Urban Metabolism and Minority Pulse: An Education and Awareness Campaign Targeting Minority Groups

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Abstract

The Sustainable Development Goals (SDGs) have set the 2030 Agenda to transform our world by tackling multiple challenges humankind is facing to ensure well-being, economic prosperity and environmental protection. However, the attainment of the SDG Agenda will greatly depend on whether the identified synergies among the goals can be leveraged to all members of society including minorities. In contrast to conventional development agendas that focuses on a restricted set of dimensions, this study uses the SDGs as a common language to educate the most vulnerable members of society through a number of tailored based method solutions, educational criteria, and interdisciplinary technical approaches. The study partners includes a collaboration between the Politecnico di Milano (POLIMI), Department of Architecture and Urban Studies in Milan, Italy and the Metabolism of Cities, in Brussels, Belgium an open source organization centered on urban metabolism research. The study aim is twofold: (i) a methodological description and replicable approach of data collection strategies in cities and; (ii) a replicable policy toolkit with a set of tailored methodology and strategy actions, policy implementation tools aimed to target minority populations. The study is developed in three phases: Phase I, consists of a campus-wide awareness initiative at POLIMI to advocate for the creation of an interdepartmental network of students, researchers, and professionals studying sustainability issues (between April-May 2017). Phase II, implement (June-July 2017), a number of community-based tailored-made workshops (based on age, style, design), training courses and educational programs targeting minority groups. The policy guideline toolkit provides information to educate institutions and academia on the importance of developing minority tailored methodology replicated action solutions to develop synergies between citizens, public and private entities. As a part of the slogan 'no one should be left behind', this study designs a set of methodology, tailored criteria kits to educate and develop awareness on themes related to climate change policies, resource consumption behaviors and environmental effects with reference to SDG 12 and SDG 13, respectively. More specifically, the study target seven minority groups: people with disabilities, children, elderly, students and academics, refugees and homeless, LGBTI+, and women. The sharing, and creation of knowledge, data, experiences and storytelling allows urban professionals to promote awareness, conservation, and preservation, towards contributing to localizing the United Nations Sustainable Development Goals by 2030.

Keywords: Urban metabolism; Minority pulse; Education; Tailored-made solutions; Sustainability; Community-based solutions; Policy, Italy, Civic Engagement

Key highlight points

- Engage all citizens by tailoring educational policies to suit their needs (i.e. language).
- Engage universities and community stakeholders as knowledge center hubs (urban walk audit campaign and educating minorities in different languages).
- Educate and engage cities, government officials, students and academics (i.e. universities, research institutions including primary and secondary schools), outdoor education groups (environmental associations), general public, and companies on current climate change and sustainable development policy Agendas.
- Engage targets through social media, culture, art and community activities/services using tailored method solutions.
- Direct governments towards an Inclusive and socially justice city environment.
- Connect local stakeholder groups, synergies, and create strong local-based networks.
- Create scalable and replicable methodology tailored solutions that suit the needs of all members of society, because no one should be left behind (UNDP 2015).

1. Introduction

In 2015, a total of 195 countries joined together to combat climate change and promote societies centered on ideas and policies of sustainable development in which “no one should be left behind” by adopting the United Nations Sustainable Development Goals by 2030 (UNDP 2015). Today, more than ever city governments are shifting towards more sustainable development strategies to combat environmental anthropogenic dangers. Unfortunately, cities don’t have the necessary tools, education and resources to successfully evaluate and promote sustainability. Within this framework, urban metabolism studies can be applied as a holistic design strategies to be used to promote resource awareness, and develop environmental policy recommendations, and design strategies for city development while preserving locally available urban resources. As cities grow bigger in size, and density as a living organism, urban areas require increasing amounts of goods, energy, food, and services to accommodate the lifestyle trends of current and future generations. The concept of urban metabolism entails the study of all flows entering an urban system in the form of material and immaterial resources, and exiting an urban system in the form of waste and pollution. Therefore, the study of the metabolic balance of cities identifies the nexus between environmental degradation on the one hand, and socio-economic behaviors of citizens and urban form on the other. An urban metabolism-based approach can help to address the major barriers to sustainable development by providing a better understanding of the more complex interconnections between an urban area, its socio-economic dynamics, environmental and ecological impacts, and quality of life and well-being of its human and non-human communities (Fernandez 2018 and Maione 2016, 24-27).

2. A focus on minority education

In the past, most national boundaries reflected linguistic, religion and ethnic homogeneity. Until the late 20th century, diversity was considered a liability, not a strength. Today, more than ever society is considered a melting pot with a diverse set of individuals characterized by their ethnic, racial uniformity, set of values, language, residence, and culture. The SDGs can potentially be utilized as a common language among minority groups to identify the social, environmental and economic factors (169 targets) that cover a broad range of sustainable development issues. Our goal is to educate the diversity of underprivileged minority groups on climate change towards a common language that can be easily interpreted and replicated across borders. A language that comes in all types of shapes and sizes to educate the diversity of minority groups on climate change using SDGs as a

common platform tool that everyone can understand regardless of their background and gender. Unfortunately, the less privileged groups are the most affected minority groups (Fernandez and Maione, 2017).
Minority populations are considered populations that are vulnerable and have limited power within the city governments.

Children are considered among the most vulnerable target due to their fragile and innocent. The number of children dying before the age of five has reached a new low of 5.6 million in 2016, compared with nearly 9.9 million in 2000 the proportion of under five deaths in the newborn period has increased from 41% to 46% during the same period (Hug, Sharrow and You 2017, 1). It is important to develop skill integration reproduction in primary and secondary schools towards an informed and environmental cautious society, skilled generation of youth free from environmental dangers and social injustices. Elderly people are known to be more vulnerable than the general population to a range of weather related hazards such as heat waves, ice conditions and cold periods. The coping capacity of the elderly to respond to extreme weather can also be limited (i.e. through impaired mobility, insulation, and poor access to health and welfare services (O'Neill et al. 2009, 100-101). As the nation's population aged 65 and over is set to nearly double by the year 2050 from approximately 48 million to 88 million the number of people living with disabilities will grow. Persons with disabilities are typically among the most 'resource poor' within a community, due to poor education, lack of income, social exclusion and limited access to decision making authorities. Persons with disabilities are in the best position to understand their own situation/condition to the problems they face. As a result, governments need to work together with disabled people in mutual learning and empowerment, to ensure that their strengths and vulnerabilities are represented in all key international, national and local forums, strategies and research on climate change. The central role of person with disabilities (and their careers) in representing their own vulnerabilities, needs and solutions in their situations. It is about their right to access health, education and livelihood opportunities in changing environments. Climate change education and awareness is necessary to develop soft skills to new generations of students and academics. Another major minority player are students and academics as they are considered to be one of the most marginalized sector of society that bears much of the impacts on social, environment, and policy pressures (Gaillard and Pangilinan, 2010). Unfortunately, young people continue to be left out of the decision making process, however slowly gaining momentum at the international and national level. Moreover, governments have affected their level of awareness on climate change. Students and academic efforts have tried to stop global warming through research and have recently gained momentum to get involved with climate change activism due to their unquestionable future.

Around the world, women disproportionately are also affected by the impacts of climate change all over the world. Women commonly face higher risks and greater burdens from the impacts of climate change in situations of poverty, and the majority of the world's poor are women. Women suffer from unequal participation in decision making processes and labor markets compound inequalities and often prevent women from fully contributing to climate related urban planning, social, environmental and policy making and implementation. Over the past few centuries, the LGBTI+ community--lesbian, gay, bisexual, transgender, and intersex (National LGBTI Health Alliance, 2015) has experienced injustices in cities and elevated number of discrimination. The lack of legal recognition for same sex relationships

also have been excluded from labor opportunities, government opportunities and climate change policies. The homeless and refugee population are among the most vulnerable population. Climate change is threatening the lives of the world's poorest and most vulnerable displacing millions. The refugee population are people that have been forced to leave their country and cannot return home safely. Members of society that are escaping war, persecution or social, environmental and political conflicts. Unfortunately, these members of society are forced to leave their homes because of environmental changes which risk their lives or livelihoods. By 2050, there could be up to 200 million people displaced by rising global temperature (International Migration Report, 2017).

The UMMP study composition includes sections on (i) data collection, action pillars and (ii) minority tailored educational strategies.

3. Methods

The "Urban Metabolism and Minority Pulse (UMMP): An Education and Awareness Campaign Targeting Minority Groups" was launched to advocate for sustainable development solutions at the city level targeting minority vulnerable populations. The UMMP is an initiative that tackles and localizes the SDGs to incorporate the concepts of climate change, urban metabolism, and sustainable consumption and production of resources into an inclusive and creative learning system that addresses all members of society. Therefore, the authors strongly believed that the society as a whole may benefit to promote community-based and minority-based education in local-based sustainable development strategies. The UMMP campaign platform features a replicable toolkit and methodology structured to facilitate awareness on resource management, community engagement, city planning, and environmental design targeting the unheard minority voices of society to provide knowledge exchange between municipal governments, educational institutions, and community based organizations. The study is then used to create cross-city analysis to identify best practices globally that can empower all citizens from different social and cultural paths worldwide to create sustainable changes in their urban environment. In this perspective, the study adopted a number of replicable and scalable tools based on a set of different approaches to education and solution design that favor transparency, ease of learning and understanding, and multidisciplinary. The study's tailored methodology includes: (i) flexibility and tailored-made criteria to be adapted to each target group's needs; (ii) diversified approaches using the communication and learning channels preferred by each target group; and (iii) creative learning based on education and experience.

Six policy recommendations were identified to execute the urban metabolism of a city (see Figure 2).

1. (i) A micro-simulation urban metabolism model is replicated in cities around the world. (ii) A micro-simulation report toolkit for policy makers explaining how the model functions and standard scenario methods that can be applied in other cities around the world.
2. Data collection predictive modeling to realize consumption and production preferences in the presence of future technologies in cities (i.e. sector(s) agriculture, residential, industry, tertiary, and transport).

The developed tailored based sustainable development inclusion policy based solutions for seven minority groups of society: (i) Children: Istituto Comprensivo di Porto Mantovano, Mantova (Italy); (ii) Elderly: Centro Sociale Anziani Soave, Mantova (Italy); (iii) Disabled

people: Anffas Onlus Mantova, Mantova (Italy); (iv) Students and academics: Politecnico di Milano, Milan (Italy)
(v) Women: City of Mantova (Italy); (vi) LGBTI+: Poliedro, Politecnico di Milano, Milan (Italy) (vii) Homeless and refugees: City of Milan (Italy). As an integral part of the campaign, the report entitled “Urban Metabolism Policy Toolkit for Climate Adaptation and Civic Engagement at the City Level: A step-by-step guide to data collection, sustainability indicators, and minority education” in collaboration with UN Environment Program, was developed in partnership with United Nations Environment Programme Global Initiative for Resource Efficient Cities (GI-REC), Metabolism of Cities, and Politecnico di Milano, Department of Architecture and Urban Studies. The technical report aims to educate urban professionals and city governments (developed and developing countries) on a number of ways to localize the SDGs through an inclusive set of guidelines and diversity-based tailored methodologies. The policy toolkit provides information on tailored-made design, structure, formats, and strategic layouts to target unrepresentative members of society using cultural activities, games, virtual reality, and charrette learning approaches (Fernandez and Maione, 2018).
The UMMP toolkit allows urban professionals to weigh in on or contribute towards a smoother/and or more efficient implementation in the long run, including: (i) better decision making that more effectively responds to the needs and priorities of a diverse community, more specifically disadvantaged groups; (ii) increase public understanding of and support for public policies and programs; (iii) increase transparency and accountability of government actions; (iv) community members and community resources become a part of the solution (Fernandez and Maione, 2018). The toolkit supports a range of organizations and roles related to urban metabolism, including government managers, policy makers, IT professionals, disability advocates, procurement officials, technology suppliers, and developers.

Phase I
Extension to the existing simulation tool to accommodate future United Nations Sustainable Development Goals to serve as indicator monitoring and reporting policies by 2030. Data collection and city classification into a set of prototype cities representative of global urban diversity (i.e. 6 cities). The development and validation of prototypical virtual city generator that is able to generative virtual urban areas for simulation. Demonstration and evaluation of future consumption and production scenarios in six large scale real network simulation models using six thematic pillars. Scenario testing and sensitivity analyses in prototypical virtual cities to realize implications of future policies on consumption and production patterns, emission levels, and energy consumptions (see Figure 1 and Figure 2).

Phase II
Through this study, we aim to deliver information on climate change, urban metabolism, and resources consumption in the form of workshop and awareness campaign, as well as provide a policy toolkit that is applicable for all levels of society with an emphasis to minority groups. These target groups include but are not limited to: children, elderly, disabled people, students and academics, women, LGBTI+, and homeless and refugees. During Phase II, we implemented a number of workshops and activities in the cities of Mantova and Milan, Italy and collaborated with several local-based institutions and organizations including Istituto Comprensivo di Porto Mantovano, Anffas Mantova Onlus, and Centro Sociale Anziani Soave based in Mantova, Italy, Metabolism of Cities, and Politecnico di Milano and Poliedro based

in Milan, Italy. Our team of experts adopted an approach consistent with other studies promoting awareness on the SDGs and sustainable development.

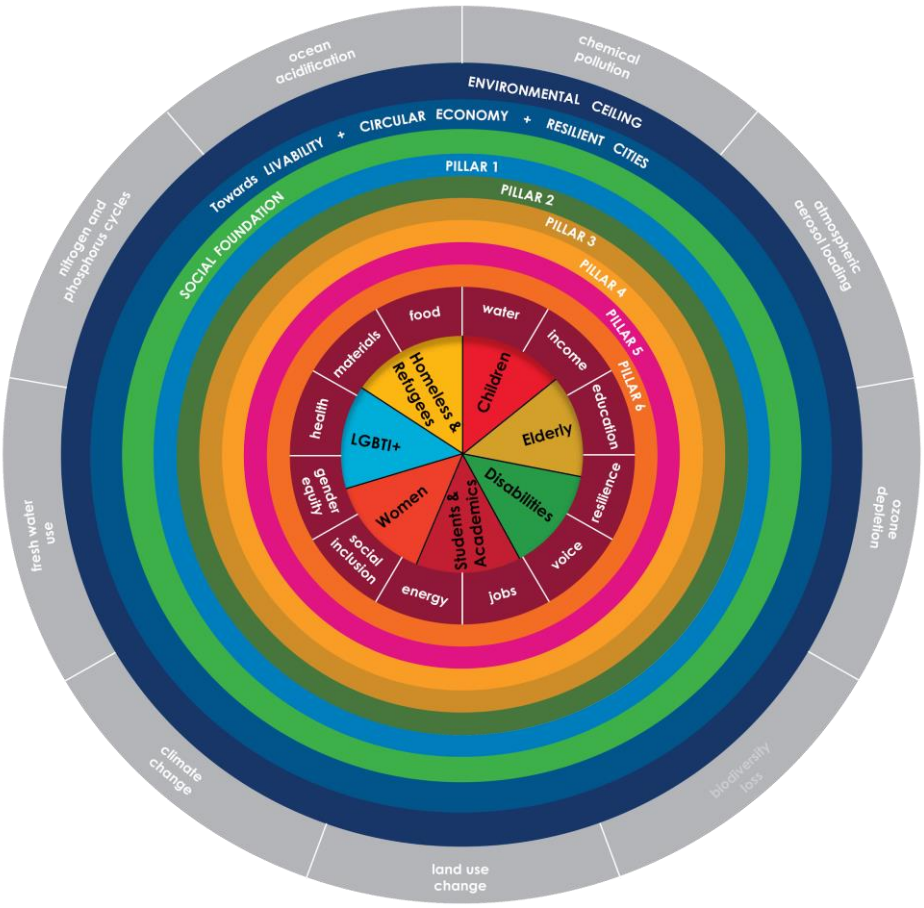

Figure 1: Urban metabolism microsimulation six pillars (Fernandez, 2018).

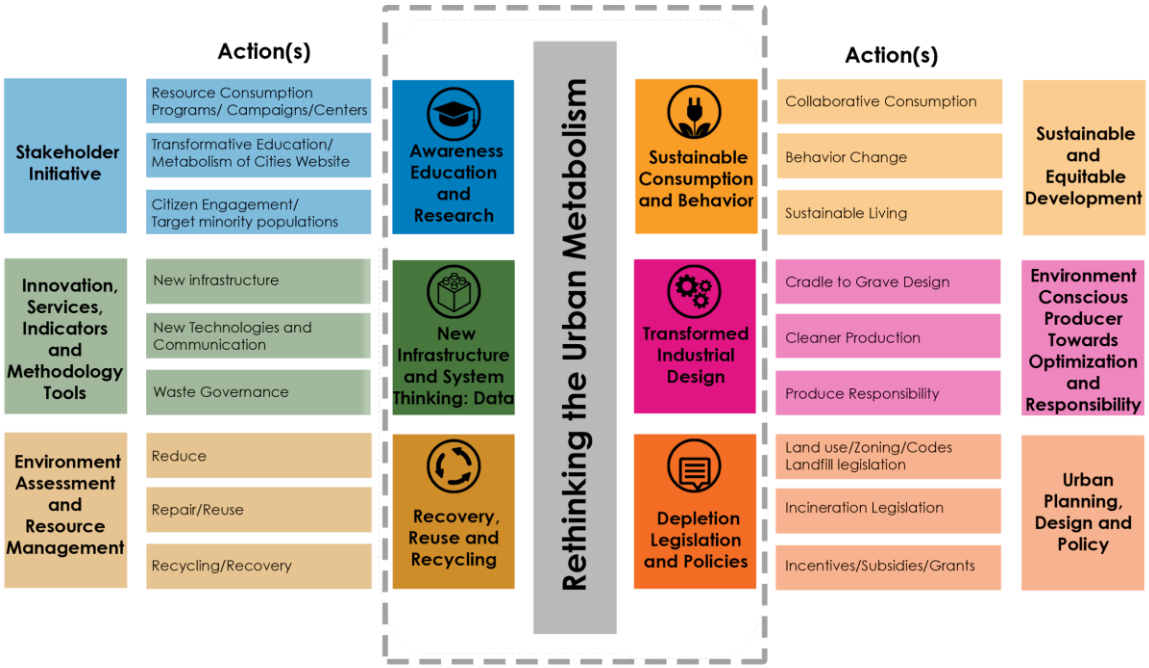

Figure 2: Urban Metabolism Policy Toolkit (inspired by Raworth, 2017).

4. Analysis

The analysis was developed in seven unique characteristics through a number of workshop, services and training courses to develop synergies among urban governments and urban professionals. The target population is composed of a (i) Step-by-step guide to data collection, sustainability indicators and minority education (analyzing, monitoring, reporting material, energy, pollution and nutrients in cities). (ii) Civic engagement through educating minorities on climate change awareness. This toolkit has detailed recent and ongoing research that aims to draw attention to the risks of climate change for the minority population and the need for adaptation responses. Moreover, the ultimate test of the tool's utility is its application by various users, and future activities could helpfully include stakeholder oriented evaluation of its usefulness and relevance to practical adaptation as well as its broader value for education and awareness raising. National climate change strategies must be inclusive of the capabilities, rights and vulnerabilities of minority people to reflect the convergence of specific types of population and climate change. It is important for minority groups, their families and governments to understand the impact of climate change on their health so they can begin planning to protect themselves from exposure. There are strong links between extreme poverty and minorities each type resulting from the other. Ending the cycle must also include addressing discrimination and negative attitudes which create barriers and exclusion, exacerbating the hardships which minorities may face. Finally, if cities started to see minorities as an asset they could develop partnerships with microfinance institutions and employment agencies (training). Such resilience is crucial in a world affected by climate change. As the aging population continues to increase as people are living longer, it will become even more important to include elderly and disabled people in the labor market. Moreover, governments in cities should make education accessible to all types of people, run awareness campaigns to challenge stereotypes in multiple languages and design, and provide accessible, low cost infrastructure that accommodates all members of society because 'no person' and 'no city' should be left behind.

UMMP Toolkit

The children educational activities were related to material, energy and pollution flows in their original Italian language. Through workshops and activities children were able to observe climate change with statements that describe the observations, understand the relationship between extreme weather events, demonstrate their knowledge of interconnections between natural systems and the built environment, observe how glaciers have changed over the last century and its effects on polar bears, energy consumption at the household level to determine good sustainable practices, importance of recycling material, their own travel mode carbon footprint, material flows, and visualization of pollution from all around the world using virtual reality cardboards.

Elderly: Through activities, workshops and games a number of tailor made designs were implemented for elderly to identify and address their own climate change concerns (to gather potential sustainability evaluation indicators) by participating in memory game, interviews, panel discussions, charrettes, virtual reality cardboards, round tables and workshop presentations. Elderly citizens were presented with information to learn where and when natural disasters form. They obtained a better understanding to how climate change may be affecting them through temperature spikes from extreme heat waves, icy cold conditions and high concentrations of pollution that may affect their vulnerable health. The majority of elderly residents spoke Mantovano--an Italian dialect from the city of Mantova--a secluded

population that remain separate from the Italian language community.

Disabled people: Participants included members with disabilities from vision impairment, mental health, intellectual disability, acquired brain injury, physical disability and autism disorders. A number of climate change tailor-made game activities took place during the workshop including questions regarding their ability to live independently within their communities as a disabled person during a natural disaster. In addition, people with limited incomes may not be able to afford air conditioning in their homes during heat waves, increasing their risk of heat stroke or health conditions. Safety measures Q&A training took place to allow disabled people a better understanding of the threats that climate change poses on human health to lower risks and allow them to be prepared from floods, droughts, wildfires, extreme heat waves and cold temperatures. During the event a number of international recycling strategies were presented to foster an intimate understanding that no single task is too small and that one simple gesture (i.e. energy savings or recycling waste) can make a difference in the world.

Students and academics campaign: International students and academics are comprised of individuals from all around the world, including members from Politecnico di Milano, Accademia di Brera, Università Cattolica del Sacro Cuore, and University of Milan. Activities included a number of conferences, workshops and activities, surveys and interviews related to localizing the SDGs by 2030. Both students and academics were interviewed and asked about their own city's environmental, social and policy conflicts and sustainability choices. An exhibition was developed about natural resource behaviors and innovative technological strategies. Students were asked about what the concept of urban metabolism means to them and were asked to sketch their own interpretation as well as the strengths and weaknesses of their own individual city. Academics were interviewed to describe their own interpretation concerning the future of urban metabolism, resilient cities, and the 17 Goals. Students and academics were educated on the importance of gathering indicators about atmosphere, consumption levels, social drivers, urban patterns, and urban quality in order to understand how a research question about the Earth system (hinterlands) can be answered by collecting data using different research platforms and instruments as environmental assessments, visualization, and monitoring and reporting material flow analysis.

Women: A number of women participated in the event and interacted with other mothers as they learn about the heat properties of greenhouse gases that contribute to climate change they learn how simple sustainable behaviors can change and alter the levels of greenhouse gases in our atmosphere. A survey took place to educate participants about positive and negative consumption behaviors on water, energy and materials.

LGBTI+: During the event a number of activities took place alongside Poliedro, the main LGBT organization at Politecnico di Milano. A number of interviews took place to highlight the social, environmental and political challenges faced by their community in their own individual cities. Participants discussed the challenges faced as a member of the LGBT community in developing countries where homophobia is more likely to be a social discriminant factor. In addition, some participants discussed the difficulties of being a transgender living in a Catholic country as Italy.

Homeless and Refugees: Interviews were conducted in Milan, Italy targeting homeless and refugee communities. A number of questions were asked in English and Italian language for the purpose of understanding whether they have experienced hardships while living out in the streets and how climate change has impacted their own lives. Many of the participants provided recommendations aimed at the Italian Government concerning aid and shelter. During the interview and survey sessions, a number of Italian homeless participants discussed their feud with refugees due to the limited amount of available resources from beds, food and clothing offered in municipal shelters.

Table 1: UMMP workshop activities divided by target group.

Target Group	**Ages**	**Partnering Institution**	**Activities**	**Date(s) 2017**
Children **(N=14)**	4	Istituto Comprensivo di Porto Mantovano	-Journey path home-school & sustainable modes of transportation. -Material categorization by color, shape, and symbols & understanding of items conditions. -Visuals on air pollution worldwide. -Creation of polar bear face masks using household recyclable material items. -SDGs before and after through an art activity. -Understanding of Earth's elements through a comic book superhero flow squad named, Urban Metabolism and Minority Pulse Squad.	June 5-6 June 12-14 June 19 June 22
Elderly **(N=14)**	60-90	Centro Sociale Anziani Soave	-SDGs video on climate change impacts. -SDGs memory game. -Interviews about climate change, environmental dangers and traditional sustainable solutions. -Q&A on natural disasters and elderly dangers. -Roundtable charrette and group discussions on local hotspot dangers. -VR to educate on the dangers concerning quality of life, pollution, heat waves, cold temperatures, and conditions.	July 6 July 12
Disabled people **(N=39)**	20-70	Anffas Onlus Mantova	-SDGs animation fact video. -Categorization of household waste products. -Hot and cold interactive hands experience. -Presentation on the dangers of animal extinction and environmental degradation. -Creation of polar bear face masks using household recyclable material items. -Interviews about real life experiences affected by climate change.	July 17 July 19
Students and Academics **(N=55)**	19-34	Politecnico di Milano	-SDGs gallery exhibition. -SDGs youth conferences and seminars in Milan (x2). -Interviews about personal contributions to the SDGs. -Art sketch activity on the interpretation of urban metabolism. -Surveys on consumption behaviors, SDG knowledge, and climate change awareness.	May-July
Women **(N=13)**	25-40		-SDGs video. -Surveys on household water and energy consumption. -Surveys on mobility. -Interviews about climate change and environmental dangers.	June 14

			-Q&A on household sustainable solutions through a reward system platform. -SDGs roundtable discussion. -VR to educate on household sustainable strategies and good practices.	
LGBTI+ **(N=13)**	19-28	Poliedro	-SDGs video. -Interviews about inclusion and diversity in job and economic opportunities. -SDGs roundtable discussion. -VR to educate on the dangers concerning quality of life, pollution, heat waves, cold temperatures, and conditions.	June 24 July 12
Homeless and Refugees **(N=9)**	27-61		-SDGs summary goals speech. -Interviews about climate change. -Q&A on natural disasters and homeless and refugee dangers. -SDGs roundtable discussion. -VR to educate on the dangers concerning quality of life, pollution, heat waves, cold temperatures, and conditions.	July 8

5. Discussion

There are a number of strategies to develop awareness on resource management in cities. While it is true that access to education has undergone an enormous progress since 2000 (UNDP 2015), this study finds that minority and vulnerable populations still struggle to gain knowledge on what experts call “hot topics” such as climate change, global warming, over-consumption of resources, and unregulated production of waste. Considering that today more than ever societies are characterized by diversity of culture, gender, socioeconomic status, language, education level, and ability to understand, there is an urgent need to provide an inclusive education and policy approach that addresses a society in its entirety.

Key findings

In our study we found that notions related to climate change, urban metabolism, and resource consumption can easily be delivered and understood by implementing diversified dissemination approaches. In particular, preliminary outcomes of our analysis demonstrate that: (i) Every group gain knowledge about climate change and resource consumption through examples and cases from their own daily life experiences: i.e. water and energy consumption at household level; pollution from private vehicles; segregated waste collection at municipal level; impacts of global warming on elderly’s health conditions; pollution in their cities; etc. (ii) Ideas of climate change, global warming, and sustainability with regard to consumption of resources and ease production are well understood even if not directly related to the words “climate change” or “urban metabolism.”

Policy recommendations

1) *Easy access to information through tailored-education/training solutions. To* consistently align with SDG4, we promote a target-based education system that disseminates information through different channels tailored to the specific needs of each target population. Target groups have been addressed through a diverse and inclusive policy toolkit that fosters awareness, easy understanding, and creativity amongst those population groups that are commonly excluded from campaigning and education on sustainable development.
2) *Recognition of boundaries between target populations.* The identification of specific target groups facilitates the creation of tailored methodology toolkit. Indicators used to categorize the seven target each group are: existence of other tailored programs

addressing the group considered; inclusion in main awareness and information campaign on resource consumption and climate change; and ability to understand information and extent to which information is assimilated. The persistence of different needs and infrastructures for all target populations requires a full understanding of each group's preferred and most understandable communication and dissemination channels.

3) *Provision of a flexible toolkit and gamification of learning experience*. This intervention allows the toolkit's users to adapt methodology and rules to the specific needs of each target population in its environment. Therefore, the toolkit provide general guidelines which can be adapted to specific user's needs and learning processes. In particular, gamification of the learning experience through learner-based activities allows for proactive and creative learning.
4) *Incentive-based system through the use of ICT platforms*. This will provide a point-based system to record and keep track of the user's sustainable actions. A digital platform will report individual actions in the form of storytelling while integrating additional information and facts on the daily achievement of SDGs. Users will be able to collect points and be awarded the title of "UMMP Promoter."
5) *Hybrid governance system integrating academia and the private sector.* This will allow professionals to make better decisions that more effectively respond to the needs and priorities of a diverse community including disadvantaged groups; increase public understanding of and support for public policies and programs; increased transparency and accountability of government actions; and assist community members in becoming part of the solution.
6) *Co-design of the gamification experience.* We aim to develop workshop and contest targeting the design of the gamification learning.
7) *Nudge interventions using technology solutions such as Virtual Reality (VR)*. These interventions address the installation and provision of virtual reality devices in order to foster creative learning and assimilation of information through gamification. The use of these devices is easy and intuitive, and an initial training section will target teachers and educators to facilitate access to knowledge and VR technologies.
8) *Incentive-based system through the use of ICT platforms*. This will provide a point-based system to record and keep track of the user's sustainable actions. A digital platform will report individual actions in the form of storytelling while integrating additional information and facts on the daily achievement of SDGs. Users will be able to collect points and be awarded the title of "UMMP Promoter."
9) *Hybrid governance system integrating academia and the private sector.* This will allow professionals to make better decisions that more effectively respond to the needs and priorities of a diverse community including disadvantaged groups; increase public understanding of and support for public policies and programs; increased transparency and accountability of government actions; and assist community members in becoming part of the solution.
10) *Co-design of the gamification experience.* Along with the final users for each population group, we aim to develop workshop and contest targeting the design of the gamification learning. In particular, we are open to suggestions from users.

6. Conclusion

The UMMP kit provides a number of tailor-made packages aimed at minorities to educate urban professionals and policy makers. In addition, direct and educate university campuses about good sustainable development solutions. This paper explores how inclusion of minority groups in education programs and awareness campaigns on urban metabolism can help policy makers to co-design solutions for sustainable development at the level of the city, as well as it can assist the academia in the creation of a pro-active learning environment where all groups are given equal consideration. Drawing on the United Nations SDGs, we

developed an inclusive and easily accessible toolkit that serves as a common language to deliver knowledge on climate change, urban metabolism, and resource consumption. This research aims at providing a non-exhaustive set of workshop activities that can be scaled and replicated, and a set of policy recommendations on innovative approaches to minority-based learning. In particular, we contend that a focus on target minority groups will benefit the society in its entirety as it will create a direct dialogue between policy and decision makers, experts on and scholars of urban metabolism, and populations that are most affected by overconsumption of resources and extreme climate events.

Limitations

We recognize that this analysis is limited to datasets obtained from two Italian cities, Mantova and Milan. We are aware that longitudinal studies that promote awareness on climate change, urban metabolism, and resource consumption in a more diverse setting would present a more accurate picture of how inclusive education can foster sustainable development. In particular, it would be of great value to replicate our workshop to developing countries where extreme climate conditions and over-consumption of locally-available resources pose a greater risk to human's ability to develop resilience and sustain their basic needs. The study was limited due to time and resource funding.

Notes (Provisions of a step-by-step tool package)

Development of indicators to implement local-based SDGs index reports: Flexibility depending on local needs, setting conditions, availability of infrastructure, target's ability to understand, ease of learning. At POLIMI it was recommended to evaluate and assess performance within a six month period and measure a number of significant indicators (number of initiative undertaken towards disseminating SDGs; number of research projects on SDGS; SDGs touched in education (courses, workshops). The selected indicators in universities can be: short vs long term impacts of the workshop: depending on how many months students remember the scope of our work/notions and gained from SDGs. For professionals and businesses it is important to consider how often a new project undergoes the SDG assessment before approval? For example there is an environmental assessment which is mandatory for new projects, but what about SDGs assessment? As SDG is more inclusive than environment.

Creation of a points-based assessment platform. Through assessing a university's performance on SDGs progress, inclusion, and minority-based education. A final score can be given to the university based on overall performance and selected studied indicators. In 2017 a project was carried out consisting in the mapping operation of the competences already present at our institution. The mapping was conducted through an inclusive call in the form of an online questionnaire submitted via email to all the members of the Politecnico di Milano university community, namely university staff (personnel), academics (Professors and Researchers, including Postdoc) and PhD students and academics. The goal of mapping consisted in identifying the domains and actors engaged in sustainability. Sustainability as a very broad and inclusive topic, possibly covering many all the different activities potentially involving all and people in that represent our community. Discovering that, even if from different perspectives, many of us are working toward a sustainable future may bring is this is a powerful message tool in order to reinforce our community, sense of belonging and cross-institutional and cross-actors relationships. In particular, we identified four major main domains in order to investigate our baseline on the following topics: research, i.e. research projects and publications by our academic staff; education, i.e. courses, theses, scholarships and contests offered to our students, management, i.e. institutional activities and projects, offices and operations run by university staff (nonacademic personnel); partnerships, participation to networks, external relations with public and private stakeholders.

The aim of this study was to map sustainability competences currently already present at a university institution (as of May 2017), in order to recognize where and to what extent we are in line with Sustainable Development Goals towards the achievement of the ambitious targets of the Agenda 2030 A mapping operation, carried out in the Spring of 2017, is only the starting point aiming at defining a baseline to track our commitment to the SDGs..

Phase 1. Recognizing: engagement and capacity building **(**March - July 2017). The launch of the mapping activity - call for contribution; Self-mapping through a first open online survey covering: research (projects, publications),

education (offered courses), institutional activities (operations, offices, and projects), data analysis, and interpretation. *Launch of the survey:* In particular, a survey with a set number of questions was launched in March and April 2017. The advertisement of the call was minimal: only two emails have been sent by the vice-Rector Emilio Faroldi to all the community members except students. Hence, everyone involved in research, teaching or institutional activities received the message twice. The advertisement of the operation was minimal on purpose, for two main reasons in particular, namely: firstly, we wanted to detect the real committed community members that took action by responding on a voluntarist basis to the call; secondly, we did not want to affect the sampling and to get the same penetration modalities to all the institutional and academic departments. As already mentioned above, in so doing, we know that the first mapping is not complete, even if 201 adhesions is not a bad starting point at all. *Phase 2. Communicating: disseminating SDGs throughout our community (*May - October 2017)

A number of open events on SDGs are proposed from a multiple events with students (projects, exhibition with thesis posters, contests and challenges); (the report of the events held on May 22nd 2017 and May 24th 2017 are reported in appendix). Another event includes a one-day event with academic staff and operations (research, and institutional activities). In addition, to participants: research + institutional/university staff + education (courses; students). *Phase 3. Taking action: committing our whole community to sustainability* (fall - winter 2017). The POLIMI mapping was used to delineate a strategy about how to make the SDGs effective for higher education and on campus. A series of dedicated tables on the different SDGs focuses were held in order to gather community members and define targets for research, teaching and institutional activities. As an open inclusive process, the subsequent steps are not fully defined yet, but will be better identified and implemented through active design with our colleagues, working with either teaching/research or technical responsibility, and with students. *Phase 4. Permanent monitoring: evaluating our progress towards the 2030 Agenda* (fall - winter 2017). At POLIMI the concept of progressive mapping strategies included a continuous monitoring and evaluation of progress in order to meet the goals of the Agenda 2030. Launch of a second call for self-mapping in order to include new tasks. Yearly mapping of SDGs commitment and spontaneous reporting to be enabled through a dedicated website. During the last years, Politecnico di Milano has been operating on the integration of programs and seminars on Sustainable Development to its coursework. To that end, a group of faculties is currently mapping research works and coordinating ongoing educational activities offering specific sessions and initiative on the SDGs and the Agenda 2030.

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