**Urban Services Planning**
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**Lecture 13**
**MSWM Plan Preparation Part I**

Welcome back. In lecture 13, we will talk about municipal solid waste management plan preparation and this is part one of the lecture.

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So, first the different concepts that we will cover our municipal solid waste management plan in general, integrated municipal solid waste management, extended producer responsibility, informal sector integration, decentralized waste management, clustering approach and few other key guiding principles of municipal solid waste management plan.

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So, as we have already discussed municipal solid waste management is a essential core municipal function and it is the core service that has to be provided in every urban areas and as per the twelfth schedule this service is mandatory. So, there is no options to it, we have to provide it. So, that, we have to also prepare a plan for the provision of this kind of service and this service should be, when we do prepare the plan of course, we have to have certain targets. So, normal municipal service sorry, the municipal solid waste management service should be efficient particularly in the urban areas should be you know it should focus on the cleanliness of the urban area that means, the urban area should look clean. It should focus on the waste processing and disposal of the residue after waste processing. Then, it should focus on the urban environment and urban health.

So, these are the key terms that has to be first explored when we prepare any kind of solid waste management plan. So, as we have learnt already, the plan preparation is guided by the state policy and strategy and solid waste management. And as you know the state policy strategy is based on the municipal solid waste management rules 2016. And the mandatory and the discretionary functions in regards to solid waste management that is undertaken by the ULBs that had decided by the state municipal acts, that means what aspects of what kind of services has to be provided in details that is decided by the state municipal acts and the state policy and strategy for that particular state.

Now, every plan that we prepare for an urban area is prepared as per the local context, because all plans cannot be uniform, it has to be adjusted as per the local area, the geographic context, the climate context and so on. It is also adjusted as per the vision and the long term

requirements of the ULB. Every ULB has got stakeholders, based on the stakeholders, based on the administrators there is a vision that is formed for that ULB. There is a long term requirement that are determined for this particular ULB based on that the plan is prepared and finally, as per the financial capacity and the resources available for the municipality plans are prepared.

So, we have already discussed service plan preparation in earlier modules. So, the municipal solid waste management plan is also followed is prepared based on those particular principles that we have discussed earlier, but with certain modifications as per the service, which is the municipal solid waste management service, which is specific to this particular service certain aspects has to be changed.

So, tools, equipment, manpower, technology, vehicles, processing and disposal facilities, the overall service design, all this needs to be decided and designed. So, we need to decide on what sort of equipment, tools, technology, how many manpower we require, all this has to be determined as per the plan that we will prepare or we will the plan will include this. And also similarly, the overall design of the service for this ULB also is part of the our municipal solid waste management plan.

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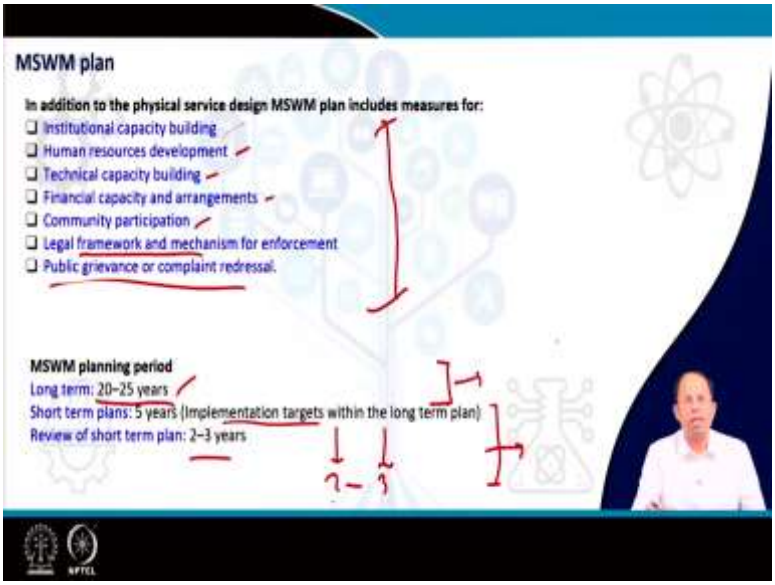


So, as we have learned in our previous lecture that not only the municipal take service that is waste collection service or transportation service, these are not only the important processes that has to be adopted or taken up in municipal solid waste management plan preparation, but there are other aspect also which has to be looked into, as per municipal management laws

2016 not only technical aspects, but other aspects which will facilitate the overall solid waste market process that has to be looked into, what are these? Institutional capacity building. So, the institutions which are involved in solid waste management, the capacity building of those institutions to make them stronger, to make them more efficient.

Human resource development, that is the people who would be engaged in a solid risk management processes, how to benefit them, or how to educate them, so, that they can conduct the process in a more efficient more knowledgeable way so, that they do not make mistakes and they have to guide the people for whom they are providing this service as well. Their technology capacity building that is use of advanced technologies and all. Financial capacity that are adequate that is, we have to make sure we have adequate funds for conducting the projects or executing the projects that we need to execute in that particular urban area.

Community Participation involving the community in the process. The overall legal framework and mechanism for enforcement because this there will be people or there will be stakeholders, who are opposed to the suggestions which are opposed to the decisions the final decisions taken by the municipality. The decisions taken for overall benefit or the greater good, but some people may always object. So, for them, there has to be a legal framework and mechanism so that we can enforce the decision. Then how to handle public grievance and complaints, that has to be also looked into. So, these are also part of the municipal plan preparation.

So, not only determining what number of vehicles we required to transport waste, or what should be the collection mechanism, but all these aspects are also part of the municipal plan preparation, solid waste plan preparation. So, coming to the planning period, usually solid waste management plans are prepared for the long term that is we have a 20 to 25 years of planning period.

Now, we can say that not all aspects are planned like that, but if I am considering a landfill facility, if I am considering a installation plant, the time period considered is around 20 to 25 years. So, for capital infrastructure, we have consider a long period and we will have an overall vision to achieve a certain level of solid waste management in an urban area, which requires a lot of time. So, that can be for a 20 to 25 year period, but every 5 years there has to be implementation targets. So, these are the short term targets or you can say for labor intensive part of that work, there will be short term targets, which could be for 5 year periods.

And there are also intermediate targets of 2 to 3 years where there will be a review of the measures or review of the processes or review of the activities that we are conducting during the short term periods and if required, we need to modify them. So, as we have discussed earlier, the distribution pattern of services may need to be modified based on changing priorities for that area, which can be done after review of a certain period of 2 to 3 years and after that, we can even modify that. So, there is a short term component and then there is a long term component, this is mostly is about the labor intensive part. This is mostly the capital intensive part.

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So, coming to the key guiding principles of Solid Waste Management Plan Preparation for Indian urban areas, as per the suggestions given in the CPHEEO manual prepared for the Ministry of urban development, a few principles are being proposed. Along with that there are other principles which are adopted or highlighted by other state governments, which we will also talk about.

So, the first principle is integrated municipal solid waste management. So, this is actually where we talk about minimizing the waste dispose and maximizing resource recovery. So, this is primarily following the 3 R process. So, that is reduce waste generation, recycle waste and reuse some amount of waste. So, but in addition to that, we can always say that recycle or reuse, how? So, we can even have other aspect which are also covered in this overall process. So, overall, the approach is to follow this 3 R process.

So, the first job is to reduce the generation of waste altogether. So, first job is to reduce during product design, production, packaging, use and reuse. That means how do I ask people to use or generate less waste? How do I ask producers to design products which generates lesser waste? So, maybe earlier discussions on your this lifecycle analysis and all these things has to be considered when we go for product designs or package designs and so on.

Similarly, for using and reusing like for example, based on our use of plastic we can say that well I can instead of using plastic I will use a proper bag and I will take it to the market every day, fill it up with whatever, I buy, instead of using plastic and I can reuse certain things like for example, I can use containers multiple times instead of throwing them away. So, and also we have to of course, design the container so, that it could be reusable. So, this is the first step and then subsequently in an integrated fashion and gradual fashion, we have to go to the second step, which is once we reduce whatever that remaining waste, we have to maximize recycling of waste from the remaining waste.

So, in here, we will try to recover as much of materials as possible, which can be recycled, and this can be only possible through waste segregation. So, if I do not segregate, I would not be able to recycle. So, that is how integration has to be, separate collection of different waste streams. So, that means not only segregation by the households, but the collection system has to be designed so that we can collect this waste separately and then take them to a recovery center or a sorting center and recovered materials, whichever we can recover, they can be again taken up and they can replace what in resources that means instead of using trees for preparation of paper pulp, so, that new paper is created, we can reuse paper, we can put it back into the process and we can reduce the utilization of trees and that can actually reduce that virgin resources.

So, that is how we can actually reduce the overall resource consumption. So, this is the second step that is once we reduce then we recycle and not only recycle, because we are segregating the waste the other components of the waste like for example, the organic fraction, we can go for composting. So, we will convert it to fertilizer. Of course, we will consider FCO norms for that. Then the other part of the waste where we can do combustion that is after composting, after recycling whatever is remaining within that we can take out the waste which is of a higher calorific value, which is more than 1500 kilocalories and we can generate energy via production of heat, electricity or fuel from segregated dry regions.

So, after I take out the wet waste, that is the biodegradable waste, after I reduce the amount of waste which can be recycled or reused the remaining waste we can go for this generation of energy. So, after generation of energy, which could be done via biomethanation, pyrolysis gasification, incineration, refuse derived fuel, co-processing, after this processes, whatever is remaining, and also these processes also generate some amount of waste, like ash and all these things are produced from incineration. So, whatever remains, whatever is produced from this process goes into the waste disposal stage, which is the inert waste which is disposed in a sanitary landfill.

So, this all these steps are done in a very integrated way and only waste from one step, these are followed in sequence so that we can gradually reduce the quantity of waste finally, which is going into the landfill site. So, this is called integrated municipal solid waste management, but integration is not only limited to the waste process, that processes that we will adopt, but it is also talks about integration of the different stakeholders, integration of the informal sector, integration of community organizations, NGOs, private companies, all this is also or integration of the different kinds of generators, so, waste generators, so, that we can utilize the waste generated from different generators and we can go for biodegradable waste segregation and all these things. So, that is the integrated solid waste management process.

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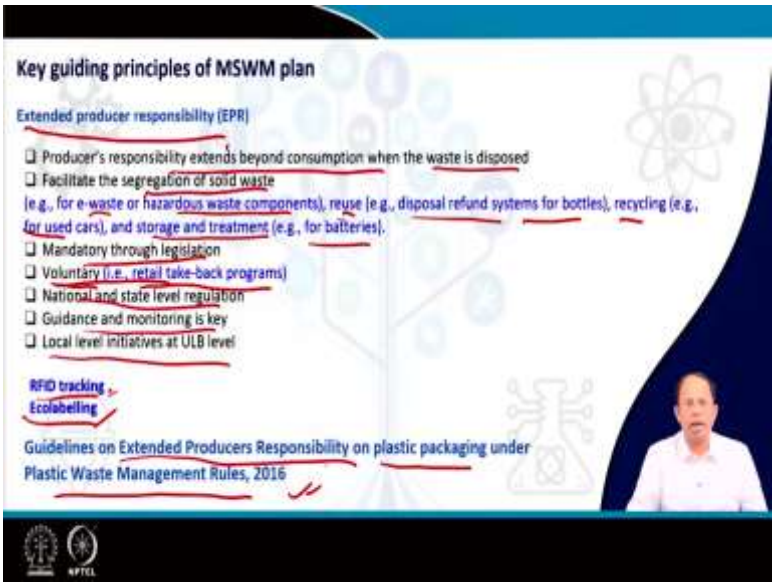


The second principle is extended producer responsibility, we have already talked about this, but to go in a little bit more detail, we say that producers responsibility extends beyond consumption, when the waste is disposed, then also there is some responsibility from the producer. So, the production or the producer should facilitate the segregation of solid waste,

how? What he can say is for hazardous waste components or e-waste components, he can say that the producer will take back this kind of components by, you have to you cannot throw them directly into the municipal stream, you have to just give there is a phone number attached with this particular component, it is given as a label with this company, you can call them and people from that company will come and they will take up this take back this kind of products.

So, what they will do is they can recover some items from this product or they will process it in a safe way and then dispose it further. So, that is the first thing. Then reuse that is for example, disposal refund system for bottles. For example, you return a aluminum cane for a soft drink or you return a glass bottle for a soft drink, you will get some money back. So, because you are getting money back, you are getting the incentive to return it and what the company does, they will take the bottle they will clean it, they will reprocess it or they will take the cane, melt it and then again make a new fresh cane and they will again reuse it. So, that is reuse.

Finally, recycling that is for used cars example is used cars for example, companies have set up some recycling plants, both scrapping and recycling plants these are done together different companies in India are also setting up where they can recover certain items from the vehicle which could be reused also and or they can recycle them also or they can reuse those particular parts.

And finally, for storage and treatment, like for batteries and all these are things which needs to be also stored safely and then they have to be worked upon as well. So, these kind of things could be facilitated by the producer themselves. Then, but if I just ask producers to do it, because these are private companies, they will not do it because it does not improve their profit. So, in that case, it has to be made this kind of extended producer responsibility has to be mandatory through legislation or rules or laws. Sometimes good companies or companies which really cares about the environment or they want to do some amount of good work for the societies at all, because that actually generates goodwill, and people will use their product more so, in that way they get benefit.

So, they could also take a voluntary approach. Like for example, there are retail take-back programs by certain companies and all. So, that means you can return some of the items and all. So, this kind of voluntary approaches are also there. So, that once your product is used, then you can return that particular product and so on. Then national and state level

regulations has to be created to make things mandatory or whatever the guidelines that is required to do this. Then guidance and monitoring is also required, because you cannot just make the rules, but you have to ensure that these are implemented by the different companies and also that monitoring and guidance is key.

And finally, some local level initiatives could be also taken up at the ULB level that means ULB can do some sort of schemes or programs with some producers and all to do some local level activities to improve the solid waste management process.

Now, one, two things, one is RFID tracking, this is one technology which is also nowadays being utilized. So, we utilize these tags, we can put it in some products, so that this tracks carry information about the product. So, what happens, once the product goes into the waste stream, it goes to the recycler which may not be that company but to some generic recycler, you can the recycler can actually scan this particular RFID and it will get the required information for recycling this product. So, that it will know that these are the components which are there, what are the processes that has to be adapted all this information is there with this RFID with this tag.

So, that kind of RFID tracking is possible. Then we can go for equal leveling of products, we can give some sort of level saying that what sort of environmental safety and all is part of this particular product or you can say that okay how this product is adhering to certain environmental norms or it can talk about how to return the product or what number to call if you want to return the product after its use and so on. So, this sort of equal level it could be also done.

So, Government of India has also come out with guidelines on extended producer responsibility, particularly for plastic packaging. And this has been done under the Plastic Waste Management Rules of 2016. So, we will talk about this in detail in subsequent lectures.

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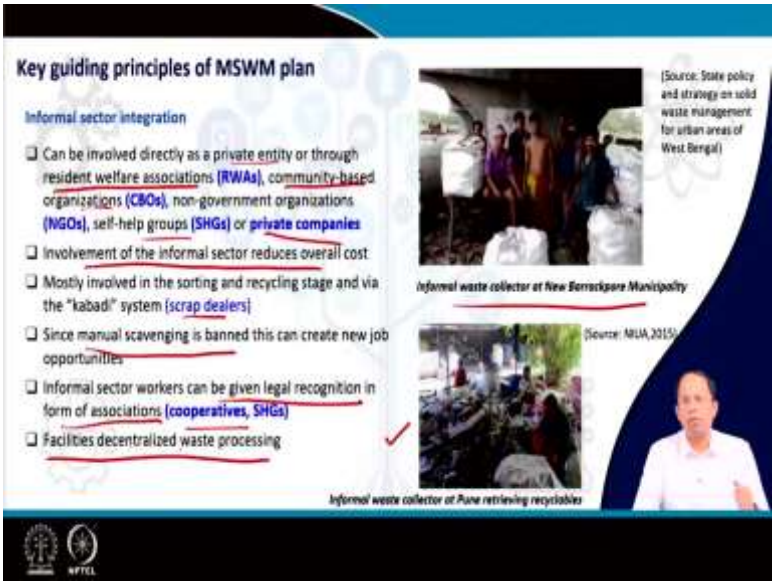


The next key guiding principle is the integration of the informal sector. Now, this is something as you can see that informal sectors has been or scavengers or waste collectors has been part of our waste management system for a long time. So, many of these people their livelihood depends on collection of garbage or if they want to they all not only collect garbage, but they also recover some of amount of materials from the garbage and they sell it to local recyclers or to the kabadi system or the scrap dealers and they earn some money out of it. So, that is their livelihood. So, but as you see that because we are going for more scientific waste processing segregation disposal systems, this kind of waste collection is not, this kind of the role of this informal waste collectors are changed.

For example, if I do proper collection, door to door collection, bring it to a sorting facility this particular waste and do a formal sorting of the waste, this waste collectors will not be able to get access to this waste. So, there is a huge lot of people who are engaged in this particular employment, this particular job, so, we have to make sure they are engaged in the formal waste collection system as well. So, they can be involved directly as a private entity, that means, we can engage them as a private entity in one of those processes, one of the sorting centers around or through resident welfare associations or through community based organizations or non-governmental organization, self-help groups or through private companies.

So, that means, we can engage them directly the ULB can engage them directly or they can be done via this set of organizations. So, sometimes, what happens, so sometimes the informal sector workers can be given legal recognition as well in form of associations such as

cooperative self-help groups and so on. So, this help, instead of just talking about self-help groups from the community or the locality, we can facilitate formation of associations, formation of self-help groups for this kind of informal workers, so that they can come as an organization and can participate in the formal waste management process. I will give examples of that.

So, what we have found out from experiences is involvement of the informal sector actually reduces the overall cost of the solid waste management service and usually earlier they were used, they were dealing with the scrap dealers or informal system, but they can now be made part of the formal general recycling system and also by law manual scavenging is banned. So, there is a need to provide job opportunities for this people and if I want to really go into decentralized waste processing, that means we want to do it at local levels, at community levels waste processing, we required the health of this informal workers in this particular formal waste management process.

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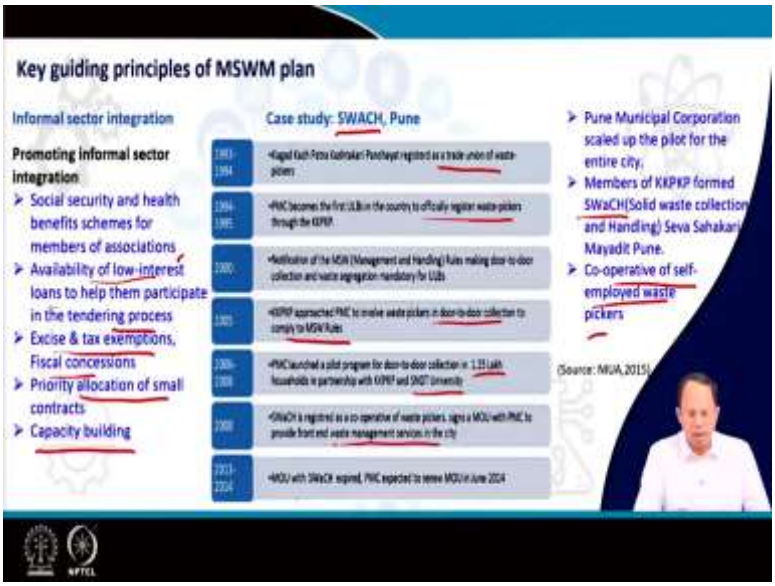


So, how we can promote informal sector integration in the formal solid waste management process? What we can do is we can provide social security and health benefits scheme for this kind of workers or this sort of members of this associations which are formed by this sort of informal workers. So, at least they have some social safety net, availability of low interest loans, why do we want to do that, suppose the municipality or the ULB gives that says that certain work has to be conducted for that tenders are floated and that request started about a guarantee of money and all.

So, if they are able to take some and also if suppose, there is a group of the self-help group of waste workers, they do not have money. So, to do something, you need to buy some equipment, you need to follow certain procedures. So, for that make the ULB can make sure that some loans are available for these people, so, that we can also participate in this tendering process. Then some excise and tax exemptions, some fiscal concessions for this self-help groups, which are made up this informal workers so, that they are exempt from paying taxes and all and so on.

Priority allocation of small contract, smaller contracts or waste segregation, waste collection can be given to this kind of workers. We can privatize that. And capacity building so that overall their capacity, their knowledge, everything increases and they can participate in that formal process. So, I will discuss a case study where a cooperative of self-employed waste pickers, SWACH was engaged in Pune and how they actually helped in improving the overall solid waste management process in Pune Municipal Corporation.

So, as municipal corporation is a progressive city, it is a growing city and solid waste management, its operations are conducted in a decentralized way in Pune Municipal Corporation, the city is divided into multiple zones and we know the administrative structure of this kind of urban bodies and there initially what happened this during the year 1993 and 1994, a trade union of waste pickers was found. This was known as Kagad Kach Patra Kashtakari Panchayat. So, this was registered as a trade union of waste pickers.

Now, once this Pune Municipal Corporation became a ULB and then they also registered this group of waste pickers, they officially this group was recognized by the PMC. So, once they were officially recognized during the year 2000, when the municipal solid waste management and handling rules came, which it made door to door collection mandatory and then what happens because this was made mandatory, this KKPKP this particular union approached the PMC and they said that they would like to participate in the door to door collection. So, that the Pune Municipal Corporation can also comply with the Municipal Solid Waste Management Rules.

So, this was a start of involvement of the informal waste pickers in the formal management system. So, first, there was a launch of a pilot program for door to door collection in Pune Municipal Corporation which involved around 1.25 lakh households, and it was done with partnership with this particular union and SNDT University. So, members of the KKPKP form SWACH, which is solid waste collection and handling Seva Sahakari Mayadit Pune. So,

this organization was formed. And there a cooperative of self-employed waste pickers. And they can now as a cooperative participate in the process of getting some contracts for door to door collection from different areas or different zones in Pune Municipal Corporation.

So, SWACH was registered as a cooperative and they are now enabled to provide door to door waste management services or other recycling waste management services or fronted wastewater services you can say for the city of Pune. So, finally, so, once that done, then they started operating and then we will discuss about that and then in 2013-14, this was expect and then finally it was renewed as well.

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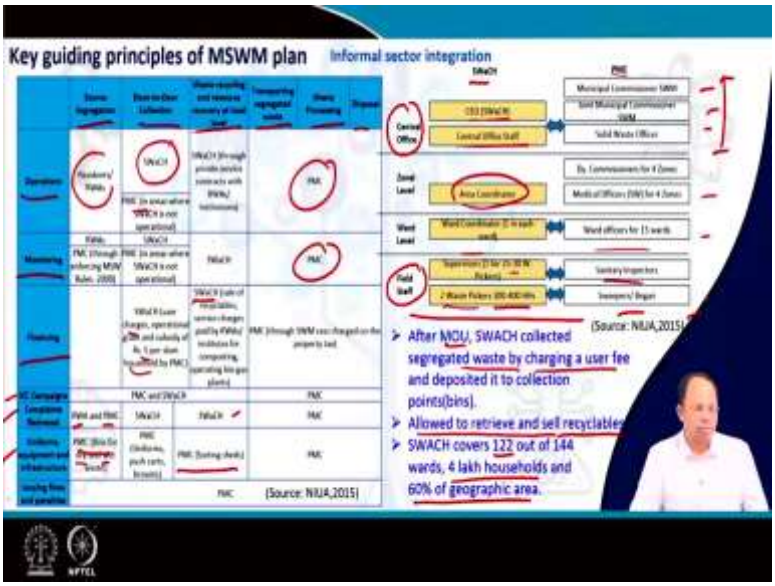


So, you can see this particular table, so, after the MOU was executed, SWaCH collected segregated waste from the different households at different generators and they also charged the user fee for this particular collection process directly from the generators and they deposited it to collection points, which is specified by the municipality or specified by Pune Municipal Corporation.

So, they were also allowed to retrieve the recyclable items from this waste that is collected from the different generators and sell the recyclable. So, whatever profit they made out of it was their solely. So, that was not taken by the corporation and eventually SWaCH covered 122 of the 144 wards in Pune Municipal Corporation and 4 lakh households were actually covered in the door to door collection process and 60 percent of the geographic area of Pune was also covered by SWaCH.

Now, looking at the table over here you can see that for different segments of the waste collection process, source segregation, door to door collection, waste recycling and resource recovery, transportation, waste processing disposal, you see that the final part that is transportation waste processing disposal is mostly the job of Pune Municipal Corporation. So, different aspects for example, operations, how the exactly the collections transportation is done. Monitoring, who checks on this operations and all. Financing, how to generate money out of all this.

Then IEC campaigns information campaigns, awareness campaigns, who conducts them, who redresses the complaints, who addresses the complaints that are form, then who provides the uniforms, who levis points for people who are not adhering to this. So, these are different responsibilities at different stages of the waste collection process. And let us take a look at who does it in case of Pune.

So, in case of source segregation of course, it is done by the different welfare organizations or the residents themselves. Now, you can say that, this is done via bins provided by the Pune Municipal Corporation for dry and wet waste, separate bins are provided and complete addressal is also taken care of by some amount of complaints regarding provision of bins and all could be taken care of by Pune Municipal Corporation, other issues could be taken care of by the resident welfare organization.

Now, door to door collection was taken up by SWaCH in most part of the city. The rest of the part was taken care of by the Pune Municipal Corporation themselves where SWaCH was not operational there they took it took care of it and monitoring was also taken care of by SWaCH and PMC as per the area they were operating. Then financing that is the charges that SWaCH was collecting, they were collecting user charges. They got a operational grant and subsidy of rupees 5 per slum household or by PMC, for slum households, they were paid some additional money by PMC, but for other houses they were collecting fees themselves.

So, similarly for waste recycling part and all entirely, this the SWaCH took care of operations, SWaCH took care of monitoring as well as generating money by selling this also was taken up by SWaCH. Similarly, complaints in regards to that and all was taken care of by SWaCH, but the sorting shades or areas where this kind of sorting was done, this was provided by PMC. Similarly, uniforms, pushcarts, all the equipment that was required, this was provided by PMC as well. So, this is how overall you can see that informal groups could

be actually formally brought into the process of solid waste collection, solid waste management for urban area.

Now, one more thing that is it is not only the informal, how the waste collectors are involved in this but because they have formed a cooperative, we have to build up the capacity and we are also have to have a certain organizational structure similar to the municipalities to conduct this kind of operations. So, this figure actually shows that so on the left side you have got SWaCH and on the side there is PMC, the PMC organization structure or organizational structure of urban local bodies we have discussed earlier for example, we have the municipal commissioner, joint municipal commissioner, solid waste officers who were there at the central offices.

Similarly, people from SWaCH also have roles who look into similar roles which are taken up by the municipal body, such as there is a CEO for SWaCH, there is a chief executive officer for SWaCH, there is a central office staff who take care of the administrative and other duties and all. So, there is a central office for SWaCH as well. Then for each zone, like we have a central office for the Municipal Corporation, they had certain activities they will conduct then there are zone level offices and also zone level activities.

So, similarly SWaCH have area level coordinator. Similarly, PMCS, deputy commissioners or medical officers at the zone level who take care of the zone level administrative and other tasks, monitoring and other tasks. At the ward level, within each zone there are multiple wards. There is a ward coordinator, one in each ward from SWaCH side. Similarly, there are ward officers for 15 wards in case of Pune. Then in the field stuff that is who actually goes to the field at checks, monitors do some kind of activities, you see there in case of SWaCH there are supervisors, one for every 25 to 30 waste pickers.

So, supervisors job is to supervise and to guide or to control the overall collect processes. And for every 300 to 400 houses, two waste pickers were employed. So, that is the structure of SWaCH that has been formed or that is how the overall organization structure of SWaCH and in case of the municipal from the municipal side, to coordinate with this SWaCH people there are sanitary inspectors sweepers who are also coordinate with activities of SWaCH as well. So, this is an informal sector has been integrated. So, this is a very very effective case study, which also could be replicated in other urban areas.

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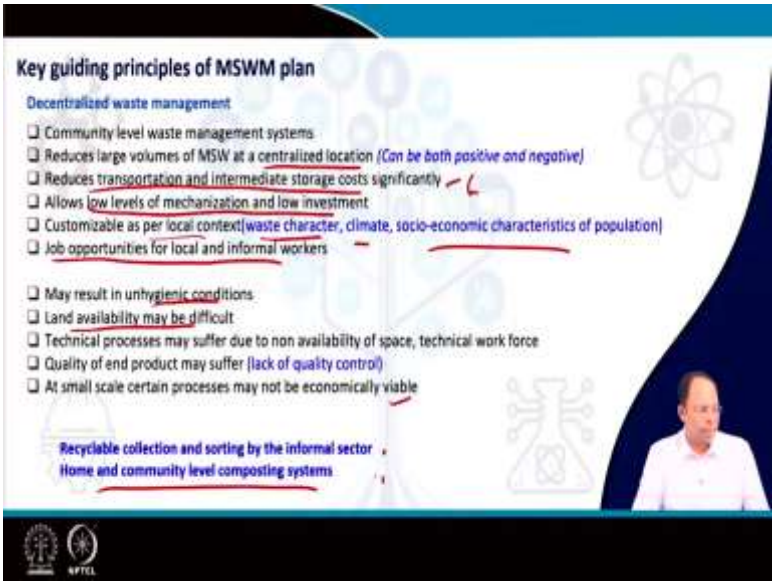


So, then we will talk about decentralized waste management. So, this is another key guiding principles for urban areas for preparation of MSWM plan and decentralized waste management has got both pros and cons. For example, because it is a community level waste management system, obviously, the volumes are much less and instead of, and because we are doing it at a smaller volume, so, it is better to do it locally.

But similarly, what happens is that we do not require large centralized facilities, but at the same time, what happens because we are doing it locally, sometimes the processes are not efficient, because we cannot have all sorts of equipment which a centralized facility can have got or sometimes the levels of mechanization are low and the investment is also not possible to be done at the local level. So, that actually reduces the overall effectiveness of the process.

So, sometimes, it will also reduce the quality of the compost that is generated in this local plans because the equipment wise or the processes, there may not be area for conducting this kind of process and so on. So, anyway, the primary positive is reduction of transportation and intermediate storage costs, that means the amount of waste that needs to be transported that will reduce significantly. So, that is a peak saving, why because transportation cost is the most costly part of the overall risk management process. So, if I can save on that automatically the overall cost will come down. So, this community level waste management or decentralized waste management also allows us to do adopt customized approaches as per the local context.

So, this as per the local context means as per the waste character, the climate of that area, the socio economic characteristics of the population, all this can help us determine what processes should be adopted. And this also gives job opportunities for local and informal worker. So, these are the good things that is come sort of decentralized waste management, but there are some issues also, local treatment may result in unhygienic conditions that may affect the health of the local population that can happen, it may also like I said, compost plant also has some amount of smell coming out of it. So, the local area may get affected, land availability may be a big challenge in many areas are very dense and all and who will share the land for that.

Technical process may suffer due to non-availability of space, technical workforce and so on. Quality of the end product may suffer because there is usually the quality control is not that strict and at small scale at certain processes may not be economically viable. So, these are some of the issues with decentralized processing, but overall decentralized waste management is beneficial for urban area.

So recyclable collection and sorting by informal sector as we were showing in the last case study, home and community level composting systems. So, these are different aspects different ways we can take up decentralized waste management.

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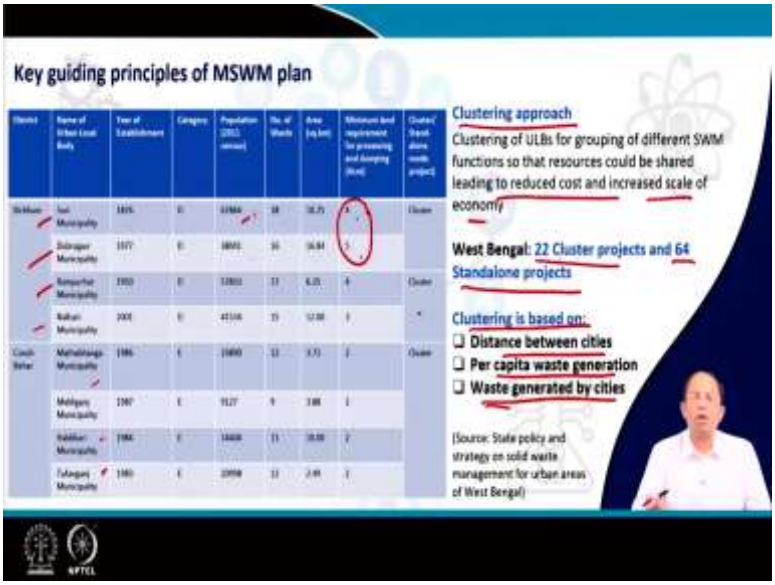


So, next, we talk about the clustering approach. So, we already have discussed clustering earlier where we talked about like, clustering of ULBs for grouping of different solid waste management functions, so, that resources could be shared reading to reduce cost and increase

scale up economy. So, I give you an example from West Bengal, out of all the municipal bodies, that are there or urban local bodies there, 64 are standalone projects. That means solid waste management is done in a standalone way in 64 municipal bodies or urban bodies, whereas for 22 other cases clusters have been formed. So, that we can economize on scale or we can reduce the cost or based on the area availability or for disposal sites and all this has been clustered.

So, as you can see in this particular table, the first cluster includes Suri and Dubrajpur municipality, these are nearby and minimum land area required is 4 acres for Suri and 5 acres for Dubrajpur. So, these are taken together and we provide some area for that. And you can see a little bit details about the amount of population or people that has been served. So, that is also key. If the people is served in both places are not that much or there has to can make some criteria on determining size or the total population of this area, so that we can determine the facility.

So, clustering could be based on the distance between the cities if these are nearby, we can cluster them. Per capita waste generation if they are similar or similar characteristics of waste that is another thing and waste generated by this that is the total quantity of waste generated also plays a role that means if the population by combining them is adequate and the waste generated is adequate in that case, we can go for a single facility. So, similarly, for Rampurhat and Nalhati they have been clustered together. In which Cooch Behar, Mathabanga, Mekliganj, Haldibari, Tufangamj, so, this all municipalities have been taken together as one cluster.

So, these are some examples of municipal clusters, which have been formed for provision of more efficient solid waste management services.

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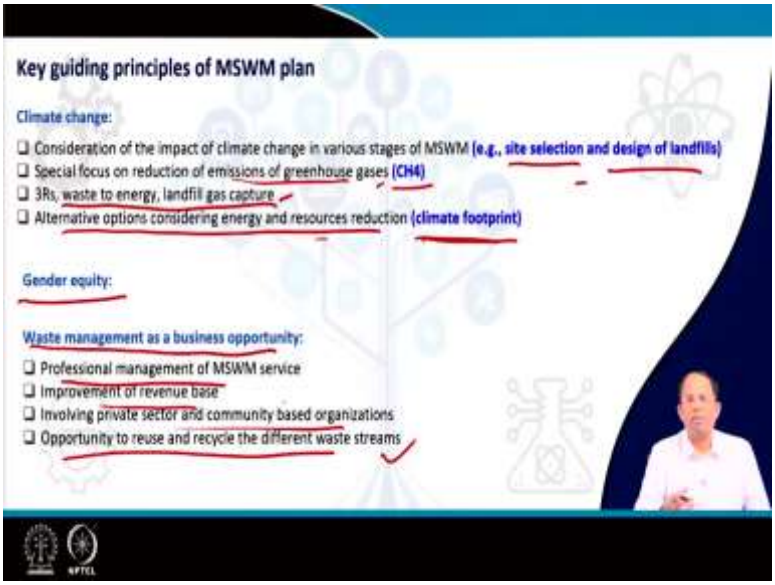


So, in addition to what we have discussed, there are few other guiding principles. One is, of course, climate change. In today's context, we have to be careful about climate change, because it is a reality now, we are seeing its effect every day. And considering the impacts of climate change, we have to consider site selection, design of landfills. Because of climate change, we are seeing increased chances of cyclones, increased flooding and all so we need to be careful about site selection and design of landfills. Spatial focus has to be a reduction of emission of greenhouse gases, because that is what leads to global warming and climate change.

3 R's, we have to really focus on the 3 R's that is waste to and also waste to energy and landfill gas capture. So, we can capture the methane that is generated in the landfill, and reduce the amount of greenhouse gas emission and alternative options conserving energy and resource reduction. So, that means overall, we have to reduce the climate footprint. So, there is carbon footprint and then there is climate footprint. In climate footprint, we take up more gases, in addition to the CH4CO2, we will consider other gases and other emissions you can say and overall we will see that we will choose processes, we will choose certain methods, which will reduce our overall resource consumption and also reduce the energy that is utilized.

The other aspects are gender equity, which is again a key item mentioned in the municipal solid waste management plans and that is one of the key guiding principles for solid waste management plan preparation and finally, sub areas are also considering waste management as a business opportunity that means you can generate money out of waste management. So,

we have to provisionally manage waste management services, improve the revenue base of particular areas, involved private sector and community based organizations in the process, because they are more efficient in managing this kind of things and opportunity to reuse and recycle different kinds of waste streams so that we can generate money which will pay for the waste management overall waste management plan for an urban area.

So, that is why take waste management as a business opportunity and actually manage it efficiently and professionally, so, that we can overall attain the different objectives of waste management for different urban areas.

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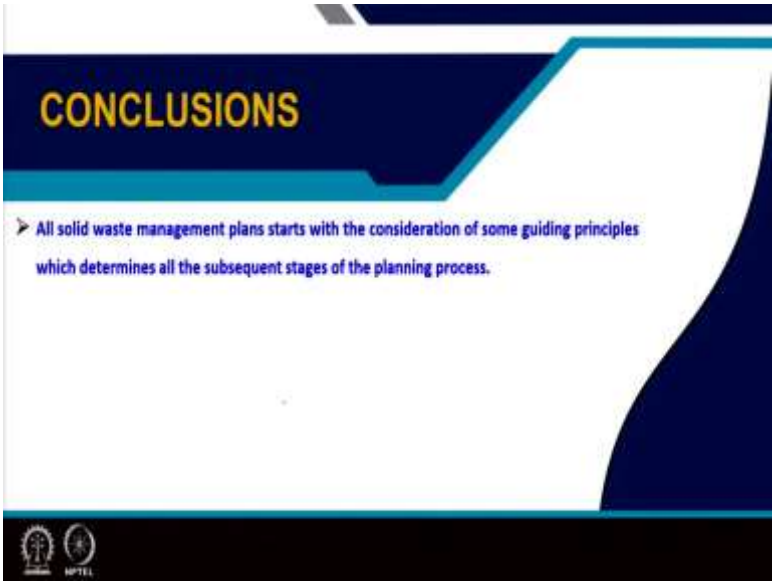

So, these are some of the references you can follow. So, to conclude all solid waste management plans start with the consideration of some guiding principles which determines all the subsequent stages of the planning process. Thank you.