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### **Establishing engineering, circularity, and intentionality at the heart of sustainable communities.**

According to NASA<sup>[17]</sup>, 2020 tied with 2016 as the hottest year on record for the planet. In recent years we have seen a growing increase in frequency of extreme weather events globally. We can see that the changing air and surface temperatures can indirectly lead to stronger tropical cyclones, hurricanes, and flooding. The IPCC<sup>[18]</sup> supports that climate change is real and that there will always be uncertainty in understanding a system as complex as the world's climate. A look at how extreme weather events affect communities also extends to further than just human safety and to the provision of essential services. Health and well-being are a key component of these impacts. Extreme weather events affect water supply and sanitation systems. We have seen a direct link between hygiene and the fight against Covid 19. Interruption to supply of essential services have a detrimental impact on communities so our systems need inherent resilience. Equally communities that rely on agriculture for their livelihoods and food security is severely compromised. Sustainable communities are inextricably linked to supporting the hard infrastructure, the natural systems, and resources and for enhancing the way people live. A possible solution includes reviewing our infrastructure systems through the lens of mitigation and adaptation to climate change. This includes the use of more robust

and sustainable materials, construction and operational methods and embracing nature-based solutions where we design for working with nature instead of contrary to how nature works. This will enable us to better manage the disruption from extreme weather events and offer a level of flexibility to deal with unforeseen changes.

Sustainable communities also relate to disaster management protocols. Responses need to address the specific impacts facing the locale of the disaster and in response to the needs of the communities affected. For example, our responses for coastal communities versus inland communities. There are several factors that affect our responses related to the stability and continuity of essential services such as water and electricity supply, access via road and rail networks and safety in terms of vulnerable communities located near or in floodplains of rivers, pedestrians who must dangerously cross rivers and streams for access, and those who must traverse unsafe crossings. In the planning, design and construction of infrastructure, these extreme weather events need to be at the forefront of the design thinking to ensure that the range of needs of the beneficiaries of the infrastructure is met in all these conditions, foreseeable and unforeseeable as best as can be predicted.

The responsibility of collaborative and inclusive sustainable development rests equally on all stakeholders in the engineering and infrastructure value chain. The extent of infrastructure development and service delivery and the subsequent impacts on climate change acceleration, mitigation or adaptation encapsulates several complementary disciplines including policy makers, politicians, legal, finance professionals and most importantly the communities and end-users. This collective has significant power and influence and should be placing appropriate levels of pressure on the teams who plan, deliver, and operate projects and infrastructure. The link to engineering and infrastructure development has engineers as one critical part of the value chain - a very small part by cost but significant in contribution. Engineers are problem solvers but when commissioned to only have input into a very narrowly defined component of the life of the infrastructure/system being planned, designed, built, or operated, the significant impacts, across its life cycle, are often driven by competing interests.

Sustainable development, and sustainable communities, extends further than just to human development, the natural environment and ecosystems are critical components of the systems that engineering affects and integrates with. In this decade of action, we have seen an increase in the number of consulting engineering firms and engineers around the world practicing as advocates for responsible and sustainable development. They have incorporated these principles into the work they do. Likewise, DFI's and private project funders and developers have realigned their priorities to support projects that have multifaceted benefits and pass a complex array of considerations for sustainability. We know all too well the challenges that face us across the world. Vulnerability from climate change and future pandemics, inadequate investment in critical infrastructure, poverty, a lack of basic services and growing unemployment – all inextricably linked to economic growth and opportunities as the way to deal with these challenges.

UNEP reports that buildings and construction together account for 36% of global final energy use and that the energy intensity per square meter of the global buildings sector needs to improve on average by 30% by 2030. On this backdrop and acknowledging the key role of engineering in enhancing our daily lives, engineers are key advocates for the sustainable development goals and their commitment toward achieving them through their work and on the projects they deliver globally. Critical systems thinking<sup>[9]</sup> in and for our sector requires a fundamental psychological shift. Due to the complex environments and conditions that we are facing, we need to get the right information to the right people at the right time and in the right way. As a traditionally grey infrastructure profession, migrating toward the integration of blue and green infrastructure, our focus toward circularity needs to be amplified and realigned. It is a matter of collaboration, agreement on interests and understanding of the interdependencies between differing purposes in order to add value for everyone.

Sustainable communities can only be realized when we prioritize sustainable infrastructure. This can only be done through creating an enabling environment within the infrastructure delivery space and through public awareness and education, mainly understanding that sustainable infrastructure aims to provide a service and value to the community. In other words, an outcome, rather than an edifice or solely infrastructure. These includes:

- Infrastructure developers in the public and private spheres to mandate a sustainability and circularity imperative as part of their projects at the master planning and feasibility stages of developments and cascading into individual building-level projects. This will enhance an enabling procurement environment.
- The teams who deliver the infrastructure including the suite of built environment professionals to prioritize responsible and sustainable development, as a matter of everyday business and to recode the blueprint of planning and design into how we do things every day than as an accidental occurrence.



- Planning with whole life cycle in mind including planning, design, construction methodologies, material selections and technology.
- Collaborative working including prioritising conversations between the built environment disciplines to break the silo mentalities – engineers, urban designers, architects and social scientists and environmentalists to work on holistic solutions that complement each other for a balanced triple bottom line and finally but most importantly,
- End users and beneficiaries of the infrastructure to demand sustainably developed goods and services. With the understanding that we've got structural societal challenges to address, we need to use this type of thinking to find equalising factors and mechanisms for the developed and developing worlds alike. This will go far to promote responsible global citizenry for communities to encourage building back better for a fundamental shift in thinking and thinking that epitomizes the circular economy.

A snapshot of the opportunities that sustainable communities bring, includes the leapfrogging of technologies to more appropriate, local, and complex systems to embrace the cradle-to-cradle approaches as it relates to all needs and not just basic infrastructure provision. Unlocking the potential and innovation of an engaged youth population will be our biggest differentiator in the built environment the world over.

This is particularly opportune for the developing world, for example in Sub-Saharan Africa where almost 60% of the population is under 25 years of age<sup>[20]</sup>. The human capital availability when matched appropriately to infrastructure has a significant multiplier effect, and this extends to full enhancement of the value chain of goods and services particularly careers in engineering and the built environment across the economy.

Latin America, for example, is characterised for rapid growing cities and urbanization<sup>[21]</sup>. On many occasions, with insufficient planning, which has created major implications for infrastructure, sanitation, housing, and public transport. Latin America in general is characterized by a lack of institutional framework and underinvestment by governments in public transport infrastructure, which has led to inefficient systems with poor quality and excessive informality. In recent years, there have been significant efforts to transitioning for sustainable, more connected, and more efficient transportation systems in the region. Further understanding on the great opportunities that public transport networks can generate in promoting sustainable growth has led to more than 50 cities in Latin America to invest (many are currently investing) in Bus rapid transit systems (Bogotá or Guadalajara), metro lines (Lima, Santiago, Sao Paulo) or Suburban trains (Monterrey) and Bi-National trains (Argentina-Paraguay).

The drive for sustainable communities through the ability to build back better is underpinned by prioritizing sustainable infrastructure and fully engaging the communities that are served. As custodians of infrastructure delivery, our role as consulting engineers and built environment professionals has never been more critical to achieving these audacious goals. It is a critical and challenging scenario, but our role is becoming more and more crucial. We are working towards better, more sustainable and more efficient sustainable infrastructure, which can allow us to have a cleaner, better working and more connected communities.

