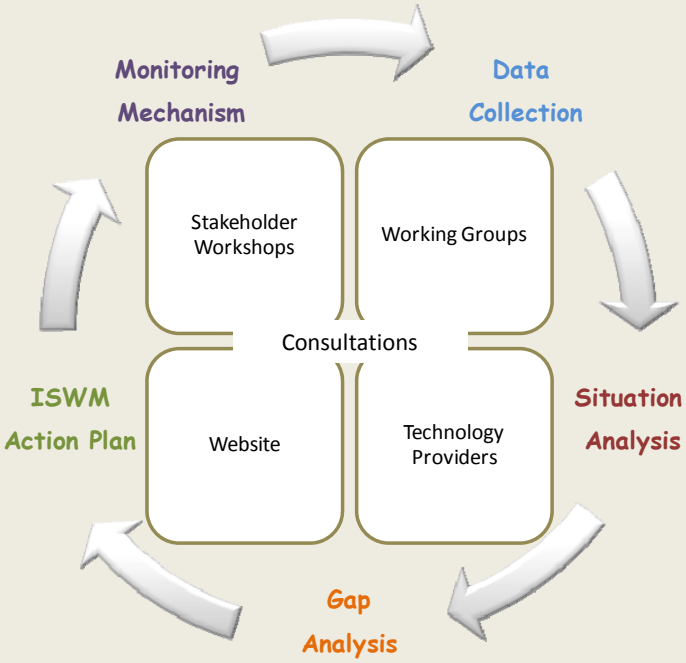
The example of Strategic Planning for Pune, Wuxi and Lesotho ISWM Plan is given below in **Box 2.5, Box 2.6 and Box 2.7 respectively**:

Box 2.5: ISWM Plan for Pune, India[7]

For development of the ISWM Plan, a participatory format was used.

- The process included consultation with stakeholders.
- Above and over this, the proper plan was developed through a continuous dialogue with a working group represented by all key stakeholders including regulatory, technical and financial organizations, key personnel representing the non-governmental organizations and professionals.
- The planning process was facilitated at every stage by involving stakeholder consultations.

The Strategic planning process incorporated Vision-Mission-Goals-Objectives-Targets-Strategies/Tactics-Actions-Tasks. The ISWM plan was divided into stages. The first report was the Situation Analysis report followed by the actual Strategic Action Plan for Pune City. The process envisaged is presented diagrammatically in the ***Figure*** below and explained in the subsequent sections.



Process of Developing the ISWM Plan for Pune

7 As referred to Draft ISWM Plan for Pune City, India

- The process of developing the ISWM plan for Pune started with **streamlining the information to be captured and analysed, and the development of data formats**.
- The Data Collection Formats were evolved based on discussions with the various agencies as well as the "*Guidelines for Data Collection and Analysis*" compiled by IETC-UNEP as the **base document, and understanding the national and local legal requirements**. This document was then submitted and approved by the project proponents.
- The **available data from the various sources was captured** and analyzed to assess the prevailing solid waste management systems in terms of their efficacy and effectiveness, including compliance with applicable legislations.
- **Understanding the overall 'situation' both in terms of environmental concerns and its institutional mechanism forms the first step of the SP process**.
- In the Pune ISWM plan, the **Situation Analysis Report provided an understanding of the existing state of affairs**. Based on the past data available, the future developmental activities and available trends of development, scenarios were developed for the future.
- **The scenario building approach was further used for the identification of gaps**. The gaps thus identified were elaborated in terms of infrastructure; institutional capacities, arrangements of human resources; financial constraints; etc. leading to a detailed Gap Analysis Report.
- Finally the **ISWM Action plan was formulated in line with the vision, mission, goals and objectives. The Action plan was structured in the form of schemes which were specifically designed for overcoming the gaps highlighted in the situation analysis report**.

Box 2.6: ISWM Plan for Wuxi New District, China[8]

Wuxi New District and UNEP have agreed to launch the project on "Development and Implementation of an Integrated Waste Management Plan for Wuxi New District". It aims at developing and implementing an Integrated Waste Management Plan (IWMP) to address the issue of solid waste being generated both from industrial as well as domestic sources.

The project is divided into three phases. In the first phase (completed), the current status of waste management in WND was studied in order to assess the gaps and identify areas for improvement. The second phase (currently ongoing) will develop an Integrated Waste Management Plan (IWMP) to address the issue of solid wastes from both municipal and industrial sources. The third phase will develop a comprehensive implementation programme for the IWMP covering capacity building, policy instruments, technological

8 As referred to Draft ISWM Plan for Wuxi New District, China

specifications, acquisition and installation.

The project is based on the concept of integrated waste management so that the waste constituents are recycled and reused to the maximum possible extent and the development of the city can take place in harmony with the environment. The project consists of the following main elements:

(a) Baseline data collection: source identification, quantification and characterization of different types of waste (including industrial, municipal, commercial, and agricultural and special wastes such as medical waste) including projections for future waste generation;

(b) Assessment of present waste management system: assess the efficacy and effectiveness of the existing waste management system covering all aspects (waste collection, segregation, transportation, treatment and disposal);

(c) Identifying issues of concern: identify and prioritize issues of concern so that they could be addressed in a systematic and effective way in the project, covering all areas such economic, technical, environmental and social;

(d) Development of an Integrated Waste Management Plan (IWMP): Based on the results of the earlier three elements, an Integrated Waste Management Plan is developed to address the issues identified and tackle the problem of solid waste in a comprehensive manner.

Box 2.7: ISWM Plan for Maseru, Lesotho

Integrated Solid Waste Management Plan (ISWMP) has been developed for the City of Maseru, capital of the Kingdom of Lesotho. This project was undertaken with a Memorandum of Understanding concluded between the United Nations Environment Programme (UNEP) and the University of Cape Town (UCT) Environmental & Process Systems Engineering Research Group.

The draft plan was developed on the basis of past experiences, independent observation, interrogation of available information (including the baseline study of waste generation in Maseru), and interaction with relevant stakeholders. The result is a concise, easy to read action plan of 15-20 pages with key deliverables and timelines. The action plan is supported by a number of technical support pages providing details on each proposed action. The ISWMP will be supported by a technical background report on Environmentally Sound Technologies (ESTs) which provides further guidance on achieving the deliverables.

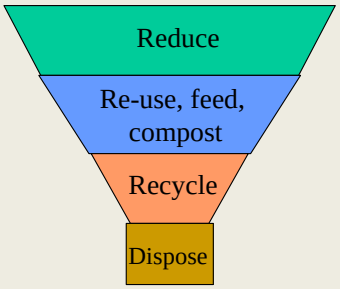
This Integrated Solid Waste Management Plan for Maseru is based on the following

principles:

1. Upholding the right of every citizen to a clean and healthy environment (Immediate need)
2. Protection of the common (public) goods for current and future generations (long-term requirement)
3. The importance of addressing economic and social value addition to waste management in terms of job creation & income generation
4. All citizens contributing to the growing problem and the potential to be a part of the solution
5. Primary focus on the promotion and implementation of the 3R principles (Reduction → Reuse → Recycle)
6. Awareness and education with a focus on resource reduction & waste-to-resource conversion
7. Building upon existing local capacities and experiences
8. Strengthening public-private partnership including community-based waste management process
9. Putting the necessary policy and institutional framework in place
10. Developing a built-in adaptive mechanism for the continuous monitoring and improvement of the system

Vision/Mission: The City of Maseru should take ownership of and drive this ISWMP by taking into consideration the following points:

- Public Health & Environment
- Delivery of Basic Services
- Efficiency & Economic Growth (private sector participation)
- Resource exchange (private sector participation)



All actions and activities proposed within this plan will be initiated and developed along a waste management hierarchy describing the order of preference of the different waste management options, starting with prevention and ending with disposal.[9]

9 As referred to Draft ISWM Plan for Maseru City, Lesotho

The following Chapters elucidate in detail various steps involved in the SP process as shown in *Figure 2.3*.

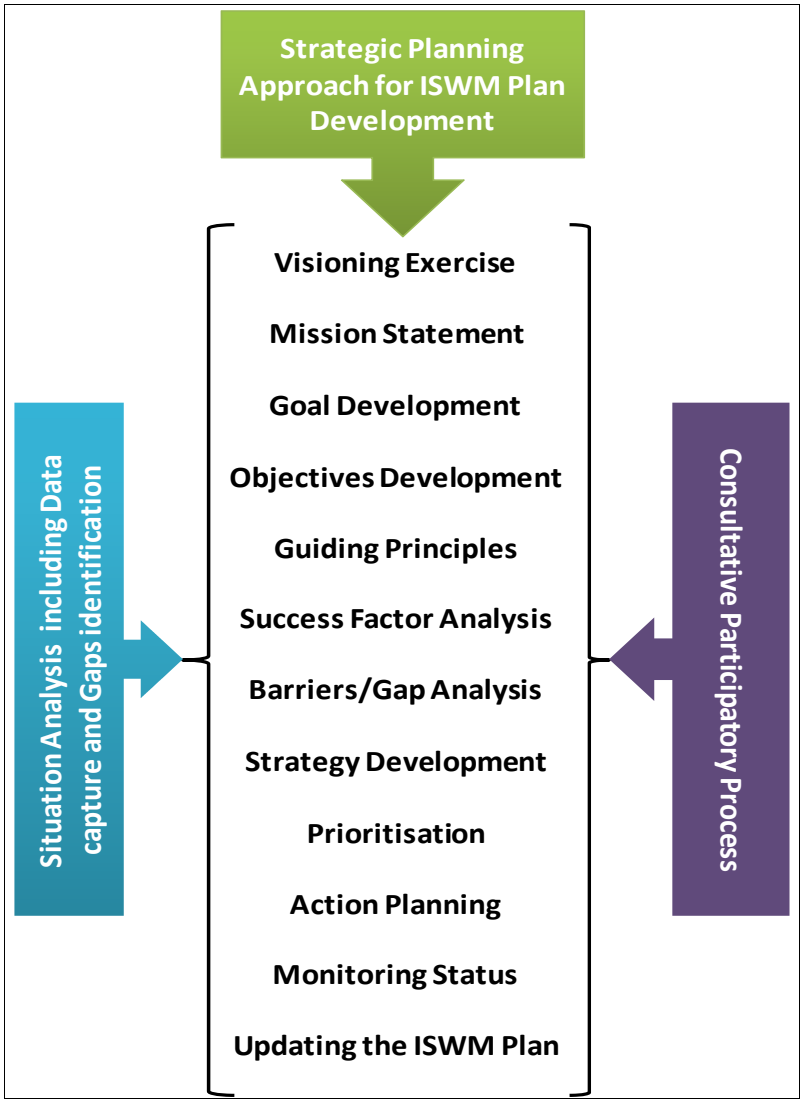


Figure 2.3: Steps in Strategic Planning for ISWM

The detailed steps involved in the development of the ISWM Plan using the Strategic approach are shown in *Figure 2.4*.

Chapter 3 highlights the preparation needed for ISWM planning including the understanding of the present situation, data capture and gap analysis. *Chapter 4* indicates the importance of participatory process used to set the strategic direction through vision, mission, goals and objectives.

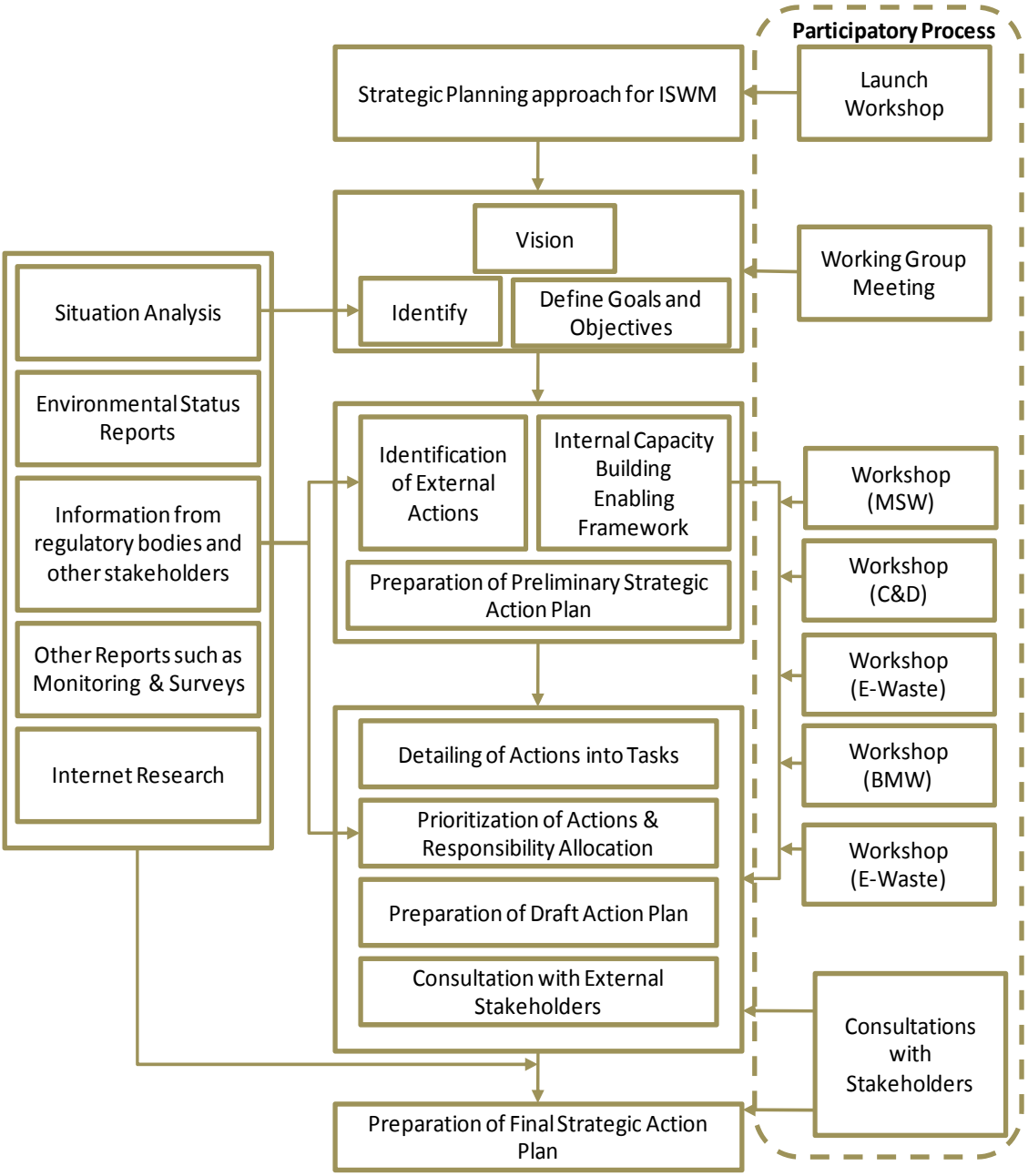


Figure 2.4: Detailed Steps in Strategic Planning for ISWM

What did you learn?

- ✓ **Strategic planning** is an organization's process of defining its strategy or direction, and taking decisions on allocating its resources, including its capital and people, to pursue this strategy. Various business analysis techniques can be used in strategic planning, such as SWOT analysis.
- ✓ **Strategic planning seeks to answer questions such as**:
  - o "What is our vision?"
  - o "How should we be organized?"
  - o "How should we allocate resources to our programs and services?"
- ✓ **SWOT Analysis** is a strategic planning tool used to evaluate the ***S*trengths, *W*eaknesses, *O*pportunities,** and ***T*hreats** involved in a project or in a business venture. It involves specifying the objective of the business venture or project and identifying the internal and external factors that are favourable and unfavourable to achieve that objective.
- ✓ SP process is about *planning* because it involves setting of targets or goals and developing a framework to achieve those goals. In other words, it can be explained as a vehicle for a journey, from the present situation to a better future.
- ✓ Strategic Planning (SP) is about the choice that is made from a number of alternatives, the prioritization of those choices, and the timing of the action associated with them. Thus, it is a proactive and target-oriented process-cum-methodology.
- ✓ Lastly, SP is essential towards achievement of long-term objective of developmental activities as it encourages a simultaneous consideration of social, environmental and economic factors.

3. Situation Analysis: A Crucial Milestone

Overview	**What will you learn**	This chapter presents a clear understanding of how to assess the present situation, collect the data required for the same, conduct analysis, scenario building, and gaps identification.
	Target addressees	• **City Authorities** • **Civic Authorities** • Professional service providers and organizations
	Attached Document	ISWM Manuals 1, 2 and 3

The detailed steps involved in the situation analysis are highlighted in *Figure 3.1*.

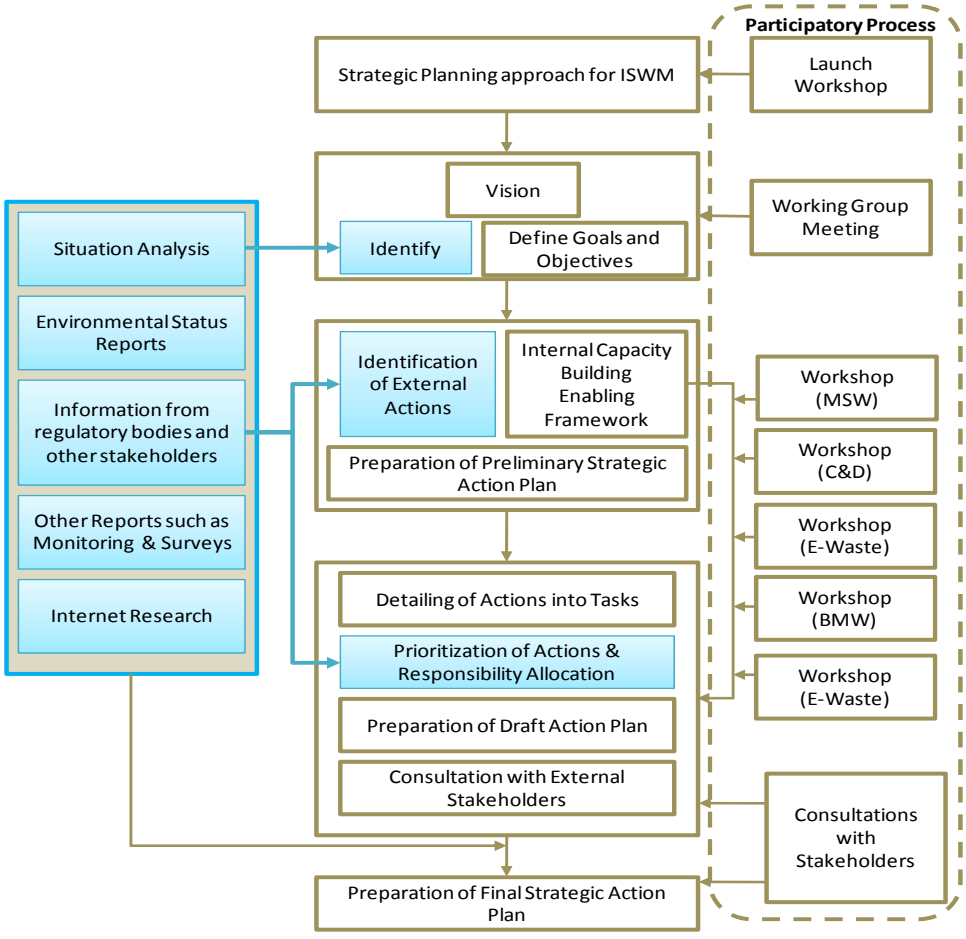


Figure 3.1: Detailed Steps involved in Situation Analysis

3.1. What is Situation Analysis

When developing strategies, analysis of the organization and its environment at the present moment and its development in the future, is important. The analysis has to be executed at an internal as well as the external level to identify all opportunities and threats of the new strategy.

Situation Analysis includes conducting a brief scan or review of the organization and its environment. A situation analysis presents the EXACT situation of the organisation.

In the context of the authority implementing the ISWM plan, situation analysis can be classified into two categories, namely:

- **External situation analysis**
- **Internal situation analysis**

The planners get a fair idea about what the organization must do as a result of the major issues and opportunities facing the organization. This leads to conclude as to what overall accomplishments (or strategic goals) the organization should achieve, and the overall methods (or strategies) to achieve them. Planners should make it a point that the goals are aptly worded and the objectives are target specific, measurable and acceptable to those working to achieve them.

3.1.1. External Situation Analysis

External situation analysis can be done by reflecting on the environment 'surrounding' the organization. The external environment typically consists of the situation of waste management in the concerned region. This would hence include all types of waste such as MSW, BMW, C&D Waste, HW and E-Waste. The external situation analysis would also cut across all the aspects of waste management i.e. from generation to disposal.

3.1.2. Internal Situation Analysis

In this category of analysis, a careful examination of the organization's various strengths, weaknesses, opportunities and threats is performed. This is also known as the "Strengths, Weaknesses, Opportunities, Threats" or SWOT analysis. Typical elements include:

- organizational structure (e.g., are there frequent changes at the top and/or middle levels of the organization?, etc.);
- staff profile (e.g., is there a shortage of skilled officers etc.);
- infrastructure availability (e.g., are the laboratories well manned and well equipped?, etc.);
- financial position (e.g., is the organization unable to perform its job due to a lack of financial resources?. etc.).

The linkages between Internal and External Situation Analysis are shown in *Figure 3.2*:

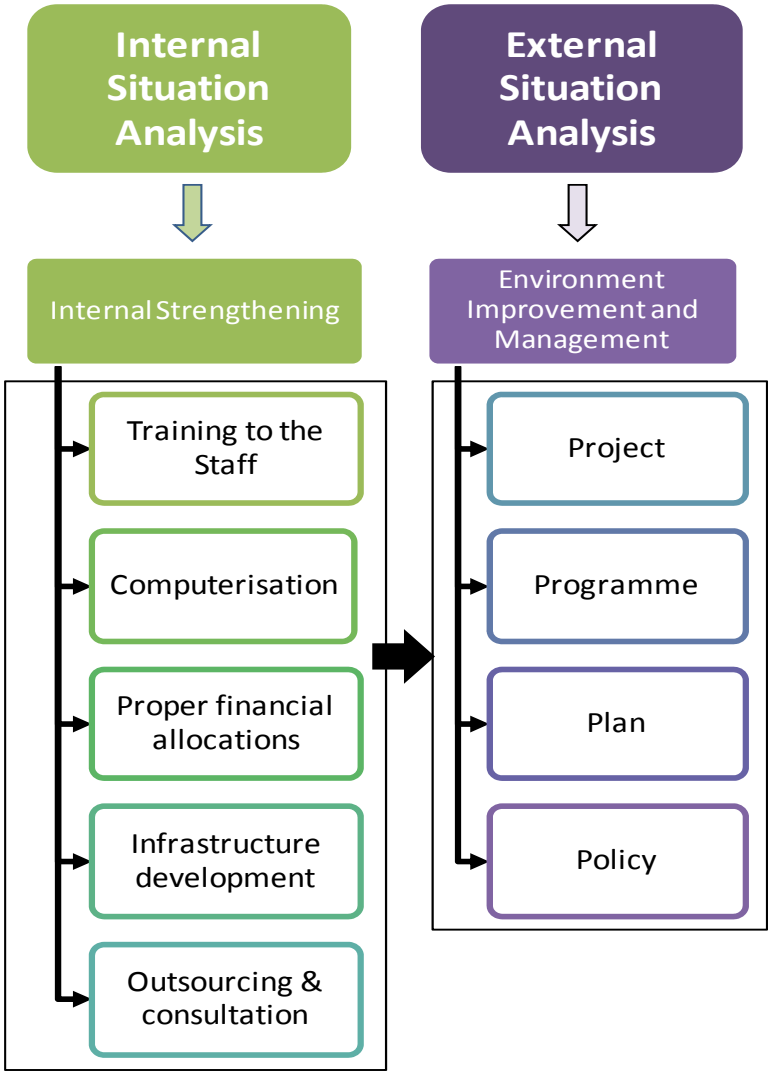


Figure 3.2: The Linkages between Internal and External Situation Analysis

3.2. What is the D-P-S-I-R Framework

The **Driving force – Pressure – State – Impact – Response (DPSIR) framework** used in situation analysis, assumes cause-effect relationships between interacting components of social, economic, and environmental systems. This framework attempts to effectively report the complex inter-relationship between the causes of environmental impacts and their effects. As a result, the DPSIR framework leads the way towards Strategic Action Planning. *Figure 3.3* shows the relationship between Strategic Action Planning and the DPSIR Reporting Framework.

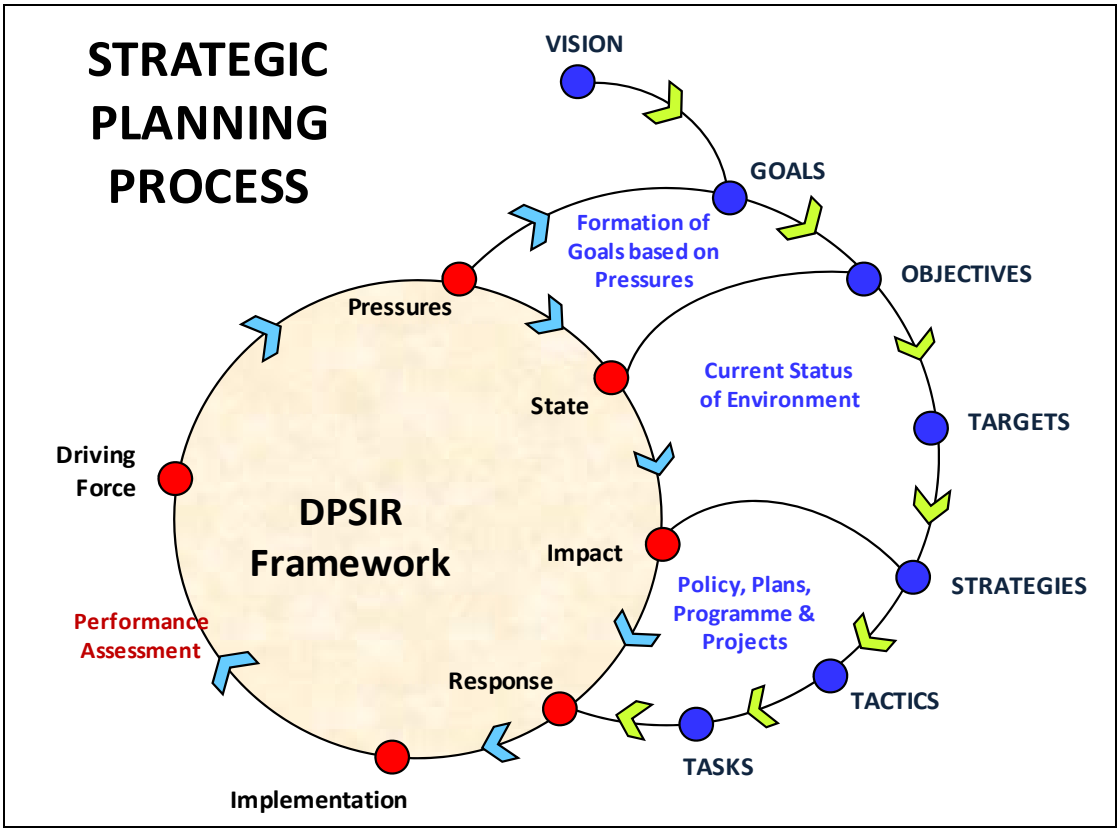


Figure 3.3: The Relationship between Strategic Action Planning and the DPSIR Reporting Framework

Some of the key terms used in the DPSIR framework are outlined below:

- **Driving Forces (D)**

A driving force is a human activity that is generated to satisfy a 'need'. Driving forces can be of two types - primary driving forces which are related to activities to fulfil the needs for shelter, food and water, and secondary driving forces which are activities to satisfy the need for mobility, entertainment and culture.

The following are some of the typical driving forces:

- Population growth
- Industrialization (resource extraction and processing)
- Urbanization
- (Lack of adequate) Infrastructure
- Intermittent driving forces such as religious- or leisure-based tourism

➢ **Pressures (P)**

The driving forces exert a stress on the available environmental resources which in turn induces pressures on the environment.

These pressures can be divided into two main types, namely:

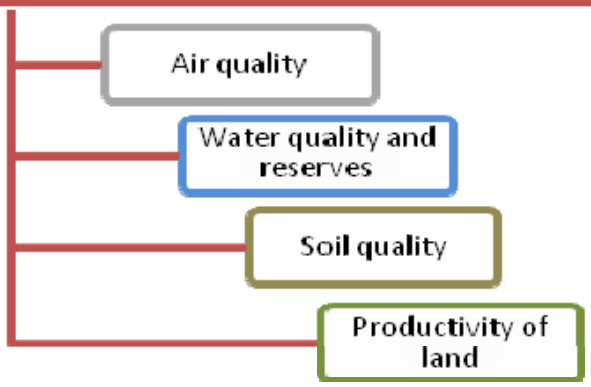
Depleting pressures, which are induced by driving forces that extract environmental resources, such as declining forest cover and reduced levels of groundwater table, etc.

Degrading pressures, which are induced by driving forces that discharge pollutants into the environment such as air pollution, water pollution and soil erosion.

➢ **State (S)**

As a consequence of the pressures, the state of the environment – its quality and quantity - gets affected.

The state of the environment is represented by the following:



➢ **Impacts (I)**

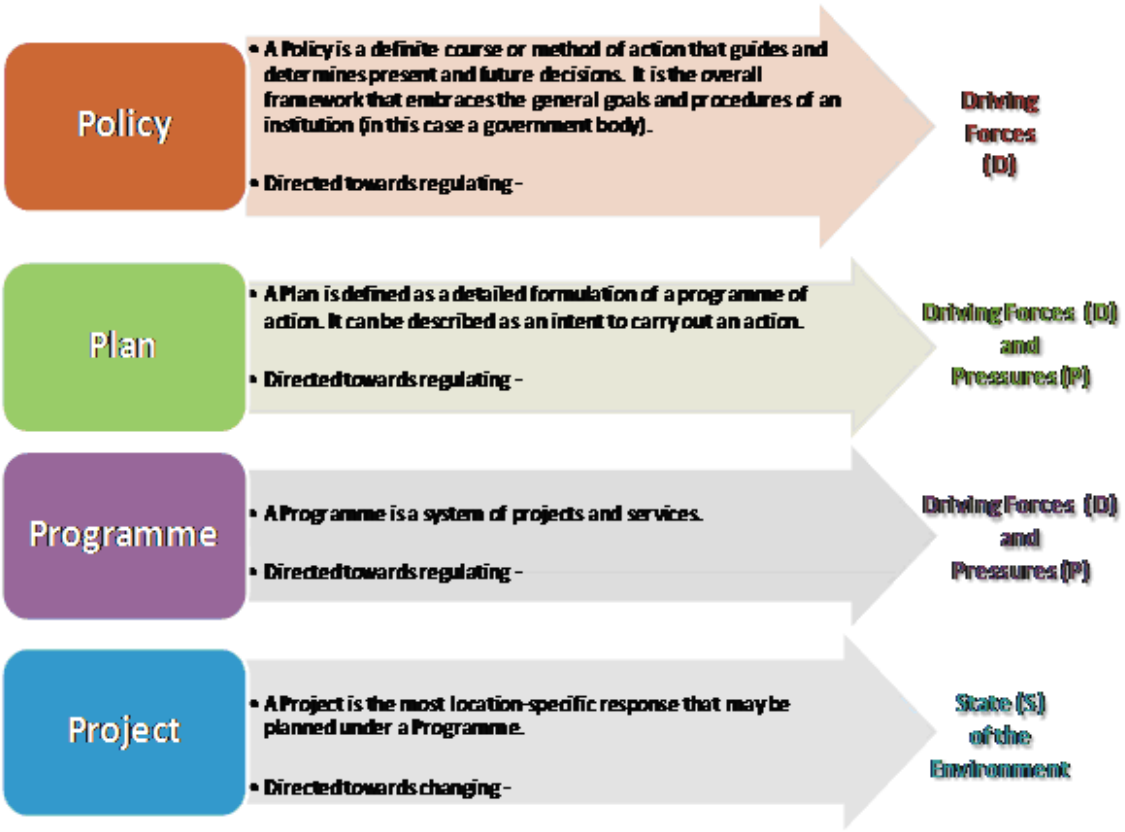
The physical, chemical or biological changes in the state of the environment have an impact on the quality of environmental resources, including biodiversity, health and welfare of humans. Polluted environmental resources have health and/or economic impacts, threatening the sustainability of all economic activities. **The following are some typical impacts:**

- **Status of biodiversity**
- **Human health**

➢ **Response (R)**

Due to an undesired impact, a response is triggered to address the change(s) in the environment. A response is directed specifically towards regulating driving forces, pressures or impacts to mitigate the environmental pollution. It should ideally

be a part of the larger Action Plan. **Response measures under an Action Plan can be categorized under four heads, namely:**



3.3. What is Data Capture

The Situation Analysis primarily aims to assess the contemporary situation. This analysis requires collection of accurate and updated data on the basis of which the assessment can be conducted. Data collection therefore forms a crucial step in the Situation Analysis process. It can either be conducted through dedicated data surveys or through the formulation of data formats.

The data formats prepared by the city/civic authorities for data collection need to be made with utmost care and the data collection procedure needs to be planned futuristically. ISWM essentially involves collection of authentic data from multiple sources concerning different waste streams. The development of data formats should be undertaken considering the following principles:

- To be prepared as a first step towards Inventorization of solid wastes generated in a region. The data formats should be able to aid the quantitative and qualitative assessment of solid wastes.

- To enable capturing the inter-linkages between different waste-streams and highlight the factors affecting overall waste generation. The data formats should also be able to speculate the probable waste generation trends.
- To allow for effective comparison between bench-marks and thereby allowing for compliance checks with the existing standards.
- To be designed in a progressive manner. The preparation of the data formats shall be guided by the existing data availability and should be duly modified with the changes along the project progress cycle.
- To account for uncertainties and variance in the data. The data formats should be so designed such that any uncertainties, variance and duplication of data is avoided at all times.

The underlying philosophy and key assumptions that should be made for data collection, analysis and projection are as follows. The data formats have been essentially derived on this basis.

- Population should be considered as the basis for calculating the municipal waste generation. Per capita figures for waste generation should be taken in accordance with the data compiled by specific organizations and agencies involved in Solid Waste Management (SWM).
- Various sources should be looked at for the basic source, for projection of demographic data. For example, population projections can be carried out by looking at data from the water supply schemes.
- The relation between per capita waste generation and socio-economic status should be investigated. Suitable modifications should be made in the per capita values accordingly.
- While reorganizing the waste generation factors which are a function of seasons, at times due to data constraints, average annual values should be considered as the basis.
- In the case of commercial establishments, where there are no guidelines available, then waste generation from such establishments should be estimated using empirical data as available. Another methodology to quantify waste from them is to develop a population equivalent. This methodology should also be attempted.
- Population forecasting is often fraught with uncertainties and limitations. The projection of waste generation taking forecasted population as a basis could have substantial variance. Further, it is very difficult to project the data on waste characteristics that need to be compounded with population projections. Hence, the Scenario Based Approach as against an approach based on Conventional Waste Projection is strongly recommended. Further, given the uncertainties in projections, population as well as the waste projections should be done only for the next 5 to 10 years (instead of 20-25 years).
- The data formats developed should be used as an aid to planning using quantitative and qualitative assessment.

- The data formats developed should be used as the starting point to enable inventorization, forecasting of various streams of solid wastes and conduct gap assessment covering all milestones such as waste segregation, transportation, treatment and disposal. Accordingly the data formats should be organized for each waste stream and for each milestone.
- The data formats should be progressive and should be updated accordingly.
- The overall data categories are explained in *Figure 3.4*

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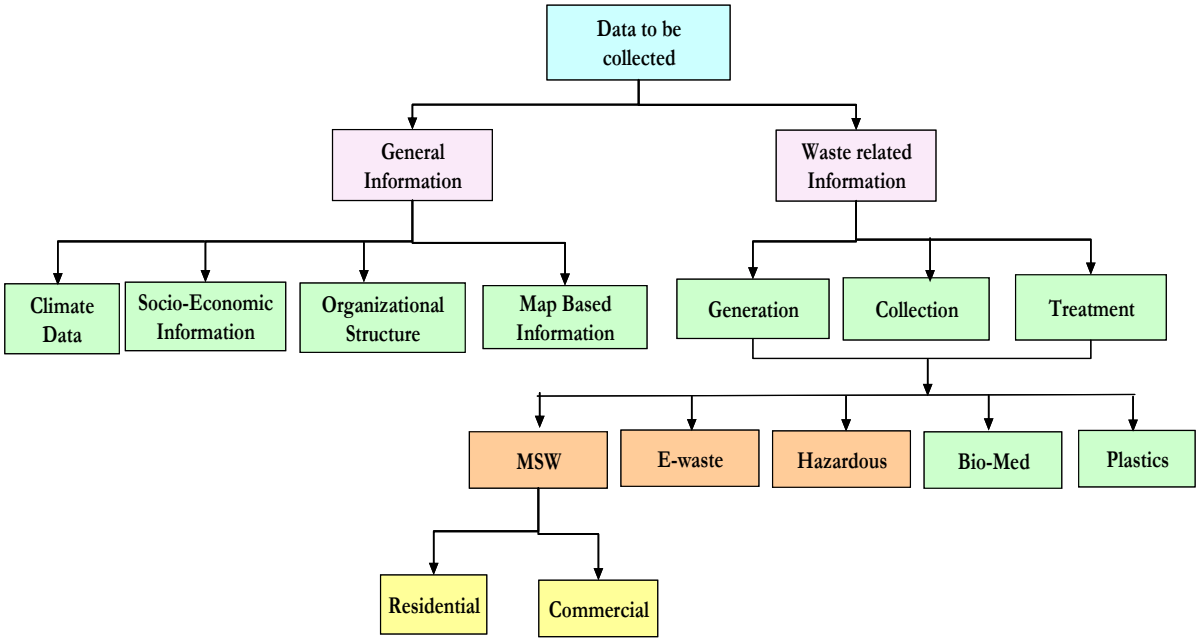


Figure 3.4: Overall Data Categories

A Set of Guidelines has been prepared for Practitioners which accompanies this Guidance Manual. These set of guidelines can be used for collection of information and data on Solid Waste from generation to disposal.

3.4. What is Gap Analysis

The SP process as discussed through the previous section is a continuous, target-oriented process. Therefore the setting of targets, needs constant updating. In order to enhance the efficiency of the SP process, it becomes crucial to bring-in specificity to the entire process. The targets set during the process should be clearly defined and quantifiable. In order to achieve setting of such clear and direct targets, the identification of gaps becomes crucial.

Situation analysis process attempts to scan the activities and present a picture of the existing scenario. It clearly outlays the existing scenario related to every aspect of

managing the existing problem. In the context of ISWM, situation analysis process helps in checking the efficacy of various systems such as financial, institutional and social. Each of these scans finally lead towards identifying lacunae in the corresponding systems. The gaps may therefore be compliance related, institutional and financial or even infrastructure related.

Gaps identified while preparing the ISWM Plan for Wuxi are listed below in **Box 3.1:**

Box 3.1: Gaps Identified – ISWM Plan Wuxi New District, China

- Though there are a lot of laws/acts established in many aspects of solid waste management, the mess still exists in some real issues. These phenomena will discourage the implementation of the policy and regulations;
- Arrangements are complicated and often overlap or have areas where no agency is responsible. Increasing volumes of waste, growing budget allocations, increasing sophistication needed for proper service delivery, equipment procurement, and private sector contracting, require improved regulation;
- Some technical standards are too old and cannot meet the current situation;
- Many laws are not effectively or completely not implemented;
- Some local regulations are in conflict with the national laws or regulations;
- Because of the situation in China, some laws and policies changed fast causing some disadvantages in solid waste management;
- There are too many administrative institutions and part of their assignment is overlapping, so in case of problems, they may owe the mistakes to each other;
- While some administrative institutions aren't responsible, and some others are non-professional;
- There is no unitive standard, so there are so many kinds of rubbish cans with different colours and materials in WND now. Some small communities do well about the MSW classification as they classify the waste according to the signs on the rubbish (such as the written "recycle" "no recycle" and et al);
- Composting should be an important waste management tool in WND. According to the investigation results on the current situation, WND's urban waste stream contains over 60% biodegradable organic matter – the managing of which is often challenging; it is wet (usually in excess of 50% moisture), which makes combustion impractical; it is dense which makes transportation more expensive, it is one of the largest sources of anthropocentric Greenhouse Gas, and its is fraction of the waste stream that causes nuisances such as odour, land fill leachate, and attracts vectors likes rats and flies;
- Experience with large-scale composting is however often poor. Most facilities developed have not performed as well as expected and the compost produced is often of poor quality. This is because most compost facilities in China, and elsewhere, attempt to compost mixed waste that has components adversely affecting

its quality. If mixed waste is shredded before composting, the finished compost quality is degraded by the presence of heavy metals, ash, pieces of plastic and glass shards;

- The majority of the people of WND do not have the ability to classify the rubbish resulting in mixed MSW;
- The sanitation situation of MSW is not proper;
- The vehicles used by the people for collection do not have a proper enclosure, and it results in leaking;
- The problem of mixed waste is serious. Some enterprises dump the HSW into the MSW collection facilities;
- The recycle activities are non-governmental, so it is difficult to administrate them;
- The soil resource is limited in Wuxi, which is not enough for sanitary landfill;
- No pre-treatment for MSW results in difficulty of proper disposal;
- The methods used for disposal of MSW are single;
- The process of existing incineration gives rise to hidden troubles;
- The places where the collection network didn't reach had a serious problem of open dumping;
- The sign to classify waste at collection facilities isn't clear in the plants of some enterprises. It gives rise to a phenomena of blend of solid waste;
- The plants of certain collection facilities are not adequate and more plants need to be placed in some enterprises. Some even have the same operating plant used for hazardous waste. It has disadvantages to the workers who are in charge of the collection and classification of ISW;
- The ISW of some enterprises didn't have a safe disposal facility, leading to the phenomena of illegal discharge, which contaminates the environment heavily;
- The government didn't provide an exchange platform on ISW, so the enterprise waste disposal can't embody the principal of "recycle economy";
- Some enterprises didn't pay enough attention on the HSW, they especially didn't realize the problems of HSW;
- Some enterprises consigned the HSW to non-qualified enterprises whereas the HSW had some economic value;
- Based on Solid Waste Law, the treatment of HSW should be authorized by the environment protection department, but the enterprises that transacted this treatment procedure were only a small part in WND;
- Some storage locations are non-regulated; they don't have the ability of preventing rain and leaking;
- Some HSW was transported for disposal out of the province, which didn't embody the principal of "Vicinity Disposal", resulting in hidden trouble during transportation;
- Some enterprises didn't follow the regulations, discharging the HSW mixed with MSW or ISW;
- There is no requirement of small clinics in MSW;
- Some hospitals didn't do well in the collection of MSW.

The details of the ISWM Plans for Pune city in India, Wuxi New District in China and Maseru, Lesotho are attached in Annexure 1, 2 and 3 respectively.

3.5. How to Move towards Action Planning

The scheduling for the SP process depends on the nature and needs of the organization and its immediate external environment. For example, SP should be carried out frequently in an organization whose products and services are in an industry that are changing rapidly. In this situation, planning might be carried out once or even twice a year.

On the other hand, if the organization has been around for many years and is in a fairly stable marketplace or external environment, then planning might be carried out once a year, focusing only on certain parts of the planning process. For most regulatory institutions a period of one year is adequate and appropriate.

The final step of bringing words into action is termed as action planning. It carefully lays out how the strategic goals will be accomplished. The intermediate steps include setting of objectives, or specific results with each strategic goal, and defining targets. Therefore, reaching a strategic goal typically involves accomplishing a set of objectives along the way - in that sense, an objective is still a goal, but on a smaller scale. Targets are measurable representation of objectives over a relatively short time. Often, each objective/target is associated with a strategy, which is one of the ways needed to reach an objective or accomplish a target. Implementing a strategy typically involves deploying a set of tactics along the way. A realization of tactic is a task. These need to be carried out to achieve expected results. Thus, the elements involved in action planning include objectives, targets, strategies, tactics and tasks. *Figure 3.5* represents the hierarchy of the key elements of the SP process.

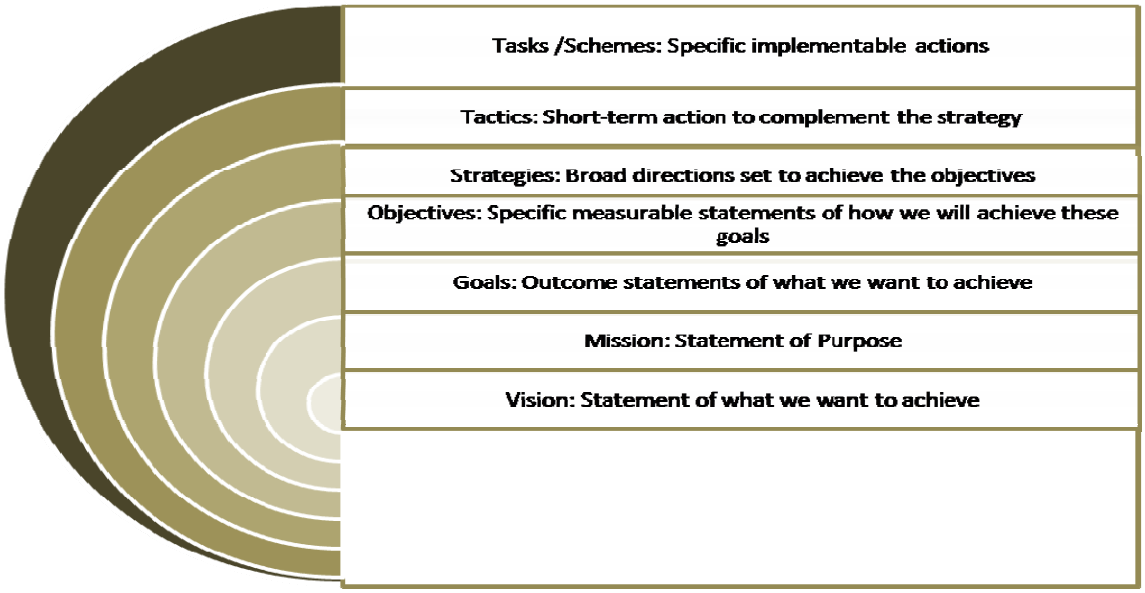


Figure 3.5: Hierarchy of Key Elements of SP Process

The framing of these key elements in a SP process is typically carried out through participatory process as discussed in subsequent chapters.

What did you learn?

- ✓ **Situation Analysis** includes conducting a brief scan or review of the organization and its environment. A situation analysis presents the EXACT situation of the organisation.
- ✓ The **Driving force – Pressure – State – Impact – Response (DPSIR) framework** is used in situation analysis, assumes cause-effect relationships between interacting components of social, economic, and environmental systems. This framework attempts to effectively report the complex inter-relationship between the causes of environmental impacts and their effects. As a result, the DPSIR framework leads the way towards Strategic Action Planning.
- ✓ The Situation Analysis primarily aims to assess the contemporary situation. This analysis requires collection of accurate and updated data on the basis of which the assessment can be conducted. Data collection therefore forms a crucial step in the Situation Analysis process.
- ✓ In the context of ISWM, situation analysis process helps in checking the efficacy of various systems such as financial, institutional and social. Each of these scans finally lead towards identifying lacunae in the corresponding systems. The gaps may therefore be compliance related, institutional and financial or even infrastructure related.

4. Drivers for ISWM Plan

 **Overview**	**What will you learn**	This chapter shows how to set the strategic directions; how to frame a vision and mission statement and the importance of the same; and how to select goals, objectives, strategies, and tasks for ISWM Planning. The participatory process that leads the way to the ISWM plan, and its significance are also explained in this chapter supported with suitable examples.
	Target addressees	• **City Authorities** • **Civic Authorities** • Professional service providers and organizations • Small and medium enterprises • Representatives or staff of other local stakeholders including community groups, NGOs, and the private sector
	Attached Document	ISWM Manuals 1, 2 and 3

The detailed steps involved in the participatory process are highlighted in *Figure 4.1*.

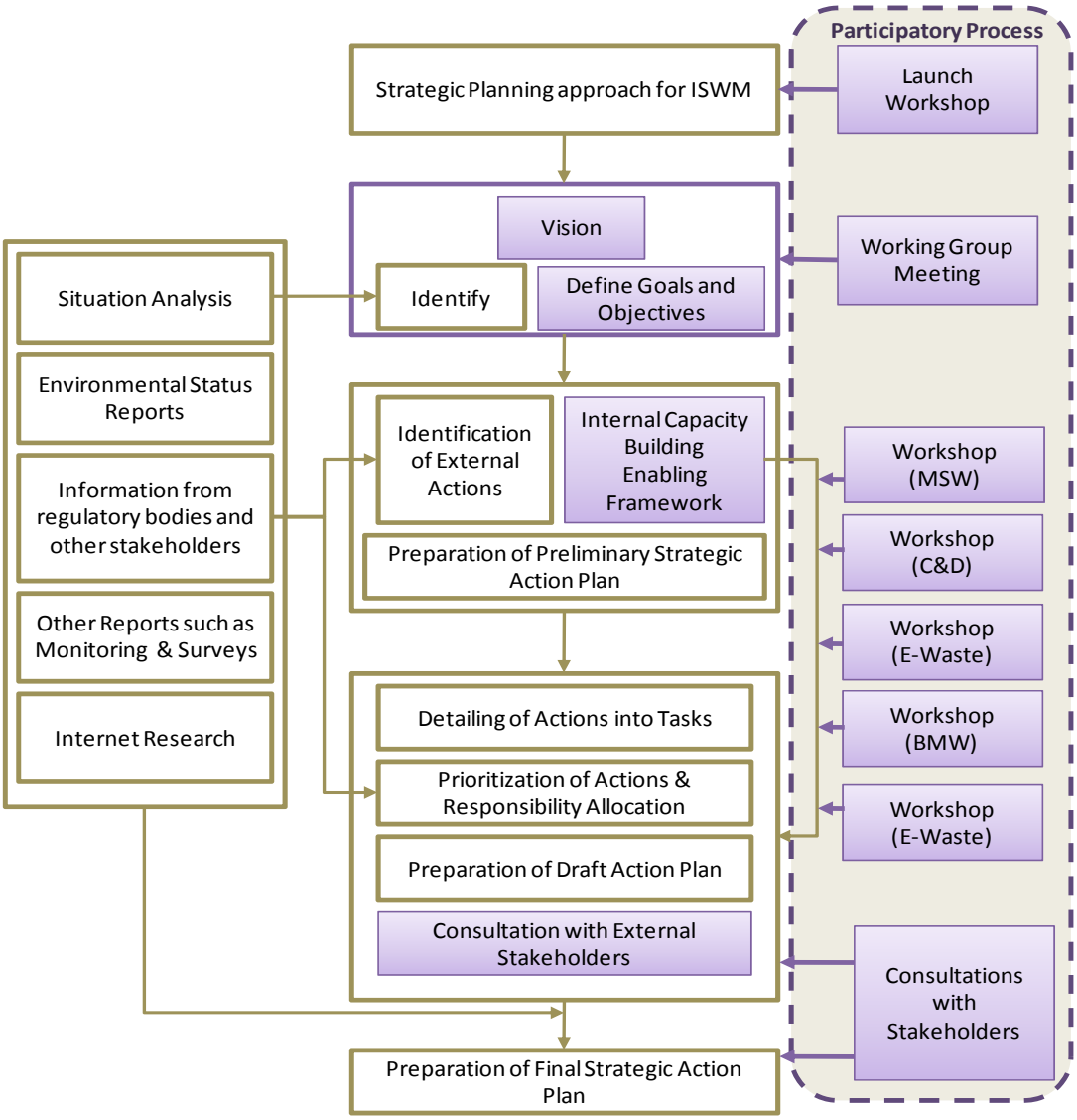


Figure 4.1: Detailed Steps in involved in the Participatory Process

4.1. How to Set Strategic Directions

The identification of gaps forms a base for the development of the ISWM plan. Once the issues have been identified, both across internal and external environment, the next process in Strategic Planning is to set an appropriate strategic direction. This is done by establishing a Vision/Mission statement, the Goals and the Objectives. In many ways, Situation analysis stimulates formation of the vision and mission statements. Such statements often find roots in the basic objectives and functions of the organization and are generated through brainstorming sessions.

Strategic planning and decision making processes should end with objectives and a roadmap of ways to achieve them. The following terms have been used in Strategic Planning: desired end state, plans, policies, goals, objectives, strategies, tactics and actions. Definitions vary, overlap and fail to achieve clarity but the most common features of these concepts are specific, time bound as well as general and continuing statements of intended future results, which most models refer to them as either goals or objectives (sometimes interchangeably).

4.1.1 What is a VISION Statement?

Vision: Defines where the organisation wants to be in future. It reflects the optimistic view of the organisation's future, a guiding image of success formed in terms of a contribution to society. It provides clear decision-making criteria.

A Vision Statement is built on reasonable assumptions about the future. It is a conceptual description of the desired future state; a compelling picture or image that helps individuals understand the future direction and achievement of the organization's purpose. A strategic vision depends on an organization's ability to see and feel the desired state. It stimulates action and is a yardstick for measuring the progress. The vision statement thus requires the organization's members to stretch their expectations, aspirations, and performance.

Expressions of a Vision could be both external as well as internal. **An External Vision** focuses on how the world will be improved, changed, or different if the organization achieves its purpose. **An Internal Vision** describes what the organization will look like when it is operating effectively and efficiently to support the external vision.

A comprehensive vision statement would convey both the external and internal vision for the organization. While, a smart sustainable growth is desired, a vision statement should be realistic and credible, well articulated, easily understood, appropriate, ambitious and responsive to change. It should orient the organization's energies and serve as a guide for action at the same time being consistent with the organization's values. In short, a vision should challenge and inspire the group to achieve its mission. **The key to developing a clear vision is to recognize that the process to form the statement is as important as the vision statement itself.**

Features of an effective vision statement include:

- Clarity and lack of ambiguity
- Paint a vivid and clear picture of the desired state and not an ambiguous one
- Describing a bright future (hope)
- Memorable and engaging expression

- Realistic aspirations that are achievable
- Alignment with organizational values and culture - have a rational approach
- Time bound if it talks of achieving any goal or objective

4.1.2 What is a MISSION Statement?

Mission: Defines where the organisation is going now, basically describing the purpose and why this organisation exists. It concentrates on the present, defines the stakeholders, critical processes and it informs you about the desired level of performance.

The mission statement is a precise description of what an organization does. It reflects the overall purpose of the organization. When wording the mission statement, organization's products, services, markets, values, and concern for public image must be considered.

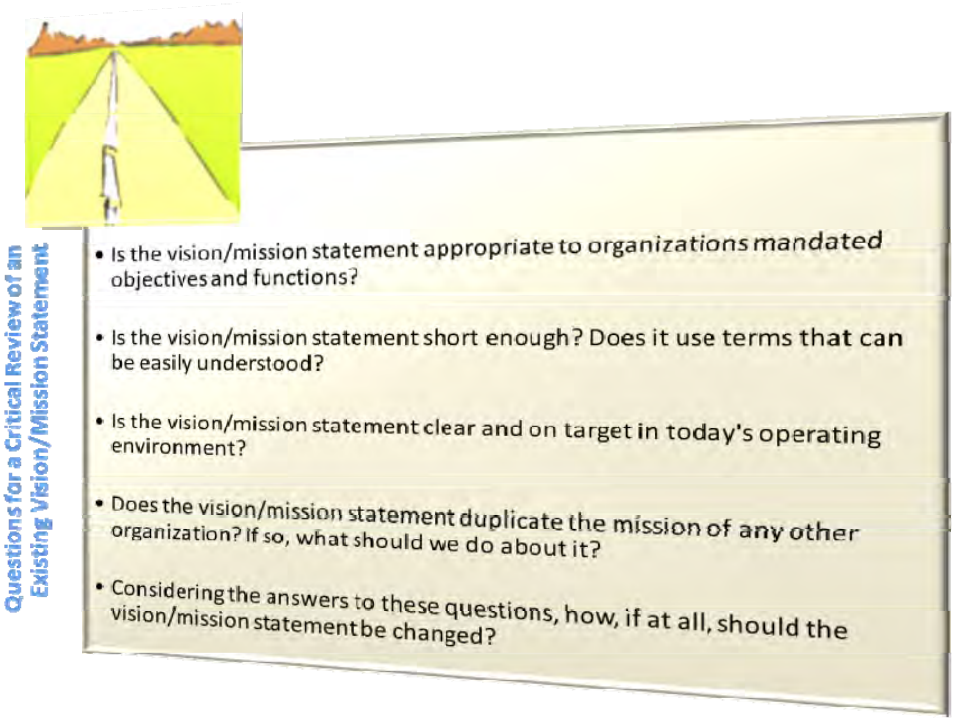
Many people mistake vision statement for mission statement. The vision describes a future identity whereas the mission describes why it will be achieved. A mission statement defines the purpose or the broader goal for being in existence or in the business. It serves as an ongoing guide and doesn't have any specific time frame. Vision is more specific in terms of objectives and future state and is related to some form of achievement if successful. The vision statement can galvanise the people to achieve defined objectives, even extended ones, provided the vision is **SMART (Specific, Measurable, Achievable, Relevant and Time bound)**. A mission statement provides a path to realise the vision in line with its values. One of the greatest problems with vision statements is that they become a blend of values, specific goals, and mission statements. Good vision statements are surprisingly rare. What is often quoted as the environmental vision, in reality is a commitment statement (e.g., "We will conduct our business with respect and care for the environment.").

In order to avoid stereotypical vision and mission statements, the organization should spend time to understand its goals, constituency, growth and expansion plans as well as why the organization was founded, and what it plans to do for its stakeholders, the community and itself in the short and long term.

How to form a Vision?

The Working/Steering Group should identify and list the current issues for SWM in the city. These issues can range from the regulatory point of view, management aspects, compliance related, institutional and financial or even infrastructure related. After the issues are discussed, the group should forecast the outcomes that it wants to achieve. While forecasting, straight line projections based on current trends should be used and also the activities that are planned or foreseeable must be considered. Once the draft vision statement is formed by the Working Group members, it can then be circulated in the consultative workshops for comments. The draft vision statement should also be

made available to all stakeholders of the programme so that it could be shared with the community and they are able to associate with it. Questions for a Critical Review of an Existing Vision/Mission Statement are shown below:



4.1.3 What are GOALS and OBJECTIVES?

Goals: Specific, discrete aims that define accomplishment of the vision and mission.

Objectives: Specific, concrete, quantifiable, realistic statements that measure the accomplishment of a goal over a specified period of time (2 to 3 year time frame).

Goals are broad statements of what the organization hopes to achieve in the next 5-10 years. Targets are sometimes treated like sub-objectives and include *"what will be accomplished"* and *"by when"* and focus on results over 1-2 years. In many ways, goals set directions, and objectives (along with targets) define what is exactly to be achieved in the chosen direction.

Some literatures refer to the definition of a goal as an objective and vice-versa. The important thing to remember is to capture the flow of logic from the general to the specific and concentrate on *describing the change* that will improve the problem you are trying to fix when writing program goals.

Goals need to be:

- Consistent with vision/mission statements
- Focused on near future
- Focused on outcomes
- Qualitative in nature

Goals and objectives can be written at several levels. Organizational goals and objectives may be written at a macro level including the city and surrounding regions followed by operational goals/objectives which maybe media specific. Individual program goals and objectives would flow from the organizational goals and objectives at more of a micro level.

Each plan or project, typically have several goals at the same time. "Goal congruency" refers to how well the goals combine with each other. Does Goal A appear compatible with Goal B? Do they fit together to form a unified strategy? "Goal hierarchy" consists of the nesting of one or more goals with other goal(s). Using one goal as a stepping-stone to the next involves goal sequencing. Goal sequencing can create a "goal stairway". In an organisational setting, the organisation may co-ordinate goals so that they do not conflict with each other. The goals of one part of the organisation should have compatibly with those of other parts of the organisation.

4.1.4 What are STRATEGIES, TACTICS and TASKS?

Strategies: Broad activities required to achieve an objective, control a critical success factor, or overcome a barrier.

Tactics: Tactics are defined as the activities to be carried out to implement the strategy i.e., "how will it be done?"

STRATEGIES

- Strategies are choices about how best to accomplish an organization's set goals and objectives. They basically address 'what' to do to achieve the given goals, objectives and targets.
- Strategies encourage to look for alternative ways and means to achieve the same objective or goal. They also assist in prioritization amongst these alternatives or choices and recommend timing of the action associated with these alternatives.
- Strategies are often derived from the results of SWOT analysis done at the time of preparing the situation analyses report. The vision statement and supporting principles also help towards generation of strategies. Many of the strategies get evolved once we subscribe to the principles such as "do no harm", "precautionary", "conservation and protection" etc. Key elements of vision such as "safeguard" and "improve" trigger subscription to these principles.

- Strategy is a process and not an isolated event. The process is adaptive; develops as it goes along and responds to change – thus strategies tend to get improvised with accumulation in experience.
- **Strategies are judged effective if they exploit opportunities for development, keeping in mind the principle of sustainability.** They should
  - Defend stakeholders against environmental threats
  - Leverage organizational competencies
  - Correct organizational shortcomings
  - Offer some basis for future competitive advantage and counteract forces eroding current competitive position

Tips for the Development of Strategies:

- The top or priority issues usually produce the most complex and contentious strategies to deal with the issues and reach each goal.
- To help refine and clarify ideas, consider asking "Why" five times to each idea. An idea is often a strategy.
- To further explore a strategy ask the speaker if his or her strategy is based on an assumption, solid data, and is it a conclusion?
- Each major function of an organization should eventually have its own *specific strategies, measurable objectives, resource needs,* financial need specification and budgets, and plans to evaluate results.
- During strategy development, continue to ask, "Is this really a strategic activity? Will it leverage change in your organization?"
- Reconsider strategies that have worked and failed in the past.
- Ensure strategies do not conflict with each other, i.e., that implementing one strategy will directly impair implementation of another.

TACTICS

- Tactics essentially looks for innovative ways of 'how' to trigger the strategies.
- Tactics often require "out of the box" thinking; being able to arrive at options that can effectively help implement the strategies. Again, tactics get evolved as one starts thinking about implementation of a strategy.
- Tactics are specific actions and deeds used to achieve goals and implement a particular strategy. There is a subtle difference between a strategy and a tactic.
- Tactics is concerned with how to make a change, while strategy is about deciding what change to make. In other words, tactics are about 'the how,' and strategies are about 'the what.' Strategy and tactics present alternatives of how to achieve objectives/targets in the direction of goals.

Figure 4.2 gives an illustration on the relationship between objectives, strategies and tactics

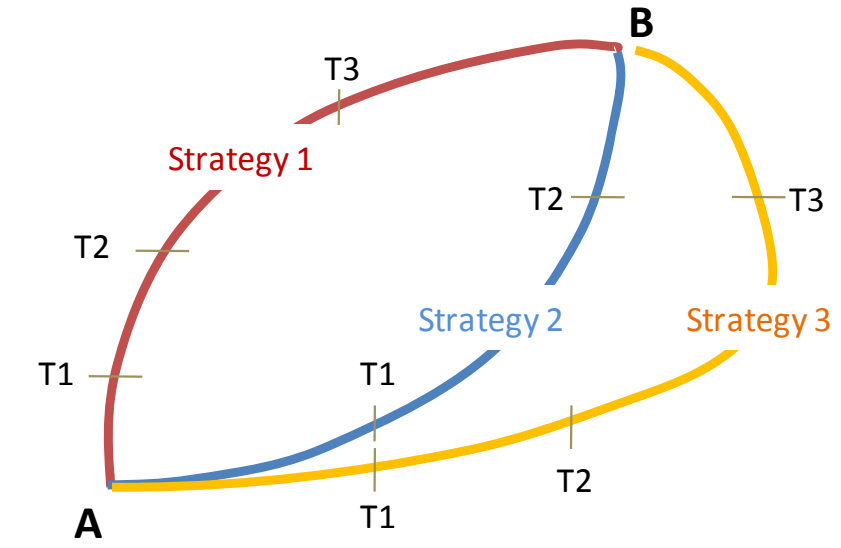


Figure 4.2: Inter-relationship between Objectives, Strategies and Tactics

Here, getting from Point "A" to Point "B" signifies achieving an objective or a target. In order to do so, there may be "n" number of strategies, with "m" number of corresponding tactics. Preference should be judged based on economic, environmental and social implications. Thus, while one may develop numerous strategies, some of them could indeed score over others, or certain tactics could be more practical and socially acceptable or certain tasks may be more economical and effective to implement than others. Hence one should not miss in highlighting of preferred strategies, tactics and tasks in the Action Plan with logical reasons.

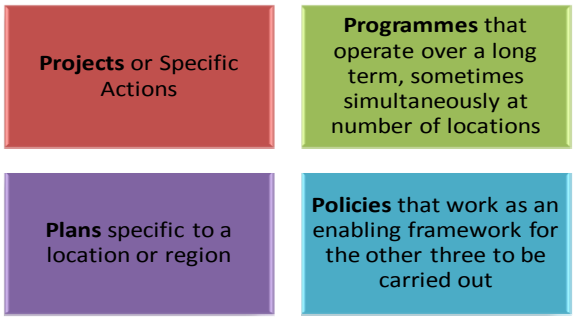
Tasks: Actual action performed to implement required tactic/ strategy. Tasks may be defined as "what will be done, and by whom?" Tasks are the specific actions that are required to be taken to implement the strategies and tactics devised earlier.

TASKS

- Tasks need to be defined with performance indicators and allocated with clear responsibilities. Resources for implementation of tasks are to be mobilized that includes financial, institutional and knowledge (technical) related requirements.

- **Tasks could include:**
  - Desk work such as literature reviews, preparing documents on terms of reference or guidelines or manuals, communication with stakeholders etc.
  - Conducting meetings with organizations/institutions to form partnerships/MoUs
  - Engaging contract agencies, consultants
  - Conducting research studies, monitoring programmes or pilot projects
  - Building common environmental infrastructure
  - Conducting training
  - Conducting field assessment
  - Initiating policy reforms, modifying standards or norms,
  - Taking legal actions such as moving or closure of industries, slapping penalties etc.
- During and after implementation of the tasks, performance of the strategic action is assessed in terms physical completion, resource utilization and effectiveness realized.
- One of the important points that accompanies task formulation activity is deciding roles and responsibilities on who will carry out these tasks and when. This is extremely important as unclear communication can cause delays or slippage of tasks and thus affect the achievement of objectives. Again, task description is not complete unless performance indicators (measurable and verifiable) are tagged to each task.
- Tasks demand resources – financial, institutional (human) as well as knowledge resources. This may need preparatory activities (e.g. fund mobilization, training etc). A strategic action plan thus consists of listing of tasks, geographic/administrative jurisdiction, priorities or timing, responsibility allocation, resource requirements, needed preparatory work and performance indicators. Unless these details are worked out at the task level, benefits of strategic planning process are not fully realized.

- **Tasks are often categorized into 4Ps viz.**



So, not all tasks are merely physical or limited to projects. A 4P consideration ensures creation of an enabling framework around the action plan to ensure long term outcome and sustainability. **A Typically enabling framework looks at:**

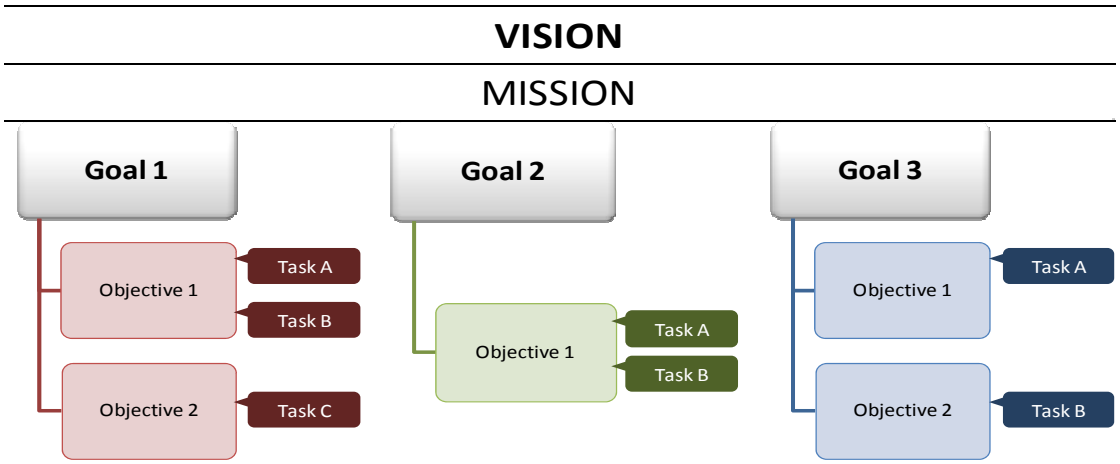
- *Policy and Regulations*: Are there any conflicts in the existing policy and regulations especially with respect to the strategies, tactics and tasks adopted? For example, certain

tactics/tasks cannot be undertaken unless there is a support from policy and regulatory framework

- *Finance*: How can the internal financial resources be better allocated, optimized (i.e. through public-private partnerships) and strengthened (using new instruments); how can the external financial resources be mobilized
- *Institutions*: Strengthening of the organization itself – its operational framework; directional powers; monitoring mechanisms, etc
- *Stakeholder participation*: How can awareness be built to obtain active participation and commitment of all stakeholders towards the vision and action plan.

Finally, in some cases, it may be difficult to differentiate between a strategy, a tactic and a task. One should not spend much time however on the semantics. The key is how to reach to a logical generation of tasks, by thinking through strategies and tactics.

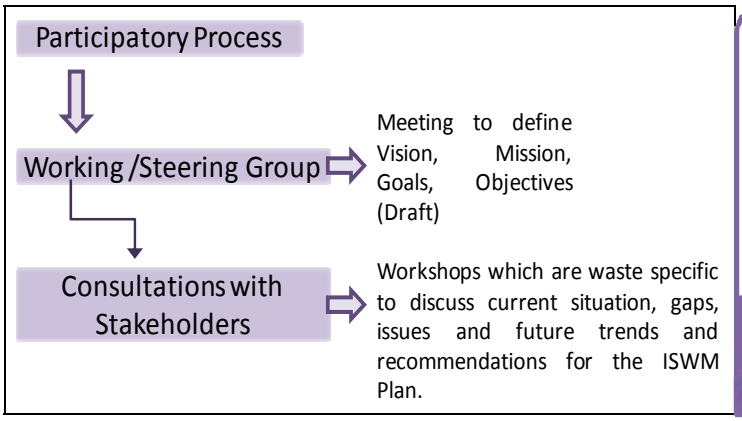
The following matrix can be used to map the vision, mission, goals, objectives and actions/tasks.



4.2. What is the Participatory Process in ISWM

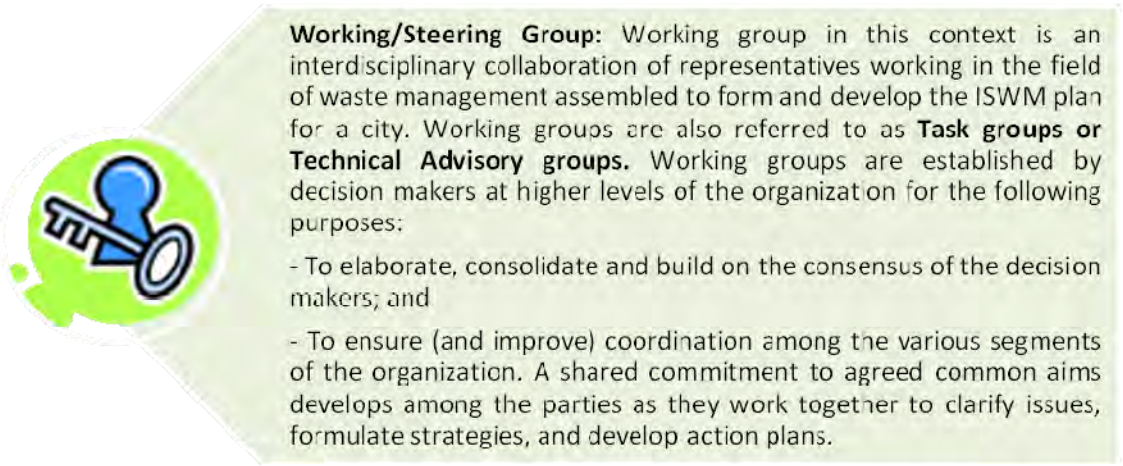
For the formation of the ISWM Plan, while the current situation is being accessed, data is collected and the gaps identified and analyzed, a consultative approach in setting the vision, mission, goals and objectives is important for proper action planning. The process of Strategic Action Planning should take place through a consultative participatory process that should consist of a dialogue and interaction between the various stakeholders involved in the ISWM planning.

Engaging stakeholders throughout the planning and the implementation process helps in building long term support from the citizens. It is important to obtain the opinion of the stakeholders on the vision and goals.



A. Formation of the Working/Steering Group: The city and civic authorities, who are responsible for the ISWM plan of the particular city, should first form a working/steering group by organizing the representatives from various organisations, such as

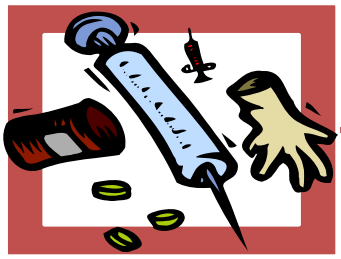
- All the waste management Regulatory Bodies,
- Technology providers
- NGOs working specifically in the waste related fields
- Citizen representatives
- Small and medium enterprises



The working group should discuss and debate on the Vision, Mission, Goals and Objectives of the ISWM Plan along with the strategies that could be deployed to achieve the targets.

B. Consultative Workshops: Subsequent to the discussions within the working group; a series of workshops or meetings should be held between various stakeholders and the civic and city authorities targeting each of the waste streams. The Stakeholder Consultation workshops can be of two types, either **thematic** or **stakeholder specific**.

- **Thematic Workshops**: Thematic workshops bring together stakeholders that are concerned with a single issue or a particular opportunity. One benefit of having such workshops is that all the stakeholders involved in the issue can interact directly with one another and can identify solutions that are mutually suitable.



Theme

Disposal of Biomedical Waste

- Stakeholders that would be invited to such a workshop include :
  - Representatives of medical associations
  - Representatives from the hospitals,
  - Government officials who are in charge of waste disposal,
  - Technology providers (suppliers of incinerators/ waste collectors etc.)

- **Stakeholder Specific Workshops**: Workshops that are specific to stakeholder groups intends to bring together various members with a common background and purpose. For example, all the NGOs working towards environmental management or all organizations working towards social and developmental change can be brought together. The benefit of this type of a consultation is that all the viewpoints from a single group can be collected.

Since the ISWM plan covers all waste streams, these can be taken as themes and such thematic workshops could be held. Stakeholder specific workshops can be held provided there are a number of similar types of organizations present in a city and their opinion would make a difference in the decision making.

C. Conducting Thematic Workshops:

I. Identification of Stakeholders:

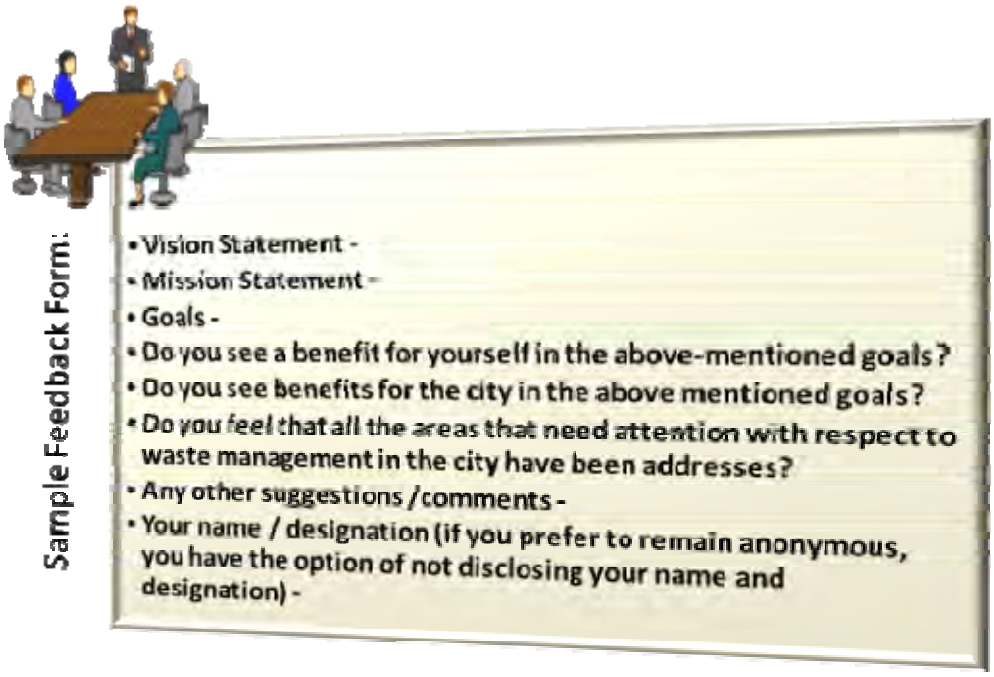
- Determine who will be directly or indirectly affected by the ISWM Plan
- Determine which groups can contribute to the project and in what way
- In order to increase participation by the stakeholders in such workshops, invitations should be sent out by the city and civic authorities. The information should also be advertised through several communication portals such as the newspapers, television, city authority website etc.

II. Consultation and Disclosure:

- The conduct of such workshops should emphasize on the aim to gather maximum inputs from the stakeholders.
- The city/civic authorities should present some of the key findings and issues based on the situation analysis study to the various stakeholders.
- Various experts and technology/service provides for the particular waste stream should be invited as panellists to facilitate the discussions with the other stakeholders and to share their experiences and views through presentations.
- Such presentations should be followed by discussions involving the key stakeholders, technology/service providers, NGOs, representatives of various educational and research institutions and concerned city/civic authorities.
- All the participants of these workshops should be briefed on the action plan which would be developed as well as their feedback should be taken for the draft vision, mission, goals and objectives.
- Obtain inputs from the stakeholders; this can help in identifying opportunities for improvement on a continuous basis.
- All the stakeholders should be informed about the potential opportunities for economic or environmental benefits that can be obtained from the ISWM Plan. This will encourage the stakeholders to participate actively in the implementation process.

III. Obtaining Feedback:

- Getting a feedback from stakeholders on a continuous basis will help in resolving problems at an early stage.
- Methods of obtaining feedback mechanism include feedback forms. These forms should be distributed during the consultation workshops and may be collected at the end of workshop. A sample feedback form is shown in the figure below:

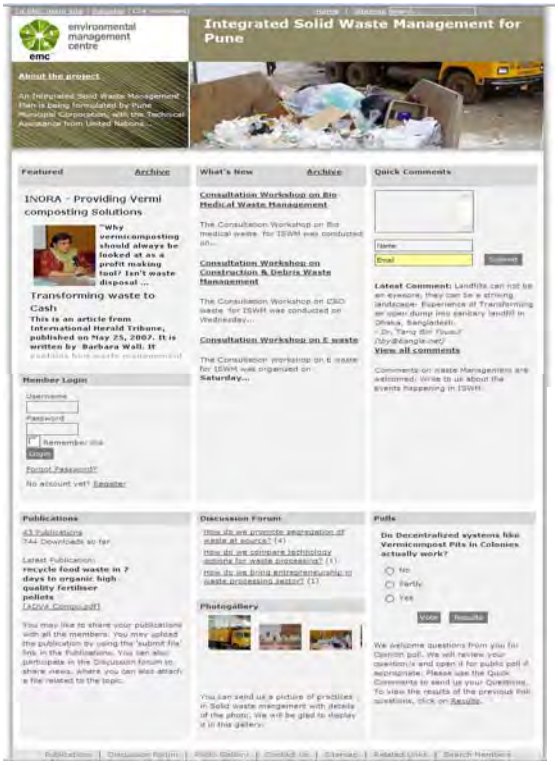


- Another method for obtaining feedback is to conduct discussion sessions at the end of the workshop. However, someone should to note all the points that arise in the discussion. The highlights of the consultative workshops on each waste stream should be analysed to distil the significant points of discussion.
- One of the most widely used methods today, is the online feedback mechanism. The city/civic authorities can have a website that gives updates about the programme. In case there is already an existing website of the city/civic authorities, then a webpage can be created for the ISWM Plan. This website can be used as a tool for spreading the word about the plan as well as obtaining feedback from various members about the development of the programme. This website can also be utilized as a platform for discussion on various issues on waste management relevant to the city.
- Examples of such websites are provided below.

http://iswm.emcentre.com

This website was started under a UNEP DTIE project, named Integrated Solid Waste Management for Pune. The website contains the following:

- Facility for send query or comment
- Information about various workshops happening in the city about waste management
- Some feature stating the existing waste regulations in such a form which can be understood by common people
- A corner/feature to highlight the innovative waste management or waste to resource which is way to appreciate as well as encouragement to other citizens
- Links to research and more information on certain topic related to waste. These topics can keep on changing according to the theme
- Guidance documents , case studies of best practices



http://www.unep.fr/en/info/publications.htm

UNEP DTIE's media and information activities are closely coordinated with UNEP's Division of Communications and Public Information in Nairobi. An information group, with representatives from all DTIE branches, meets on a regular basis. The group, chaired by the Division office, aims to bring a strategic and cost effective approach to DTIE's media relations, publications, videos and other public information activities.

Box 4.1 highlights the best practices in conducting Stakeholder Consultation.

Box 4.1: Best Practices in Conducting Stakeholder Consultation[1]

The Australian Government has made a commitment to improve mechanisms for consultation with businesses and supporting appropriate consultation with all relevant stakeholders.

Australian Government
Office of Best Practice Regulation

In 2006, the Australian Government adopted a policy on consultation requirements, which sets out the best practice principles that needs to be followed by all agencies while developing any regulations. This policy is based on seven principles for best practice consultation.

- Continuity - Consultation should be a continuous process that starts early in the policy development process.
- Targeting - Consultation should be widely based to ensure it captures the diversity of stakeholders affected by the proposed changes. This includes the appropriate state, territory and local governments, and relevant Commonwealth departments and agencies.
- Appropriate timeliness - Consultation should start when policy objectives and options are being identified. Throughout the consultation process stakeholders should be given sufficient time to provide considered responses.
- Accessibility - Stakeholder groups should be informed of proposed consultation, and provided with information about the proposals, via a range of means appropriate to those groups.
- Transparency - Policy agencies need to explain clearly the objectives of the consultation process, the regulation policy framework within which consultations will take place and provide feedback on how they have taken consultation responses into consideration.
- Consistency and flexibility - Consistent consultation procedures can make it easier for stakeholders to participate. However, this must be balanced with the need for consultation arrangements to be designed to suit the circumstances of the particular proposal under consideration.
- Evaluation and review - Policy agencies should evaluate consultation processes and continue to examine ways of making them more effective.

1 As referred to http://www.obpr.gov.au/consultation.html

4.3. What is the significance of the Participatory Process in ISWM

The strategic planning approach should be used for preparation of the ISWM Plan. Strategic Planning through a participatory process can benefit the city/civic authorities in many ways:

- Participatory process can help to articulate a framework, lead the exercise, facilitate discussion, mediate and summarize debate, help reach consensus and add objectivity[2].
- It enables waste management to become a shared responsibility of all the stakeholders and the city/civic authorities.
- It provides for a shared responsibility of the strategy and joint decision making. Participation by stakeholder groups is critical for decision making. The result will be a realistic strategy with a broad base of knowledge, understanding and commitment from the groups involved.
- Participants bring information to the strategy, ensuring that it is based on a common understanding of purpose, problems and solutions
- Participation is the most effective way of communicating information on which the strategy is based, its goals and tasks to be undertaken
- Participation should be expanded as the strategy develops
- Such participation could help in obtaining a broad policy input on key waste management issues of the future.

4.4. Illustrative Example of Participatory Process in ISWM around the World

Box 4.2 to 4.6 highlights the Participatory Process carried out to develop the ISWM like projects around the World.

Box 4.2: Participatory Process for development of California (Cal) EPA – Integrated Waste Management Board Strategic Plan

Data Gathering:

- Input from a broad representation of internal and external stakeholders was solicited and received throughout the development of this plan.
- Public forums were conducted so that the Board could obtain broad policy input on key waste management issues of the future from a representative group of its internal and external stakeholders.
- Stakeholder groups participating in the forums included representatives from the regulated community, environmental groups, local and state government agencies, CIWMB staff, and other experts in the field of waste management.
- In addition, upon completion of the public forums, each Board Member provided his

2 As referred to http://www.caledonia.org.uk/papers/a-albee-1994.pdf

or her views on the key waste management issues impacting the future direction of the CIWMB to guide the development of priority goals and objectives.

Strategic Planning Steering Committee and Workgroups:

- A steering committee with representation from Board Member offices and executive staff crafted the process for the development of the strategic plan.
- In developing the plan's content, the organization's executives guided cross-organizational workgroups, including representation from staff and Board Member offices.
- At several key points in the development process, Board Member inputs and public comments were received on draft portions of the content.
- In addition, the draft plan was presented to a cross-agency workgroup with representation by Cal/EPA's boards, departments and office, as well as Cal/EPA's Office of the Secretary for review and comment.

Box 4.3: Participatory Process for development of Waste Management Plan 2005 – 2010 – for the Dublin Region

Public Consultation and Involvement: Public consultation and involvement played a major role in the formulation of Waste Management Plan for the Dublin Region. In order to obtain maximum feedback reflective of all sectors of the Region, consultation was sought using a number of methods:

- Newspaper advertisement calling for written public submissions
- Consultation days for the waste industry
- Regional Stakeholder Meeting
- Consultation with Elected Members of the Region

The issues that were common to all audiences were:

- Planning/Permit Process
- Awareness/Prevention
- Inter-regional movement of waste
- Infrastructure/facilities
- Regulation and Enforcement

The submissions, meetings and briefings in the pre-Draft phase resulted in numerous ideas and initiatives which were included in the Draft Plan, and have been considered in the development of implementation plans for the Region. A second phase of consultation took place on the Draft Plan from April – June 2005, the feedback from which led to a series of revisions and amendments to the Draft before it was finally adopted.

Box 4.4: Participatory Consultation for Integrated Sustainable Waste Management Strategy for Aberdeenshire 2001-2020

This Integrated Sustainable Waste Management Strategy will guide waste management in Aberdeenshire over the next 15-20 years. It is a product of extensive consultation with the general public, business and other organisations over a period of two years. In reflecting those views it also takes into account legislation, national and regional waste strategies, Area and Service Plans of the Council, the Joint Structure Plan and the Aberdeenshire Local Plan.

Outcome of Consultation

The consultations held during the development of this Strategy corroborated the findings of other similar studies on public opinions and awareness of waste issues. It highlighted the extent to which the waste collection and disposal service was out of sight, out of mind. Many suggestions were made as to how Aberdeenshire Council could change the method of waste management; however little thought was given to what individuals could do about minimising the waste they produce.

The various commitments of this plan are as follows:

- To take up the challenge of the National Waste Strategy in reducing annual waste arising.
- To follow the Waste Hierarchy for the management of waste that is produced.
- Continue to enhance the system of bringing waste for recycling wherever appropriate.
- Extend and develop the Civic Amenity, Recycling and Disposal facilities throughout Aberdeenshire.
- To re-introduce measures to encourage and increase the number of participants in home composting.
- Assess all waste management policies and practices against the criteria of Proximity, Regional Self-Sufficiency, Polluter Pays Principles, BPEO and sustainable development.
- Develop systems of recording statistics in order to identify trends in waste production and improve waste management decision making.
- Continue to prioritise available Landfill Tax Credit money towards local research projects, to improve knowledge and understanding of waste management issues.
- Establish an ongoing programme of awareness raising initiatives for both the general public and private businesses.
- Research the potential for and implications of introducing a segregated waste collection service in a pilot project.

- To work in partnership with other groups (such as the Waste Resources Action Programme, Scottish Executive, Scottish Waste Awareness Group) in developing and implementing a programme on awareness raising.
- Provide guidance and information to householders on waste reduction.
- Apply the .polluter pays principle to domestic waste producers by charging for special collections of bulky household waste.
- Ensure that the .polluter pays principle is applied to all trade waste customers receiving the Council waste management service.
- To provide guidance and information on waste reduction to Aberdeenshire Councils trade waste customers.
- Continue to support and participate on the North East Business Waste Management Partnership.
- Support the Remade scheme in identifying potential markets/uses for recovered material and make use of local reprocessing companies where possible.
- Continue the promotion of Buy Recycled and lead by example through the Green Purchasing Policy.

Box 4.5: ISWM Plan for Pune Consultation Workshops

The process of Strategic Action Planning took place through the conduct of six participatory workshops including the launch workshop. The theme of the **ISWM Launch workshop** was the IETC-UNEP's approach and programme on ISWM. Subsequently, each type of wastes to be considered under the ISWM plan was addressed in the thematic sessions. A Working Group - comprising of a conglomerate of various stakeholders was formulated. This workshop was followed by the **First Working Group Meeting** on development of ISWM plan for Pune. The Working Group members have representatives from the regulatory bodies, technology providers, Non-Governmental Organizations (NGOs) working specifically in the waste related fields and citizen representatives. The basic aim for formulating such a group was to discuss and debate on the Vision, Mission, Goals and Objectives of the ISWM Plan. In order to further attend to specific waste-stream related issues, a series of consultation workshops were proposed and organized. These involved developing a Draft Vision and Mission statement for the ISWM plan, followed by the formulation of goals and objectives with a discussion on strategies that could be deployed to achieve the targets.

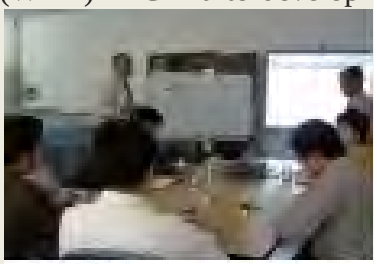
The first consultation workshop (**Workshop I**) focused on the generation, segregation, 3Rs (Reduce, Reuse, Recover) and Decentralized Treatment of MSW.

The second workshop (**Workshop II**) focused on the technology provisions for Solid Waste Management.

Three more workshops (**Workshop III, IV and V**) were held with their focus on C & D wastes, E-Wastes and BMW respectively.

Box 4.6: UNEP-DTIE-IETC and Wuxi Consult Stakeholders on Waste Management[3]

UNEP-DTIE-IETC has been assisting Wuxi New District (WND) in China to develop an Integrated Solid Waste Management (ISWM) Plan. This includes capacity building on data collection for quantification and characterization of solid waste; assessment of prevailing waste management systems; target setting for ISWM; identification of issues of concern and developing ISWM that includes identification of technologies, policy and regulatory measures, and voluntary actions.



IETC staff members and Wuxi New District officials discussing the plan

To identify the issues of concern, a Stakeholders Consultation Workshop was co-organized by UNEP and the WND local government on 26-27 March 2007 in Wuxi, P.R. China.

High-level officials of the local government, service providers, and representatives of industries, hospitals, residents, and civil society, identified and discussed various issues of concern on wastes. They discussed preliminary targets for waste generation, segregation at source, collection and transfer, sorting and material recovery, treatment

[3] As referred to http://gec.jp/gec/en/publications/ENL22.pdf

and resource recovery and final disposal. Suggestions on financial, technological, policy and regulatory, environmental and social aspects of ISWM were also made during the consultation.

A Set of Guidelines has been prepared for Practitioners which accompanies this Guidance Manual. These set of guidelines can be used to understand how to do target setting and identify the issues of concern of the stakeholders.

The next chapter highlights the structure of the ISWM Plan and how the participatory process explained in this chapter enables the evolution of the schemes.

What did you learn?

- ✓ Once the issues are identified, both across internal and external environment, the next process in Strategic Planning is to set an appropriate strategic direction. This is done by establishing a Vision/Mission statement and the Goals and Objectives.
- ✓ A vision statement is a conceptual description of the desired future state.
- ✓ The mission statement is a precise description of what an organization does. The mission statement reflects the overall purpose of the organization.
- ✓ Goals are broad statements of what the organization hopes to achieve in the next 5-10 years. Targets are sometimes treated like sub-objectives and include *"what will be accomplished"* and *"by when"* and focus on results over 1-2 years. In many ways, Goals set directions, and objectives (along with targets) define what is exactly to be achieved in the chosen direction.
- ✓ For the formation of the ISWM Plan, while the current situation is being accessed, data is collected and the gaps are identified and analyzed, a consultative approach in setting the vision, mission, goals and objectives is important for proper action planning. The process of Strategic Action Planning should take place through a consultative participatory process that should consist of a dialogue and interaction between the various stakeholders involved in the ISWM planning.

5. How to Structure the ISWM Plan

Overview	**What will you learn**	This chapter highlights the structure of the ISWM Plan, it shows how the Schemes/Tasks need to be formulated, prioritised and how the action plan should be implemented.
	Target addressees	• **City Authorities** • **Civic Authorities** • Consultants
	Attached Document	ISWM Manuals 1, 2 and 3

The detailed steps involved in structuring the ISWM Plan are highlighted in *Figure 5.1*.

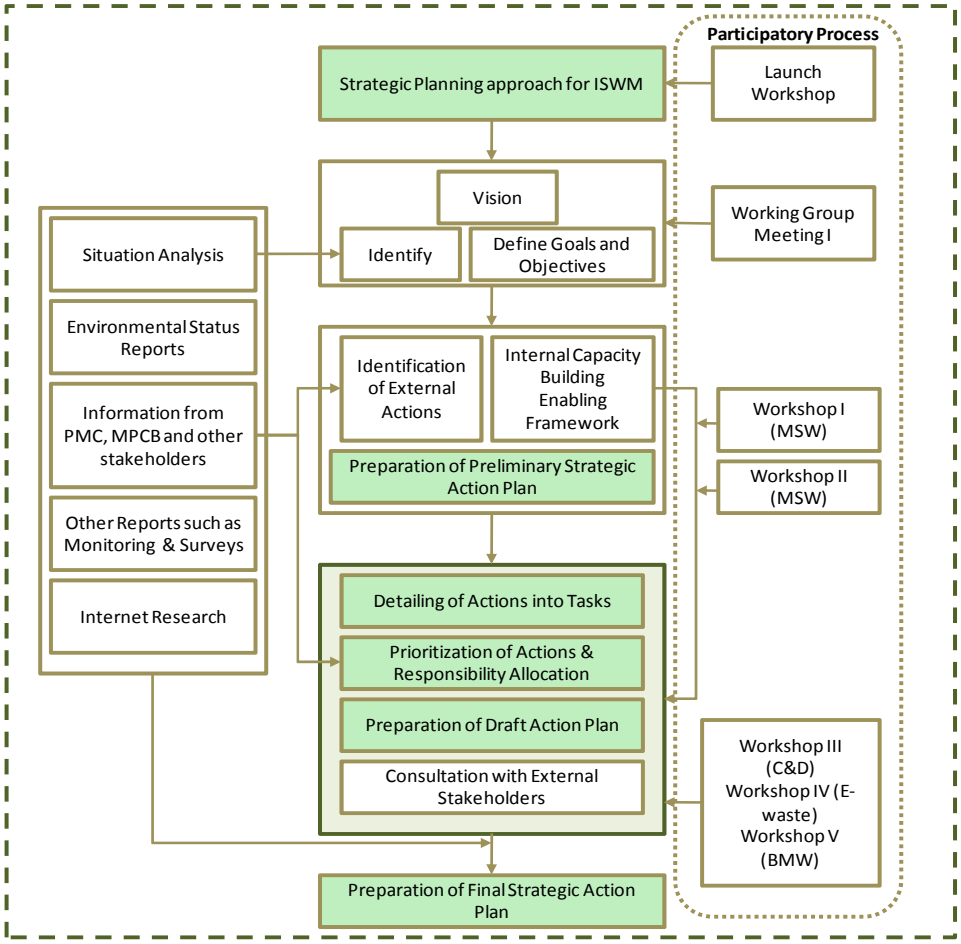


Figure 5.1: Detailed steps of Structuring the Action Plan

5.1. How to formulate Schemes/Tasks?

The ISWM Action Plan which the city/civic authorities would develop using the Strategic Planning Approach would emerge as a result of the discussions throughout the participatory process. In order to enhance the efficiency of implementation of the plan, the authorities should structure the plan in a properly defined fashion.

The plan should be developed in the form of implementable, defined tasks allocating clear responsibilities to various stakeholders. The building blocks to the Action Plan should be in the form of Schemes/Tasks that address project/programmatic issues to come up with a rounded intervention while considering institutional, financial as well as implementation aspects. The schemes should present a blue-print for the city/civic authorities to implement the ISWM plan.

Scheme is an elaborate and systematic plan of action, it is an internal representation of the world; an organisation of concepts and actions that can be revised by new information about the world.

Formulation of the schemes or drafting of the ISWM plan forms the last step of the SP process. The findings of the initial steps of the SP process, which include

- Preparation of Data Formats for capture of effective information
- Situation analysis for evaluating the "as is" condition of Solid Waste Management
- Identification of Gaps: Infrastructural, Technical, Financial and Institutional
- Formulating the Vision, Mission, Goal and Objectives

A. Evolution of the Schemes

- ISWM process incorporates the active inclusion and participation of several stake-holders across five waste streams. These waste streams involve different agencies for generation, management and regulation. Certain waste streams prove to be more relevant than the other streams.
- Situation analysis process attempts to scan the activities and present a picture of the existing scenario. Each of these scans lead towards identifying lacunae in the corresponding systems. The gaps may therefore be compliance related, institutional and financial or even infrastructure related.
- The identification of gaps forms a base for the development of the management plan. Once the issues are identified, both across internal and external environment, the next process in Strategic Planning is to set an appropriate strategic direction. This is done by establishing a Vision/Mission statement and the Goals and Objectives. In many ways, Situation analysis stimulates formation of vision and mission statements and these often find roots in the basic objectives and functions of the organization and are generated through brainstorming sessions.
- The above mentioned steps form the basis for the preparation of the actual plan. On the basis of the information gathered during the initial process, the Strategic

Action Plan in the form of schemes or tasks attempts to target the significant issues identified during the gap analysis process.

- In order to provide a focus to the Schemes, a prioritization approach should be followed.

The overall process of evolution of schemes is described in *Figure 5.2* below

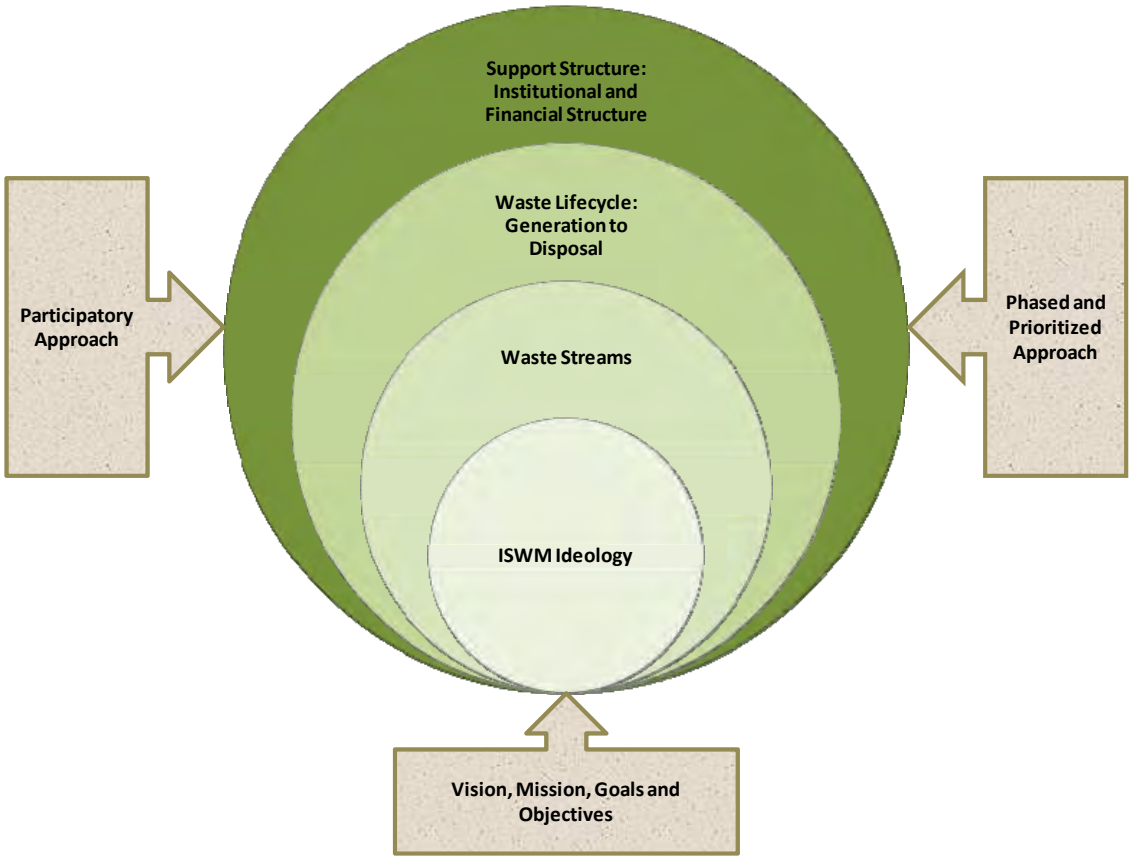


Figure 5.2: Evolution of Schemes under the ISWM Action Plan – The Conceptual Process

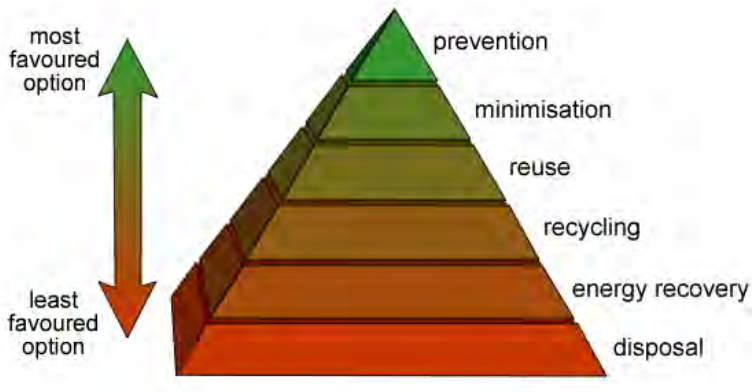
City/Civic Authorities should keep in mind that the schemes should be generated to support the goals and objectives of the ISWM Plan. Some of the broad goals and objectives of ISWM Plan are listed below.

Broad Goals and Objectives of an ISWM Plan

- Minimization of the solid waste generated
- Improvisation in the solid waste management and handling
- Reduction of waste disposed via landfilling or dumping
- Reduction of risk to human life via waste disposal and handling
- Reduction in harmful exposure to the environmental components
- Improving compliance to regulations
- Building capacities
- Making the city/civic authorities more transparent
- Building of partnerships
- Etc.

The schemes should be devised emphasizing the 3R principle of Reduce, Reuse and Recycle across the Life Cycle of the waste streams and aim to go up the waste hierarchy[1].

Waste Hierarchy refers to the '3 Rs" Reduce, Reuse and Recycle, which classify waste management strategies according to their desirability. The 3 Rs are meant to be a hierarchy, in order of importance.



The Waste Hierarchy[2]

1 Sustainability is an attitude, says new coordinator. UTSC. Retrieved on 2007-10-09.

2 http://en.wikipedia.org/wiki/Image:Waste-hierarchy.png

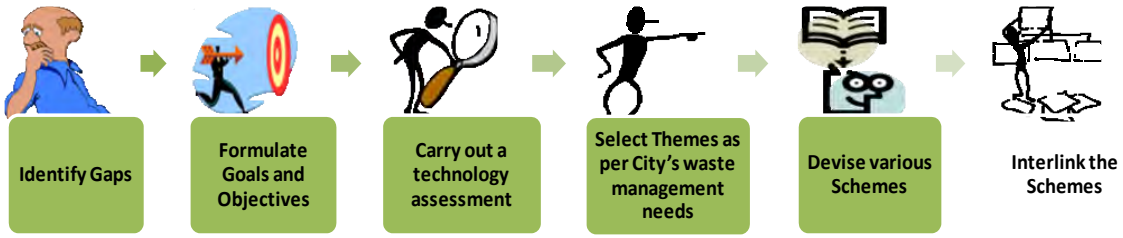
In order to categorize the Schemes at operational level, various themes should be identified based on the functional nature so as to address ISWM, starting with the least favoured option in the waste hierarchy to the most favoured option.

Themes should demonstrate a rounded and balanced approach to plan development. They should encompass the entire lifecycle from generation to disposal, be applicable to all waste streams and also target a particular waste stream. Various themes maybe assessment of data, recycle and reuse options, infrastructure development, awareness and training, capacity building, partnerships etc.

The Schemes should also address the Strategic and Operational Selection of technologies. The Schemes are equally distributed across protectionary as well as compliance related Goals, themes, priority and budget.

B. Steps involved in evolution of Schemes

The city/civic authorities should:



C. Steps for Strategic and Operational Selection of technologies

The city/civic authorities should carry out an assessment of different technologies related to Collection, Sorting, Recovery and Reuse and Treatment along with Public Awareness and Capacity Building, to propose suitable schemes. For the assessment of technology options it is proposed that the technology assessment address all three pillars of sustainability – viz. economic, environmental and social. In effect, the outcome should be "Sustainability Assessment of Technology" (SAT) rather than emphasizing on any single aspect alone. The assessment of technologies can be done by utilizing the "*Sustainability Assessment of Technology*" (SAT) methodology as developed by UNEP – IETC.

The **SAT methodology** is a tiered approach to assess the feasibility of a technology with respect to economic, environmental and social aspects. The technique used for assessment is participatory and requires inputs from the users. However the data requirements gradually increase on for a select few technologies which do not get eliminated during the initial stages of assessment.

D. Proposed Description of a Scheme

The city/civic authorities should include the following while developing a particular scheme:

- Introduction
- Purpose
- Description
- Implementation Steps
- Lead and Support Agency
- Location
- Budget
- Timeframe
- Several examples of successful implementation of similar actions/interventions
- Inter-linkages with other proposed Schemes to get a rounded perspective

5.2. How to Prioritise the Actions and allocate Responsibilities?

While developing the actions it is important to take stock of the actions previously taken and the results obtained. This will help to identify and address the shortcomings in previous actions. Some questions that should be asked to determine if the appropriate actions are included in the Plan are given in the box beside.

Some questions to ask when determining appropriate actions include:

✓ Will the actions allow us to achieve the targets we have set?
✓What are the actions' impacts — social, economic, and environmental?
✓Will the actions address identified barriers to the plan?
✓Does any of the actions conflict with one another or overlap with other action(s)?
✓Do any of the actions have benefits in more than one area?
✓Are there resources or might resources become available to implement the action?
✓Is the action cost-effective?
✓Can the action be allocated a timeline?
✓Does the action have the support of the citizens?
✓Is there a person or organization who will lead the action?
✓As a set of actions, are they realistic and desirable for the city?

The working/steering group should discuss and analyse the ideas that should be listed and prioritized. The following should be taken into consideration:

- **Prioritization** can be made based on number of factors like severity of the issue to which the action is addressed; whether the action benefits more than one stakeholder; whether the action has a long term benefit, etc.
- Prioritization can be made easy by ranking the schemes/actions. Ranking can be in the form of High, Medium or Low based on various factors such as long term benefits, short term benefits, self reliance, growth of the community, equitable sharing of the outcomes, and financers multiple benefits.
- Another option is following a decision matrix that allows analyzing the actions against certain criteria.
- A sample decision matrix is shown in **Table 5.1**:

Table 5.1: Decision matrix for rating the Action

Scheme/Task/Action:		
Sr. no.	**Factor**	**Rate on scale of 0 to 10**
1	Long-term benefits	
2	Short-term benefits	
3	Economic feasibility	
4	Self reliance	
5	Outcomes beneficial for more than one stakeholder	
6	Growth in terms of knowledge	
7	Improvement in standard of living	
8	Other (specify):	
10: Highly positive outcome **0: Neutral** **NA: Not applicable**		

- Schemes then need to be tested or piloted at few locations
- Phased approach of implementation is recommended for schemes that are resource intensive or need a policy change or compilation/analyses of primary data.
- Then the city/civic authorities should begin to choose which actions to implement and how. Some of the larger long-term activities may require generating outside support and interest.
- Every stakeholder who is a beneficiary to the programme, directly or indirectly, must be assigned an appropriate role and responsibility. The responsibilities should be clearly defined and preferably documented.

- When choosing actions, it is important to establish a number of specific actions that can be commenced immediately and which can motivate and demonstrate the benefits of the Plan. This step can also help in seeking finances from the companies/ financial institutions.

5.3. Illustrative Examples of ISWM Schemes/Tasks

Box 5.1: Schemes proposed in ISWM Plan, Pune[3]

The Pune Municipal Corporation (PMC) and the International Environmental Technology Centre (IETC) of United Nations Environment Programme (UNEP) in Japan signed a Framework for developing an ISWM Action Plan for Pune. Accordingly, a launch workshop was organized on December 22nd 2006. The ISWM Plan takes a comprehensive approach across all the waste streams including Municipal Solid Waste (MSW), Plastic Waste, Biomedical Waste (BMW), Hazardous Waste, Electronic Waste (E-Waste) and Construction and Demolition Waste (C&D Waste). The Action Plan is developed following the Strategic Planning process emphasizing on Reduction, Reuse and Recycle (3R) principle across the Life Cycle of waste streams.

The final outputs of the ISWM project thus include reports on Situation Analysis, Strategic Action Plan (in two volumes) and Training & Awareness Resources. It is hoped that the process followed (i.e. strategic planning) and the various outputs listed above will provide guidance for PMC as well as other city corporations to implement ISWM.

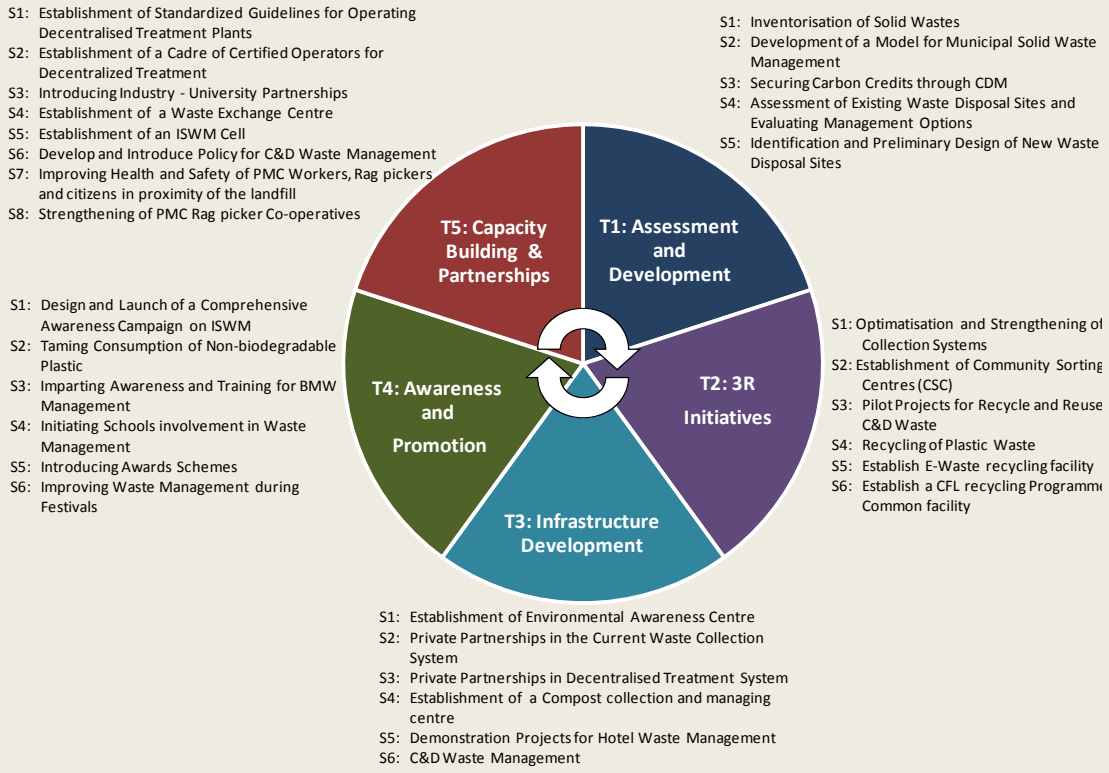
The Action Plan Report proposed several Schemes which covered the needed infrastructural augmentation as well as institutional capacity building in the form of an ISWM cell, infrastructure development such as waste sorting and recycling centres, decentralized waste treatment plants, development of landfill facility etc. as well as application of training and awareness modules. The various Schemes proposed in the Action Plan are shown below:

In order to categorise the Schemes at operational level, five themes were identified based on the "functional nature". These themes include,

- Assessment and Development
- 3R Initiatives
- Infrastructure Development
- Awareness and Promotion
- Capacity Building and Partnerships

3 As referred to Draft ISWM Plan for Pune City, India

Such a thematic classification of Schemes is shown below:



Box 5.2: Schemes proposed in Wuxi New District, China[4]

Integrated Solid Waste Management (ISWM) for WND is a comprehensive document containing baseline information on waste and current waste management systems, a list of posed targets for ISWM, stakeholders' issues of concern and measures, categorized under policies (regulatory and fiscal), technological and voluntary measures, to achieve the targets in best possible manner. These measures are the strategic actions, required under the ISWM Plan. Some of the strategic actions are comprehensive schemes, which need proper planning, development and implementation. These schemes are identified in the document labelled as "ISWM Plan for WND – Volume 2."

Various schemes being proposed as part of the ISWM Plan for WND are as follows:

A. Generation, Collection and Transportation

1. Establishment of Waste Inventory Cell.
2. Development of Local Policies on Segregation and Collection.

4 As referred to Draft ISWM Plan for Wuxi New District, China

3. Development of Awareness Raising Tools for Waste Management
4. Supply of Waste Bags for Segregation of Food Waste.
5. Construction/Provision of Collection Points.
6. Development of Primary Collection Systems.
7. Procurement of Collection Vehicles – Secondary Collection.
8. Development of Operational Plan for Collection and Transportation.

B. Sorting, Treatment and Disposal

1. Upgrading of Transfer Stations for Material Recovery.
2. Development of Biogas Plant.
3. Upgrading Incineration Plant with Resource Recovery.
4. Upgrading Sanitary Landfill with Landfill Gas Utilization.
5. Establishment of Waste Exchange Platform
6. Establishment of Eco Town
7. Setting up Industrial Waste Treatment Facility
8. Development of Monitoring Mechanism for ISWM.

Box 5.3: Waste Management Actions proposed in Maseru, Lesotho[5]

Integrated Solid Waste Management Plan (ISWMP) has been developed for the City of Maseru, capital of the Kingdom of Lesotho. This project was undertaken with a Memorandum of Understanding concluded between the United Nations Environment Programme (UNEP) and the University of Cape Town (UCT) Environmental & Process Systems Engineering Research Group.

The draft plan was developed on the basis of past experience, independent observation, interrogation of available information (including the baseline study of waste generation in Maseru), and interaction with relevant stakeholders. The result is a concise, easy to read action plan of 15-20 pages with key deliverables and timelines. The action plan is supported by a number of technical support pages which provide details on each proposed action. The ISWMP will be supported by a technical background report on Environmentally Sound Technologies (ESTs) which provides further guidance on achieving the deliverables.

In order to achieve the vision embodied in the principles, the following framework is proposed. Four fundamental pillars are supported by a sound educational platform. Waste Management Actions – grouped according to the hierarchy are as follows:

Pillar 1: Capacity to prevent wasteful resource use at source.
This theme addresses: what is consumed (sustainable consumption), how it is produced

5 As referred to Draft ISWM Plan for Maseru, Lesotho

(cleaner production), where resources are routed once used (source separation), and at-source value addition (re-use, composting …)

Actions:

1. Integration of Waste Prevention Measures
2. Introduction of Cleaner Production Measures
3. Implementation of a Source Separation System
4. At Source Value-Addition

Pillar 2: Strong, diversified and appropriate collection systems

Recycling, energy recovery and disposal - all require materials (resources or waste) to be collected. Different collection systems will work best in different settings (e.g. weekly curb-side collection in serviced suburbs; coupon-based fuel for recyclables take-back schemes in informal settlements; removal on call at commercial establishments). It must be the core job description of a skilled professional to ensure that each ward, each commercial establishment and each industrial site are appropriately serviced. The operation of the collection services does not need to be performed by council.

Actions:

1. Establishment of Ward-Specific and Material-Specific Collection Systems
2. Systematic Infrastructure and Route Planning
3. Optimisation of Collection Services Offered by MCC and Private Recyclers and the PPPUE

Pillar 3: A healthy recycling industry

The more materials are recycled, the lower the amount to be transported to disposal (and hence the lower the cost to the public). With money to be made from the sale of recovered resources, and from re-manufactured products, the private sector is best equipped to harness potentials. Like all other industrial sectors, there must be business development support, a competitive spirit, and an industry association that subscribes to a code of conduct and can speak for joint concerns.

Actions:

1. Support for the Development of a Local Recycling Economy
2. Regulatory Framework to Support Local Recycling Markets
3. Coordination of Local Recycling Activities
4. Develop Capacity to Work with Take-Back Levies

Pillar 4: An environmentally safe disposal site for real waste

When resources have really and finally become waste, they must be disposed off in a properly engineered sanitary landfill that does not affect the surrounding environment. The full cost of proper disposal must be borne by the user to avoid over-use but this should not be the easy way out for those wanting to waste. On the other hand, this route must be accessible when needed so that there is no resorting to wild dumping. There should be a careful balancing act, requiring further thought on the most appropriate pricing structure.

Actions:

1. Adjustment and Integration of Planning Activities for Sanitary Landfill Site
2. Amendment of EIA
3. Capacity to Thermally Use Non-Recyclable Paper

The Platform: Education, built upon real and up-to-date information

The generators of waste (in households, commerce, hospitals, schools, offices industry), as well as professionals, officials and labourers working within each of the above four pillars need to be educated and trained, with regular updating of skills. Education must be based on an up-to-date knowledge of the real issues in Maseru, so a regularly updated waste information system is also required.

Actions:

1. Use of School Infrastructure as Awareness Creation Medium
2. Establishment of Waste Minimisation Clubs
3. Establishment of a Waste Information System (WIS)
4. Awareness Creation through Common Media
5. Review of this ISWMP on a Regular Basis

Annexure 4 shows an example of a scheme as proposed in the Pune ISWM Plan.

5.4. What should be the Basic Structure of the ISWM Plan Report?

The city/civic authorities should prepare an ISWM Plan report including the following sections or include a single report for each off the following sections for a detailed report:

5.5. How to Implement the Action Plan?

After having made an Action Plan, it is important to see that it gets implemented. *Figure 5.3* shows the steps in the implementation of the Action Plan.

Figure 5.3: Steps in Implementation of the Action Plan

5.5.1 Institutionalise the Action Plan

- After the Plan has been prepared and commented by the Stakeholders, it should then be finalized and passed on to the concerned implementing agency.
- Incorporating the comments in the Plan is the responsibility of the Working/Steering Group.
- The finalized Plan should then reach the appropriate implementing agency so that further steps are taken in time to implement it.
- This is an important task for the city/civic authorities as it involves contacting various institutions, explaining their role and gaining their support.

- Though the partnering institutions are identified broadly while preparing the Action Plan, there could be new developments/ changes to the earlier Plan.
- The institutions involved can be private organizations, NGOs or any other associations, depending upon the type of the actions.

After the implementation commences, it is necessary to continuously monitor progress and evaluate the actions taken so far.

What did you learn?

- ✓ The plan should be developed in the form of implementable, defined tasks allocating clear responsibilities to various stakeholders. The building blocks to the Action Plan should be in the form of Schemes/Tasks that address project/programmatic issues to come up with a rounded intervention while considering institutional, financial as well as implementation aspects. The schemes should present a blue-print for the city/civic authorities to implement the ISWM plan.
- ✓ The city/civic authorities should carry out an assessment of different technologies related to Collection, Sorting, Recovery and Reuse and Treatment along with Public Awareness and Capacity Building, to propose suitable schemes.
- ✓ In order to categorize the Schemes at operational level, various themes should be identified based on the functional nature so as to address Integrated Solid Waste Management starting with the least favoured option in the waste hierarchy to the most favoured option.
- ✓ **After the implementation commences, it is necessary to continuously monitor progress and evaluate the actions taken so far.**

6. Next Steps

 **Overview**	**What will you learn**	After developing and implementing the ISWM Plan for the city, the next steps that need to be taken are highlighted in this chapter including communicating the plan, monitoring and review and continual improvement.
	Target addressees	• **City Authorities** • **Civic Authorities** • Professional service providers and organizations • Small and medium enterprises • Representatives or staff of other local stakeholders including community groups, NGOs, and the private sector • Consultants
	Attached Document	ISWM Manuals 1, 2 and 3

6.1. What should be done next?

Solid waste management is a municipal responsibility in nearly all developing countries. Therefore after development of an ISWM Plan for a city several steps need to be taken for its effective implementation.

- The city/civic authorities that provide the service typically need to be restructured so that they are more accountable and transparent to the residents and business establishments they serve.
- Organizational development support would typically include improved job descriptions, training, operations rationalization, and reduction of labour redundancy.
- The implementation of the plan is entirely dependent upon the **effective communication of the plan to all the stakeholders** about their responsibilities towards improvement of the waste management services.
- The stakeholders getting aware about the action plan will not be enough for actions/strategies to be implemented at the ground level. There should be **appropriate and specialized training for upgradation of technical know-how as well as building certain specific skillsets and competencies required for a particular sector**.

6.2. Why is there a Need to Communicate the Action Plan

Communication is a task of getting specific information or ideas across the people not as learners but as a target audience.

Communication is a mix of social instruments (e.g. information, exchange, dialogue, ecucation, training, and marketing). Communication is always part of a mix of other instruments (research, policy development, law enforcement, etc.), which it reinforces. 'Strategic Communication is the oil that makes the technical mechanisms of solid waste management work'.

After the development of the action plan, the city/civic authorities should communicate the plan to various stakeholders along with their own staff because **the ISWM action plan will not be useful and successful if there is no response and participation from the various stakeholders involved.**

- The plan is made to improve solid waste management in the city.
- All the quantitative and qualitative parameters are involved in the improved waste management plan. There are various institutional, technical, social and financial factors affecting the success of the ISWM Action Plan.
- So communication of the action plan, the suggestions and recommendations in the plan to and from all the stakeholders becomes an extremely important task.
- There are various ways in which the action plan could reach the masses. The ways of communication will vary according to the stakeholders. The means of communication to industrial sectors would be different from that to the citizens of the city. The various means for communication are indicated in *Figure 6.1*.

6.3. How to Communicate the Action Plan

Communication is generally a one way process than interactive. It is not an open ended process as it is aimed at changing a certain set of behaviour in defined ways. Information and messages can raise awareness and can be used for educational purposes but cannot on their own achieve the required outcomes. So the **communication of the specific information for a target audience in a structured format is necessary.**

A. Whom should the ISWM Plan be communicated to?

The solid waste management is an issue where a variety of stakeholders are involved for the various waste streams. A need arises to communicate the integrated Solid Waste Action Plan to all the stakeholders and efforts to be taken towards individual and institutional capacity Building.

Educational strategies should be designed for the following sectors targeting both, the causes of the waste problems as well as symptoms.

- Community

- Schools, Colleges and Educational Institutions
- Industries
- Hospitals, hotels and related service providers
- Planners, Policy makers and Administrators

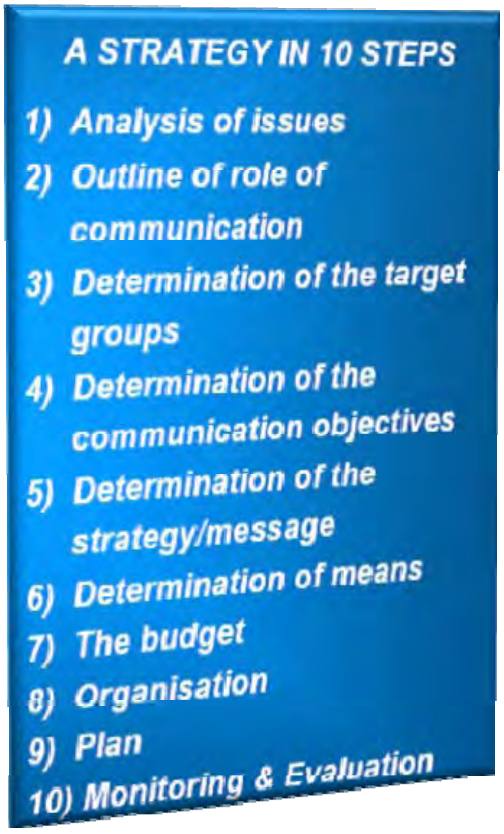
The city/civic authorities while communicating the action plan should[1]

- Segment out the stakeholders - segmentation of stakeholders requires identification and analysis.
- After segmentation of stakeholders, they can decide which group to target - these become the *target groups*.
- Target groups to be prepared for different reactions to an ISWM issue
- Analyse the perceptions of the target groups.
- Analyse their own perceptions, the working group perceptions along with those of the target groups and realise what the differences imply.

B. Vehicles for Communicating the Action Plan

One strategy for communication could be working on one theme at a time (say a week) which is to be communicated.

The various means for communication are indicated in *Figure 6.1*.



1 As referred to http://www.metap-solidwaste.org/fileadmin/documents/participation_CPPA/training/En-TM-7-2.pdf

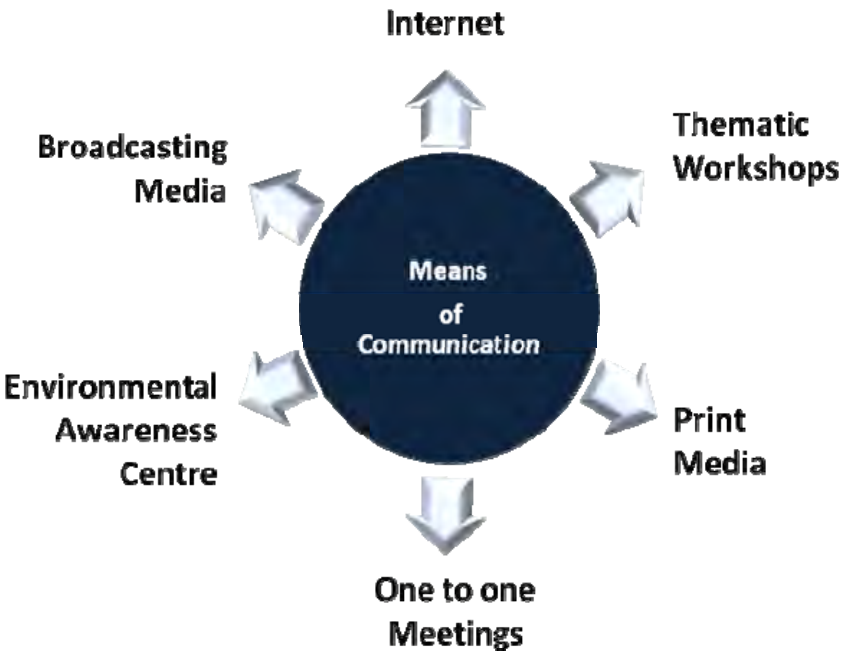


Figure 6.1: Various means of communication

i. Print Media

- Weekly fact sheets related to themes
- Press advisories for upcoming events and interview opportunities

ii. Local broadcasting media

- Radio advertisements
- Television advertisements
- Press advisories for upcoming events and interview opportunities

iii. Internet - by putting up a dedicated website

Interactive website can prove to be an effective mode of communication especially to reach the children, college going students and also the working class in the society.

The website should include the following features:

- Frequently Asked Questions (FAQ) in question and answer format.
- Accept queries or comments
- Provide Information about various workshops happening in the city on waste management
- A feature stating the existing waste regulations in a form easily understood by common people
- Facility for lodging complaints

- A corner/feature to highlight the innovative waste management or waste to resource - a way to appreciate as well as provide encouragement to other citizens
- Links to research for gathering more information on certain topics related to waste. These topics can keep on changing according to the theme
- Guidance documents; case studies of best practices
- Inventory of waste management solution providers

iv. Thematic workshops:

Workshops for different stakeholders could be arranged periodically based on specific themes. For example, workshops on waste minimization could be arranged for stakeholders related to all the waste streams. Seminars/conferences and workshops are the most commonly used delivery mechanisms. While seminars and conferences focus on the concept and case studies, workshops are useful to deepen the concept in terms of methodologies and to gain experiences of putting the ISWM Strategic action plan into practice. Half-day seminars are particularly useful in influencing associations, community leaders etc, whereas one-day workshops focusing on themes such as energy efficiency, water conservation etc. are more suited (effective) for technical cadre of the society. While organizing such seminars/conferences, the primary focus of awareness raising must be retained and should not diverge into skill-building or training at this stage.

v. One-to-one meetings

After a seminar or a workshop, one-to-one meetings serve as a good follow-up mechanism, moving a stakeholder to the next intended step such as undertaking a green productivity opportunity assessment or taking part in a demonstration project.

vi. Setting up of an Environment Awareness Centre

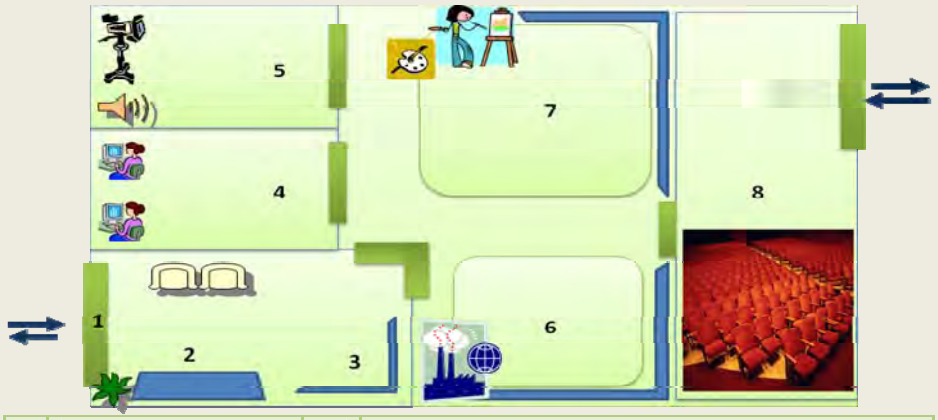
This is an innovative and very effective way in facilitating communication with all kinds of stakeholders. The details of Environmental Awareness Centre and the facilities are given in **Box 6.1**.

Box 6.1: Setting up an Environment/Integrated Waste Management Awareness Centres

The core purpose of such a centre will be building up an environmentally aware and well-informed community - an essential first step towards developing an improved environmental ethic within the community. It will provide services for the public with easy access to environmental information and will also be a venue for environmental education programmes for schools, community organizations and residents. There will be one such centre in the city. A shopping mall will be an ideal place to have such a

Centre.

The EAC may have all or some of the following facilities.



1	**Main Entrance**	**5**	**Audio visual Room**
2	**Reception Area**	**6**	**Section for Industries**
3	**Information Hall**	**7**	**Waste to Art Section, Display and Exhibition Hall**
4	**Computer Room**	**8**	**Lecture and Discussion room**

Exhibition Hall:
The colourful exhibition hall with exhibition panels, interactive games and models will be divided into various thematic display zones related to solid waste, energy conservation, air pollution, water resources, noise pollution, etc.

Waste to art section:
There will be a separate section devoted to waste crafts, which will exhibit craft and art pieces developed from the waste. The items displayed in this section will be contributed from various competitions at different levels (schools, colleges, housing communities, rag pickers etc.) which will be conducted by the EAC with support from other organizations and stake holders. These competitions will help to encourage this type of art and make the people aware about the importance of waste utilization and reduction. Apart from these competitions, independent contributions will also be allowed. Also the art pieces displayed in this section will be available for sale and will help in generating funds.

Separate section for the industries:
There will be a separate section for the industries to facilitate show casing of environmentally sound technologies, products, initiatives to achieve waste minimization, cleaner production technologies etc. The industries will be charged for the space which they'll be provided. This will help to enhance the financial sustainability of the EAC's. The section will attract the industries as it will help them in

marketing their product or brand and also enhance their image in the eyes of the people.

Information hall:

- Leaflets and publications from the government, Environmental Committees, green groups and other related organizations will be made available here.
- Also, there will information regarding the activities of the EAC in the past month and also in the coming month.

Reference library:

- A collection of books, magazines, information leaflets, booklets, teaching kits and other publications produced by government departments, local and overseas green groups, community groups and other organizations on various environmental topics will be made available here.
- Local and overseas environmental journals and press cuttings in different categories will also be made available.
- Access to environmental information through the Internet will also be provided.

Computer Room

- Computers for CD-ROMs on various environmental and conservation issues will be made available to the visitors.
- Provision of a television set for videos, sound-slide programmes, laser discs and VCD's will also be made.

Public relations cell:

This cell will be responsible for interacting with different organizations and stakeholders and thus will keep the EAC informed about their needs and accordingly scheduling of various activities could be done. In short this cell will act as an interface between the various stakeholders in the city and the EAC.

Technical support cell:

This cell will provide technical support to the various environmental initiatives (such as composting, Vermi-composting, Bio-Methanation plants, recycling activities etc.) that are going on in the city and will also encourage more such initiatives.

C. There may be some barriers in communicating the plan, such as[2]:

- Scale of problem – lack of insight
- Duration in time to see improvements or deterioration
- Separation of causes and effects of adverse behaviour
- Perceptions towards changes in own behaviour – "why should we change?"
  - Own benefits are more important than collective disadvantage (NIMBY)
  - No confidence in the cooperation of others ('after you' effect)
  - No confidence in own behaviour ('drop in the ocean')
  - We cannot go back anymore ('society is like that')

D. However, the Stimuli for communicating ISWM plan are as follows[3]:

- Relevance to people's life
- Credibility sender ('if she says so...')
- Attraction sender ('he is a nice person, so he must have the correct opinion')
- Number of people that agree ('if everyone believes it, it must be true')
- Number of arguments in the message ('it is well thought-through, so it may be true')
- NIMBY ('if we participate in the decision-making, the solution may be more satisfactory')
- What can you offer?

Communicating the action plan is an ongoing activity. The scope of this activity is largely dependent on the finances available, timeline of the programme and the partnering organizations.

6.4. Why should there be Capacity Building

Capacity Building refers to activities that strengthen an organization or an individual and help it fulfil its mission better. Capacity building is often regarded as the assistance provided to the entities which have a need to develop certain skills or competence, or for general upgrading of performance ability. These activities include, among others, strategic planning, technology upgrades, operational improvements, and board development.

The ISWM Action Plan developed should address all the aspects of Capacity Building which is much more than training and includes the following:

2 As referred to as http://www.metap-solidwaste.org/fileadmin/documents/participation_CPPA/training/En-TM-7-2.pdf

3 As referred to as http://www.metap-solidwaste.org/fileadmin/documents/participation_CPPA/training/En-TM-7-2.pdf

- Human resource development - the process of equipping individuals with the understanding, skills and access to information, knowledge and training that enables them to perform effectively.
- Organizational development - the elaboration of management structures, processes and procedures, not only within the organization but also the management of relationships between the different organizations and sectors (public, private and community).
- Institutional and legal framework development - making legal and regulatory changes to enable organizations, institutions and agencies at all levels and in all sectors to become more proficient. More recently, capacity building is being used by government to transform community and industry approaches to social and environmental problems.

6.5. How to Build Capacities

After the actions have been identified and prioritized, there might be a need for building capacities in order to ensure the implementation of the actions. Training is both resource intensive and time consuming and hence should be planned properly by the city/civic authorities.

A. Institutional capacity building

For Solid waste management in developing countries, the systems have not been upgraded for improvisation of service since a long time. For this, knowledge of new technology and methods along with the training at all levels is necessary. No specialized courses have so far been designed to meet the needs of different levels of staff, hence short and medium term courses should, therefore be designed for the sanitation workers and supervisory staff. Special training and refresher courses may also be conducted for the municipal corporation staff and administrative personnel.

- **Special training to unqualified staff:** They may be sent for training to institutions responsible for designing special courses for sanitation workers and supervisors.
- **Refresher course at all levels of staff:** Refresher course should be conducted for the sanitation workers as well as supervisory staff at least once in every 5 years, or they should be sent for training to prepare themselves with the advances made in the field.
- **Exposure to elected members:** If these members are given appropriate orientation towards the modernization of solid waste management and importance of the same in terms of sanitation and health they would be able to overcome the financial and other administrative hassles and strengthen the implementation of the action plan. They would also help in gaining the public support through their network of field workers.
- **Promotional Opportunities:** To retain the supervisory staff in the department adequate promotional opportunities should be made available in the

decentralized SWM hierarchy. This also helps to maintain their interest in their job.

- **Building partnerships:** The Department of Solid waste Management should develop working partnerships with the organizations in the public and private sector and also community groups by providing support to their businesses on resource and waste management.

Institutions other than Municipal Corporations, like the academic institutions, various NGOs working in the field of Environment and education and stakeholders dealing with different kind of waste streams also need capacity building. The academic institutions should conduct specially designed Solid Waste Management Courses. The students of medical sciences should be made to study on solid waste management with special emphasis on biomedical waste management including its regulatory part. The students of science and engineering should undergo a detail study on solid waste management covering the technical and engineering aspects along with relevant legislations with the scope of taking up some research projects.

B. How to carry out an Awareness/Training Programme

The City/civic authorities should:

i. Identifying the Target Stakeholders and Training Needs

- The city/civic authorities should identify the target stakeholders and those who were involved in the initial process of Stakeholder Consultation.
- To plan training programmes, a Training Needs Assessment (TNA) should be conducted by the Working/Steering group to understand the training modules needed for the various types of stakeholders. A TNA is best prepared by sending questionnaires to representative stakeholders followed by one-to-one meetings.
- The questionnaire should also seek comments on the proposed contents/coverage of the training modules. Additional training modules may also be listed.

ii. Identifying and selecting the Training Partners/Team

- The city/civic authorities may not be in a position to deliver all the needed training modules by themselves. Therefore an appropriate partnering organization should be sought by the Working/Steering group.
- The team may consist of someone, or some organisation that has considerable experience and knowledge in the area of training and has a good reputation. Typically, universities offering courses on environmental

management, energy technology, business management etc., or vocational training institutes have the potential of becoming a part of the training team.

iii. Preparing the Training Programme

The city/civic authorities should prepare for the training programme in consultation with the working/steering group and selected team partners on the following:

I. The content of the training programme

- In situations where ISWM is being delivered as a new concept, the content of the training programme should focus on creating core competencies.
- If the core competencies are already in place, the content could then include broader topics that are more quantitative, or knowledge driven and discussion-oriented.

Content of the Training Programme should...

- Be in a language and style the stakeholders are most familiar with
- Be easy to read and grasp
- Reflect the actual training needs
- Be based on four important components; viz. lecture notes, self-assessment questions, case studies and resources
- should test the conceptual, analytical and quantitative understanding of the trainee
- Have self-assessment exercises could include short problems and quizzes
- Include case studies to induce problem solving approach by the trainee
- incluce resources which can be used by the trainee at a later date as a reference material. Resources can typically include benchmarks, technology fact sheets, important formulae, etc

II. The preferred delivery mechanism

There are a number of possibilities in deciding on the delivery mechanisms. The following are some of the commonly used ones. Generally, a mix is recommended to the city/civic authorities to get the best results.

- Classroom instruction
- Group work based or case study driven instruction
- Field or facility based instruction

Again, training can be delivered in different forms such as:

- A continuous training event; e.g. over three days to five days at one time
- A discrete training event; e.g. one day a week over a long duration; e.g. three months
- A flexible learning event; e.g. distance learning

A continuous training event; e.g. a hands-on training workshop over say 3 to 5 days, should be used to build focused skills in a relatively short time. Distance learning (e.g. by correspondence or via the Internet) can also be effective to provide basic training on ISWM to a large number of stakeholders. However, this technique is appropriate only when the training resources are sufficiently built and have been adequately tested or accredited.

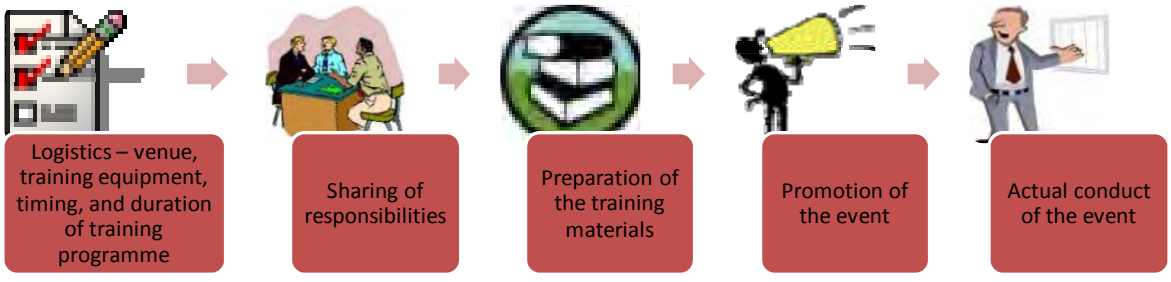
iv. Organising the Training Programme

It is desirable that the training programme include the following items, apart from the conduct of the actual technical sessions:

- A short presentation on the purpose or objectives of the training programme
- A self introduction of the participants and faculty
- Time slotted for discussions/questions after each presentation or session
- Adequate time for experience sharing by the participants
- Time reserved at the beginning and close of each day for making any practical announcements
- Sessions to assess the trainees (short quizzes, group work, etc.)
- A closing session on evaluation of the training programme

It is equally important for the trainer(s) to pay attention to time management during the planning, preparation and conduct of the training programme.

v. Conducting the Training Programme



- The city/civic authorities should conduct the training programmes in a disciplined and standardized manner.
- All the persons involved in conducting the training programme should be provided with standardized templates to prepare lecture notes and overhead projections.
- Details such as type of font, size, and formatting should be specified to achieve uniformity in the training materials.
- All materials should be carefully proofread. Key portions of the text may require to be translated depending on the background of the trainees. Hence, the training materials should be prepared well in advance.

There have been several schemes proposed in the Draft ISMW Plan for Pune city that address the above aspects which are as listed in **Box 6.2.**

Box 6.2: List of Schemes that address Capacity building and awareness in Pune ISWM

Establishment of Environmental Awareness Centre	The core purpose of this centre will be building up an environmentally aware and well-informed community - an essential first step in developing an improved environmental ethic within the community. It will provide services for the public with easy access to environmental information and it will be a venue for environmental education programmes for schools, community organizations, businesses and residents. Environmental Awareness Centre will facilitate as a venue in the city of Pune which will be utilized by PMC, all other stakeholders like industries, NGO's, educational institutions and the citizens for spreading information and awareness about various waste management techniques and issues.
Private Partnerships in the Current Waste Collection System	Private partnerships would help to overcome some of the problems in solid waste management like, community resistance both towards source segregation as well as setting up of a centralized treatment and/or disposal facility, paucity of funds, lack of adequate space, lack of adequate technological know-how, etc.
Design and Launch of a Comprehensive Awareness Campaign on ISWM	To cope with all these waste related issues and to manage the waste properly there is a need of technological, financial and environmental expertise. But even with the highest level of technology the problem will not be solved if the citizens have not been properly informed about all these systems. This

	scheme focuses on introduction of structured awareness programmes about waste and waste related issues for various stakeholders.
Taming Consumption of Non-biodegradable Plastic	Film packaging and polymer plastic bags are the major contributors to the plastic waste being dumped into municipal solid waste stream. Consumer behaviour and pattern is one of the key players in the overall usage of plastic bags. This scheme enlists the possible recycling potential of plastic waste and investigates the use of biodegradable plastics and its implementation with reference to Pune.
Imparting Awareness and Training for BMW Management	Currently some amount of BMW is mixed with MSW, thus leading to potential health risks. This happens due to the lack of awareness on BMW and the required training to carry out its handling and storage. It can lead to a disaster, if the infectious waste or BMW is improperly handled, stored, transported or processed. This scheme focuses on the awareness raising and training programmes to the BMW generators.
Establishment of Standardized Guidelines for Operating Decentralised Treatment Plants	Several wet waste treatment methodologies exists in the market. However, there are no guidelines on the quality, design and operation as well as maintenance of such plants which is one of the key problems in implementation of decentralised waste treatment. This is a scheme to evaluate the decentralised treatment technology procedures and establish standardized procedures for Decentralised Treatment Plants
Introducing Industry - University Partnerships	In the context of Solid Waste Management, several technological interventions are needed at every level/step of waste management. This scheme focuses on introducing areas where Industry–University (I/U) partnerships can be taken up in the field of solid waste management for Pune.
Establishment of an ISWM Cell	The target of this scheme is to formulate an ISWM Cell for Pune to assist PMC as an institutional body for managing the wastes. An ISWM Website is also proposed in this scheme. This website will work as an information portal for Pune's waste management aspects.
Strengthening of PMC Rag picker Co-operatives	To promote the segregation and sorting of waste, PMC has adopted the policy of institutionalizing rag-pickers. Strengthening the rag pickers cooperatives will help PMC

	achieve its policy objectives. Some of the objectives of this scheme include imparting vocational training and providing incentive and benefits to such cooperatives.

6.6. Why Monitor and Review the Action Plan

Once the city/civic authorities have developed and implemented the ISWM Action Plan, they need to monitor and review the plan in order to assess the effectiveness of the programme. An effective monitoring, reviewing and evaluating process will ensure that the plan remains relevant to the city and the stakeholders over time. Reviewing and monitoring the plan includes determining if the targets are met. It should also help in identifying areas for improvements.

The monitoring process would involve asking the following:

- Does the process continue to involve the citizens and the various stakeholders? Perhaps the citizens' make-up has altered so the information program needs amendment?
- Is there a commitment to the process by the Government?
- Are the Vision and Goals still relevant or have changing circumstances, knowledge and priorities left them no longer appropriate?
- Are the indicators the most appropriate? Perhaps there are new technologies or resources available that would make other indicators more appropriate?

Evaluation of the Action Plan entails the following key principles and is most effective when

- It is a continuous (not just one-off) process informing planning and delivery as the project develops;
- It involves all those with an interest in the project in defining the questions they want answered;
- It uses imaginative and creative approaches, which engage those involved;
- It helps projects to be more accountable to the wider community;
- It highlights and celebrates successes and achievements;
- It encourages an honest appraisal of progress, so that you can learn from

what hasn't worked as well as what has.[4]

The city/civic authorities can develop and maintain certain Key Performance Indicators which will help them to monitor and review the Action Plan over a period of time.

The purpose of the monitoring and review process is the following

- Provide information on the status of the ISWM plan to various stakeholders on a regular basis
- Analyse the status to assess effectiveness of the Schemes implemented
- Adapt, modify or strengthen the ongoing Schemes as well as conceive new Schemes as relevant
- Draw on the learnings, update and disseminate knowledge

A. What are Key Performance Indicators?

The ISWM Plan would represent a number of Schemes/Actions that are to be implemented within the plan's timeframe. It is important that an adequate monitoring and review process is set up by the authorities to achieve the desired outcomes. In order to monitor the Schemes, a set of Key Performance Indicators (KPIs) are required that relate to the Plan and its elements (i.e. Schemes) under review.

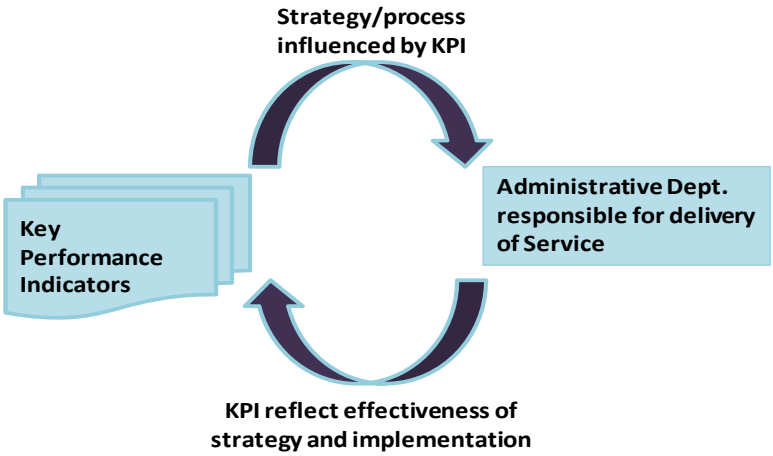
Key Performance Indicators (KPIs) are parameters that provide a meaningful, concise, overall picture of an organizations performance or that of the project/programme, used to report progress that is chosen to reflect the critical success factors of a program or plan. The KPI's reflect long-term considerations.

- Targets are also required for each Key Performance Indicator in order that the outcomes can be achieved.
- A Key Performance Indicator that is generally looked upon as a barometer to measure the overall performance of solid waste management is the year-on-year reduction of waste generated and/or disposed.
- The overall cleanliness of a city is also considered to be another key parameter to be measured. These aspects have to be well reflected in the city's ISWM Action Plan by setting appropriate Vision, Goals, Objectives and Targets.
- A KPI is a quantitative measure of whether the system is delivering its service at the desired level. In order to evaluate a KPI, appropriate data must be gathered by the concerned department using a certain methodology.

4 As referred to http://www.jrf.org.uk/bookshop/eBooks/1859354157.pdf

While creating a set of KPI for a particular ISWM Plan, the city/civic authorities should see that the following is done

- Attach a KPI to every function of the delivery system that has to do with an outcome that affects the citizens
- Include a Financial KPI that ensures that the delivery of that service is done in a financially efficient manner
- Identify the data that needs to be available to quantify the KPI
- Set-up a way to support the data that the Municipality will publish



Care must be taken to make sure that a KPI is

- *Quantifiable* – Creating a KPI for which data cannot be realistically gathered or corroborated should be avoided.
- *Actionable* – It should be possible for the city/civic authorities to influence the outcome of a KPI through concrete measures that they can take. A very "high level" KPI does not lend itself well to a strategy. For e.g. "citizen satisfaction" is a very high level KPI which is influenced by a host of factors. It will not be possible to create a set of strategies that can affect this KPI unless the exact nature of "dissatisfaction" is clear.
- *Outcome oriented* – A KPI should represent an outcome and not a strategy to achieve the outcome. The Municipality should be free to weigh the options and pursue any strategy to achieve better performance and thus improve every KPI.
- *Symptom vs. Indicator* – Often citizens' behaviour is an outcome of the nature of service delivered. A KPI should reflect a facet of the actual delivery of service, not an outcome of the service.
- *Answerable to all citizens* – A KPI should relate to an outcome (operational or financial) that affects all citizens and not individual stakeholders in the service. In a Public-Private partnership, that the Municipality might enter in order to deliver a service, the nature of the PPP is not subjected to assessment, only the outcome of that partnership is.

While it is understood that the exact terms of the PPP will heavily influence the outcome, the PPP itself is a strategy. If the PPP fails to deliver the expected outcome measured by an indicator, the Municipality should evaluate the terms of the PPP or even dissolve such a partnership, but this should be considered as a strategy choice.

KPI are defined through a collective process that involves the Municipality, all major stakeholders and citizens at large. Once decided, they are considered to be a binding evaluation criterion, acceptable to both the Municipality as well as the citizens. Once the set of KPI for a Municipal Service is created, they can be used by various agencies.

An example of the owner and use of KPI are given in the table below:

Who?	How?
Municipal Dept. responsible for delivery of Service	• to judge its own performance • to evaluate strategies • to institute new processes
Superior Officers	• to judge effectiveness of staff • to make decisions regarding promotions and rewards
Elected Body of Representatives	• to judge performance of the administration • to create policy that will aid in the delivery of performance • to take action (reward or punitive) against administrative officials
Citizens	• to judge performance of dept • to recommend/push for policy and/or staff changes
Budgeting Agencies (internal or external)	• to decide allocation of funds to help improve performance • to reward performing implementers

A KPI is only worth the quality of the data that is used to evaluate it. It is important to define the methodology that will be used to collect the data needed for every KPI. This includes:

- Data should be at the most granular (disaggregated) level. This will allow for analysis of the data in a way that is most suitable.
- The exact formats in which data will be gathered and the person/s responsible for recording the data should be specified
- Existing systems for gathering data should be evaluated. They may be adequate or may need to be enhanced or changed, or a complete new system may have to be put in place.

Given the general lack of systems in a typical Municipality, it will take time for the data gathered by it to be reliable and trusted by the public at large. Both as a confidence building measure as well as a way for the Municipality to further pull its own systems to improve the data quality, an independent effort must be undertaken by citizen groups to check the data presented by the Municipality. This can be done in a few ways

- check the consistency of the data
- do spot checks or sampling of the data
- undertake a survey that covers a certain geographical area or time period

The manner in which these are done should be shared with the Municipality so that the validity of these independent corroboration efforts is recognized by it. The results of the independent assessment and the Municipal data should not differ from one another by an unreasonable amount – determined by whether public confidence in the official data is undermined.

In the end, the focus of the public audit should be on the improvement of the services and not a debate about the validity of the data itself. It is expected that with time, not only will the services improve, but also the reliability of the official data improves.

B. Illustrative Key Performance Indicators

Table 6.1 shows a list of various types of KPIs along with the output that is being measured[5].

Table 6.1: Illustrative Key Performance Indicators

Perspective	Key Performance Area	No.	KPI Unit	Key Performance Indicator	Output Measure
1. Institutional	Implement New Organisational Structure	1	%	Placement of staff in new structure	Staff placed in structure
		2	%	Implementation of operational and service links with city as regulatory Authority	Improved Assessment
		3	%	Integration of operating strategies and alignment with city structures	Adherence to Plan
	Promote a Business and Performance Culture	4	%	Implementation of Business Improvement processes	Degree of satisfaction with process

5 As referred to http://www.capetown.gov.za/iwmp/sept2004/section3keperformanceindicators.pdf

	Communication with Internal and External Stakeholders	5	%	Development and Implementation of a Citizens Charter for Solid Waste Management	Success of Charter
	Human Resource Development	6	%	Develop and implement a Workforce Skills Training Programme, including audit baselines study	Achievement of Skills Development targets as per plan
		7	%	Budget spent on implementing the Workforce Skills Training Programme	Percentage of total annual budget
		8	%	Development of Top and Middle Management using CPM business improvement techniques	Managers empowered
		9	%	Compliance with Corporate Employment Equity Plan	Adherence to plan
2. Financial	Risk Management	10	%	Development and Implementation of a Risk Management Plan	Adherence to Plan
	Revenue	11	%	Assessment of Revenue Base (Internally and Externally)	Increase in Revenue
		12	%	Optimisation of Revenue	Increase in Revenue
	Expenditure	13	%	Optimisation of Costs through improved internal efficiencies	Reduction in costs to overall budget
		14	%	Optimisation of Expenditure	Reduction in costs to overall budget
	Asset Management	15	%	Development and Implementation of an Asset Management Plan	Adherence to Plan
	Budget	16	%	Capital Expended against Budget	Capital Spent
		17	%	Adherence to Operating Budget	Operating expenses Spent
3. Waste Minimisation	Regulatory and Co-regulatory instruments	18	%	Development and Implementation of a Waste Minimisation Plan	Adherence to Plan

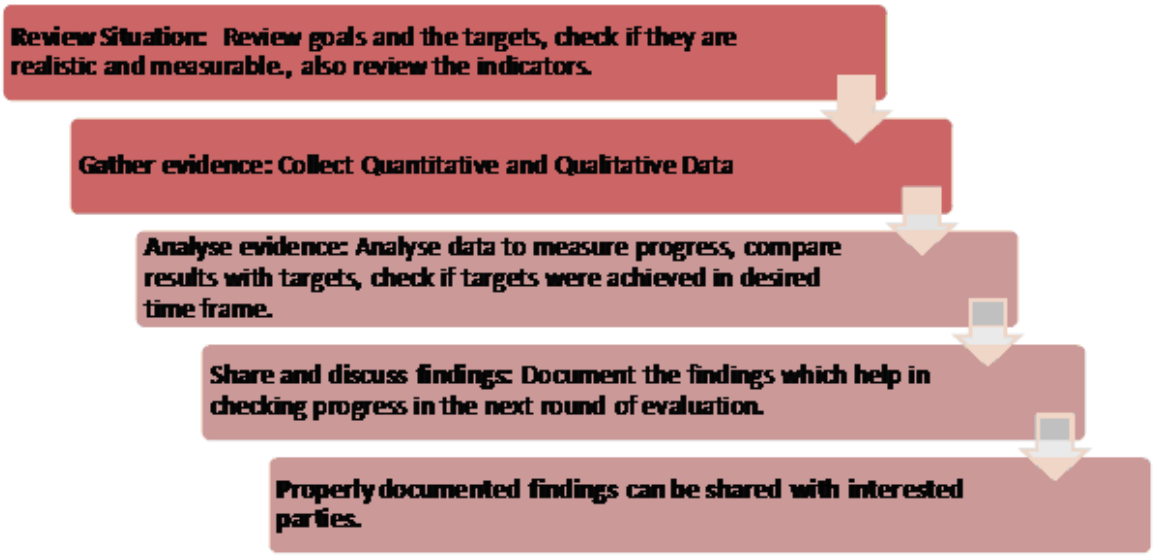
	Waste Minimisation Infrastructure and Methodologies	19	%	Development and Implementation of a Waste Minimisation Infrastructure Development Plan	Adherence to Plan
		20	No.	Development and Implementation of a Waste Minimisation Partnership Plan	Number of Partnerships developed
4. Waste Education, Awareness and Training	General Waste Education, Awareness and Training	21	%	Development and implementation of Waste Minimisation Communication Plan	Degree of success in accordance with Plan
		22	No.	Development and Implementation of a Schools' Waste Awareness and Education Plan	Number of Projects initiated
		23	No.	Development and Implementation of a Waste Awareness and Education Plan for Industry and Commerce	Number of Projects initiated
		24	No.	Development and Implementation of Waste Awareness and Education Plan for Institutions and Tertiary Education Institutions	Number of Projects initiated
		25	%	Development and Implementation of Waste Awareness and Education Plan for Public Events and Special Projects	Degree of success in accordance with Plan
5. Waste Information Management	Management Systems	26	%	Development and Implementation of a Waste Information Management System	Award of Capital Credits
	Waste Minimisation Targeting	27	Tonne	Reduction of Waste disposed of to landfills	Waste entering all landfills (Baseline date = 2000)
6. Waste Collection	Policy and Management Plans	28	No.	Improvement of Service Delivery to all formal households	Total number of households
		29	No.	Improvement of Service Delivery to all informal households	Total number of households

		30	%	Development and Implementation of a Plan for collection of waste from formalised informal traders on Council property	Adherence to Plan
		31	No.	Optimisation of Collection Operations	Properties serviced per vehicle
		32	No.		Properties serviced per employee
		33	tonne		Tonnage collected per employee
		34	R		Average cost per tonne collected
		35	R		Average cost per property serviced
	Fleet Management	36	%	Improvement in Fleet Maintenance	Reduction in downtime
7. Area Cleaning	Policy and Management Plans	37	%	Finalisation of Area Cleaning Services Policy	Implementation of Policy
		38	%	Implementation of Area Cleaning Services Policy	Total extent of public areas serviced
		39	%	Overall cleanliness of the City	Compliance with standards set using a photographic cleanliness index
	Fleet Management	40	%	Improvement in Fleet Maintenance	Reduction in downtime
8. Hazardous and Special Waste Management	Management Systems	41	%	Development and Implementation of a Hazardous Waste Management Plan	Implementation of plan
		42	%	Monitoring of contamination levels at Waste Facilities	Reduction in levels of contamination
9. Waste Processing and Disposal	Management Systems	43	%	Development and Implementation of a Waste processing and Disposal Policy	Implementation of policy
	Disposal Facilities	44	%	Compliance with Regulatory Requirements	Degree of compliance

		45	%	Development and commissioning of Regional Waste Disposal Facility by Year 2011	Adherence to project programme
	Transfer Stations and Material Recovery Facilities	46	No.	Implement Development of transfer stations in accordance with policy plan	Number of facilities provided
	Drop-off Facilities	47	No.	Implement development of drop-off facilities in accordance with Policy plan	Degree of satisfaction with processes
	Compost Facilities	48	%	Development and Implementation of a Plan to address organic wastes	Implementation of Plan
	Builders' Rubble Facilities	49	%	Development and Implementation of a Plan to address organic wastes	Implementation of Plan
10. General	Integrated Waste Management Plan	50	%	Implementation of plan	Adherence to plan

C. How to carry out Monitoring and Evaluation

The city/civic authorities should follow these steps in carrying out the monitoring and evaluation as shown below[6]:



The city/civic authorities should allocate the responsibility of monitoring and evaluation to the appropriate person/organisation such as external consultants, experienced academicians or facilitators. A sample format for recording the results of the monitoring and evaluation is present in **Table 6.2**

6 Guide to Implementing Local Environmental Action Programs in Central and Eastern Europe, Prepared by PAUL MARKOWITZ Institute for Sustainable Communities, USA in cooperation with The Regional Environmental Center for Central and Eastern Europe, Hungary

Table 6.2: Format for recording the Monitoring and evaluation results

Action:					**Date:**
	Status (Completed/in process)	Time taken	Benefits achieved	Barriers faced	Remarks
Task 1			1		
			2		
			3		
Task 2			1		
			2		
			3		
Task 3			1		
			2		
			3		

6.7. Continual Improvement

ISWM Plan is intended to bring changes in the consumption pattern and improve solid waste management on a continuous basis. Usually a number of projects acquire support from all the stakeholders in the beginning and are important for everyone for some period but after a couple of months, these projects take a backseat. It is therefore necessary to maintain the awareness and the importance of the ISWM Plan with all the stakeholders. The city/civic authorities can do this through various activities. Some of them are enlisted below:

- Communicating the results of the ISWM Plan's Schemes/Actions, monitoring and evaluation through an established reporting system, will help in maintaining the interest of the various groups in the programme. The progress reports can be published on the website dedicated to the ISWM Plan or in the newsletter. (The various means of communication described in Chapter 4 can be used to communicate the progress)
- Creating awareness should be on a continuous basis through various means like conducting workshops for various segments such as students, consumers, and businesses. Setting up an Environmental Awareness Centre can also help in supplying the updates of the project to the people. The display of the success stories can be made in the EAC which will encourage other citizens to undertake similar activities. Replication of Actions will thus lead to a greater positive change.
- It is also necessary to secure the support of the Government on a long term basis. This can help in extending the objectives of the citizens to the

national level. The regulatory framework of the country can then encompass the sustainability objectives.

- As new technologies keep coming in the market for continuous improvement in the management of solid waste, the need for training and capacity building also keeps changing. Identifying the training needs and building capacities of the concerned officials on a continuous basis is also necessary to sustain the ISWM Plan.

What did you learn?

- ✓ After the development of the action plan, the city/civic authorities should communicate the plan to various stakeholders along with their own staff. **The plan should be communicated because the ISWM action plan will not be useful and successful if there is no response and participation from the various stakeholders involved.**
- ✓ **Communicating the action plan is an ongoing activity. The scope of this activity is largely dependent on the finances available, timeline of the programme and the partnering organizations.**
- ✓ After the actions have been identified and prioritized, there might be a need for building capacities in order to ensure the implementation of the actions. Training is both resource intensive and time consuming and hence should be planned properly by the city/civic authorities.
- ✓ Once the city/civic authorities have developed and implemented the ISWM Action Plan, they would have to monitor and review the plan in order to assess the effectiveness of the programme. An effective monitoring, reviewing and evaluating process will ensure that the plan remains relevant to a city and the stakeholders over time. Reviewing and monitoring the plan includes determining if the targets are met. It should also help in identifying areas for improvements.
- ✓ ISWM Plan is intended to bring changes in the consumption pattern and improve solid waste management on a continuous basis. Usually a number of projects acquire support from all the stakeholders in the beginning and are important for everyone for some period but after a couple of months, these projects take a backseat. It is therefore necessary to maintain the awareness and the importance of the ISWM Plan with all the stakeholders.

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- Guide to Implementing Local Environmental Action Programs in Central and Eastern Europe, Prepared by PAUL MARKOWITZ Institute for Sustainable Communities, USA in cooperation with The Regional Environmental Center for Central and Eastern Europe, Hungary

Annexure

Annexure 1

Highlights from ISWM Plan, Pune, India

The process of Strategic Action Planning took place through the conduct of six participatory workshops including the launch workshop. The theme of the **ISWM Launch workshop** was the IETC-UNEP's approach and programme on ISWM. Subsequently, each type of waste to be considered under the ISWM plan was addressed in the thematic sessions. A Working Group - comprising of a conglomerate of various stakeholders was formulated. This workshop was followed by the **First Working Group Meeting** on development of ISWM plan for Pune. The Working Group members are representatives from the regulatory bodies, technology providers, Non-Governmental Organizations (NGOs) working specifically in the waste related fields and citizens' representatives. The basic aim behind formulating such a group was to discuss and debate on the Vision, Mission, Goals and Objectives of the ISWM Plan. In order to further attend to specific waste-stream related issues, a series of consultation workshops were proposed and organized. These involved developing a Draft Vision and Mission statement for ISWM plan, followed by the formulation of goals and objectives with a discussion on strategies that could be deployed to achieve the targets.

The first consultation workshop (**Workshop I**) focused on the generation, segregation, 3Rs (Reduce, Reuse, Recover) and Decentralized Treatment of Municipal Solid Waste (MSW).

The second workshop (**Workshop II**) focused on the technology provisions for Solid Waste Management.

Three more workshops (**Workshop III, IV and V)** were held with their focus on C & D wastes, E-Wastes and BMW respectively.

The overall approach followed for the workshops is illustrated in *Figure 1*.

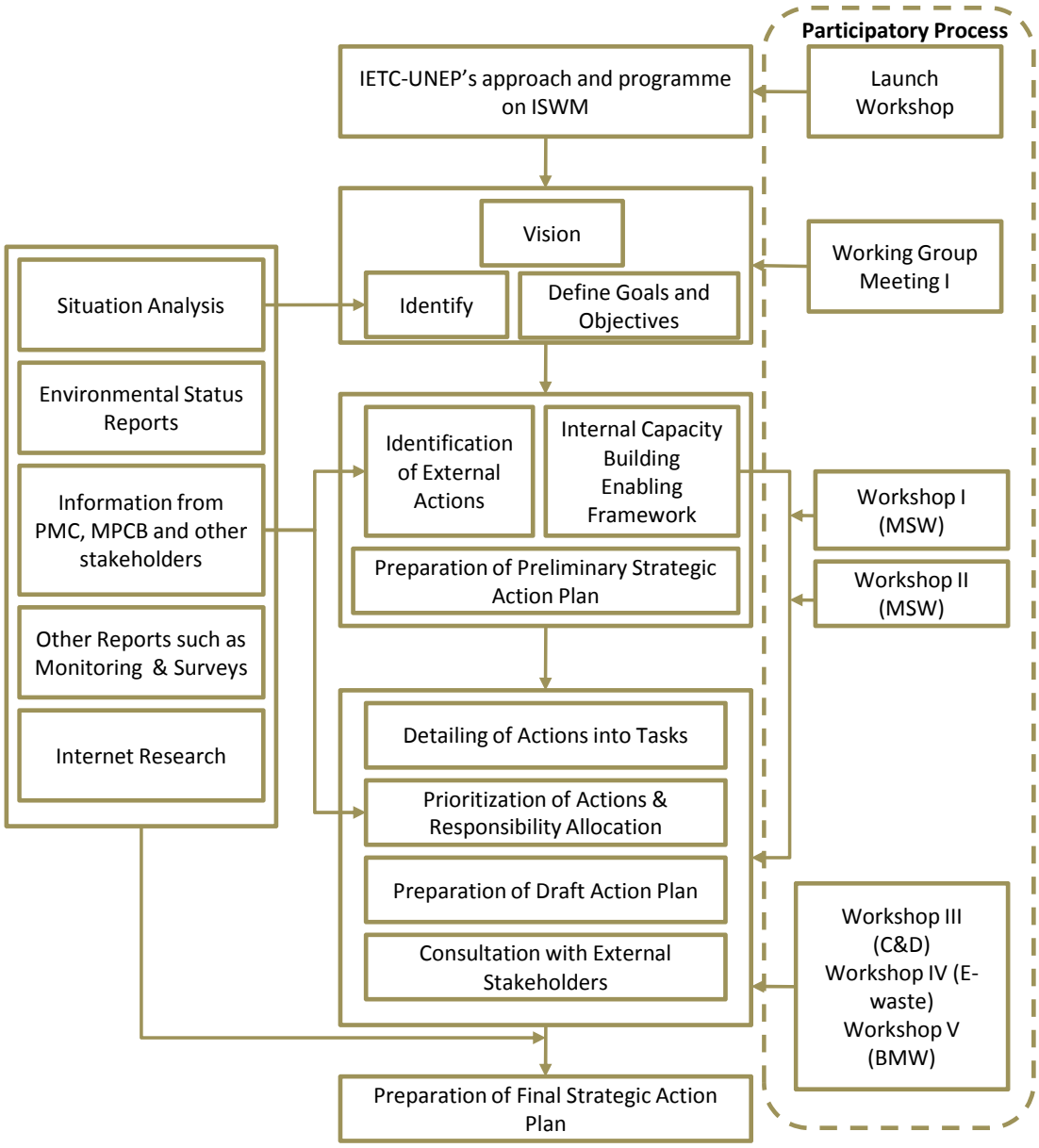


Figure 1: Overall Methodology for the Consultation Workshops

The ISWM project was launched in Pune through a launch workshop on **December 22nd, 2006.** The workshop was also supported by the Maharashtra Pollution Control Board (MPCB) and was commenced by Dr. Nitin Kareer, IAS, Municipal Commissioner and Dr. Dilip Boralkar, Member Secretary, MPCB. Mr Surya Chandak, Dy. Director of IETC-UNEP, Japan, was also present and delivered a presentation on IETC-UNEP's approach and programme on ISWM.

The workshop included a number of presentations from experts and technology/service providers involved in the various aspects of SWM. The presentations covered status of MSW, waste recycling initiative, biomedical waste management and MPCB's work on hazardous waste and e-waste management. This workshop had representatives from most of the stakeholders related to solid waste management. In all, 47 delegates participated in the workshop. Representations varied from regulators to administrators and technology providers to citizen activists. Representatives from other urban bodies besides Pune Municipal Corporation were also present. Through this workshop, the stakeholders and the media at large were informed about the ISWM initiative as well as the future course of action to be taken.

Subsequent to this, a workshop was organized along with the Working Group that comprised of selected representatives of PMC, Key Institutions, NGOs, Industries, Electronics and IT sector, etc on January 29, 2007 to kick start the Strategic Planning process towards preparation of the ISWM Plan for Pune. During the day long workshop a draft Vision & Mission statement for ISWM plan was developed. Further, Goals and Objectives were formulated with a discussion on strategies that could be deployed to achieve the targets.

Subsequent to these workshops, a series of consultation workshops were organized. In order to maximize the participation, besides the invitations being sent by the PMC, information was disseminated through the website http://iswm.emcentre.com - a web portal specially created to share the various outputs produced in the ISWM Plan development process as well as to solicit views and pool resources.

Box 1: Details of ISWM Website for Pune City

Website on Integrated Solid Waste Management for Pune City

A website dedicated to ISWM plan for Pune city was launched to encourage communication between stakeholders, policy makers and the planners. This website has served as a common platform for people to comment and provide suggestions in the planning process. The website is continuously updated to inform about the upcoming events related to SWM in the city of Pune.

This interactive site also holds about 42 publications including the reports and presentations that were made during the Consultation Workshops. Opinion poll was one of the features of the website, wherein various themes were put up for views. The other features include Quick Comments and photo gallery.

There are now about 120 members registered on the site who are actively involved in the discussions and other activities on the website. The member composition consists of students, professionals, researchers, NGO representatives, Industry people as well as Government officials.

Table 1 lists the series of consultation workshops organised with their respective dates, addressing various solid waste streams as below:

Table 1: Consultation workshops

Sl. No.	Consultation Workshop	Date
01.	Municipal Solid Waste – I Focus: Generation, Segregation, 3Rs and Decentralized Treatment Systems	February 17, 2007
02.	Municipal Solid Waste – II Focus: Treatment, Recovery and Disposal	February 24, 2007
03.	Electronic Waste Management	March 24, 2007
04.	Construction & Demolition Waste Management	March 28, 2007
05.	Bio-Medical Waste Management	March 30, 2007

The conduct of these workshops was emphasized with the aim to gather maximum inputs from the stakeholders. Each of the workshops started with the presentation of some key findings and issues based on the situation analysis study carried out as part of the project. Various experts and technology /service providers specialized for the particular waste stream were invited as panellists to facilitate the discussions and to share their experiences and views through presentations. Their presentations were followed by discussion involving the key stakeholders, technology/service providers, NGOs, representatives of various educational and research institutions and concerned PMC officials. The participants were also briefed on the Action Plan being developed as well as the Vision, Mission and Objectives being framed for Pune and were encouraged to give their feedback on the same. *Figure 2* presents the snap-shots of the consultation workshops.

Figure 2: Consultation Workshops in progress

The highlights of the consultation workshops on each waste stream were further analyzed to distill the significant points of discussion. Table 2 presents a summary of the key highlights of the consultation workshops.

Table 2: Key remarks from the Consultation workshops

No.	Subject		Waste Stream	Remarks
01.	Separate system should be operated for collection of waste from slums and also from bulk generators		Municipal Solid Waste	The slum covers dense population and generate high quantity of MSW; the solid waste collection and transportation should be done more frequently
	Plan of Action	Assess any slum for verification and to take pro active actions		
	Benefit	Cleanliness of slum with hygienic living standards		
	Barriers	---		
02.	Increase the staff for collection of waste		Municipal Solid Waste	As the number of PMC personnel allocated in MSW management is too less, an appropriate measure is required. The proposed measure is thought to be effective.
	Plan of Action	To introduce public private partnership (PPP)		
	Benefit	More job opportunities, efficient cleaning		
	Barriers	---		
03.	Raise awareness among citizens for segregation of waste		Municipal Solid Waste	The separation of dry and wet waste is not being practiced still. The citizens have to be made aware of the various treatment options of waste so that the basic requirement of waste segregation could be implemented.
	Plan of Action	Organise awareness programmes		
	Benefit	The segregation of waste happens at source hence it becomes easy to handle and treat the waste		
	Barriers	Lack of awareness; lack of infrastructure to support this initiative (it gets mixed at the transfer station)		
04.	Operating decentralized treatment systems i.e. vermi-composting at ward level to make them sustainable		Municipal Solid Waste	The wet waste generated at societal level or house hold level is not that big, hence if the waste is collected at some designated place and processed, the results would be better and the quantity will also make the project feasible.
	Plan of Action	----		
	Benefit	It will process the waste in the respective ward and the quantity going for landfilling can be reduced.		
	Barriers	The space required for such facility		

No.	Subject		Waste Stream	Remarks
05.	Up gradation of the existing transport systems		Municipal Solid Waste	Vehicles used are not proper as the waste litters from them itself, application of GIS can make the transportation efficient; maintenance of vehicles takes time and other resources.
	Plan of Action	A study should be carried out to know the clear view of the situation		
	Benefit	More efficient transport systems		
	Barriers	---		
07.	Increase in the fleet of waste collecting and transporting vehicles		Municipal Solid Waste	
	Plan of Action	---		
	Benefit	Better and efficient transportation		
	Barriers			
08.	The schedule for MSW collection should be revised periodically		Municipal Solid Waste	This will help in allocating vehicles; citizens will also be able to deposit the waste in time
	Plan of Action	A schedule should be prepared		
	Benefit	Proper management of MSW		
	Barriers	---		
09.	Provide some incentive if appropriate decentralized treatment systems are applied		Municipal Solid Waste	At present some incentives are provided but this application is mostly hindered in view of other issues like space constraints, infrastructure, equipments and market
	Plan of Action	---		
	Benefit	Reduction in the quantity that goes for open dumping; Revenue generation opportunities		
	Barriers	Space to operate, equipments		
10.	Assistance in marketing those products that have yielded from such treatment systems		Municipal Solid Waste	There is little market for compost fertilizers in case of vermi-composting.
	Plan of Action	To explore the market conditions and carry out viability analysis		
	Benefit	Increase in such types of projects, hence reduction in quantity going for open dumping		
	Barriers	---		

No.	Subject		Waste Stream	Remarks
11.	Estimate the carbon credit potential for MSW in Pune		Municipal Solid Waste	By implementing eco friendly technologies and treating the waste through vermi-composting, biomethanation, etc., the escape of methane can be reduced.
	Plan of Action	Identify and study suitable technologies in transportation and processing of waste		
	Benefit	Reduction in GHG as well as gaining monitory benefits		
	Barriers	Authentic data generation and collection of the same		
12.	Inventorization and classification of E-waste in context of Pune city		E-waste	There is no available data either on generation of electronic waste or on collection pattern and processing of the same.
	Plan of Action	MPCB has carried out a survey and the data would be available soon but to identify its impacts would be important		
	Benefit	Handling and management of e-waste can be streamlined		
	Barriers			
13.	Establishing regulatory framework		E-waste	The regulatory framework on e-waste in India does not exist.
	Plan of Action	To approach a regulatory body		
	Benefit	Handling and management of e-waste can be streamlined		
	Barriers	---		
14.	Awareness and training to the concerned stakeholders for appropriate E-waste Management.		E-waste	As it is a relatively new field and with no existing regulation, there is unavailability of any guidelines, thus making it difficult to handle and monitor this waste stream.
	Plan of Action	Organise awareness generation workshops		
	Benefit	Handling and management of e-waste can be made efficient		
	Barriers	Unavailability of guidelines		
15.	Encourage stake holders to adopt recycle and reuse techniques for e-waste management		E-waste	This is seen as proactive/precautionary approach to e-waste management so that the quantity going for open dumping can be reduced
	Plan of Action	Prepare checklist of items those can be reused/recycled and dissemination of the same		
	Benefit	Resource conservation and reduction in quantity of waste going for open dumping		
	Barriers	Identification and study of the LCA of E-waste		

No.	Subject		Waste Stream	Remarks
16.	Inventorization of C&D waste for Pune city		Construction & Demolition Waste	Recently, Pune is witnessing a rapid development in urban infrastructure; hence the generation of waste by demolition of old building is very high. C&D waste handling and management related regulations are being developed by MCGM; PMC can develop or replicate these regulations and guidelines in similar fashion.
	Plan of Action	Generate, assimilate and compile data on C&D waste		
	Benefit	Resource conservation		
	Barriers	---		
17.	Identification of adequate technologies for separation of C&D waste from Municipal Solid Waste		Construction & Demolition Waste	
	Plan of Action	Study the Best Practices being implemented in other cities		
	Benefit	Resource conservation and less amount of waste generation		
	Barriers	---		
18.	Promote the use of recycled products in construction sector		Construction & Demolition Waste	
	Plan of Action	Study the Best Practices being implemented in other cities		
	Benefit	Resource conservation and less amount of waste generation		
	Barriers	---		
19.	To develop Rules for construction and demolition waste management in line with MCGM		Construction & Demolition Waste	
	Plan of Action	Study the rules being implemented by MCGM as a case study and prepare it for Pune city		
	Benefit	Better handling and management of C&D waste, resource conservation, less amount of waste generation		
	Barriers	---		
20.	To adopt efficient monitoring to ensure the compliance		Construction & Demolition Waste	There are incidents that at various locations the construction debris has been dumped causing a lot of trouble.
	Plan of Action	To develop strategy and to train officials		
	Benefit	Effective implementation of such regulations		
	Barriers	To prepare the regulation and guidelines		

No.	Subject		Waste Stream	Remarks
21.	To ensure that proper segregation takes place which is an important aspect of Bio-medical waste handling and management		Bio-Medical Waste	Even a small quantity of infectious waste mixed with MSW can contaminate the whole waste.
	Plan of Action	Surprise checking of hospitals, bins etc. Train medical practioners on BMW (M & H) Rules 1998		
	Benefit	Proper handling and management of BMW		
	Barriers	---		
22.	The need for awareness and training on legislatory requirements regarding BMW management		Bio-Medical Waste	Many from the medical fraternity are unaware about BMW rules and its various categories; hence at times the separation is not done.
	Plan of Action	Organise series of seminars on BMW (H&M) rules		
	Benefit	Segregation of BMW will take place thus its dumping in MSW bins will stop		
	Barriers	---		
23.	Monitoring and reviewing for the service provider for BMW		Bio-Medical Waste	This point was stressed by IMA, Pune chapter as the service provider has shown some irregularities towards collection of BMW
	Plan of Action	Strategy can be developed for monitoring, and monthly meeting with feed backs can be arranged		
	Benefit	Quality and efficiency of service will improve		
	Barriers	---		
24.	To incorporate the subject on BMW management in college syllabus		Bio-Medical Waste	This point was also stressed by IMA, Pune chapter to introduce this subject in the curriculum at the university level.
	Plan of Action	---		
	Benefit	Awareness creation on BMW rules		
	Barriers	---		
25.	To take action against those who are not complying with the regulations		Bio-Medical Waste	According to IMA and PMC, there are many medical practitioners who are not registered with them or the service provider and no actions have been taken against them yet while they are still practicing to dump the BMW along with MSW.
	Plan of Action	Take action against such professionals, institutions and hospitals.		
	Benefit	Proper handling and management of BMW rules		
	Barriers	---		

The strategic planning process emphasizes visioning on action process conducted through consultation with stakeholders. The report provides statement of Vision, Goals and Objectives accordingly to form a basis in the drawl of Action Plan.

A review of the SWM situation in Pune brings out the following features:

- The quantity of all types of solid waste is increasing continuously thus proportionately increasing the pressure on Pune's landfill.
- Pune's solid waste problem is multi-dimensional covering MSW, C&D waste, E-waste, Industrial hazardous solid waste and Biomedical waste. An integrated approach to solid waste is very relevant
- An optimal mix of both decentralized and centralized approaches for waste management is needed for Pune with more emphasis on the former one.
- The infrastructure available for handling the solid waste in most cases is under pressure
- There is a dire necessity to have trained human resources in SWM, especially at PMC. While there are several interested and committed institutions, there is a need for harmonization and networking
- The perception of waste is changing over the past few years as it is being seen as a resource. Efforts are needed to tap some of the good initiatives in Pune and mainstream 3R considerations
- The financial requirements for satisfactory implementation of SWM are increasing. Models under PPP will need to be promoted and tested
- A strategic approach is needed ad-hoc or as the reactive approaches alone are not going to lead to sustainable solutions

The Situation Analysis Report formed the base for the development of the **Integrated Solid Waste Management Plan** for Pune. To assist the plan development, a review of various ISWM plans implemented across the world has been done. These would provide key inputs in terms of the features as well as help in avoiding pitfalls. The planning process was facilitated at every stage by involving stakeholder consultations. A **Working Group** has been formed in consultation with PMC and through invitation to have representations from all the stakeholders. The stakeholders were led through the strategic planning process to develop the ISWM Plan incorporating:

Vision --- Mission --- Goals, Objectives, Targets --- Strategies & Tactics --- Tasks with responsibilities, resources required, proposed institutional arrangements & expected capacity building. Simultaneously through a series of consultation workshops, the stakeholders related to each type of waste would be conferred for the various activities of the management functions of the SWM. The identification of the sustainable technologies and systems have been addressed using the **"Sustainable Assessment of Technologies" (SAT)** methodology. The outcome of the whole of the above process was the refined and final version of the **Integrated Solid Waste Management Plan for Pune**.

The following vision, mission and goals have been derived in Pune ISWM following the working group meeting and the consultation workshops as shown in *Figure 3*.

Figure 3: Vision-Mission-Goals derived in Pune ISWM

Vision for Pune ISWM

A vision is a guiding image of success formed in terms of a contribution to society that describes the future destination; it provides an image in words of what success would look like and is built on reasonable assumptions about the future. Expressions of a Vision could be external as well as internal.

An external vision focuses on how the world will be improved, changed, or different if the organization achieves its purpose.

An internal vision describes what the organization will look like when it is operating effectively to support the external vision.

The present waste management scenario especially for MSW in Pune is disposal in landfill. However, landfill space is always a constraint. Improper dumping of wastes in the landfill also causes several problems with regard to environmental pollution, health issues and social problems. Therefore, this ISWM plan for Pune city has been visualised as a way to achieve a cleaner city of Pune without landfills. The Vision statement of Pune ISWM is as follows:

'To make Pune, a clean city without landfills'

Mission for Pune ISWM

The mission statement reflects the overall purpose of the organization, thus, it is a precise description of what an organization does. When wording the mission statement,

the organization's products, services, markets, values, and concern for public image must be considered.

The mission statement for the Pune ISWM project has tried to incorporate several aspects of managing solid wastes effectively. It included the idea of provision for better infrastructure, more proactive management, emphasis on 3R's and integrated approach to managing the wastes. The mission state of Pune ISWM is as follows:

> ***'Provide, facilitate and operate infrastructure and services to all, to achieve excellence in integrated solid waste management in a proactive, participatory, socially responsible and cost effective manner to protect health and ecosystems. Relentlessly pursue reduction, reuse and recovery working collaboratively with all stakeholders, build appropriate capacity and competencies and forge partnerships'***

Goals and Objectives

For each goal, the following objectives have been derived which are shown in **Table 3**.

Table 3: Goals and Objectives of Pune ISWM

	Goal 1 Reduce Risk to Public Health and Ecosystems	**Goal 2** Achieve Compliance with solid waste related regulatory requirements	**Goal 3** Strengthen PMC in order to achieve the above goals
Objective 1	Minimize human exposure to solid wastes	Achieve Compliance with MSW (M&H) Rules	Build internal capacity of human resources in terms of adequacy and competency
Objective 2	Minimize exposure of environmental components (air, water, soil, flora and fauna) to solid wastes	Achieve Compliance with Biomedical (M&H) Rules	Improve internal SWM infrastructure
Objective 3	Minimize the quantum of solid waste generated, transported, treated and disposed	Achieve Compliance with Hazardous Waste (M&H) Rules	Make the operations of SWM department transparent, accountable, efficient and cost-effective
Objective 4		Achieve Compliance with Other Legislation (Plastic recycling, Batteries etc.)	Forge synergistic partnerships with stakeholders

In order to achieve the final vision of converting Pune into a clean city without landfills, several options were looked at and analyzed on the basis of the present situation.

Based on the Vision and Mission statement of Pune ISWM, the three main aspects included in the goals were reduction of risk from solid wastes, achievement of compliance to regulations and finally to strengthen the governing body i.e. PMC by improving the infrastructure, making management of solid wastes more cost effective and forging public private partnerships to manage the increasing complexity and amount of the waste streams.

Goal 1: Reduce Risk to Public Health and Ecosystems

Objectives under Goal 1 are:

- Minimize human exposure to solid wastes
- Minimize exposure of environmental components (air, water, soil, flora and fauna) to solid wastes
- Minimize the quantum of solid waste generated, transported, treated and disposed

This goal concentrates on reduction of risk from solid wastes to humans as well as the environment and finally it emphases the reduction in the quantity of wastes itself which can be done by levying penalties to all stakeholders and citizens of the city, providing incentives for lower per capita generation, conducting training and awareness programmes and to improve the efficiency of waste management chain from generation to disposal stages. Proper baseline for all waste streams need to be generated in order to ensure protection of human health and environment.

Goal 2: Achieve Compliance with solid waste related regulatory requirements

Objectives under Goal 2 are:

- Achieve Compliance with MSW (M&H) Rules
- Achieve Compliance with Biomedical (M&H) Rules
- Achieve Compliance with Hazardous Waste (M&H) Rules
- Achieve Compliance with Other Legislation (Plastic recycling, Batteries etc.)

At the national level, there are numerous provisions in the Indian legislative structure to have a bearing on the State's management of environmental resources. Several local rules also help towards management of solid wastes. However non-compliance to these rules is one of the main reasons for transforming SWM as one of the most compelling problem of urban environmental degradation. A phase compliance strategy may be followed to achieve this goal.

Goal 3: Strengthen PMC in order to achieve the above goals

Objectives under Goal 3:

- Build internal capacity of human resources in terms of adequacy and competency
- Improve internal SWM infrastructure
- Make operations of SWM department transparent, accountable, efficient and cost-effective
- Forge synergistic partnerships with stakeholders

Individual or fragmented approach is bound to become unsustainable in view of increasing complexity of the waste streams, increased urbanization and industrialization. The approach of managing these waste streams has to be in the integrated format with due consideration not only to the various forms of wastes but also to the existing systems. Institutionalizing rag pickers and other informal sector and promotion of decentralized treatment may be some of the strategies for achieving this goal.

Benefits to Pune City from this Project

Benefits of this project to Pune City are shown in *Figure 4.*

Figure 4: Benefits of Strategic Action Plan to Pune City

Annexure 2

Highlights from ISWM Plan, Wuxi New District, Peoples Republic of China

UNEP-IETC has been assisting Wuxi New District (WND) in China to develop an Integrated Solid Waste Management (ISWM) Plan. This includes capacity building on data collection for solid waste quantification and characterization, assessment of prevailing waste management system, target setting for ISWM, identification of issues of concern and developing ISWM that includes identification of technologies, policy and regulatory measures, and voluntary actions.

To identify the issues of concern, a Stakeholders Consultation Workshop was co-organized by UNEP and the WND local government on 26-27 March 2007 in Wuxi, P.R. China.

High-level officials of local government, service providers, and representatives of industries, hospitals, residents, and civil society identified and discussed various issues of concern on wastes. They discussed preliminary targets for waste generation, segregation at source, collection and transfer, sorting and material recovery, treatment and resource recovery and final disposal. Suggestions on financial, technological, policy and regulatory, environmental and social aspects of ISWM were also made during the consultation.

WND project team carried out the data collection and analysis and generated the waste data for all waste sources and waste types. The details are shown in Annex I. Following are the important points from waste data:

- Overall waste from domestic and commercial sources is 333 tons per day and domestic waste from industries is 82 tons per day – total waste is 415 tons per day
- Per capita waste is 0.8 kg per day from households; however, it is about 1 kg per day for combined domestic waste from residential, commercial and industrial sources
- Future generations show an increase of 18 per cent from 2006 to 2010 and further 42 percent from 2010 to 2020 (415, 490, and 700 tons per day respectively)
- Domestic and commercial waste contains about 70 per cent of food waste, while domestic waste from industrial sources contain less than 15 per cent of food waste.
- Plastic waste is another major component as domestic, commercial and industrial (domestic) waste contains 17, 14 and 22 per cent of plastics respectively

- Paper is 6 per cent in waste from domestic and commercial sources, while it is more than 50 per cent from industrial sources.
- There is a huge quantity of industrial processing non-hazardous waste (213826 tons per year) and most of that is suitable for recycling
- Although hazardous waste makes relatively small amount (29807 tons per year from industry and 72 tons per year from healthcare facilities), its improper handling may contaminate all the waste and make non-hazardous waste unsuitable for recycling

WND goals for IWM are:

- To promote minimization of waste at source, incorporating it at every stage of production and consumption to reduce the amount of waste generated
- To ensure environmentally sound reuse and recovery of resources from wastes through segregation, collection and processing.
- To ensure environmentally sound disposal of residual wastes.
- To integrate ISWM activities within the harmonious development of WND's economy, society and environment.

The IWM Plan document, covering all these elements, is illustrated in a flow chart as shown in *Figure 1*.

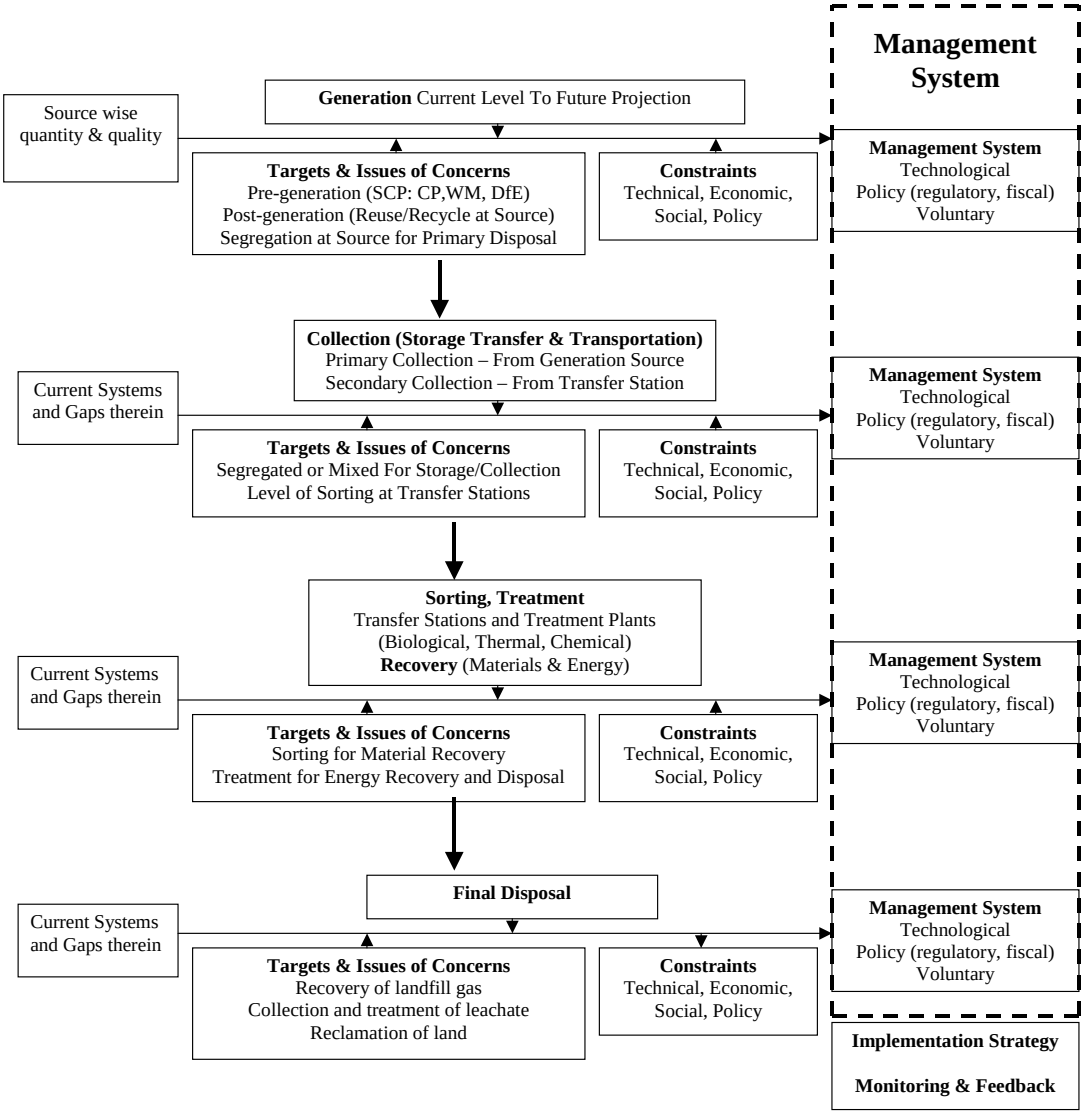


Figure 1: Flow Chart for ISWM Plan

Current Gaps/problems

- Though there are a lot of laws/acts established in many aspects of SWM, the mess still exists in some real issues. These phenomena will discourage the implementation of the policy and regulations;
- Arrangements are complicated and often overlap, or have areas where no agency is responsible. Increasing volumes of waste, growing budget allocations, increasing sophistication needed for proper service delivery, equipment procurement, and private sector contracting, require improved regulation.

- Some technical standards are too old and can not meet the current situation;
- Many laws were not effectively or completely not implemented;
- Some local regulations are in conflict with the national laws or regulations.
- Because of the situation of China, some laws and policies changed fast causing some disadvantages in SWM.
- There are too many administration institutions and part of their assignment is overlapping, so in case of problems, they may owe the mistakes to each other.
- While some administration institutions aren't responsible, and some others are non-professional.
- There is no unitive standard, so there are many kinds of rubbish cans with different colours and materials in WND now. Some small communities do well about the MSW classification as they classify the waste according to the sign on the rubbish (such as the written "recycle" "no recycle" and et al).
- Composting should be an important waste management tool in WND. According to the investigation results on the current situation, WND's urban waste stream contains over 60% of biodegradable organic matter - the managing of which is often challenging; it is wet (usually in excess of 50% moisture), which makes combustion impractical; it is dense which makes transportation more expensive, it is one of the largest sources of anthropocentric Greenhouse Gas, and it is the fraction of the waste stream that causes nuisances such as odour, landfill leachate, and attracts vectors likes rats and flies.
- Experience with large-scale composting is however often poor. Most facilities developed have not performed as well as expected and the compost produced is often of poor quality. This is because most compost facilities in China, and elsewhere, attempt to compost mixed waste that has components adversely affecting its quality. If mixed waste is shredded before composting, the finished compost quality is degraded by the presence of heavy metals, ash, pieces of plastic and glass shards.
- The majority of the WND do not have the ability to classify the rubbish resulting in mixed MSW.
- The sanitation situation of MSW collection is not proper.
- The vehicles used by the people for collection do not have a proper enclosure, and it results in leaking.
- The problem of mixed waste is serious. Some enterprises dump the HSW into the MSW collection facilities.
- The recycle activities are non-governmental, so it is difficult to administrate them.
- The soil resource is limited in Wuxi, which is not enough for sanitary landfill.

- No pre-treatment for MSW results in difficulty of proper disposal.
- The methods used for disposal of MSW are single.
- The process of the existing incineration gives rise to hidden troubles.
- The places where the collection network didn't reach had a serious problem of open dump.
- The sign to classify waste at collection facilities isn't clear in the plants of some enterprises. It gives rise to a phenomena of blend of solid waste;
- The plants of certain collection facilities are not adequate and more plants need to be placed in some enterprises. Some even have the same operating plant used for hazardous waste. It has disadvantages to the workers who are in charge of the collection and classification of ISW;
- The ISW of some enterprises didn't have a safe disposal facility, leading to the phenomena of illegal discharge, which contaminates the environment heavily;
- The government didn't provide an exchange platform on ISW, so the enterprise waste disposal can't embody the principal of "recycle economy";
- Some enterprises didn't pay enough attention on the HSW, they especially didn't realize the problems of HSW;
- Some enterprises consigned the HSW to non-qualified enterprises whereas the HSW had some economic value;
- Based on Solid Waste Law, the treatment of HSW should be authorized by the environment protection department, but the enterprises that transacted this treatment procedure were only a small part in WND;
- Some storage locations are non-regulated; they don't have the ability of preventing rain and leaking;
- Some HSW was transported for disposal out of the province, which didn't embody the principal of "Vicinity Disposal", resulting in hidden trouble during transportation;
- Some enterprises didn't follow the regulations, discharging the HSW mixed with MSW or ISW;
- There is no requirement of small clinics in MSW;
- Some hospitals didn't do well in the collection of MSW.

Annexure 3

Highlights from ISWM Plan, Maseru, Lesotho

Integrated Solid Waste Management Plan (ISWMP) has been developed for the City of Maseru, capital of the Kingdom of Lesotho. This project was undertaken with a MoU concluded between the United Nations Environment Programme (UNEP) and the University of Cape Town (UCT) Environmental & Process Systems Engineering Research Group.

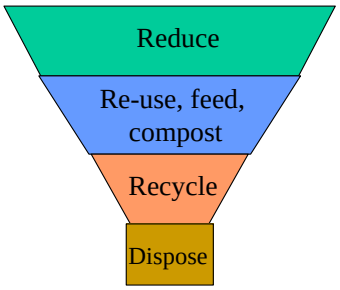
The draft plan was developed on the basis of past experience, independent observation, interrogation of available information (including the baseline study of waste generation in Maseru), and interaction with relevant stakeholders. The result is a concise, easy to read action plan of 15-20 pages with key deliverables and timelines. The action plan is supported by a number of technical support pages which provide details on each proposed action. The ISWMP will be supported by a technical background report on Environmentally Sound Technologies (ESTs) which provides further guidance on achieving the deliverables.

This ISWM Plan for Maseru is based on the following principles:

1. Upholding the right of every citizen to a clean and healthy environment (Immediate need)
2. Protection of the common (public) goods for current and future generations (long-term requirement)
3. The importance of addressing economic and social value addition to waste management in terms of job creation & income generation
4. All citizens contributing to the growing problem and the potential to be part of the solution
5. Primary focus on the promotion and implementation of the three-R principles (Reduction → Reuse → Recycle)
6. Awareness and education with a focus on source reduction & waste-to-resource conversion
7. Building upon existing local capacities and experiences
8. Strengthening public-private partnership including community-based waste management process
9. Putting the necessary policy and institutional framework in place
10. Developing a built-in adaptive mechanism for the continuous monitoring and improvement of the system

Vision/Mission: The City of Maseru should take ownership of and drive this ISWMP by taking into consideration the following points:

- Public Health & Environment
- Delivery of Basic Services
- Efficiency & Economic Growth (private sector participation)
- Resource exchange (private sector participation)



All actions and activities proposed within this plan will be initiated and developed along a waste management hierarchy, describing the order of preference of the different waste management options, starting with prevention and ending with disposal.

Gaps Identified

I. A profile of current solid waste management & problems related to it:

In terms of current SWM situation and the associated problems, it was found out that waste management in Maseru City is solely mandated to MCC. It was also established that there is no enforcement of laws and regulations that control waste management or there are no waste management guidelines or policy. However, there has been an establishment of Environment Act No.15, 2001 by the National Environment Secretariat, though there has been a delay in putting it into practice due to administrative hitches.

The MCC does not have enough capacity and resources in terms of manpower, finance, infrastructure or machines to deal with the masses of litter in the streets and residential areas. The vehicles being used are too old and too few and need to be replaced and increased in number. An alternative will be outsourcing of waste collection from private companies (service providers) as they are already assisting. For example, Lefielo Cleaning Services already has a mobile compactor truck and it is believed that it can buy more if given the opportunity. From interviews, Scichem and Aero Tech cleaning service providers have also shown interest in the business. Further investigations can be conducted in this area to make an assessment of local and regional companies to determine various options for service provision. The investigation can look into matters like financial aspect, availability of machines and equipment and so on.

II. Review of the past and present studies and efforts made to address the problem of solid waste management in Maseru and identify the data gaps for the baseline assessment:

As past studies indicate, the dumpsite at Tšosane needs to be closed and rehabilitated, and an alternative landfill be constructed with immediate effect. Rehabilitation of the Tšosane dumpsite is imperative. Several options may be considered

into the rehabilitation process depending on the availability of resources. Nonetheless, there are two ways of rehabilitation proposed here to lessen the environmental impacts and health hazards around the Tšosane area.

1. Excavation and removal of the waste dumped in the area over the years. This may be the logical way, as the aim is to prevent contamination of the nearby water bodies as well as the Maqalika reservoir and to minimize or remove the environmental and health hazards posed by this dumpsite.

It must be noted that since dumping has occurred over a prolonged period of time, it might be a very costly exercise to excavate the dumped materials. The following action is therefore further proposed:

2. Closure of the dumpsite and full rehabilitation of the area.
    - Construction of surface runoff diversion channels around the dumpsite.
    - Application of about 500 mm of soil as final cover over the dumped material.
    - Insertion of pipes to release methane gas produced by decaying waste.
    - Should leachate be produced, it should be contained in a dam downstream from the dumpsite.
    - Leachate will be analyzed and treatment protocols will depend on the analysis results.
    - Surface water quality must be monitored by taking samples from surface water bodies for chemical, biological and heavy/toxic metal analysis.
    - Groundwater quality must be monitored, by extracting water samples from groundwater monitoring boreholes around the dumpsite. Chemical, biological and heavy/toxic metal analysis must be done.
    - The top of the dumpsite, covered with soil, must be grassed.
    - Develop marketing strategy for recycled products.

MCC in partnership with BADEA aims to build a sanitary landfill at Tšoeneng (Rothe). However, the EIA or feasibility study which was initially conducted for this landfill proved to be incomplete and the study is to be commissioned again.

III. Evaluation of existing waste management operations in Maseru City including the coverage of waste collection and methods of disposal:

There are not enough street bins for city dwellers to use, which is the reason why street littering has become a problem. Instead of addressing that problem, the MCC has hired ninety seven (97) street cleaners and sweepers to sweep the streets all day long. These labourers are not trained on handling, storage, transportation and disposal of waste. They are simply employed without undergoing any waste management training course. It is proposed that protective clothing be provided for waste handling cleaners. It is further recommended that the infrastructure for waste storage to be improvised so that the number of street cleaners and sweepers can be reduced because this exercise is not cost effective.

IV. The determination of the volume and characteristics of waste that is generated from all sources:

Considering the volume and characteristics of waste generated from sources, it was found out that a large proportion (78%) of waste generated does not reach the disposal site. Instead, it is being absorbed by the environment, while 31% is being re-used. Most of the residents, businesses, schools and some industries tend to dispose their waste in illegal dumpsites, often located along the roads and in dongas.

There are no clear records from the MCC on the amount of waste generated, collected and disposed off at the disposal sites (Tšosane and Tikoe).

It has been found out that a sample of 110 low-income households produced 27,375kg per annum, 85 middle-income households produced 41,975kg per annum and 25 high-income households area produced 14,710kg per annum. This means that the total waste generated by sampled residences was 84,060 kg per annum, while the total waste generated by all residential areas in Maseru was found to be 32,900. The average per capita waste was found to be 0.3kg per day and the average household size was 4.2.

The waste generated by woven garments industries was found to be 3,600 tons of sludge, 3,000 tons of blasting sand and 6,600 tons of pumice stone, making a total of 13,200 tons. The knitting garments industries produced 3,000 tons per annum while the brewing company produced 1,678 tons per annum. Therefore, the total amount of waste generated by industries was 17,878 tons per annum.

It was found out that there are 1250 existing commercials in Maseru but only 1,091 types were considered by the study. The 101 sampled commercial establishments generated about 179,266,190 litres per annum or 17,376,555kg per annum, while 1,091 produces 187,701,203kg per annum or 187,701 tons per year. Each business was found to generate 471kg per day.

A total of 9 schools were sampled; these comprise 4 primary schools, 4 high schools and 1 tertiary school. The total waste generated by primary schools was found to be 27,180kg per annum, that by high schools was found to be 111,780kg per annum, while, tertiaries were found to generate 94,680kg per annum. Each pupil in primary generated 0.03kg per day, each pupil in high school generated 0.2kg per day while each student in tertiary school produced 0.2kg per day. The total waste generated by all schools in Maseru was 890,874kg per annum.

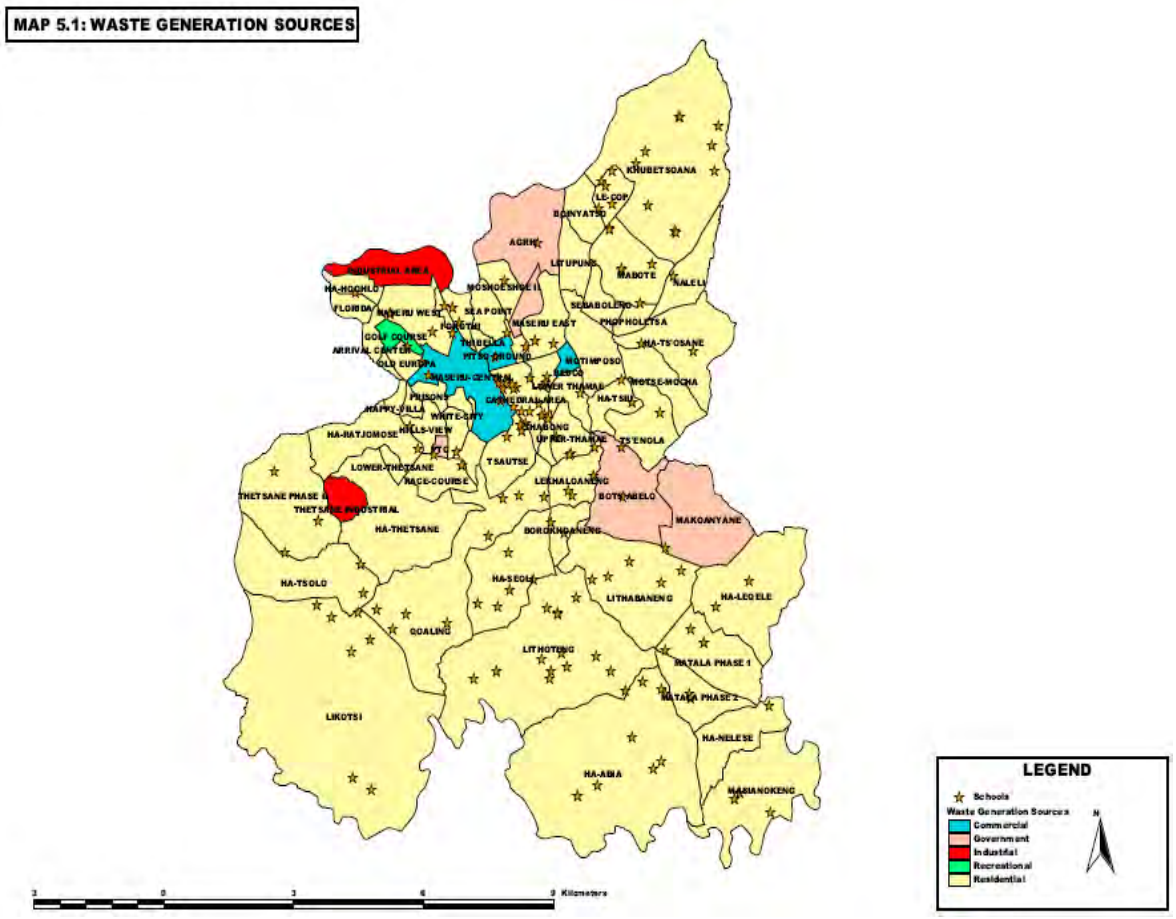
The total waste generated by 6 hospitals in Maseru was found to be 129,210 kg per annum and the occupancy rate was found to be 80% on average. Each bed generated 0.64kg per day. While Queen II hospital (the only referral hospital in the country) generated 83,950 kg per annum

The administrative establishment generated 5,322,640kg per annum or 5,323tons per annum. The overall waste generation by sources of waste under consideration is 244,832tons per annum.

In Gaborone, the amount of solid waste disposed at the landfill sites was around 151,383 tons per annum in 1998, including rubble and soil cover. Each person generated 3.1kg per day. According to Soepol1 (2001), urban dwellers in developing countries generate from 0.3 – 0.8kg/person/day. In the present study, Maseru City has been found to fall within this range, with low-income residents generating 0.2kg/person/day, middle-income generating 0.3kg/person/day, while high-income residents generate 0.4kg/person/day. The mean for Maseru City is 0.3 kg/person/day. Soepol1 (2001) indicated that in Windhoek the mean is approximately 0.5 kg/person/day and the figure ranges from 0.33 kg for people in the low-income portion of the population to 0.54 kg for middle-income earners and 0.68 kg/person/day for people with high-income.

Presently, very little waste is recycled. In terms of reduction at source, industries are far more advanced than any other category of waste generators considered in this study. Specifically, textile factories re-use most of their fabric scrap to fuel boilers. Only excess is disposed off. They also give ash from boilers to people who make bricks with that material. Paper and plastic wraps are respectively given to recycling agents and the local plastic-making factory. The total amount of waste recovered is 9,600 tons per annum constituting 7% of the total waste.

It seems the biggest problem of waste coming from textile factories is sludge, which cannot be re-used or recycled (LNDC 2004). Fabric scrap is the second biggest problem, as it is produced in excess of its re-use and causes a lot of pollution. Thus, it is recommended that the Southern African Customs Union (SACU) agreement that prevents the sale and re-use of this fabric scrap be revised as it would benefit people if recycled and used for making such things as pillows, duvets inners, puppets.



In order to achieve the vision embodied in the principles, the following framework is proposed. Four fundamental pillars are supported by a sound educational platform. Waste Management Actions – grouped according to the hierarchy are as follows:

Pillar 1: Capacity to prevent wasteful resource use at source.

This theme addresses: what is consumed (sustainable consumption), how it is produced (cleaner production), where resources are routed once used (source separation), and at-source value addition (re-use, composting …)

Actions:

1. Integration of Waste Prevention Measures
2. Introduction of Cleaner Production Measures
3. Implementation of a Source Separation System
4. At Source Value-Addition

Pillar 2: Strong, diversified and appropriate collection systems

Recycling, energy recovery and disposal - all require materials (resources or waste) to be collected. Different collection systems will work best in different settings (e.g. weekly curb-side collection in serviced suburbs; coupon-based fuel for recyclables

take-back schemes in informal settlements; removal on call at commercial establishments). It must be the core job description of a skilled professional to ensure that each ward, each commercial establishment and each industrial site are appropriately serviced. The operation of the collection services does not need to be performed by council.

Actions:

1. Establishment of Ward-Specific and Material-Specific Collection Systems
2. Systematic Infrastructure and Route Planning
3. Optimisation of Collection Services Offered by MCC and Private Recyclers and the PPPUE

Pillar 3: A healthy recycling industry

The more materials are recycled, the lower the amount to be transported to disposal (and hence the lower the cost to the public). With money to be made from the sale of recovered resources, and from re-manufactured products, the private sector is best equipped to harness potentials. Like all other industrial sectors, there must be business development support, a competitive spirit, and an industry association that subscribes to a code of conduct and can speak for joint concerns.

Actions:

1. Support for the Development of a Local Recycling Economy
2. Regulatory Framework to Support Local Recycling Markets
3. Coordination of Local Recycling Activities
4. Develop Capacity to Work with Take-Back Levies

Pillar 4: An environmentally safe disposal site for real waste

When resources have really and finally become waste, they must be disposed off in a properly engineered sanitary landfill that does not affect the surrounding environment. The full cost of proper disposal must be borne by the user to avoid over-use but this should not be the easy way out for those wanting to waste. On the other hand, this route must be accessible when needed so that there is no resorting to wild dumping. There should be a careful balancing act, requiring further thought on the most appropriate pricing structure.

Actions:

1. Adjustment and Integration of Planning Activities for Sanitary Landfill Site
2. Amendment of EIA
3. Capacity to Thermally Use Non-Recyclable Paper

The Platform: Education, built upon real and up-to-date information

The generators of waste (in households, commerce, hospitals, schools, offices industry), as well as professionals, officials and labourers working within each of the above four pillars need to be educated and trained, with regular updating of skills. Education must be based on an up-to-date knowledge of the real issues in Maseru, so a regularly updated waste information system is also required.

Actions:

1. Use of School Infrastructure as Awareness Creation Medium
2. Establishment of Waste Minimisation Clubs
3. Establishment of a Waste Information System (WIS)
4. Awareness Creation through Common Media
5. Review of this ISWMP on a Regular Basis

Annexure 4

Example of a Proposed Scheme from ISWM Plan for Pune

Optimisation and Strengthening of Municipal Solid Waste (MSW) Collection Systems:

1. **Introduction:** The MSW consists of household waste, waste from hotels and restaurants, garden waste as well as street sweepings. Solid waste collection is done in 1 to 3 shifts using different types of vehicles. The daily generation of MSW is around 1093 MT. The waste from households and commercial premises is primarily collected through community collection bins. The container bins for collection of waste are placed at designated locations in the streets and along the roads across the city.

   Door to door collection has also been introduced in all wards with the help of *Ghantagadi or Ghanta trucks*[1] while collection through cycle rickshaws and wheel barrows are offered to the areas which are not easily accessible to *Ghanta* Trucks. The waste lifted from bins is transported to the nearest Transfer Station generally with help of Compactors and Dumper Placers and from there it is further transported to the Disposal Site at *Urali Devachi*. The Bulk Refuse Carriers are being employed for this purpose. The transportation system for different types of waste from various sources to the disposal sites in Pune are as shown in the *Figure 1* below:

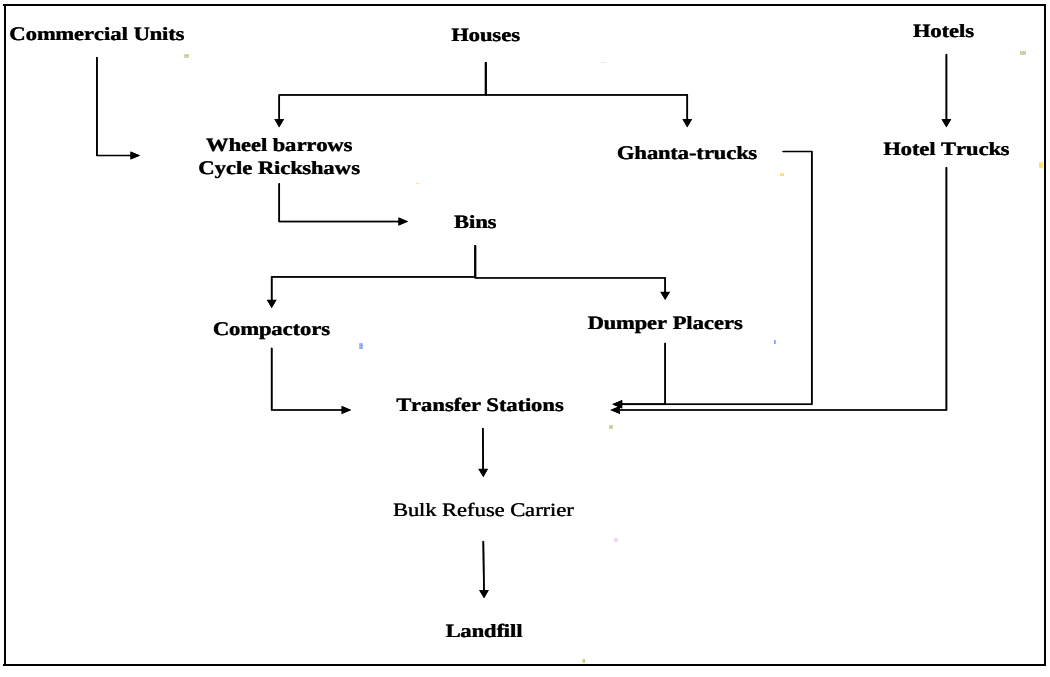


Figure 1: Typical Waste Collection System in Pune

1 Vehicles with bells

2. **Purpose:** About 1500 containers with different sizes have been spread across the city for MSW collection. The placement is however not optimal and also these containers are open causing nuisance in terms of odour, and disease vectors that thrive in the accessible waste. The vehicles carrying the waste are also not covered thereby spreading the waste during transportation. The analysis of waste collection and waste generation information available for Pune estimates that the uncollected waste can be deduced to be in between 8 to 9 %. In terms of quantity this would mean about 95 MTPD of waste is probably remaining unattended.

Consider the following *Figure 2* which depicts of the travel of a G*hantagadi* in the Ghole Road ward in Pune.

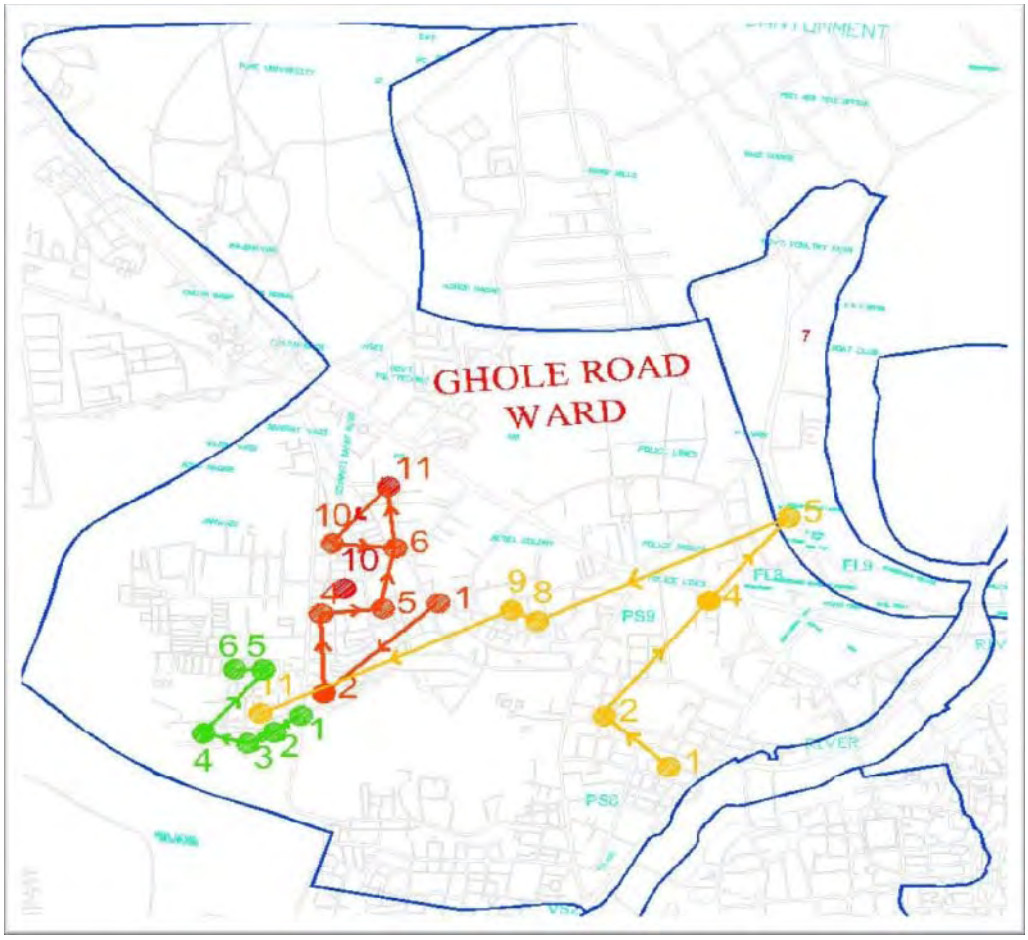


Figure 2: Travel of a Ghantagadi in Ghole Road Ward

The figure shows that the route crosses itself too many times showing that the vehicle has not taken the best possible path considering the least travel path. This shows the necessity of the involvement of a vehicle routing application which can aid

to select the best and the most optimum route. The placement of collection bins, the vehicle routing, the condition of bins and vehicles and capacities etc are all important factors which are responsible for sound and defined collection systems. The following points would need to be covered to improve the collection systems.

- To improve the house to house collection
- Other waste streams such as C&D Wastes, E-Wastes, and horticultural wastes can be collected separately
- To avoid the overflow of the bins and containers
- To make proper use of the Ghanta trucks which are currently under utilized
- To restore the broken down DP's and compactors with proper maintenance
- To suggests different types of waste collection system as compactors which have the advantage of handling larger quantity of wastes are not able to move through old parts of the city which have narrow lanes.

3. **Target**: To suggest and investigate various methods for optimizing and strengthening the MSW Collection systems.

4. **Type:** Project

5. **Lead Agency:** Pune Municipal Corporation (PMC) – Transport Department and Town Planning Department

6. **Support Agency:** ISWM Cell, PMC and use the service of consultants, NGO's, generators and housing societies.

7. **Location (Suggested):** City wide – taken up for the entire city of Pune. GIS based models can be prepared and implemented throughout Pune for properly defined collection systems. Implementing may be done in phases based on the ward prioritization.

8. **Budget (Estimated):** Transportation and collection of MSW accounts to almost 60-70 % of the total expenditure on SWM in Pune, its optimization is extremely important.
   - For auditing present assets – Rs. 2 Million
   - For Consultation process and preparing a model for optimized collection systems – Rs. 8 Million

9. Time Frame (Estimated):

Activity	Year 1				Year 2			
	Oct-Dec	Jan-Mar	Apr-Jun	Jul-Sept	Oct-Dec	Jan-Mar	Apr-Jun	Jul-Sept
Auditing the present assets and operational patterns								
Tools for optimisation of collection								
Bids for optimisation study to PPP								
Cost Estimation								
Bids evaluation								

10. Description:

Factors needed for route optimization: The following factors need to be considered in planning and further optimization of the waste collection system:

- Population distribution and density
- Overall topography and road layout
- Characteristics of waste generated and quantity
- Disposal methods used
- Type and number of vehicles used
- Number and location of transfer stations
- Road design

Some of the factors mentioned above e.g., population distribution and characteristics of waste generated determine the frequency of collection and also whether sorting at source is beneficial over segregation at a later stage. The right kind of planning can help decide allocation of available labour i.e., human resources, the equipments to be used and the municipal budgetary allocation. It can also be used for forecasting the future demand for SWM.

Aspects of Route optimization: Various Aspects of route optimization are depicted in *Figure 3* below**.** The figure depicts the various levels which decide route of a waste carrier (shown in coloured boxes) and the factors which need to be considered for efficient route management (shown in white boxes). The further details are described subsequently.

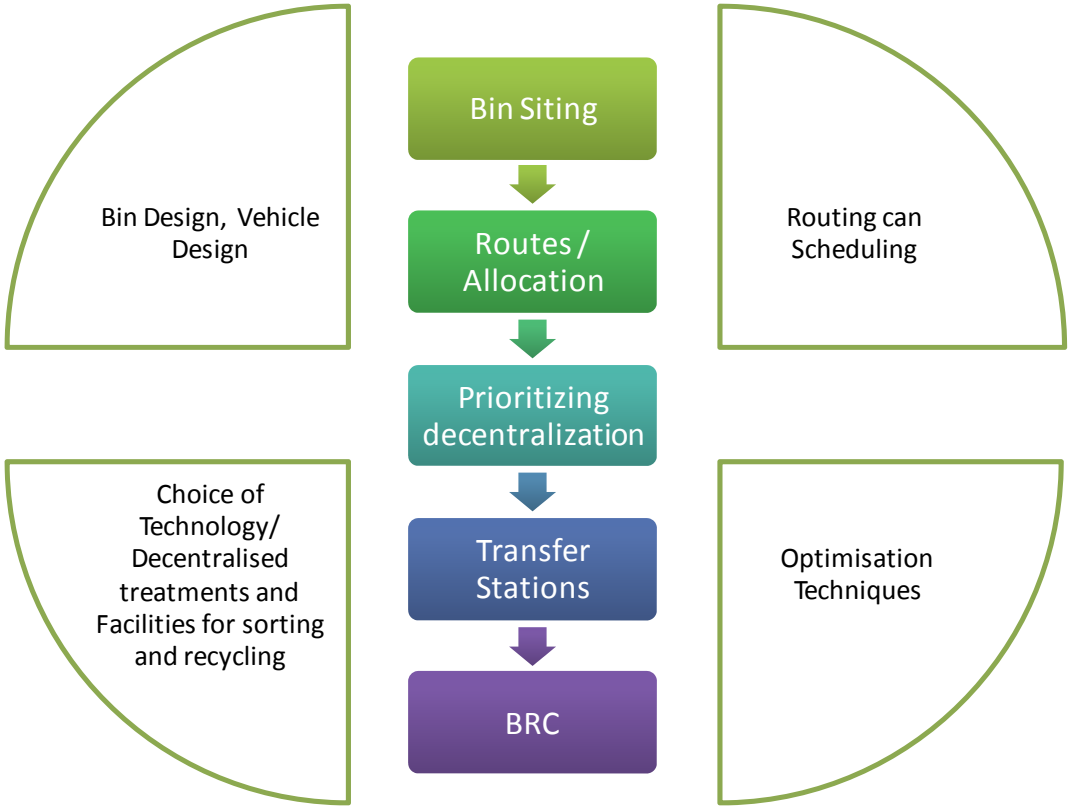


Figure 3: Aspects of waste collection to disposal

PMC should use the services of a consultant to develop a model for optimized waste collection systems. The consultant can investigate several waste management collection models available (example as shown in box below) and then shortlist the model which is most suitable for Pune city.

However, in order to implement such a model, various factors like the distance between stops, number of bags at each stop, number of refuse containers at each stop, number of personnel involved, and waste characteristics etc. would have to be measured and calculated. Therefore, manual methods adopted for analysis of many factors would be a lengthy and tedious work. Also there are possibilities of errors while merging the spatial and non spatial data.

The tracking of the waste from source to the end disposal site can be done with the help of Geographic Information System aided with Global positioning system. In GIS, as the work is carried in layers, there are least chances of confusion or error and the system is capable enough to coordinate between spatial and non spatial data. GIS is a good decision support tool for planning waste management.

A Waste Collection Model

The efficiency of waste collection or productivity depends on many factors like distance between stops, number of bags at each stop, number of refuse containers at each stop, number of personnel involved, and waste characteristics, etc. Stearns (1982) developed a model to evaluate the efficiency of waste collection by a two-person crew working with a rear-loading compactor as follows:

$$P = 0.0033D + 0.16N + 0.09T + 0.03S + 0.02,$$

Where

P = productive collection time required per stop including the driving time from the previous stop (min)
D = distance between stops (m)
N = number of refuse containers at a stop
T = total number of throw-away items at a stop
S = number of services collected at each stop.

For one operator, using a rear-loading compactor, the equation is modified to:

$$P = 0.0165D + 0.15N + 0.089T + 0.08.$$

However, this model does not consider other factors like non-productive time, waste characteristics and so on, but is based on route-related factors only.

Stone and Stearns (1969) have proposed a more detailed model which incorporates both route-related parameters and other factors associated with the set of activities normally occurring during an entire work day of a collection crew:

$$X_1 = V t \rho / Q + B + K + D$$

Where

X_1 = total time requires to complete one trip (collection and disposal of one full load) (min)
V = volumetric capacity of vehicle (m^3)
t = average time per collection stop and travel time to the next stop (min)
ρ = average density of refuse in vehicle (kg/m^3)
Q = average quantity of refuse per collection stop (kg)
B = one-way average driving time between route and disposal site (min)
K = total non-productive time (min)
D = Average disposal time (min/load)

To determine the number of trips that can be made by the crew many factors need to be defined or set. For example, what is the minimum load allowed before the crew returns to the disposal site? Also to be fixed is the duration allowed for overtime.

In general, when **n** is the total number of trips made by the truck per day, then

$$X_1 = (n+a-1)\, V t \rho / Q + (2n-1)\, B + K + nD$$

Where

a = minimum partial load stipulated, for example a > ¼ if the truck is allows to return to the disposal site when it is only ¼ full

Bin and Vehicle Design: In Pune, the ward-wise allocation of different capacity containers in each ward is indicated in *Figure 4* below. The containers are of different sizes as indicated below:

- Containers handled by dumper placers - 3.8 cu.m.
- Containers handled by compactor vehicles - 2.2 cu.m., 1.1 cu.m. and 1.5 cu.m.

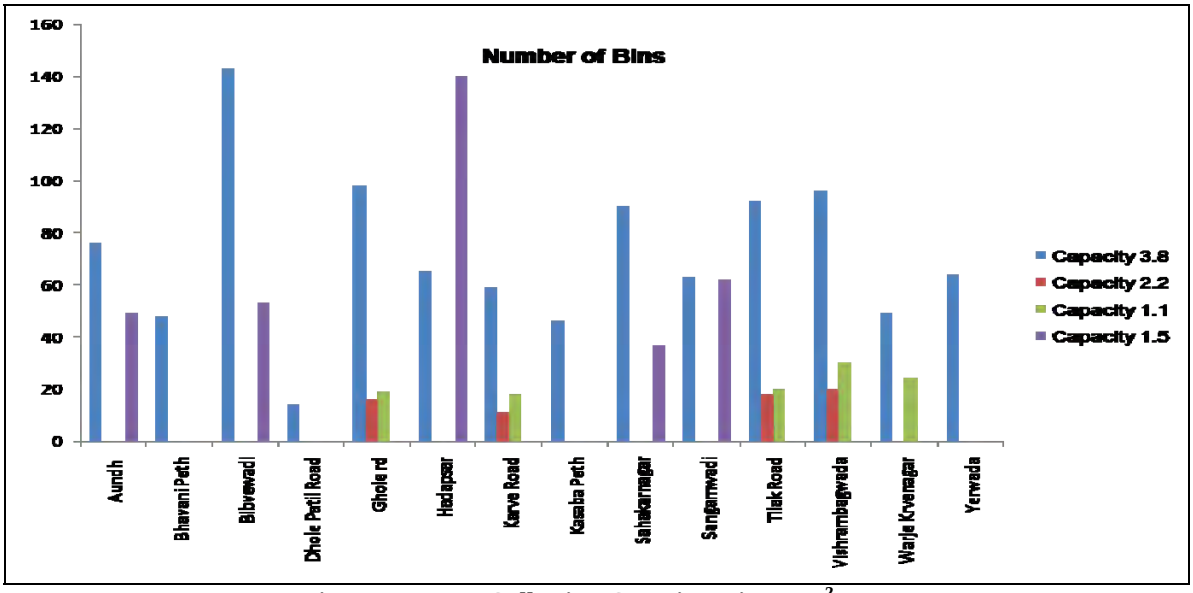


Figure 4: Waste Collection Containers in Pune[2]

With the increase in door to door collection system the numbers of containers in Pune have significantly reduced (see *Figure 5* below)

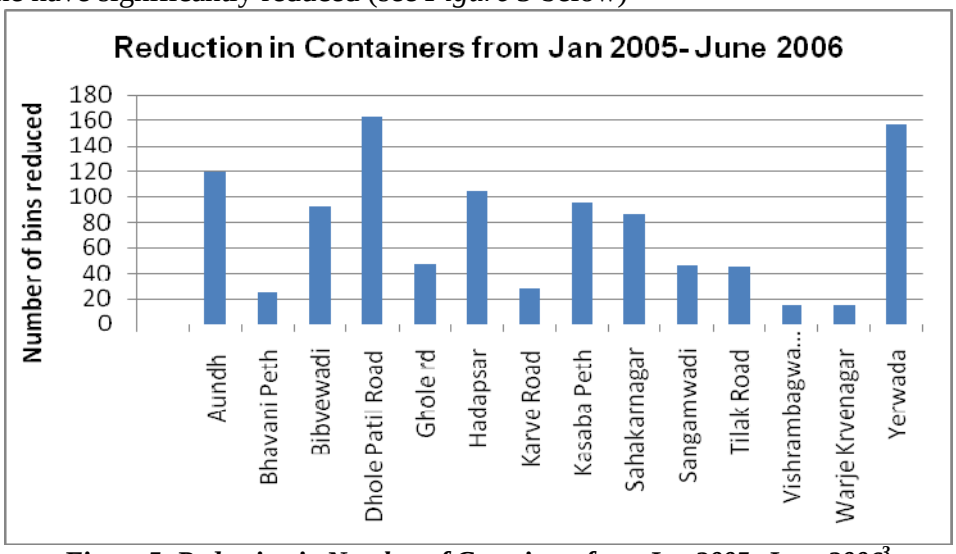


Figure 5: Reduction in Number of Containers from Jan 2005- June 2006[3]

2 As per data obtained from PMC

The vehicles used for the transportation of solid waste are managed by the transport department of PMC in coordination with the Health & SWM dept of PMC. **Table 1** below shows the various vehicles used by PMC for vehicle transportation and waste collection.

Table 1: Type of PMC Vehicles for Waste Collection and Transportation[4]

Sr. No	Type	No.	OEM, vehicle model	Nos.	Capacity
01.	Dumper Placer	93	Tata 709	81	3.8 m^3
			Ashok Leyland Cargo 759	12	3.8 m^3
02.	Compactor	34	Tata – City Cleaner (Single Axel)	12	12 m^3
			Eicher With Hopper (Double Axel)	4	20 m^3
			Tata - With Hopper (Double Axel)	18	14 m^3
03.	Hotel *Gadi*	51	Tata	51	6 m^3
04.	*Ghanta Gadi*	25	Eicher	15	4.5 m^3
			Tata	10	6 m^3
05.	BRC	66	Tata (Double Axel)	36	30 m^3
			Ashok Leyland (Double Axel)	10	20 m^3
			Single Axel*	16	
06.	Refuse Truck	09	Tata	05	6 m^3
			Ashok Leyland	04	
07.	Wheel Barrows	1208	-	-	-
08	Cycle Rickshaws	136	-	-	-

So in order to overcome the shortcomings in the design of vehicles and bins, the following vehicle and bin design is listed in **Table 2** below:

3 IBID

4 Data obtained from PMC

Table 2: Proposed Vehicle & Bin Design

Vehicle	Collection Container Type	Typical range container capacities ($m^{3)}$
Hauled-container Systems		
Tilt-frame	Open-top, also called debris boxes	8-40
	Used in conjunction with stationary compactor	10-30
	Equipped with self-contained compaction mechanism	15-30
Truck-tractor	Open-top trash-trailers	10-30
	Enclosed trailer-mounted containers equipped with self-contained compaction mechanism	15-30
Stationary-container System		
Compactor, mechanically loaded	Open top and enclosed top and site-loading	0.6-8.0
Compactor, manually loaded	Small plastic or galvanised metal containers, disposal paper and plastic bags	75 – 200*

75 – Small plastic or galvanised metal containers, 200*L
* Litres L Loaded mass of container should not exceed 30kg.

Another option for types of bins is the installation of new recyclable waste bins in some areas. For the allocation of the recyclable waste collection bins, the location is preferred to be close to the existing municipal waste bins. This would make it convenient for users to know about the placement of the recyclable waste bin and it is more practical to use. It is seen that at places where segregation bins are placed, people bring their waste to the bins and separate it at the waste bin before dumping it and it seems to be feasible also. So in the analysis, whichever area demands, the requirement of a recyclable waste bin should be furnished next to the organic waste bin.

Bin Siting: The population distribution of a city can help build a solid waste generation database by calculating the waste generated both by monitoring and theoretical calculations. This database can further be modelled spatially viz. using population from each ward and theoretical solid waste generation so the location of bins can be decided accordingly. *Figure 6* below gives an idea of location of bins and area it covers, it also suggests the areas where new bins are required. Highlights can also be provided to locate the bins which need to be replaced.

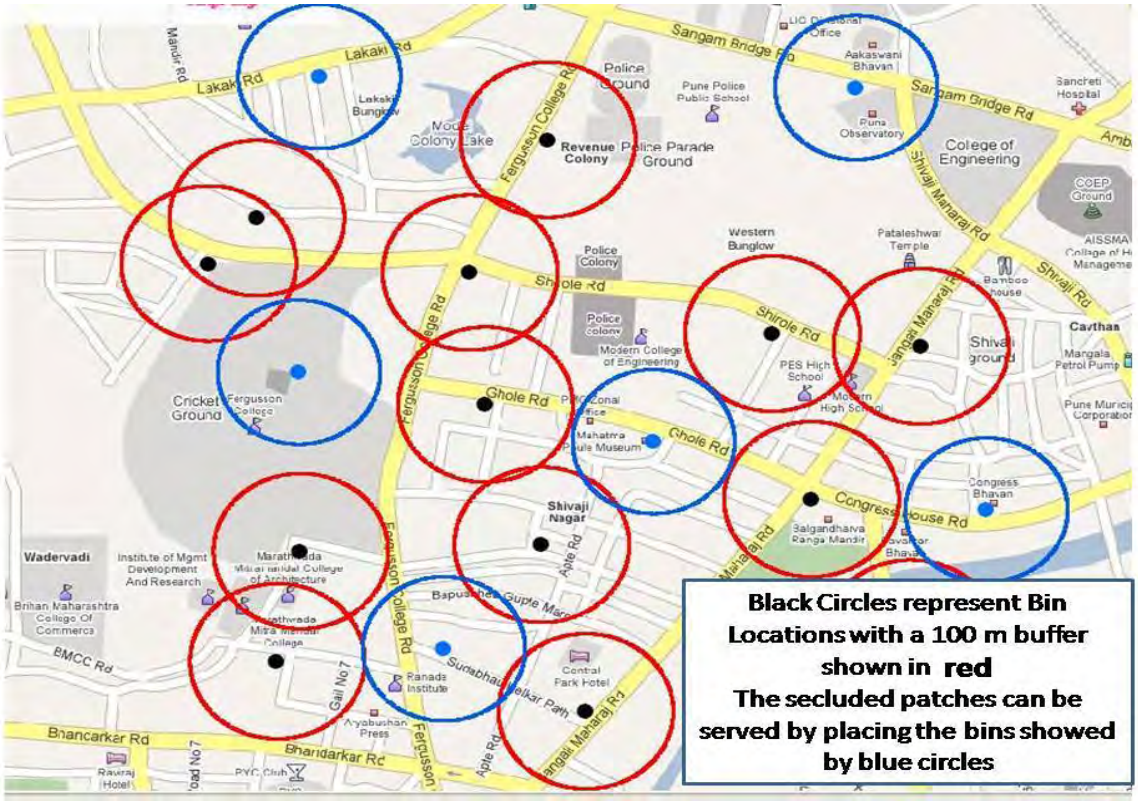


Figure 6: Location of Old bins and proposal for new bins

Route Allocation / Optimization: The transportation of waste from the bins to the collection centres and further to the landfill disposal site is done by vehicles. These can be dynamically monitored using GPS (Global positioning systems) for tracking them. This will help to determine real time vehicle location and operational status. Optimized routes thus can lead to efficient transport mechanisms considering time-cost factors. *Figure 7* below shows optimized routes for collection of waste from the bins to the collection centres.

A Management Information System of the vehicles can be used in case private firms are involved in transportation so that the vehicle logs can be automatically generated.

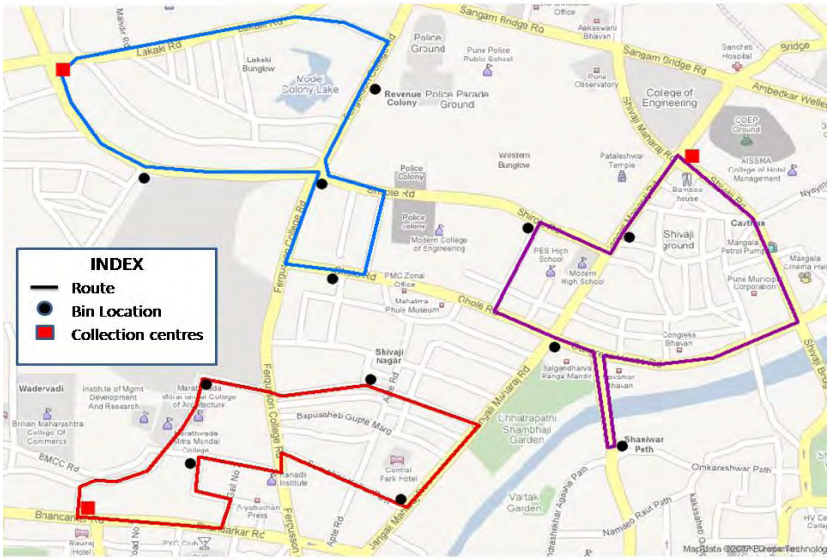


Figure 7: Optimized routes for transfer of waste from bins to collection centres

Prioritizing Decentralization: The waste in its entirety, must not travel the entire path, it can either be segregated at the source or sorted out before being sent to disposal sites. Organic waste can be diverted to compost pits which are at community level as well as central level which are built for sorting at the later stage.

Community level compost pits can be marked by the operating individuals on a web based map so as to spread awareness and inform people about its location. *Figure 8* below shows a map which has been marked with compost pit.

Figure 8: Map showing location of compost pits

Transfer Stations and Bulk Refuse Carriers: The transporting of waste from the transfer stations to the landfill site involves all available bulk refuse carriers in the city. The routes have to be fixed considering the cost-time functions for the vehicle travel as well as the quantity of waste in the transfer stations. Optimum jurisdiction of transfer stations and BRCs can be done by zoning of transfer stations.

11. **Implementation:** PMC can hire the services of a consultant to carry out an assessment of the present scenario and formulate a plan for implementation which can be undertaken in the phased approach method. Consultants can use the ward prioritization done in the Strategic Action Plan. Consultant should prepare a training programme, carry out asset evaluation, and prepare a plan to identify points for Private Partnership intervention and PPP models (*Figure 9*).

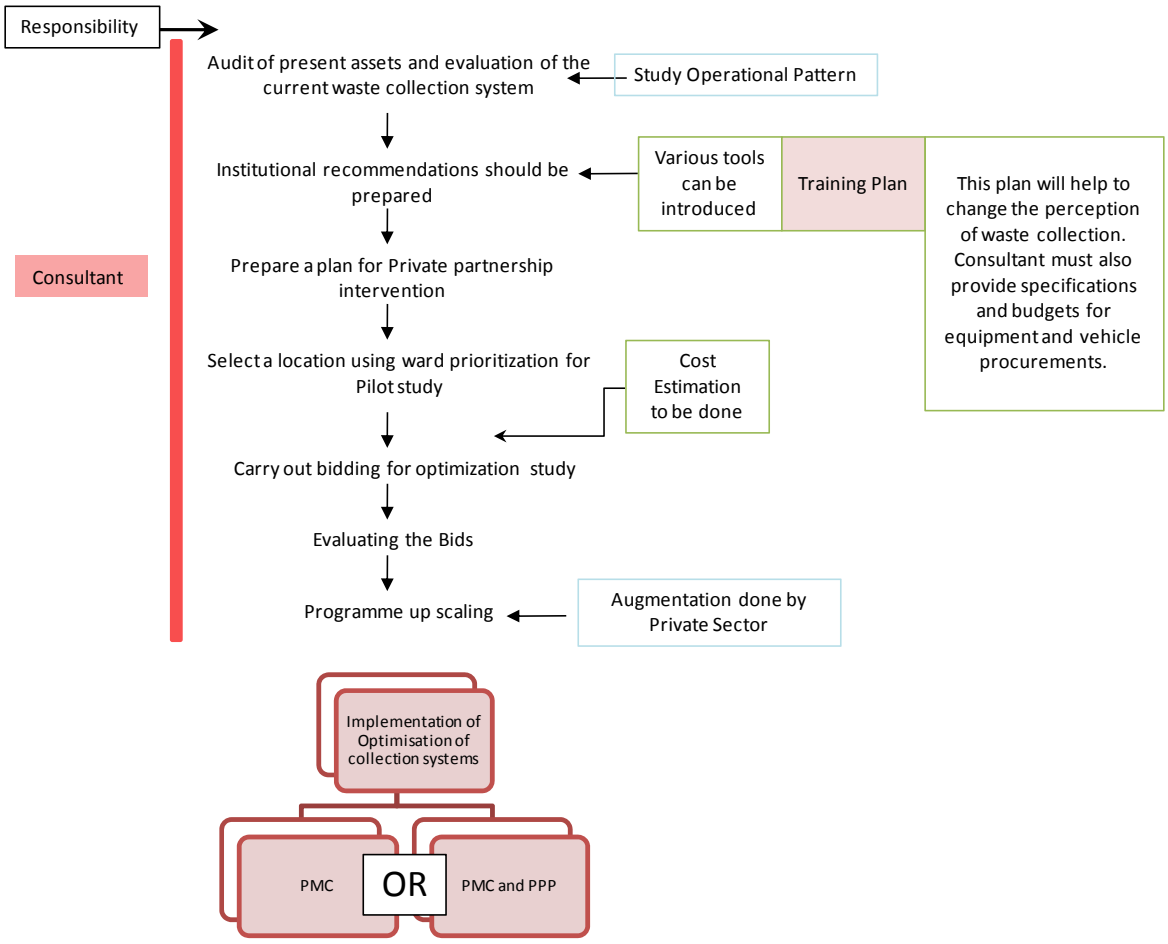


Figure 9: Assessment & Formulation of a plan by a consultant

12. Other similar experiences:

GIS-GPS system for solid waste management system[5]: Good municipal SWM practices requires collection of critical information which is not just for keeping the records updated but also to use effectively for taking corrective measures as well as proper planning for the future. There is also a need for integration and assimilation of information from various levels of jurisdiction. GPS-GIS systems can be powerful tools to revolutionise the waste management systems in Bangalore. A management information system is required to manage large amount of spatial and attribute data related to the wards and generate reports (daily, weekly etc) at various levels (city, zone, range etc.) with details of the waste, types of vehicles etc. In Bangalore, trucks are the only means of removing garbage and other waste materials from the city. These vehicles perform multiple trips in a day and it is essential to monitor and track these trucks to improve efficiency. In this regard, global positioning system (GPS)

5 As referred to wgbis.ces.iisc.ernet.in/energy/paper/Solidnew/issues.html

would be helpful and cost effective. It also helps in optimising truck routes there by increasing the efficiency of the transport mechanism. Analysis of spatial data i.e. land use and land cover pattern, transport network, collection network etc., along with information related to quantity and quality of wastes (through GIS) enable the authorities involved in waste management to come out with feasible options. These tools have been selected because 80% of information used by the health official has spatial components (city, zone, range and health ward level). These systems can be installed in BMP and zonal offices and establish monitoring centers in Bangalore. Training can be imparted to personnel in handling and updating the data.

***GIS System for Waste Management in IISc Campus*:** A GIS system has been developed for Indian Institute of Science campus. The campus limits are enclosed within 13.01055° to 13.02083°latitude and 77.55944° to 77.57388° longitude. IISc is located in the northern part of Bangalore City having lush vegetation and campus has green canopy of trees covering the buildings. The main campus covers around 150 hectares. IISc has 40 departments,2 banks, 1 school, 4 canteens, 1 restaurant, 4 guest houses, 400 faculty members, 800 supporting staff, 1500 students and 450 residential quarters representing a typical urban community. The institute generates all kinds of waste arising from residential, commercial, educational, open and vegetative area. Waste bins of different types are distributed around the campus. Collection of waste is done by a truck, a tractor and mini pick up trucks. The frequency of collection is 1 to 3 days. Collected wastes are dumped or burnt at common dumping site about 12kms away from IISc. Regular street sweeping and roadside garden trimmings are done and wastes are dumped in bins. Transferring of waste to vehicles is done manually. The route followed is currently the one convenient to the driver rather than from the collection point of view or from type and composition of wastes. All sensitive bins are not given priority in this method of collection. There is a need to evolve an optimal route evolved on the basis of waste composition and quantities generated in each bin. Integrating spatial information along with corresponding attribute information was part of the study. Map info 5.5 was used to create vector layers from the Survey of India (SOl) toposheets of scale 1:1000. Digitised vector layers include boundary, road network, building distribution, distribution of bins, open dumping sites, land use and land cover, optimal routing etc.

***GIS System used for SWM Model for Aurangabad City*[6]:** There has to be appropriate planning for proper waste management by means of analysis of the waste situation of the area. This paper would deal with, how GIS can be used as a decision support tool for planning waste management. A model is designed for the case study area in an Indian city for the purpose of planning waste management. The suggestions for amendments in the system through GIS based model would reduce the waste management workload to some extent and exhibit remedies for some of the SWM problems in the case study area. The waste management issues are considered to solve

6 As referred to www.diva-portal.org/diva/getDocument?urn_nbn_se_liu_diva-6470-1__fulltext.pdf

some of the present situation problems like proper allocation and relocation of waste bins, check for unsuitability and proximity convenience due to waste bin to the users, proposal of recyclable waste bins for the required areas and future suggestions. The model will be implemented on the Aurangabad city's case study area data for the analysis and the results will suggest some modification in the existing system which is expected to reduce the waste management workload to a certain extent.

PPP for SWM Collection in Chennai[7]: In March 2000, C.E.S. Onyx, a Chennai-based company set up by Onyx, won a contract with the Chennai Municipal Corporation to "manage" the garbage and street litter from three key areas of the city. At a cost of Rs. 650,000 (US$13,700), the company collects and disposes at least 1000 tons of garbage every day in and around the freshwater wetlands of Pallikaranai towards the south of the city.

13. **Barriers:** Implementation of GIS and GPS for route optimization would mean a change in the waste management being handled. This change needs to become a system which means that old and additional data need to be incorporated and regularly updated. This if not performed properly would lead to failure of the change. Another important factor is the cost implication. The involvement of new technology would require a large capital investment. The accurate systems would be more costly. For e.g. a differential GPS would be ten times costlier than a normal GPS. This involves strategic placement of a combination of costly and cheaper alternatives for the best possible solution. The achievement of such combination involves understanding of the entire process and the role of technology at each step.

14. **Benefits:**
    - Monitoring the waste at every stage
    - Improved operation and cost efficiency for waste management
    - Planning for strategic bin location that serves the local population
    - Route optimization from collection point to the landfill site which can save fuel cost and the reduction in trips and time for the waste travel
    - Tool as a decision making for future investment in infrastructure
    - Maximizes the use of all infrastructure facilities.
    - Provide a transparent working system thus helpful for involvement of stakeholders

Benefits of vehicle tracking:
- To increase efficiency of the transport logistic
- To prevent rogue drivers from straying off way-points
- To pin-point location of vehicle in event of emergency
- To give assurance to customers on safe transportation of the waste
- To ensure contractor transport waste to destination

7 As referred to http://www.spectrezine.org/global/Water.htm

- To ensure "cradle-to-grave" responsibility is carried out
- Accountability of licensed contractors
- Higher esteem for the scheduled waste industry

15. Links to other ISWM Pune Schemes:

- Inventorization of Solid Waste
- Establishment of Community Sorting Centres
- Private Partnerships in waste collection and management system
- Establish Take back policy for E-Wastes
- Demonstration Projects for Hotel Waste Management
- Introducing Industry-University Partnerships
- Strengthening of PMC Rag picker Co-operatives
- C&D Waste Management

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This book is the fourth and last volume in the series of training manuals on developing Integrated Solid Waste Management (ISWM) plan. This manual aims to build the capacity of practitioners and policy makers for developing a comprehensive ISWM Plan by utilizing the information collected earlier regarding waste characterization and quantification, assessment of current waste management system and gaps therein, and targets and issues of concern for ISWM.

The objective of the manual is to facilitate the development of a comprehensive ISWM Plan including policy, technical and voluntary interventions. The manual provides a methodology for developing the ISWM Plan utilising the information from Volume 1 and Volume 2 as baseline information and information from Volume 3 for contextualising the Plan. The manual also provides guidelines for developing specific projects/schemes along with an implementation strategy.

DTI/1140/JP