

BIOMEDICAL ENGINEERING FOR SUSTAINABLE DEVELOPMENT

SEPTEMBER 12-15, 2022

Together we can reach beyond our limits

MOC-LLAB

Center for Human Dynamics in the Mobile Age (HDMA) - San Diego State University

The importance of good data Analysis for SDGs compliance

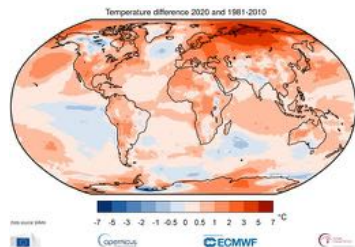


LIVING LAB

Domenico Vito, Ph.D. MOC-LLAB, San Diego
State University, San Diego, California



PhD Bioengineer Observer to the Conferences of the Parties since 2015 , **Member of the Italian Society of Climate Sciences (SISC)**, active in various environmental organizations and networks (The Climate Reality Project) and an active participant in UN YOUNGO, the constituent of young people within the Framework Convention of Nations United in which take part on various working groups (Energy, Health, and Agriculture) and serve as a thematic coordinator of **UNEP Major Group for Children and Youth (MGCY) Microplastics and Marine Litter (ML&MP) Working Group** and **MOC-LLAB**. Member of GACSA and promoter of the blog / YouTube [channel HubZine Italia](#) for dissemination on international negotiations and organizer of the Climate Change Symposiums and Climate Social Forum.



Climate Change



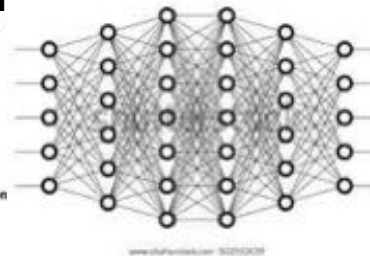
Marine litter

AREAS OF INTEREST

Bi-directional communication contributes to strengthen two mechanisms related to a community within its environment that are:



ICT 4 DEV



Data Mining & ML



One Health

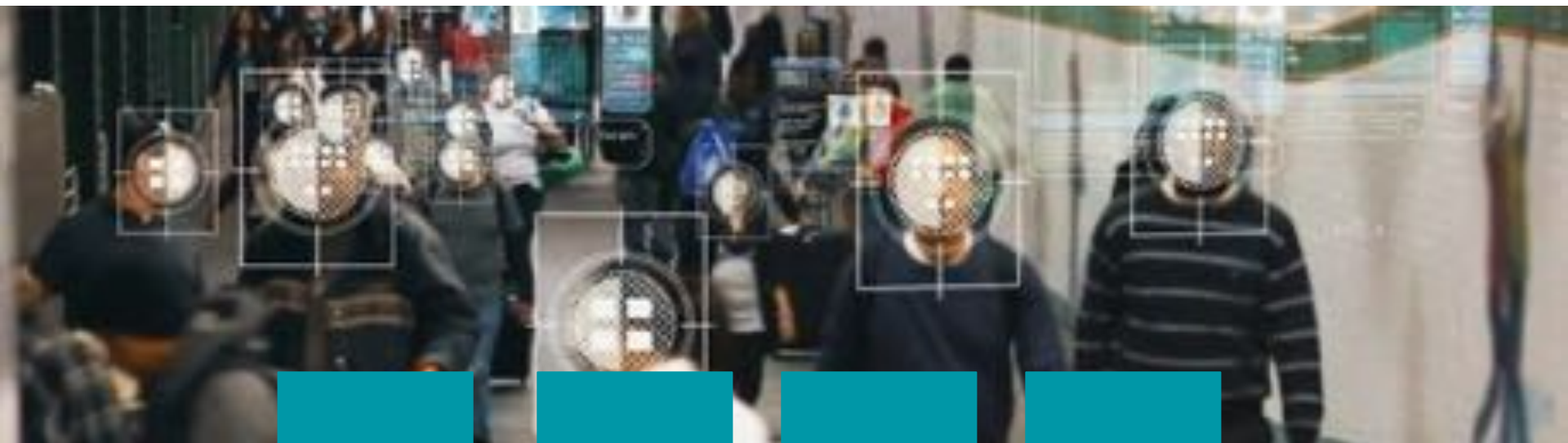
Metabolism of Cities Living Lab (MOC-LLAB)

Create Knowledge
Foster a Community
Share Knowledge Apply Knowledge

Our Mission

At MOC-LLab we recognize that in order to achieve the Global Goals. It is crucial for people to acquire this knowledge, values, and skills, enabling communities to better respond to the external challenges while **promoting more equitable, inclusive, and resilient societies.**

Our Mission



Create
Knowledge

Share
Knowledge

Apply
Knowledge

Foster a
Community

City as a Living Organism: Urban Metabolism





Dr. Gabriela Fernandez

Director, Metabolism of Cities Living Lab (MOC-LLAB),
Department of Geography, San Diego State University
Graduate Advisor, Master of Science
in Big Data Analytics
San Diego, California, USA

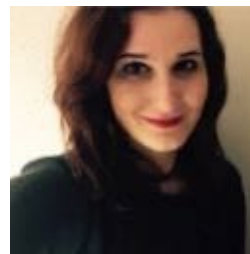
gfernandez2@sdsu.edu



Dr. Domenico Vito

Researcher, Metabolism of Cities Living Lab (MOC-LLAB),
Department of Geography, San Diego State University
PhD Bioengineer@Politecnico di Milano, Italy
San Diego, California, USA

dome.vito@gmail.com



Carol Maione

Researcher, Metabolism of Cities Living Lab
(MOC-LLAB),
Department of Geography, San Diego State University
PhD Student
Dept. Management, Economics and Industrial Engineering,
Politecnico di Milano, Italy |
carol.maione@polimi.it



SDSU
METABOLISM
OF CITIES
Together for the SDGs

LIVING LAB



SAN DIEGO STATE
UNIVERSITY



HDMA
@SDSU
THE CENTER FOR
HUMAN DYNAMICS
IN THE MOBILE AGE

WE ARE TRANSPARENT.
KNOWLEDGE DISSEMINATES
STRATEGISTS TAILORED TO
ADAPTIVE GOALS AND (S)LOCAL
CONDITIONS.

WE CO-DESIGN WITH THE
PUBLIC IN ORDER TO
REDEFINE PUBLIC
FRAMWORKS.

WE EXPERIMENT, WE CHALLENGE
AND WE REACH FOR DYNAMIC
LONG-TERM RELATIONSHIPS

WE EXPLORE ALTERNATIVE
FUTURES IN CONSENSUAL
APPROACH WITHOUT FIXED
BIASES OR PRECONCEIVED
SOLUTIONS

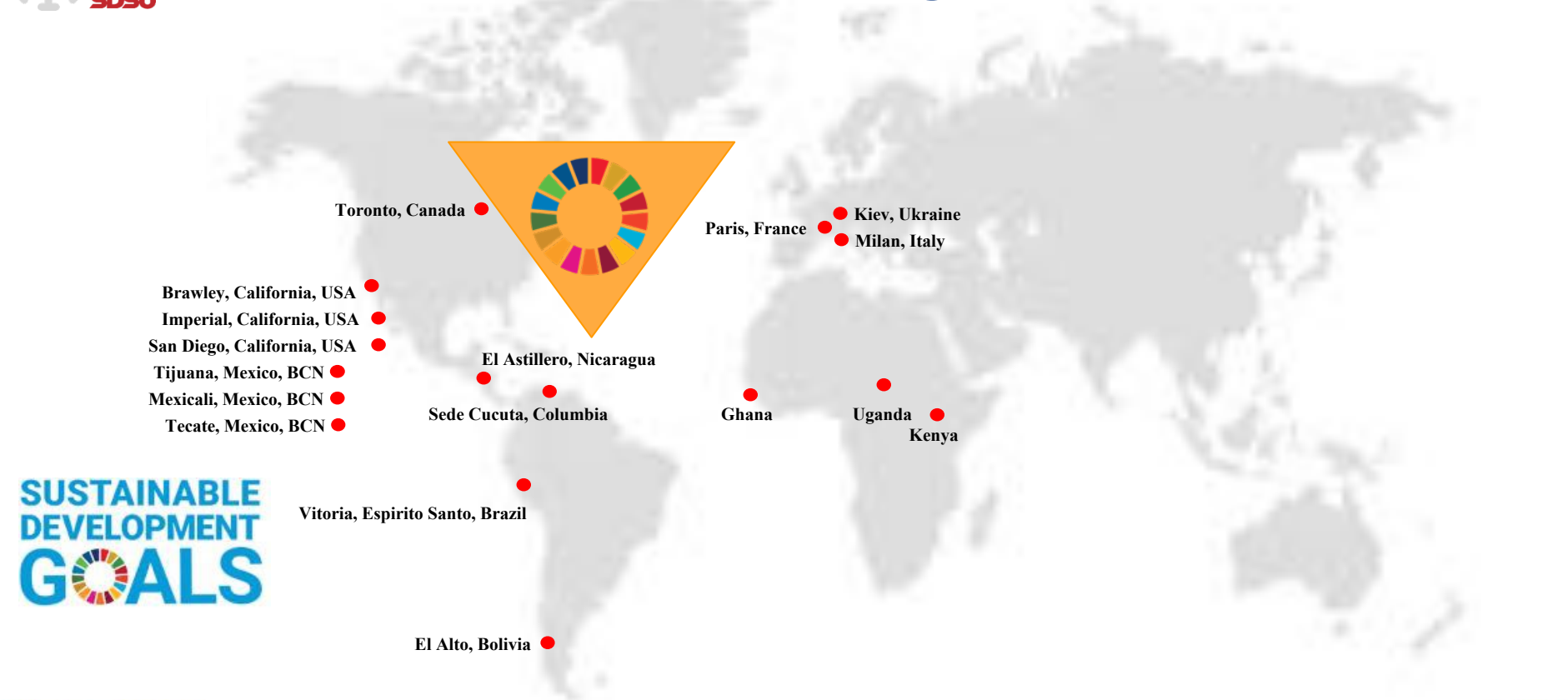
WE CATALYTIZE CITIZENS' INFLUENCE IN EVERYDAY URBAN METABOLISM

WE ARE HYBRID; THE MARGIN
BETWEEN INSTITUTIONS

WE ARE ALTERNATIVE
DIVERSE AND FLEXIBLE
ACTORS

WE HARVEST
AND ANCHOR
CITIZENS'
KNOWLEDGE
THROUGHOUT
GOVERNMENTAL
STRUCTURES.

URBAN LABS AIM TO
MAXIMIZE LEARNING FROM
LAB EXPERIMENTS BY
MULTIPLE ACTORS.



Structure of the presentation

PART 1: What are the SDGs?

PART 2 : Why the SDGs?

PART 3 : Why Data for SDGs?

PART 4: Case Studies and Examples

Conclusions

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What are the Sustainable Development Goals?



DEVELOPMENT - The limits to growth - 1972

Commissionaire dal Club of Rome;

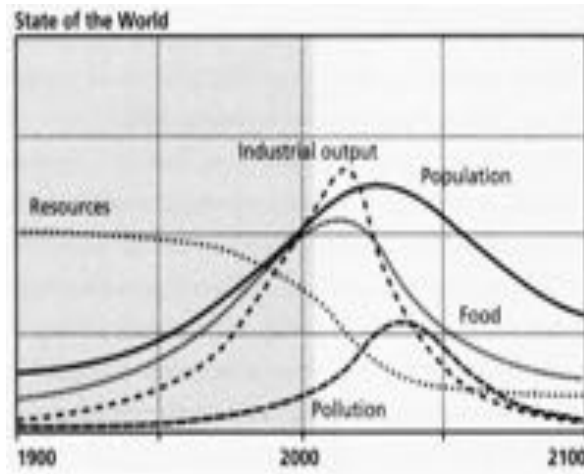
Authors: Donella H. Meadows, Dennis L. Meadows, Jørgen Randers, and William W. Behrens III, del MIT di Boston;

Objective: to investigate the possible consequences of exponential growth within a finite system such as the earth;

Based on 6 variables:

- industrializing world population; pollution;
- food;
- production;
- consumption of resources.

Instrument: World3 model



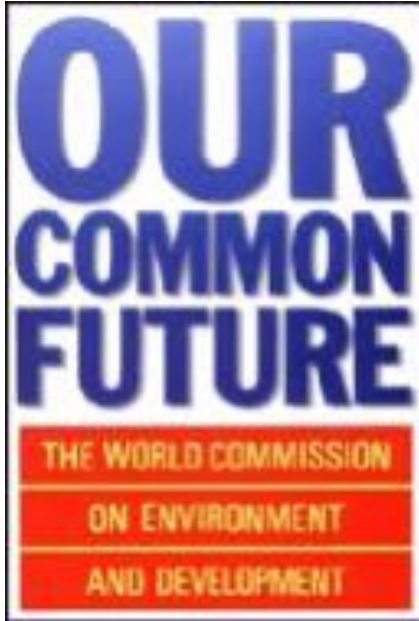
Most of the resulting scenarios highlighted a steady growth of the population and the economy, up to a turning point around 2030.

Two of the scenarios highlighted a future of “arrest and consequent collapse” of the global system around the middle of the 21st century.

TO AVOID ALL THIS

implement drastic measures to protect the environment

SUSTAINABLE - The Bruntland Report



The Brundtland Report (also known as Our Common Future) is a document published in 1987 by the World Commission on Environment and Development (WCED) in which, for the first time, the concept of sustainable development was introduced. The name was given by coordinator Gro Harlem Brundtland, who was president of WCED that year and commissioned the report. Its definition was as follows:

"Sustainable development is development that satisfies the needs of the present without compromising the ability of future generations to satisfy their own "

(WCED, 1987)



SUSTAINABLE - The Rio+ Summit

EARTH SUMMIT RIO (1992)

1992 – Sustainable Development

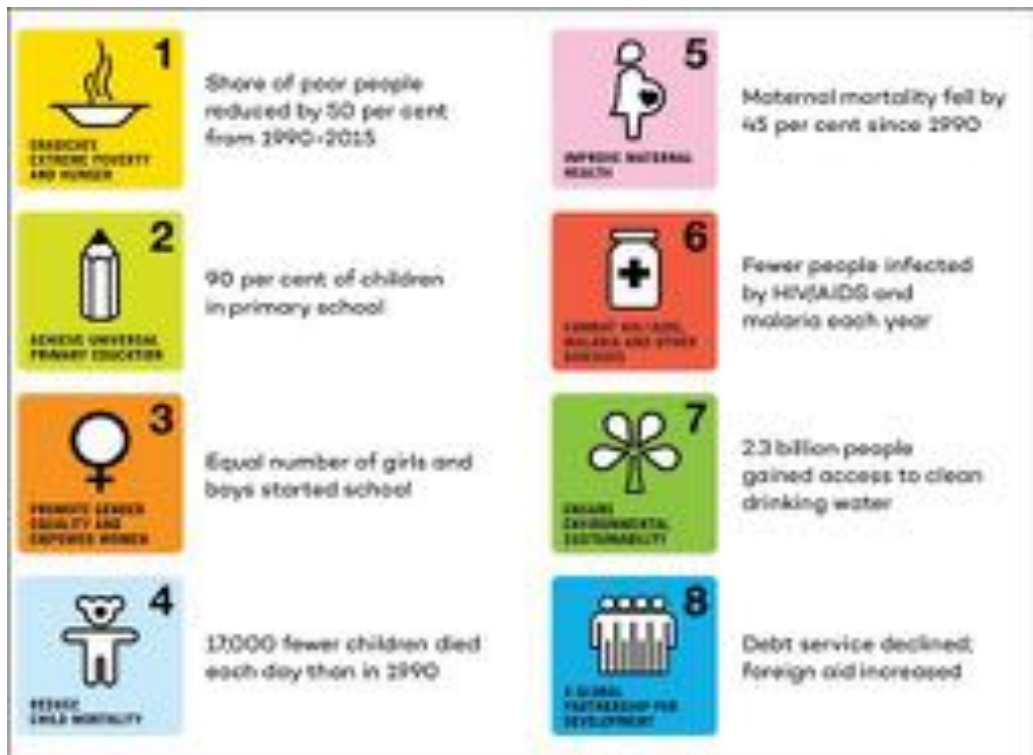
"Sustainable development can be defined as development that meets the needs of the present without compromising the ability of future generations to meet their own needs"

Outcomes of RIO+ Conference

- **Rio Declaration on Environment and Development**
- **Agenda 21**
- **Convention on Biological Diversity**
- **Forest principles**
- **Climate Change Convention**



A step before - MDGs



The **Millennium Development Goals (MDGs)** were **eight international development goals** for the year 2015 that had been established following the Millennium Summit of the United Nations in 2000, following the adoption of the United Nations Millennium Declaration.

These were based on the **OECD DAC International Development Goals** agreed by Development Ministers in the "*Shaping the 21st Century Strategy*".

Outcomes of the Millennium Development Goals. Source: UN Millennium Development Goals Report 2015.

The Johannesburg Declaration on Sustainable Development

The **Johannesburg Declaration on Sustainable Development and the Plan of Implementation**, adopted at the World Summit on Sustainable Development in South Africa in 2002, reaffirmed the global community's commitments to poverty eradication and the environment, and built on Agenda 21 and the **Millennium Declaration** by including more emphasis on **multilateral** partnership



Planetary boundaries (2009)

The **planetary boundaries** concept presents a set of nine planetary boundaries within which humanity can continue to develop and thrive for generations to come

In **2009**, former centre director **Johan Rockström** led a group of 28 internationally renowned scientists to identify the nine processes that regulate the stability and resilience of the Earth system.

The scientists proposed **quantitative planetary boundaries within which humanity can continue to develop and thrive for generations to come**. Crossing these boundaries increases the risk of generating large-scale abrupt or irreversible environmental changes

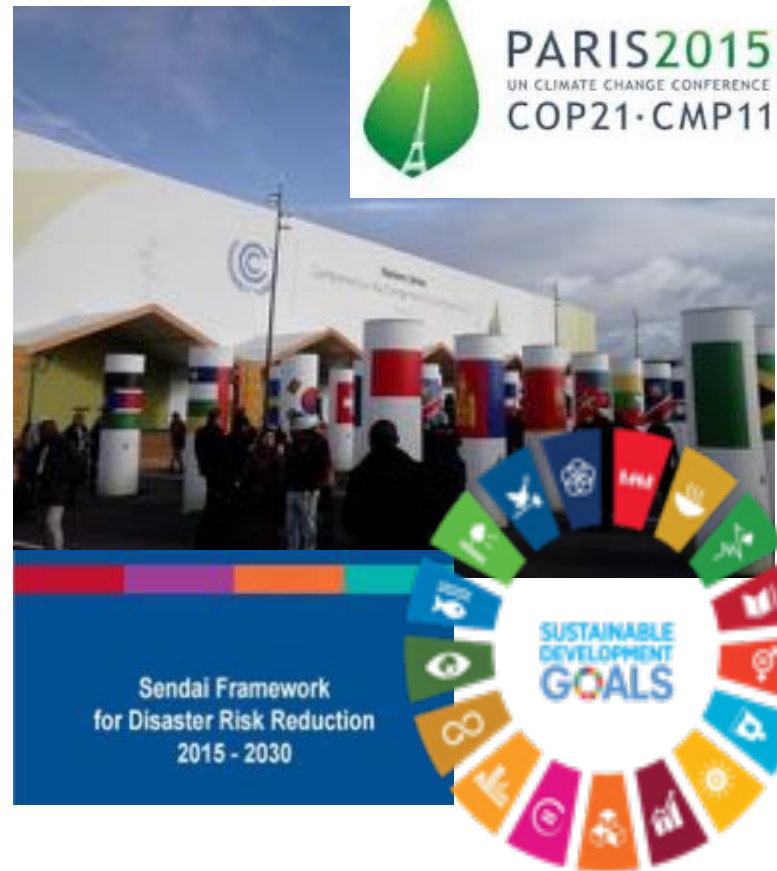


Outcomes of the Millennium Deve

2015 a year of change

2015 was a landmark year for multilateralism and international policy shaping, with the adoption of several major agreements:

- **Sendai Framework for Disaster Risk Reduction** (March 2015)
- **Addis Ababa Action Agenda on Financing for Development** (July 2015)
- **Transforming our world: the 2030 Agenda for Sustainable Development** with its 17 SDGs was adopted at the **UN Sustainable Development Summit** in New York in September 2015.
- **Paris Agreement on Climate Change** (December 2015)



From MDGs to SDGs



The **Sustainable Development Goals (SDGs)** were approved in **September 2015**.

The United Nations 2030 Agenda for Sustainable Development, which consists of 17 SDGs, was ratified.

This agenda provides a framework upon which governments **can implement policies and actions towards achieving these goals by 2030**

Sustainable Development Goals



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The 5P of development



The SDGs have been written **by nations, for nations** but they want to reach civil society, entrepreneurs, non-governmental organizations NGOs, and public actors and **involve them in achieving** peace, prosperity, partnership, and justice for all.

The 17 SDGs can be in fact also categorized into the five “Ps” model to better assess them: **people, planet, prosperity, partnership, and peace**

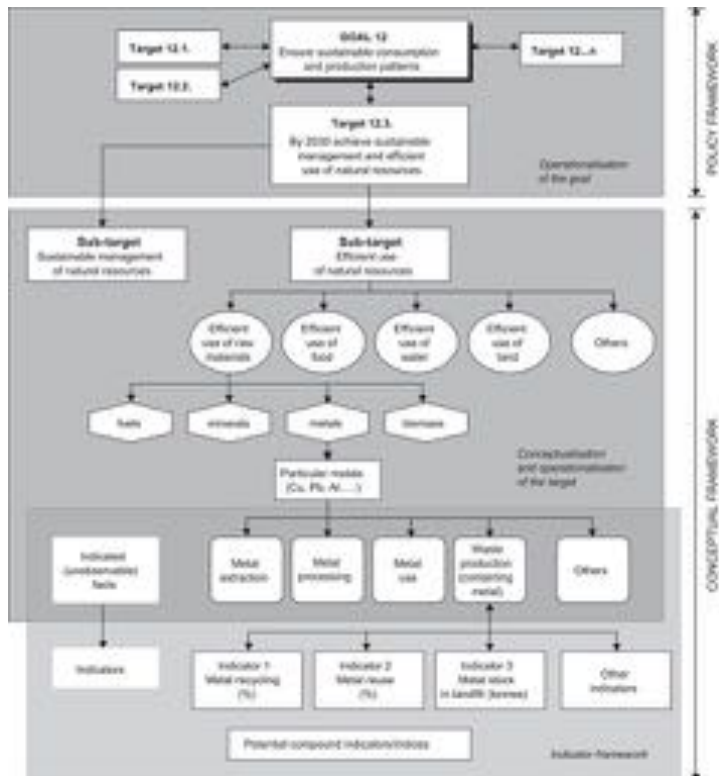
SDGs for driving policies

To be effective the SDGs need to be declined to the civil society level: this enclosed in the open problem of the **compliance of the SDGs and localization**



The *Barcelona Institute for Global Health (ISGlobal)* has proposed the use of “health in all policies” (HiAPs) - Starting from SDGs 3 and SDG 11

The framework of SDGs



Currently, the framework of the SDGs is composed of **17 goals, 117 targets, and 241 indicators** and this structure is the backbone to monitor SDGs progress at the local, national, regional, and global scale.

Now, the annual **High-level Political Forum** on Sustainable Development serves as the central UN platform for the **follow-up and review of the SDGs**

A sound indicator framework turns the SDGs and their targets into a management tool and every 4 months the UN Statistical Commission updates this set

Measurability of Sustainability



3 GOOD HEALTH AND WELL-BEING



- 3.1 Reduce the global maternal mortality ratio to less than 70 per 100,000 live births
 - 3.1.1 Maternal mortality ratio
 - 3.1.2 Proportion of births attended by skilled health personnel
- 3.2 End preventable deaths of newborns and children under 5 years of age
 - 3.2.1 Under-five mortality rate
 - 3.2.2 Neonatal mortality rate
- 3.3 End the epidemics of AIDS, tuberculosis, malaria and neglected tropical diseases and combat hepatitis, and other communicable diseases
 - 3.3.1 Number of new HIV infections per 1,000 uninfected population
 - 3.3.2 Tuberculosis incidence per 1,000 population
 - 3.3.3 Malaria incidence per 1,000 population
 - 3.3.4 Hepatitis B incidence per 100,000 population
 - 3.3.5 Number of people requiring interventions against neglected tropical diseases
- 3.4 Reduce by one third premature mortality from non-communicable diseases through prevention and treatment and promote mental health and well-being
 - 3.4.1 Mortality rate attributed to cardiovascular disease, cancer, diabetes or chronic respiratory disease
 - 3.4.2 Suicide mortality rate
- 3.5 Strengthen the prevention and treatment of substance abuse
 - 3.5.1 Coverage of treatment interventions
 - 3.5.2 Harmful use of alcohol
- 3.6 By 2020, halve the number of global deaths and injuries from road traffic accidents
 - 3.6.1 Death rate due to road traffic injuries
- 3.7 Ensure universal access to sexual and reproductive health-care services
 - 3.7.1 Proportion of women of reproductive age with need for family planning satisfied
 - 3.7.2 Adolescent birth rate
- 3.8 Achieve universal health coverage
 - 3.8.1 Coverage of essential health services
 - 3.8.2 Proportion of population with large household expenditures

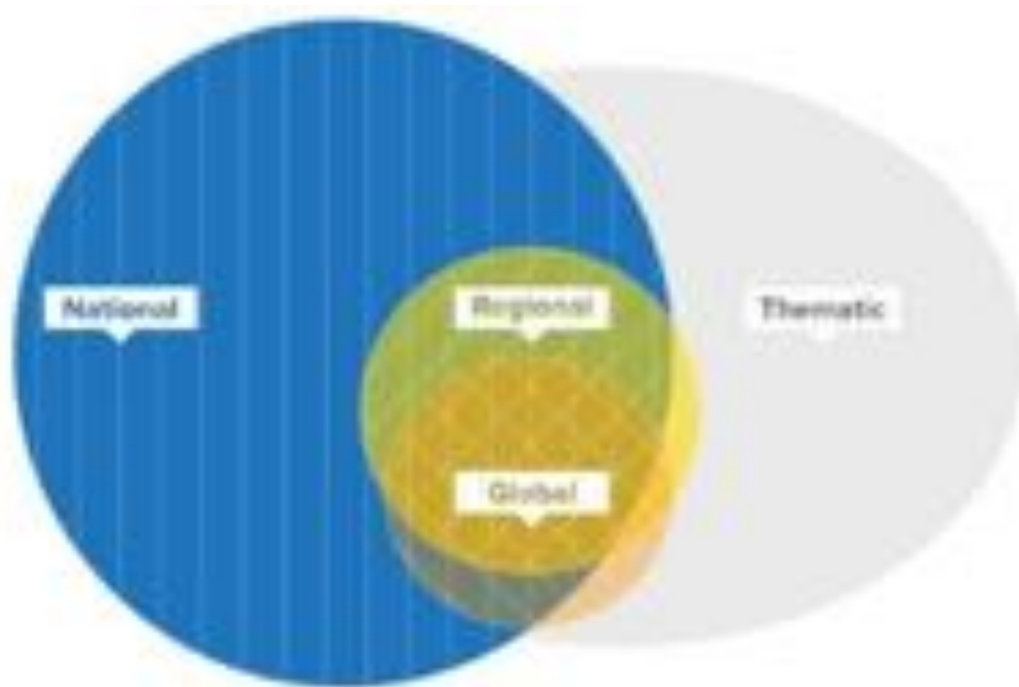


SDGs: measurability of sustainability

As they have a global target the indicator need to be measurable in different parts of the world and at different scales, So to be worldwide applied and scalable they need to match some criterias as follow:

- **link to the target:** the indicator should be clearly linked to one or more targets and provide robust measures of progress towards the target(s):
- **policy relevance:** the indicator should be relevant to policy formulation and provide enough information for policy making:
- **applicability at the appropriate level:** for global monitoring, the indicator should be relevant to all countries; for national monitoring, the indicator should be relevant to national priorities. Indicators are thought to be the backbone for monitoring the progress towards the SDGs at the local, national, regional, and global levels

Why SDGs? - multiscale monitoring and compliance



In such a **framework SDGs** became a strong technical matter where **measurement and monitoring** of the impact of SDGs has a strong role. Indicators can also **monitor actions, indeed investments and policies**

Different levels of SDG monitoring:

National, prerogative of each national government

Global, based on a set of global monitor indicators following an harmonized standard for high level political forums,

Regional, provides a platform for knowledge sharing peer review and reciprocal learning across regions

Thematic comprises special indicators can include input and process matrix useful to complement the other sets

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SDGs as part of a statistical infrastructure

Indicators as part of the statistical infrastructure



DATA BEHIND INDICATORS

To assess the real compliance of indicators and to make them reliable every 4 months indeed the **United Nations Statistical Commission** updates and refines the set of SDGs indicators in collaboration with the *custodian*

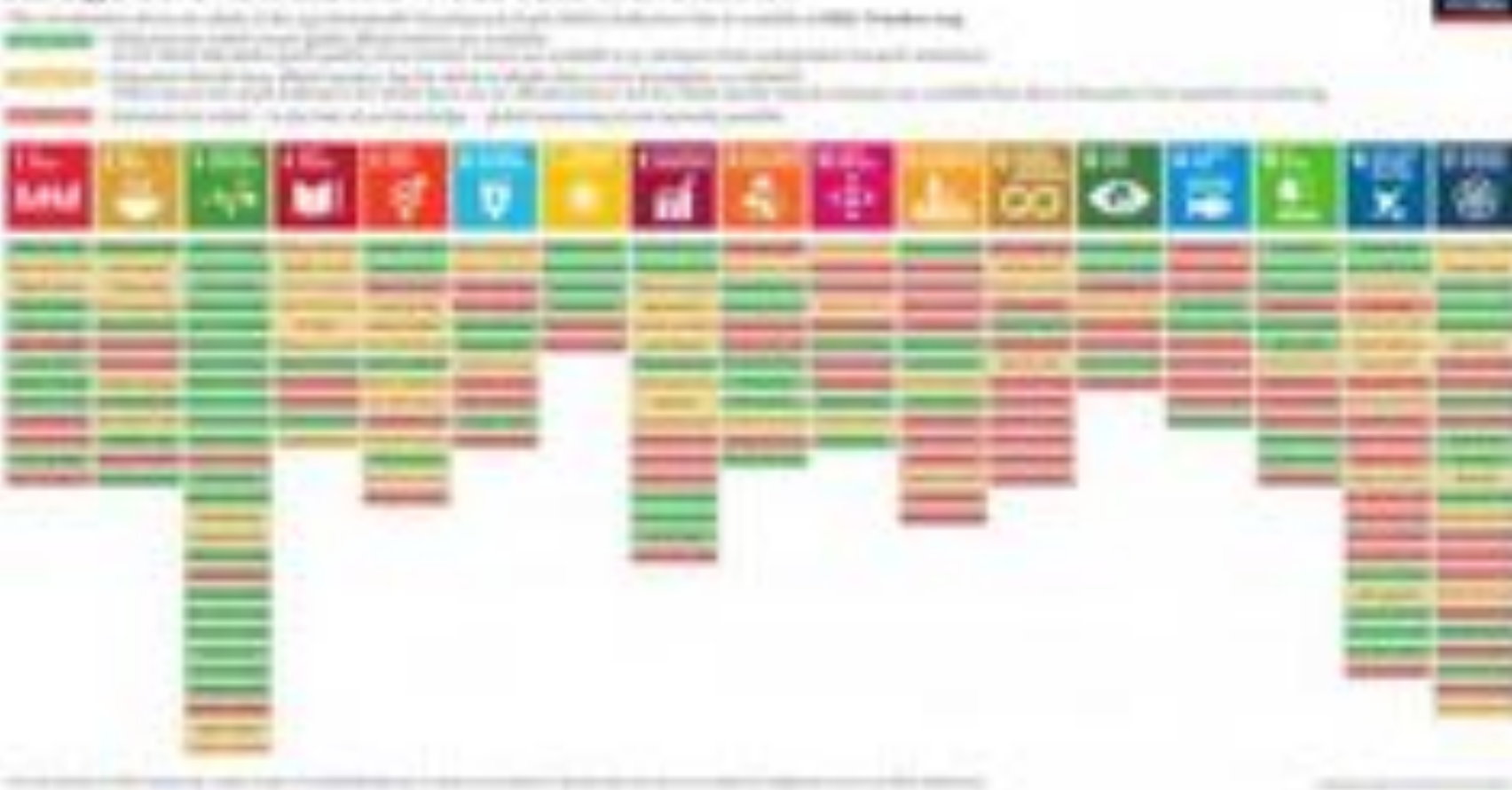
Table 3: Different Levels of SDG Monitoring

Level	Reference to be monitored	Main Actors	Indicator set
Global (UN)	Agenda 2030's 17 goals and 169 targets	UNSC, UNIC-SDGs, "Transform" agencies, ECADOC & UN JG	Global set of 144 SDG indicators (112 different ones), includes unavailable indicators
UN region (UNECL)	Developing guidance for member countries but no monitoring carried out		
EU	SDGs to an EU context Focus on 12 policies	European, other Commission services, National statistical offices	EU SDG indicator set, based on existing indicators
National	National SD strategies, implementation of Agenda 2030 in national policies	National statistical offices and other national agencies	National SD indicator sets (most in some countries, are being developed in others)

Source: Presentation by Marko De Smaet, Advisor to the DG European Commission, Eurostat, UNECL Expert meeting
10-11 April 2017, Geneva



All 232 SDG Indicators: What data is available?



Classification of indicators

	Data	Methodology
Tier 1	Data available (at least 50% coverage)	Methodology Agreed
Tier 2	Data not available (less than 50% data coverage)	No Methodology Agreed
Tier 3	Data not available	No Methodology Agreed

Tab. 2. 1. Categories of SDGs indicators

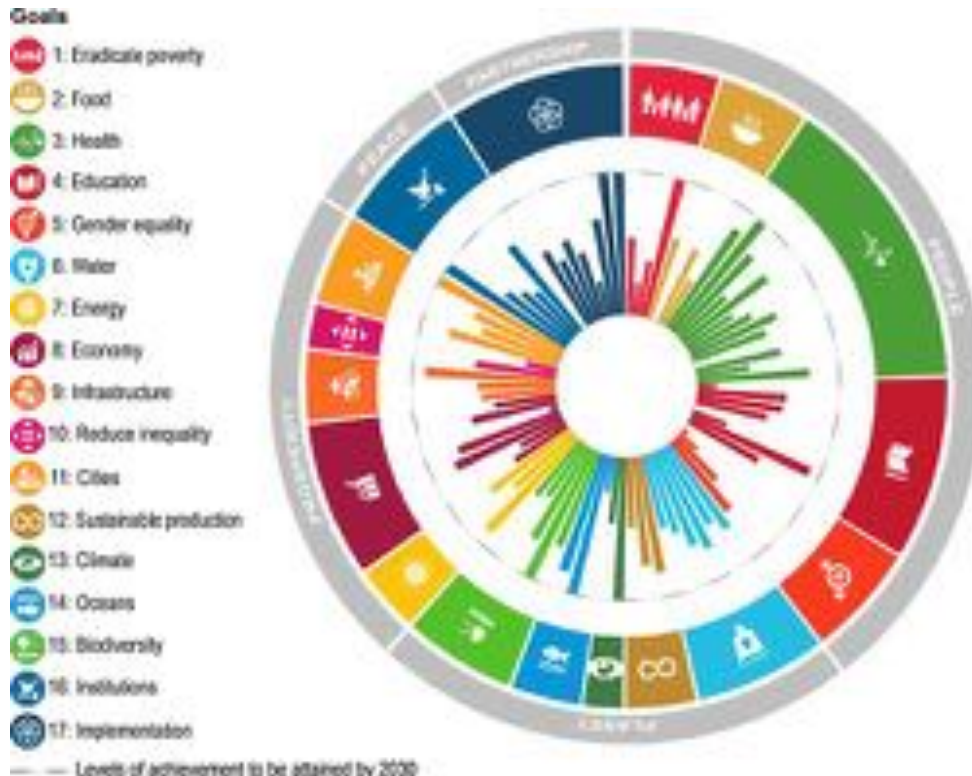
In order to facilitate the implementation of the global SDG indicator framework, all indicators have been classified by the IAEG-SDGs into three tiers based on their level of methodological development and the availability of data at the global level, as follows

Tier I: Indicator is conceptually clear, has an internationally established methodology and standards are available, and data are regularly produced by countries for at least 50 per cent of countries and of the population in every region where the indicator is relevant.

Tier II: Indicator is conceptually clear, has an internationally established methodology and standards are available, but data are not regularly produced by countries.

Tier III: No internationally established methodology or standards are yet available for the indicator, but methodology/standards are being (or will be) developed or tested

SDGs assessments



How far are OECD countries from achieving SDG targets for women and girls?

Applying a gender lens to measuring distance to SDG targets. The longer the bars, the shorter the distance to be travelled by 2030; target levels are represented by the outer dotted circle. The inner circle (the starting point for the bars) represents a score of 3 or more standardized distances away from target, which most OECD countries have achieved on most targets. Targets are shown by goal, and goals are clustered by the “5Ps” of the 2030 Agenda (OECD)

SDGs assessments

Actually, UNECE does not perform monitoring activities, that in Europe, at European level are delegated to other agencies like **Eurostat**, **European Commission** and other **communitarian offices**.

The reference framework of indicators is the EU SDGs indicator set

Es. VOLUNTARY NATIONAL REVIEW, Agencies





Sustainable Development Goals (SDGs)

2019 ITALY REPORT



SDGs in Italy - ISTAT

In Italy a relevant activity is done by ISTAT by the annual Report on **Sustainable Development Goals** .

The Report on SDGs offers statistical measures aimed at monitoring the 2030 Agenda for our country and at the same time contributing to the realization of this global project.

The **fourth edition of 2021** the Report is accompanied by the publication of 354 statistical measures for 135 UN-IAEG indicators (Inter-agency and Expert Group on Sustainable Development)



COMUNICATO STAMPA
RAPPORTO SDGS 2021: INFORMAZIONI STATISTICHE PER L'AG

Il Rapporto sul Sustainable Development Goals (SDG) offre le misure statistiche finalizzate al monitoraggio dell'Agenda 2030 per il nostro Paese e al tempo stesso contribuisce alla realizzazione di questo progetto globale.

I 17 obiettivi di sviluppo sostenibile (SDGs), e i relativi 169 target in cui sono descritti, sfociano in tre dimensioni dello sviluppo sostenibile, intendendo l'Agenda 2030 dal suo pilastro sociale, previsto dagli Obiettivi del Millennio, agli altri due: economico e ambientale, cui si aggiunge la dimensione istituzionale.

Questa quarta edizione del Rapporto è accompagnata dalla pubblicazione di 354 misure statistiche per 135 indicatori UN-IAEG. Rispetto alla diffusione di marzo 2021, sono state aggiornate 119 misure statistiche e introdotte altre 30 nuove.

Il Rapporto è accompagnato da una dashboard che permette la navigazione interattiva degli indicatori, oltre alla diffusione per file di dati e metadati riferiti alle misure statistiche. Tutte le

<https://www.istat.it/it/archivio/260102>

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SDG data source and availabilities



Official data sets compiled within national spatial data infrastructures (such as buildings, roads and hydrological networks) and geographic information systems.

Official sensor networks, for example, those for monitoring weather, air pollution and traffic

Commercial data sets (for example, utility and telecommunication companies, Coca Cola's global monitoring of water quality and commercial 'data philanthropy' spearheaded by UN Global Pulse (<https://www.unglobalpulse.org/data-for-climate-action>))

Earth observation (for example, satellite imagery, LiDAR and drones).

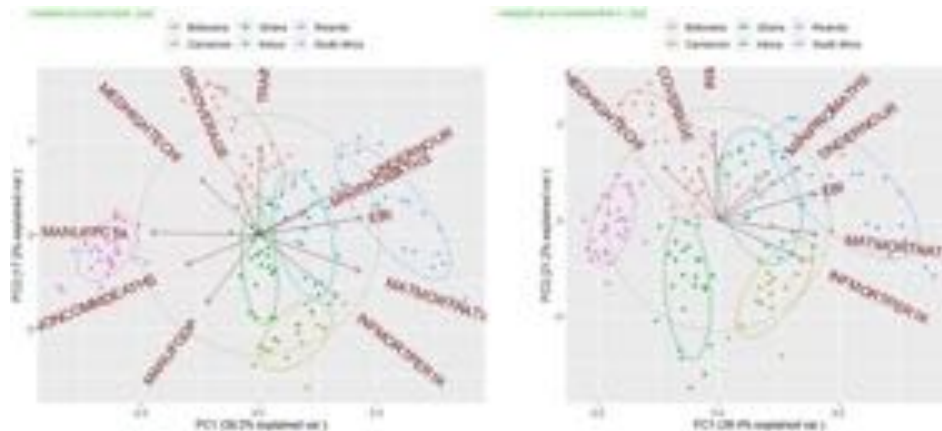
Multiple sources of data generated by citizens and volunteers, both actively contributed through citizen science, or passively through social media, location-aware mobile phone data and low-cost sensors and wearables.

UN Secretary General's Independent Expert Advisory Group on the Data Revolution for Sustainable Development and the Inter-agency and Expert Group on SDG Indicators (IAEG-SDGs)

Machine learning and SDGs

Beside the classical statistical methods several **machine learning and data mining techniques** often developed in the biomedical field could serve as a useful instrument for the compliance of SDGs

Mwitondi and Munyakazi proposed a robust machine learning approach to data segmentation to expound triggers of SDG indicators via interdisciplinary modelling

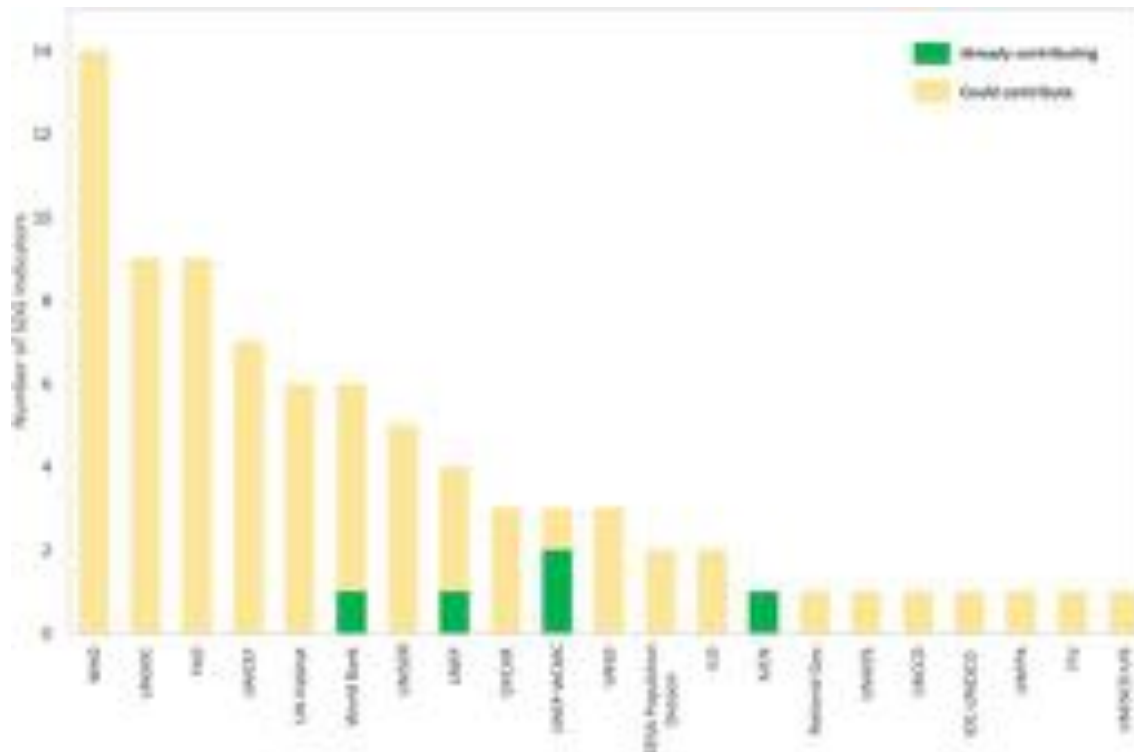


Their work focused only on structured data from five of the 17 SDGs (# 1, 2, 3, 4 and 9) using measures of SDG indicators in six African countries: Botswana, Cameroon, Ghana, Kenya, Rwanda & South Africa.

The study has considered **each SDG as a Big Data source node**, with the potential to contribute towards a unified understanding of implementation of SDG in order to assess interdependence, patterns or major influences of the different socio-economic variables

Mwitondi, K. S., Munyakazi, I., Gatsheni, B. N. (2020). A robust machine learning approach to SDG data segmentation. *Journal of Big Data*, 7(1), 1-17.

The increasing role of citizen science

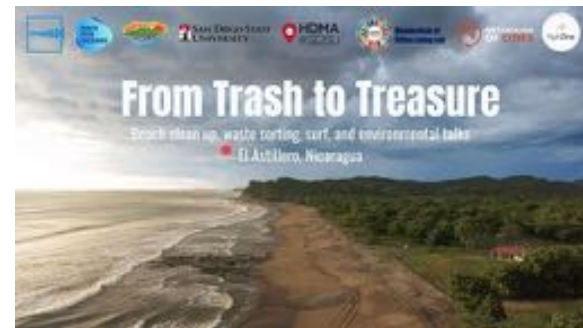


Source Frails et.al,2020

Unleash - Race for Oceans + Casa Congo + MOC-LLAB, El Astillero, Nicaragua, December, 2021



Metabolism of
Cities Living Lab



Sample collection					
	Organics	Plastics	Paper	Metal	Glass & ceramic
Waste	Food waste, bones, blood		Newsprint, stationery		
Household waste	Household waste, food, paper, plastic, metal, glass, ceramic, wood, etc.	Household waste, food, paper, plastic, metal, glass, ceramic, wood, etc.	Household waste, food, paper, plastic, metal, glass, ceramic, wood, etc.	Household waste, food, paper, plastic, metal, glass, ceramic, wood, etc.	Household waste, food, paper, plastic, metal, glass, ceramic, wood, etc.
Waste - a separate line	Household waste, food, paper, plastic, metal, glass, ceramic, wood, etc.	Household waste, food, paper, plastic, metal, glass, ceramic, wood, etc.	Household waste, food, paper, plastic, metal, glass, ceramic, wood, etc.	Household waste, food, paper, plastic, metal, glass, ceramic, wood, etc.	Household waste, food, paper, plastic, metal, glass, ceramic, wood, etc.



Beach Clean Up – Virtual Lectures on Waste



Unleash – Race for Oceans Beach Cleanup El Astillero, Nicaragua



SDSU SDGs Tracking Dashboard

[Home](#)
[About the Dashboard](#)
[Data Sources](#)
[Contact Us](#)



Sustainable Development Goals Dashboard



Researchers: Harmit Chima, Nika Zaballa, Harrison Yang, Dustin Harrison, Yaya Shaker, Carol Maione, and many more

International Team on Covid-19-HDMA@SDSU



- Weekly Zoom Meetings
- Interdisciplinary Professionals from: Italy, Spain, Malta, New York, San Diego, London, Taiwan, Philippines, Korea, and Australia and more.



Taking Action: Towards fighting Covid-19



METROPOLITAN OF CITIES

SAN DIEGO STATE UNIVERSITY

Timeline of Covid-19 spread

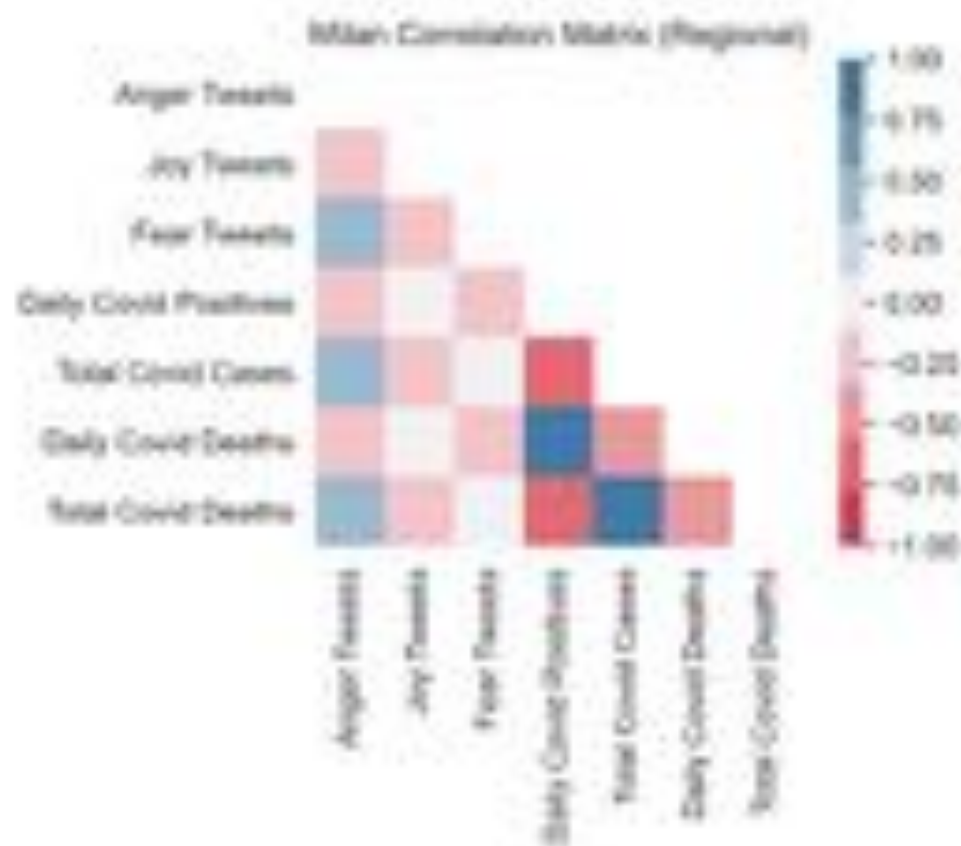


Monitoring Milan's Sentiments During Covid-19

Findings:

- Anger and Covid Cases
- Anger and Deaths
- Fear and Anger
- Covid Cases and Covid Deaths

(Policy Influences)





Smart Social Media Dashboard: Milan, Italy



SDG 3 - Machine learning

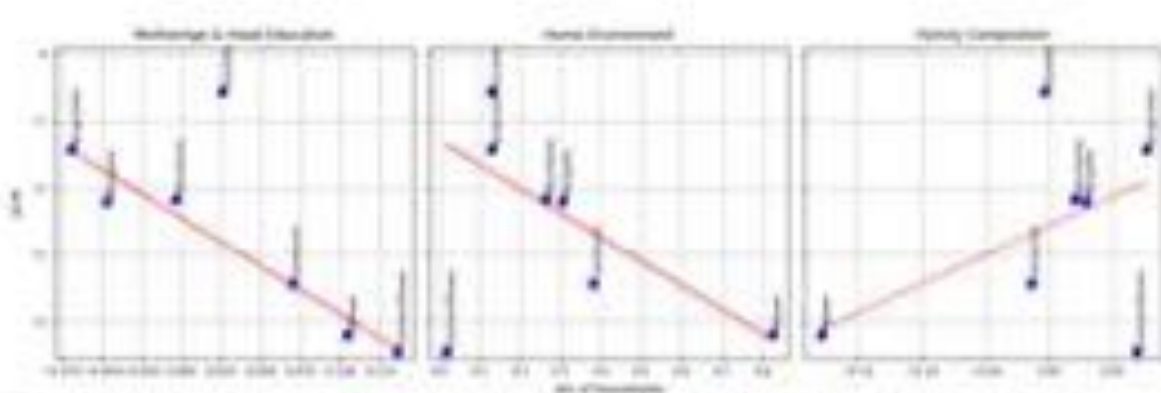
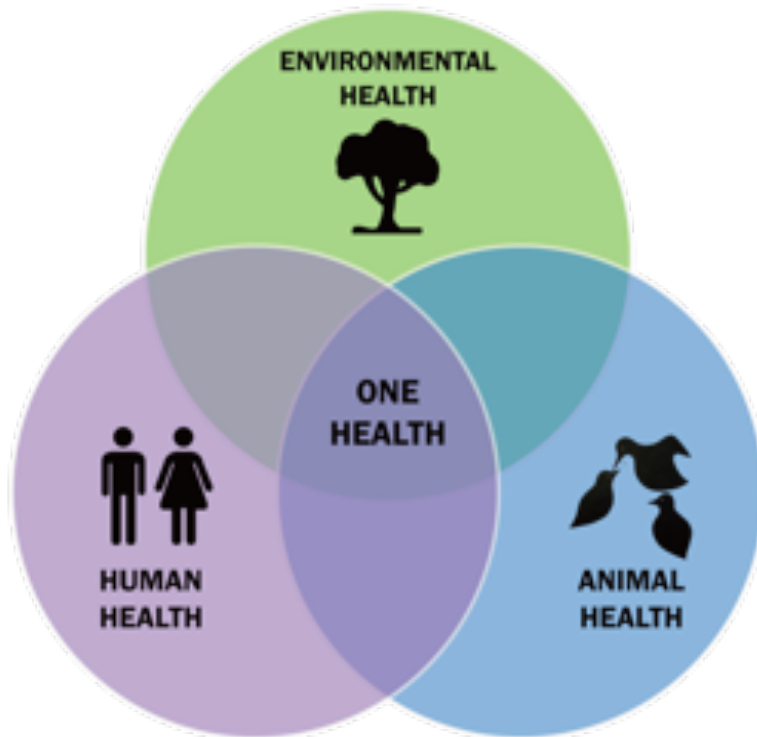


Fig3.6 Association between the improvement of distal causes and 5-Child Mortality (CM) and $\Delta CM\%$ (variation of the incidence of CM) [46]

Bizzego, A., Gabrieli, G., Bornstein, M. H., Deater-Deckard, K., Lansford, J. E., Bradley, R. H., ... & Esposito, G. (2021). Predictors of contemporary under-5 child mortality in low-and middle-income countries: a machine learning approach. *International journal of environmental research and public health*, 18(3), 1315

SDGs - One Health



One-Health Conference 22



**Catania September - 27-28
International One-Health
Conference**

<http://www.onehealthconference.it/>

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Conclusions

1. SDGs have been a framework written by nation for nations that offers a schema to address political governance and challenge governments and partners to be more political, systemic and holistic.
1. To be effective SDGs need to be compliant and for this reason SDGs are addressed by targets and indicators. To be measurable, verifiable and comparable SDGs need to be supported by quality data and analysis techniques.
2. Currently there is still a lack of the necessary data to properly monitor SDGs, however new approaches both in data collection, as citizen science, as well in data management and analysis, like machine learning and data mining techniques, can open the way to improve the current status of data availability and exploitation to better implement SDGs.
3. Into this growing field, biomedical engineering, signal processing, and bioinformatics can offer great contributions in terms of knowledge expertise and the case of applications for SDGs data mining.



THANKS FOR THE ATTENTION

Dr. Gabriela Fernandez

Director, Metabolism of Cities Living Lab (MOC-LLAB),
Department of Geography, San Diego State University
Graduate Advisor, Master of Science in Big Data Analytics
San Diego, California, USA
gfernandez2@sdsu.edu

Dr. Domenico Vito

Researcher, Metabolism of Cities Living Lab (MOC-LLAB),
Department of Geography, San Diego State University
PhD Bioengineer@Politecnico di Milano, Italy
San Diego, California, USA
dome.vito@gmail.com

Carol Maione

Researcher, Metabolism of Cities Living Lab (MOC-LLAB),
Department of Geography, San Diego State University
PhD Student
Dept. Management, Economics and Industrial Engineering,
Politecnico di Milano, Italy |
carol.maione@polimi.it



**Metabolism of
Cities Living Lab**



**METABOLISM
OF CITIES**



**SAN DIEGO STAT
UNIVERSITY**



**HDMA
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THE CENTER FOR
HUMAN DYNAMICS
IN THE MOBILE AGE

Local Partners (US-Mexico)



UC San Diego



AYUNTAMIENTO
DE TIJUANA



GOBIERNO
DE MEXICALI

TECATE
XXIII AYUNTAMIENTO





International Venues - Activities and Awards

