



WRC CEO, Dhesigen Naidoo



Fluid Thoughts

Sanitation – a global revolution is afoot

More than a thousand delegates from sixty one countries converged in Chennai, India in the third week of February to discuss the global sanitation challenge.

This was the 4th international conference on Faecal Sludge Management – known as FSM4. In her opening keynote address, Minister of Water and Sanitation, Nomvula Mokonyane, was clear – the economic and social arguments were stronger than ever for a huge investment injection into safe sanitation globally, but, perhaps our strongest driver is the quest to expand the frontiers of dignity. The SDG (sustainable development goal) target for sanitation is an ambitious one, and was the subject of much discussion and anxiety for delegates from around the world. Global universal sustainable access to safe sanitation by 2030 is without doubt an immense challenge.

The experiences of various countries, including South Africa and India, served as important case studies not only for their triumphs, but perhaps more importantly for the learnings from the various interventions that were not as successful. It was also clear that many countries have plans to meet the SDG targets well before the 2030 timeframe. Perhaps one of the more ambitious is India's target in the context of the Swachh Bharat or the 'Clean India' campaign. This is led directly from the office of the Prime Minister. The target is to end open defecation and achieve universal access to improved sanitation by 2 October 2019. This is the date of the 150th birthday of Mahatma Gandhi. The progress reports presented at the conference by the secretaries of the various national and state ministries indicated a rate of progress that is very encouraging. South Africa's own trajectory also indicates a sustainable achievement of the target well before 2030.

South Africa featured prominently at FSM4 through the national ministry's efforts on the policy and the roll-out of the bucket eradication campaign; the WRC, led by Executive Manager, Jay Bhagwan, and the sanitation research management team, with its global leading work on sanitation innovations; and the City of eThekweni, in partnership with the University of KwaZulu-Natal, as one of the world leading city's demonstration on the ground, the foundation of a new sanitation platform for the world. The key of course is the treatment of the waste that will eventually decide the level of sustainability. This was the focus of the majority of the conference sessions. The presentations and workshops ranged from smarter business models for removal of faecal sludge to cutting edge technologies for faecal waste beneficiation. The latter ranged from the classic solutions of fertilizer production

to biogas harvesting and even biofuels production. All of which turns the conversation from 'waste to wealth' – a slogan that has been adopted in many environments already.

It was also gratifying to get global acknowledgement for the leading work that is happening on the African continent, both in the domain of creating new solutions as well as being the test-bed of preference for many of the new technology platforms and business models. The road is a combination of daunting and incredibly exciting as we explore the pathway to accelerate the access to safe sanitation and higher health security for all the world's people; but we are approaching it in a manner that is catalytic for waste beneficiation and resource recovery that may well turn the blight of poor sanitation of the past, into a vibrant pillar of development tomorrow.

It is important to acknowledge the contributions of the Bill and Melinda Gates Foundation. The foundation has catalysed the global dialogue on the back of the 'reinvent the toilet' campaign, and through the hard work of the likes of Doulaye Kone, Brain Arbogast, and their team, helped to glue together the various initiatives around the world into the powerful global force that was witnesses in Chennai.



Minister of Water and Sanitation, Nomvula Mokonyane, delivering the keynote address at the 4th Faecal Sludge Management Conference in Chennai, India.

University presents first learning programme in water governance skills

A group of 25 municipal officials and educators from Technical Vocational Education and Training (TVET) colleges in the Western Cape attended the first Water Governance for Water Leaders learning programme at Stellenbosch University (SU) in February.

The programme, presented by the SU Water Institute (SUWI) in partnership with its School of Public Leadership (SPL), was developed specifically for municipal councillors and officials by the SPL's Prof Erwin Schwella in collaboration with several experts in the water sector.

According to Prof Schwella, the course connects the fields of leadership development, practices in water governance and leadership innovation in public water utilities and institutions by way of comparative and relevant case studies. The course, which is registered with SU and holds nine credits on level eight of the National Qualifications

Framework, took place from 6 to 10 February 2017.

Municipal officials from Hessequa, George, Knysna, Swellendam and the City of Cape Town attended, as well as educators and officials from Boland College, South Cape College, Northlink College and representatives from various non-governmental organisations and small to medium-sized enterprises (SMEs) operating in the water sector. A representative of the policy and regulation division of the Department of Water and Sanitation attended as an observer.

During the course, participants had to complete a class-based group project and an examination at the end of the programme. Participants also have to submit an individual assignment by the end of February, after which the successful candidates will receive a Certificate of Competence.

Manuel Jackson, project-manager at SUWI, says apart from the learning programme they are also developing an occupational qualification in wastewater treatment in partnership with EWSETA under the framework of the Quality Council for Trades and Occupations.

"TVET Colleges can play a pivotal role in building capacity in the water sector and specifically in a critically important area such as waste water treatment," he adds.

The next learning programme will take place from 8 to 12 May 2017 at the Saldanha Municipality. For information about upcoming workshops and short courses, contact Katherine Morris at kmorris@sun.ac.za or Tel: (021) 808 9453.



Water Diary

Large rivers April 18-21

The Third International Conference on the Status and Future of the World's Large Rivers will be held in New Delhi, India. Topics to be covered include hydrology, hydraulics and water quality; sediment transport and river morphology; ecology and restoration; and integrated river management.

Visit: <http://worldslargerivers.bku.ac.at>

Water sustainability May 7-10

The Water Institute of Southern Africa (WISA) is hosting a Water Sustainability Forum with the theme 'From scarce to sufficient', aimed at turning current water challenges into opportunities.

Visit: www.wisa.org.za

Water history June 15-17

The conference of the International Water History Association will be held in Grand Rapids, Michigan, USA. The conference is co-hosted by the Western Michigan University.

Visit: www.iwha.net

Hydrology July 10-14

The annual conference of the International Association of Hydrological Science will be held in Port Elizabeth. Visit www.iahs.info

Catchment management October 9-11

The International Water Association in association with WISA is hosting a

specialist conference on watershed and river basin management at Skukuza camp, Kruger National Park.

Visit: www.rbm2017.com

Groundwater October 14-18

The Groundwater Division of the Geological Society of South Africa will be hosting its Biennial Conference at Spier Hotel, outside Stellenbosch with the theme 'Change, challenge, opportunity'.

Contact: Deidre Cloete;

Email: deidre@iafrica.com;

Visit: www.gwd.org.za



New CEO for premier research institution



From 1 February the CSIR has a new CEO.

Dr Thulani Dlamini is no stranger to the CSIR. He first joined the organisation in 2005 as head of the CSIR National Laser Centre. In 2008 he was appointed to the position of Group Executive for Research

and Development, a position he held until 2011. Dr Dlamini then left the CSIR to join Sasol as the Executive Manager: Research and Development and later the Vice-President for Strategic Research and Technology.

Dr Dlamini holds a PhD in Chemistry from the University of the Witwatersrand and a Masters in Business Leadership from the University of South Africa. He is a member of the Academy of Science of South Africa and has served on numerous Boards, including those of the Sasol Pension Fund, Automotive Industry Development Centre, Sasol Technology UK and the Netherlands.

"I am excited about my return to the CSIR to take forward the excellent work of my predecessors," noted Dr Dlamini. "I look

forward to working with our partners and the brilliant minds in the organisation. The CSIR is well positioned to have an impact beyond the South African border, and it is my hope that together with our global partners we can deliver on the mandate of the CSIR to use science, engineering and technology to advance society and industry."

CSIR Board Chairperson, Thokozani Majosi, said that by appointing such a thought leader in science, the CSIR was poised for greater success ahead. "The Board is excited about Dr Dlamini [re]joining the CSIR, and we have full confidence in his leadership and management skills. He is indeed the ideal incumbent to usher the CSIR into a new phase."

Drought fears turn to flood fears as dams fill fast

Following a week's rain in February the Department of Water and Sanitation (DWS) warned communities located in the floodplain area of the Vaal and Bloemhof dams to vacate as they were exposed to possible flooding.

The Vaal Dam was expected to reach 100% full for the first time in many years, followed by Bloemhof Dam located downstream in the North West province. The sluices of both dams were due to be opened to reduce pressure on the dam walls.

South Africa experienced torrential rains towards the end of February following tropical storm Dineo. The system caused widespread rain showers over eastern Mpumalanga and Limpopo, in particular.

When the storm dissipated tropical conditions caused widespread rain over much of the country.

Flash flooding was experienced at the Augrabies Falls, in the Northern Cape, while in the North West all provincial dams reached full capacity, with the exception of the Molatedi and Klein Marico dams.

In KwaZulu-Natal, DWS was closely monitoring Mearns Dam whose water storage level had risen to over 120%. While no casualties had been reported at the time of writing, the department warned people living in the dam catchment to relocate immediately. Despite the full capacity of the Mearns Dam, average storage in the Umgeni

storage system remained at a low 54%.

The Marico, Crocodile (West), Vaal, Vals, Wilge (Free State), Caledon, Upper Olifants, and Thukela rivers were all flowing strongly, and dams were all filling up. The DWS warned that care should be taken downstream of dams and on the floodplains of all rivers in the central and northern provinces.



Science Minister wins international award

Minister of Science & Technology, Naledi Pandor, has been chosen by the American Association for the Advancement of Science (AAAS) to receive the 2016 Award for Science Diplomacy.

The minister was honoured by AAAS not only for integrating science in policymaking in South Africa, but also for her advocacy for young scientists and women scientists by supporting initiatives that encourage international collaboration

for both groups.

"Science not only enables us to more decisively respond to major societal challenges," Pandor said, "but also plays a critical part in helping to foster international partnership, friendship and solidarity." She explained that the role of science diplomacy is more important than ever, and said she is humbled and honoured to receive this award.

"Under her leadership, South Africa has made numerous contributions to building science structures in organisations such as the African Union and the Southern African Development Community, to strengthening the science granting councils of other African countries, and to expanding the role of the Global Research Council," noted Tom Wang, AAAS' Chief International Officer.

NGO reacts to coal mine threat in strategic water resource

Non-governmental organisations have reacted vehemently to the news that Minister of Environmental Affairs, Edna Molewa, approved an application for coal-mining to go ahead in the Mabola Protected Environment – less than three years after the area gained protected status.

Along with four other wetland areas in Mpumalanga, the 8 772-ha Mabola Protected Environment was declared on 22 January 2014. It is a strategic water source area, generating critical water supplies for agricultural, industrial and human use.

"The Protected Areas Act recognises that there are areas that play such an important role in safeguarding the

country's ecological services that they require safeguarding at all costs," noted Dr Morné du Plessis, CEO of WWF South Africa (WWF-SA). "That an incompatible activity such as coal-mining has been given the go-ahead is a worrying turn of events that does not bode well for other protected areas."

"Coal-mining in strategic water source areas is not only contrary to sound scientific advice, but also to basic common sense. These are areas of high biodiversity which are critical for water generation and future economic growth. WWF will leave no stone unturned to ensure that the best interests of society are pursued," Dr du Plessis added.

WWF-SA reported that it has a copy

of the letter indicating that Molewa authorised the application in August 2016 for an Indian company, Atha-Africa Ventures (Pty) Ltd, to develop an underground mine in the Mabola area. She is a co-signatory with the Minister of Mineral Resources, who signed off on the application in November last year. In terms of the law, both signatures are required for mining to go ahead.

However, at the time of writing there had been no public announcement on the decision. "We are increasingly aware of the trend of diminishing transparency in decisions related to mining activities in general. This is fast becoming a significant concern of short-sighted decision-making that has the consequence of short-changing society," concluded du Plessis.

Consultancy grows its groundwater capabilities

JG Afrika, a leading multi-disciplinary engineering and environmental consultancy, has grown its groundwater division by acquiring Geowater IQ, a specialist in the field of geohydrology, water-resource management, research and other related disciplines.

Paul Olivier, MD of JG Afrika, says the acquisition of the 100% black-owned

consultancy comes at a time when the management of South Africa's scarce water resources and the upgrading of related infrastructure have been placed at the top of the agenda.

This intense focus on water infrastructure is mirrored by the recent appointment of JG Afrika as the geohydrologist professional for a large water and

sanitation project for schools in rural areas that is being driven by the KwaZulu-Natal Department of Public Works.

This contract, awarded to JG Afrika by the firm Ramgoolam complements the company's already extensive portfolio of successful water-related initiatives.



New test for waterways finds crazy list of pollutants



A new way to test for a wide range of micropollutants in waterways has already turned up a nightmarish cocktail of contaminants.

"Water quality monitoring is conventionally done by narrowly investigating one or a few contaminants at a time. We aimed to develop an analytical method that would be as broad as possible," explained Damian Helbling, assistant professor of civil and environmental engineering at Cornell University. The work appears in the journal, *Environmental Science: Water Research & Technology*.

"We demonstrate that our approach can more than double the amount of information that would otherwise be obtained from more conventional methods," Helbling noted, "This has important implications for risk characterisation and exposure assessment."

The new technique—using high-resolution mass spectrometry—assessed 18 water samples collected from New York state waterways. A total of 112 so-called

micropollutants were found in at least one of the samples—chemicals including pharmaceuticals, pesticides, and personal care products. Helbling said that eight of the chemicals were found in every sample and dozens more were found in most samples. Helbling and graduate student Amy Pochodylo refer to their approach as 'suspect screening.' The spectrometer analysed the chemical composition of the water samples and the researchers compared the resulting data with a large list of 1 100 'suspect chemicals' by employing a nimble data-mining algorithm.

The unmasked contaminants read like a soup recipe concocted in a pharmacist's nightmare, as they found anticonvulsants (levetiracetam), antihistamines (fexofenadine), and muscle relaxants (carisoprodol, metaxalone, and methocarbamol)—all chemicals that have rarely been reported as water contaminants and some of which are being reported for the first time. Prominent chemicals found in New York's waterways include triclosan, an anti-bacterial agent found in liquid hand soaps and toothpaste; the anaesthetic and heart

medicine lidocaine; diethyl-phthalate, a component of plastics; and the herbicide atrazine.

In all of the 18 waterways, researchers detected atenolol acid (a high-blood-pressure medication component); 5-methyl-1H-benzotriazole (a corrosion inhibitor found in dishwasher detergent); caffeine; the insect repellent DEET; gabapentin (an epilepsy medication); metformin (a medication that controls blood sugar); saccharin and sucralose (Splenda).

Citing how this new technique represents a broad range of chemical structures unlikely to be found using conventional means, noted Helbling, "These results are not only interesting from a novelty perspective, but demonstrate the breadth of chemical coverage that our suspect screening affords."

To access the original paper, visit: <http://pubs.rsc.org/en/Content/ArticleLanding/2017/EW/C6EW00248J#divAbstract>

Language a barrier to flow of scientific knowledge

Language is still a major barrier to the transfer of scientific knowledge even though English is increasingly used as the global language of science, a study has found.

The research, published in the journal *PLOS Biology*, highlights a practical problem that scientists in many parts of the world have long struggled with. Its authors took a close look at scientific documents on biodiversity conservation published in 2014. The documents – more than 75 000 in total – were written in 16 different languages.

For every ten documents, roughly six were in English and three in other

languages. The number suggests that English remains a leading language within scientific communities. But the results also underline the fact that a great deal of research is still conducted in languages other than English, and that they end up having little visibility.

That is particularly true for universities and research centres in several African countries that do not use English as their primary language.

“I have long been interested in how language barriers could affect science in general,” noted Tatsuya Amano, lead researcher on the study. “However, this problem has rarely been tackled by

scientific communities so far.”

Native English speakers tend to assume that all important knowledge is available and can be communicated in English, according to Amano. On the other hand, he noted, non-native English speakers tend to think that conducting research in English is the first priority, and often they end up ignoring non-English language science. “Ignoring such non-English knowledge can cause biases in our understanding of study systems,” the researchers wrote in their paper.

To access the original article, Visit: <http://journals.plos.org/plosbiology/article?id=10.1371/journal.pbio.2000933>

Water has another phase we did not know about



Scientists have discovered that there are two types of liquid water – not just one as previously thought.

This new peculiarity adds to the growing list of strange phenomena in what we imagine is a simple substance. The discovery could have implications for making and using nanoparticles as well as in understanding how proteins fold into their working space in the body or misfold to cause diseases such as Alzheimer’s.

Writing in the international *Journal of Nanotechnology*, Oxford University’s Laura Maestro and her colleagues in Italy, Mexico, Spain and the USA, explain how the physical and chemical properties

of water have been studied for more than a century and revealed some odd behaviour not seen in other substances. For instance, when water freezes it expands. By contrast, almost every other known substance contracts when it is cooled. Water also exists as a solid, liquid and gas within a very small temperature range (100 °C) whereas the melting and boiling points of most other compounds span a much greater range.

Many of water’s bizarre properties are due to the molecule’s ability to form short-lived connections with each other known as hydrogen bonds. There is a residual positive charge on the hydrogen atoms in the V-shaped water molecule either or both of which can form such bonds with the negative electrons the oxygen atom at the point of the V. This makes fleeting networks in water possible that are frozen in place when the liquid solidifies. The bonds are so short-lived that they do not endow the liquid with any structure or memory.

The team has looked closely at several physical properties of water, such as its dielectric constant or the proton-spin lattice relaxation (the process by which the magnetic moments of the hydrogen

atoms in water can lose energy having been excited to a higher level). They have found that these phenomena seem to flip between two particular characters at around 50 °C, give or take 10 °C. The effect is that thermal expansion, speed of sound and other phenomena switch between two different states at this crossover temperature.

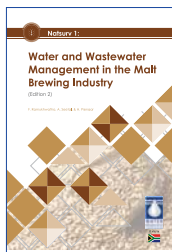
These two states could have important implications for studying and using nanoparticles where the character of water at the molecule level becomes important for the thermal and optical properties of such particles. Gold and silver nanoparticles are used in nanomedicine for diagnostics and as antibacterial agents, for instance.

Moreover, the preliminary findings suggest that the structure of liquid water can strongly influence the stability of proteins and how they are denatured at the crossover temperature, which may well have implications for understanding protein processing in the food industry but also in understanding how disease arises when proteins misfold.

Source: sciencedaily.com



New WRC reports



NATSURV 1: Water and wastewater management in the malt brewing industry (Edition 2)

Since the publication of the first edition of Natsurv 1 in 1986, the number of breweries in South Africa has increased from eight to more than 150, as have production volumes. Previously, most breweries were locally-owned; however, current ownership is both national and multi-national for

the large breweries, whilst the medium-, small and craft/micro-breweries tend to be locally owned. Water consumption estimates range from 4 to 8 l/l beer produced, but may be higher in the case of small breweries, generally owing to inefficient water management processes and systems. Water is used for beer production and also for cleaning, sanitation, heating and cooling processes. The study has shown that, for a number of different industrial sectors, there are common technologies available and applicable to reduce resources use and impacts (such as energy and water consumption) and wastewater generation. Many of these technologies would be applicable to breweries in general.

Report No. TT 676/16

Water use and crop parameters of pastures for livestock grazing management

Sustainable pasture production requires optimal nutrient, water and defoliation management practices in order to attain good yield and forage quality. The basic understanding of the water requirements and drivers of irrigated pasture production systems are essential for the development of sound water management strategies. Pasture systems, however are highly complex, involving interactions between crop growth, soil and plant nutrient dynamics, and livestock and pasture management systems. This project focused on mixed pastures which either included the subtropical kikuyu pasture over-sown with a temperate grass, or a temperate grass mixed with a temperate legume. The two most important legume species evaluated in this project included lucerne and white clover.

Report No. 2173/1/16

Improving weather radar estimates of rainfall using a high density

Advancing radar rainfall estimates in South Africa is extremely important as the South African Weather Service (SAWS) upgraded its network of radars between 2009 and 2012 for millions of rands. The initial objective of this study was to calibrate this radar network to improve the accuracy and reliability of the data measured by these radars. Due to unavailability of SAWS radar network for research, the North-West University purchased and installed its own Parsivel

disdrometer radar called NWU Lekwena weather radar in Potchefstroom in August 2014. Preliminary (1 year) results from this radar have highlighted the need to customise radars from overseas for the South African climatic conditions. After the calibration and customisation, results from this radar were compared to the newly installed rainfall network, and the results were highly correlated. The combination of the ongoing rainfall monitoring from the rain gauge network and rainfall measurement from the radar has greatly improved rainfall estimates in the area covered by this radar.

Report No. 2062/1/16

Fate and behaviour of engineered nanoparticles in simulated wastewater and their effect on microorganisms

Despite the numerous advantages of nanotechnology and nanomaterials applied in a variety of study fields ranging from catalysis and water treatment materials, to environmental remediation and biomedicine, concerns have been raised for the human health and the environment. Nanomaterials, especially zinc oxide and silver, are increasingly being applied in consumer products. It is expected that such products will be on the increase. As such, substances from these nanomaterials might increasingly be released into wastewater processes, where the knowledge of their fate and ecotoxicological effects on the microbial population of wastewater systems is still lacking. The focus of this project was on the investigation of the potential impact of ENMs on wastewater treatment plants, using laboratory scale activated sludge based wastewater treatment systems.

Report No. KV 350/16

Modelling impacts of climate change on selected South African crop farming systems

The agricultural sector is physically and economically vulnerable to climate change. In most regions of South Africa, the availability of water is the most limiting factor for agricultural production. Any change in rainfall attributes could have wide-ranging implications for commercial and subsistence food and fibre production, as well as for the GDP, employment and foreign exchange earnings. Climate change is superimposed upon all existing agricultural stressors and is anticipated to exacerbate these issues, and in combination with low adaptive capacity, the South African agriculture sector through the value chain is highly vulnerable to effects of climate change and the associated increase in climate variability. There has been limited research on climate change and related impacts on livelihood and the natural resources in some African countries. However, evidence from global climate models developed thus far suggests that the agricultural sector in the Southern African region is highly sensitive to future climate shifts and increased climate variability.

Report No. 1882/1/16

Smallholder irrigation entrepreneurial development pathways and livelihoods in two districts in Limpopo Province

In South Africa, unemployment and poverty are closely associated and the rural areas are nodes of both unemployment and chronic poverty. Agriculture makes an important contribution to food security at a household level, particularly for the poorest households. Agriculture is also seen as one of the key strategic opportunities for employment and rural development but smallholder farmers face formidable challenges. It is well-established that a poorly-functioning rural economy with undeveloped infrastructure, weak market linkages and poor agricultural support services isolate rural households from the mainstream economy and from important agricultural value-chains. Weak and conflicted land institutions add uncertainty and limit transactional opportunities. Enhancement of entrepreneurship is seen as key to growth in a free-market economic system including in the agricultural sector. Entrepreneurship in the South African informal sector is by and large, small-scale entrepreneurship, and largely synonymous with self-employment. Two categories of informal enterprise have been identified, namely survivalist enterprises and micro- or growth enterprises. Whilst survivalist enterprises are motivated by necessity (a push factor), generate limited income and rarely go beyond self-employment, micro-enterprises tend to be more motivated by opportunity (a pull factor) and offer the best potential to grow, create employment and bring about economic development.

Report No. 2179/1/16

Using membrane distillation crystallisation for the treatment of hypersaline mining and industrial wastewater

Membrane Distillation Crystallisation (MDC) offers a sustainable wastewater treatment process, particularly when using excess heat from peripheral processes to produce pure water as well as salt(s) products, thereby converting a waste material into a product of value that can be reused, recycled or sold to offset water treatment costs. MDC is also attractive because it requires lower operating temperatures (40-60°C) than evaporative crystallisation, enabling the efficient use of waste heat or renewable energy. This project investigated the applicability of MDC for the treatment of industrial wastewater with a specific focus on the treatment of mine water, and the impact that the presence of antiscalants had on the MDC process. Aqueous thermodynamic modelling using two different brines showed that the propensity for crystallisation increases with an increase with water recovery in the MDC process; this is directly linked to the increase in the supersaturation and consequently the driving force for crystallisation as a result of the removal of permeate water from the brine.

Report No. 2223/1/16

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No hidden figures: Success stories can help girls' STEM careers



What makes a young girl believe she is less intelligent and capable than a boy? And what happens when those children face the “hard” subjects like science, technology, engineering and mathematics (STEM). United Nations Women Executive Director, Phumzile Mlambo-Ngcuka, weighed in on society’s role to promote gender equality in science on the International Day of Women and Girls in Science, celebrated on 11 February.

A recent study showed that by the age of six, girls were already less likely than boys to describe their own gender as ‘brilliant’, and less likely to join an activity labelled for ‘very, very smart’ kids.

Research tells us repeatedly that girls and boys are strongly influenced in the development of their thinking and sense of themselves by narratives and stereotypes that start to be learnt at home and continue at school and through life, reinforced by the images and the roles they see in advertising, in films, book and news stories.

So, how do we change this, and what should girls learn now that sets them up to thrive in a transformed labour market of the future? The answer is not simply more and better STEM subject teaching. They must also learn that girls have an equal place in that future. This isn’t a given. A major and underestimated obstacle for girls in STEM is the stereotype that has been created and perpetuated that boys are better at these subjects and careers.

Not only do we have to ensure that children enter and stay in education, we must equally pay close attention to what they are learning. The changing future of jobs means that fields of study for children now in school should include equipping them for ‘new collar’ jobs in the Fourth Industrial Revolution. Jobs that do not exist

today may be common within the next 20 years, in the green economy, or areas such as robotics, artificial intelligence, biotechnology and genomics.

The media plays a powerful role in biases, with the power through effective storytelling to reinforce negative perceptions and norms or to set the record straight and create new role models. *Hidden Figures*, Margo Lee Shetterly’s book, that tells the untold story of the black women mathematics who helped win the space race, has been released as a film and bring recognition to those who were doubly invisible at NASA – as women and as black women. Making accomplished women scientists visible is important for the accuracy of news and history. It is also an essential part of building further scientific success.

Census data in the United States shows that women comprise 39% of chemists and material scientists, and 28% of environmental scientists and geoscientists. These are not the equal proportions that we ultimately want – but they are far higher levels of success in science than fiction tells us. Alarming, best-selling movies have tended to significant underrepresent the facts. A 2015 global study, supported by UN Women, showed that, of the onscreen characters with an identifiable STEM job, only 12% were women. This tells us

that women are still hidden figures in science, and it has a chilling effect on girls’ ambitions.

According to a 2016 Girl-guiding survey, fewer than one in ten girls aged 7 to 10 in the UK said they would choose a career as an engineer or scientist. Un-learning this bias and changing the stereotypes is not a simple matter, yet it is essential if we are to see boys and girls able to compete on a more equal footing for the jobs of the future. This goes hand in hand with the practical programmes that teach immediately relevant skills.

UN Women is working with partners around the world to close the gender digital gap. For example, in Moldova, GirlsGoIT teaches girls digital, IT and entrepreneurial skills and specifically promotes positive role models through video. Similarly, in Kenya and South Africa, Mozilla Clubs for women and girls teach basic coding and digital literacy skills in safe spaces.

We need to deliberately and urgently un-stereotype the ecosystems in which children play, learn and grow up. Across the world, in schools, at home, in the workplace and through the stories we tell – we all need to reflect and enable a world where girls can thrive in science, so that their success becomes as probable as they are capable.