



Non Sequitur

Integrating the Illogical



Introducing

Non Sequiturs and Constraints for Sustainable Development



ESRI Geodesign Summit
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ISO 37120: Sustainable Development of Communities

The requirements contained in this International Standard are applicable to **any** city... that undertakes to measure its performance in a comparable and verifiable manner, **irrespective of size and location**.

ISO 37120: Sustainable development of communities, Indicators for city services and quality of life. First edition 2014-05-15 ISO 37120



Infrastructure for Stable Communities and Non Sequiturs



What are Engineering 'Non Sequiturs'?



**Visible
Non Sequiturs**

Are sometimes unknown explanations and behaviors associated with infrastructure



“Physical structure is crucial in a system, but is rarely a leverage point, because changing it is rarely quick or simple. The leverage point is in proper design in the first place.”

- Donella H. Meadows, Thinking in Systems – A Primer

Urban infrastructure are “socio-technical systems” that determine the nature of flow and interaction

What's the Project? What Expertise is Required?

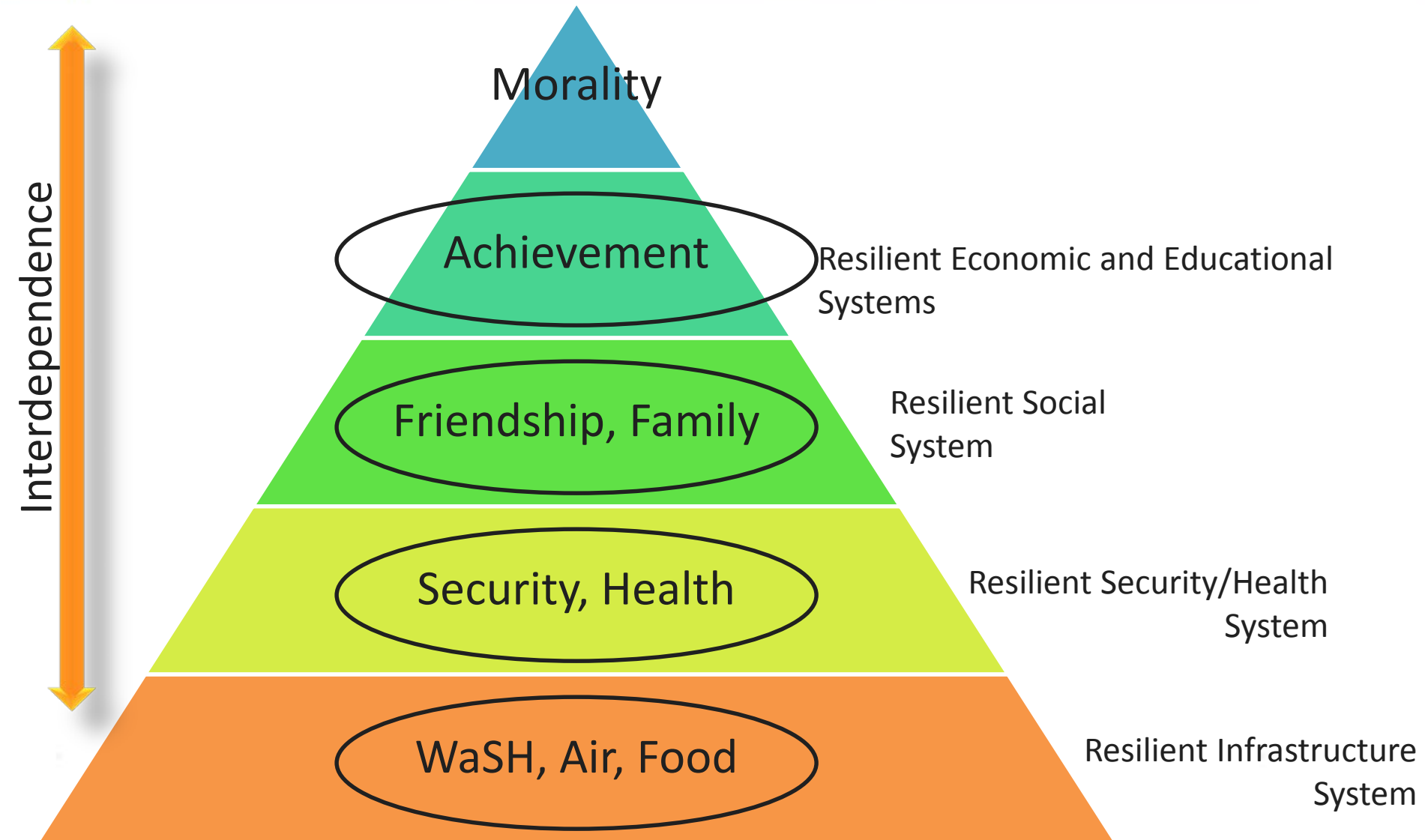


How A Lack Of Toilets Puts India's Women At Risk Of Assault

by JULIE MCCARTHY

June 09, 2014 3:59 AM ET

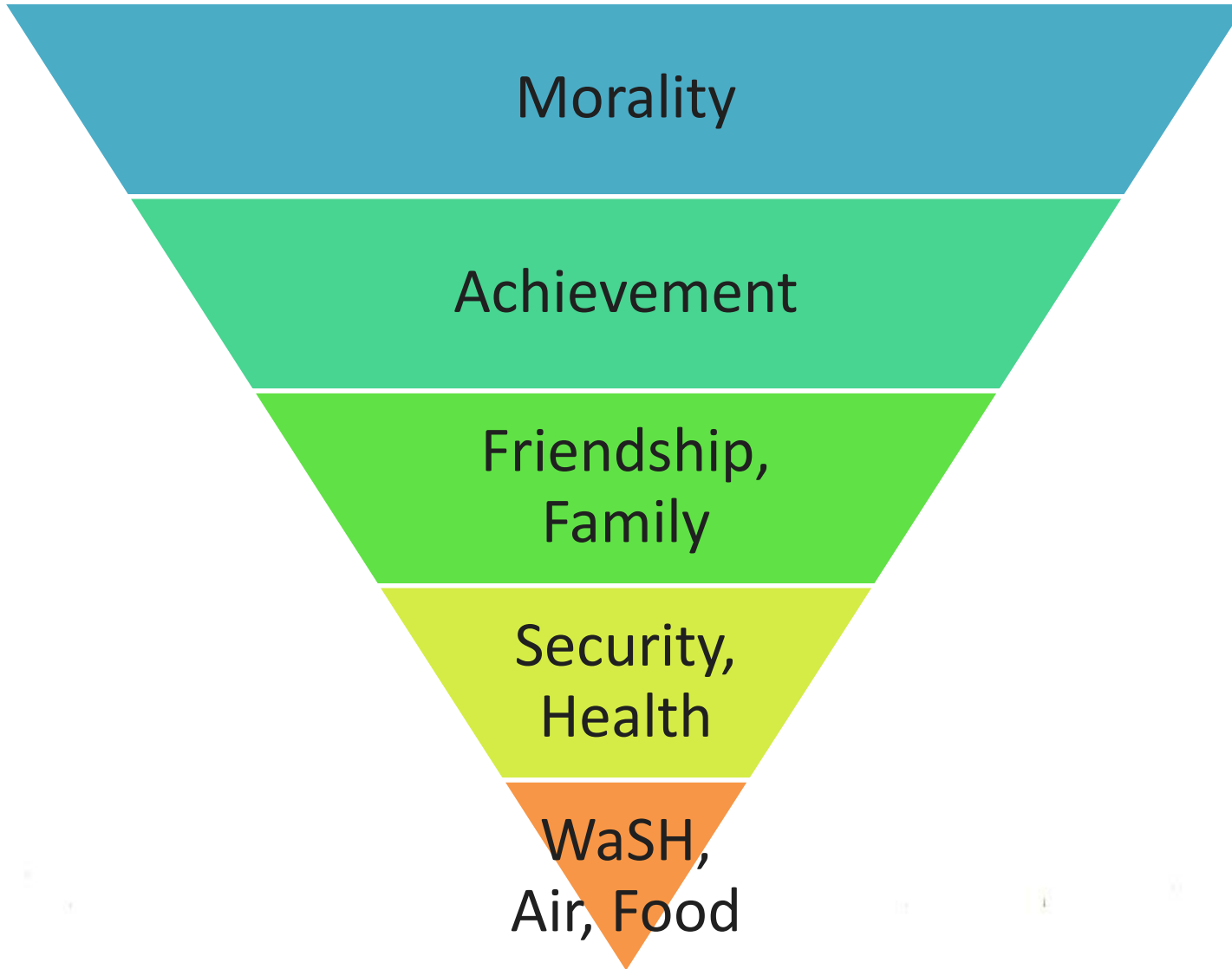
Maslow and Underlying Systems



Proportional Time Spent: Post Disaster/Informal Slums



Proportional Time Spent: Developed Nations



Proportional Time Spent: Developing Nations



Morality

Achievement

Friendship,
Family

Security,
Health

WaSH, Air, Food



Systems and Paradigms

“Paradigms are the sources of systems.”

- Donella H. Meadows, Thinking in Systems – A Primer



Comprehensive Infrastructure, e.g. Denver



Potable water supply is an indicator of city health and quality of life.

- ...potable water through a pipe that is connected to a network, the supply of which is relatively continuous given that it includes a deposit built for its storage.

What is the effect of
'relatively continuous'
water supply?



2014
REVISION

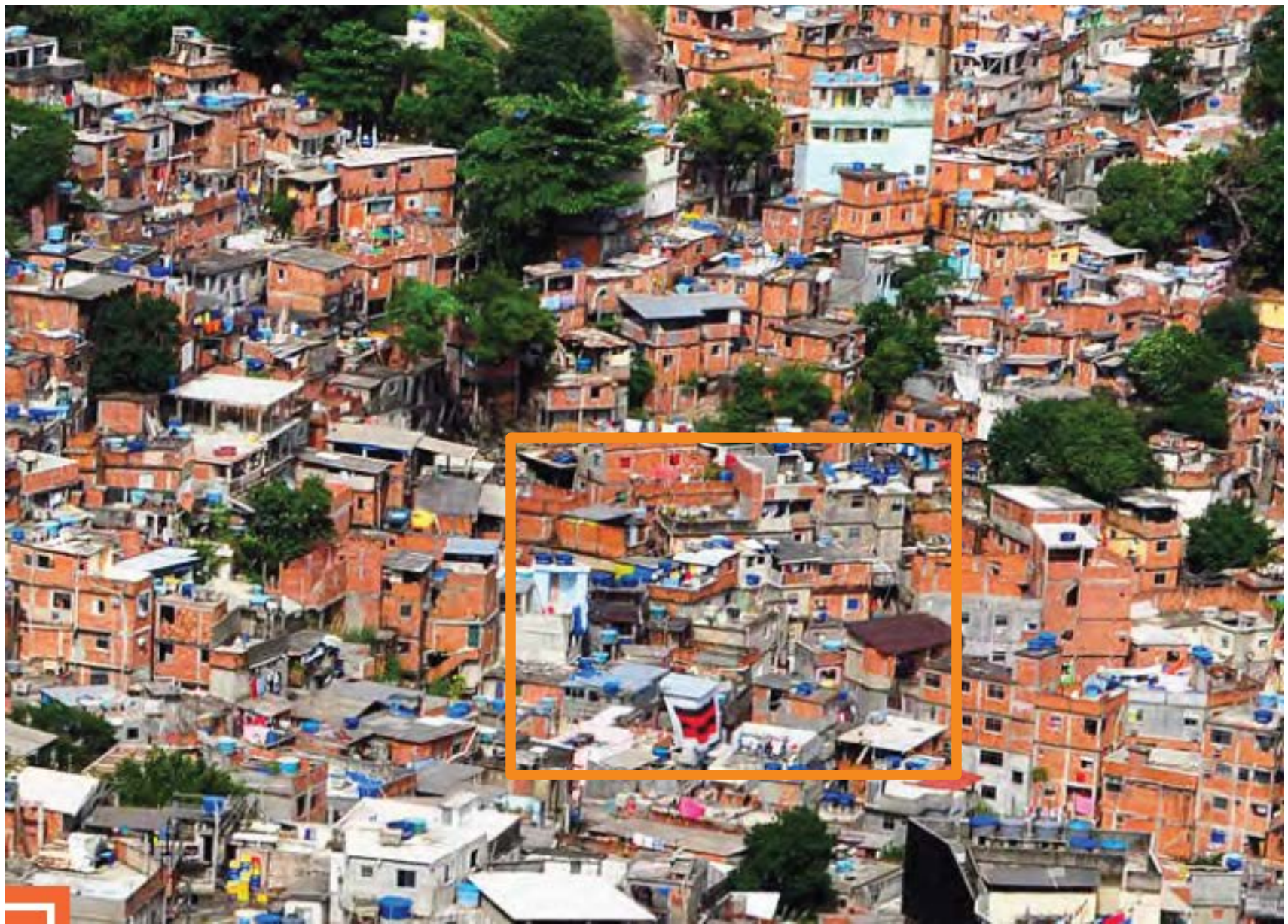
World Urbanization Prospects



[highlights]

United Nations, Department of Economic
and Social Affairs, Population Division
(2014).

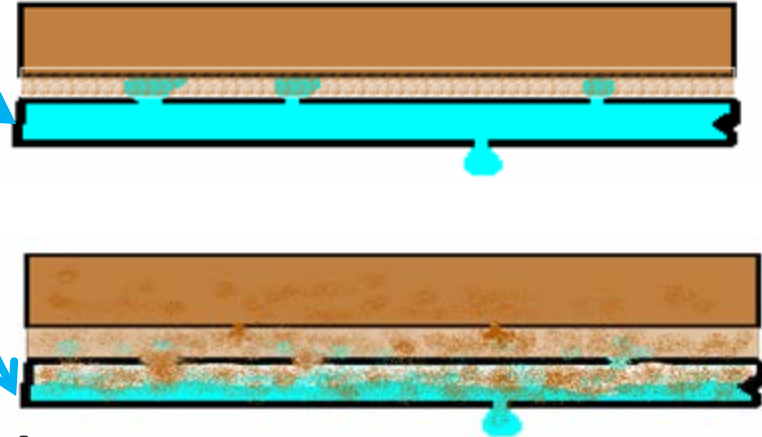
*World Urbanization Prospects: The 2014
Revision, Highlights (ST/ESA/SER.A/352).*





'Relatively Continuous' Water Contamination

Pressurized
Unpressurized



1. Reverse pressure in pipes
2. Insect and air-borne contamination
3. Unsanitary mobile storage vessels



A Single Approach for Sustainable Development?

A

Failed Comprehensive

Formal?

B

Disconnected

Humanitarian?



Can you look at both paradigms as a single system?

Are 'appropriate technologies' the common denominator?



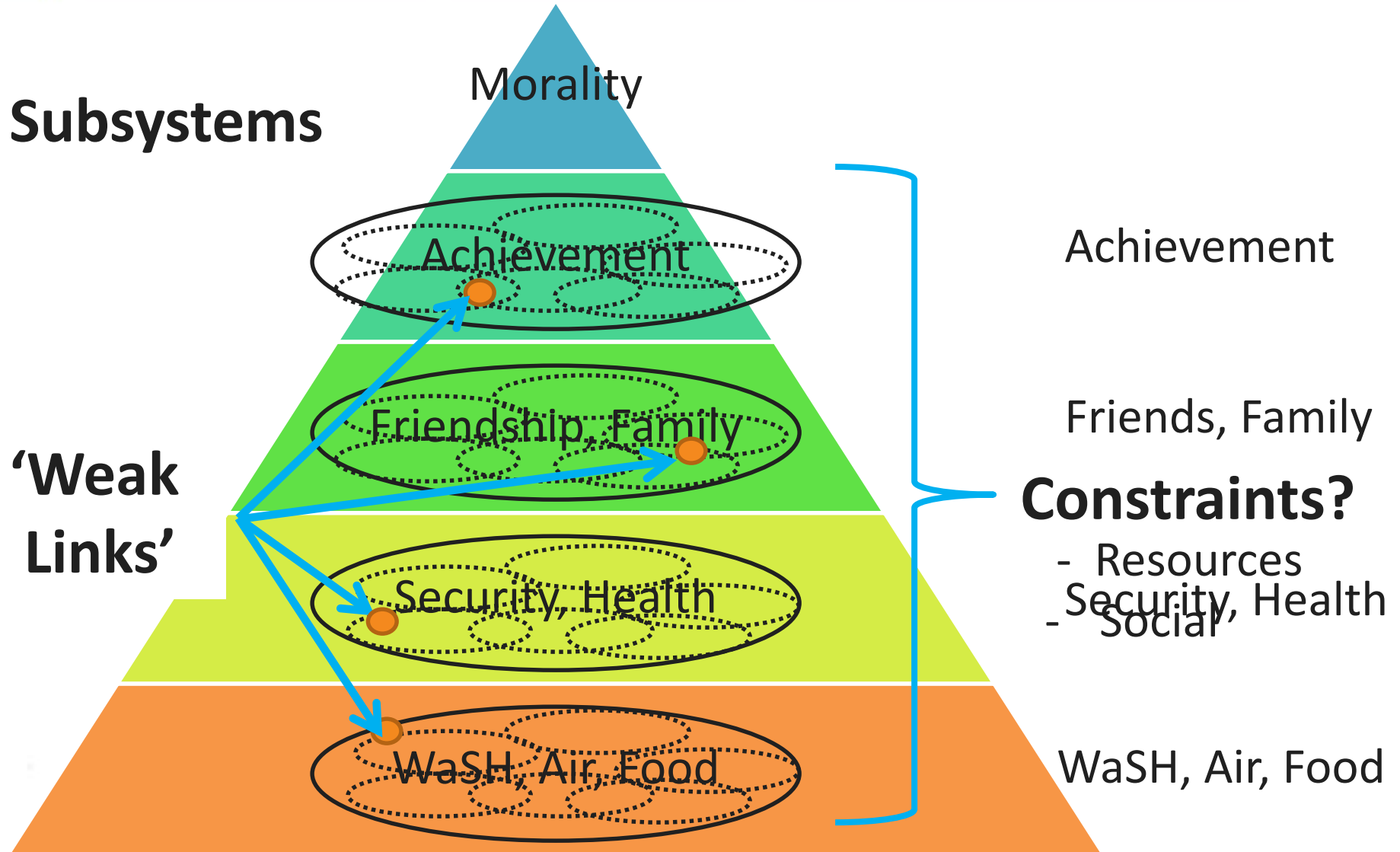
Resilient Cities and Constraints for Low-Carbon Infrastructure: Kigali

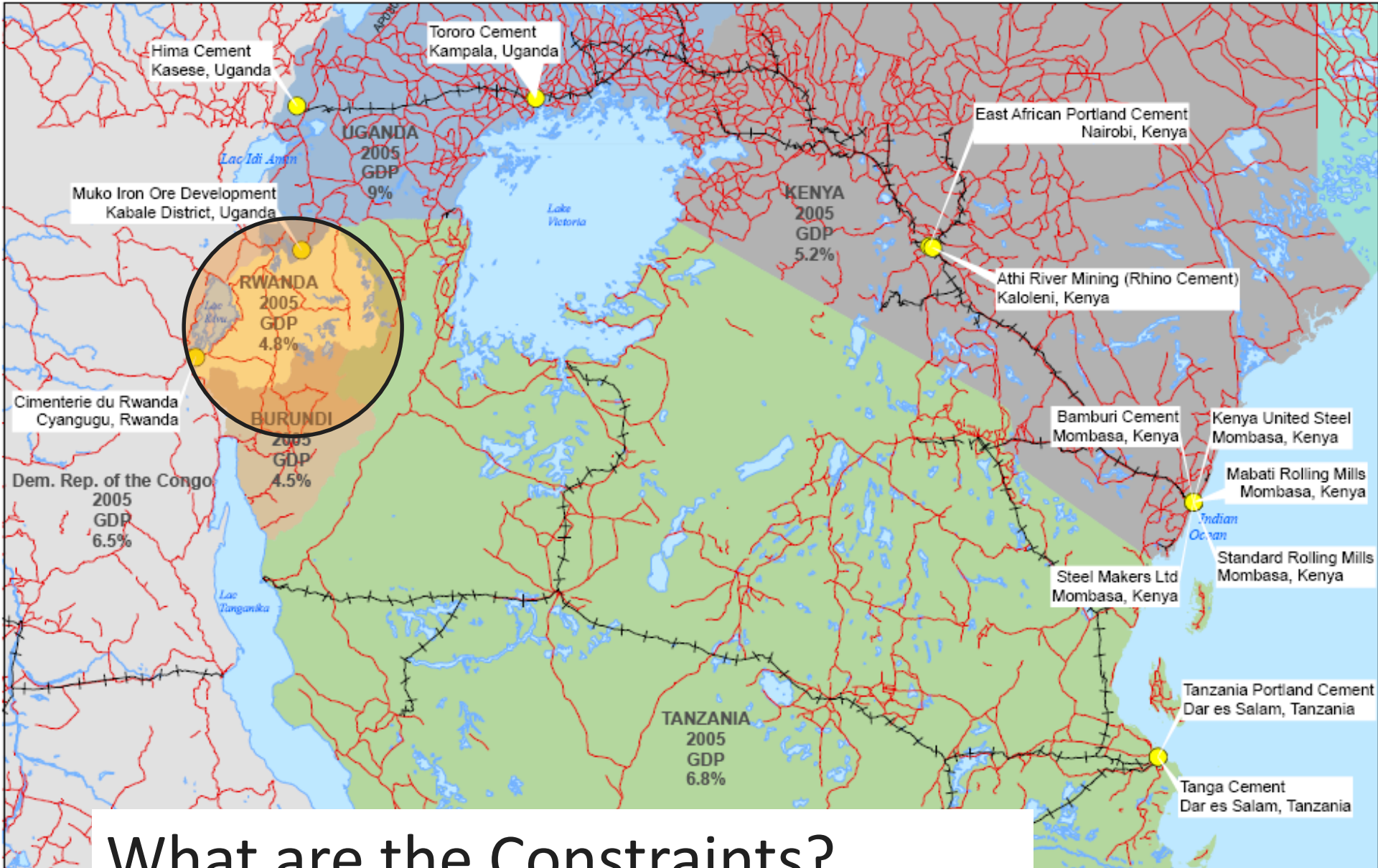


“The ability to self-organize is the strongest form of system resilience.”

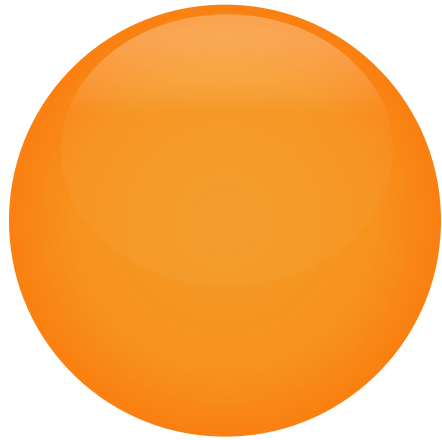
- Donella H. Meadows, Thinking in Systems – A Primer

Resilience and a City's DNA





What are the Constraints?



ENERGY AND SOCIAL CONSTRAINTS

Storm Water and Municipal Solid Waste

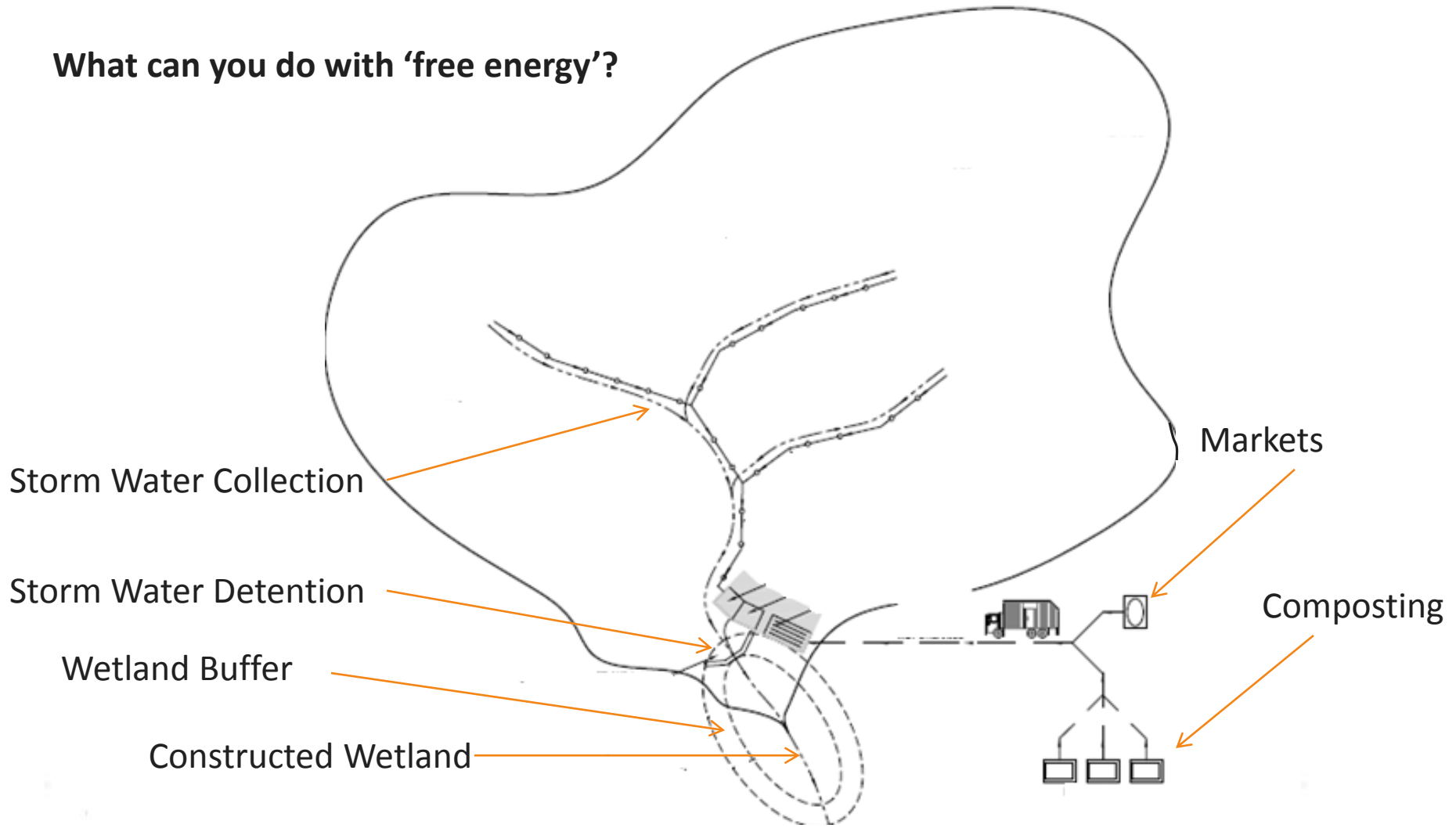


Panic can drive innovation!!



Kigali: One Watershed at a Time

What can you do with 'free energy'?



Human-Centered Before Metric Centered

- MSW *unregulated* by government. Nearly all collected by genocide survivor women associations: SAMI and AMIZERO
- Household collectors transport waste (up to 5 km) to separation sites by foot or bicycle.
- Design is to reduce burden of vertical gains on collectors and facilitate the good work.

A: MSW Landfill

B: Hazardous Waste Facility

C: Separation Site

D: Central Collection

E: Industrial Source

F: Processing Briquettes/Compost

G: Residential Source

H: Commercial Source

ETZ: Environmental Treatment Zone

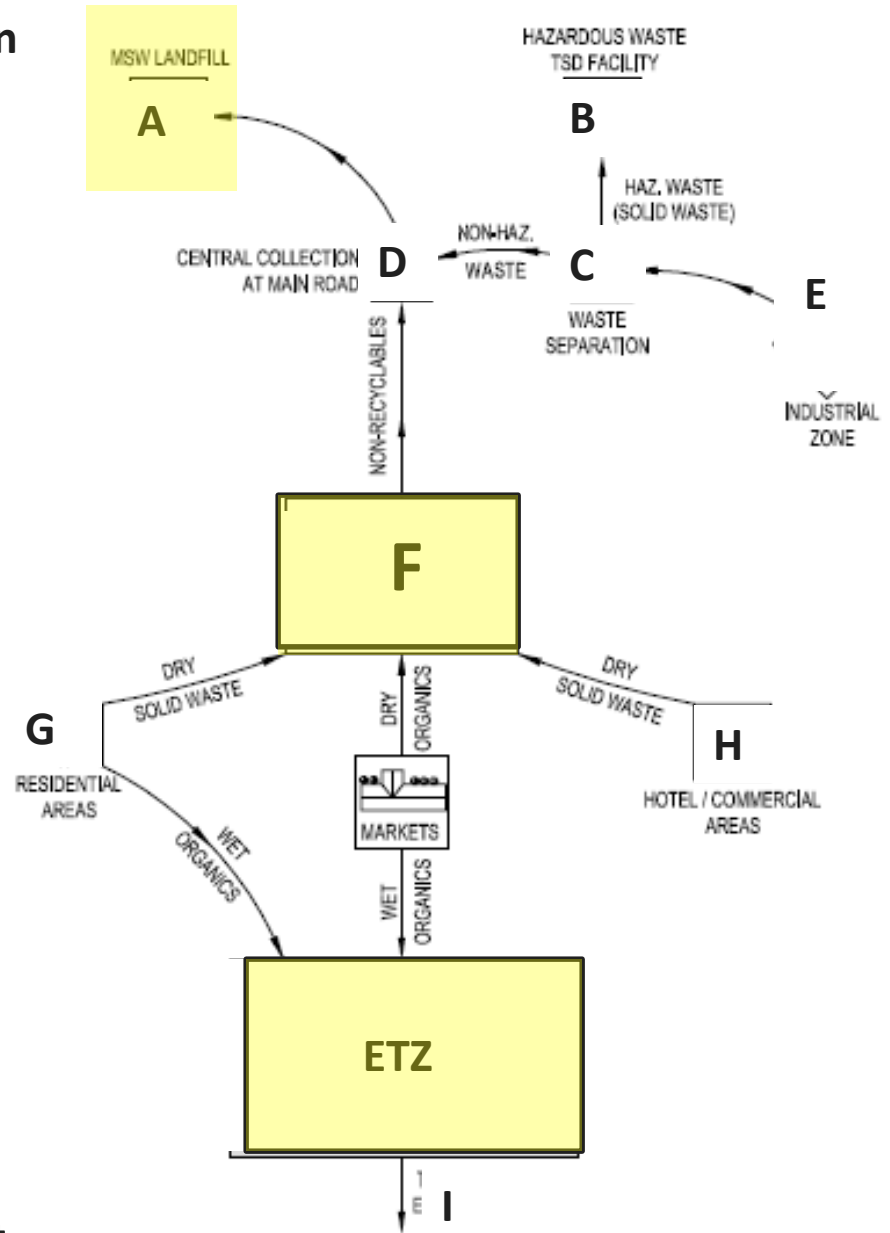
I: Primarily Treated Effluent

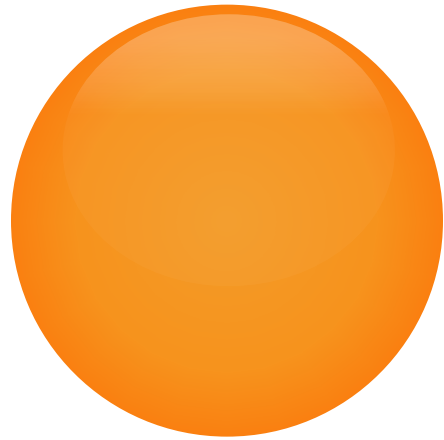


Elevation

Highest

Lowest





MATERIAL AND PHYSICAL CONSTRAINTS

Housing and Roads 

Road Typologies and Material Flow and Employment



Cobblestone: Local, Labor-Intensive, and Repairable



Lack of Defined Building Codes: Impact to Shelter

“Durability”

National Policy of the Habitat [MINIFRA, 2004]

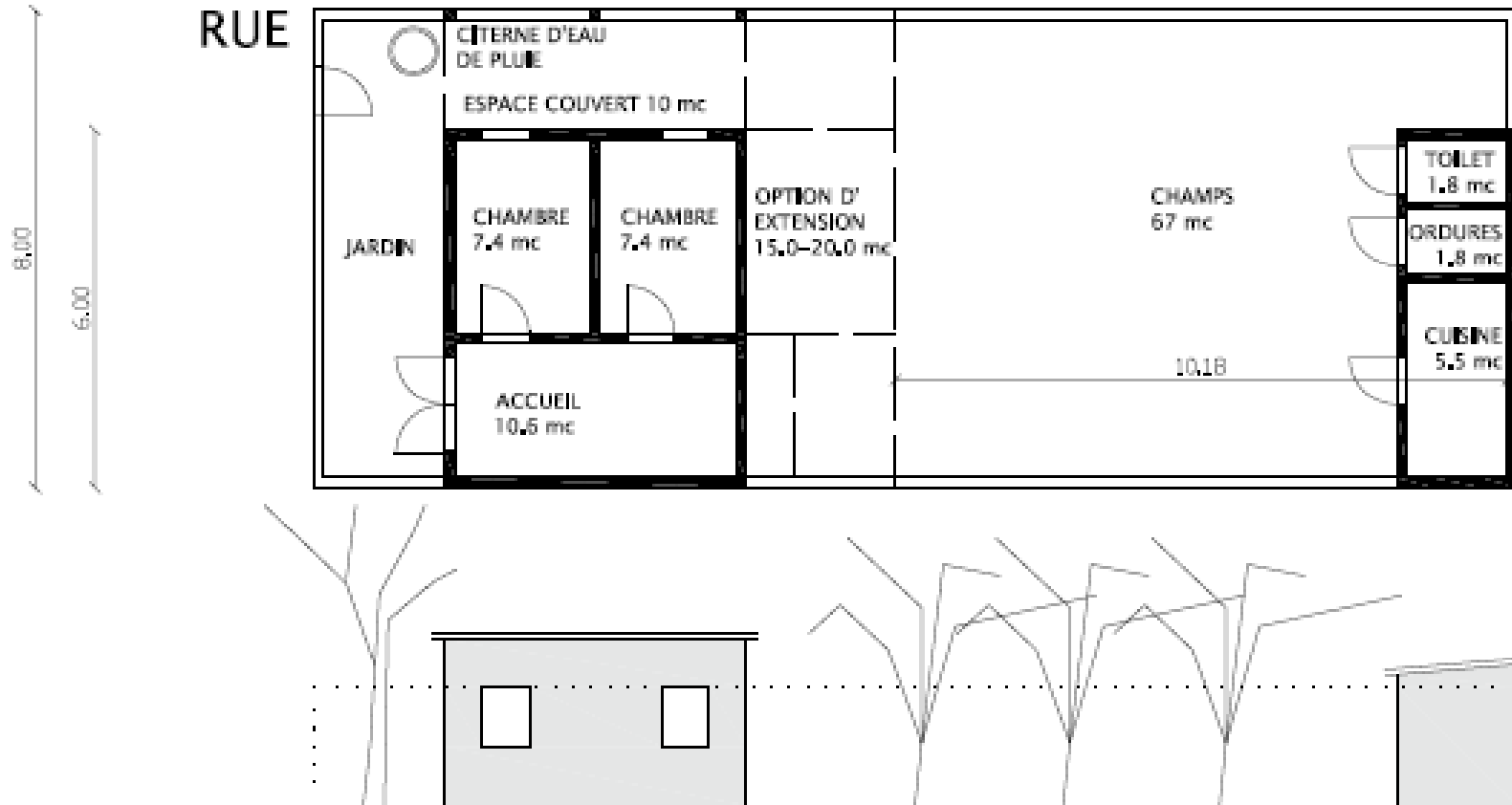
CHAPTER III. GUIDING PRINCIPLES

- ***Strategy 3.1.*** Promotion of the production and use of local materials of construction.
 - The creation of manufacturing units of *durable* local materials, the control of the techniques of production, the lowering of the costs to make them available to the weak rural incomes of households.

Informal Communities: Physical Constraints



Initial Layout of Low Cost Single Family House



Integrated Infrastructure for Maslow



Low-cost, Integrated Infrastructure: Kimisange



Batsinda: Low-income Community



Conclusions

- Non Sequiturs are long held beliefs that impact the expected performance of infrastructure and should be considered for overall project approach.
- In most countries, constraints are more than economic. Being forced to consider these constraints can lead to innovation.
- Incorporating Non Sequiturs and Constraints requires true interdisciplinary coordination.

Thank You

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