Workshop Application Form

EMEA WSEC 2023

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Agenda

Smart Cities Overview

INCOSE Role

Definition, Framework, and Metrics

Next Steps and Outreach

Purpose

- Support communities
  - Concepts
  - Applications
  - Technology
  - Services (CATS)

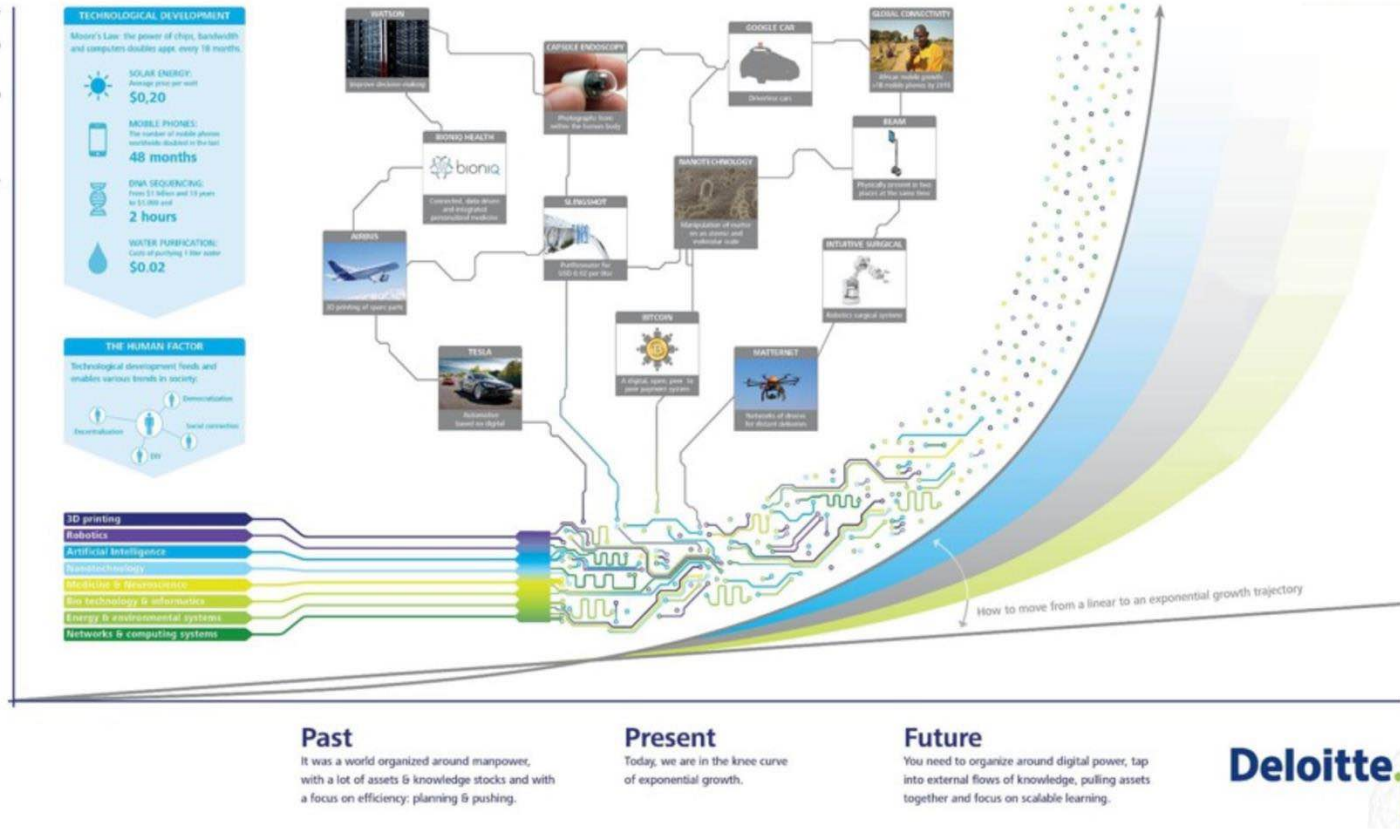 by leveraging systems engineering tools and principles

Goal

- Create a model that illustrates the resources
- Enabling
  - interconnectivity
  - reuse
  - consistency

Smart Cities are a moving target

And lack of success has diminished the concept and term

Technology focused smart cities are rethinking their approach

Electronics

'Frankenstein' lunges to new life for Cisco and smart Carlsbad, California

by Matt Hamblen | Feb 5, 2021 5:12pm

Success in a smart city "has nothing to do with technology and has to do with people. We need to invite the public into co-creating these experiences with high degree of civic engagement. Cities need to be engaged with the public around connecting communities."

- David Graham, Chief Innovator Officer for the City of Carlsbad, California.

INCOSE

We need a common definition for a smart city

Guiding the evolution of smart cities

By Calil Queiroz June 01, 2021

The idea of the "Smart City" is a fashionable one. However, there is no common definition of what a smart city should look like.

(Image credit: Image source: Shutterstock/ jamesteohart)

Smart Cities Products Plan

complete

- ✓ Definition of Smart City
- ✓ Metrics
- ✓ Reference model

started

- Case Studies
- Stakeholder List + Management Plan
- Architecture template for Smart Cities ~ MBSE model

future

- Input on other Smart Cities publications

INCOSE Smart City Definition provides evaluation and comparison

A smart city is capable of

identifying its problems and

mitigating root causes

by generating and processing

engineered quality data in a continuous and inclusive manner.

Smart Cities Initiative

Human Fundamental needs are the basis for a Smart City's goal
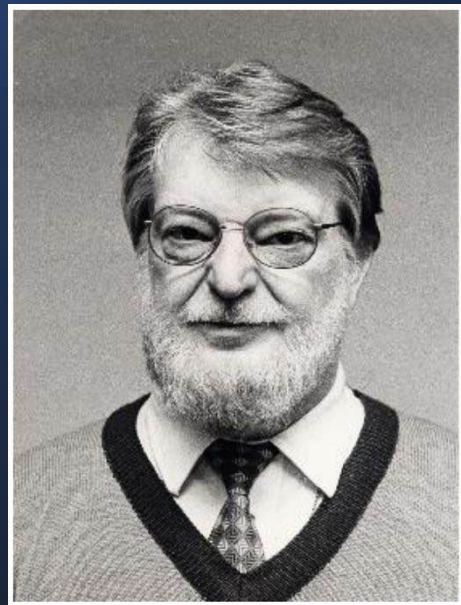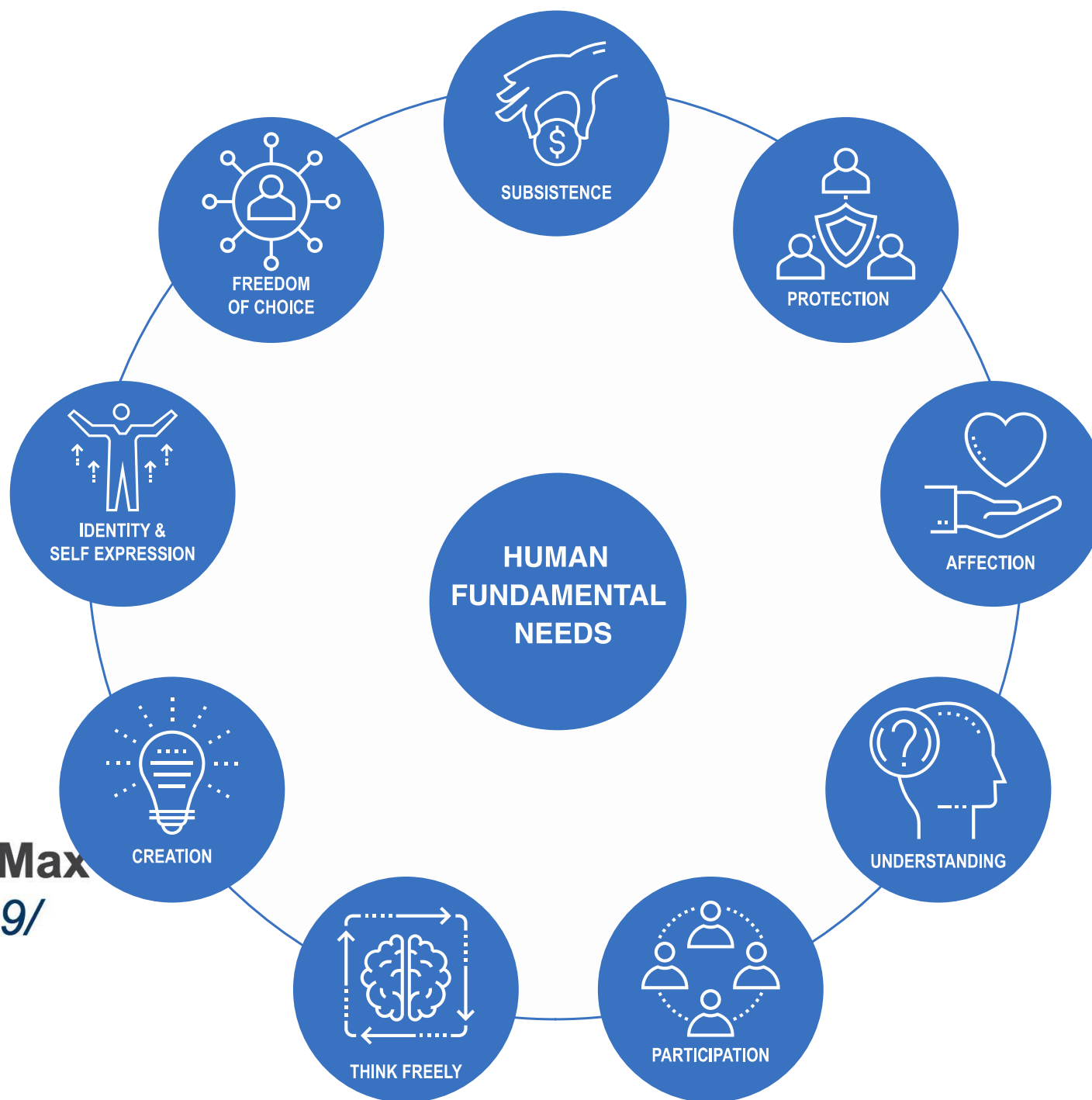
Economist
Artur Manfred Max Neef */1932-2019/*

Smart Cities Initiative

SUBSISTENCE

PROTECTION

FREEDOM OF CHOICE

AFFECTION

IDENTITY & SELF EXPRESSION

HUMAN FUNDAMENTAL NEEDS

UNDERSTANDING

CREATION

THINK FREELY

PARTICIPATION

The INCOSE-TUS Reference Model is a robust, tailorable, and systematic way to view and evaluate a smart city as an integrated complex social system

AUTHOR NAME | AUTHOR NAME | AUTHOR NAME

Smart Cities
Initiative
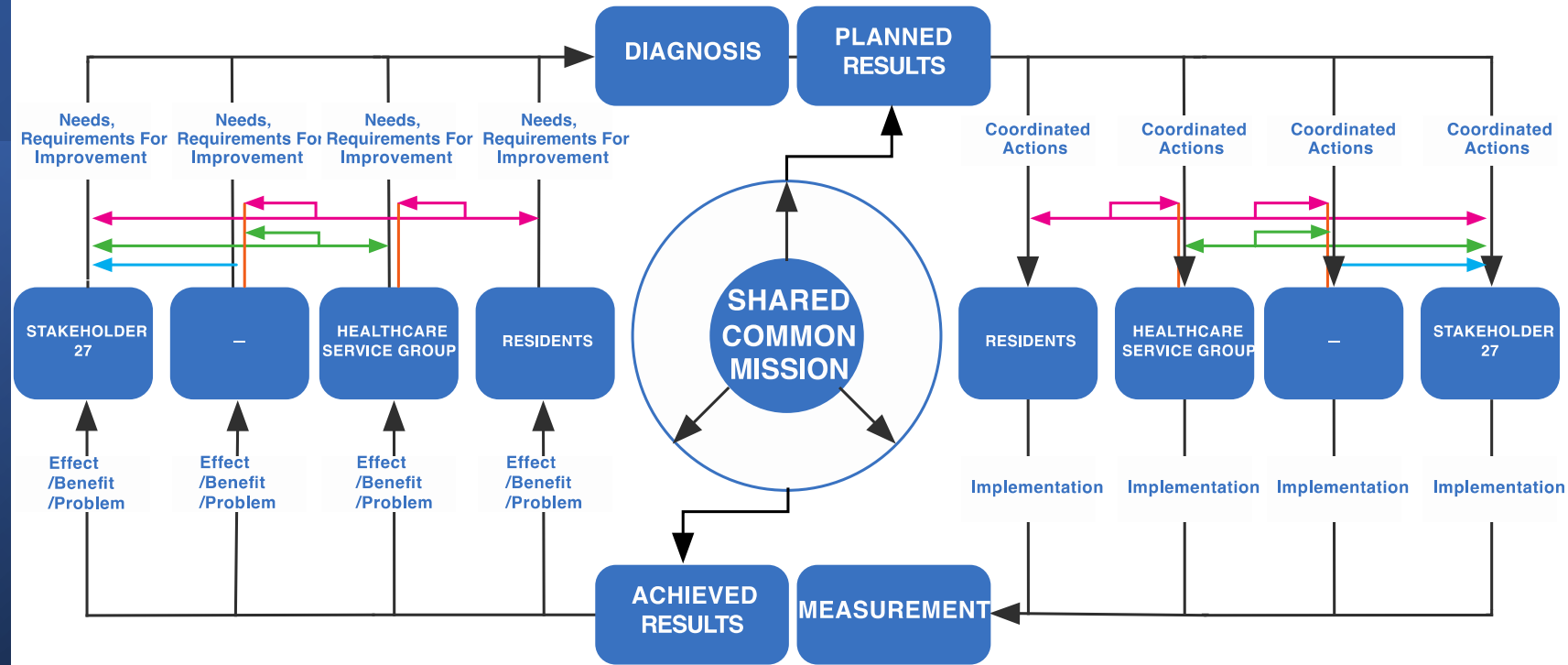
People are at the center of the most complex challenges facing today's municipalities around the world. Economic development, homelessness, healthcare, racial equity, and many other issues are directly related to the humans in the city. Meanwhile, technology continues to provide new resources and opportunities. Smart Cities efforts often attempt to leverage technology to solve the human challenges, however the efforts can fall short. The INCOSE Smart Cities Initiative has developed an approach to focus on the humans in the city and identify solutions to best support their needs.

We propose a human-centric model to help cities make decisions with human needs in focus. This model helps identify and classify technological and other investments with the greatest positive impact for the residents. This document proposes a new framework, a definition of a smart city, and human-centric metrics to consider for evaluating a smart city.

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A better world through a systems approach

INCOSE
International Council on Systems Engineering

A better world through a systems approach

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Smart Cities Initiative
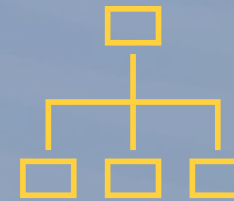
7.27.3   Smart Cities example

Citizen & business centric capabilities

Emergent characteristics by design

- Security
- Safety
- Privacy
- Resilience
- Interoperability
- Low cost for operations
- Short time to market

City Governance

City Management

City Operations

Urban Leading capabilities

- Facilities & buildings management
- Energy management
- Water management
- Waste management
- Public safety and security management
- Environment (nature) management
- Transportation management
- Healthcare and wellness management
- Education management
- Societal development management
- Economic development management
- Culture & entertainment management
- Tourism management

Urban Core capabilities

Geomatics | Census | Registries | Urban info

Urban Enabling capabilities

Procurement | Legal | Media | PMO | ICT | Finance

Urban Supporting capabilities

Figure 31 – Potential SCRA level 1 reference capability map

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- Unhoused people have interactions with multiple organizations and systems in Autoville.

- This helps to understand the positive and negative effects that homeless people have on city elements, and vice versa.

- Understanding this will help to frame solutions.

Operational High Level Taxonomy [HighLevelOperationalConcept Homeless]
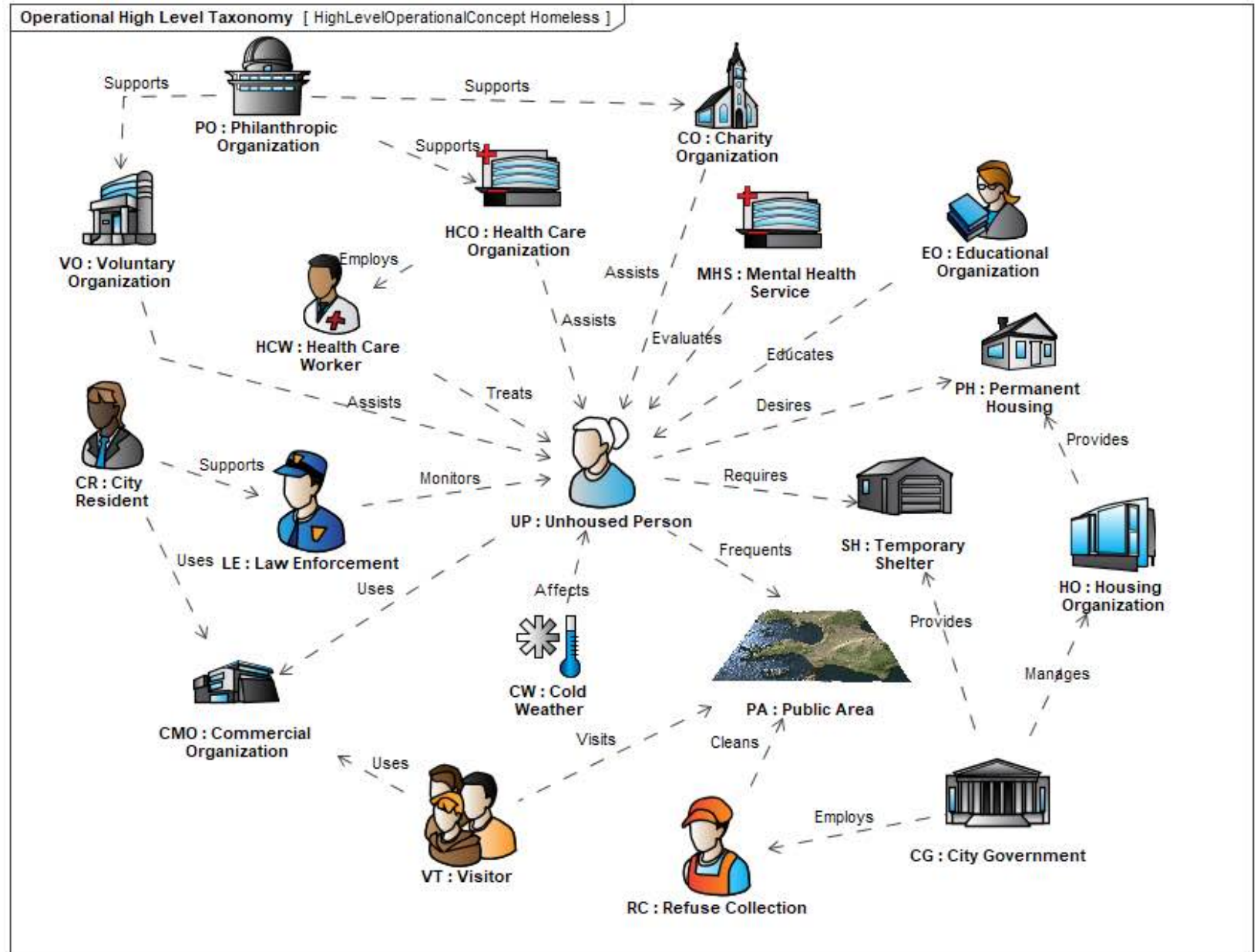
Why a new model?

cities face serious problems

Smart cities face serious hardships

NATIONAL POST

PMN Politics / PMN News

Smart cities: The promises and failures of utopian technological planning

The Canadian Press
April 22, 2019 · 5 minute read

This article was originally published on The Conversation, an independent and nonprofit source of news, analysis and commentary from academic experts. Disclosure information is available on the original site.

Smart cities fail to take off

Kapil Dave & Kalpesh Damor | TNN | Updated: Jan 9, 2016, 12:31 IST

Ad Analysing the Investment Landscape of Health Tech Companies
Oddup

Ahmedabad: Gujarat may be ... up to build smart cities ...rack record in

Ghost Towns Or Boomtowns? What New Cities Really Become

Wade Shepard Contributor
Asia
I travel the New Silk Road, reporting on the developments that are shaping the 21st century.

This article is more than 2 years old.

TWEET THIS
- However, new city building is a long-term game whose natural timeline doesn't exactly match that of the global economy.
- While it's common for onlookers to criticize new cities and shower them with proclamations of doom, we are all too often too quick at the trigger

What are the root causes ?

1. The Game of the Name
2. Technology Myopia
3. Solutionism
4. Lack of Clear Objectives
5. Smart Cities as a Matter of Public Sector Procurement
6. Stuck in Silos
7. No Plan to Replicate or Scale
8. Digital Divides and the Lack of Community Communications
9. Legacy IT, Sub-optimal Networks
10. Three Traps of the Top-Down Versus Bottom-Up Dichotomy
11. Closed Architectures
12. You Must Be This Tall to Enter the Smart Cities Club

Source: A new digital beyond smart cities by Bas Boorsma, 2020

A new paradigm is needed to re-imagine our future cities

№	Legacy Paradigms	INCOSE-TUS Proposed Paradigms
1	A smart city is a city with all problems solved.	A smart city is a city capable of promptly identifying its problems and the root causes and mitigating the root causes.
2	Humans are beneficiaries of a smart city.	Humans are designers, inventors, developers, and beneficiaries by generating knowledge for Smart cities.
3	Technologies make Smart cities.	Humans build Smart cities. Humans develop technologies that support human activities aimed at building smart cities.
4	Big data is critically important for every decision making for Smart cities.	Big data is important, but it is not enough. To make fast and accurate decisions, the city needs engineered quality data.
5	A city has its own goal	A city doesn't have its own goal, but it has a goal-reflecting the common needs of the humans in the city.
6	The city government guarantees rights of city residents.	The rights of city residents are guaranteed by services provided (or duties performed) by the stakeholders within the city government.
7	A city must satisfy the needs of its residents.	A city must create an environment enabling its residents to satisfy their own needs.

INCOSE
Working Groups

Our path

Smart Cities Initiative
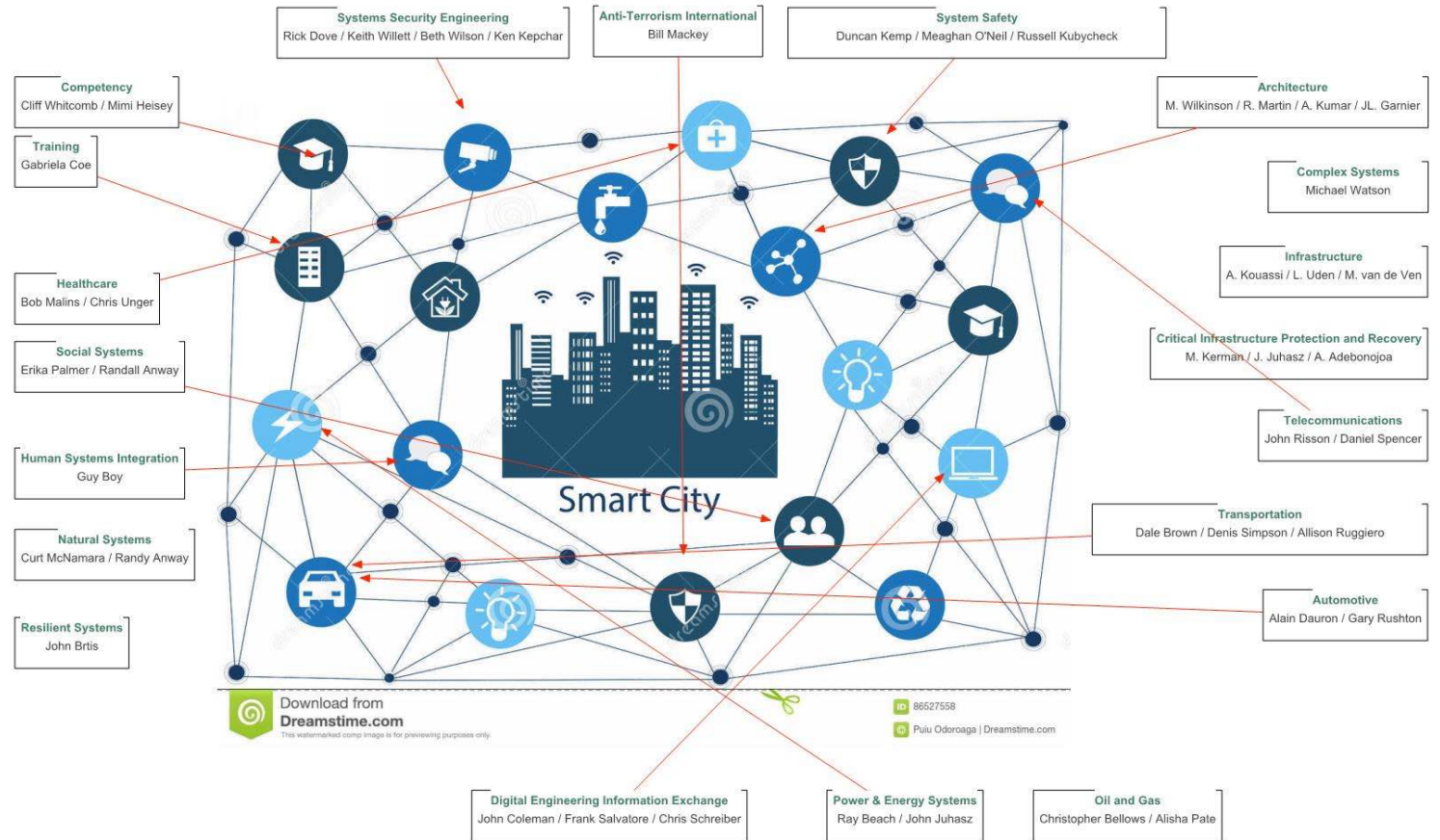
How we got here
- Practical application
- International community
- Wide range of contributors

What we know
- Strong IT basis
- Solution looking for problem
- IT standards
- Each city unique

Where we're headed
- Definition + Metrics
- Stakeholder Management Plan
- Top-Down model

Collaboration

IEEE   IEC   Municipalities (in progress)   Smart Cities organizations (in progress)

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INCOSE

How do we build a smart city more closely aligned with the needs of the residents?

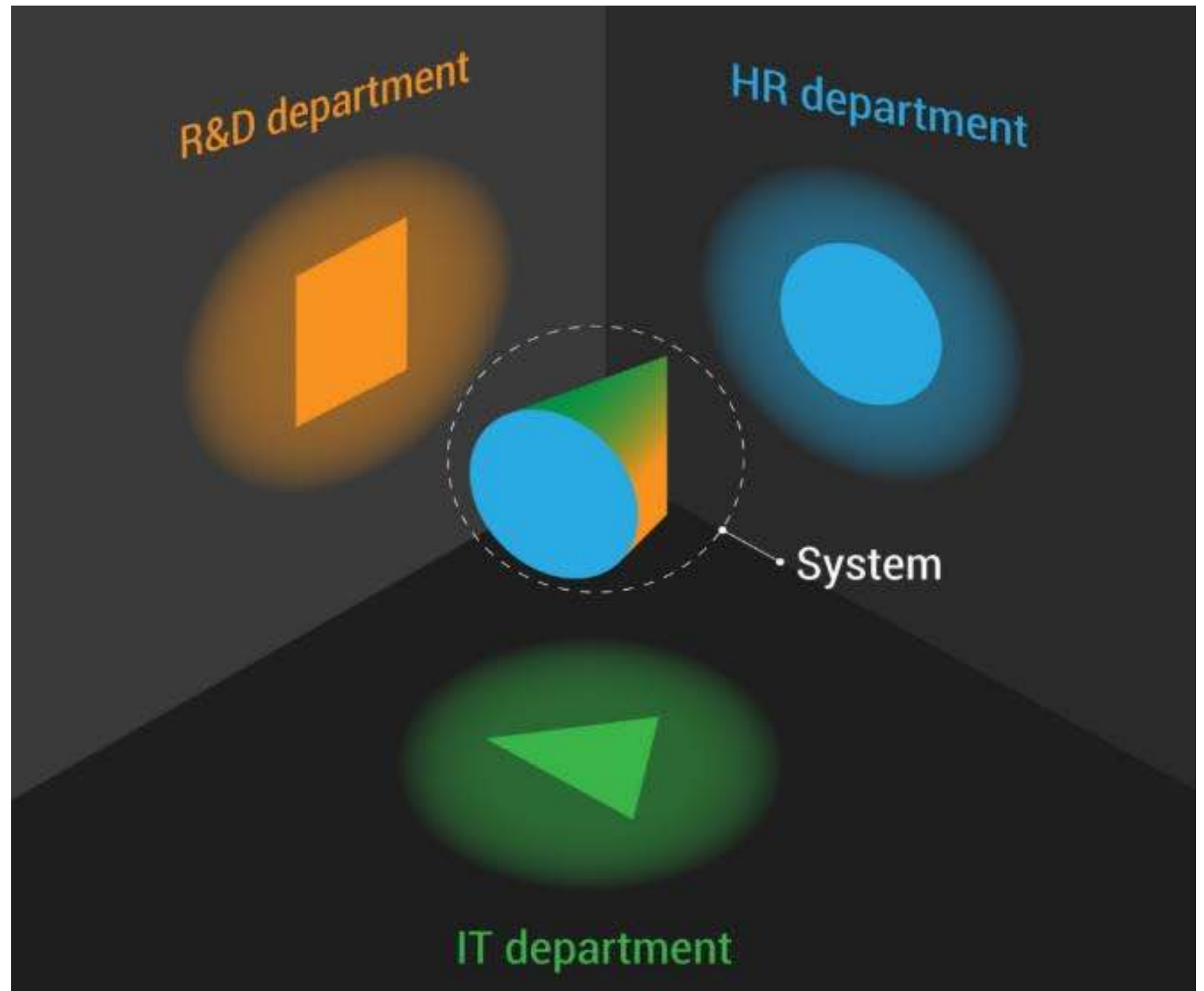**Smart Cities Initiative**

1) Humans belong at the center of the smart city

2) Objectives are dynamic and adjust over time

3) Effectively link digital data solutions to human needs with a feedback loop

Should we change our thinking style and try a new approach?

Other definitions provide formalized consistency

Being Smart

Social System

City

Model

Engineered Quality Data

Smart Cities Initiative
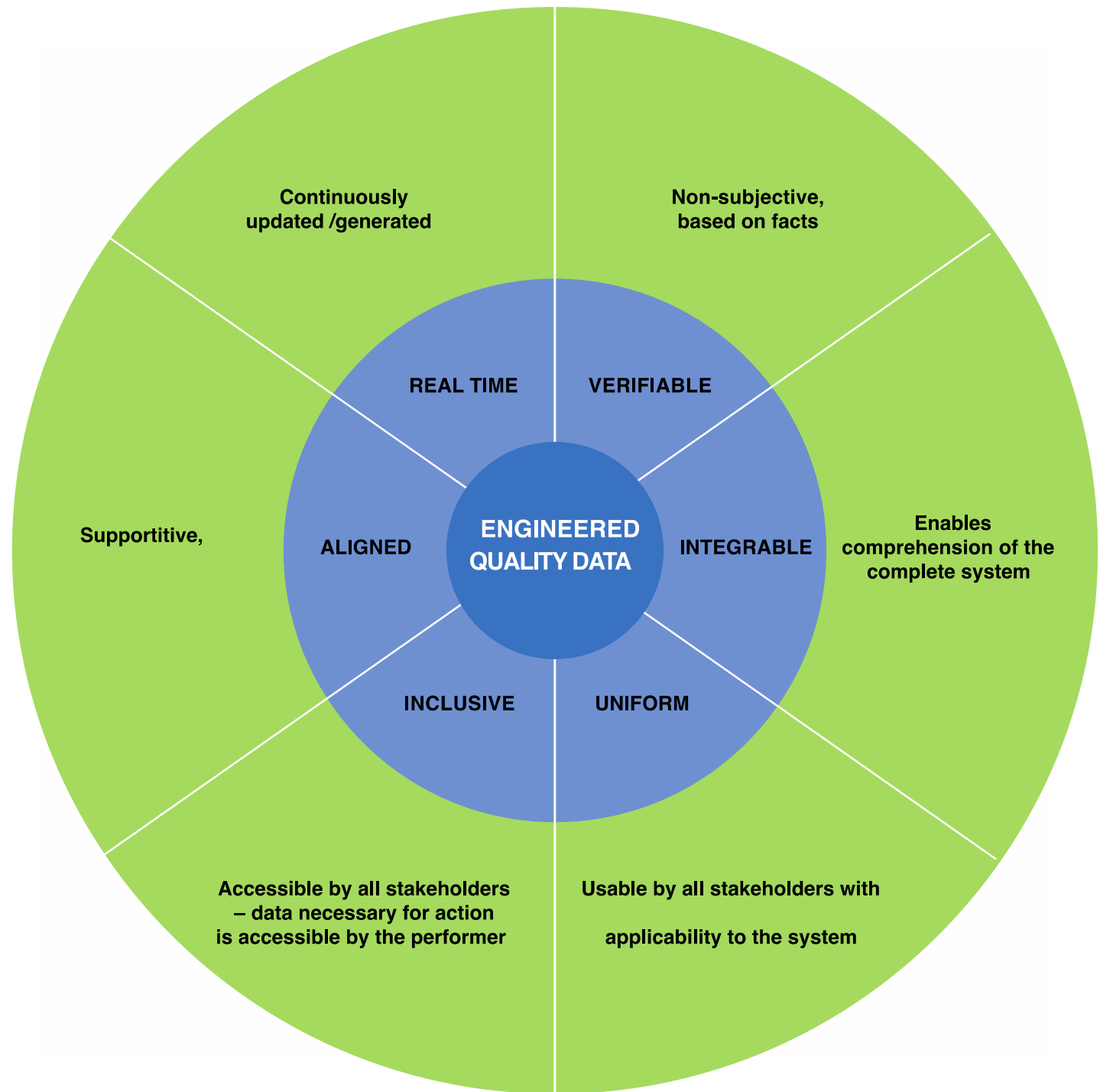
The Goal of a Smart City guides decision making for new technology

Smart Cities Initiative

The purpose of a smart city is to

create and maintain an environment that

enables its residents to

satisfy their fundamental needs by

interacting in fair, mutually beneficial, and sustainable ways.

A single set of holistic metrics provide a consistent benchmark for evaluation and comparison

TUS INDEX

SYSTEMS PROPERTIES ALIGNMENT INDEX /SPA/

SYSTEMS OPERATIONS PERFORMANCE INDEX /SOP/

UNIFIED

WELL-BEING INDEX /WPR-SPR/

SOCIAL RESPONSIBILITY INDEX /SR/

TAILORED

Smart Cities Initiative
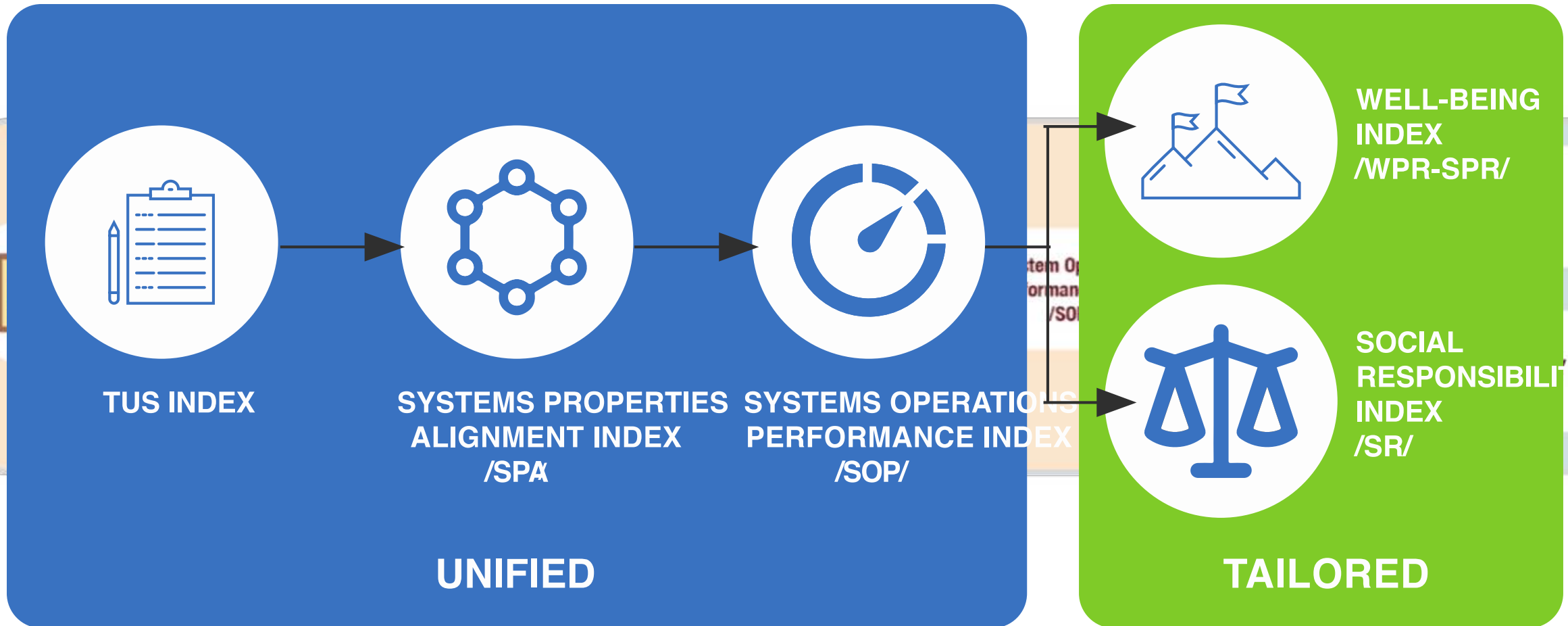
The Well-Being Index was developed based on ISO standards

Indicators for City Services & Quality of life (ISO 37120:2019)

Indicators for Small Cities (ISO 37122:2019)

Indicators for Resilient Cities (ISO 37123:2019)

Social Responsibility index has a direct connection to the 17 United Nations' Sustainable Development goals

Engaging those who deliver the smart city results can improve the likelihood of a realistic and achievable implementation
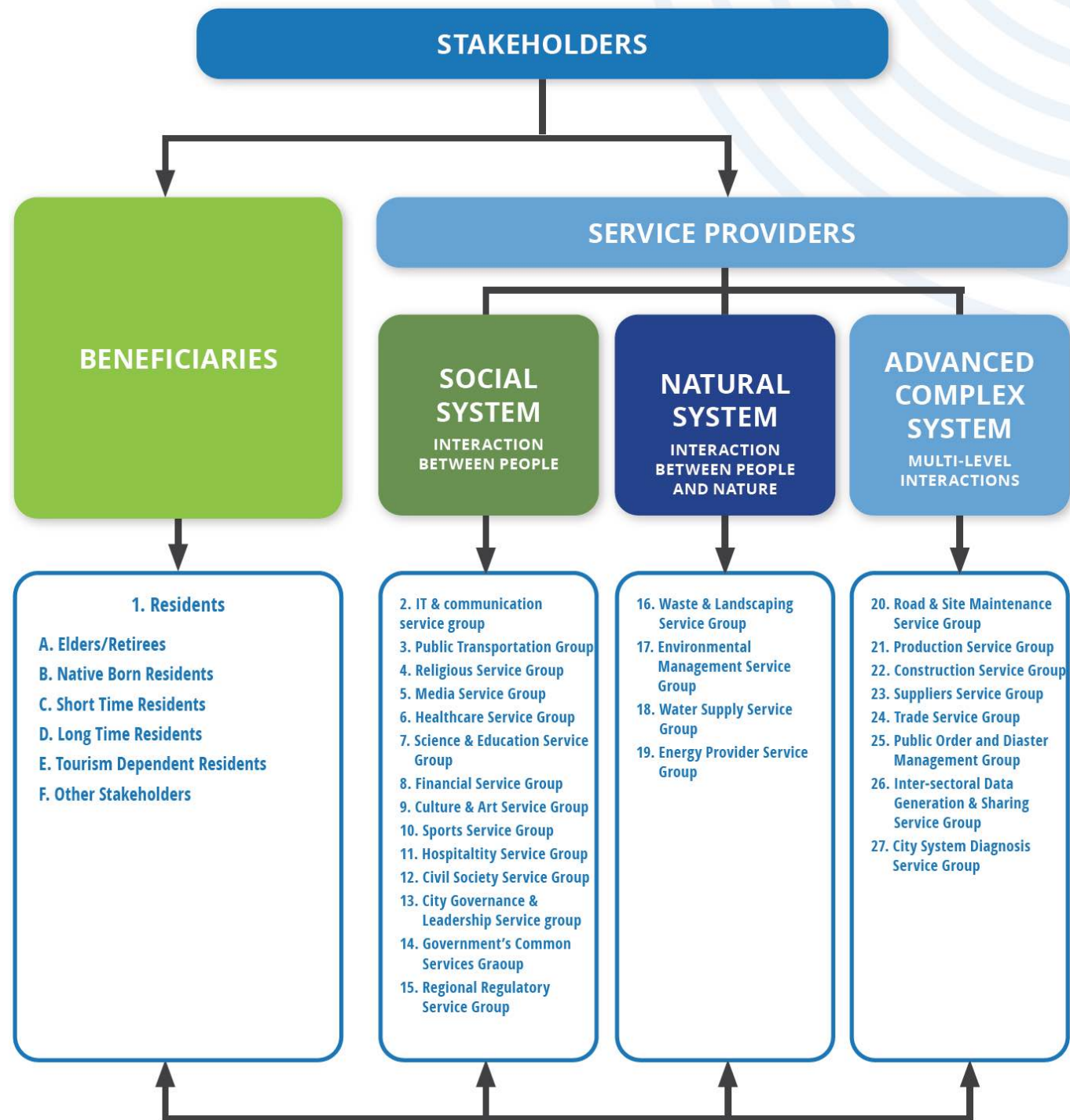
Smart Cities Initiative

DIAGNOSIS

PLANNED RESULTS

Needs, Requirements For Improvement

Needs, Requirements For Improvement

Needs, Requirements For Improvement

Needs, Requirements For Improvement

Coordinated Actions

Coordinated Actions

Coordinated Actions

Coordinated Actions

STAKEHOLDER 27

—

HEALTHCARE SERVICE GROUP

RESIDENTS

SHARED COMMON MISSION

RESIDENTS

HEALTHCARE SERVICE GROUP

—

STAKEHOLDER 27

Effect /Benefit /Problem

Effect /Benefit /Problem

Effect /Benefit /Problem

Effect /Benefit /Problem

Implementation

Implementation

Implementation

Implementation

ACHIEVED RESULTS

MEASUREMENT

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Demonstration applications

City of Ulaanbaatar, Mongolia

City of Monterey, CA, USA (??)

Kansas City, MO, USA (??)

Initiating collaboration with Ulaanbataar city government and Business community

Stakeholders & their Concerns Captured in Business Questions about the Enterprise

IEC Collaboration

Stakeholders — have → **Concerns** — analyzed using → **Models**

Concerns — about → **Enterprise**

Enterprise — support → **Missions**

Models — generate → **Views**

Enterprise — characterized by → **Architecture**

Views — depict → **Architecture**

Architecture — provides capabilities for → **Missions**
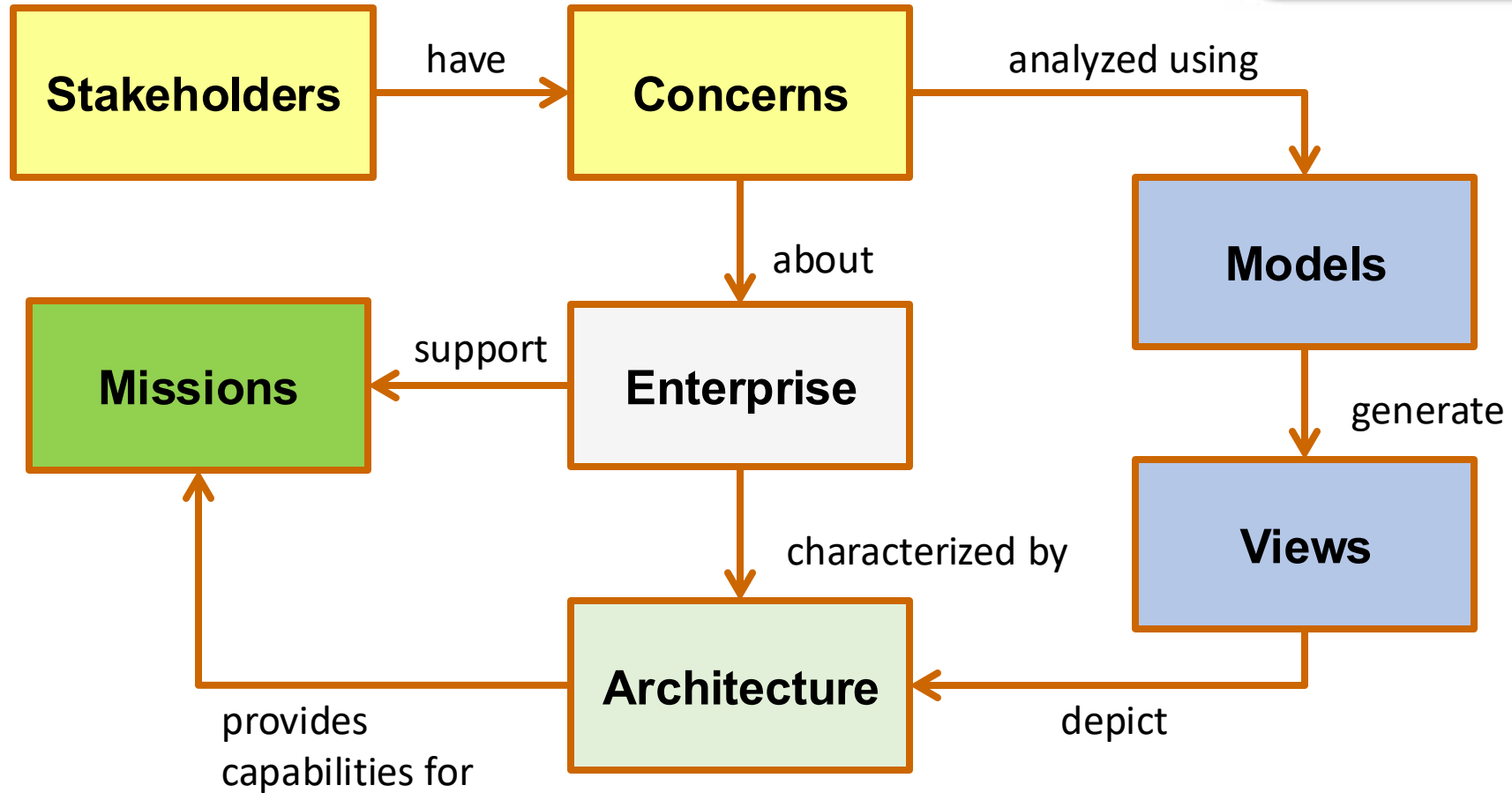
Question-based approach helped us to remain focused on the most important issues relevant to key decision makers

INCOSE

Call for Modelers!!

Reference Architecture Input

Reference → Solution → Implementation
Simple scenario

Out of SyC scope

Various needs
- stakeholders
- system
- domain

align

architect

architect

extract

1.Reference model

2.Reference architecture

design and engineer

refine

design and engineer

extract essentials

refine

3.Solution architecture A

build and test

refine

4. Implementation A1

4. Implementation A2

3. Solution architecture B

Problem space

Solution space

Figure B.37 – Simple scenario

16

Solution Architecture Development

Interested? See Jennifer Russell, Marcel van de Ven, Rael Kopace, Matthew Hause, Damian Rogers

IEC/INCOSE In-progress diagram of Reference Architecture

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Smart Cities Initiative Introduction: Charter

WG Scope

A Smart City is capable of identifying its problems and mitigating root causes by generating and processing engineered quality data in a continuous and inclusive matter
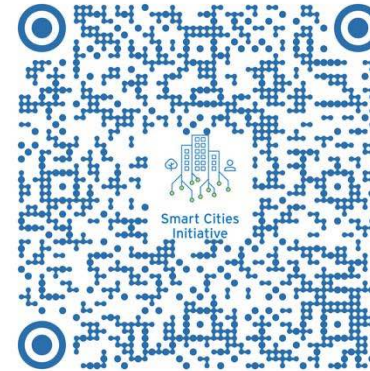
Co-Chairs

Jennifer Russell

Rael Kopace

Marcel van de Ven

INCOSE Web Page

INCOSE Yammer Address

https://web.yammer.com/main/groups/eyJfdHlwZSI6Ikdyb3VwIiwiaWQiOiI4NjEzNzQ5NTU1MiJ9

UN Sustainable Development Goals

Goal #	Goal Title	Description
1	GOAL 1: No Poverty	End poverty in all its forms everywhere
2	GOAL 2: Zero Hunger	End hunger, achieve food security and improved nutrition and promote sustainable agriculture
3	GOAL 3: Good Health and Well-being	Ensure healthy lives and promote well-being for all at all ages
4	GOAL 4: Quality Education	Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all
5	GOAL 5: Gender Equality	Achieve gender equality and empower all women and girls
6	GOAL 6: Clean Water and Sanitation	Ensure availability and sustainable management of water and sanitation for all
7	GOAL 7: Affordable and Clean Energy	Ensure access to affordable, reliable, sustainable and modern energy for all
8	GOAL 8: Decent Work and Economic Growth	Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all
9	GOAL 9: Industry, Innovation and Infrastructure	Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation
10	GOAL 10: Reduced Inequality	Reduce inequality within and among countries
11	GOAL 11: Sustainable Cities and Communities	Make cities and human settlements inclusive, safe, resilient and sustainable
12	GOAL 12: Responsible Consumption and Production	Ensure sustainable consumption and production patterns
13	GOAL 13: Climate Action	Take urgent action to combat climate change and its impacts
14	GOAL 14: Life Below Water	Conserve and sustainably use the oceans, seas and marine resources for sustainable development
15	GOAL 15: Life on Land	Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss
16	GOAL 16: Peace and Justice Strong Institutions	Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels
17	GOAL 17: Partnerships to achieve the Goal	Strengthen the means of implementation and revitalize the global partnership for sustainable development

Smart City Metrics

Fundamental human needs		Sample metrics of a Smart city, Updated version	Reference properties measured by the Smart city metrics	UN Sustainability Goal
Subsistence	GDP for per capita	GDP per capita	Should have active economy	
	Apartment availability per 1000 family	Homelesness rate	Should have sufficient supply of accomodations	
	Employees per 1000 population	Employment rate /Employed/Total population/	Should have sufficient job positions	
	Average family income	Average household income	Should have households with stable income	
	Number of individuals living with good air quality index environment per 1000 population	Air quality index	Should have unpoluted air	
	Number of individuals provided with good water per 1000 population	Water quality index	Should have healthy water supply	
	Number of individuals living with good soil quality index environment per 1000 population	Soil quality index	Should have uncontaminated soil	
	Mean age	Life Expectancy	Should have citizens with high life span	
	Consumer good index	Consumer price index	Should have stable consumer price	
	Import dependency ratio	Import Dependency Ratio	Should have self sufficient gross domestic production	
Protection	Illness inverse coefficient per 1000 population	Population health index	Should have healthy citizens	
	Mortality inverse coefficient per 1000 population	Mortality rate	Should have low mortality	
	Number of individuals with over 10$ income daily per 1000 individuals	Number of households below minimum Income Standard	Should aim to eliminate poverty	
	Victims of crime inverse coefficient per 1000 individuals	Crime rate	Should protect citizens from criminal activities	
	Exposure to trauma inverse coefficient per 1000 individuals	Injury incidence rate	Should protect citizens from incidence	
	Number of infant mortality per 1000 childbirth	Infant mortality rate	Should aim to eliminate infant moratlity	
	Family violence inverse coefficient per 1000 family	Domestic violence rate	Should aim to eliminate domestic violence	
	Inverse coefficient of unlicensed business	Number of license with subjective registry criteria	Should provide fair opportunities to citizens Should protect citizens from subjective decisions	
	Proportion of government organization and public organization with glass account	Budget transparency score	Should have transparent spending	
Affection	Number of newly registered marriage per 1000 individuals	Marriage rate	Should aim to eliminate forced marriages	
	Mean duration of marriage	Mean marriage duration	Should have stable households	
	Number of childbirth per 1000 individuals	Birth rate	Should provide risk-free birth environment	

Smart City Metrics

Fundamental human needs		Sample metrics of a Smart city, Updated version	Reference properties measured by the Smart city metrics	UN Sustainability Goal
Creation	GDP per capita	GDP per capita	Should have active economy	
	Number of newly registered profit organization	Number of new business applications per capita	Should provide equal opportunity to initiate business	
	Number of registered profit organization	Number of businesses per capita	Should support business activities	
	Number of intellectual property per 1000 individuals	Number of IP licenses registered per capita	Should ensure intellection property rights	
	Number of newly published books per 1000 individuals	Number of scientific articles published per capita	Should support scientific activities	
	Average cost of art service per individuals	Average household spending on entertainment	Should support art and sport activities	
	Gross industrial product per capita	Gross output of manufacturing industry	Should have stable manufacturing output	
	Public spending on infrastructure	Infrastructure spending as share of GDP	Should have comprehensive infrastructure	
	Resource directed by economic entities as payment for using infrastructure	Infrastructure tax income	Should have robust infrastructure	
Identity	Number of organization including international and national top 500 organization	Number of companies in international and national top 500 per capita	Should be recognized internationally	
	Number of newspaper and paper per 10000 individuals	Number of local news outlets per capita	Should ensure freedom of speech rights	
	Number of tv channel per 10000 individuals	Number of local tv channels per capita	Should ensure freedom of speech rights	
		Time required to establish local policies	Should measure local initiation of control and authority	
		Number of local, public events annually per capita	Should measure the civic pride	
	Mean duration of get approval to initiate non profit organization	Time required to start a non-governmental organization (business or philanthropic)	Should provide opportunity to initiate communal activities	
Freedom	Number of non profit organization per 1000000 individuals	Number of non-governmental organizations (business or philanthropic) per capita	Should support volunteering activities	
	The ratio of voters to non-voters	Voter turnout percentage	Should ensure right to vote on consience	
	The ratio of approved parade to non-approved parade	Protest events per capita	Should ensure right to a protest	
	Number of women civil servant per 1000 civil servant	Gender equality in public sector employment	Should ensure right of equality and non-discrimination	
	Prisoners inverse coefficient per 1000 individuals	Wrongful conviction rate	Should aim to eliminate wrong conviction	

Smart City Metrics

Fundamental human needs		Sample metrics of a Smart city, Updated version	Reference properties measured by the Smart city metrics	UN Sustainability Goal
Understanding	Number of literate people per 1,000 people	Literacy rate	Should provide citizens with literacy	
	Number of preschool children per 1,000 children aged 0-5	Enrollment rate in early childhood education (children aged 0-5)	Should provide inclusive early childhood education	
	Number of students in secondary schools per 1,000 children aged 6-18	Enrollment rate of secondary education (children aged 6-18)	Should provide inclusive secondary education	
	Average downtime of the city's IT infrastructure	Municipal IT infrastructure uptime	Should provide inclusive information flow	
	Number of people with higher education per 1,000 people	Enrollment rate of tertiary education	Should provide inclusive tertiary education	
	Education expenditure per capita	Government expenditure on education per capita	Should provide quality education infrastructure	
	The Average cost of education per capita	Personal expenditure on education per capita	Should provide affordable education	
	Number of people connected to the Internet per 1,000 people	Internet access rate	Should provide inclusive information flow	
	Number of people with mobile phones per 1,000 people	Mobile network coverage rate	Should provide connectivity among citizens	
	Number of surveys per 1,000 people	Number of scientific articles published per capita	Should support scientific activities	
Participation	Number of non-governmental organizations per 1,000 residents	duplicated	Should provide opportunity to join communal activities	
	Number of events organized by non-governmental organizations per 1000 residents	Number of non-governmental organization (business or philanthropic) events per capita	Should provide opportunity to join communal activities	
	Number of churches and monasteries per 1,000 people	Religious organizations per capita	Should ensure freedom of religion rights	
	Number of social users per 1000 people	Social media penetration rate	Should provide inclusive digital environment	
Idleness	Number of people traveling abroad per 1,000 people	Number of outbound international travels per capita	Should support international tourism	
	Number of domestic tourists per 1,000 people	Number of outbound domestic travels per capita	Should support national tourism	
	Number of official sports competitions per 1,000	Number of public sport events per capita	Should support sport activities	
		Percentage of green space/parks within city	Should indicate the relative green space and open space available.	
		Park use per capita (may be seasonally adjusted)	A measure recommended by Parks professionals as a measure of park value to a community. Combines cleanliness, resources provided, and other measures into a single factor.	
		Resident satisfaction with recreational offerings and availability	Should indicate the variety and availaility of recreation opportunities meet the needs of the residents	
		Participation in cultural activities (as defined by values of city) related to arts and culture.	A measure recommended by Arts and culture professionals as a measure of cultural activity value to a community. Combines art types, benefactor support, cultural diversity.	
	The average cost of a sporting event per person			

Workshop Agenda: Smart Cities Initiative Metrics and UN Sustainability Goals

How to make it a perfect match

Discussion (Groups): How can **you** map the UN Sustainability Development Goals to **our** Metrics

Please put output on flipchart or Sticky notes

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