

**PREPARATORY SURVEY  
FOR  
INTEGRATED SOLID WASTE MANAGEMENT  
IN NAIROBI CITY  
IN  
THE REPUBLIC OF KENYA**

**FINAL REPORT**

**VOLUME 4**

**DATA BOOK**

**SECTION B**

**ORGANISATIONAL, INSTITUTIONAL AND HUMAN RESOURCES  
DEVELOPMENT**

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## 1. Snapshots of the PCM Workshop



**The Opening Remarks by Ms. Leah Oyake, the Director of Environment.**



**The presentation on the PCM methodologies by Mr. Ogawa**



**Group A: Moderator by Mr. Maeda, Team Leader**



**Group B: Moderator by Mr. Ogawa**



**Group A: Discussions**



**Group B: Discussions**

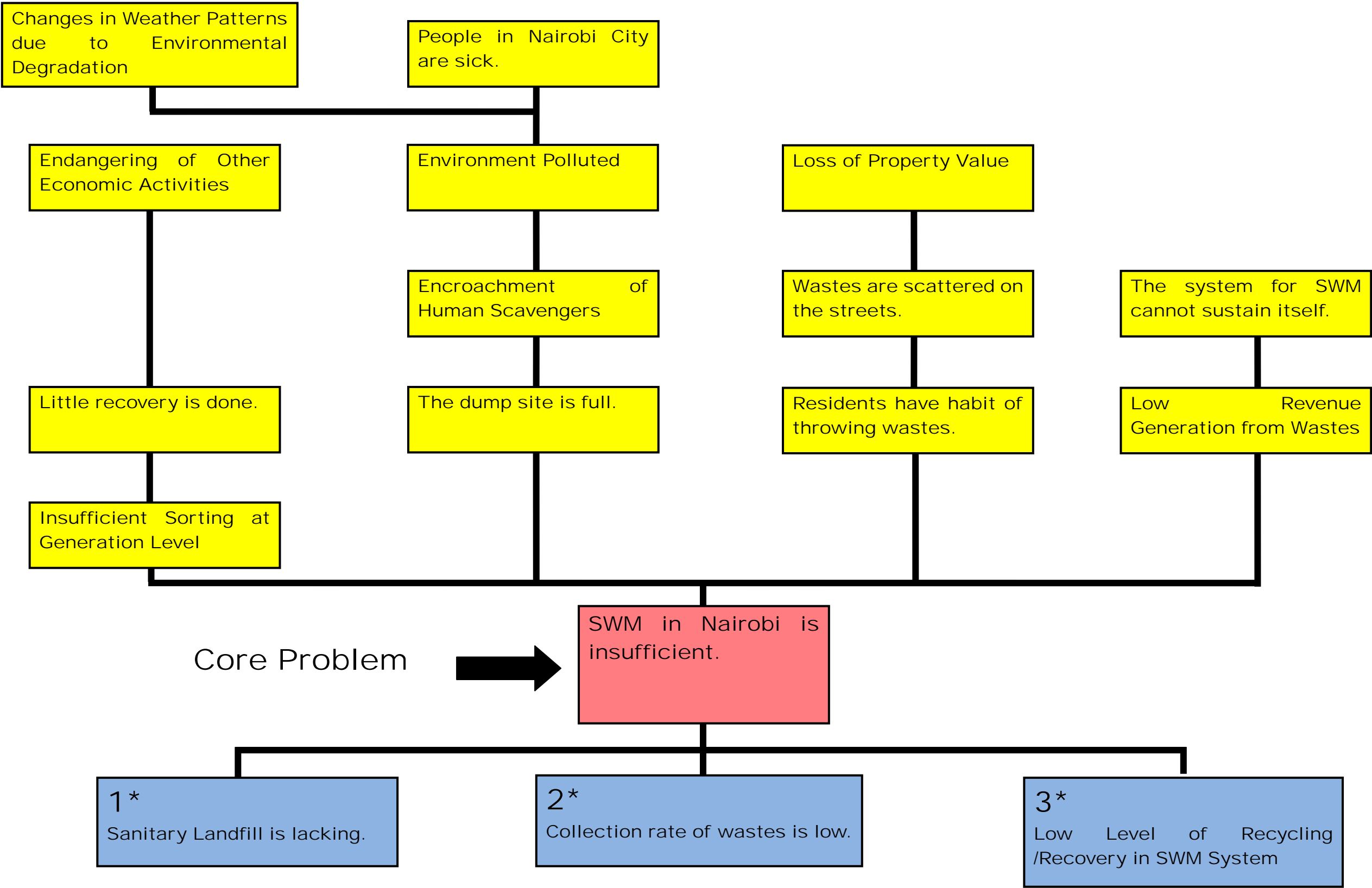


**Group A: Wrap-up Presentation**

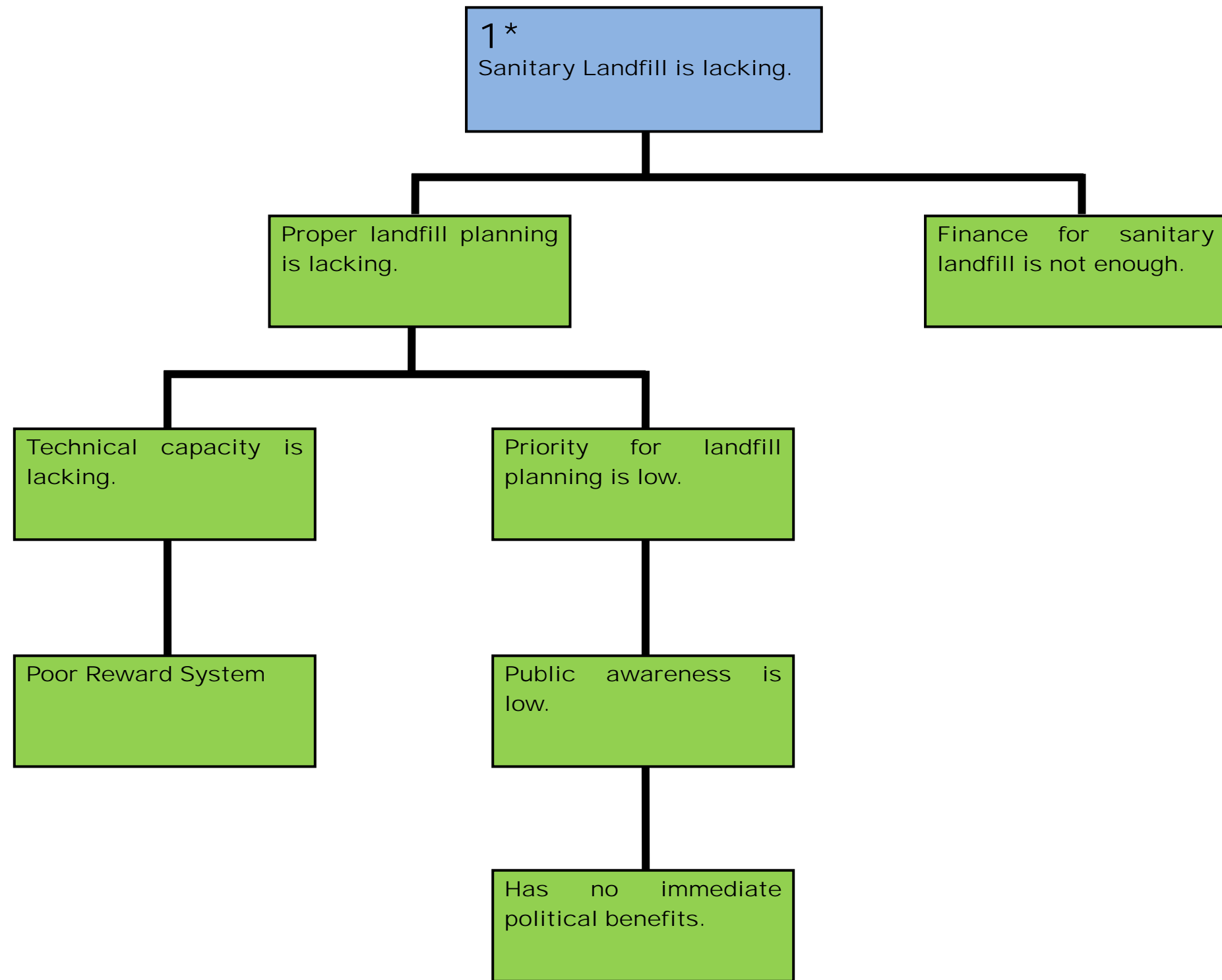


**Group B: Wrap-up Presentation**

Group A (Problem Tree: Upper)

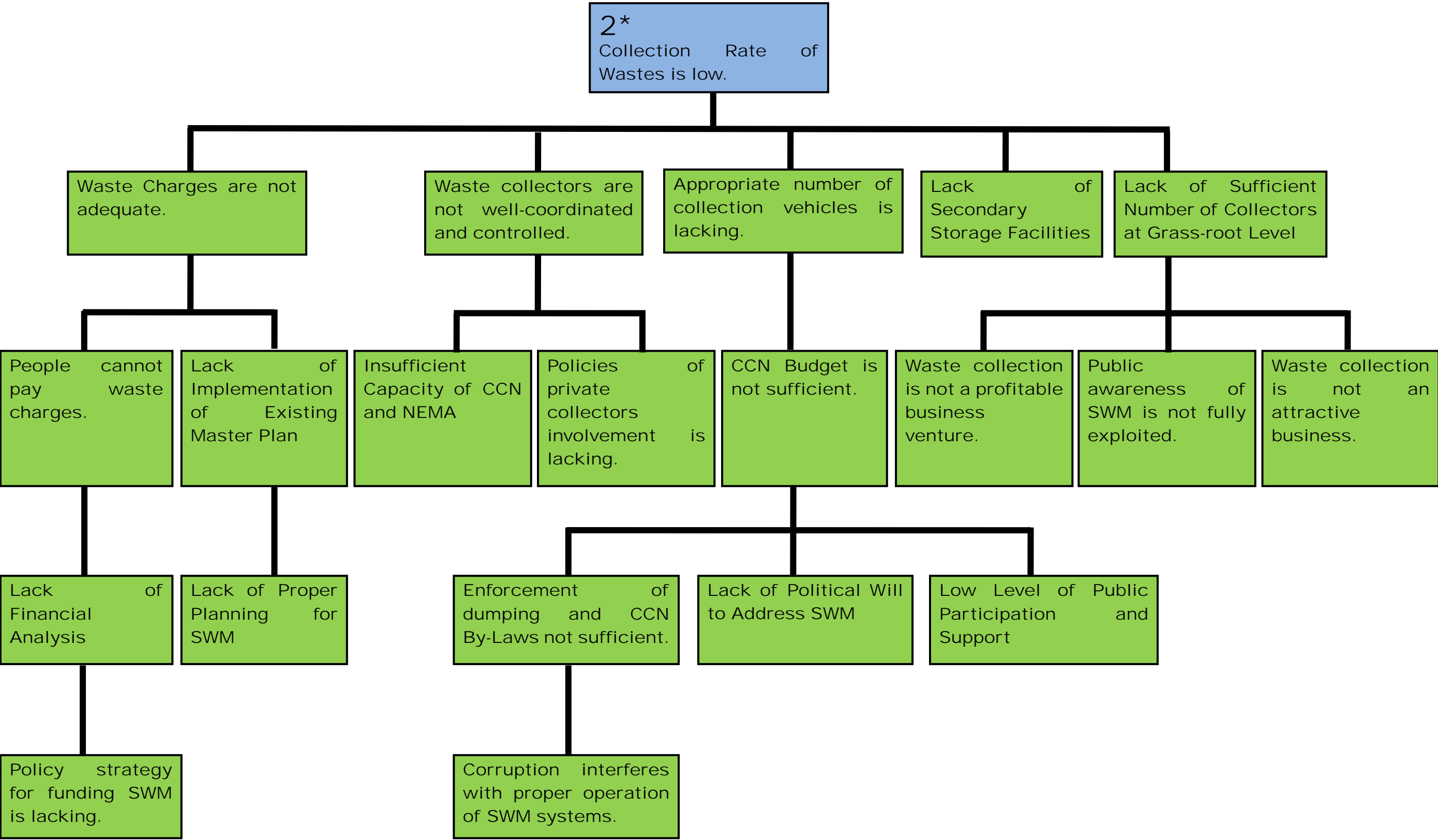


## Group A (Problem Tree: Lower, Cause 1)

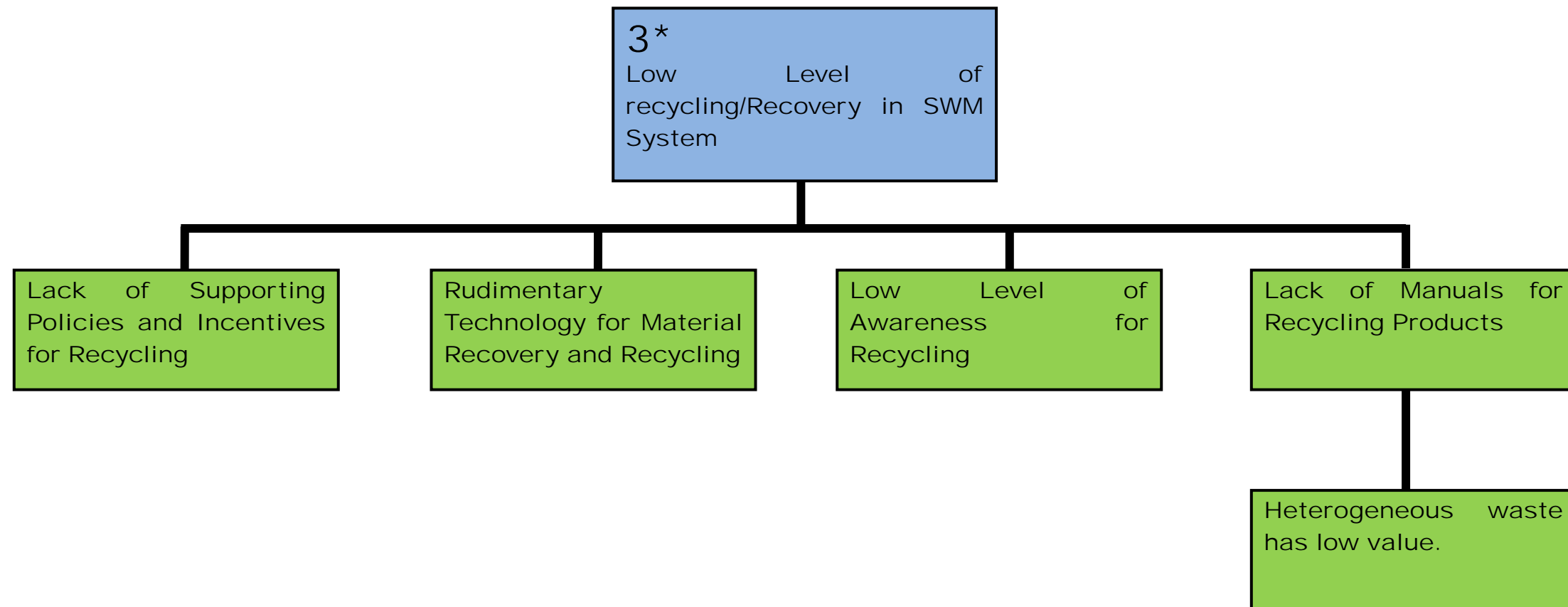




Group A (Problem Tree: Lower, Cause 2)

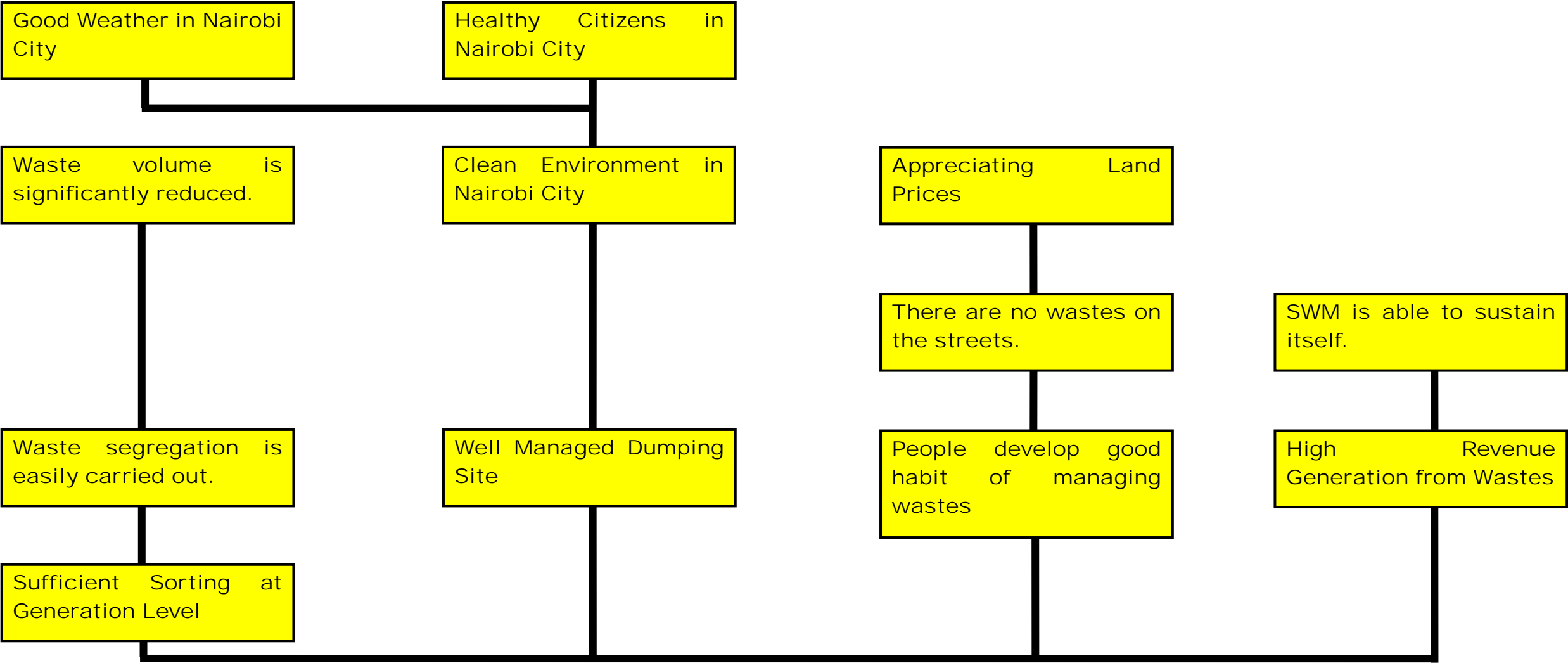


## Group A (Problem Tree: Lower, Cause 3)





Group A (Objective Tree: Upper)



Solution of Core Problem



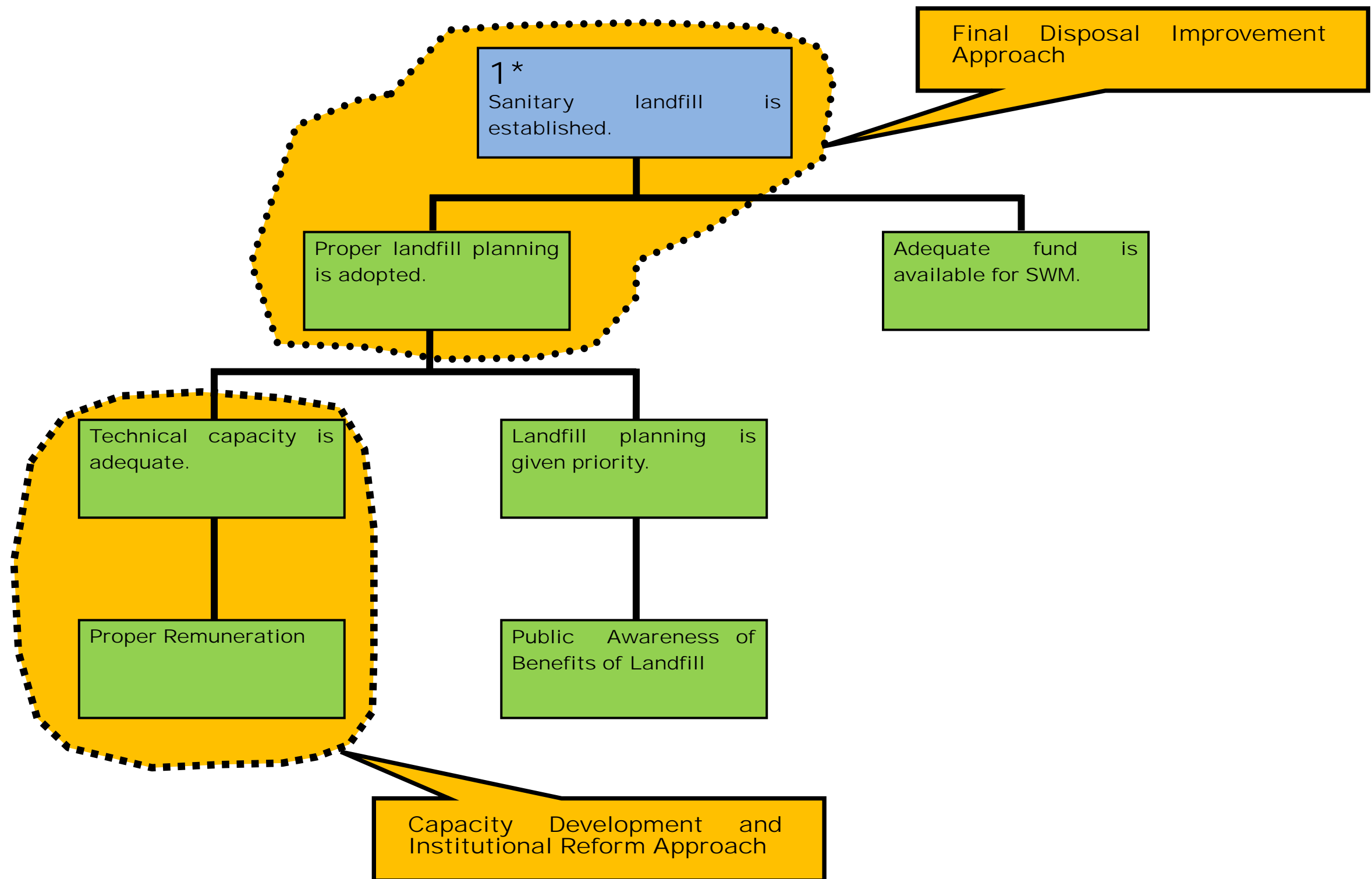
SWM in Nairobi is sufficient.

1\*  
Sanitary Landfill is established.

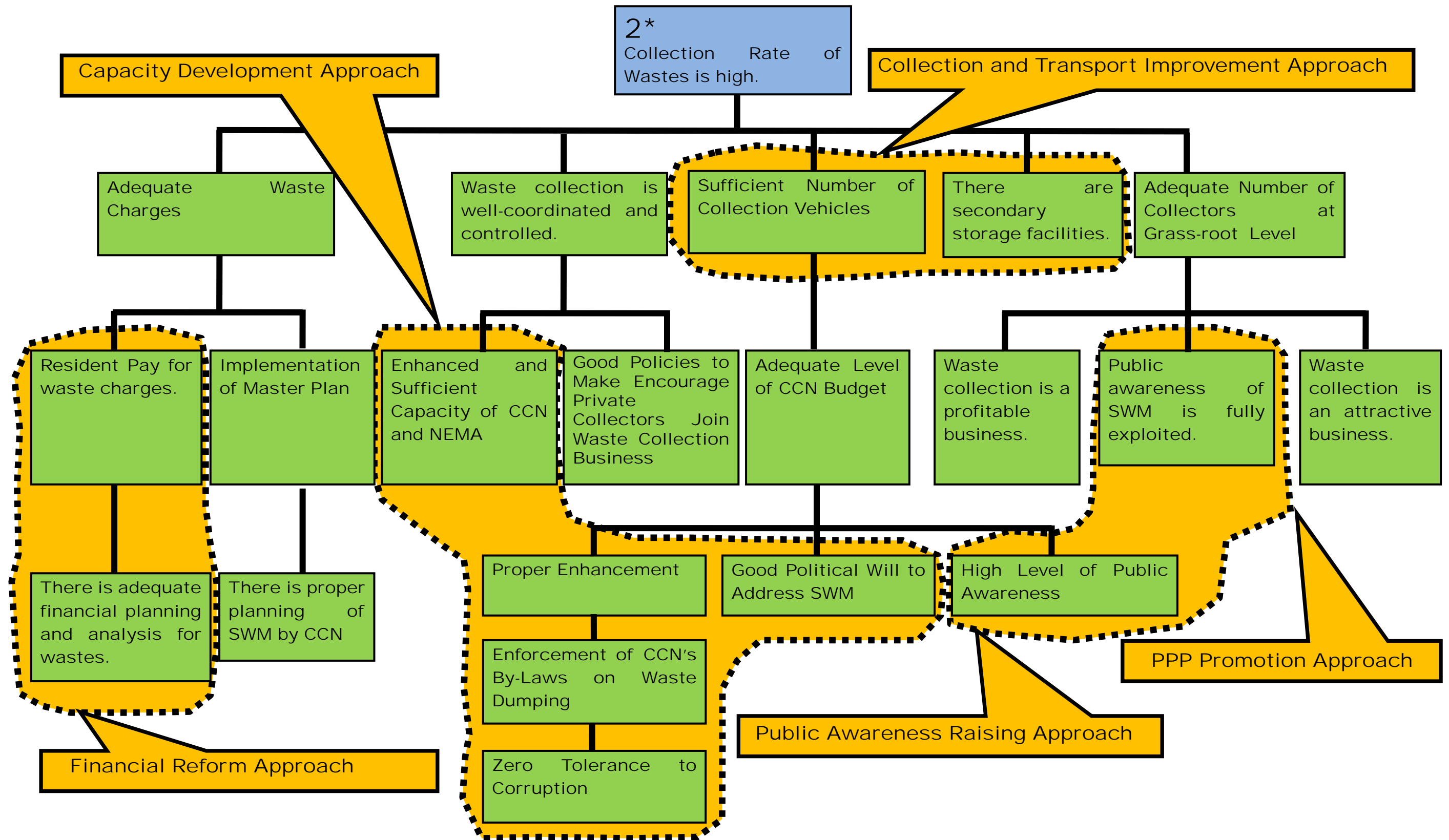
2\*  
Collection rate of wastes is high.

3\*  
Well-managed Recycling System

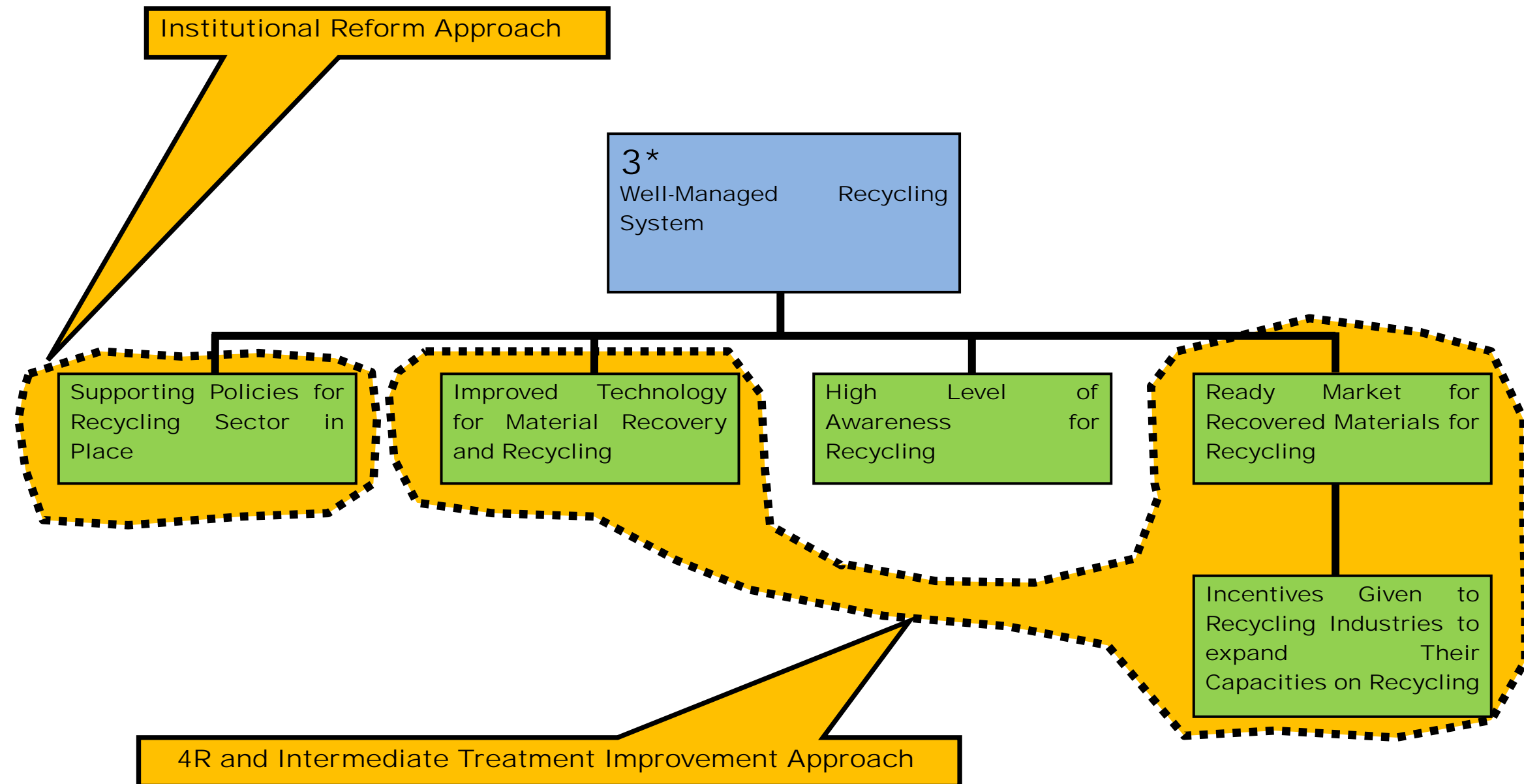
## Group A (Objective Tree: Lower, Solution 1)



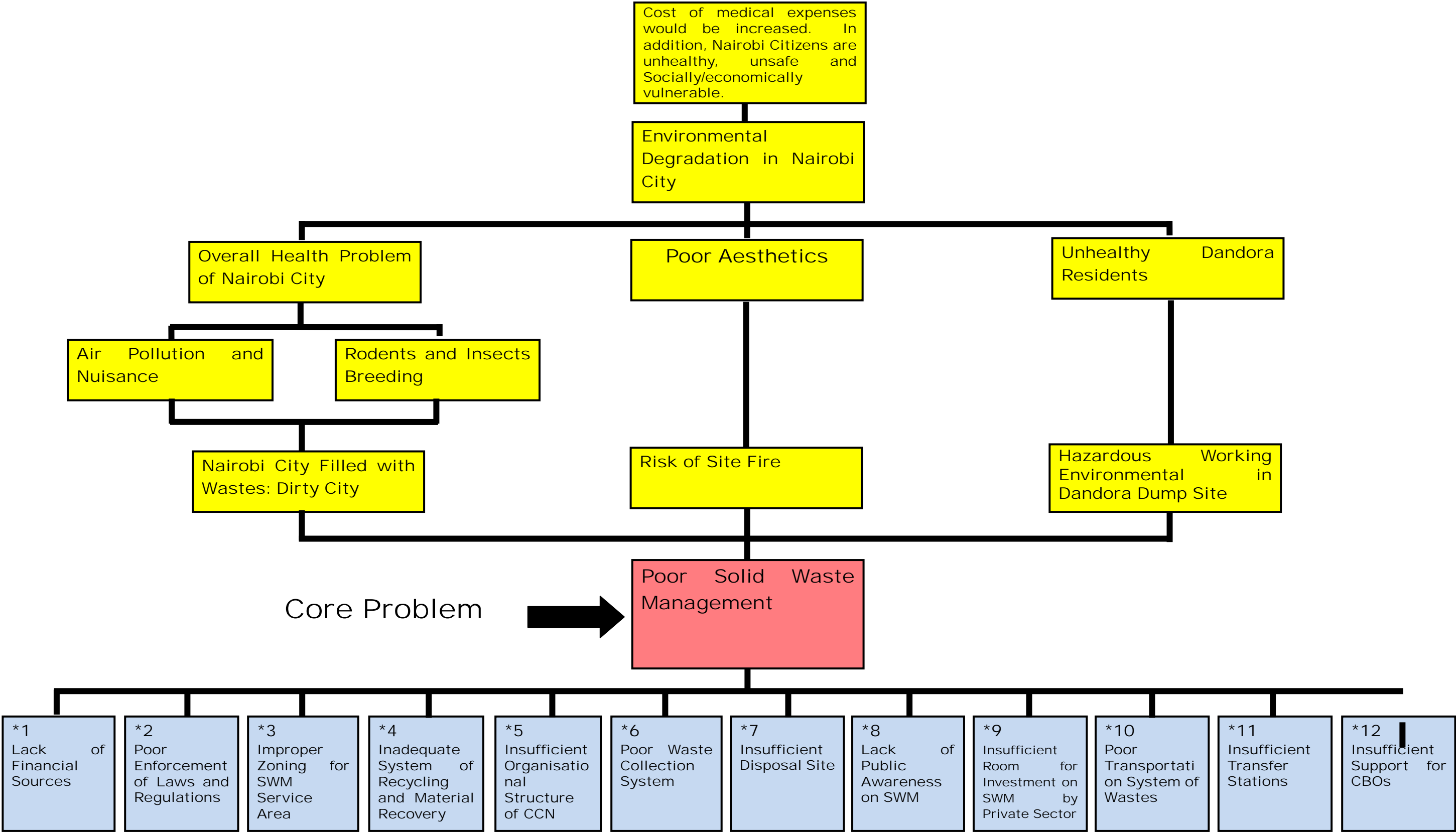
Group A (Objective Tree: Lower, Solution 2)



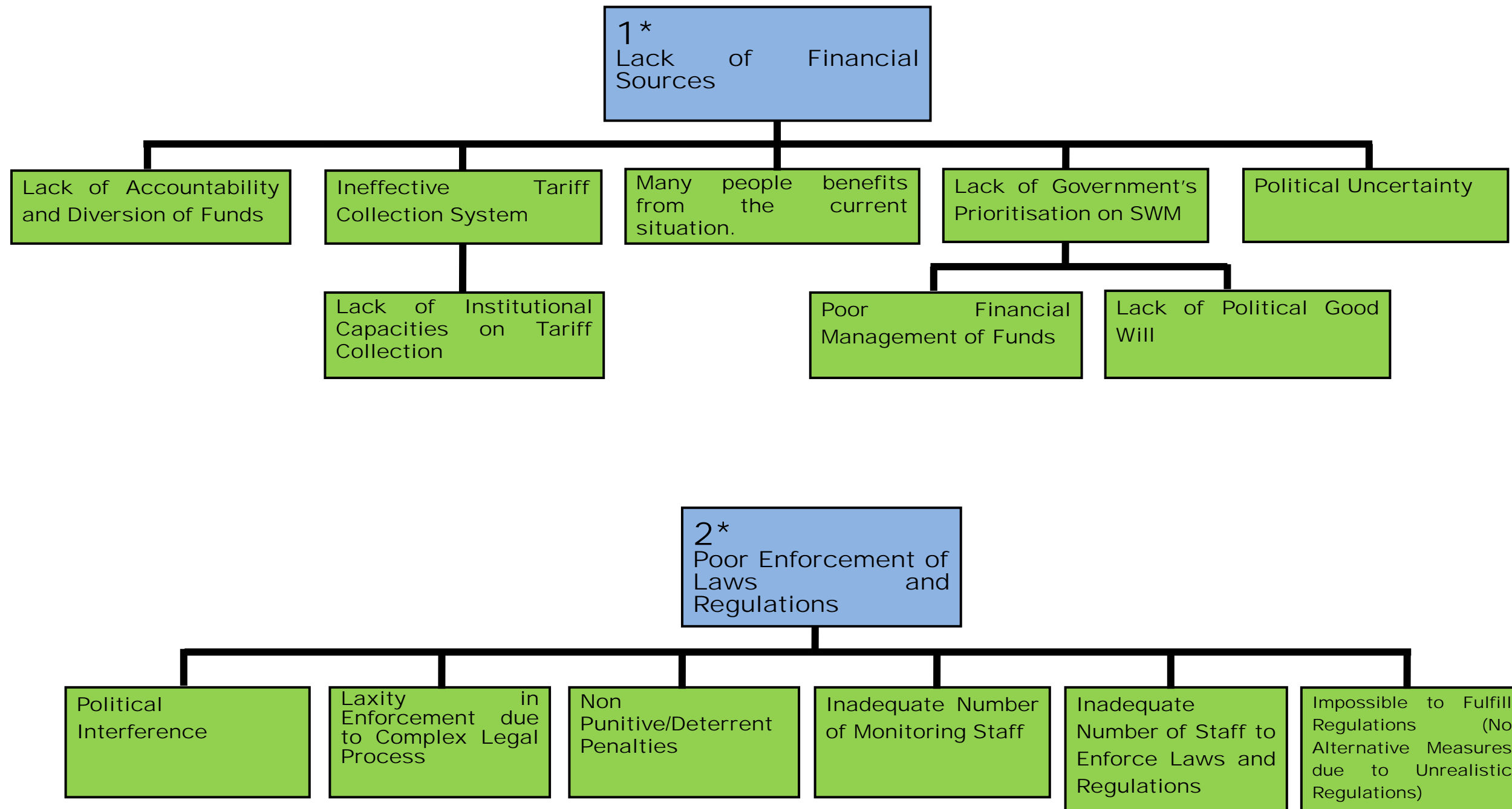
## Group A (Objective Tree: Lower, Solution 3)



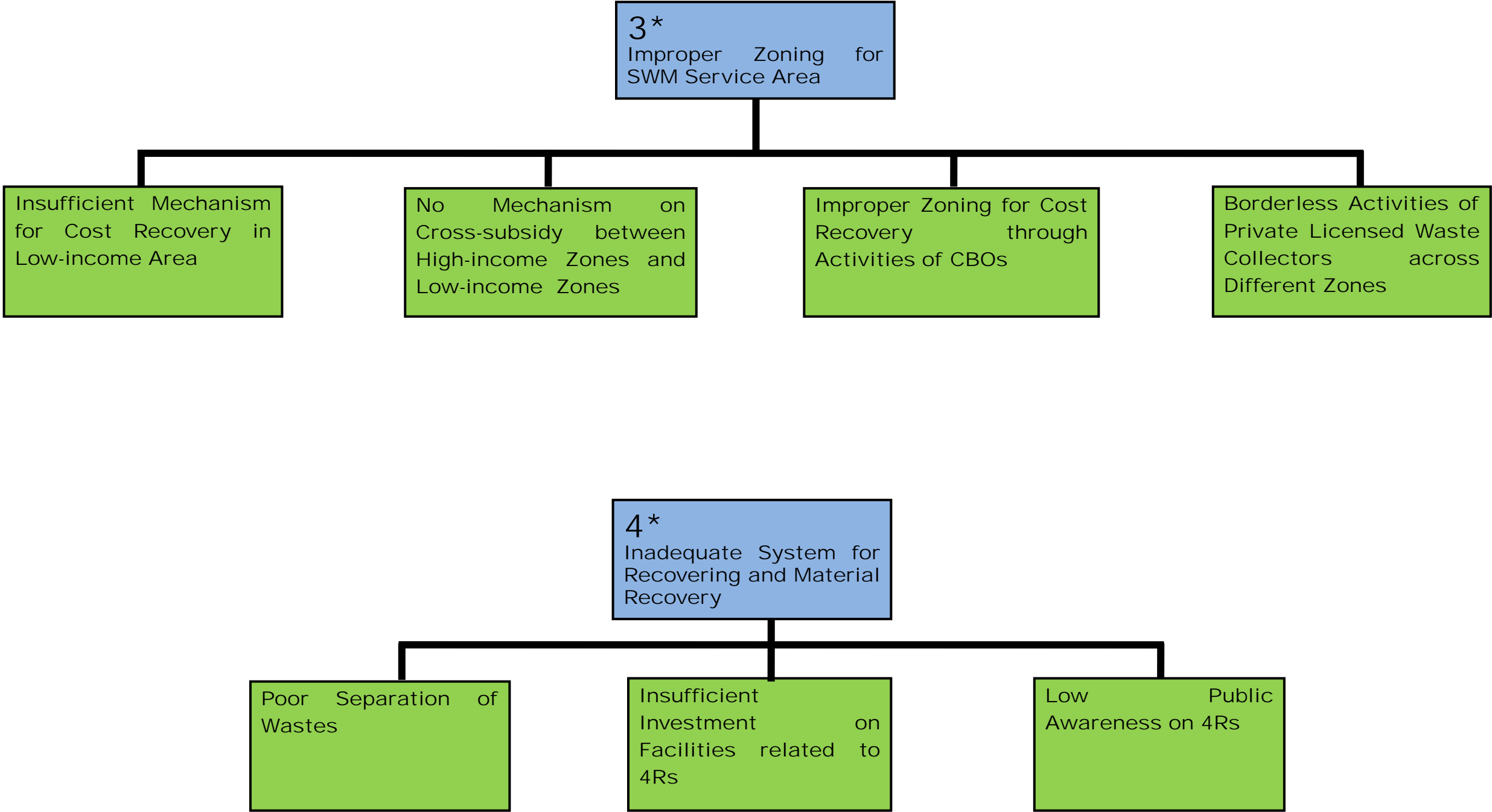
Group B (Problem Tree: Upper)



## Group B (Problem Tree: Lower, Cause 1 and 2)

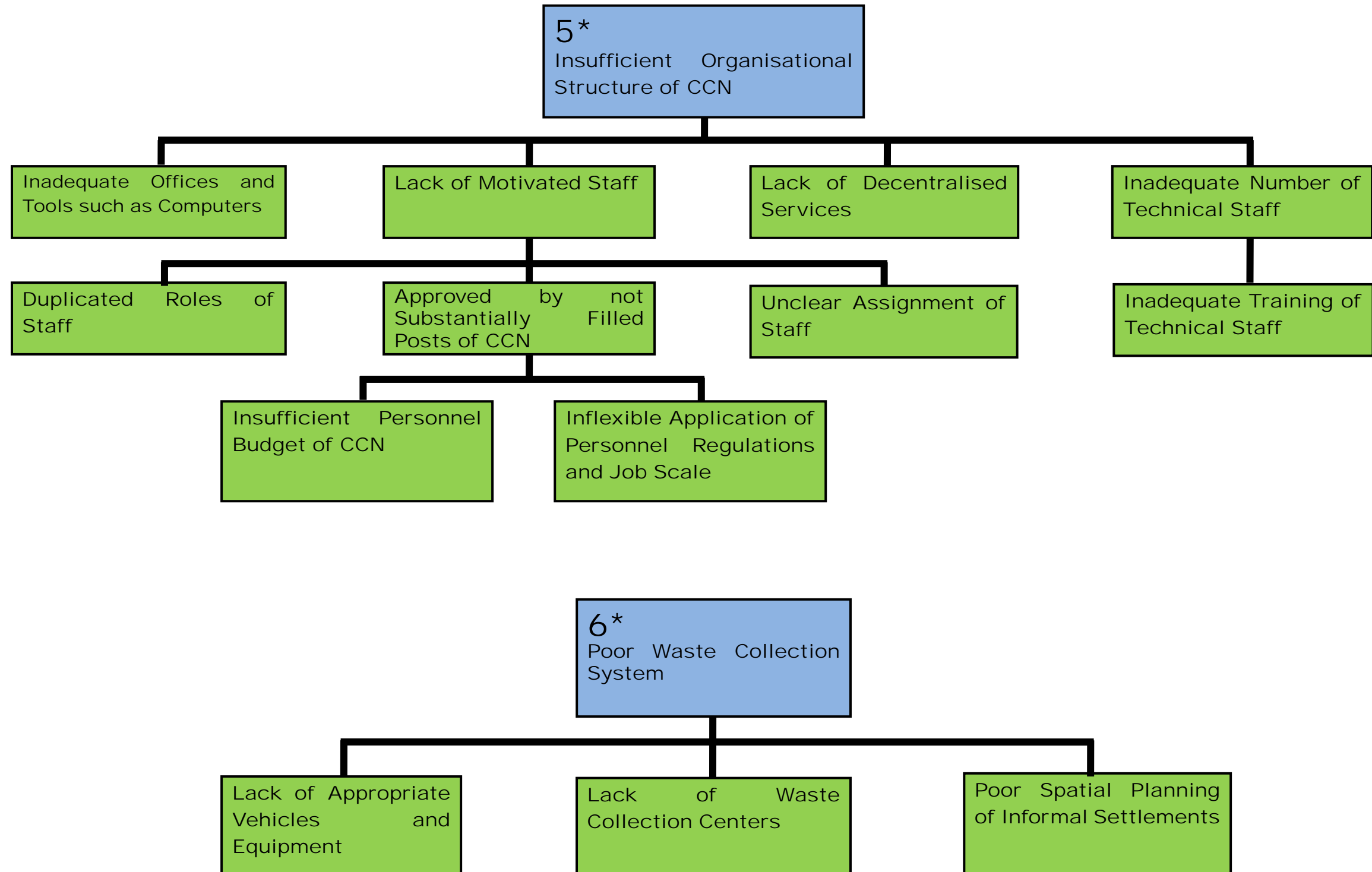


Group B (Problem Tree: Lower, Cause 3 and 4)

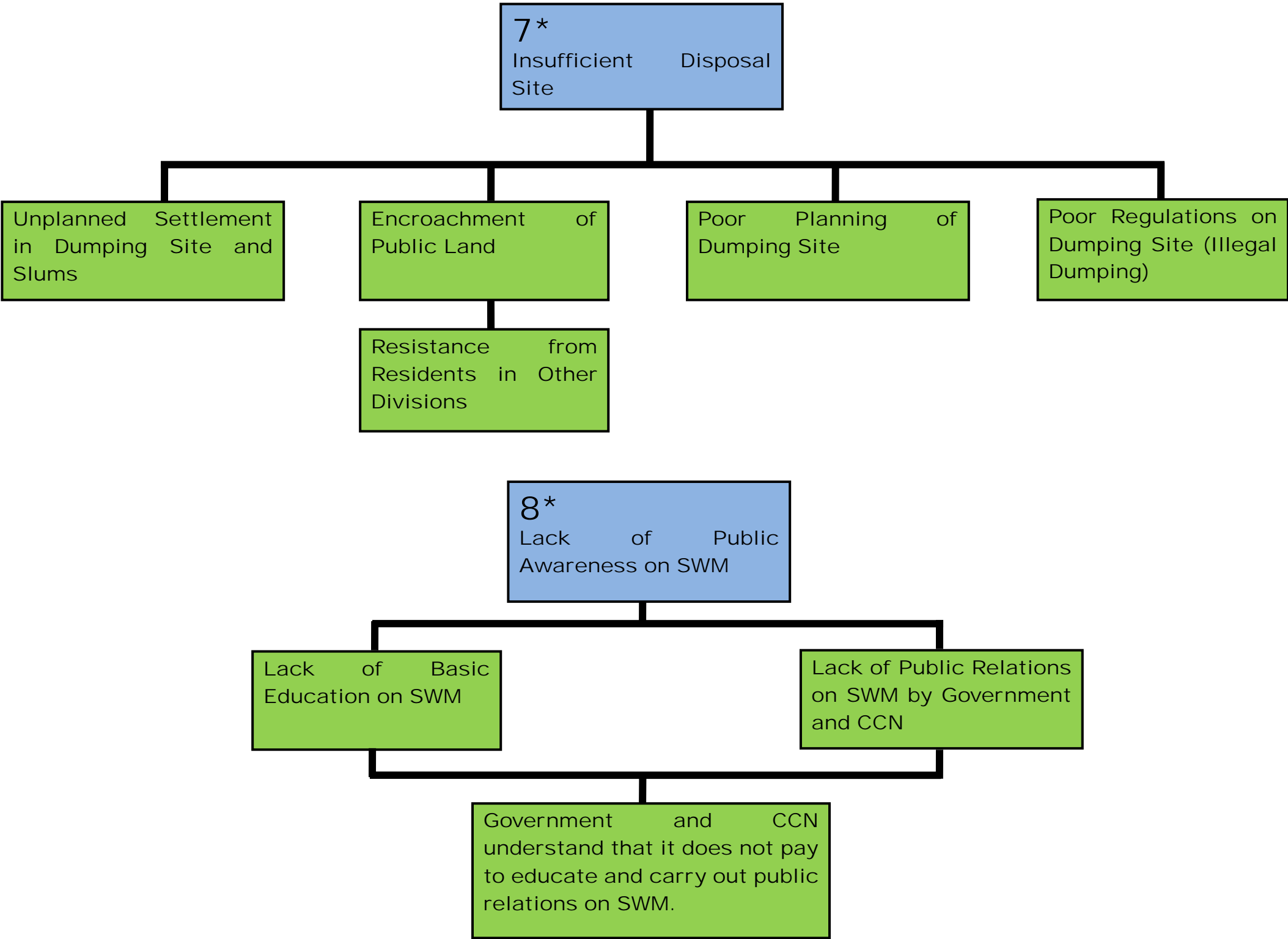




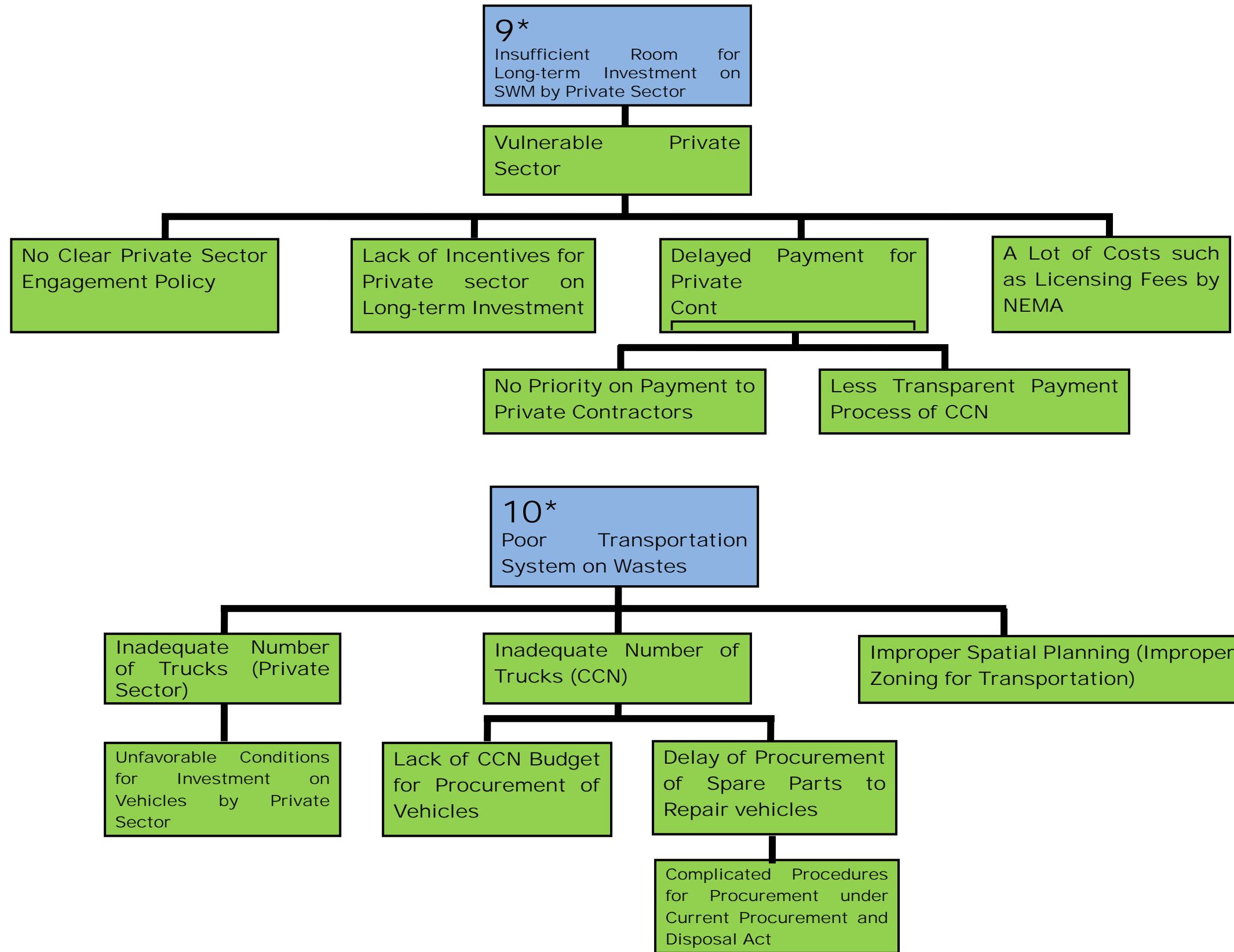
## Group B (Problem Tree: Lower, Cause 5 and 6)



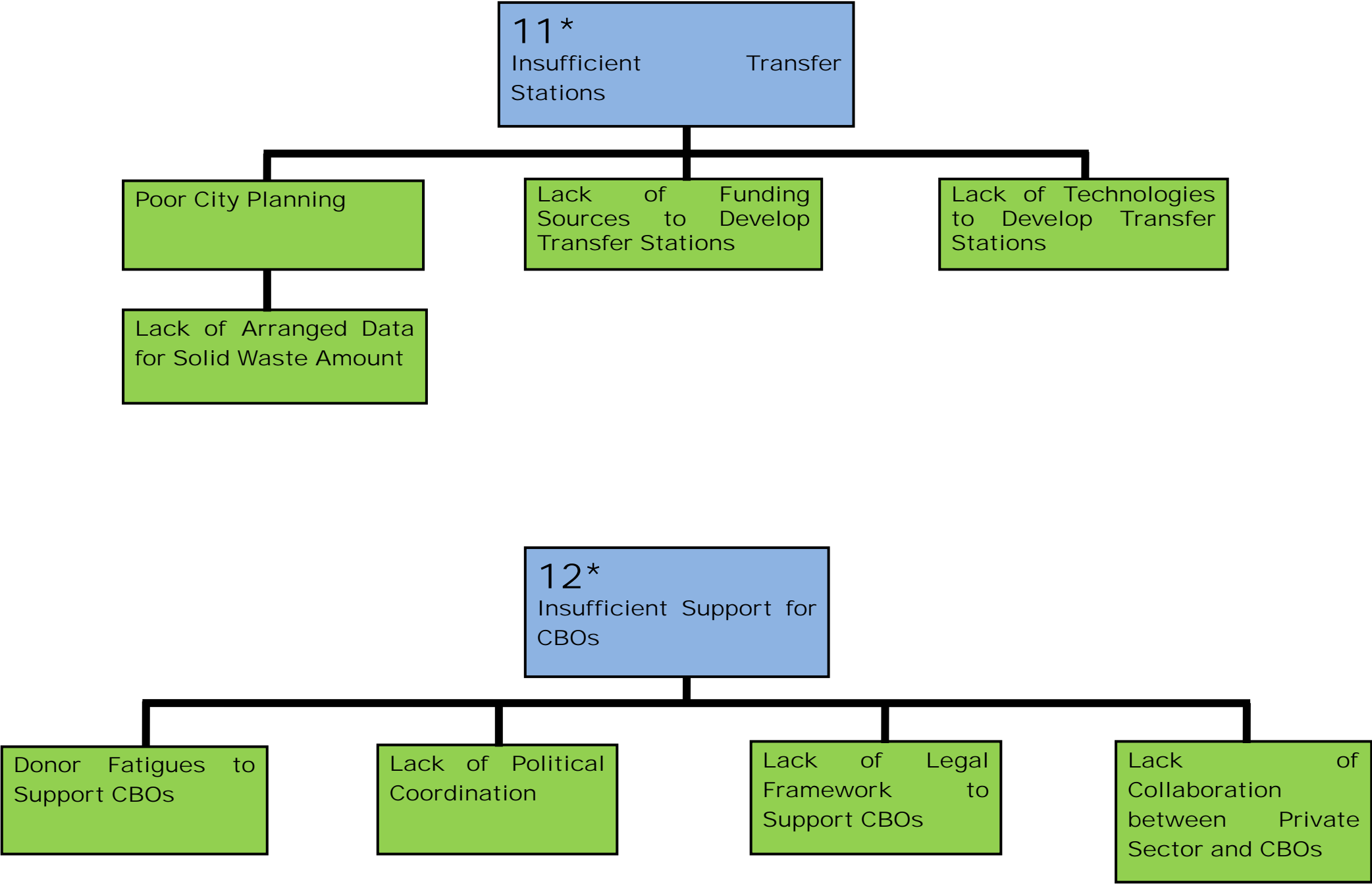
Group B (Problem Tree: Lower, Cause 7 and 8)



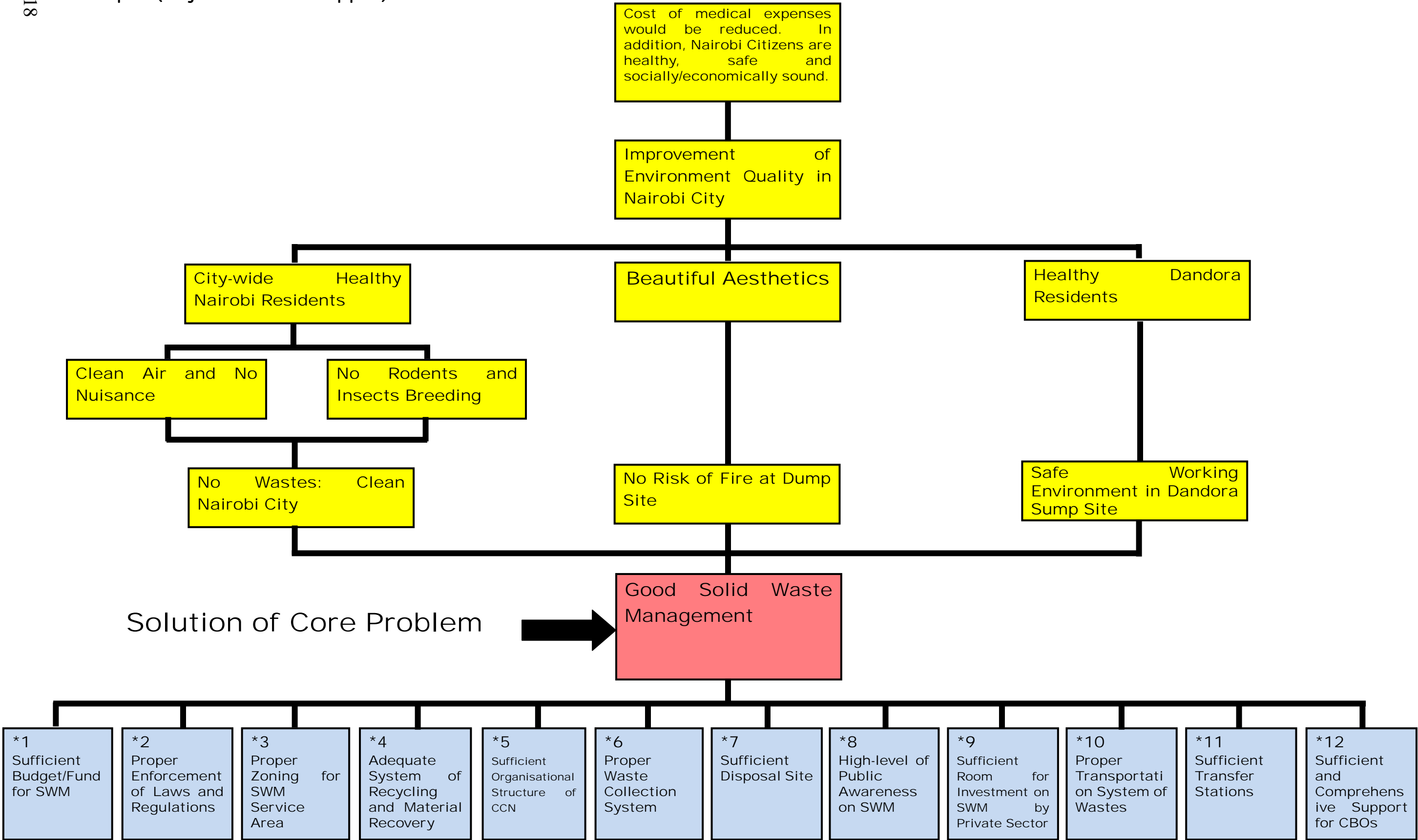
## Group B (Problem Tree: Lower, Cause 9 and 10)



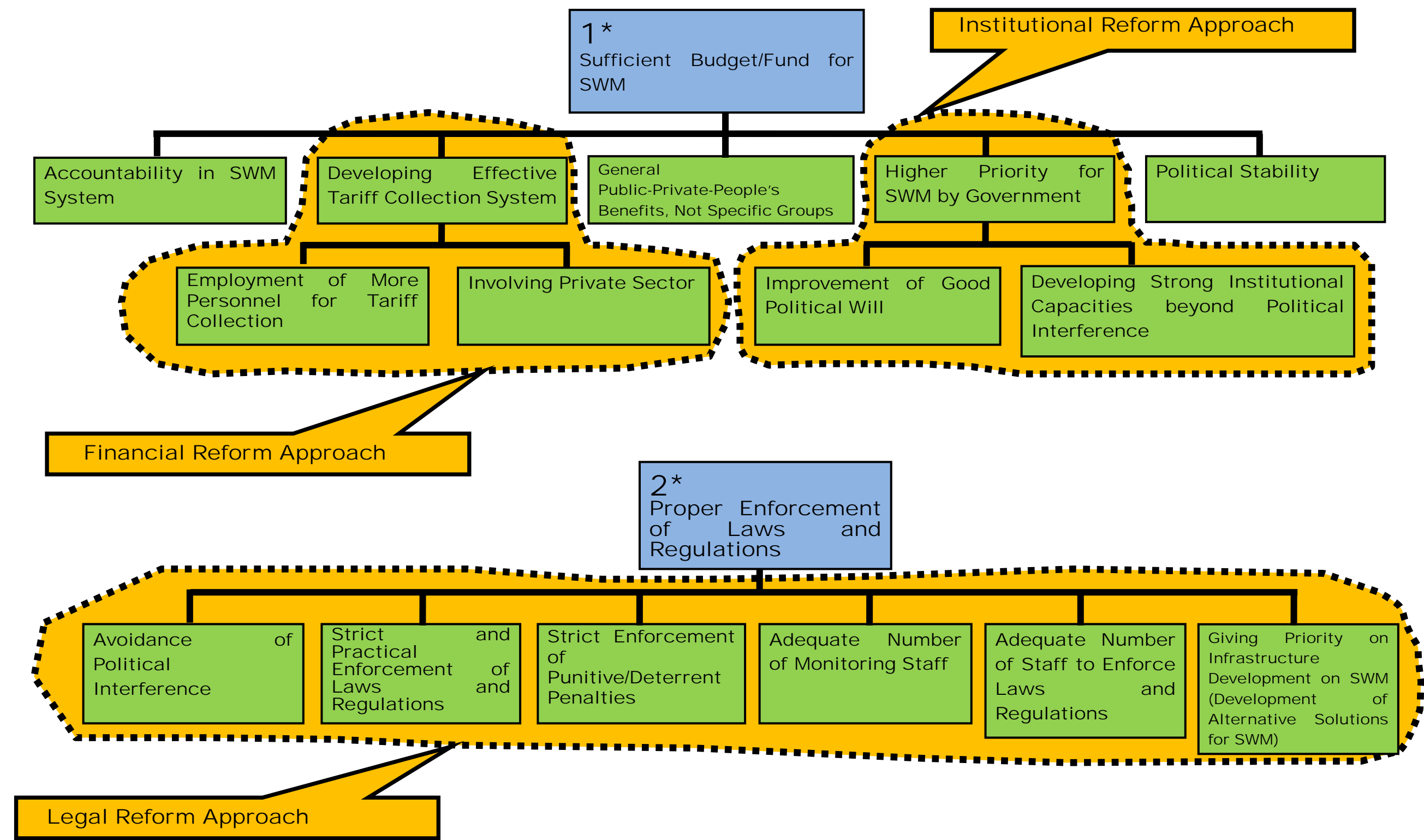
Group B (Problem Tree: Lower, Cause 11 and 12)



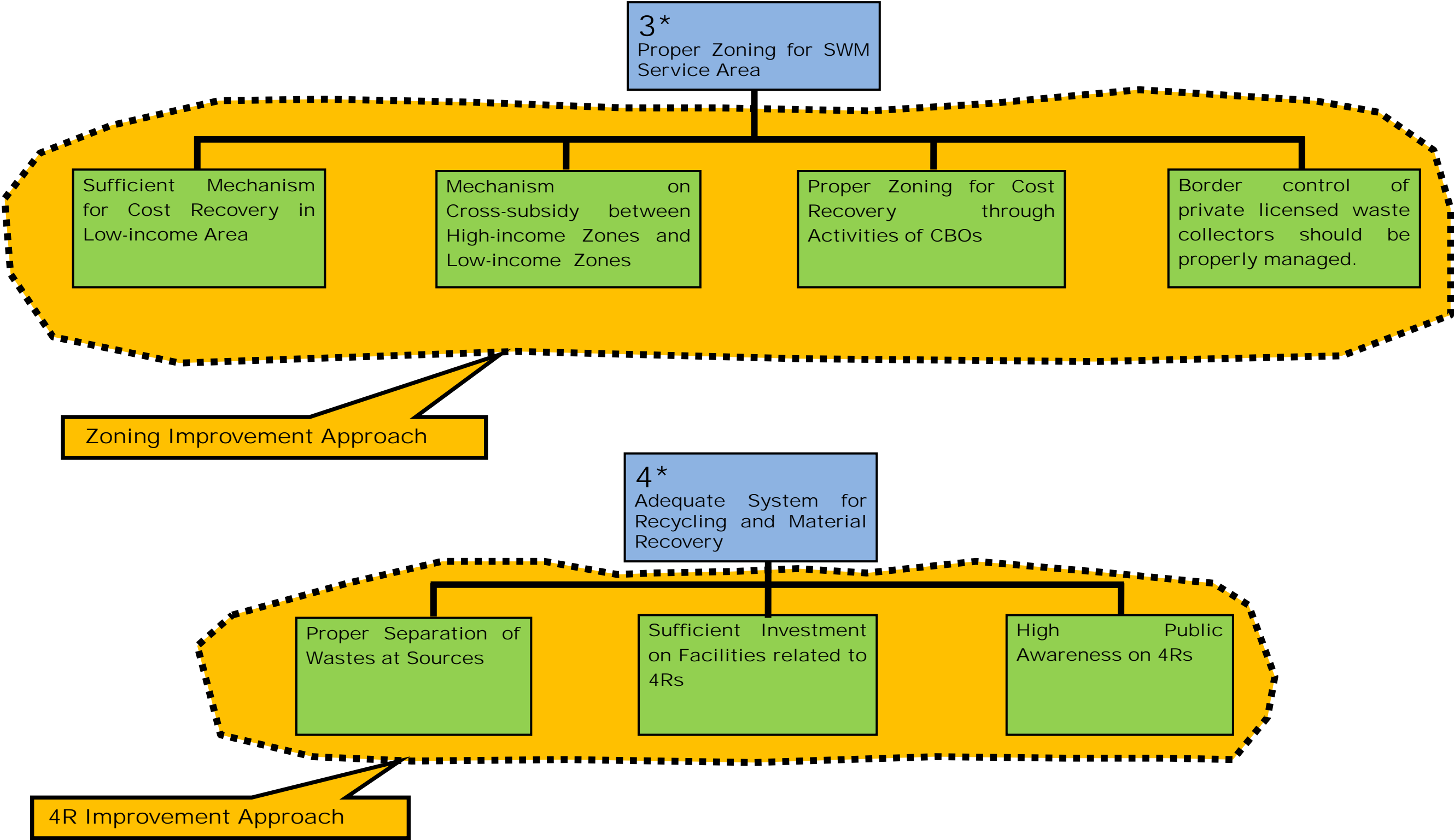
Group B (Objective Tree: Upper)



Group B (Objective Tree: Lower, Solution 1 and 2)

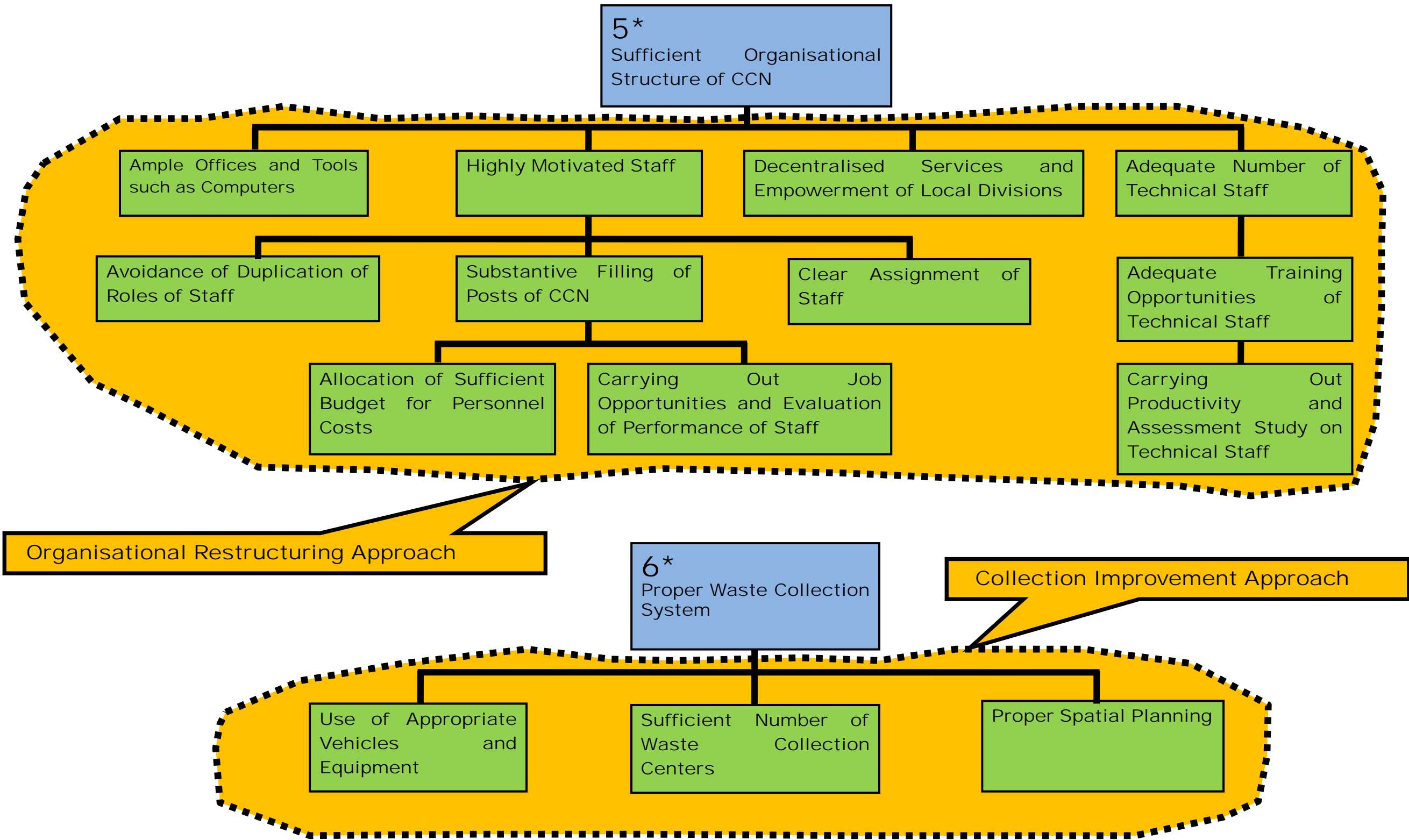


Group B (Objective Tree: Lower, Solution 3 and 4)

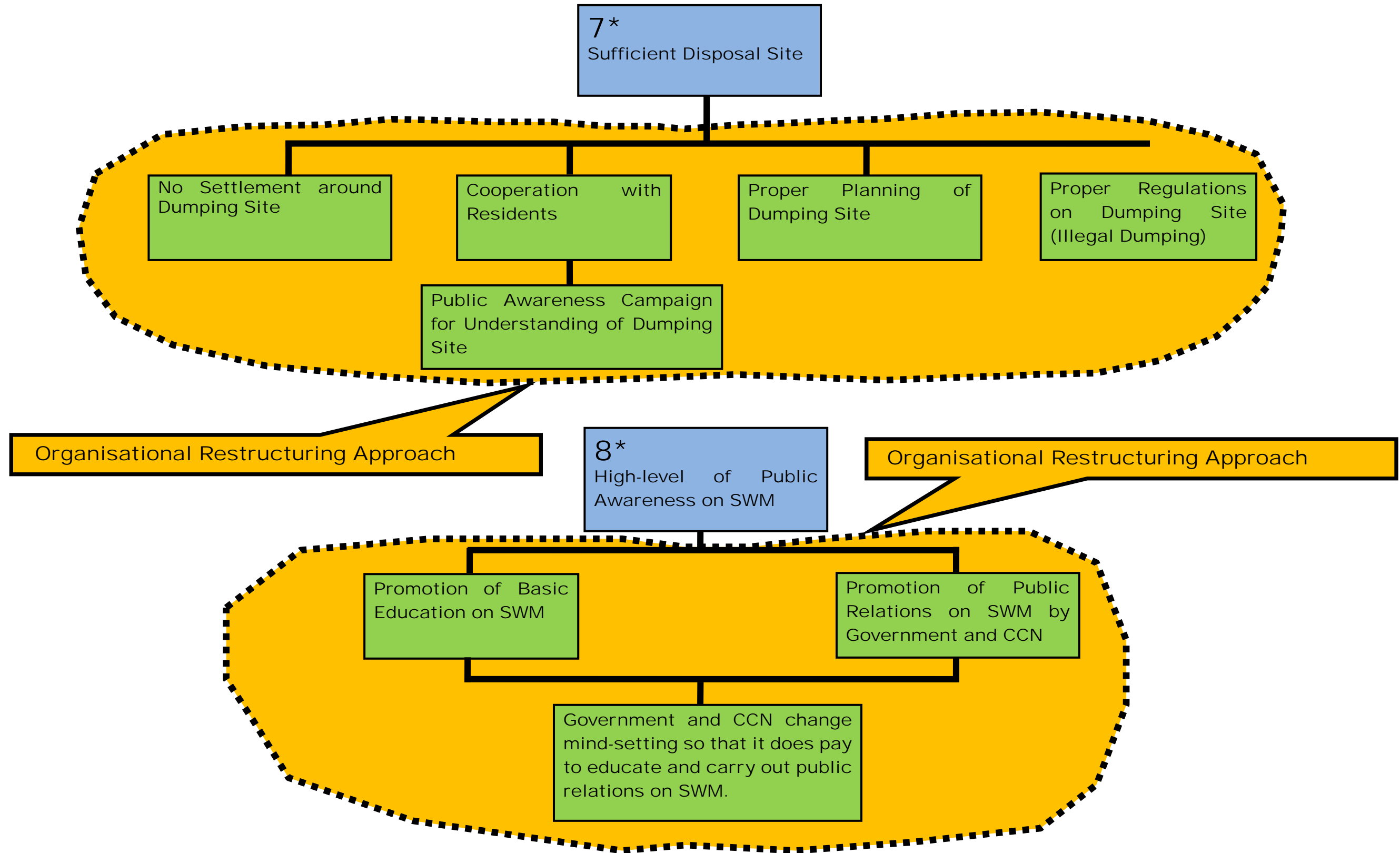




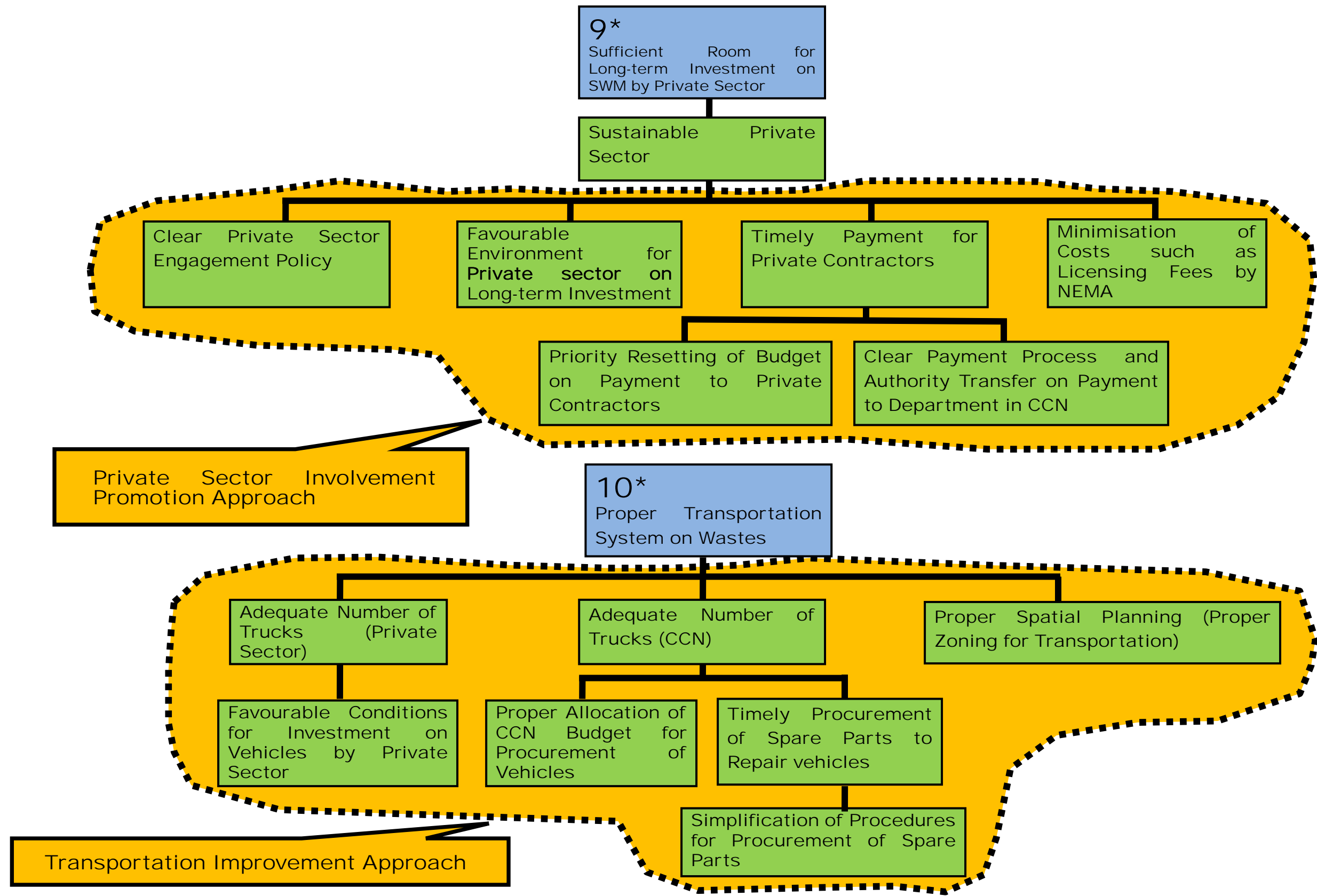
Group B (Objective Tree: Lowe, Solution 5 and 6)



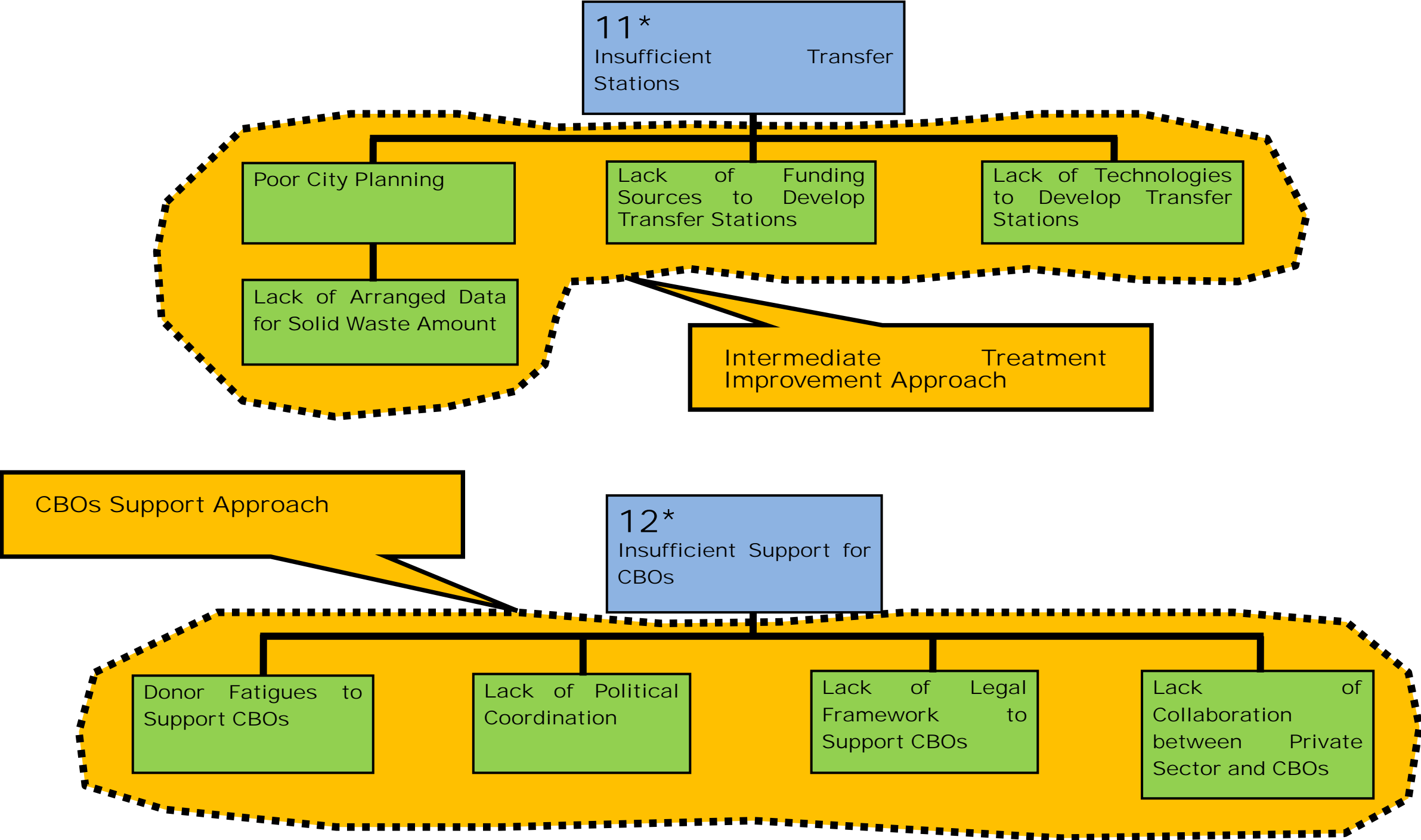
## Group B (Objective Tree: Lower, Solution 7 and 8)



Group B (Objective Tree: Lower, Solution 9 and 10)



Group B (Objective Tree: Lower, Solution 11 and 12)



Project Title:  
Comprehensive Capacity Upgrading Project for Solid Waste Management in Nairobi City

3. Tentative Project Design Matrix

Narrative Summary	Objectively Verifiable Indicators	Means of Verifications	Key Assumptions
<b>Overall Goal</b> The overall goal of the solid waste management in the Nairobi City are proposed as follows: 1. To significantly extend resource recovery, including but going beyond the creation of enabling environments and the development of markets for recyclables;  2. To build awareness and capacity for source separation as essential components of sustainable waste management;  3. To restructure and extend efficient and equitable collection of source-separated waste streams with the view of protection of public health and the environment; and  4. To build environmentally sound infrastructure and systems for safe disposal of residual waste, replacing current disposal sites which must be rehabilitated.	The collection rate of 100% in year 2030, together with the following relevant targets, is an ultimate goal for the solid waste management in the Nairobi City.  <b>1. Collection Rate of Wastes</b> (a) Up to 50% in 2015 (b) Up to 65% in 2020 (c) Up to 100% in 2030 <b>2. Waste Reduction Rate</b> (a) 5% to the potential waste discharge amount in 2015 (b) 10% to the potential waste discharge amount in 2020 (c) 10% to the potential waste discharge amount in 2030 <b>3. Total Resource Recovery Amount</b> (a) 180 ton per day, or the equivalent ratio about 10% to the potential waste collection amount in 2015 (b) 270 ton per day, or the equivalent ratio about 12.5% to the potential waste collection amount in 2020 (c) 450 ton per day, or the equivalent ratio about 16% to the potential waste collection amount in 2030	<b>1. SWMPC's Records on Collection Rates</b> <b>2. SWMPC's Records on Waste Reduction Rates</b> <b>3. SWMPC's Records on Total Resources Recovery Amount</b> <b>4. SWMPC's Annual Report</b>	
<b>Project Purpose</b> In order to significantly improve the efficiency and sustainability of the solid waste management services, the public-owned and ring-fenced Solid Waste Management Corporation (SWMPC) will be established as a fundamental organisational reform of the solid waste management sector. The SWMPC will be established by the end of 2014, and will start its operations at the beginning of 2016.	<b>1. Completion of Smooth Transfer of SWMPC</b> (a) Transfer of Budget to SWMPC by the end of 2014 (b) Transfer of Assets to SWMPC by the end of 2014  <b>2. Completion of Smooth Transfer of Candidate Staff to SWMPC</b> The approximately 600 candidate staff and workers for SWMPC will be smoothly transferred to the following sections of SWMPC by the end of 2014. (a) Executive Board (b) 3 Units (Auditing Unit, Capital Revolving Fund Management Unit, Operating Revolving Fund Management Unit) (c) 9 Departments (Administrative Department, Strategy and Planning Department, Zonal Management Department, Disposal and Intermediate Treatment Department, Direct Service Department, Procurement and Contract Department, Technical Department, Monitoring and Enforcement Department, Community Support Department)	<b>1. Organisational and Staffing Status Report on SWMPC</b> <b>2. Capacity Assessment Report on Candidate Staff of SWMPC</b>	<b>1. The strong political commitment to the implementation of the new Master Plan will be guaranteed.</b> <b>2. The implementation of the new Master Plan is regarded as a priority policy by CCN and the Government of Kenya.</b> <b>3. The construction of the sanitary landfill and the intermediate treatment facilities will be timely funded by external lending organizations.</b> <b>4. There will be full commitment to continuous cooperation to the implementation of the new Master Plan by all stakeholders including the private sector and beneficiaries</b>
<b>Output</b> In order to smoothly transfer the responsible organisation for the solid waste management services from the current DoE to the proposed SWMPC, the creation of the preparatory unit of SWMPC inside the Department of Environment, starting its operations from the middle of 2011, is proposed. The overall goals of the preparatory unit are: <b>1. to comprehensively reorganise functions of the Department of Environment to the ring-fenced SWMPC through the activities of the preparatory unit so that it can effectively and efficiently manage its responsibilities and services of solid waste management; and</b> <b>2. to comprehensively strengthen the human resources capacities of the candidate staff and workers of the preparatory unit to support the function of the SWMPC.</b>	<b>1. Establishment of SWMPC</b> The organisation for the proposed SWMPC with 9 departments and 3 units will be established by the end of 2014.  <b>2. Capacity Development of Candidate Staff of SWMPC</b> A wide range of the following capacities required for the approximately 30 representatives of the candidate staff of SWMPC will be upgraded in parallel with the establishment of the SWMPC. (a) Capacity for Public-Private Partnership and institutional Reform (b) Capacity for Establishment of SWMPC and Financial Management (c) Capacity for operating 3R, intermediate treatment and collection/transportation (d) Capacity for operating the new sanitary landfill site (e) Capacity for planning and operating community participation and public awareness	<b>1. Organisational and Staffing Status Report on Preparatory Unit for SWMPC</b> <b>2. Capacity Assessment Report on Candidate Staff of SWMPC</b>	<b>1. Strong political commitment to initiate the new Master Plan will be guaranteed.</b> <b>2. The budget to establish SWMPC will be properly allocated.</b> <b>3. The Act for the Establishment of SWMPC will be timely enacted.</b> <b>4. Zoning for the introduction of the new franchise system will be properly streamlined.</b>
<b>Activities</b>	<b>&lt;Donor Organisation&gt;</b> <b>1. Dispatch of Consultants</b> (a) Team Leader/Comprehensive Integrated Solid Waste Management: 9 M/M (b) Public-Private Partnership and Institutional Reform: 36 M/M (c) Establishment of SWMPC and Financial Management: 32 M/M (d) 3R/Intermediate Treatment/Collection and Transportation: 18 M/M (e) Final Disposal: 11 M/M (f) Community Participation Promotion : 18 M/M  <b>2. Procurement of Equipment</b> (a) Vehicles : 2 Units (b) PC : 12 Units (c) Local Area Network : 1 Unit (d) Office Equipment for Preparatory Unit : 1 Unit (e) Equipment and Materials for Pilot Projects: 1 Unit  <b>3. Overseas Training for Counterparts</b> (a) Counterpart for Team Leader: 2 Months (b) Counterpart for Public-Private Partnership and Institutional Reform: 2 Months (c) Counterpart for Establishment of SWMPC and Financial Management: 2 Months (d) Counterpart for 3R/Intermediate Treatment/Collection and Transportation : 2 Months (e) Counterpart for Final Disposal: 2 Months (f) Counterpart for Community Participation: 2 Months  <b>4. Implementation of Pilot Projects</b> (a) Pilot Project for Improvement of Primary Collection in low-income and Slum Areas (b) Pilot Project for Community Composting (c) Pilot Project for Improvement of Capacity of Charge Collection in Low-income and Slum Areas	<b>&lt;Kenyan Side&gt;</b> The director of the Department of Environment of CCN will be the head of the counterpart organization, while the following staff, office space /equipment, and operating budget of the current Department of Environment of CCN will be utilised as input of the Kenyan side. <b>1. Counterpart Staff</b> (a) Unit and Department Managers: 12 (b) Unit and Department Deputy Managers : 12 (c) Other Counterparts: 6:  <b>2. Office Space and Equipment</b> (a) SWMPC Preparatory Unit Office: 1 (b) Office Equipment (c) Local Area Network  <b>3. Operating Budget</b> (a) Personnel Cost for Counterpart Staff (b) Running Cost for Office Space	<b>1. The new Master Plan will be accepted by all stakeholders including the private sector and communities.</b>  <b>Pre-condition</b> <b>1. The implementation of the new Master Plan is regarded as a top priority issue by CCN and the Government of Kenya.</b> <b>2. Ample financial resources will be available for the preparation of the full-scale implementation of the Master Plan.</b> <b>3. The preparatory unit for SWMPC will be timely approved.</b> <b>4. The special account for SWM will be timely approved.</b>

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**SECTION C**

**COLLECTION AND TRANSPORTATION STUDY**

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## **1. Time and Motion Survey**

### **1.1 Background of the Survey**

In response to the request of the Government of Republic of Kenya, the Government of Japan decided to conduct “The Preparatory Survey for the Integrated Solid Waste Management in Nairobi City in the Republic of Kenya” in cooperation with the authorities concerned of the Government of Republic of Kenya.

The Time & Motion Survey was carried out mainly for the collection vehicles of CCN, the subcontracted contractors’ vehicles and the private collection vehicles subordinately for comparison of the vehicle operation efficiency.

### **1.2 Objective of the Time and Motion Survey**

This survey was conducted for the purpose of evaluation of the efficiency of waste collection and transportation efficiency of the garbage collection trucks operated by the CCN and the CCN sub-contracted service providers in comparison to the waste collection operation by the private service providers.

The result of the survey has been evaluated for the basic data for a waste collection plan.

### **1.3 Selection of Objective Collection Vehicles**

The selected trucks were two CCN trucks, two subcontracted contractors’ trucks and four private trucks. The selected subcontractors are Dorkam Enterprises and Jesker. The four private collectors are Simple Garbage, Zoa Taka, Garbage Dot Com and Bins Nairobi Services.

Time and motion survey was adopted for the purpose of analyzing the different collection vehicles’ efficiency in terms of route conditions and distances, carried waste amounts per unit times such as travelling time, loading time and offloading time in the two distinct seasons of the year namely the wet season and the dry season.

The type of vehicles and number of survey days for CCN, sub-contracted contractors and private collection services was done in consideration of the types of vehicles, collection areas and waste discharge methods as well as their working hours.

In general, the sampled trucks can be categorized as below:

<b>Collection area</b>	<b>CBD</b>	<b>Residential Area</b>	<b>Industrial Area</b>	<b>No of days</b>	<b>Total</b>
CCN collection Area	KAW 732Z	KAW 743Z		12	12 unit-days
Sub-contracted Contractor Area		KWD 632		6	12 unit-days
		KAC 088J		6	
Private Service Area	KPB 307		KAM 906Z	12	24 unit-days
	KAD 891J		KAM 019E	12	
<b>Total unit-day per season</b>					<b>48 unit-days</b>
<b>Total unit-day for 2 seasons</b>					<b>96 unit-days</b>

However, it should be noted that in some days the trucks would collect into other regions outside the category above.

## **1.4 Survey Area**

Time and Motion Survey was planned for the representative collection vehicles that collect garbage in the CBD region, Lang'ata region, Westlands region, Makadara region and Embakasi region.

However on some days, various vehicles went out of their designated routes and collected garbage in Kasarani region, Kamukunji region, Mlolongo Area and Starehe region.

## **1.5 Survey Method**

The survey was conducted based on the following set up:

### **1.5.1 Survey period**

Wet Season - from Monday 30<sup>th</sup> November 2009 to Thursday 17<sup>th</sup> December 2009.

Dry Season - from Monday 4<sup>th</sup> January 2010 to Wednesday 20<sup>th</sup> January 2010.

Each season had 48 unit-days.

The two seasons therefore had 96 unit-days from Monday 30<sup>th</sup> November, 2009 to Wednesday 20<sup>th</sup> January, 2010

### **1.5.2 Coordination prior to the time and motion survey**

Prior to the commencement of the survey, the survey plan was explained to the respective CCN area Environment Supervisors, the Proprietors of the sub-contracted contractors and the Proprietors and operation managers of the Private collection services providers.

The surveyors were carried in a chase car that met the representative vehicles at their days start point i.e. garage and monitored the representative vehicles through all their day's operations and back to their day's end point i.e. garage or otherwise.

### **1.5.3 Deployment of Surveyors**

Four surveyors were deployed, one for each truck for the two different seasons and followed the representative trucks in a chase car together with the GPS device.

### **1.5.4 Recording method**

One set of GPS device model Garmin foretrex 301 was used by each surveyor to mark the arrival and departure at the collection points for recording the odometer reading, the waypoints of time of arrival and departure for every stop point in the truck's route.

## **1.6 Processing of Survey Data**

The software, Google Earth was used for importing the GPS record into computer and for the data to plot the tracking route on the map.

Excel was used for processing the KASHMIR data into cumulative time and mileage graph.