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Summit on Science and Technology Enablement for the Sustainable Development Goals

Meeting Report • January 23, 2017 • Jennifer Costley

TABLE OF CONTENTS

INTRODUCTION[1]

On November 29, 2016, the New York Academy of Sciences hosted the **Summit on Science and Technology Enablement for the Sustainable Development Goals** (SDGs). Adopted by the United Nations in 2015 as the centerpiece of the 2030 Agenda for Sustainable Development, the SDGs are a roadmap for the future: a set of 17 global goals and 169 specific targets aimed at saving the planet and its people and forging peaceful, just societies. The Goals are both extraordinary and ambitious, seeking to raise the world's most vulnerable people out of poverty and strife, ensure access to clean water, nutrition, and education, and transform urban centers into safe, livable cities reliant on clean energy. Gender equality, inclusive employment, and urgent action to combat climate change and protect wildlife are also included.

Science and technology are central to achieving the Sustainable Development Goals. Indeed, UN Secretary-General Ban Ki-moon has commented that scientists themselves are also crucial to the success of the SDGs, not only as innovators, but as nonpartisan players capable of marshaling global cooperation. At the Summit, over one hundred representatives from industry, academia, NGOs, and UN organizations and Member States, came together to mobilize the scientific and technical community on behalf of the SDGs. These multidisciplinary science and technology representatives from around the world were assigned to one of four working groups, or "streams," each charged with creating a roadmap for applying existing and emerging technologies to the Global Goals. The groups were instructed to identify research and data gaps, discuss best practices for bringing innovation to scale in their fields, and agree upon a list of action items and recommendations. The four streams— Early Childhood Development, People in Crisis, Sustainable Consumption and Production, and Urbanization—cross-cut multiple SDGs and targets, encouraging participants to think holistically and consider solutions that may advance multiple Goals.

This white paper provides a summary of the plenary sessions and the work of each of the four streams. It also discusses next steps for the collective impact of the participants as they move forward on the commitments and key actions defined at the Summit.

The final section of the paper outlines a potential secretariat for this initiative that would:

- Review next steps, establish steering committees and develop work plans for each of the four streams.
- Engage with organizations such as ARM, the EAT Forum, and the UN Sustainable Development Solutions Network to move the initiative forward
- Provide a database of activities underway by Summit participants and a centralized location for access to materials, schedules and shared documents for participants
- Hold a follow up Summit where progress on the Stream roadmaps and other actions will be reviewed

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1   This introduction was adapted from an article by Hallie Kapner originally appearing in The New York Academy of Sciences Magazine.

OPENING SESSION

In his opening remarks, Ellis Rubinstein, president and CEO of the New York Academy of Sciences, identified the Summit as a first step in driving collective action within the scientific community to bring viable proofs-of-concept for delivering on the SDGs to scale. He related how the Summit originated with a request from UN Secretary-General Ban Ki-moon, who saw an opportunity to use the Academy's neutral platform and vast network to help harness the power of the private sector in the effort to achieve the SDGs through science. The Summit took its first steps toward realization when David Nabarro, UN Special Adviser on the 2030 Agenda for Sustainable Development and Climate Change, articulated its mission to integrate work across "big ideas with huge impact" and proposed four overarching themes.

UN Secretary-General Ban Ki-moon speaking at the Summit

In his keynote address, UN Secretary-General Ban Ki-moon described the Summit as a meaningful occasion to accelerate implementation of progress on the SDGs by mobilizing the scientific community. He described ten ways the scientific community might play an even bigger role in delivery of the SDGs:

1. Embrace with meaningful action the objectives of the 2030 Agenda and Paris Agreement on Climate Change. "Let us not be daunted by the ambition contained in these agreements," he said. "Scientists are quite at home with big goals and new ways of thinking."
2. Help the UN learn what works (and what does not) across the Goals and to better understand links among the Goals.
3. Continue providing evidence to guide an effective response to climate change.
4. Contribute input to the Global Sustainable Development Report, a vital instrument for consolidating and presenting scientific knowledge, influencing policy, and accelerating efforts.
5. Support the UN Technology Facilitation Mechanism, which aims to improve access to technology across many fields.
6. Help address significant inequalities beyond the technology gap. "We are all aware of the need for more research into neglected tropical diseases and for a green revolution in Africa," Ban said.
7. Seize the remarkable potential of the data revolution.
8. Foster the empowerment of women, who still make up less than 30% of world's researchers.
9. Bring more young people into science.
10. At a time when extremist groups and even some politicians strive to separate people into opposing camps, be an example of problem-solving across lines that might otherwise divide.

He encouraged the scientific community to continue to do what they do best – produce valuable findings and outputs – but also to go beyond, by both applying and communicating results. He closed by saying, "We need more advances. This is an era of remarkable opportunity. If we implement the two important visions of the 2030 Agenda and the Paris Agreement in full, we will be living in a much better and more prosperous world."

FRAMING THE SUMMIT:
WHY WE NEED SCIENCE TO HELP DELIVER THE SDGS

This session consisted of a panel discussion with three participants:

- Jeffrey Sachs, Special Advisor to UN Secretary-General Ban Ki-moon on the Sustainable Development Goals
- Oh Joon, Permanent Representative of Republic of Korea to the UN
- David Nabarro, UN Special Adviser on the 2030 Agenda for Sustainable Development and Climate Change

Jeffrey Sachs

Sachs noted that with a global population of 7.5 billion, people cannot live decent and secure lives without advanced complex technological systems. "A simpler life is not possible; we have no other options," he said.

What is needed to accomplish the sustainable development goals in this context? Sachs identified two critical concepts:

1. ***Directed technological change.*** Successful, complex human efforts cannot manifest through a Darwinian approach of "random evolution." Sachs cited the example of sending a man to the moon before 1970, a goal not nebulously conceived of as "let's do space science" but a specific, directed goal with commensurate financial commitments. In the same way, Sachs advocated for reading and embracing the SDGs as time-based objectives with a serious, time-based agenda: directed technological change that respects the RDD&D pathways.
2. ***RDD&D*** (research, development, demonstration and diffusion) - a value chain moving from basic ideas to mass uptake. Each stage in the chain has its own complex systems, and movement from research to diffusion isn't possible without passing through the interim stages. The entire value chain must be understood in order to achieve success.

Sachs noted that R&D is typically carried out by government laboratories, businesses and academia. It is 2.5% of US GDP, but should rise to 4% to be comparable to other developed countries such as Sweden and Korea. We need to direct part of this apparatus away from profit-motivated projects toward directed change programs to meet the SDGs. Demonstration projects are also essential, and the philanthropic sector should continue to focus on getting demonstrations out into the world.

Diffusion is the least understood stage in the RDD&D chain. Without a better grasp on it, "shelf-loads of unused technology" will continue to languish, according to Sachs, who said effective diffusion requires analytical tools, a re-emergence of planning as a discipline at all levels, and public funds for scale-up. He also emphasized the need for public awareness and education to encourage people to champion innovations.

Sachs provided several examples where he thought near-term successes might be achieved, including:

- Ending the AIDS epidemic with the tools at hand. The "90/90/90" approach of UN AIDS offers a rigorous way to break the epidemic, if scaled up.
- Malaria deaths could be eliminated by scaling up community health workers with the right resources.
- Renewable energy solutions (e.g. batteries) are within technological reach, but require massive R&D efforts to find the best alternatives.
- A massive carbon capture and sequestration program to drive real environmental change.

Finally, he gave his views on key aspects of the Summit's four themes:

- For Urbanization, "all electric" cities and smart systems are vital.
- For Sustainable Consumption and Production, the main issue is the ability to track flows and break the destructive practices of the international value chains.
- For People in Crisis, achieving peace (SDG 16) is paramount, but beyond that, technology systems that can address basic human needs must be developed.
- For Early Childhood Development, Summit participants have shown that if the first two years are lost, the effects last generations. Every child deserves investment.

He closed by saying, "This work is not easy, but it could not be more exciting."

Oh Joon

As president of the UN United Nations Economic and Social Council (ECOSOC) when the SDGs were adopted and chair of the first high-level review forum for the SDGs, Joon spoke of how issues related to the role of science and technology in implementation of the SDGs are dear to him, and that the transition from the Millennium Development Goals to the SDGs was one of the most important transitions of the last few years. Having seventeen goals compared to eight is a great leap and an ambitious one; now the goals cover almost all human activities. Joon joked that one thing good stemming from such a comprehensive program is "you know how you can reach paradise if you achieve all of them." Though all seventeen are unlikely to be achieved in fifteen years, articulating good goals and ultimate targets aids tremendously in driving progress.

David Nabarro, Jeffrey Sachs, and Oh Joon (at podium)

During Joon's ECOSOC presidency, the UN launched the Technology Facilitation Mechanism (TFM), an important tool for supporting the implementation of the SDGs, which aims to assist member states and facilitate comprehensive support within the UN for capacity-building, with developed countries assisting developing countries to improve in science, technology and innovation (STI). Joon offered the example of South Korea, which was heavily agricultural in 1945, in contrast to North Korea. The advancement of South Korea from the period of 1945 through 1972 (when South Korea's industrialization caught up with North Korea) through today was dependent on the transfer of technologies from elsewhere and the success of the South Koreans in building on the contributions of others. "The way I see it, even when it comes to scientific and technological achievements, it is important to build on the knowledge of others," he said. STI can spark increases in income and job creation for inclusive growth, leaving no one behind.

David Nabarro

Nabarro said he considered the Summit an important gathering of an extraordinary group of transformers and described four important takeaways from the 2030 Agenda:

- It represents an amazingly ambitious plan that involved the voices of millions of people.
- It offers the ultimate plan -- universal, interconnected, and inclusive. To achieve it, participants must be able to *backcast* – to imagine the world as it should be in 2030 and unpack what it will take to meet the Goals.
- As well as a plan, the 2030 Agenda is a political manifesto that lays out choices that need to be made by those in power in order to create benefits for the people of the world. Thus, is *political*, but not *partisan*. Its only agenda is a better future.
- Achieving the 2030 Agenda requires a collective of activists. Being an activist means harnessing power for an outcome. Being a collective means being prepared to make the extra effort to work together.

Nabarro further stated that the work must be guided by scientific methods in all sciences – physical, social, and managerial. It requires evidence, innovation, and demonstration, as well as illustration of progress to the decision makers.

He concluded by saying, "I would like this to become a landmark day and a point of reference - the place where we committed and agreed and promised to work hard to make a difference. My request is for you to remember that this is about science, but also about how power is applied to make change to reach the outcomes we are all aiming for."

EARLY CHILDHOOD DEVELOPMENT STREAM[2]

The Early Childhood Development Stream working group comprised 24 participants with a wide range of expertise including child development and pediatrics, telecommunications, bioethics, early childhood education, and nutrition.

The SDGs represent an unprecedented opportunity to showcase the role of Early Childhood Development (ECD) as a foundation for sustainable development—prior to the 2030 Agenda, the many dimensions of child development had never been prioritized on a global scale. The human brain develops most rapidly during the first three years of life, and stress, poor health, malnutrition, and a lack of stimulation during this crucial time have lifelong, negative impacts on developmental potential. At present, more than 250 million children under the age of five are failing to reach their developmental potential due to adversity.

The field of Early Childhood Development lacks unique metrics and assessment techniques, particularly those that can be deployed in the field. Most assessments of child development rely on proxy measures—for example, stunting, micronutrient deficiencies, or poverty. While these factors certainly correlate with child development, they provide little nuance or insight into the aspects of cognitive, social, and emotional development ECD programs seek to strengthen. As a result, the ECD field is hampered by difficulties assessing children in the remote or impoverished areas where services are most likely to be needed, a lack of standard metrics, and assessment instruments that provide only indirect measures of child well-being.

The working group discussed how ECD field data is collected and shared—or more often, not shared. Specifically, there is usually a gap between those working in the field to test children and perform evaluations and those who monitor a program's progress. It was suggested that closing that gap is a key step in scaling up ECD programming and ensuring that existing programming is effective. Improving data reporting systems will not only boost the quality of ECD services delivered to children and families, but will ensure that policymakers have access to localized data that accurately represent both the positive outcomes from ECD programs as well as unmet needs and challenges. The ability to gather actionable data and share it quickly is at the heart of closing the information gap. The working group agreed that technology was a clear source of solutions in this area. The potential for mobile and smartphone technologies to aid in ECD data collection is vast and underutilized. Mobile infrastructure can and should be tapped for ECD.

More universal metrics and better data collection, likely aided by technology, will bring much-needed rigor to the ECD field and may help build political and industry support for programs and partnerships.

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2   This summary was adapted from a report on Stream activities by Hallie Kapner.
        http://www.nyas.org/asset.axd?id=5169a997-40ce-4486-9471-6a892516196f&t=636204242932900000

The innovation and implementation discussion began with a brainstorming session about existing technologies and programs that may be adapted for ECD purposes. A tablet-based data collection system called Tangerine was discussed as a potential model for a device-based system to assess interaction between a parent or teacher and a child. Ecological Momentary Analysis (EMA) uses real-time assessment methods to capture behavior in everyday life. The group believed that both EMA and the Tangerine system could be usefully adapted for ECD purposes.

Also discussed were applications in the mobile health community, including smartphone apps deployed to help community medical workers improve their skills and services, text messaging programs like text4baby, and an application currently being tested in China which provides real-time health records to both healthcare staff and patients.

The working group acknowledged that even the most exciting scientific or technological advances are useless without a better understanding of ECD program implementation. The group identified a lack of implementation science as it applies to ECD programs – investigation into why a program or intervention succeeded or failed - as the single greatest barrier to scaling up services and achieving the SDGs in this area.

In this vein, the working group proposed a series of bold recommendations and ideas. First, a new set of reporting standards for ECD programs that transcends outcomes to shed light on the "why" factors. Next, a commitment to "scaling evidence"—research specifically designed to yield best practices for taking ECD programs to scale. The goal is to understand how every factor that goes into designing and implementing an ECD program impacts success or failure in implementation.

In this new research realm, case studies from the field that would not normally meet the criteria required for research publications would serve as legitimate, valuable evidence to inform scaling efforts. The group acknowledged that it will be no small feat to build momentum in the scientific community for embracing less traditional data or research methodologies. However, there was clear consensus that a new paradigm is needed for ECD research.

It was suggested that NGOs, academia and funders partner in the early stages and that a pioneering publisher agree to "take a chance" and publish the results. If accomplished, this could be a major contribution to implementation research as it applies to ECD.

The cost of scaling up ECD is another "black hole" identified by the working group. There are few case studies and sparse research and analysis on the costs of implementing ECD at scale. As such, there are no best practices for translating these costs into budget allocations and financial mechanisms.

The final session on partnerships opened with a statement of principles. The working group set forth a mandate that all partnerships to advance ECD must embrace shared core values—among them, the belief that a sustainable future is impossible without the success of children, and that all parents and communities share a universal wish for children to thrive. Participant also felt strongly that long-term partnerships with government and private sector partners must serve to advance each entity's business goals while moving ECD forward.

The working group identified the information and communications technology (ICT) sector as a primary partner, with a focus on mobile technologies. An ICT/ECD partnership is key to improving ECD data collection, and the group felt strongly that ICT partners must be engaged as early as possible to ensure that any mobile technologies designed for ECD meet researchers' specifications and collect the right kind of data. Additional key partners that were identified included parents, communities, and governments.

In conclusion, standardized metrics, affordable, field-based assessment instruments, improved data collection, open data sharing via mobile technologies, and a new approach to researching program implementation will facilitate the first global studies that harmonize local data to reveal how children develop in various environments, and how ECD interventions may optimize development. The ultimate goal is to create a dashboard for children's well-being that can be implemented at the community level, along with an evidence-based package of interventions for children from preconception to age eight.

PEOPLE IN CRISIS STREAM[3]

In the working group for the People in Crisis Stream, 14 leaders from academia, the private sector, civil society, United Nations agencies and not-for-profit organizations, came together to discuss the opportunities and barriers that science and technology have in advancing action around the SDGs to improve the lives of people in crisis. They focused on health and education and agreed on key activities for a holistic roadmap for future action and key metrics for measuring success.

The number of refugees and displaced populations has reached the highest level since the Second World War. Currently, over 60 million people are displaced around the world today—a number that does not include populations who are in distress in their own homes, or who are under threat of being displaced due to future climate change events, economic decline, or political upheaval.

The term "People in Crisis" was initially defined as "people who are forced to flee their homes due to armed conflict, violence, violations of human rights, or natural or human-made disasters and as a result are disconnected from their original environment and networks." The working group expanded this definition to include people in, or at risk of, persistent displacement. This incorporates refugees, people in economic crises, and people at risk of displacement by climate change events. It was also established that a crisis would consist of contexts of "conflict or a natural disaster, and where the state cannot provide basic needs" to populations.

One major knowledge gap identified by the working group is the lack of demographic information. It is especially challenging to gather this information in rapidly shifting contexts where people are constantly moving, particularly in health crises. Accurate data on people's geographic locations and sex and age distribution can be beneficial in the development of specific vaccines or for detecting emerging infections. While such data can be essential in facilitating access to services, it is also highly sensitive, since it may jeopardize people's privacy rights and even safety. This is exceptionally critical in cases of persecution and cross-border displacement. Therefore, the research questions the group identified included how technology, science and research can facilitate the process of gathering demographic data while securing the rights of the people involved.

The technological mechanisms and tools for quantifying and establishing identities for people who lack it are available and in use today. However, agencies and organizations use varying methods to collect and store this data making it hard to share and coordinate across stakeholders. This presents an opportunity for the development of tools that facilitate this coordination in conducting collaborative research to track crisis situations accurately over time.

Starting by defining "scale" as the ***elimination of needs***, the group agreed that the key to scaling of responses is a holistic planning and programming approach that brings people from different sectors and disciplines to the same table. However, challenges for consistently achieving such approaches include the lack of both horizontal collaboration between sectors and disciplines, and vertical collaboration that links administrative structures, governments or large-scale nongovernmental organizations across sectors.

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3   This summary was adapted from a report on Stream activities by Nadine Rachid.
        http://www.nyas.org/asset.axd?id=86c49ae1-8952-41a9-8e05-e4d225aa71ca&t=636204242815100000

Researchers and technologists can facilitate the scaling and outreach of such services and programs by enabling collaboration and data coordination between stakeholders, providing access to existing resources, and improving existing infrastructures. To scale programs effectively, new and innovative funding mechanisms must be created that incentivize funding in science, research and technology and focus on impact.

There are multiple opportunities for research to advance the SDGs in crisis contexts. First, there is a need for researchers to integrate health and education studies and investigate emerging technologies in these sectors. There is also a need for innovative research methods for impact assessment that are collaborative and accessible. Such methods should identify and analyze programs that have been effective in meeting their goals for future reference and implementation. Additionally, there is opportunity for investment in research networks local to crisis contexts.

Another missed opportunity is for research to influence policy. The challenge here is not in conducting more research; rather it is in communicating findings to influence decision makers. It was largely agreed that for research to have a large impact on crisis situations, an overall shift in research incentives is required. This could happen on the academic level by shifting the "impact factor" from being measured by the number of citations, to instead measure the impact of science, evidence and research on the ground. The group also highlighted the need for an overarching body that coordinates between stakeholders and prioritizes goals for the development of collaborative research and programming.

The working group synthesized their findings into an implementation and partnership roadmap highlighting areas for innovation, key actions, and innovative metrics for measuring success, including:

1. A collaborative approach to crisis situations, building partnerships and platforms between the private and public sectors and the academic community to consolidate, integrate, and share data across agencies and organizations.
2. Impact incentives in both publication of research and funding. In research, publishing incentives need to shift from a basis in the number of citations to a basis of impact on the ground. Similarly, the incentives for funding must shift from focusing on return on investment to impact of investment.
3. Targeted evidence, data analysis and data representation tools that can make data available for specific audiences whether policy makers, community leaders and donors, or intermediaries such as advocates and media organizations.
4. Development of prevention methods for populations at risk.
5. Holistic and systemic approaches analyzing the impacts of responses on the entire system, prioritizing between challenges, and working collaboratively across sectors and disciplines.
6. A collaborative effort to monitor technological advances that have the potential to revolutionize global health and development, including a forward look on diseases that may lead to future epidemics.

SUSTAINABLE CONSUMPTION AND PRODUCTION STREAM[4]

The 25 members of the Sustainable Consumption and Production Stream working group included representatives with a wide range of backgrounds from non-governmental organizations, academic institutions, and major corporations around the world.

Finding sustainable ways to produce and consume our goods is both a prerequisite and a critical pathway for achieving the United Nations' Sustainable Development Goals (SDGs). The working group began by defining the scope of this vast undertaking as "minimizing the use of natural resources as well as the emissions of waste … so as not to jeopardize the needs of future generations."

The concept of sustainable production remains amorphous, despite being called out specifically in the UN's Sustainable Development Goals (SDGs). In general, experts in the field define sustainable production as a set of closed-loop systems. The ideal sustainable manufacturing plant, for example, would recycle all of the matter and energy used to make its products. The practical goal of sustainable production is to close production loops as far as possible in all sectors. The group focused on the need to close current production and consumption lifecycles to points that are both environmentally and socially sustainable.

Closing production loops poses a tremendous scientific challenge. Much of the current literature focuses on "decarbonization," or reducing the carbon footprint and resulting climate impact of industries. While that's clearly important, true sustainability will require a much broader "dematerialization," reducing inputs and outputs of virtually every element in the periodic table.

Under the SDGs, a "sustainable" process must be more than just environmentally or economically capable of continuing into the future. It must also be politically and socially sustainable, achieving - or at least not undermining - goals such as peace, justice, and economic equity for all people globally. For example, the production of goods must benefit the people who make them, with workers receiving appropriate compensation and working in safe conditions.

Meeting that need will require scientists across multiple sectors to close major gaps in our current knowledge. For production, those gaps include the need for better data on production methods, analysis of the scalability of different technologies, the internalization of costs that are currently being deferred to future generations, and improved traceability of resources through production chains. Consumption is the major driver of production, so researchers - especially in the social sciences - need to improve our understanding of consumers' motivations. The key gaps in that area include understanding what drives people to adopt and retire technologies, how to scale sustainable solutions across a market, and how to provide transparent, understandable data to the public to shift mindsets toward new consumption patterns.
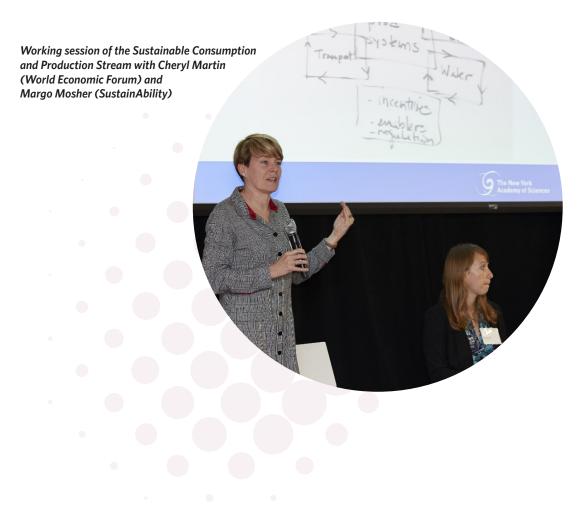
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4   This summary was adapted from a report on Stream activities by Alan Dove.
        http://www.nyas.org/asset.axd?id=1c228d26-1736-4e59-b3fd-28ed13911dfd&t=636204243040700000

With the major gaps identified, the group developed a preliminary road map to address them. They identified several activities that can push production toward greater sustainability, including explorations of scaling strategies, interdisciplinary collaboration, better data collection and analysis, promotion of systems-based thinking across sectors, and establishing specific sustainability targets for each industry. To change consumer behavior, the group recommended clear frameworks for product labels explaining how sustainable each product's manufacture is, advocacy to nudge consumers away from unnecessary materialism, improved education, and better, more transparent data for product life cycle analysis. All of these activities need to be coordinated not only across industries, but across academic, nongovernmental, and international government boundaries.

To measure the success of these efforts, the working group recommended setting specific sector-wide or system-wide targets, for example reducing the material use in a particular sector by a specific percentage within the next five years. These targets must be aimed at achieving both social and environmental sustainability.

Crossing the boundaries between academic, corporate, and government efforts will require even broader collaboration. To that end, the group advised assembling larger communities of participants to discuss each sub-topic on the road map to sustainable production and consumption. Having made considerable progress establishing a plan for action, the working group agreed to widen and extend the discussion, re-convening either in person or through teleconferences and bringing in more participants to encompass all of the relevant viewpoints.

Working session of the Sustainable Consumption and Production Stream with Cheryl Martin (World Economic Forum) and Margo Mosher (SustainAbility)

URBANIZATION STREAM[5]

The Urbanization Stream working group was comprised of 17 participants from academia, advocacy groups, governmental bodies, and the corporate sector, from software to construction and manufacturing companies.

The eleventh UN SDG focuses on sustainable cities and communities and sets a number of targets to achieve by 2030, such as safe and affordable housing and transportation systems, in order to make cities a place of opportunity for everyone. But how can we define the opportunity and scope of urbanization? If aspects such as mobility, infrastructure, and health are some of the criteria or outcomes for urbanization, what is urbanization's opportunity? The urbanization working group determined that the central opportunity of urbanization is to make cities livable. All of the criteria or outcomes for urbanization can be encapsulated in the concept of livability.

The livability of a city depends on the condition of the individuals residing in the city and whether the majority of individuals in the city receive the city's benefits. These benefits include the basic physical infrastructure, such as housing and energy, and the service infrastructure, such as healthcare and education. Beyond those basic services, a host of economic opportunities, including innovation, has to be available for a city to meet the criterion of livability.

A second major opportunity of urbanization that the group identified was resource consumption. The concentration of people and the demand for resources make cities ripe for the sharing economy, whether in terms of sharing housing, appliances, or automobiles. The upshot of a sharing economy is greater resource efficiency.

The Urbanization working group assumed that there are still open research questions about cities and proceeded to identify what those questions are, both practical and theoretical, which entities should be involved in answering them, and which challenges and opportunities are associated with tackling them.

In many cases, clear agreement already exists on what the important research questions are. The challenge lies in accessing the datasets to answer these research questions. They agreed that among the most useful datasets would be those that pertain to mobility, energy, green buildings, health, and education. The group stressed that it would be useful to have a list of the datasets that are available, along with those that are not available and for which recommendations should be made to private sector entities to share the data with academic research communities.

To guide what data that should be collected, the working group advocated assigning a research agenda and key performance indicators (KPIs) to the 169 targets of the SDGs. These KPIs, which could be created by a separate working group, could help foster partnerships and opportunities for cross-fertilization between entities. For example, if groups were collecting two different sets of data about the same system, both datasets could be collected at the same time, and probably in a more precise way, by a central source.

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5   This summary was adapted from a report on Stream activities by Carina Storrs.
     http://www.nyas.org/asset.axd?id=0fa07c80-4b0b-438d-8a51-40c8cbc6fa79&t=636204243154000000

An important barrier to conducting urbanization research is the lack of funding for applied science questions such as how cities can use data to make decisions and apply new technologies. The working group described a funding framework for public sector groups working on important questions that do not have a clear path to profit, and brought up the possibility that cities could create a mechanism similar to a subsidy program where they could support new technologies until they have scaled up to a point that they could be economically feasible.

The working group homed in on the critical role of public-private partnerships in bringing new technology and infrastructure to fruition. Public-private partnerships can be especially beneficial for projects in which the public sector lacks capital, but can provide private sector partners with a lease that ensures profit for the first several years of operations. However, not all public-private partnerships are created equal and some may be inefficient and fail to bring benefits to citizens. To safeguard against these possible shortcomings, the working group agreed that it is important for local authorities to be equipped with the tools to properly assess the partnership and make sure it is delivering its intended benefits. One of the big questions the working group addressed was how to bring the appropriate groups together to create public-private partnerships. Cities—mayors and city councils—should play a leading role as matchmakers to connect universities, corporations, and NGOs that are willing to participate in partnerships.

In considering which aspect of urbanization needs to be addressed first, the working group emphasized the importance of planning. While the majority of urbanization has yet to take place, so far most development has been done rapidly with little thought to land use, building codes, and other aspects, particularly in developing countries. In contrast, planning ought to be carried out by urban planning offices that incorporate local regulations and best practices. But even before getting to planning, the working group agreed that it is key to have a "system of systems" mindset when thinking about new infrastructure. Every new program can have far-reaching effects that touch every industry and the economy in a circular manner.

The working group raised the point that in the push to implement new technologies, limited resources will make it important to set priorities. For example, if there is a strong focus on developing public transportation systems, it may be less important to work on expanding the use of electric cars. Meanwhile, there are many cases of disruptive technology that are not being pursued, for example clothes that can heat and cool the wearer and systems to grow produce building basements rather than importing.

The working group reiterated the vital role of considering the human component of cities. A city cannot be considered livable if the human rights dimension is missing; if residents do not have access to housing, decent work, transportation, clean air and water, and public and green spaces. The working group argued that technology could enable and support those services.

Finally, the working group tackled the question of what a future city will look like. Answering the question will involve creating a reference architecture for the sharing of data between city agencies, corporations, NGOs, and other entities. In addition, the planning and operational model of cities will need to be flexible, because as operations are underway the plan could change, and vice versa.

COMMITMENTS TO COLLECTIVE ACTION

During the day, eight Summit participants were provided an opportunity to briefly describe their ongoing activities and proofs of concept supporting delivery of the SDGs. The audience was encouraged to seek out these participants and join in their commitments.

1. *Global Goals Technology Forum (Dominic Vergine, Head of Sustainability and Corporate Responsibility, ARM).* GGTF is a new initiative intended to help the technology sector understand its role in the 2030 Agenda and to create a dialogue between sectors to understand the potential benefits that technology innovation can bring.

2. *Education Initiative (Margie Wang, COO & CFO, JA Worldwide).* JA is one of the largest youth-focused NGOs, dedicated to developing and empowering young people ages 5–25 by teaching them to be financially literate, work-ready and to have a spirit of entrepreneurship.

3. *Patient Innovation (Pedro Oliveira, Professor of Technology and Innovation Management, Católica Lisbon School of Business & Economics).* Patient Innovation is a platform to share patient and caretaker-developed health solutions, including a database of over 2000 ideas and an accelerator to help solutions to market.

4. *The EAT Forum (Johan Rockström, Executive Director, Stockholm Resilience Center).* EAT fosters collaboration across scientific disciplines interfacing with food issues, in order to improve nutrition and food safety, as well as tackling global health and environmental challenges such as obesity and non-communicable diseases, climate change and degradation of ecosystems.

Seema Kumar speaks on J&J's commitment to the SDGs

5. *Reducing Health Disparities through Data (James H. Faghmous, CTO, Arnhold Institute for Global Health).* ATLAS is a tool to obtain high-quality subnational data by using tools from the high-tech sector to identify and target "cold spots" areas where data in high-risk regions is incomplete or inaccurate – and obtain that data via on-the-ground resources.

6. *Johnson & Johnson Programmatic Commitment to the SDGs (Seema Kumar, Vice President, Innovation, Global Health and Science Policy Communication, delivering remarks on behalf of Dr. Paul Stoffels, Chief Scientific Officer, J&J).* Johnson & Johnson optimizes its diverse expertise, capabilities, collaborations and resources to make scalable and sustainable impact in promotion and advancement of the health workforce, women's and children's health, ensuring access to essential surgeries, environmental health and global disease challenges.

7. ***Global Compact for ECD (Gilles Bergeron, Executive Director, The Sackler Institute for Nutrition Science).*** GCECD is an alliance of innovative city leaders, policymakers, practitioners, educators and researchers that will foster an exchange of ideas and information among cities and across disciplines and work together to ensure early childhood development for everyone.

8. ***Supporting the SDGs through Research (Takao Kuramochi, Senior Deputy Director General, Center for Research & Development Strategy, Japan Science & Technology Agency).*** The Japan Science & Technology Agency conducts a wide range of activities promoting not only cutting edge R&D but application of this work to society. One example is the Science and Technology Research Partnership for Sustainable Development (SATRPSD), an international joint research collaborative between Japan and partner countries.

CLOSING SESSIONS

Guido Schmidt Traub, Executive Director, UN Sustainable Development Solutions Network

Traub started his remarks by noting the remarkable nature of the day, and that it clearly represented the first step of many such discussions. Traub identified a key missing ingredient toward progress on the SDGs as knowledge, an arena which puts science and technology at the center. The objective is to imagine how we can achieve the goals in total - not to make marginal progress, not half way - 100% in all countries, he said. This will requires that the challenges be aligned very specifically with clear goals. He noted the clear goal for HIV eradication provided in the remarks from J&J. "Do we have … clear purpose goals for ECD, for urban development?" he asked. "Do we have clear goals so that we can mobilize, compete for grants and funding, and develop creative solutions? We need clear goals, a common language, and shared understanding of the issues so we can more clearly coalesce around priority objectives." He described two critical steps toward this: The first is to take the goals seriously; the second is a shared understanding of the pathways. We can't have a solution today, but we need to define what a pathway might look like over 20-30 years.

Guido Schmidt Traub, Executive Director, UN Sustainable Development Solutions Network

Traub recommended several steps for achieving this, including surveying the field, defining pathways, and comparing and critiquing pathways between streams. "Pathways are the tools to identify the specific innovation challenges so that there are a thousand people working on the same question."

As a final observation, he told the participants not to lose sight that the process can be fun and engaging and to think deeply about what can be achieved. He committed to work with the Academy to collectively identify very specific tangible deliverables to work on and report back on in time for the group's next convening.

Lise Kingo, Executive Director, UN Global Compact (UNGC)

Kingo spoke about how the UNGC has been very busy making all of their member companies aware that there is "a new lighthouse that directs exactly where we want to take the world." As such, the SDGs are thematic, systemic and deeply strategic and will require companies to take an inside-out perspective on how to create a world that they can turn over to the next generation.

Achieving the SDGs will require breakthrough innovation, and Kingo described three ways in which the UNGC is engaged in leveraging contributions from science and technology:

1. The top five risks (and hence areas of opportunity) identified in the UNGC's 2016 Global Opportunity Report all rely on science, technology and innovation for solutions:
   - loss of ocean biodiversity
   - resistance to life-saving medicine
   - accelerating transport emissions
   - a generation wasted
   - the global food crisis
2. The UNGC is developing a new engagement platform for breakthrough innovation, with more 70 companies already engaged in innovation challenges in food production, environmental degradation, gender inequality, food for all, and clean and affordable energy.
3. The UNGC, together with a group of partners, is working to build the largest open platform of solutions, business cases, and concrete, implemented actions. The first group of ten "SDG pioneers" who provided science and innovation solutions to the SDGs were honored in September 2016.

Jan Eliasson, Deputy Secretary-General, United Nations

In his closing remarks, Eliasson thanked the Academy for taking on the initiative to mobilize the science and technology community toward the goals, and commented that the speed with which participants are mobilizing is astonishing. Moreover, he said, it is important to stand up for cooperation, diversity and common challenges in a more determined way than ever, as there are currently strong forces pushing to turn our collective gaze inward (and even backward) rather than outward.

He recalled the moment when the idea for the Summit originated, during Ellis Rubinstein's visit to the UN where they discussed the implementation of the SDGs with the Secretary-General. It was then that Eliasson became convinced that the private sector, scientists and the academic community had to be mobilized for success. He said, "You lift our hope. I have a few hope factors – youth, women, knowledge and science, and international cooperation. Technology and science have so much to give."

He thought the Academy could bring together such a group, demonstrate the aspirations the UN had for science, and disseminate that message throughout their network. For Eliasson, the most important word today is "together"—the idea that while "[n]obody can do everything, everybody can do something" – and in this context, creating progress means learning to work in a new way that respects individual mandates but also goes horizontal to solve issues on the ground while taking advantage of a cross-cutting approach. Place the problem in the center and the actors around it, he said. The SDGs provide inspiration for just such an approach because they are interrelated and mutually reinforcing, and already demonstrating that they can be used effectively for planning. Scientists have long operated by creating horizontal teams, and thus possess a particular understanding of what needs to be done.

Eliasson asked the participants to consider an additional challenge that he has witnessed up close: the need to prioritize new solutions for water and sanitation, especially in urban areas, and to recognize the overall impact of water and sanitation on families, health, productivity of labor, and risk of conflict. "You can save lives and see results," he said.

Finally, he noted that while the UN has been asking what the participants can do for us, he would like to let the audience know what the UN is committed to do for science. Namely, it will continue to:

- Call for more public expenditures on R&D.
- Firmly uphold the critical importance of climate science.
- Use the convening power of the UN and bring the STI community to the table.
- Support the UN Scientific and Advisory Board, UNESCO and other agencies.
- Support the UNGC as a place for business to connect and contribute to the SDGs.
  Eliasson concluded by reminding attendees that the UN Charter begins "We the peoples…" When talking about accountability and the rational for individual organizations, participants must return to understanding for whom these Goals were designed – the disabled and forgotten and deserted – and that there is an imperative to prove that the institutions we create deliver on people's dreams and aspirations. It is a hopeful project, he said, and today "a seed was planted, is now growing, and can make a tremendous difference."

NEXT STEPS

The concept paper announcing this event emphasized that it would be the first step toward creating a collective impact initiative capable of "extend[ing] beyond the Summit to continue the partnership among the participants." All of the Streams indicated the desire to continue their work, providing not only roadmaps with concrete actions, but in some cases requesting support in moving forward by expanding the working groups to include additional stakeholders or setting up ongoing meetings.

The Academy has agreed to act as the Secretariat for this initiative, with the following actions completed or underway:

- Producing this report on the Summit.
- Producing in-depth reports on each of the four streams, including outcomes and next steps.
- Working with the stream leads to review next steps, establish steering committees and develop work plans for each of the four streams.
- Determining the intersection of the ECD Stream with the Global Compact for ECD.
- Formally engaging with ARM and others to establish the Global Goals Technology Forum.
- Engaging with the EAT Forum on sustainable food systems.
- Engaging with the UN Sustainable Development Solutions Network to develop pathways for the SDGs.
- Providing a database of activities underway by Summit participants and a centralized location for access to materials, schedules and shared documents for participants.

Based on availability of adequate funding, the New York Academy of Sciences intends to hold a follow up Summit tentatively scheduled for November 30, 2017, where progress on the Stream roadmaps and other actions will be reviewed.

ABOUT THE AUTHOR

Jennifer L. Costley, PhD is the Director of Physical Sciences, Sustainability & Engineering at the New York Academy of Sciences where she develops professional scientific conferences and symposia that explore cutting-edge topics, as well as ongoing initiatives in the physical sciences and sustainability. Costley has more than 20 years of experience in the tech sector as a technology manager for such leading firms as Credit Suisse, DoubleClick, and Bell Labs, and as principal of her own consultancy where she conducted research on major technology trends and advised corporations on technology strategy and governance. She is the Chair of the JTG-ESS, a joint NSF-IEEE working group developing an environmental standard for computer servers as well as serving on the boards of directors of several nonprofit organizations. She is currently treasurer and member of the Executive Committee of the Waterfront Alliance of New York. Costley earned a Ph.D. in Chemical Physics from Columbia University, an Advanced Certificate in Finance from New York University, and a Certificate in Conservation Biology from Columbia University's Center for Environmental Research and Conservation. She has been designated a "Thought Leader" by Wall Street & Technology and is a frequent speaker on topics ranging from artificial intelligence in finance to green technology.

ABOUT THE NEW YORK ACADEMY OF SCIENCES

The New York Academy of Sciences is an independent, not-for-profit organization that, since 1817, has been driving innovative solutions to society's challenges by advancing scientific research, education, and policy. With more than 20,000 members in 100 countries, the Academy is creating a global community of science for the benefit of humanity. Please visit us online at http://www.nyas.org/ and follow us on Twitter @NYASciences.

APPENDIX: SUMMIT PARTICIPANTS

NAME	TITLE	AFFILIATION
Ban Ki-Moon	Secretary General	UN
David Nabarro	UN Special Adviser on the 2030 Agenda for Sustainable Development and Climate Change	UN Office of the SG
Ellis Rubinstein	President and CEO	The New York Academy of Sciences
Jennifer Costley	Director, Physical Sciences, Sustainability & Engineering	The New York Academy of Sciences
Dominic Vergine	Head of Sustainability and Corporate Responsibility	ARM
Johan Rockström	Executive Director	Stockholm Resilience Center
Dawda Jobarteh	First Officer	UN Office of the Secretary General
Stefan Swartling Peterson	Assoc Director	UNICEF
Jan Eliasson	Deputy Secretary-General	UN
Lise Kingo	Executive Director	UN Global Compact
Joanna Rubinstein	President & CEO	World Childhood Foundation
Hugh Welsh	President & General Counsel	DSM North America
Michael McBurney	VP Science Communications & Advocacy	DSM
Pedro Oliveira	Professor of Technology and Innovation Management	Católica Lisbon School of Business & Economics
Margo Mosher	Manager	SustainAbility
Lara Allen	Director	Centre for Global Equality
Harrison Xia	Secretary General	STEM Education Foundation
Guru Banavar	Vice President, Cognitive Computing	IBM
Ravi Gurumurthy	Chief Innovation Officer	International Rescue Committee
Cheryl Martin	Head, Centre for Global Industries	World Economic Forum
Norine Kennedy	VP, Strategic International Engagement and Energy and Environment	US Council for International Business
Jeff Sachs	University Professor	Columbia University
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Mariana Muruzabal	Executive Director, Corporate Strategy Group	SAP
Pia Britto	Senior Advisor on Early Childhood Development	UNICEF
Maureen M. Black	Clinical Professor	University of Maryland School of Medicine
David Le Blanc	Senior Sustainable Development Officer	UN DESA
Elliott Harris	Assistant Secretary-General and Head of the New York Office	UN Environmental Program (UNEP)
Guido Schmidt Traub	Executive Director	UN Sustainable Development Solutions Network
Ingeborg Rocker	Vice President	Dassault Systèmes
Max Anderson	Executive Director	New Cities Foundation
Nadine Rachid	Urban Strategist	The New School
Hiro Yoshikawa	Co-Director	Global TIES for Children Center
Sara Watson	Global Director	ReadyNation
Catherine Monk	Director for Research	Women's Program, Columbia University Medical Center

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Elizabeth J Heider	Chief Sustainability Officer	SKANSKA
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NAME	TITLE	AFFILIATION
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Hallie Kapner	Writer	
Carina Storrs	Writer	
Milagros Nores	Associate Director of Research	National Institute for Early Education Research
Takao Kuramochi	Senior Deputy Director General, Center for Research & Development Strategy	Japan Science and Technology Agency
Shigeru Kitaba	Manager, Washington D.C. Office and Center for Research and Development Strategy	Japan Science and Technology Agency
Oh Joon	Ambassador and the Permanent Representative	Republic of Korea
Yeongmoo Cho	Counselor	Republic of Korea
Namki Kim	First Secretary	Republic of Korea
Morris (Chee Yuen) Wo	Director, International Business	Gaopeng
Sebastian Fries	Executive Director, Population Health Partnership	Columbia University
James H. Faghmous	CTO	Arnhold Institute for Global Health, Mount Sinai Health System
Lorraine Hariton	SVP Global Partnerships	The New York Academy of Sciences
Seema Kumar	Vice President, Innovation, Global Health and Science Policy Communication	Johnson & Johnson
Heikki Hietala	First Secretary, Unit for Development and Human Rights	Permanent Mission of Finland to the United Nations
Genevieve Begkoyian	Senior Health Specialist	UNICEF

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