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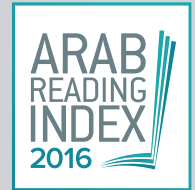
A MONTHLY MAGAZINE ON KNOWLEDGE AND DEVELOPMENT
BY THE MOHAMMED BIN RASHID AL MAKTOUM FOUNDATION

DECEMBER 2016
ISSUE 24

#2016YearOfReading

The Knowledge Summit 2016

Knowledge ... Present and Future



AED10





مبادرات محمد بن راشد آل مكتوم العالمية
Mohammed Bin Rashid
Al Maktoum Global Initiatives



مؤسسة محمد بن راشد آل مكتوم
MOHAMMED BIN RASHID
AL MAKTOUM FOUNDATION

جائزة الشيخ محمد بن راشد آل مكتوم للمعرفة

SHEIKH MOHAMMED BIN RASHID AL MAKTOUM
KNOWLEDGE AWARD

Honoring International Achievements in Knowledge and Innovation



Awarding Ceremony, 5 December 2016 - Grand Hyatt Hotel Dubai
The Knowledge Summit 2016



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مؤسسة محمد بن راشد آل مكتوم

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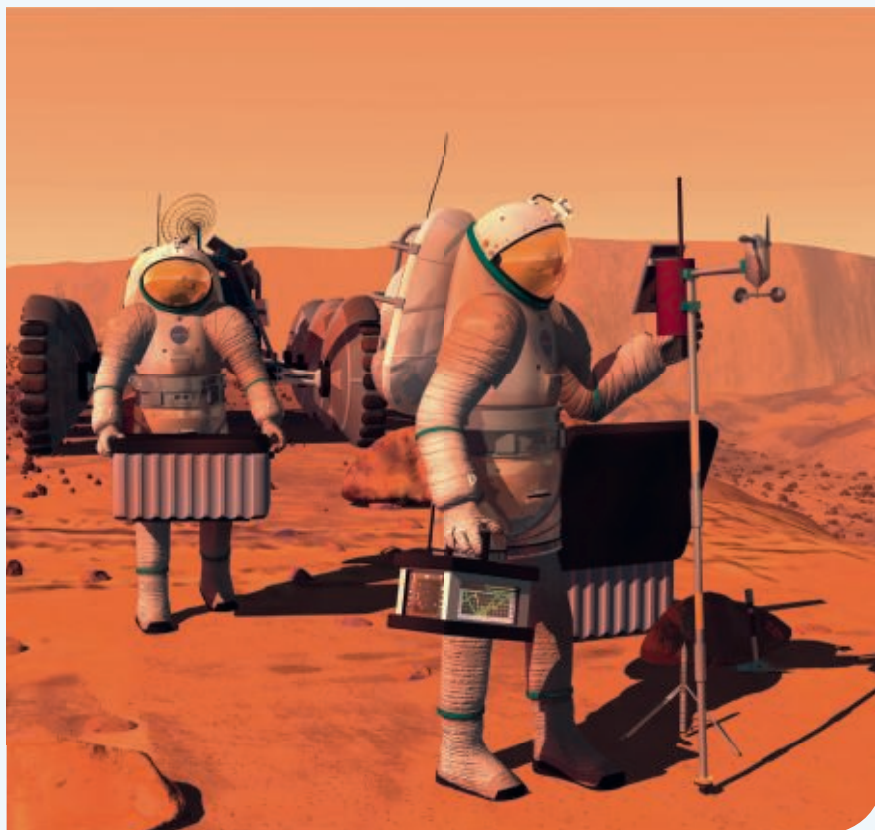
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The First
in the
Arab World

ARAB
READING
INDEX
2016

“There is
no future
without books”



The Knowledge Summit 2016
Knowledge... Present & Future

5-7 December 2016, Grand Hyatt Hotel Dubai

Stay tuned for the launch of the Arab Reading Index

The Arab Reading Index is an initiative launched by MBRF and UNDP to measure the status of reading and determine the level of cultural development in the Arab World and identifies the requirements needed for fostering a reading culture in the region.

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FOREWORD

Dear readers,

This time of the year is particularly exciting for the Mohammed Bin Rashid Al Maktoum Foundation (MBRF) as we host the annual Knowledge Summit. This year's theme, "Knowledge ... Present and Future" has once again attracted a body of high-ranking decision makers, ministers, senior officials, academics, and specialists from around the world.

Knowledge is a true cornerstone when it comes to building societies, and the main pillar that supports a nation's progress, its sustainable development, and the welfare of its people. It is the only true wealth that we need to invest in if we want to establish the UAE's stature among the advanced nations of the world.

That is why MBRF is proud to present the annual Mohammed Bin Rashid Al Maktoum Knowledge Award, which recognizes significant contributions to the advancement of knowledge and encourages individuals and entities to innovate in order to contribute to the development of a knowledge-based economy.

A significant contributor to knowledge is reading, a subject that is central to MBRF's mission. At this year's Knowledge Summit we will reveal the results of the

first Arab Reading Index, which are based on a poll of around 150,000 people from all Arab countries, conducted by MBRF and the United Nations Development Program (UNDP).

This initiative, which is the first of its kind in the region, resonates with the UAE's vision that considers reading an essential element in the process of acquiring knowledge and promoting innovation in an effort to establish a well-educated generation capable of producing and spreading knowledge.

The UAE is a leader when it comes to launching such initiatives, and this adheres to the intentions of His Highness Sheikh Khalifa bin Zayed Al Nahyan, President of the UAE, who declared 2016 a 'Year of Reading' and launched the National Reading Strategy.

The Arab Reading Index is yet another example of MBRF's tradition of launching creative initiatives and projects to share knowledge, identify problems and propose solutions.

Jamal Bin Huwaireb

MD of Mohammed Bin Rashid Al Maktoum Foundation



New “Reading Law” Issued

His Highness Sheikh Khalifa bin Zayed Al Nahyan, President of the UAE, has issued the first law of its kind that aims to put in place legislation and executive programmes, along with well-defined governmental duties, to enshrine the importance of reading in the UAE.

HH Sheikh Khalifa said that the law aims to invest in human beings and boost the UAE's image as an example for the region. He also said that reading and knowledge is key for the progress of the UAE. “Our objective is to prepare generations that work for a brighter future of the UAE,” the President said.

His Highness Sheikh Mohammed bin Rashid Al Maktoum, Vice President and Prime Minister of the UAE and Ruler of Dubai, praised the law as an unprecedented cultural and legislative insight. “The law takes a key value such as reading and turns it into an integrated government project,” His

Highness said. Sheikh Mohammed celebrated this announcement with the top students of the Arab Reading Challenge in his office in Emirates Towers.

Sheikh Mohammed said that the law was drafted based on international legal experiences, which took into consideration local heritage and the Arabic identity of this society. He also stressed the importance of reading as a right for everyone in society that is granted by law, where the government will provide a “knowledge briefcase” to families with newborn babies. “Our objective is to make reading a daily habit of our people, where relevant entities will be required to translate this law into reality,” he said.

The law also will grant employees dedicated time to read during working hours, and consolidates the cultural image of books in society and obliges coffee shops in shopping malls to offer reading material for its customers. ↑

10-YEAR NATIONAL POLICY FOR READING

UAE's multi-pronged initiatives to make reading a part of the UAE's core values and national identity.

INTEGRATING READING AT EVERY LEVEL

UAE law on reading has been announced

AED100 MILLION

Fund to support reading and its related activities will be implemented.



Every year will contain a month of reading. This year, it is October. For 2017, it is March.



An educational bag will be given to new parents to inform them on child reading while providing their children with appropriate reading material.



Volunteering programmes to read for the elderly, the sick, children and the disabled will also be set up.



School assessment will focus on reading objectives.



Number of UAE publications aims to go up from 400 to 4,000.



Reading material will be mandatory at cafes.



Public libraries will have branches at malls

Dubai Ruler Issues Law on Establishment of MBR Library

His Highness Sheikh Mohammed bin Rashid Al Maktoum, Vice President and Prime Minister of the UAE, has issued Law No. (14) for the year 2016 in his capacity as the Ruler of Dubai for the establishment of the Mohammed bin Rashid Al Maktoum Library as a public foundation, along with Decree No. (36) for the year 2016 to form the board of directors for the Establishment of Mohammed bin Rashid Al Maktoum Library. The board is in charge of drawing up public policies and strategic plans required to achieve the Library objectives.

“We want this library to serve as a cultural forum, an incubator for knowledge and a civilisation centre in the region,” said Sheikh Mohammed, adding that the library would play a part in the promotion of reading as well as contributing to the development of the country.

“The knowledge provided by the library will encourage authors and translation while bringing intellectuals



closer, and spreading the culture of dialogue, tolerance and acceptance of others,” he said.

The new law defines the objectives of the Library, which aims to support and enhance the comprehensive strategy of the government in the cultural and knowledge sector, as well as boosting general knowledge in the Arab world, among many other aims.

His Highness launched the Library last February, which is set to be the biggest library in the Arab world. The project will cost AED1bn, and have an area of one million square feet. It is set to include 1.5 million books serving 42 million people across the region and the world. The Library will also host more than 100 cultural and knowledge events annually. ↗

20 Strategic Initiatives Approved

His Highness Sheikh Mohammed bin Rashid Al Maktoum, Vice President and Prime Minister of the UAE and Ruler of Dubai, approved 20 strategic initiatives for the Emirates Scientists Council, with the aim to create a conducive environment for innovation and scientific research in the country, and develop a generation of Emirati scientists and researchers for the benefit of the country.

“Our objective is to set our scientific and research priorities that serve our interests, cement our economy and build a future for our generations. We bet on young scientists to establish a national scientific and research platform,” His Highness said. “Scientists and academicians are partners of the government in facing the challenges, saving costs, and making people happy.”

Sheikh Mohammed stressed the importance of the approved strategic initiatives as it offers a holistic approach to achieving scientific excellence. “We work today to develop a generation of UAE scientists able to compete for Nobel Prizes in the next decades,” Sheikh Mohammed added.



In November, His Highness launched the UAE University (UAEU) Science and Innovation Park at the university campus in Al Ain. This is a first-of-its-kind research hub and student innovation incubator in the region and also worldwide. ↗

A Message of Tolerance

His Highness Sheikh Mohammed bin Rashid Al Maktoum, Vice President and Prime Minister of the UAE and Ruler of Dubai, issued a message of tolerance to celebrate the International Day of Tolerance on 16 November. In it he highlighted that openness and tolerance were the hallmarks of what made the UAE great.

His Highness wrote: “What makes us proud of our nation is not the height of our buildings, the breadth of our streets, or the magnitude of our shopping malls, but rather the openness and tolerance of our nation. Our pride stems from the fact that we are a country where everyone thrives equally regardless of their differences, with true love and acceptance: a country where people live and work harmoniously, raising their children to enjoy a future free of the fear of extremism, intolerance or discrimination based on their race, colour, religion, sect or ethnicity.”

The promotion and protection of tolerance is taken seriously by the UAE. The “Sheikh Mohammed bin Rashid Award for Tolerance” was recently launched by His Highness and aims to create a foundation for developing young Arab leaders in the field of



“What makes us proud of our nation is not the height of our buildings, the breadth of our streets, or the magnitude of our shopping malls, but rather the openness and tolerance of our nation.”

His Highness Sheikh Mohammed Bin Rashid Al Maktoum,
Vice President and Prime Minister of the UAE and Ruler of Dubai

tolerance and providing support to the intellectual, cultural and media promotions of values of tolerance.

A further initiative is the International Institute of Tolerance, which will be the first of its kind in the Arab world. It will offer consultation, advice and expert views for promoting values

of tolerance among nations.

In order to protect the country from intolerance, His Highness Sheikh Khalifa bin Zayed, President of the UAE, recently introduced an Anti-Discrimination Law in order to protect the community and preserve the UAE's legacy of tolerance. [f](#)

Global Future Councils Meets in Dubai

His Highness Sheikh Mohammed bin Rashid Al Maktoum, Vice President and Prime Minister of the UAE and Ruler of Dubai, inaugurated the first Annual Meeting of the Global Future Councils on November 13. In his opening remarks His Highness stressed that the UAE has long been keen to cooperate with its partners in its efforts to build a sustainable future for generations to come.

“The UAE is a key player in the global efforts to build a better future for mankind,” His Highness said. “We

strongly believe that constructive cooperation is a real catalyst for positive development. Working alone in our rapidly changing world is guaranteed to fall short of affecting real change.”

The Annual Meeting of the Global Future Councils brings together 700 high-profile decision makers and influential business leaders, grouped into 35 councils, to proactively propose solutions for the most pressing future challenges such as climate change, water demand and economic issues. The future experts devise global

models inspired by the principles of the Fourth Industrial Revolution that promotes stability and sustainable development. The UAE is regarded as a world leader when it comes to planning for the future at the government level.

The Annual Meeting of the Global Future Councils – set to be held in Dubai for the next two years – is a culmination of a long and successful partnership that saw the emirate host the Global Agenda Councils for the past eight years. [f](#)



MBRF's Knowledge Summit 2016 Takes an In-depth Look at "Knowledge ... Present and Future"

The scene is set for the third edition of The Knowledge Summit, which takes place from 5th to 7th December under the patronage of His Highness Sheikh Mohammed bin Rashid Al Maktoum, Vice President and Prime Minister of the UAE and Ruler of Dubai. This annual event is organised by the Mohammed bin Rashid Al Maktoum Foundation (MBRF).

The theme of this year's event is "Knowledge ... Present and Future" and under the directives of HH Sheikh Ahmed bin Mohammed bin Rashid Al Maktoum, Chairman of MBRF, the summit will also discuss the future of sectors deemed vital to countries' development – most notably, reading, which forms the cornerstone for knowledge, besides other industries such as medicine, technology, and education.

A body of high-ranking decision makers, ministers, senior officials, academics, and specialists from around the world will attend the Knowledge Summit 2016 to share their insights, expertise, and success stories in relation to the Summit's insightful session topics. Among the luminaries are Tony Abbot, former Prime Minister of Australia. The three-day event, which is being held at the Grand Hyatt Dubai Hotel, is set to tackle a host of knowledge-related topics. It will also highlight Dubai's unique experience in the process of shaping the future, as well



"It is the only true wealth that we need to invest in if we want to establish the UAE's stature among the advanced nations in the world."

HE Jamal bin Huwaireb,
Managing Director of MBRF

as efforts and initiatives that have been put forward in this area.

HE Jamal bin Huwaireb, Managing Director of MBRF, said: "Knowledge is a true cornerstone when it comes to building societies, and the main pillar

that supports a nation's progress, its sustainable development, and the welfare of its people. It is the only true wealth that we need to invest in if we want to establish the UAE's stature among the advanced nations in the world. It is the sector we need to be paying most attention to if we want to develop our societies, and eventually turn them into productive, intelligent, and creative communities, able to achieve comprehensive development. The Foundation brings yet another edition of the Knowledge Summit to shed light on the latest developments and methodologies in knowledge production and dissemination in the Arab region."

Two key events on the first day of the Summit will be the announcement of the Sheikh Mohammed bin Rashid Al Maktoum Knowledge Award and the results of the Arab Reading Index.

The Mohammed bin Rashid Al Maktoum Knowledge Award, which is presented annually by MBRF, recognizes significant contributions to the advancement of knowledge and encourages individuals and entities to innovate. The award also aims to contribute to the development of a knowledge-based economy. The winner, which can be an individual or an institution, receives \$1 million.

A board of trustees, chaired by HE bin Huwaireb, Managing Director of MBRF, Vice Chairman of the Board of Trustees and Secretary General



The Knowledge Summit attracts high-ranking decision makers, ministers, senior officials, academics, and specialists from around the world.

of the Award, selects the winners. Other Members of the Board are Nick Rawlins, Professor of Behavioural Neuroscience at the University of Oxford; David Bennett, Vice President, Global Corporate Partnerships at National Geographic; Dr. Ali Ahmed Al Ghaffli, Vice Dean for Social Sciences at the College of Humanities and Social Sciences, UAE University; and Alexander

J.B. Zehnder, Visiting Professor and Member of the Board of Trustees of Nanyang Technological University (NTU), Singapore.

The results of the Arab Reading Index, which are based on a poll conducted by MBRF and the United Nations Development Program (UNDP), canvassed around 150,000 people from all Arab countries to

determine the status of reading in the region. The Index, which is the first of its kind in the region, is a scientific and standardised tool that tracks knowledge-focused initiatives in the Arab World and measures their impact on society, all in a bid to assign quantifiable numerical data to the process of cultural development in the region.

The critical importance of reading is further underlined by the fact that the Knowledge Summit devotes a number of sessions to it.

“The Future of Reading in the Arab World” will delve deeper into the Arab Reading Index with a detailed presentation and analysis of the results. “Reading... Diagnosing Reality and Future Foresight” examines topics such as the importance of reading in promoting social culture and the protection of national identity, while “The Arab Reading Challenge” examines its role in achieving reconciliation between different generations and reading.

HE bin Huwaireb noted: “The Arab Reading Index initiative resonates with



The Board of Trustees for the Mohammed bin Rashid Al Maktoum Knowledge Award

the UAE's vision, which considers reading an essential element in the process of acquiring knowledge and strives to promote innovation as a principle in the local community, all in an effort to establish a well-educated generation capable of producing and spreading knowledge."

Predicting the future, which is also known as future foresight or futurology, aims to detect future opportunities, as well as identifying and defining risks.

HE bin Huwaireb pointed out that the Knowledge Summit 2016 comes at a time when the most developed of nations set their sights on the future, formulating strategies to predict that future, and aim to have a hand in shaping it. The UAE is making tremendous strides in that regard, and to a great extent, is leading the global charge to achieve that goal.

"Predicting the future, which is also known as future foresight or futurology, aims to detect future opportunities, as well as identifying and defining risks."

The first session on Day One of the Summit is devoted to "Future Foresight and Decision-Making". Among the topics will be the concept of futurology, its importance, governments that succeeded in future foresight, and future global trends. The future foresight theme continues in the second session, which focuses on "Future Technologies ... What's Hidden?" The last two sessions of the day look at two particularly important topics, "Future Foresight – Against Ideological Extremism" and "Knowledge and the Future of Cities."

The latter is particularly pertinent to Dubai, with the topics centring on Dubai Government's efforts in future foresight, smart cities and technological



The Mohammed bin Rashid Al Maktoum Foundation participated at the Sharjah International Book Fair 2016



Qindeel Printing and Publishing was established in 2014 by MBRF.

knowledge advancement, and the role of cities in knowledge economies. HE Saeed Al Tayer, MD and CEO of Dubai Electricity and Water Authority, and Dr Aisha Bin Bishr, Director General of the Smart Dubai Office, are two speakers with excellent credentials in this regard.

The futurology theme continues on the third and final day with Sessions entitled "Knowledge and the Future of Health", "A Journey to the Future", which highlights prominent trends in future technologies, and "Media and Making the Future".

The Knowledge Summit 2016 comes to a close with a detailed presentation by the Arab Knowledge Index team on the index and its various categories,

including pre-university education, higher and vocational education, information and communications technology, research and development, innovation and the knowledge economy.

"The Arab Knowledge Index has come a long way and has recently concluded many rounds of evaluations and reviews. Data provided by the Index was verified by international bodies, asserting its credibility and ensuring its compatibility with international standards," commented Bin Huwaireb.

The data generated by the Index will provide valuable support for governments' efforts to set plans and strategies to build their knowledge economies and achieve sustainable development. 

EXPLORE

ARE BOOKFAIRS STILL RELEVANT?

Technology and digitization have massively disrupted the traditional publishing industry. Yet publishers and book fairs are proving extremely adaptable to changing trends



The first moveable type system was created in China around 1040, while Johannes Gutenberg created the first European system in 1439. By 1455 he had published the first copies of the Gutenberg Bible, which were presented at the Frankfurt Book Fair that same year and cost the equivalent of three years' pay for the average clerk.

A decade later the European print industry was flourishing, revolutionizing communication, book production and ultimately the spread of knowledge that gave rise to the Renaissance. Printing has arguably been the most important technological achievement of humanity by promoting literacy and creating a solid foundation of knowledge. The European output of printed books skyrocketed into the hundreds of millions of copies during the following century and this access to information influenced every major cultural and political event for centuries. No less significant was the impact of the printing press on scientific development as, for the first time, scientists could both educate and learn from an international community of peers through publication.

The Frankfurt Book Fair, the world's oldest, was held for the first time in 1454. It brought together authors, publishers, booksellers and readers. The economic principle was simple: the publishers bought the intellectual rights for a book from the author and undertook the printing, editing, copy-righting, distribution and marketing in exchange for retaining about 85 per cent of the income from book sales to offset expenses. The publisher was in charge of quality control by choosing what and who was published. This system has now been disrupted. Until 2007, when Amazon introduced the Kindle, the only viable means of book distribution was paper. By July 2010, Amazon announced that sales of its eBooks for the Kindle outnumbered sales of hardcover books. Six months later, eBooks outsold paperbacks on Amazon.com.

Digitization marks the declining role of publishers, or at the very least, the unbundling of the services traditionally

provided by publishers. Digital publishing reduces the cost of writing and self-publishing. Amateur writers can join the writing scene and may collaborate in writing and editing texts. The technological context of the internet enables massive collaborative writing, with Wikipedia being a classic example. The digital format even expands the role of writing, as it creates opportunities for incorporating additional formats into text and for telling stories through multimedia such as videos and music. Publishing houses no longer control access to distribution nor define quality as the online environment offers several alternatives to publishers' selections, such as ratings by peers, recommendations on social networks and reviews. Facebook, Twitter, Snapchat and Instagram provide outlets to connect with existing fans, while Amazon and Goodreads are doing their best to become the new booksellers. Kindle, iBooks and Google Play Books provide new reading ecosystems.

Against this backdrop of massive disruption to traditional publishing, it is fair to ask if book fairs are still relevant today. In fact, the International Publishers Association (IPA) – which is involved in 40 annual book fairs – asked that very same question in 2015 and 2016 surveys. >

Below: Johannes Gutenberg's moveable type system revolutionised book production and the spread of knowledge.





Above: The Frankfurt Book Fair attracts around 7,300 exhibitors from more than 100 countries and 275,000 professional visitors.

Right: eBooks have played a major role in disrupting traditional publishing.



➤ The IPA's findings were that 63 per cent of respondents described the value of attending book fairs as either "very good" or "good". They also cited that the media coverage and profiles of book fairs were important factors. These findings reflect that in an age where much business is conducted online, book fairs remain highly valued by publishers. This is likely due to the nature of publishing as a business, particularly in the way in which rights sales are conducted, where success is built largely via personal relationships. Book fairs represent the best and often only opportunity for trade professionals to meet and connect.

The IPA also points out that book fairs consist of numerous components, and different organisers focus on separate areas. The major function of book fairs is still as a market place for professionals, while they also serve as exhibitions where technology firms and distributors can showcase

their products and services. Book fairs serve an important educational purpose for book trade professionals by making them aware of key trends through seminars, panel discussions and presentations. Book fairs also offer a range of events designed to facilitate networking.

Book fairs across the world also have unique elements. In the Middle East, Abu Dhabi and Sharjah (UAE) are growing hubs for rights sales, as well as translating books from Arabic to English and vice-versa. Cairo (Egypt) is the region's largest publicly attended fair. Frankfurt Book Fair remains the biggest international trade book fair as it is a key market place for the rights business and, thanks to its wide media coverage, a platform for publishers to announce deals. Bologna (Italy) specializes in children's literature, while BookExpo America is the main market place for US publishers. Liber (Spain) and Guadalajara (Mexico) are the main rights fairs for Spanish-language publishers, while Beijing, Hong Kong and Taipei (Taiwan) are important rights fairs for the Chinese market, as is Moscow for Russian publishing. The Salon du livre de Paris, Sweden's Göteborg Book Fair, Bogota (Columbia) and the Buenos Aires fair (Argentina) are high-profile cultural events and major drivers of their national book industries.

There are further unique elements to different book fairs. Ahmed Al Ameri, Director of the Sharjah International Book Fair (SIBF), says the event's primary aim is to promote reading as a habit among the younger generation, whilst instilling the love of literature among all people

of the region. “SIBF has always had a strong emphasis on improving the quality of children’s book in Arabic, and established a Sharjah Children’s Reading Festival (SCRf) seven years ago, which takes place in April. The children’s hall at SIBF itself is visually appealing and offers great facilities for children and families – there are workshops, activities, readings and book signings to inspire and encourage participation, as well as provide great entertainment. SIBF is enduringly popular with the local community and millions of books are sold from publisher stands every year. The large Indian diaspora in Sharjah and neighbouring Dubai means that a who’s who of Indian publishers attend, alongside Arabic and a growing number of international publishers.”

The Abu Dhabi Book Fair, which showcased 1,260 exhibitors from 63 countries this year, has similar aims. Mohammad Khalifa Al Mubarak, chairman of TCA Abu Dhabi, said, “Abu Dhabi has championed education and educational

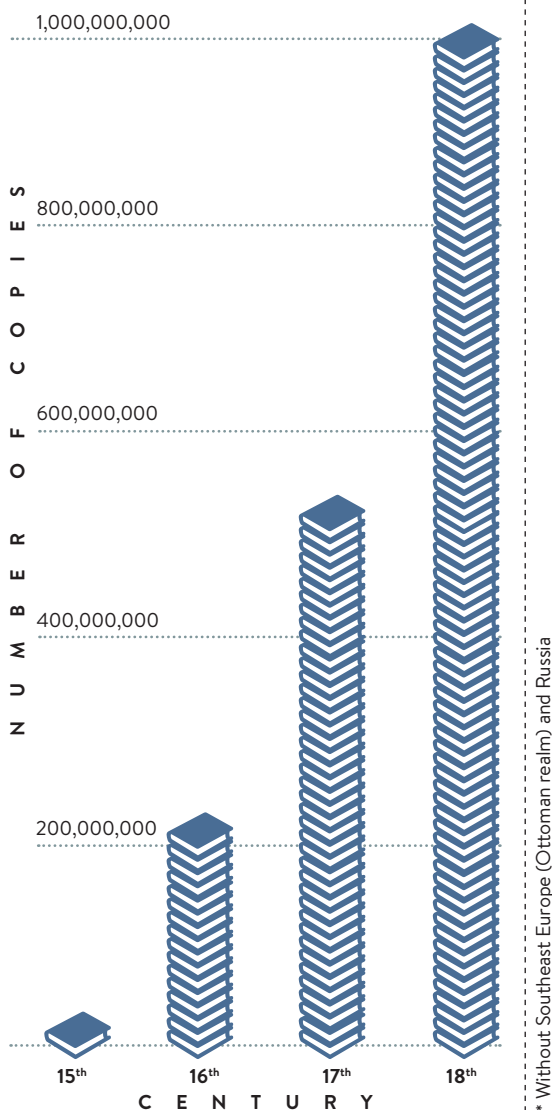
and distributors. We have expanded our Brand Licensing, Comics and TV and Film sectors too, with the same aim. It is also true to say that every development within the book fair is introduced with a clear remit of putting the book industry and its business imperatives at the centre of what we do.”

Adapting has been key for publishers and book fairs to stay relevant. A decade ago there was still a division at book fairs with technology relegated to separate halls. Today, the Frankfurt Book Fair



EUROPEAN OUTPUT OF PRINTED BOOKS

ca. 1450-1800*



“Digital innovation delivers great cross industry opportunity and we have taken great strides in boosting interaction and education at the Fair with other aligned creative industries.”

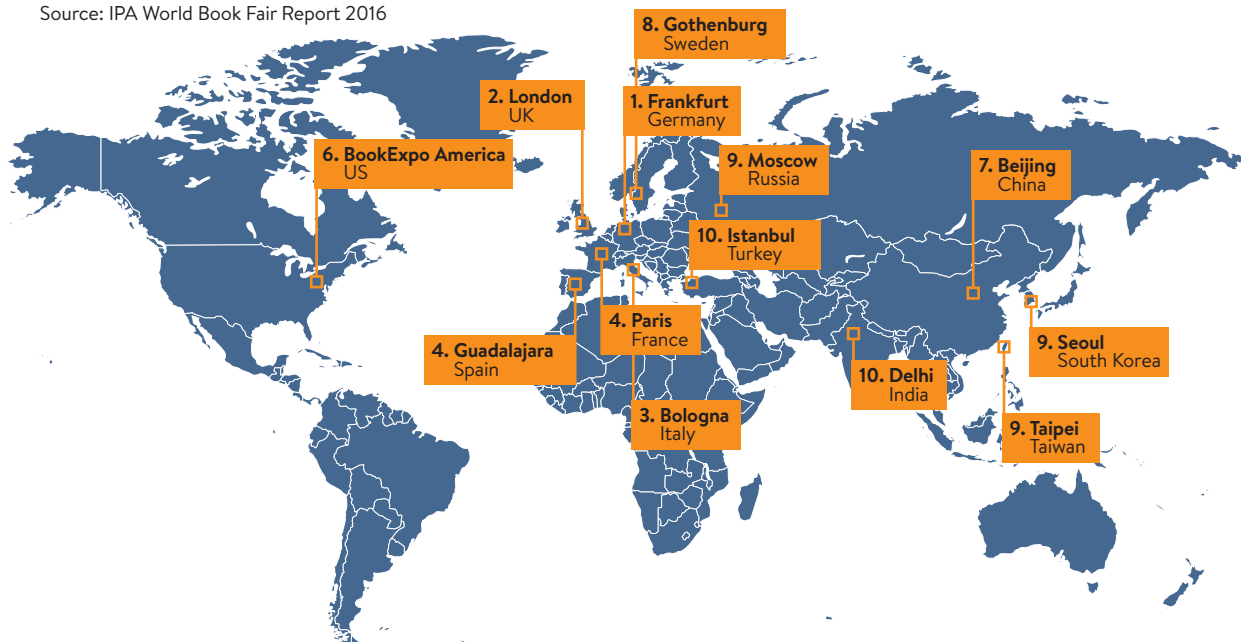
- JACK THOMAS

excellence and having the book fair here for many years and, hopefully, for many years to come, showcases our capability. It also exhibits some of the best world talent here in Abu Dhabi and encourages reading so that every household in the UAE is reading.”

Jacks Thomas, director of the London Book Fair, believes being relevant is of vital importance. “Digital innovation delivers great cross industry opportunity and we have taken great strides in boosting interaction and education at the Fair with other aligned creative industries. We want to enable exhibitors and visitors to learn and make new, unexpected and fulfilling connections with lucrative outcomes! Last year we launched the Gaming Pavilion, giving publishing exhibitors and visitors the chance to connect with gaming developers, publishers

MOST VISITED BOOK FAIRS BY PROFESSIONALS 2015

Source: IPA World Book Fair Report 2016



► presents the full spectrum of digital trends and technological developments in the publishing industry. At this year's event they were grouped together in Hot Spots, the special exhibition formats for providers of services and technology to interact directly with traditional publishers.

Jürgen Boos, director of the Frankfurt Book Fair, says: "We're seeing that the publishing world is growing tighter and that there is increasing demand for contacts and networking with other industries – whether brand licensing, film, games, augmented reality or the crafts community. We're currently seeing that intellectual property is becoming more relevant in the creative industries. This is especially true in the visual arts, where unique works of art can be converted to tradable – digital – serial products. As a result, we're working on a new format for trading this kind of intellectual property."

The European Commission is aware just how fast technological developments are changing the face of publishing and it is providing support to help publishers and book fairs to cope with the digital transformation. One example is that the European Commission is funding the activities of the Technologies and Innovation for Smart Publishing project. This is a joint platform of the IT industry and publishers whose objective is to help the cross sector exchange of ideas and technologies.

Furthermore, the Commission supports and is

working in close cooperation with the New European Media Initiative, which represents companies and clusters active in the creative industries and develops a common research agenda. The Frankfurt Book Fair and major publishing houses are members of these two organisations.

In a similar vein the Mohammed bin Rashid Al Maktoum Foundation (MBRF) and the Frankfurt Book Fair recently signed a Memorandum of Understanding (MoU) that plans to form a

Below: The Sharjah International Book Fair has a strong emphasis on promoting reading among the younger generation.





global strategic partnership for the development of media and content-related projects and events. This will start in Dubai and the wider Arab region as a first step, before targeting the entire world. The aim of this partnership is to create conventions and interdisciplinary business platforms dedicated to the current and future challenges of the new creative ecosystem. By bringing together global players from all creative industries, the events will provide a comprehensive overview of the developments in the content market.

This focus on the “content market” itself signals what the future of publishing may look like. As soon as content went digital, everything in the media industries became blurred and interlinked. In the past, different types of media had been separated by their individual physical formats. The written word was imprisoned in the form of books. Movies were caged as videos or DVDs, while music was distributed in the form of records, tapes and CDs. As soon as multi-format devices popped up, this problem of incompatibility vanished and different types of media were free to mingle and meld in one glorious mix of information and entertainment.

This is reflected in some of the companies that are making waves in the publishing industry. Hardbound is a new platform that mixes text, storytelling, images and graphics to bring a new experience that aims to educate. Longform curates the best stories on the web. The Pigeonhole is an app that serialises fiction and allows reading to be social and interactive. Visual Editions is a publisher creating books that tell stories in a visual way, thereby testing how we engage with books, exploring narratives through shifting text and visual. This inspires creativity without boundaries, a feat of tech-meets-publishing.

Markus Dohle, the CEO of Penguin Random

House, recently said that “tech firms are a huge opportunity for publishers, they provide us with the opportunity to reach even more readers, and the book consumer base is growing by 25 million people a year, and so we need each other, and the relationship between tech firms and publishers should not be confrontational but collaborative.”

By embracing the new norm, where digital outputs do not necessarily threaten physical ones – and letting the market decide what format to choose – book fairs and publishers should remain relevant, even in a world where broadband and wireless connectivity is taken for granted. †

Above: A participant at the Frankfurt Book Fair takes a break from the more than 4,000 events on offer.

THE UAE'S DIGITAL LIBRARIES

According to the *OverDrive Reports 2016 Digital Library Trends for Public Libraries* eBook, audiobook and digital magazine checkouts are on track to grow 30-40 per cent for 2016 over the record levels achieved for 2015.

The UAE has joined this growing trend. In early 2016 the Mohammad Bin Rashid Al Maktoum Foundation (MBRF) launched the first phase of the Dubai Digital Library, which aims to provide an advanced electronic platform that supports a culture of reading by showcasing an extensive collection of Arabic books, including translated works covering all genres. It will also feature Arabic and international periodicals, dictionaries, biographies, photographs and maps.

The UAE Digital Library was launched earlier this year at the Abu Dhabi International Book Fair. The project, which encourages the spread of cultural and scientific knowledge on a digital platform, will make more than a million books available. The library will also promote local and Arab authors and benefit readers all over the world with an open access. The initiative is inviting all local and international institutions and publishing houses to join the efforts in building the library.



THE RISE OF NANOMACHINES

Nanomachines, once perfected, will have numerous applications. However, it is in the field of medicine that some of their biggest promise lies

Nanomachines have been in the news after a European trio of chemists won the Nobel Prize in chemistry for developing technology that is already being used to create medical micro-robots and self-healing materials. Sir Fraser Stoddart, from Scotland, Bernard Feringa, from the Netherlands, and Jean-Pierre Sauvage, from France were hailed by the Nobel committee for developing the “world’s smallest machines”.

How small is small? In Latin, *nanus* means “dwarf”. In science, the prefix “nano” denotes “one billionth” of something. Nanomachine is the general term for a machine ranging in size from one micrometre (one-thousandth of a millimetre) to one nanometre (one-millionth of a millimetre) using MEMS (Micro Electro Mechanical Systems) technology. In other words nanomachines, which are also called molecular machines and nanorobots, work on the molecular level and are composed of individual atoms. They are so tiny about 40 billion individual machines would fit in a single drop of water.

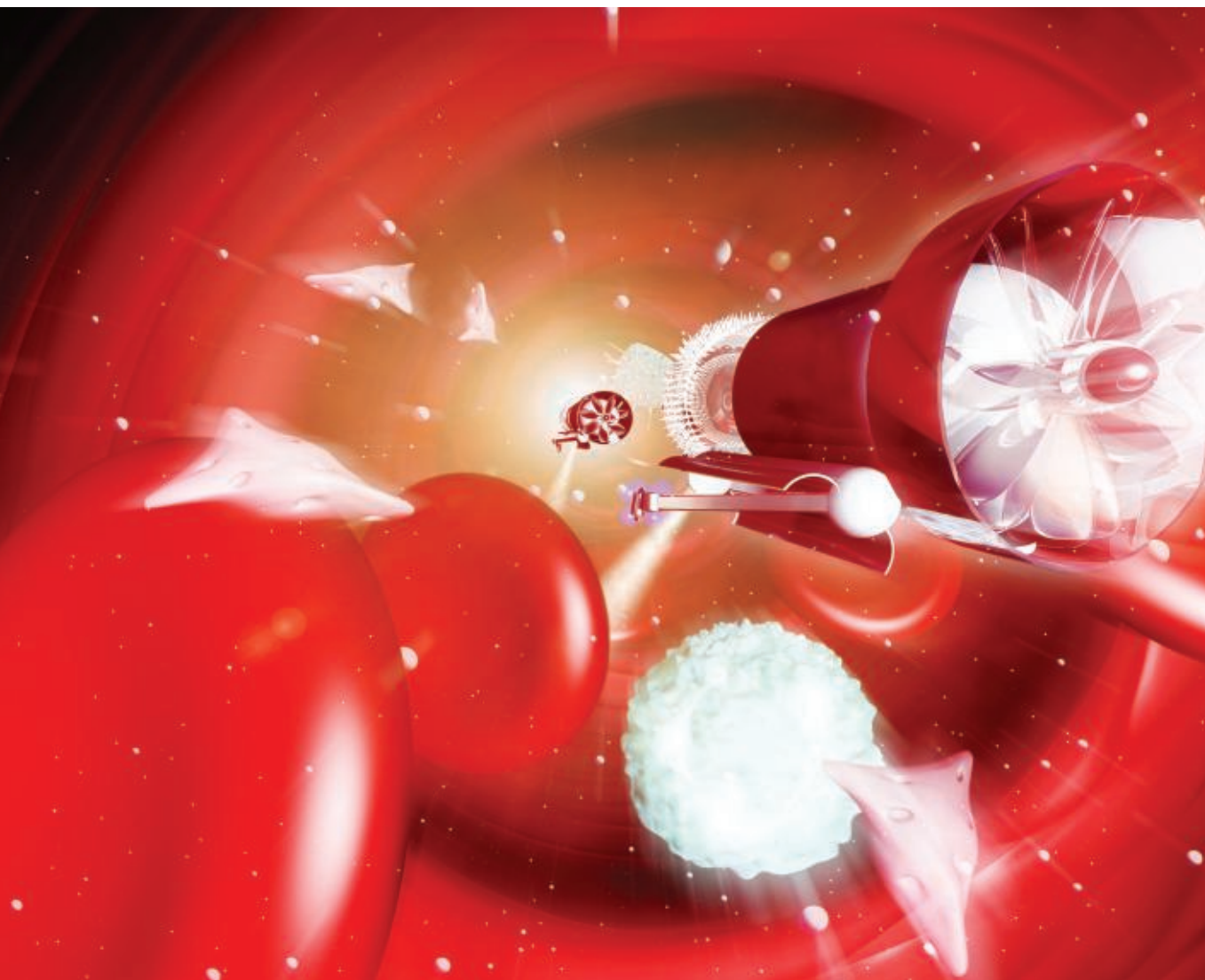
The ultimate goal of nanomachine technology is to manipulate matter at the atomic level. According to futurist and visionary K. Eric Drexler, nanomachines called assemblers will one day be able to rearrange atoms from raw material in order to produce useful items. In theory, one could shovel earth into a vat and wait patiently for a team of nanomachine assemblers to convert the dirt into an apple, a chair, or even a computer.

Another goal of nanotechnology is to design nanomachines that can make copies of themselves. If a machine can rearrange atoms in order

to build new materials, it should also be able to build copies of itself. If this is achieved, products produced by nanomachines will be extremely inexpensive as the technology (once perfected) will be self-replicating and will not require specific materials.

Medicine, in particular, has embraced nanotechnology. Nature has actually already shown us that nanomachines are possible. For example, certain proteins can travel along a surface using a rotating mechanism that creates movement from chemical energy. These motor proteins are what cause cells to contract and so are responsible for our muscle movements. Furthermore, there are molecule-building factories called ribosomes inside every living cell. These tiny machines read blueprints of genetic information and fabricate the molecules that make up all life. Biomolecular motors are also responsible for the delivery of packages inside cells and, to prevent aging and disease, these processes have to run smoothly for a lifetime. Biological mechanisms, such as the continuous replacement of molecular parts, have evolved to prevent the rapid degradation of the body’s nanomachines. Unfortunately, many human illnesses and injuries also have their origin in nanoscale processes.

This explains why the application of nanotechnology to the practice of medicine and biomedical research opens up new opportunities to treat illnesses, repair injuries, and enhance human functioning beyond what is possible with macroscale techniques. At the nanoscale level, the distinctions between mechanical and biological



Above:
Nanomachines could be used to absorb toxins and kill cancer cells in the bloodstream.

processes blur. Nanoparticles can attach to certain cells or tissues and provide medical images of their location and structure. Hollow nanocapsules with pharmaceutical contents can attach to cancer cells and release their payloads into them – maximising targeted delivery and minimising systemic side effects.

Scientists have identified a number of areas where nanomachines would be useful in medicine:

⇒ **MEDICINE DELIVERY**

Using nanomachines to deliver drugs to specific locations in the body could be more effective than consuming pharmaceutical drugs or injecting medicines into the body. For example, nanobots could be loaded with certain DNA codes or drugs

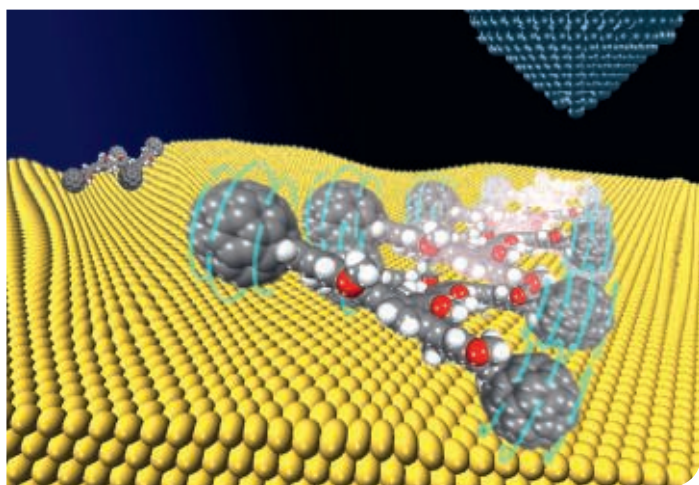
that are lethal to harmful microorganisms. When the nanobots are injected into the body, they can destroy harmful microorganisms by attaching themselves to them and injecting lethal doses of drugs into their body.

⇒ **DETOX**

Nanomachines could be used to absorb toxins and remove these toxins from organs and the bloodstream. A person who has a weak immune system and liver problems should benefit a lot from this type of nanomedicine.

⇒ **MONITOR HEALTH CONDITIONS**

Scientists have found that some nanomaterials have the ability to detect certain drugs and



Top: Nobel Prize winners Jean-Pierre Sauvage, Sir Fraser Stoddart and Bernard Feringa. Above: Feringa built a molecular machine that resembled a car and moved on its own.

nutrients. With better understanding of nanotechnology, scientists could create nanomachines that have the ability to detect the levels of chemicals and nutrients in the body. This can be very useful for diagnosing disease and health conditions and finding ways to treat them.

∞ TISSUE REPAIR:

Nanomachines may repair vital tissue damaged by injury or disease, or destroy cancerous tissue that has gone awry, without invasive surgery.

So where are we when we separate the science from the fiction? The breakthrough made by the Nobel trio is that they were able to replicate the kind of function exhibited by a motor protein in synthetic molecules, by working out how to convert chemical energy into mechanical motion. This allowed them to construct molecular devices a thousand times smaller than the width of a human hair, including switches, motors, shuttles and even something resembling a motorcar.

Sauvage, professor emeritus at the University of Strasbourg, made the first step towards a molecular machine in the 1980s, when he succeeded in linking two ring-shaped molecules together

paper-chain style, and later showed one ring structure could rotate freely relative to the other.

In the 1990s, Stoddart, who is based at Northwestern University, Illinois, built the first molecular wheel – a free-moving ring structure on an axle that was later used to develop a molecular muscle and an abacus that could act as a computer chip.

Feringa, who works at the University of Groningen, pioneered the nano-motor, by first showing that a molecular rotor blade could be made to spin continually in the same direction. He later put four of these together to make a car smaller than the width of a human hair that could “drive” across a surface.

These advances have allowed scientists to develop materials that will reconfigure and adapt by themselves depending on their environment – for instance contracting with heat, or opening up to deliver drugs when they arrive at a target site in the body.

The Graphene Research Centre at the National University of Singapore recently demonstrated a simple but nano-sized engine made from a highly elastic piece of graphene. Graphene is a two-dimensional sheet of carbon atoms that has exceptional mechanical strength. Inserting some chlorine and fluorine molecules into the graphene lattice and firing a laser at it causes the sheet to expand. Rapidly turning the laser on and off makes the graphene pump back and forth like the piston in an internal combustion engine.

The Singapore researchers think the graphene nano-engine could be used to power nanomachines, for example to attack cancer cells in the body. Or it could be used in a so-called “lab-on-a-chip” – a device that shrinks the functions of a chemistry lab into tiny package that can be used for rapid blood tests, among other things.

In 2010, researchers from Germany created a molecular rotor by placing moving molecules

“Henderson’s nanotechnology could be fabricated cheaply and deployed easily. Used in conjunction with a smartphone app, nearly anyone could use the technology to detect Ebola or any number of other diseases and pathogens.”

inside a tiny hexagonal hole known as a nanopore in a thin piece of silver. The position and movement of the molecules meant they began to rotate around the hole like a rotor. Again, this form of nano-engine could be used to power a tiny robot around the body.

Eric Henderson, a professor of genetics, development and cell biology at Iowa State University, along with Divita Mathur, recently published an article in the peer-reviewed *Scientific Reports* describing his laboratory's successful effort to design a nanomachine capable of detecting a mockup of the Ebola virus.

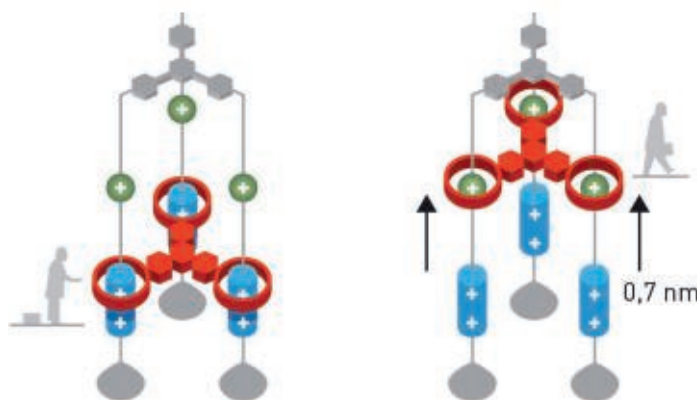
The duo made use of the double-helix structure of DNA, which has the unique property that one strand of DNA will bind only with a complementary side. Even better, those compatible strands find each other automatically. Henderson harnessed those same principles for his nanomachines. The components, once added to water and then heated and cooled, find each other and assemble correctly without any further effort from the individual deploying the machines.

According to Henderson such a machine would prove valuable in the developing world, where access to diagnostic medical equipment can be rare. He said his nanotechnology could be fabricated cheaply and deployed easily. Used in conjunction with a smartphone app, nearly anyone could use the technology to detect Ebola or any number of other diseases and pathogens without the need for traditional medical facilities.

Scientists are also exploring ways to carry drugs through the body with magnetic nanoparticles. Drugs are injected into a magnetic shell structure that can expand in the presence of heat or light. This means that, once inserted into the body, they can be guided to the target area using magnets and then activated to expand and release their drug.

Some universities are currently developing and testing nanosensors that have the ability to

MOLECULAR MACHINES



detect very low levels of cancer cells. These nanosensors are more sensitive than traditional cancer tests, making them great for detecting cancer at an early stage. This could reduce cancer deaths, as the sooner cancer is diagnosed, the easier it is to treat it.

Researchers have also found that certain nanoparticles combined with gold nanoparticles are effective for starving cancer cells. These special nanoparticles are created to look like HDL cholesterol, so that when they attach to a lymphoma cell, they prevent cancer cells from attaching to real HDL cholesterol, causing cancer cells to starve to death. Another way to use gold nanoparticles to destroy cancer cells is to attach anti-cancer RNA molecules to gold nanoparticles and apply them to the skin or inject them into the body. As the nanoparticles penetrate the body of cancer cells, they can stop them from producing proteins and therefore preventing cancer cells from growing.

The use of nanomachines in medicine is still currently at the research stage, but it appears that we are moving ever closer to the first working prototypes. When that happens, medical treatments will be revolutionised. 

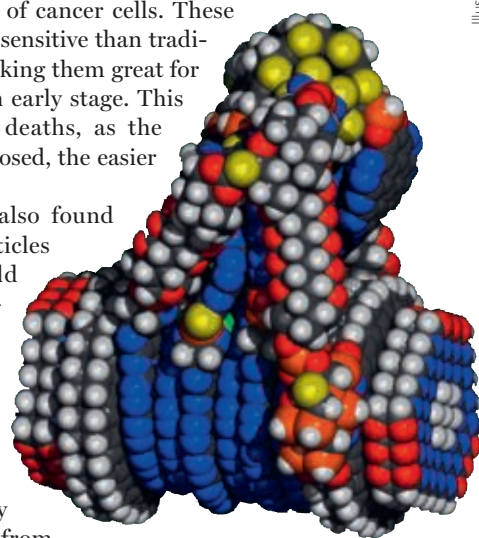
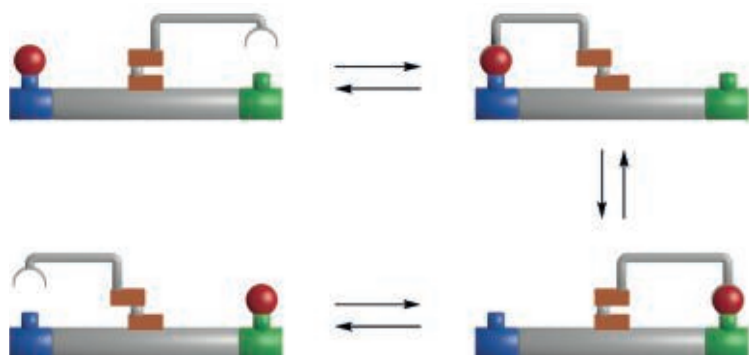


Illustration: Johan Janestad/The Royal Swedish Academy of Sciences

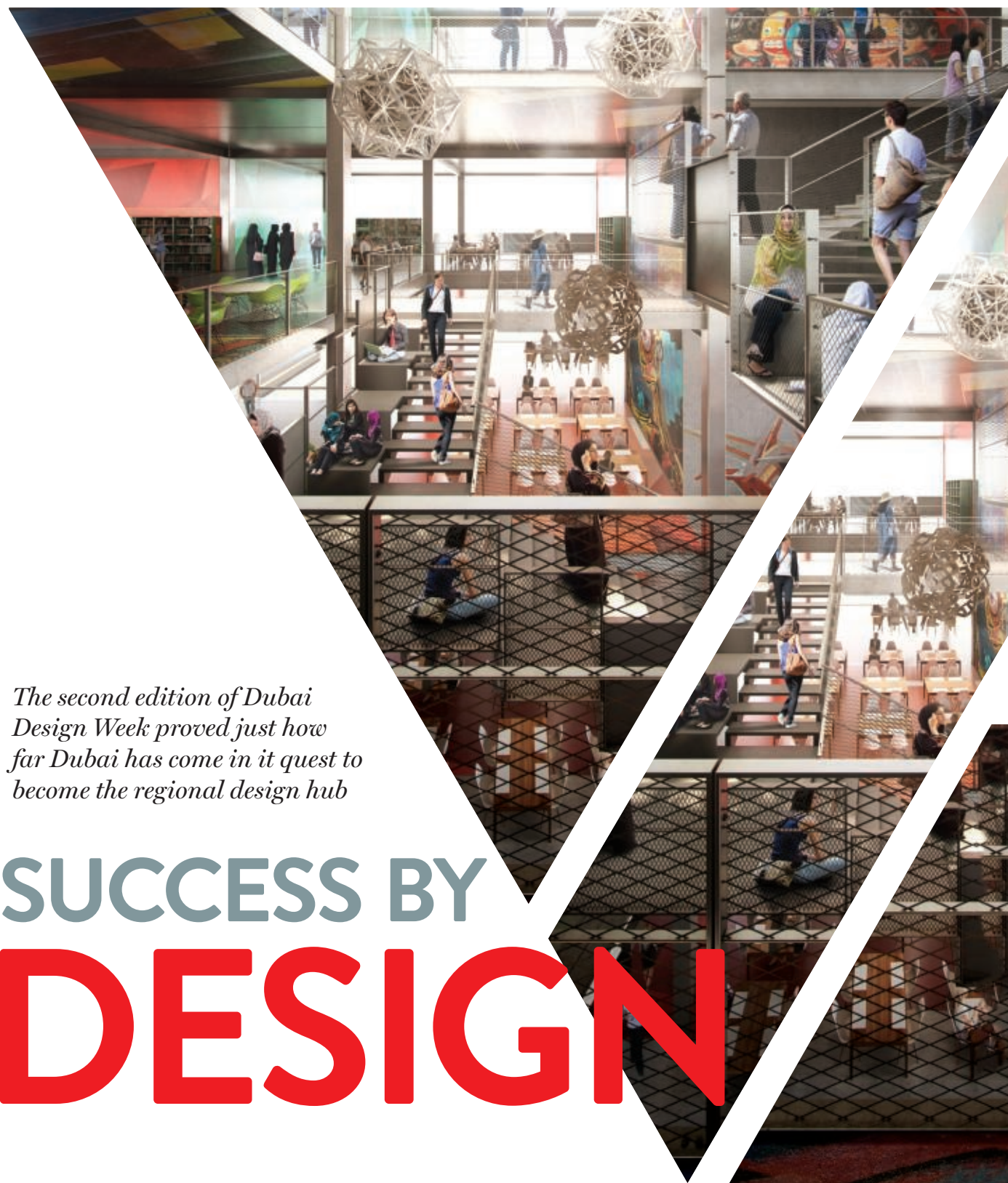
Photo: imm.org



Top: Stoddart's research group constructed a nanomachine that functions as a lift. It can raise itself 0.7 nanometers above a surface.

Above: Nanomachines are composed of individual atoms.

Left: A molecular arm has been created that grabs, transports and releases molecular cargo.



The second edition of Dubai Design Week proved just how far Dubai has come in its quest to become the regional design hub

SUCCESS BY DESIGN



Dubai takes design seriously as proven by the fact that it dedicates two weeks to it annually: Design Days Dubai in March and Dubai Design Week in October. This year the second edition of Dubai Design Week – double in size compared to last year with more than 150 design-related exhibitions, fairs and events – ran from October 24–29 around the city with its hub of exhibitions and installations at Dubai Design District (d3).

Dubai has a reputation for identifying opportunities and seizing them. A study undertaken by Dubai Design and Fashion Council (DDFC) and d3 revealed the region's design industry is poised for serious growth – if equipped with the necessary human and material resources. The *MENA Design Education Outlook* report estimates that “at least 30,000 design graduates” are needed in MENA (a nine-fold increase) by 2019, in order to support the growth projected for the sector. According to the report the MENA region's design industry has grown at twice the pace of the global industry since 2010, with a market value that surpassed \$100 billion in 2014. The region's design industry is expected to grow at six per cent over the next five years, and creative industries – emerging as a promising sector – account for almost 1.5 per cent of the region's GDP.

In terms of specific roles, the report notes architecture, fashion and interior design to be professions that will be in demand and will require professionals. However, a lack of dedicated design education facilities and courses are

identified to be key barriers to growth. The study also touches upon the need to learn from and adopt global best practices of international design education hubs such as the USA, UK, Singapore and The Netherlands.

The findings of the *MENA Design Education Outlook* report obviously resonated with Dubai's leadership, as evidenced by the fact that this year's Dubai Design Week got off to a flying start with the launch of the Dubai Institute of Design and Innovation (DIDI) by Dubai Holding and Dubai Creative Clusters Authority on October 24.

That Dubai acted so quickly is hardly surprising. Innovation has been identified as a key driver to achieve the ambitious goals the UAE has set for its economic and knowledge development in Dubai Plan 2021.

His Highness Sheikh Hamdan bin Mohammed bin Rashid Al Maktoum, Crown Prince of Dubai and Chairman of the Board of Trustees of Dubai Future Foundation, highlighted this fact. “The launch of DIDI supports the government's efforts to develop design talent in the region and the vision of Vice President, Prime Minister and Ruler of Dubai, His Highness Sheikh Mohammed bin Rashid Al Maktoum, to make Dubai a model for sustainable economic development based on innovation and productivity as outlined in the Dubai 2021 Plan. Dubai seeks to constantly enhance its capacity for sustainable development by driving innovation and creativity, and creating an environment for skilled graduates across sectors to acquire the skills that will enable them to meet the challenges of the job market.”

DIDI will be housed in an AED270 million, 100,000 square feet campus designed by Foster + Partners in the Creative Community at d3. Plans for the development of DIDI were made in collaboration with the Massachusetts Institute of Technology (MIT) and Parsons School of Design, the world's foremost design schools. DIDI will offer a tailor-made curriculum to meet the region's needs culminating in a Bachelor of Design degree with cross concentrations in Product Design, Strategic Design Management, Media, Visual Art, and Fashion Design. DIDI will accommodate 550 students and the first intake is planned for Autumn 2018.

The launch of DIDI wasn't the only good news to emerge from this year's Dubai Design Week. Underlining d3's emergence as a global design hub it was announced that Santiago Calatrava, Zaha Hadid Architects, Foster + Partners and Benoy, four of the world's most prestigious architecture firms, would open their doors there this year. Collectively they are responsible for redefining modern architecture and creating some of the world's most spectacular and innovative buildings. There are currently already more than 30 architectural practices located at d3. In fact, all through the last

12 months, d3 has been rated as the best performing destination in Dubai on the leasing side. Since its 2015 opening, d3 has attracted more than 6,000 people to work there with 85 per cent of the space now occupied.

One of Dubai Design Week's annual highlights is the Global Grad Show that showcases how innovation and design go hand in hand.





Clockwise from top: Zeinab Al Hashemi, one of the UAE's most promising names in contemporary art, designed *The Hexalite*; Afaaq Al Musaqbal was a tongue-in-cheek rendition of kitsch Emirati café culture; the Burj Khalifa was illuminated by two regional design studios; Dubai Institute of Design and Innovation is expected to open in 2018.

This year the young and entrepreneurial designers presented 145 innovative projects from 30 countries that included the Swedish designer Fredrik Ausinsch's proposal for an algae-eating drone to keep oceans clean; Gabrielle Geagea and Anne-Sophie Geay's design for a wearable shelter; and a hands-free system that assists with medical surgery by the designers Jiachun Du, Tom van Rooij and Tong Wu. Award-winning curator Brendan McGetrick selected the projects that hailed from 50 leading universities. "The projects that I find the most exciting are the ones that respond to experiences that I hadn't thought of before," said McGetrick. "It really kind of expanded my own humanity in a way." Hopefully, in the near future, graduates from DIDI will feature prominently in this event.

Another curator who had his hands full was Cairo-based architect, independent researcher and writer Mohamed Elshahad who organised more than 65 Egyptian architects, designers, entrepreneurs and graphic artists for the Iconic City event. This annual showcase, which focused on Beirut last year, acts as the event's commercial hub and "open museum of design". This year's theme was Cairo Now! City Incomplete, a tongue-in-cheek reference to the many part-realised projects in and around Cairo. That there is no shortage of regional talent was made clear in the Iconic City event. It captured for the first time under one roof the innovation and emerging talent from MENA's most populous city.

Up-cycled products that are made from repurposed garbage were one innovative aspect showcased here.



Up-Fuse, a social design enterprise helmed by Rania Rafie and Yara Yassin recycles neglected plastic bags into colourful and durable backpacks, tote bags, wallets and cases. The two designers collaborate with Roh al-Shabab, an NGO in Cairo's garbage collectors' district, in the up-cycling process of plastic bags.

"We taught them how to process and clean the bags in an environmentally friendly and hygienic way, which they do in their spare time to create income," Rafie explained. "Part of our revenue goes to the NGO for education and hygiene awareness programmes."

Reform Studio is another initiative creating products from waste plastics. It uses a fabric called Plastix, which is made from plastic bags and recycled cotton threads, to upholster furniture, beach clutches, placemats and rugs. Plastix was born out of a university project by Hend Hafez and Mariam Hazem in 2013. "We never do design for the sake of design," Hamez said. "It has to solve a problem."

By focusing on utilising old craftsmanship to create new materials, particularly in furniture, Egypt is strengthening its competitive advantage. The country's furniture exports are projected to grow by nine per cent annually to reach \$1.9 billion in 2019 according to the *MENA Design Education Outlook*.

The centrepiece of Dubai Design Week was *The Hexalite*, an collaboration between Emirati artist and graphic designer Zeinab Al Hashemi and Swarovski – the Austrian fine crystals manufacturer. This giant kaleidoscopic sculpture looked extraordinary in Dubai's bright sunshine, and it also transformed after dark. The interactive installation comprised of 1,145 Swarovski crystals and 33 hexagonal mirrored-steel structures that played with light from the surrounding buildings. The entrancing effect and incredible focus on detail highlighted why Al Hashemi is one of the UAE's most promising names in contemporary art and design. Her signature piece, *San'am*, was also on display.

Emirati artists also made their presence felt at the Abwab exhibition (named after the Arabic word for 'doors'), which shows works in a national pavilion format. This year, artists representing Algeria, Bahrain, India, Iraq, Palestine and the United Arab Emirates tackled the theme of 'The Human Senses'. Dubai-based architecture and design studio A Hypothetical Office was chosen to design six transitional pavilions as blank canvases for the countries to personalise.

The UAE's offering, from a team of seven including husband and wife Salem and Maryam Al-Qassimi, was as entertaining as it was talked about. *Afuaq Al Mustaqbal* was a tongue-in-cheek rendition of kitsch Emirati cafe culture, where you could drink karak tea surrounded by wallpaper that was printed with bottles of Al Ain water and Excellence hot sauce.

For a more commercial approach, the fourth edition of Downtown Design brought together more than 100 brands from 25 countries. Luxury and high-end, and a strong influence of Islamic pattern and design dominated proceedings.

One thing became clear throughout this second installment, namely that Dubai is rapidly succeeding in its aim to become

the design hub of the MENA region. Dubai Design Week 2016 attracted a record crowd of 40,000 visitors, an increase of 75 per cent compared to 2015. The cultural fulcrum of the exhibition was the Downtown Design trade fair, which doubled its visitors to around 12,500, of which 80 per cent were industry professionals. There were also double the number of events staged in d3 and around the entire city, reaching a total of 150 during the week.

Mohammad Saeed Al Shehhi, chief operating officer of d3, said: "As a leading design fair that attracts many international brands through its doors, hosting such events is important for us as a district as they support our greater vision to make Dubai a recognized global design destination, as well as allowing our own residents and business partners to see at first hand some of the latest design trends taking place within the industry."

By the end of this year, d3 expects to have 10,000 people working in the creative hub. This rapid growth means that phases two and three of d3 will be ready by 2019 and 2021. Add to that the opening of DIDI in 2018, and it becomes clear that design in Dubai is growing at an exponential pace. ↑





Learning a foreign language appears to be an excellent way to boost brain power

Learning a foreign language isn't just good for your planned trip around the world but also enhances the brain's elasticity and its ability to code information according to scientists from the Higher School of Economics and the University of Helsinki. In fact, the more foreign languages you learn, the better your brain can process and respond to the data collected in the course of learning.

Previous studies have already identified that a bilingual person's brain contains a higher density of grey matter, which contains most of the brain's neurons and synapses. A Swedish study using magnetic resonance imaging (MRI) discovered that specific parts of the brain, namely in the hippocampus and cerebral cortex area of language students, developed in size whereas the brain structures of a control group remained unchanged.

Engaging in a second language also leads to more activity in certain brain regions, giving it a mental workout. Researchers have also shown that the bilingual brain can have better attention and task-switching capacities than the monolingual brain, thanks to its developed ability to inhibit one language while using another. In addition, bilingualism has positive effects at both ends of the age spectrum: Bilingual children as young as seven months can better adjust

to environmental changes, while bilingual seniors can experience less cognitive decline.

The latest study, carried out by Yury Shtyrov, Leading Research Fellow of the HSE Centre for Cognition & Decision Making, Lilli Kimppa and Teija Kujala (University of Helsinki), took this research further. Twenty-two students – 10 male and 12 female – participated in the study. The researchers played recordings of different words, both known and unknown, to the students in their native as well as foreign languages. Electroencephalography or EEG was used to track the changes in the electrical activity of their brain when the words were played.

The brain's ability to process information depends upon the person's linguistic history, say researchers. So, the data collected from the above experiment was measured against factors such as how many languages the individual knew and at which age they started to learn them, to name a few factors. A major focus of the study was the speed at which the brain altered its activity to process the unknown words.

Participants who already knew some foreign languages displayed a higher level of electrical activity in their brain. This is due to "Linguistic Anamneses", which is the ability to recall any



Above: EEG readings revealed how individual's brains reacted to know and unknown words.

method of expression in relation to communication. Shtyrov links this enhanced electrical activity to the pace at which the neuron network coding the information on the new words is formed. Feeding the human brain with new knowledge boosts its elasticity and the same physiological change happens when a person is exposed to new words.

The researchers say that the inability to study verbal function on test animals has resulted in insufficient attention being given to the neuro-physiological mechanics of language and speech acquisition compared to the brain's other functions. They believe there is a lot more to explore and discover in this realm.

Feeding the human brain with new knowledge boosts its elasticity and the same physiological change happens when a person is exposed to new words.

"When we achieve better insight into the principles of creating and strengthening neuron networks, we will be able to harness these mechanisms, speed them up and improve the learning process," Shtyrov explained.

The current study is an important one for the scientific community. Understanding how the brain functions in acquiring language will prove crucial in diagnosing speech impediments after accidents and strokes. Better insight into the way neuron networks are created and strengthened will allow scientists to harness the mechanisms and eventually. †

TALK YOURSELF SMART

Understanding language is one of the hardest things our brain does and the benefits of learning an additional language are proportional to the effort invested by the brain.

DELAYS DEMENTIA

Learning a new language can prevent or delay Alzheimer's disease and dementia by almost four years. Studies have proved that speaking more than one language increases the number of neural pathways in the brain. This means that information received can be processed through a greater number of channels.

IMPROVES YOUR MATH SKILLS

A 2007 study conducted by The American Council of Teaching of Foreign Languages reported that children who studied a foreign language, even when this study took them away from studying math, outperformed children who did not study math and received more mathematical instruction. Another study published by the University of Michigan in 1997, showed that students who studied a foreign language for just one term for 90 minutes per week scored significantly higher in math.

FASTER LEARNING AND MULTI-TASKING

Memory retention is also improved when learning a new language. Continually absorbing and retaining information shortens the learning curve. Studies also show that bilinguals are better multi-taskers than people who speak only one language.

DEVELOPS EMPATHY

Ideally, to learn a new language exposure to native speakers and their culture is essential. Stepping into the shoes of another person helps one see the world in a different perspective – therefore developing empathy for others.

DOUBLES CREATIVITY

When speaking a new language, we have to take extra effort to form coherent sentences. This piecing together of words improves divergent thinking skills, training us to think of a variety of solutions to problems on a regular basis. Thanks to the constant experimentation, multilingual individuals are more creative than monolingual individuals according to researchers.

COOLING THE PLANET

Refrigerants play an important role in global warming by destroying the ozone layer and being a 10,000 times stronger greenhouse gas than carbon dioxide. Fortunately, help is at hand

In October this year an amendment to the Montreal Protocol was signed in Kigali, Rwanda, to eliminate hydrofluorocarbons (HFCs) and take 0.5°C out of future global warming. This amendment was successfully negotiated by 170 countries with the aim to phase out 90 per cent of HFCs that are used as refrigerants in everything from air-conditioning units to industrial refrigerators and home appliances.

The Montreal Protocol, a landmark international agreement, was originally signed in 1987 and substantially amended in 1990 and 1992. It stipulates that the production and consumption of compounds that deplete ozone in the stratosphere – chlorofluorocarbons (CFCs), halons, carbon tetrachloride, and methyl chloroform were to be phased out by 2000. This was successful as nearly 97 per cent of ozone-depleting chemicals had been phased out by 2010.

In order to understand the importance of the Montreal Protocol and the recent Kigali deal, one has to look at the impact that refrigerants have on a global scale.

There are a wide variety of fairly benign refrigerants available, with some of them having been successfully used in the past such as ammonia, methyl chloride, propane, sulphur dioxide and carbon dioxide (CO₂). However, they do have some problems. Ammonia, methyl chloride and sulphur dioxide work well, but they are reactive molecules that can be toxic to people if they leak out of the refrigerant system. Propane isn't toxic, but it is flammable. So each of those early refrigerants has a risk associated with their use.

That is why Thomas Midgley and his research team at the Frigidaire division of General Motors were charged with coming up with a new refrigerant in the late 1920s with two criteria: The refrigerant had to be non-toxic and nonflammable. With hindsight a third criteria should have been added: environmentally benign.

Midgley's first commercial refrigerant was a chlorofluorocarbon compound, named CFC-12, which was produced by DuPont under the Freon brand. It was perfect as a refrigerant gas because it is nontoxic, nonflammable, and fairly inexpensive. CFC-12 and a succession of related compounds such as CFC-11 and CFC-113 became widely used as refrigerants in home and automotive applications, as well as other uses such as propellants in aerosol spray cans, foam blowing agents, and fire suppressants.

It took until the 1970s before scientists discovered that CFCs participate in atmospheric reactions that destroy the Earth's protective ozone layer, which serves as a filter to prevent the sun's most harmful ultraviolet rays from reaching the planet's surface. By 1985, predictions of an "ozone hole" over the Antarctic had come true.

That led to the signing of the Montreal Protocol in 1987 to phase out the numerous substances





responsible for ozone depletion, with the main target being CFCs. By eliminating the use of CFCs, ozone depletion was stopped and a tipping point was reached in 1993. The ozone layer is now gradually healing and is expected to be back to its former level around 2050. Scientific research indicates that phasing out CFCs has been the equivalent of eliminating 200 billion metric tons of greenhouse gases, which is five years' worth of total global emissions.

The phasing out of CFCs led chemists to search for replacements that were equally efficient, non-toxic, non-flammable, and would not harm the ozone layer. Chemists started by looking at other types of halocarbons and the first round of replacement refrigerants included the hydrochlorofluorocarbon HCFC-22. These compounds also depleted the ozone layer, but to a much lesser extent than CFCs. Next up were hydrofluorocarbons, such as HFC-134a, that are safe to use and don't deplete the ozone layer.

Unfortunately, HFCs also have a major downside as they contribute to global warming. On a molecule-for-molecule basis, these compounds are up to 10,000 times more potent greenhouse gases than carbon dioxide. The United Nations Environmental Investigation Agency estimates that without controls, HFCs could be responsible for the equivalent of about 10 gigatonnes of CO₂ emissions per year by 2040, or about one-third of the world's current emission of fossil fuels. A recent study, published in *Proceedings of the National Academy of Sciences*, showed a dramatic rise in HFC emissions from 303 to 463 million tonnes of CO₂ equivalent between 2007 and 2012. This equates to an increase of 33 million tonnes per year, similar to the annual fossil fuel carbon emissions of New Zealand. This upwards trend reflects that the worldwide use of HFCs has soared in the past decade as rapidly growing countries such as China and India adopted air-conditioning in homes, offices and cars.

The international consensus is that HFCs have to be phased out, yet the Kigali deal took years to negotiate in various technical and political forums. Ultimately, the agreement institutes a three-phase process that reflects countries' differing levels of development:

- The US and the European Union (and other developed economies) will freeze production and consumption of HFCs by 2018 (Europe had already adopted its own regulations in 2014, America via the EPA in 2015);
- China, Brazil, and African nations will start their freeze in 2024; and



Above: The executive team applauds the ratification of an amendment to the Montreal Protocol on October 15 this year in Kigali, Rwanda.

- The hottest countries – including Kuwait, Pakistan, India, Saudi Arabia – get to stick with HFCs until 2028.

The Kigali deal keeps the Paris agreement on track and is a vital step towards reducing global emissions.

The question is, what refrigerants are replacing HFCs and will they be safe for the environment? The Air-Conditioning, Heating and Refrigeration Institute (AHRI), US government agencies, and energy-efficiency advocacy groups have been working toward ensuring a phasedown of HFCs. In 2011, AHRI initiated a global refrigerant research programme known as the Low-Global Warming Potential Alternative Refrigerants Evaluation Program (Low-GWP AREP), to identify the most promising HFC alternatives. After two phases of research, the most promising alternatives are currently classified as mildly flammable or flammable, so additional field research is being undertaken to determine their suitability in different applications. The refrigerants currently known to us are the following:

In 2015, the US Environmental Protection Agency (EPA) gave the green light to five new refrigerants through the EPA's Significant New Alternatives Policy (SNAP) programme. These include ethane, propane, isobutane, difluoromethane (HFC-32), and a blend of four alkanes called R-441A (ethane, propane, butane, and isobutane). Replacing older refrigerants with these will reduce greenhouse gas emissions by an estimated 600,000 metric tonnes by 2020, equal to the emissions from the annual electricity use of nearly 75,000 homes.

In the European Union, the first regulations were adopted in 2006 that succeeded in stabilizing the use of HFCs by 2010. Further regulations, which replace the first set, were applied from 1 January 2015 to strengthen the existing measures and introduces a number of far-reaching changes. As a result, over 90 per cent of new appliances within the EU nowadays contain hydrocarbon refrigerants. In industrial refrigeration, ammonia systems are being successfully used. In several countries, such as India and China, the use of hydrocarbons and ammonia have been proven to be safe and energy-efficient alternatives to HFCs and HCFCs, both under moderate and high-ambient temperature conditions.

By 2030 the EU's regulations will cut HFCs by two-thirds compared with 2014 levels. The expected cumulative emission savings are 1.5 Gigatonnes of CO₂-equivalent by 2030 and 5 Gigatonnes by 2050. The latter number is more than the CO₂ produced by a billion return flights from Paris to New York.

The question is, are flammable and mildly flammable refrigerants safe to use in home

ALTERNATIVE	GLOBAL WARMING POTENTIAL (GWP)	PROPERTIES TO BE ADDRESSED	COMMERCIAL AVAILABILITY
Hydrocarbons	3-5	Flammable	Immediate
CO ₂ (R744)	1	High pressure	Immediate
Ammonia (NH ₃ , R717)	1	Toxic	Immediate
Water (R718)	1	No risks	Immediate
R32 (an HFC)	675	Mildly flammable	Immediate
HFOs	4-9	Mildly flammable	Immediate/Short-term
R32-HFO blends	200-400	Mildly flammable	Mid-term

Hydrofluorocarbons (HFCs)

HFCs are man-made fluorinated powerful greenhouse gases rapidly building up in the atmosphere. They are used as replacements for ozone-depleting substances (ODS) in air conditioning, refrigeration, foam-blowing, fire retardants, solvents, and aerosols.

LIFETIME IN
ATMOSPHERE

15 years

(Weighted by
usage)



HFCs are powerful
GHGs which
contribute to
global warming

CONSUMPTION by sector

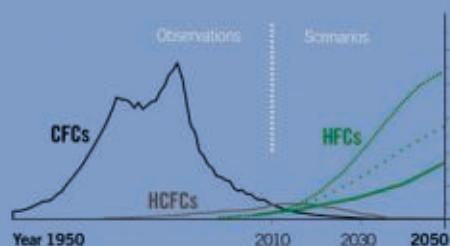
While HFCs have caused less than 1% of total global warming to date, production, consumption, and emissions of these factory-made gases are growing at a rate of 8% per year.



PROJECTED GROWTH

The demand for air conditioning and refrigeration is increasing as the world warms and as wealth increases.

The use of HFCs is rapidly growing because they are widely adopted as replacements for Ozone Depleting Substances (ODS), such as Chlorofluorocarbons (CFCs) and Hydrochlorofluorocarbons (HCFCs), whose use is being phased out under the Montreal Protocol.



appliances such as fridges? The answer is yes, as technology has moved on. In the early 1930s, fridges were far less efficient and used a lot of refrigerant – more than three pounds – which was enough to be dangerous. Modern fridges use far less, as little as two per cent of what the old fridges had, which is the equivalent of two butane cigarette lighters.

Hydrocarbon refrigerants, such as isobutane and propane, have a greater heat exchange capacity than any of the halogenated refrigerants. As a result, smaller compressors and heat exchangers

can be used with a lower volume of refrigerant, which saves weight, space and electricity. However, in order to use these refrigerants in older appliances some retrofitting is needed, which is beyond the means of many in the developing world. That is one reason for the Kigali deal's three-phase process.

Scientists are still searching for more efficient and inert refrigerants, but for the time being it appears that the current crop of refrigerants is here to stay, at a far lower cost to the environment than their predecessors. [f](#)

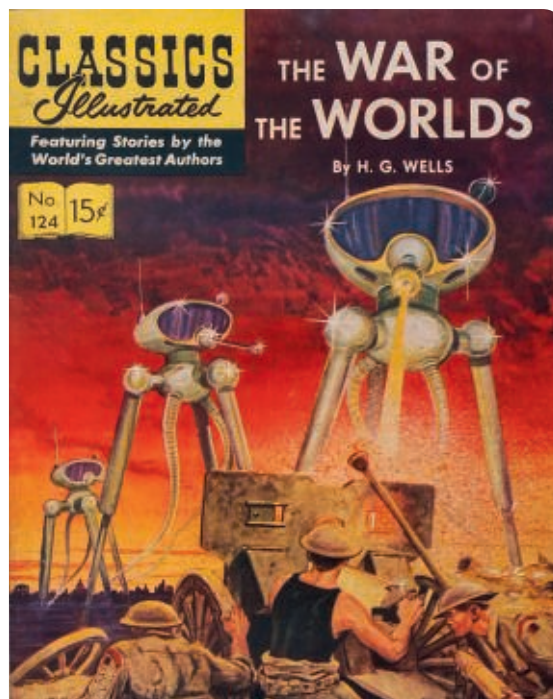
Above: HFCs, which replaced CFCs, have both domestic and industrial uses.

Below: The growing use of air-conditioners in developing countries has led to a steady rise in HFC use.





JOURNEY TO MARS



Mars has always occupied a vivid place in human imagination. One reason is that it is one of five planets – Mercury, Venus, Jupiter and Saturn are the others – which are visible to the unaided eye. Secondly, its reddish-orange hue inspired some ancient peoples to imagine it as the symbol of violent deities. Furthermore, Mars and Earth have an elliptical orbit, which makes Mars appear to wax and wane in the sky. This phenomenon, when the red planet appears largest, is known as the Mars Close Approach and happens every 26 months, although all close encounters are not equal. In 2003, Mars made its closest approach to Earth in nearly 60,000 years and it won't be that close again until the year 2287.

The ancient Mesopotamians linked Mars to Nergal, a god who ruled the realm of the dead and who sometimes led the other gods into battle. The ancient Greeks associated the red planet with Ares, the warrior god, and in Roman mythology, Ares became the war god Mars. The recorded history of Mars observation dates back to the ancient Egyptian astronomers in 2000 BCE, followed by the Babylonians, Greeks and Indians.

Humans were able to see Mars and some of its surface details more clearly in the 1600s thanks to the development of telescopes. This led to the planet being compared to our own, opening a new chapter in human knowledge and fantasy. In 1877, the Italian astronomer Giovanni Schiaparelli observed lines in the planet's equatorial region and called them canali. This once again gripped the popular imagination as some people thought that the red planet had waterways built by an alien civilization.

The idea of life on Mars so fascinated people's >

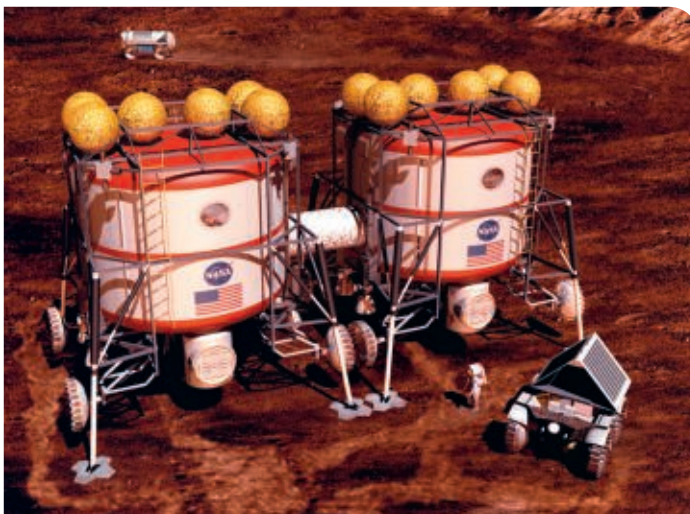


imaginings that writers of the still emerging genre of science fiction and fantasy began to utilise it as a premise. British author H.G. Wells' 1898 novel *War of the Worlds* envisioned Mars as a dying planet whose technologically-advanced civilization sought to conquer Earth as a new home. Stories of Mars were a staple of the golden age of pulp science fiction magazines in the 1920s and 1930s.

In 1950 Ray Bradbury published *The Martian Chronicles*, where he depicts Mars as being filled with empty cities from a fallen civilization, and imagines a rush of colonists from Earth who aim to wrest the planet from its original inhabitants.

The Martian canals had a surprisingly long life, and not only in the popular imagination. Assumptions that there was, or had been, intelligent life on Mars remained dominant into the 1940s and 50s. The hope of finding large organisms, at least, was still alive in the 1970s, as the probe Mariner 9 beamed back images of dried riverbeds.

The first concrete proposal to send humans to Mars was made by Wernher von Braun, the Nazi-era German rocket scientist who later worked for the US military and NASA. He was instrumental



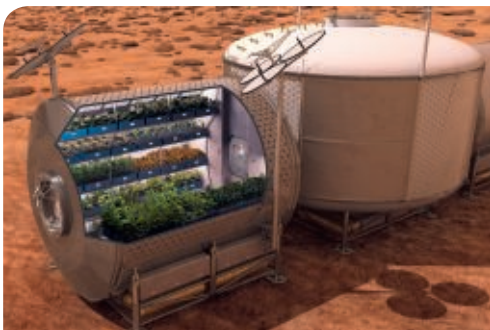
in the space programme that culminated in Apollo 11 and the first moon landing in 1969. Von Braun outlined a Martian expedition in the magazine *Collier's* in 1952, where he proposed to send 70 astronauts in 10 spaceships on a one-way trip to Mars. Such grandiose notions died in the 1970s after the Apollo lunar landings revealed the costs and dangers of manned spaceflight.

Since the late 1950s, numerous studies have been done by the US, Russia and China on the feasibility of sending humans safely to Mars. In fact, NASA was barely six months old in 1960 when the agency was planning a mission to Mars. In 1966, NASA fought hard to send astronauts past Mars in 1976 under the Joint Action Group (JAG) plan, but the idea was scrapped when the 1965 flyby by the Mariner 4 probe revealed a barren planet with a thin atmosphere. In 1989, President George H.W. Bush announced his Space Exploration Initiative

➤ Above: A design by NASA of living quarters for future Mars missions.

Above left: An artist's impression of Mars exploration. Vehicles similar to the one in the picture are currently being tested.

Below left: Mars living quarters will be equipped with a food production unit.



THE UAE'S MISSION TO MARS

The United Arab Emirates is currently working on becoming the first Arab and Islamic country to send a spacecraft to Mars. The Emirates Mars Mission was announced in 2014 and the spacecraft is set to arrive at Mars in 2021 to coincide with the 50th anniversary of the founding of the UAE. The aptly named Hope spacecraft will weigh around 1,500kg and it will be equipped with instruments to study the Martian atmosphere. All data gained from the mission will be made available to 200 universities and research institutes across the globe for the purpose of knowledge sharing. His Highness Sheikh Mohammed bin Rashid Al Maktoum, Vice-President and Prime Minister of the UAE and Ruler of Dubai, reviewed the designs of the Hope Probe in November and gave the green light to start manufacturing the probe's prototypes.

- (SEI), a lofty realignment of NASA's priorities that culminated with humans on Martian ground by 2019, the 50-year anniversary of Apollo 11. However, the \$450 billion budget never made it past Congress.

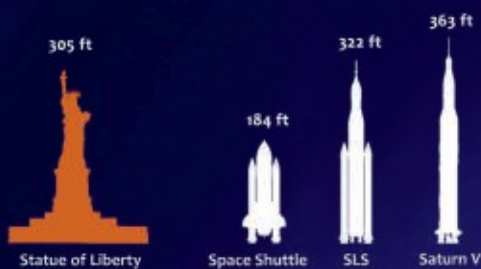
In 2010, these plans became more concrete with NASA announcing the goal of sending humans to the Red Planet in the 2030s. Thanks to numerous missions to Mars by orbiters, landers and rovers we

have dramatically increased our knowledge about the Red Planet, which paves the way for future human explorers.

NASA is currently engaged in the first phase of a three-phase programme for a manned mission. Each phase crosses three thresholds, with increasing challenges as humans move farther from Earth: Earth Reliant, the Proving Ground, and Earth Independent.

M E E T T H E R O C K E T

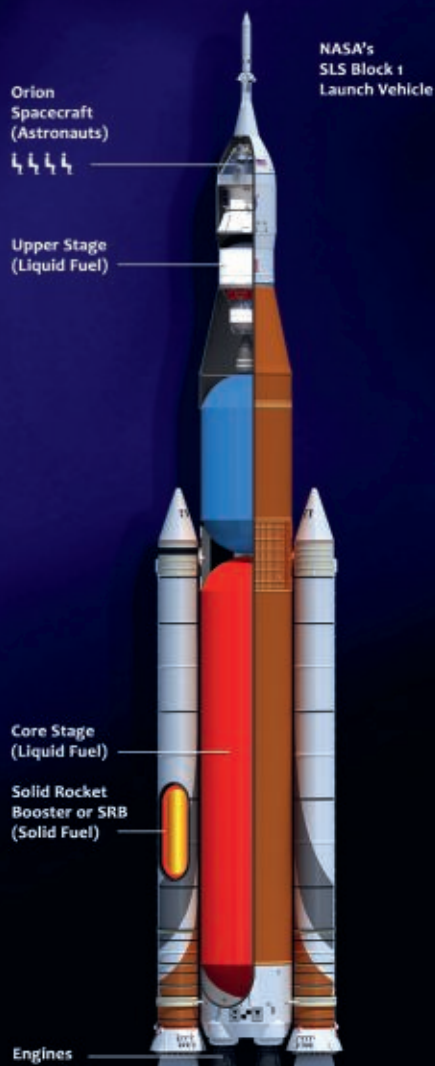
If you wonder how NASA's Space Launch System, or SLS, compares to earlier generations of NASA launch vehicles...



SLS will produce 13% more thrust at launch than the space shuttle and 17% more than the Saturn V.



SLS will launch more than three times as much weight into space as the space shuttle.



www.nasa.gov/sls #SLSinspires

In March this year the Earth Reliant phase was successfully concluded after Commander Scott Kelly and his Russian counterpart Mikhail Kornienko returned to Earth after a historic 340-day mission aboard the International Space Station. Kelly and Kornienko specifically participated in a number of studies to inform NASA's Journey to Mars, including research into how the human body adjusts to weightlessness, isolation, radiation and the stress of long-duration spaceflight. Other studies such as 3D printing and communications systems tests were also a part of this phase.

Proving Ground, the second phase, will feature tests of NASA's Space Launch System (SLS) heavy-lift vehicle coupled with the Orion capsule that is being specifically developed to get humans to Mars. Plans also include the construction of a new deep space habitat, and an unmanned mission to retrieve a small asteroid and bring it to lunar orbit, where it can be studied. Much of the activity in this phase will take place in cislunar space (the vicinity of the Moon). There may well also be missions to the lunar surface to test technologies for use on Mars.

NASA will shortly commence tests of the RL10 rocket engine that is scheduled to blast the world's most powerful rocket into space next year. NASA hopes to reach a flight rate of one SLS and Orion launch per year by 2023. Currently the SLS system is consuming \$3 billion annually in development cost and NASA recently reached out to the space industry and academia to find ways to cut costs. This indicates that the third phase, Earth Independent, is still some way off. It will feature human missions to Mars, perhaps first to Martian orbit



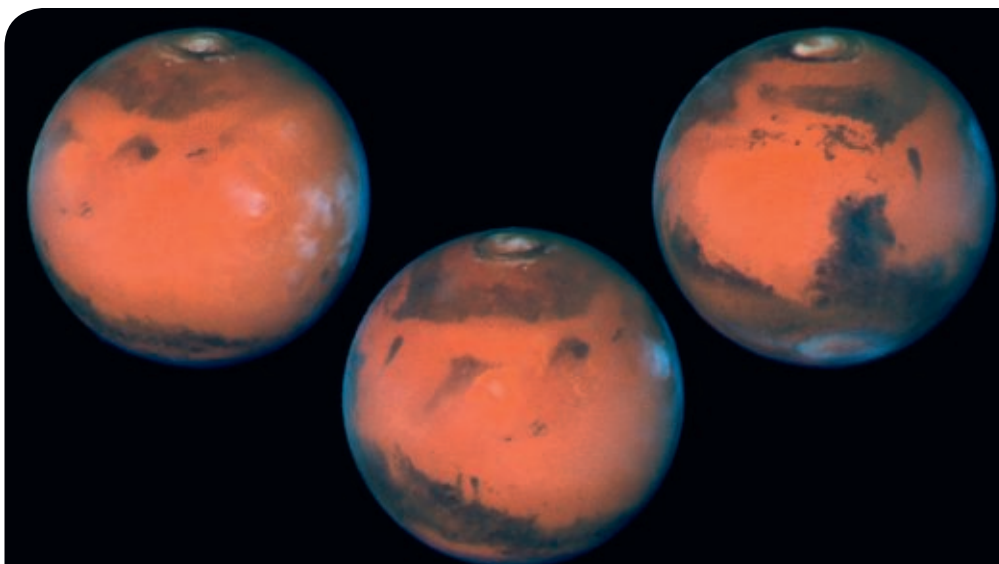
Left: The Orion capsule will be coupled with NASA's Space Launch System (below). The first flight is scheduled for next year.

Below left: Three images of Mars captured by the Hubble space telescope.

and to its moons, followed by landings on the planet itself.

NASA isn't the only one with an eye on the red planet. China plans to launch an orbiter, lander and rover to Mars in July or August 2020, and a crewed phase is planned for the 2040-2060 timeframe. Russia plans to send humans in the 2040-2045 timeframe, perhaps in conjunction with the European Space Agency (ESA).

The private sector also has its sights set on Mars, with billionaire businessman Elon Musk leading the pack. Musk, who founded SpaceX, which is successfully launching satellites and resupplying the International Space Station (ISS), outlined his highly ambitious vision for manned missions to Mars earlier this year. He said these could start by 2022 using a multi-stage launch and transport system, including a reusable booster – like the Falcon 9, which SpaceX has already successfully





Above: NASA's Space Launch System is costing \$3 billion annually in development costs.

Below: The blockbuster movie *The Martian* was based on scientific fact and features technology NASA is developing for Mars missions.

tested – only much larger. The booster, and the “interplanetary module” on top of it, would be nearly as long as two Boeing 747 aircraft.

Similar modules, also launched using reusable boosters, would remain in Earth's orbit to refuel the interplanetary for multiple trips, including to other parts of the solar system such as Enceladus, a moon of Saturn on which NASA's Cassini mission recently found evidence of a polar subsurface water ocean that could harbour life.

Musk also outlined a system by which fuel could be synthesized on Mars from water and carbon dioxide in order to fuel return journeys to Earth. He estimated the current cost of sending someone to Mars at “around \$10bn per person”.

NASA said in a statement that it welcomed Musk's plans. “NASA applauds all those who want to take the next giant leap – and advance the journey to Mars. We are very pleased that the global community is working to meet the challenges of a sustainable human presence on Mars. This journey

will require the best and the brightest minds from government and industry, and the fact that Mars is a major topic of discussion is very encouraging.”

Another private sector attempt is Mars One, a controversial initiative by a Dutch nonprofit to send a series of crews on a one-way journey to Mars to colonise that world. There has been no shortage of volunteers and the number of candidates has been reduced from at least several thousand (more than 200,000 people had expressed interest, if not formally applied, through the Mars One website) to 100, with a further cut down to 24 (six crews of four astronauts each) yet to be made. The date for the first crewed landing has been pushed back from 2023, the date given when the project was announced in 2012, to 2027. The manned landings – expected to be made in SpaceX Falcon Heavy rockets with Dragon capsules – would be preceded by several unmanned missions, to deploy a communications satellite, test a Mars lander, find a spot for the colony, and deliver supplies in advance of the first landing.

Whether there will be a manned mission to Mars in the foreseeable future is still highly debatable. After all, NASA has been planning such a mission for the past 70 years. What is indisputable is that the human fascination with the red planet is as strong as ever.

That was proven by the hit 2015 adventure film *The Martian*, that depicts a space-age castaway who is stranded on Mars when a dust storm separates him from his team. Astronaut Mark Watney is compelled to use his ingenuity to survive and launch himself from the planet's surface to be rescued. Unlike most science-fiction works that came before, the book and movie are based upon real, scientific knowledge about Mars' environment, and feature technology that NASA is actually developing for a planned mission to Mars. Perhaps fiction can become fact. ↑



PUTTING WASTE TO WORK

Dubai currently has a waste to energy plant in tender that will burn non-organic waste and be capable of generating about 600 megawatts of power. This will have a significant effect on the emirate's greenhouse gas emissions

The Middle East's largest waste to energy (WtE) plant is being built in Dubai. To be ready by the second quarter of 2020, the AED2 billion plant will be constructed in two phases. The first phase will be built on 7.5 hectares of land and will have the capacity to process 2,000 metric tonnes of waste daily, producing 60 megawatts (MW) of energy. A grate furnace will be used to burn the waste to produce electric power from it. The electricity so generated will benefit over 14,000 homes, while Dubai will rid itself of 70 per cent of its waste mass through this plant. Ninety per cent of the remaining ash will be used as a base for construction materials.

The second phase will see the plant size expand to a little more than double at 15.5 hectares. Located in Al Warsan 2, the project is in keeping with Dubai Municipality's mission to make Dubai the most sustainable smart city by 2021. It's also a step towards achieving the National Agenda's goal of reducing the number of landfills in the country by 75 per cent by 2021. Achieving this target will amount not only to the freeing up of land plots currently being used to store waste, but also a significant reduction in the amount of methane emitted by the landfills.

On the horizon is another AED980 million

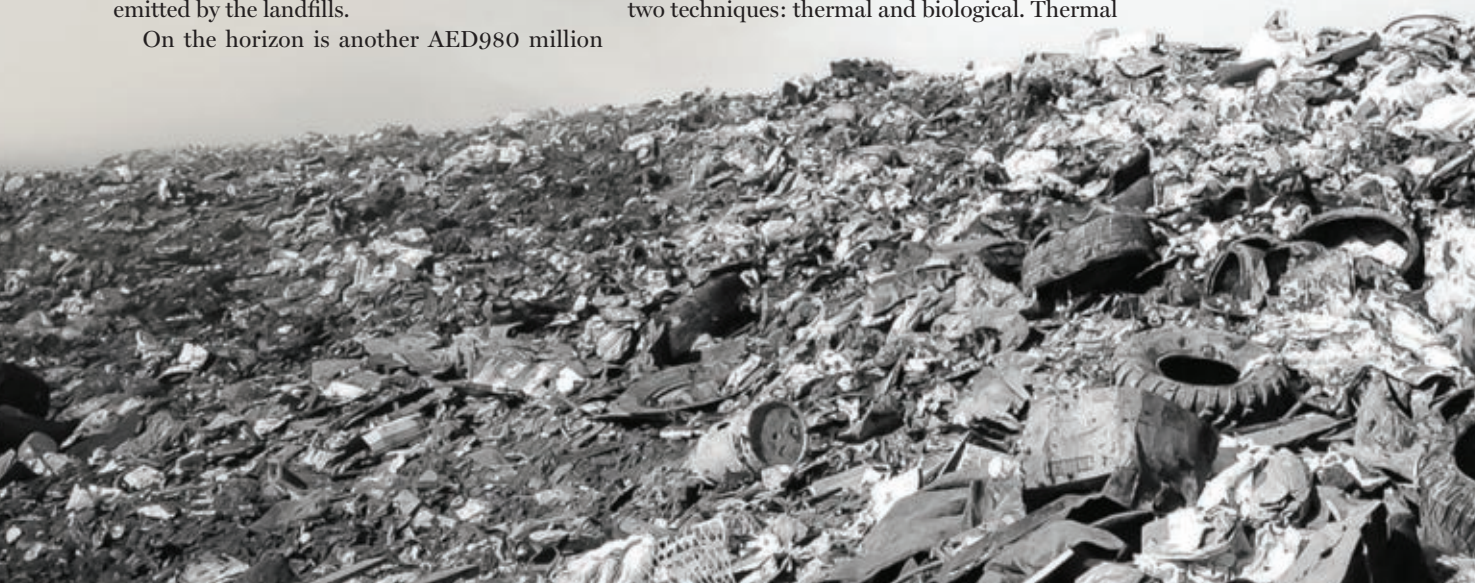
project that will convert landfill gas into energy, boosting the city's production capacity by 12 times. Dubai now produces one MW of energy from landfills and the new facility will increase this to 12MW.

WHAT DOES WASTE TO ENERGY MEAN?

The GCC states rank among the highest per-capita producers of municipal solid waste in the world with the majority of waste dumped in landfills using valuable land and resulting in quantified environmental damage. In 2015, the UAE produced 94 million tonnes of waste annually and this is expected to increase to 120 million tonnes per annum by 2020 according to a study by Frost and Sullivan. That is why there is an urgent need for effective solutions and countries like the UAE, Kuwait and Qatar are putting in place initiatives such as WtE plants to combat the issue.

WtE is a waste management process that uses organic and inorganic waste to generate energy in the form of electricity, heat or fuel. Application of advanced technologies can even produce biogas, synthetic natural gas and liquid bio fuels.

Waste can be converted into energy through two techniques: thermal and biological. Thermal



WtE is created by burning trash while the biological method involves anaerobic digestion or the breaking down of biodegradable material by micro-organisms in the absence of oxygen.

Thermal technology has been the technique of choice for the majority of countries. This is due to its ability to reduce the volume and weight of waste in a relatively simple manner. Despite its advantages, analysts predict it will be biological-based technology that will gain popularity during the next few years.

WTE AROUND THE WORLD

According to a report by American research and consultancy company Global Market Insights, the global WtE market is valued at \$21 billion and is estimated to grow to more than \$33bn by 2023. A 2015 study by energy consulting firm Ecoprog GmbH, reported a growth in the prospects of WtE initiatives in national markets in India, Thailand and Australia with more active incineration plants and more facilities under

construction than before.

The report listed over 2,200 operational waste incineration plants around the globe, with installed treatment capacity of nearly 280 million tonnes of waste per year. Over the next decade, 550 more plants with a capacity of 150 million annual tonnes will be constructed.

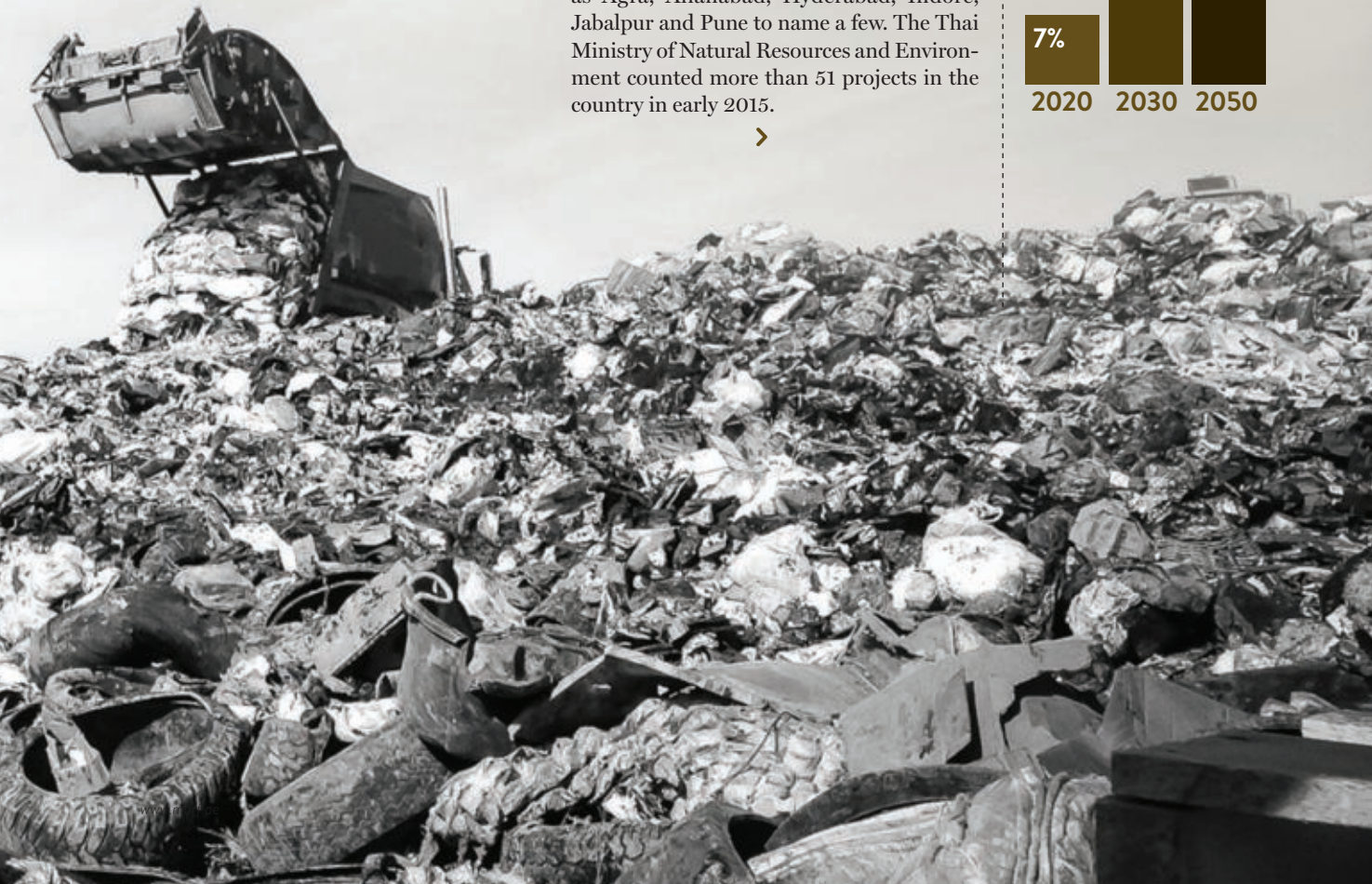
The WtE sector is showing phenomenal growth and Asia is identified as the driver of this worldwide growth – it has more than 40 per cent of the total market. China alone reported almost 200 active plants with a capacity of more than 60 million tonnes in 2014 – a huge leap from the mere six that were functioning in 2000. The country also has plans in place to commission 35 more facilities hiking the overall capacity to 75 million annual tonnes.

Other Asian countries that have jumped on the WtE bandwagon are India and Thailand. Last year, six waste-to-energy plants with installed capacity of about 74 MW were commissioned in the Indian capital Delhi. By 2018, a further 40 projects are expected to complete the conceptual and design phases in various Indian cities such as Agra, Allahabad, Hyderabad, Indore, Jabalpur and Pune to name a few. The Thai Ministry of Natural Resources and Environment counted more than 51 projects in the country in early 2015.



CLEAN ENERGY SOURCES IN DUBAI

SOURCE: DEWA





While India and China hold the potential to generate massive volumes of waste that can feed their WtE plants, it is Japan that has the highest level of sustainable waste management. Take for instance the 23 plants in Tokyo, which together produce up to 1.1 billion KWh of electricity, 571MW of which is sold to 159,000 households and industries in Tokyo.

Neighbouring Singapore recently launched an anaerobic digestion-based demonstration facility that is designed to generate biogas from food waste and the leftover sludge from its water reclamation plants.

WTE IN EUROPE & AMERICA

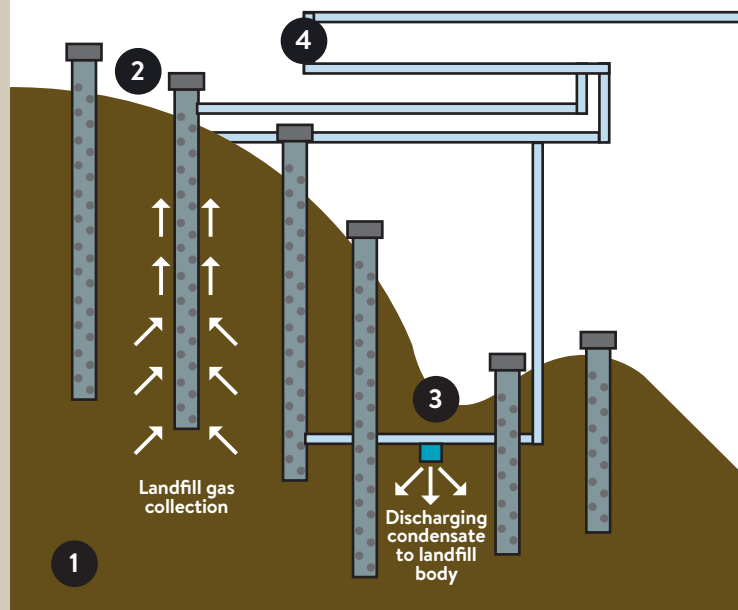
Europe holds the distinction of being the global leader of the WtE movement. Waste incineration in Europe has generated averages of between 4 to 8 per cent of its countries' electricity and 10 to 15 per cent of the continent's domestic heat. In 2013, around 520 WtE plants were functional on the continent, treating around 95 million tonnes of waste. Since then, 73 new plants have been commissioned and the European WtE capacity has grown by 19 million tonnes annually.

At the end of 2015, 71 plants with a total generating capacity of 2.3 GW was the United States of America's contribution to the WtE sector. This is a relatively small portion compared to the country's total electricity requirements – WtE provides only about 0.4 per cent of the total electricity generation. In the past decade,

LANDFILL GAS TO ENERGY

Methane is one of the biggest contributors to global warming as it is around 28 times more efficient at capturing heat than CO₂. Unfortunately, landfills produce lots of methane gas, which makes them the world's fourth largest contributor to greenhouse gases. Globally, trash released nearly 800 million metric tons of CO₂ equivalent in 2010 — about 11 per cent of all methane generated by humans.

When organic waste is deposited into a landfill, anaerobic bacteria produce gas during the decomposition process. This gas mainly consists of CO₂ and methane, with production starting after about six months of the waste being deposited and reaching a peak at 20 years before falling off. The landfill gas can be utilised directly on site by a boiler or any type of



Above: WtE projects in the GCC will produce between 300 to 500 MW of power by 2020, about 10 times larger than the current WtE production.
Opposite page: Dubai is planning an AED980 million project to convert landfill gas into energy.

only one plant – Florida's Palm Beach Renewable Energy Facility Number 2 – has come online.

ENERGY OF TOMORROW

High rates of population growth and rapid urbanisation have accelerated the amount of waste generated around the world. The problem is compounded due to limited landfill capacities and growing concerns for the environment. Waste to energy technologies can help resolve these issues. It would not only reduce the volume of waste but also cut down on greenhouse gas emissions and provide alternate eco-friendly fuels. With proper management and implementation, WtE plants can become important sources of tomorrow's energy. ↗



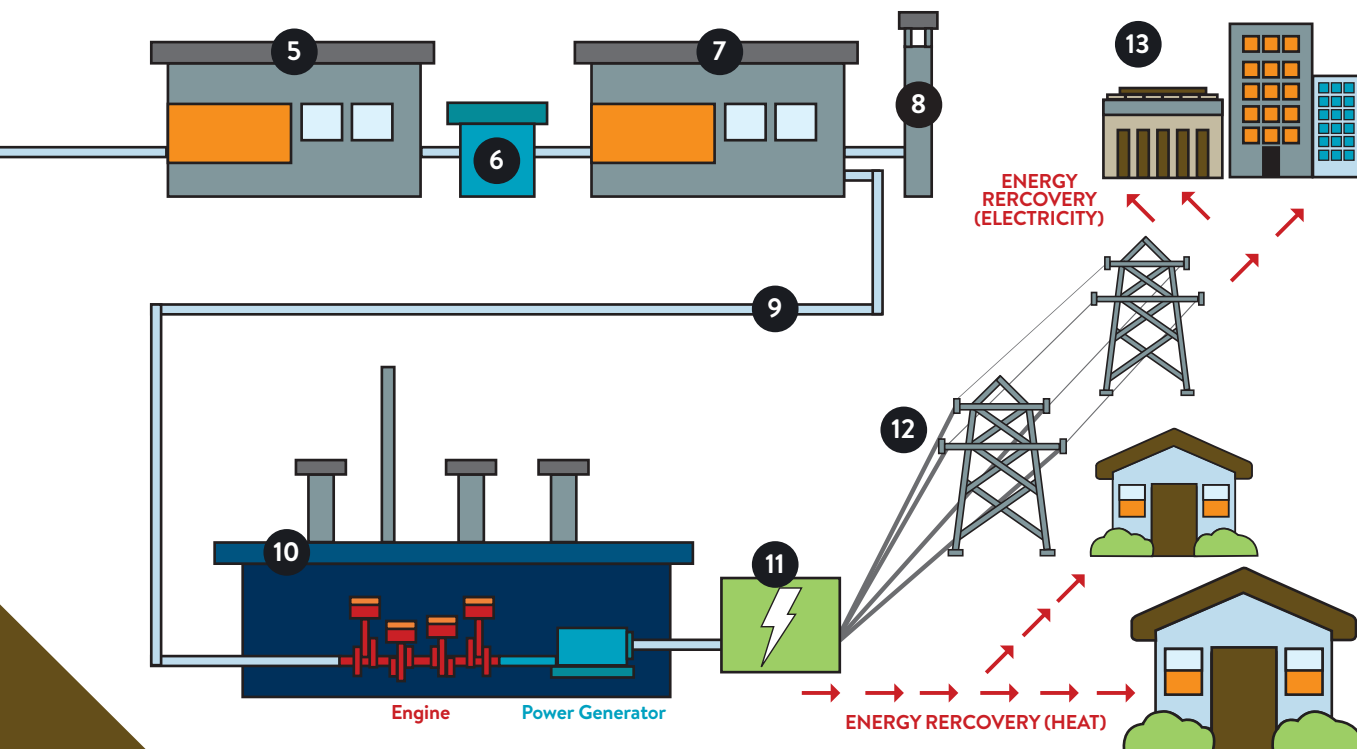
combustion system, providing heat. Electricity can also be generated on site through the use of microturbines, steam turbines, or fuel cells. The landfill gas can also be sold off site and sent into natural gas pipelines. The efficiency of gas collection at landfills directly impacts the amount of energy that can be recovered – closed landfills (those no longer accepting waste) collect gas more efficiently than open landfills (those that are still accepting waste). A comparison of collection efficiency at closed and open landfills found about a 17 percentage point difference between the two.

The one positive about methane is that it typically has a much shorter life in the atmosphere than CO₂ (12 years as

compared to 200 to 300 years for carbon dioxide). This means that reducing methane release from landfills will help rapidly reduce climate change.

NOTATIONS

- | | |
|-----------------------------|-----------------------------|
| 1. Landfill Body | 8. High Temperature Flare |
| 2. Gas Well | 9. Gas Pipe |
| 3. Condensate Knock Out Pot | 10. Cogeneration Plant |
| 4. Gas Collection Pipe | 11. Transformer Station |
| 5. Manifold Station | 12. Power Transmission Line |
| 6. Condensate Collector | 13. Office Buildings |
| 7. Booster Station | |





DRONES FOR LIFE

For drones, there is no terrain too treacherous to handle. Now these compact devices are being used to provide essential medical aid to some of the world's most isolated areas

Drones recently made headlines in the UAE for all the wrong reasons. Since June, the airspace around Dubai International airport had to be closed three separate times due to unauthorised drone activity that led to flight diversions and delays that cost millions of dirhams. That is the downside of drones, also known as Unmanned Aerial Vehicles (UAVs), but they have an upside as well.

Drones have quickly flown out of their classification as military devices and into the realm of civilian life. Right now, there are around 2.5 million drones that regularly fly in American skies, according to the Federal Aviation Administration (FAA). Of the drones currently buzzing around, they're split between roughly 1.5 million hobbyist drones and 500,000 commercial ones. By 2020, seven million drones are projected to be active in the skies according to the FAA.

Drones have a wide variety of functions. They are being used for aerial photography, surveillance, security, search and rescue, inspections, science and research, surveying and as unmanned cargo systems. These different capabilities have made drones increasingly important in humanitarian work.

In recent years, drones have been utilised to survey disaster zones, capturing imagery to determine where assistance should be delivered in areas inaccessible by roads. Drones successfully delivered small aid packages after the Haitian earthquake in 2012. In Nepal, drones surveyed the aftermath of devastating earthquakes, while in the Philippines they were deployed to reach out-of-the-way areas of the archipelago struck by a typhoon. Drones are also increasingly being used to carry medical supplies in countries such as Rwanda, Malawi and Bhutan according to Arthur Holland Michel, co-director for Bard College's Center for the Study of the Drone.

One area where drones are having an impact is overcoming the so-called 'last mile problem'. This term is derived from logistics where the last leg of the supply chain is often the least efficient, comprising up to 28 per cent of the total cost to move goods. A related last mile problem is the transportation of goods to areas in need of humanitarian relief. Aid supplies

are sometimes able to reach a central transportation hub in an affected area but cannot be distributed due to damage caused by a natural disaster or a lack of infrastructure.

This problem is now being addressed by a number of startups and manufacturers who are marketing drones as "life-saving technology" for humanitarian work.

Zipline International, a San Francisco-based startup, is one of the major players in this field. It has been delivering essential medical supplies to the hardest to reach parts of Rwanda in Africa. In partnership with the Rwandan government, the small robot planes deliver blood and other life saving supplies to hospitals and healthcare centres in the country.

Zipline's electric-powered drones, called "Zips," can carry up to 1.5kg of blood or medicine, and can fly for up to 120 kilometres on a single charge. Hospitals can order blood or medicine via text message, and have them delivered by parachute from a Zip. The 11-kilogram planes navigate using GPS and cellular networks, and can make deliveries within 30 minutes, negating the need for onboard refrigeration.

"When you look at rural or isolated communities, you have serious health outcome inequalities," says Keller Rinaudo, Zipline's founder and CEO. "There's a linear relationship between how far away you live from a city and your expected lifespan. So our hope is that this type of technology can solve those kinds of inequalities."

The initial results have been so positive that the Rwandan government is expanding the Zipline service to reach all of the nation's 11 million citizens in the coming months. The service is also being expanded to dropping off other medical products, including ant-venoms, vaccines and rabies treatments.

The Costa Rican social security authority has also employed Zipline for a testing phase. The company is expected to make test flights in the next six months and the use of drones is expected to reduce the waiting time for receiving medicines to 45 minutes after an order is placed. Currently, it takes several hours to three days to receive the medicine in remote areas.



Top: His Highness Sheikh Mohammed bin Rashid Al Maktoum, Vice-President and Prime Minister of the UAE and Ruler of Dubai, presented Loon Copter with the second UAE Drones for Good Award.

Below: Vayu transports blood samples in rural Madagascar.



As far as the Rwandan initiative goes, the UAE is playing an important role as the Dubai headquarters of logistics company UPS, in partnership with Zipline, serves as the hub from which the drones are dispatched to the African country. Furthermore, an international partnership between UPS, Gavi, the Vaccine Alliance, and Zipline is quickly expanding the range of medicine and vaccines that can be delivered, thanks to \$33m of funding from His Highness Sheikh Mohammed bin Zayed Al-Nahyan, Crown Prince of Abu Dhabi and Deputy Supreme Commander of the UAE Armed Forces. Zipline has also raised another \$25 million in a series B funding round to expand its humanitarian drone delivery business in Rwanda, the US and beyond.

However, Zipline isn't the only startup that is focusing on medical drones. In June this year, Nevada-based drone startup Flirtey Inc, demonstrated its drones' ability to deliver medical supplies to and from an offshore

vessel in the first 'ship-to-shore' journey. On the first leg of the trip, pathologists from John Hopkins Hospital loaded the delivery drone with blood samples that were delivered from land to a testing facility on a barge.

This was a significant flight as coastal disaster-prone areas are easier to reach by ship in the event of a calamity.

Following Flirtey's flight, UPS announced a partnership with startup company CyPhy Works in September to deliver medical supplies to islands that do not have spaces for runways or ferries. So far the company has only staged a mock flight where an inhaler was delivered from Beverly in Massachusetts to Children's Island 3 miles off the coast of Massachusetts in eight minutes. No bridges or roads connect to the island so a drone-delivery service could be the perfect solution for emergencies.

The Matternet Project in California is taking drone deliveries a step further as it wants to build a network of small drones and stations that will allow packages to be transported over long distances to remote areas. Sub-Saharan Africa and other developing nations are the targets of Matternet's eight-propeller drones that can lift up to 2kg of goods. While the plan is a good one, it will take time to execute as Matternet's delivery service requires an established infrastructure of stations.

A fully autonomous drone developed by Vayu recently flew blood samples from rural Madagascar to a central lab. Daniel Pepper, who founded the company, aims to bridge the gap between far-flung villages and healthcare that is so often centrally available, but out of reach for local inhabitants. Pepper discovered a chasm between medicinal availability and supply while working as a



journalist in India. Governments, healthcare organisations and NGOs fund Vayu.

While the technology from Vayu, Flirtey and Zipline is revolutionary in providing marginalised communities with access to healthcare, experts say its success will be hindered without a holistic approach. For example, vaccines are only useful if village health workers are able administer them, and diagnoses can only be made if samples are taken in sterile conditions and packaged correctly.

Peter Small, founding director of Stony Brook University Global Health Institute, who has worked alongside Pepper in launching the Vayu project in Madagascar, said he was currently working on a full-circle project. "The project trains village health workers to identify prolonged coughs and send for drones to deliver tuberculosis testing kits," he said.

Upon return to the lab, the drone will fly back out with suitable medication should the samples test positive for TB. This delivery will also include a tablet containing video instructions to enable untrained individuals to administer the treatment.

Search-engine giant Google has also been working on drones for humanitarian causes. The company recently made public its Project Wing, an initiative it has been testing for the past two years in secret. Project Wing's drones differ in that they have fixed wings, sit on their tails on the ground, take off vertically and are capable of hovering. These drones are being developed for disaster relief by delivering aid to isolated areas. The pre-programmed drone, which flies to the destination by itself, has successfully delivered a first aid kit, candy bars and water to Australian farmers in Queensland.

Support for drones that do humanitarian work is on the rise. Recently, the Bill & Melinda Gates Foundation awarded \$100,000 to a team at Harvard-MIT Division of Health Sciences and Technology to develop drones that can be deployed via instant messaging or SMS. This will enable health care workers to swiftly transport small quantities of medication to isolated locations.

The UAE Drones for Good Award offers two \$1 million prizes for the best international and the best national entry. The Award is dedicated to transforming innovative technologies behind civilian drones into practical solutions for improving peoples' lives today. One recent project that drew attention was using a drone to release sterilised tsetse flies into the wild, where they compete with their wild counterparts for males and make it more difficult for the females to breed. Tsetse flies spread sleeping sickness, which threatens millions of people in 36 countries in sub-Saharan Africa.

In a world that often bemoans the flagrant misuse of technology, drones for humanitarian services lend a new and positive perspective. ✈

DRONES FOR GOOD

KEY FACTS

\$8-10BN

Projected economic impact of drone industry by 2025

10X

Less than a helicopter to operate, drones provide affordable solutions

100,000+

Anticipated international job creation directly related to drone industry

5CM

Drone can be as small as 5cm and as large as 50 meters



The Zipline team with drones.

THE NEED FOR CYBER SECURITY

As Gulf cities embark on their smart city programmes and companies and individuals embrace connected devices, cyber security is becoming ever more important

The word 'smart' has become synonymous with Dubai as the city embarks on its vision to become the smartest and most connected in the world.

In 2014, His Highness Sheikh Mohammad bin Rashid Al Maktoum, Vice President and Prime Minister of the UAE and Ruler of Dubai, announced 100 initiatives in transport, communications, infrastructure, electricity, economic services and urban planning. His Highness also called for 1,000 government services to go 'smart' in the next three years, according to official news agency *WAM*.

This vision is now becoming a reality with smart palms providing free WiFi at the emirate's parks and beaches, government services increasingly digitally enabled and new regulations making the city smarter than ever before.

However, along with the efficiency benefits and new capabilities connected technologies are providing governments, companies and individuals

in Dubai and the wider Middle East there are also concerns that not enough consideration is being given to the vulnerabilities these systems present.

"If you are connected somewhere, somehow you should be in an assumed state of compromise," says Harshul Joshi, senior vice president of cyber governance, risk and compliance at UAE cyber security firm DarkMatter.

"Take a simple example like refineries or trains or subways. All these technologies were never meant to be connected, the internet is only 20 or so years old and it has moved so quickly that now we're trying to take old technologies and connect them and they were never created with security in mind."

As these vulnerabilities grow, hacker groups and cyber criminals are increasingly targeting Gulf countries, with some estimates suggesting there



has been a 500 per cent increase in the frequency of cyber attacks on the UAE over the past five years.

Yet there are signs that many in the region are still not taking cyber security seriously.

A survey carried out in August by cyber security firm Kaspersky revealed that 21 per cent of users in the UAE currently believe they are not threatened by anything online. This was despite 42 per cent of UAE respondents admitting they had fallen victim to cyber criminals. Similarly only 47 per cent of UAE users said they had installed security solutions on all their devices to access the internet.

It is not just individuals in the crosshairs. Another report by security firm FireEye estimates 96 per cent of global organisations were unknowingly breached from January to June this year. FireEye said 19 per cent of firms in Saudi, 14 per cent in Qatar and 11 per cent in the UAE were exposed to at least one targeted attack during the period.

On a regional level the most popular targets for cyber criminals and hackers were the energy, government and financial services sectors, including oil production facilities, industrial control systems, foreign and defence ministries, retail banks, investment banks and sovereign wealth funds, the firm said.

The perpetrators were as varied as government-based espionage actors targeting data related to political, military and economic issues and Iran-based threat actors targeting aviation, finance, government, technology, and telecommunications.





Photo: General Electric

> The costs associated with these incidents are not to be underestimated. According to the Ponemon Institute, annual losses from cyber attacks now exceed \$7.7m on average per large organisation.

Regional companies and governments would be wrong to think they are not in the firing line, with one major incident targeting state oil giant Saudi Aramco in August 2012 dubbed the 'biggest hack in history'. Although the full details have still not been disclosed, it is said that more than 30,000 computers were partially wiped or destroyed in a matter of hours after an Aramco employee opened a scam email and clicked on the enclosed link.

What followed was chaos as staff at the firm's offices across the world yanked out cables to prevent the malware, named Shamoon, from spreading. Corporate email was shut down and employees were forced to use typewriters and fax machines for contracts and other paperwork, former security advisor Chris Kubecka told CNN last year.

It took five months, a team of IT experts and a fast-tracked purchase of 50,000 hard drives for the company to bring its newly secured network back online, he said.

Top: Internet connected devices such as webcams and digital video recorders have been used in cyber attacks.

Above: A power station linked by General Electric's smart city software.

Many suggest a company without Aramco's financial muscle would be killed by a similar incident.

Unfortunately, new technologies and connected devices mean a repeat is more than likely.

Where once it was just computers connected to the internet, now it is kettles, fridges, thermostats, cars, watches and phones. Smart city plans will see traffic, water and electricity systems, and other key infrastructure connected.

"If you have more windows in your house for more ventilation you increase the attack surface of your house. It is the same thing with smart cities. If you install more sensors and you connect various entities, whether it's your electric grid, transportation or your police force, a breach in one entity will proliferate to other entities," says Joshi.

The proposition of your fridge or other smart devices being hacked may not be as unrealistic as you think.

A massive cyber attack on internet infrastructure company Dyn in October made popular websites including Twitter, Amazon, Tumblr, Reddit, Spotify and Netflix unavailable to users in October. The most surprising aspect was that the distributed denial of service attack, which flooded Dyn with internet traffic, was carried out using connected devices such as webcams and digital video recorders.

Malware named Mirai was used to compromise cameras, including those using components made by Chinese tech firm XiongMai Technologies, and turn them into a virtual army.

The incident led the company to recall some of its products sold in the US, strengthen password protection and send patch updates for those made before April.

Pete Costa, vice president for MENA at Honeywell, which is piloting a smart air conditioning system linked to prayer times for mosques in Sharjah, says cyber security will always be a concern when it comes to connected devices.

"We're always going to have to keep pushing on that, the bad guys are always going to get smart," he says. "The good thing is I know we are certainly putting a lot of effort into it. We have 22,000 engineers at Honeywell, half of them are software and they are very closely looking at cyber security."

However, some cyber security aspects are less optimistic about the current state of cyber security for connected or Internet of Things (IoT) devices.

"At present there is no regulation or standardisation requiring a base-line security standard for IoT, meaning there is little incentive to make device manufacturers meet any minimum criteria

of security, as there are few, if any commercial repercussions for not having done so outside of successful third-party litigation,” Joshi notes.

“For as long as device manufacturers are removed from the negative financial and logistical impacts triggered by the compromise of poorly secured devices, we will continue to count the escalating costs of botnet attacks through IoT devices.”

Given these concerns it is perhaps no surprise that demand for cyber security services, such as antivirus, intrusion prevention systems, data encryption, firewalls and DDoS mitigation, is on the increase in the Middle East.

In a report released in May, MarketsandMarkets predicted the regional cyber security market would grow at a compound annual growth rate of 13.07 per cent between 2014 and 2019 from

\$5.17bn to \$9.56bn, with Saudi Arabia expected to present the biggest opportunities.

The firm notes that major enterprises in the region, including those in the energy, utilities, oil and gas industries, are highly dependent on network and industrial control systems that have become exposed to the internet in recent years making them more vulnerable to cyber attacks.

“These vulnerabilities are forcing these industries to adopt the latest technological solutions, thereby increasing the growth of cyber security in this region,” it said.

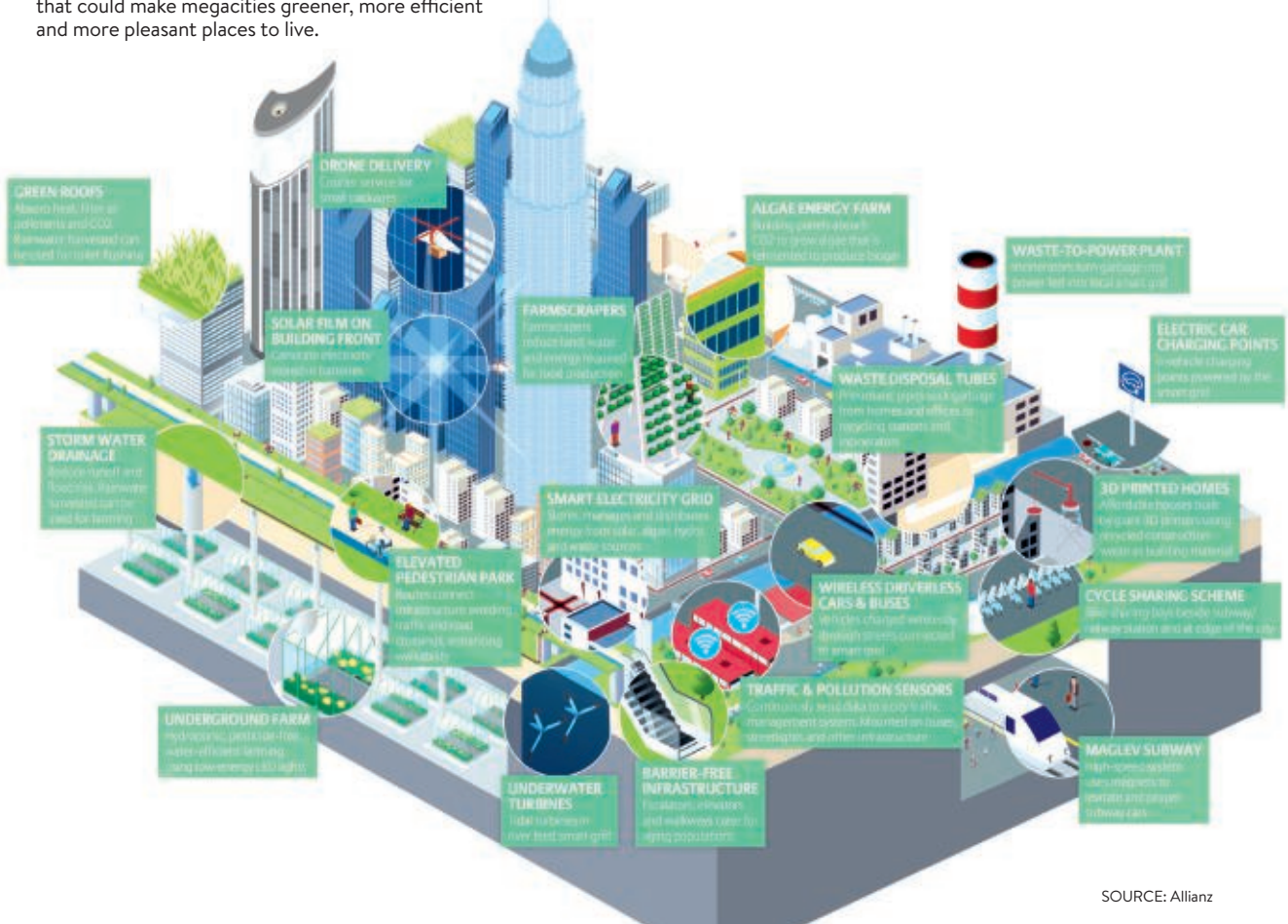
Perhaps the biggest challenge facing those with an eye on securing their networks, systems and devices or seeking support in the wake of a large-scale attack will be having adequate experts at hand to assist them.

“There is a huge shortage in cyber security talent globally and Dubai and Abu Dhabi are no exception,” says Joshi. “We are all learning what a big breach on a smart city will turn into.”

Filling this talent gap will be crucial as Dubai and the wider region embraces smart technology and a connected future. ↑

SMART CITY SOLUTIONS

Megacities must adapt and innovate to meet the challenges residents face. Here are some solutions that could make megacities greener, more efficient and more pleasant places to live.



SOURCE: Allianz

A BRAVE, NEW WORLD

With the launch of Noon.com, Emirati businessman Mohamed Alabbar has firmly stepped into the digital world

Emirati businessman Mohamed Alabbar is best known as the Chairman of Emaar Properties, a property developer that has transformed the Dubai skyline with many landmark projects, of which the Burj Khalifa is the most famous example. However, he is also a visionary entrepreneur who, as the head of numerous investment funds, fearlessly seizes opportunities.

As the son of a ship's captain, Alabbar knows it takes bravery and good decision making to get ahead in life. "As captain of a ship, my father took risks, he went into the unknown. He sailed with no GPS system, no weather forecast, there were pirates at sea, and these ships used to leak. Who chooses to sail for days on end with that in mind? You have to be brave and learn how to make big decisions."

Alabbar graduated from Seattle University with a degree in finance and business administration. After 25 years in Abu Dhabi, he became the director of Al Khaleej Investments in Singapore where he learnt "to be positive and not to hesitate."

In 1992, he decided to go back to Dubai with his family and he was given the role as the founding director of the Department of Economic Development (DED). Four years later he organised the Dubai Shopping Festival in order to promote retail trade in Dubai. These were busy times for Alabbar as he was a member of the Dubai Executive Council, the Dubai Economic Council, the Vice Chairman of Dubai Aluminium Company and Chairman of Dubai Cable Company. However, Alabbar didn't regard it as

work. "I was fulfilling a vision and an ambition, a passion I have."

Arguably the most important chapter in Alabbar's life began in 1997, when he founded what became Dubai's largest listed property developer – Emaar Properties. "I had a passion that our city would grow, so that's how I started my first project, the AED15 billion Dubai Marina project. Had I done it before? No. Did I have experience? No. I had a lot of love and a passion to learn," he explains. Next up was the Dubai Downtown development, which included The Dubai Mall and Burj Khalifa.

This year, Alabbar has been on a shopping spree. That doesn't sound too unusual for the Chairman of Emaar Properties, whose subsidiary Emaar Malls owns and operates Dubai Mall, which just happens to account for 50 per cent of the emirate's luxury goods market.

In February this year Adeptio Investments, a UAE-based investor group led by Alabbar, bought a \$2.4 billion majority stake in the Kuwait-based food group Americana. Besides making consumer foods, Americana owns the Middle East franchises for Yum! Brands Inc's fast food chains KFC and Pizza Hut.

Buying a food group did little to slack Alabbar's appetite. In April, he bought a four per cent stake in international online luxury fashion retailer Yoox Net-A-Porter (YNAP) for \$113 million. In July, Alabbar Enterprises bought a 9.9 per cent stake in logistics company Aramex PJSC for an estimated \$142 million. The fact that Aramex would provide a key element within the e-commerce supply chain did not go unnoticed by market watchers.







Above: In 1997 Alabbar founded Emaar Properties. The AED15 billion Dubai Marina was the company's first project.

Below right: Alabbar, a member of Dubai Executive Council, at the World Economic Forum in Dubai.

So nobody was too surprised when on 13 November Alabbar unveiled that he was launching an e-commerce business in partnership with Saudi Arabia's sovereign-wealth fund. What did surprise was the scale of the investment. The new venture, called "Noon", will receive an initial investment of \$1 billion and will offer 20 million products – ranging from fashion to electronics – to consumers in Saudi Arabia and the UAE in January. The company plans to expand to Egypt, the Arab world's most populous country, by late 2017, and is also looking at Kuwait and Oman. This is no less than a bid to create a home-grown version of e-commerce giants such as Amazon and Alibaba Group. Naturally, Noon.com will use Aramex's and Americana's logistic capabilities to deliver goods.

Alabbar is clear in his motives. "We expect the new venture to be a global player. In one move, we are launching a future-focused company which is the biggest online shopping platform ever seen in the region. We need to turn the retail space upside down and then in six months turn it upside-down again. We need to think ahead, we will make profit in five years and maybe we will float in about seven years. We owe it to our region; it's a fabulous environment."

The operation will be headquartered in Riyadh with 10 million square feet of warehousing across the UAE and Saudi Arabia, including 3.5 million at a Dubai fulfilment centre – an area larger than 60 football fields. This sheer size makes Alabbar's business plan clear. "We have the credentials to dominate and that's the only thing we're going to do," he says. "This is nothing less than a quantum leap for retail in the region, and the world."

Shortly after announcing the launch of Noon.com, Alabbar signed a joint venture deal with international online luxury fashion retailer Yoox Net-A-Porter (YNAP) to set up an online luxury retail business in the Middle East. The Joint Venture (JV) – worth a combined \$138.5 million, will be owned 60 per cent by YNAP and 40 per cent by Alabbar's Symphony investment group. It will manage all of the group's existing multi-brand online stores in the region including Net-A-Porter, Mr Porter, Yoox and The Outnet – as well as, in agreement with the brands, certain existing and future online stores that have significant business potential in the Middle East.





Left: Dubai Mall is owned by a subsidiary of Emaar Properties.

This move was another step towards e-commerce domination. “The Middle East is a sizeable market for e-commerce and specifically for online luxury fashion retail,” says Alabbar. The region accounted for three per cent of global luxury consumption in 2015 and is slated to outpace global growth in the sector over the next five years, according to a recent report by Bain.

While the luxury market has slumped in recent months due to slackening economic conditions, Alabbar says he’s not worried.

“The market goes through cycles and we have good years and bad years. For now, the market is ok, maybe not as rosy as the previous years, but we are looking at a long-term investment of 10 to 15 years. We believe that digital is the path ahead. E-commerce is still in its baby stages here and we think that scale and velocity is needed in the market. We need to be a regional player.”

The Middle East is still in its infancy when it comes to e-commerce. Consultancy A.T. Kearney estimated its size to be about \$5.3 billion in 2015, contributing a mere 0.4 per cent to the region’s gross domestic product. It is estimated that only two per cent of regional retail sales are conducted online against more mature markets such as the UK, where 17 per cent of retail sales are online. However, the numbers are growing rapidly. Souq.com, currently the region’s biggest online retailer, said it sold 1.2 million products over the so-called “White Friday” weekend – more than double last year’s total.

The Middle East region also stands out for its digital penetration with people spending an average of four hours a day on their smartphones, using them 150 times a day, and sending and

receiving an average of 40 WhatsApp messages a day. The Arab world is also ranked number one when it comes to watching videos on YouTube, with 14.5 million hours of video consumed.

This is a fact that Alabbar is very much aware of. He often cites a conversation he had with his nine-year-old nephew Jumma. When he asked him what the three most important things in the world are that he cannot live without, his nephew replies: “Air, water and wi-fi.” When Alabbar asked him why he didn’t mention food, Jumma pointed out that he could order it online. In June, Alabbar told the Ramadan Majilis of His Highness Sheikh Mohammed bin Zayed Al-Nahyan, the Crown Prince of Abu Dhabi and Deputy Supreme Commander of the UAE Armed Forces, that the Arab world was lagging behind the rest of the world in the digital revolution.

“In the Arab world, there will be 300 million internet users by 2020,” Alabbar said. “Our lives have become entirely dependent on the internet. We spend four hours a day connected on our mobile phones of which three hours are spent on social media. The overall commercial value of trade in the country was Dh600 billion and only a small portion of this is traded online. Those numbers are really low and we need to get into the opportunities that the digital revolution is providing.

“Huge global companies collect and aggregate data about our purchase patterns, eating habits, beliefs, friends and financials. They mine that data for insights and over time do a significantly better job than us at targeting our own consumers. The profit pool then begins to shift away from asset owners and towards tech companies leaving us all behind.”

Alabbar outlined there was only one way forward. “The solution is to establish our own digital fortresses. We must invest in our growing digital ecosystem and we must build our own services. This has been done in China, in Russia and in other countries. It is possible. We must step up and control our destiny for the sake of our children and for the sake of our future.”

Alabbar has taken a firm step in that direction with the launch of Noon.com. However, in all developed countries e-commerce has taken a large chunk of the business from traditional brick and mortar stores. Is that something that worries the owner of Emaar Malls? “I do not think it will cannibalise the traditional retails industry,” says Alabbar. “But it is better to be the future than have the future overtake you.”

It is clear that Alabbar is bravely captaining his ship into a brave, new digital world. 🚢

THE ROOTS OF CIVILIZATION

The Eurocentric view of Western civilization is becoming discredited as the modern day world owes a lot to the oldest civilization in Middle Eastern history – Mesopotamia

The Greek city-states are often regarded as the originators of civilization, but they were merely building on Mesopotamian and Egyptian knowledge. Alexander the Great conquered 'Mesopotamia' – a Greek word meaning 'Land between the Rivers' – in 332 BCE, which resulted in a hybrid civilization called the Hellenistic age. The Hellenistic civilization was much admired by the Romans, who incorporated it in their own empire, which means elements of Middle Eastern discoveries became incorporated into Western civilization.

It is undisputed that the earliest seeds of agriculture, urbanisation, civilization, and the rule of codified law were sown during the Mesopotamian era that began around 3,100 BCE and ended in 539 BCE when the Achaemenid Empire conquered Babylon.

The Mesopotamian era itself was made out of separate empires, which included the Sumerian, Akkadian, Babylonian and Assyrian empires. Although these empires rose and fell, the Mesopotamian civilization remained centred on the Tigris-Euphrates river system, which occupies most of modern day Iraq, Kuwait, the eastern parts of Syria and the regions along the Turkish-Syrian and Iran-Iraq borders. It was here that the Neolithic revolution began with nomadic man evolving from hunter-gatherer to agricultural societies.

AGRICULTURE, CITIES AND WRITING

The majority of the land between the Tigris and Euphrates is infertile, too dry for crops and the rains are intermittent. However, near the rivers themselves, the soil is extremely fertile as it is made up of rich mud brought down by the rivers from the mountains, and deposited over a wide area during the spring floods. When watered by means of

irrigation channels, it makes for excellent farmland.

The Mesopotamians were the first people to attempt to control water on a large scale by the use of an integrated system of dykes, reservoirs, canals, drainage channels and aqueducts.

The Sumerian nomads began to harness the Tigris and the Euphrates' water and started growing barley and wheat in a systematic way on the fertile soil around the rivers. The canals they built were the world's first engineering works. Water was hoisted using the swape, and the Assyrians discovered the qanat, which is a tunnel used to bring water from an underground source in the hills down to the foothills. Laws in Mesopotamia not only required farmers to keep their basins and feeder canals in repair but also required everyone to help with hoes and shovels in times of flood or when new canals were to be dug or old ones repaired.

Agricultural productivity was further enhanced through the invention of the plough, known as the 'ard' in Mesopotamia. The surplus food grown in this fertile landscape enabled the farming societies to feed a class of people who did not need to devote their lives to agriculture. These were the craftsmen, priests, scribes, administrators, rulers and soldiers who made civilization possible.

With the ability to stay in one place, the people of Mesopotamia improved crop cultivation through developing higher-yielding cultivars, developed selective breeding of domesticated animals and built settlements. As a result a dense population grew up along the Tigris and Euphrates in the centuries after 5000 BCE. By 3500 BCE, the first cities had appeared.



Above: Alexander fighting the Persian king Darius III. From the Alexander Mosaic, Naples National Archaeological Museum.



Politically, each Sumerian city formed its own city-state, composed of the city itself and the farmland surrounding it for several miles. In early Sumerian cities, the temple stood at the very centre of political and religious public life. The temple acted as a major centre of distribution: receiving, storing and disbursing the food (and other goods, such as seed and agricultural implements) as needed, and keeping back stocks for years of poor harvest or floods.

In these circumstances the first bureaucracies

in history emerged, which necessitated the development of written records.

The first script appeared around 3500 BCE. As it was based on pictures, it was known as 'pictographic'. By 3000 BCE the pictograms (of which there were more than a thousand) had become highly stylised, and were gradually becoming more 'phonetic' – that is, reflecting spoken words. Finally, around 2500 BCE, the script had evolved into 'cuneiform' – or wedge-shaped – writing. This was written by means of triangular-tipped stylus





At the time when civilization first arose in Mesopotamia, the population was divided into two distinct groups: those who spoke Sumerian (a language unrelated to any modern language), and those who spoke Semitic dialects (related to modern Arabic and Hebrew).

Cuneiform was at first written in the Sumerian language. For more than a millennium Sumerian retained importance as the language of administration, religion and high culture. However, in the centuries after 2000 BCE, it increasingly fell out of everyday use. In its place, a Semitic dialect, Akkadian (also known as 'Old Babylonian') became widespread. Later still, in early 1000 BCE, another Semitic dialect, Amaraic, took its place. The waxing and waning of these languages reflected population movements within Mesopotamia, and the rise and fall of ruling kingdoms and empires with which they were linked.

The written system of cuneiform took many years to master and this is why only a few individuals were trained as scribes. A lot of Babylonian literature was written in cuneiform, with the most famous work being *The Epic of Gilgamesh*. In fact, a lot of what we know about the Mesopotamian civilization is due to the records and accounts kept in cuneiform.

THE RULE OF LAW

The growing city-states with their expanding bureaucracies needed laws to function properly, and as conquests created the first kingdoms, power became more centralised.

One of the major contributions of ancient Mesopotamia to government practice was the development of written law codes. The most famous of these is the Code of Hammurabi, written



about 1780 BCE (named after the king of Babylon who lived from 1792-1749 BCE). However, this code drew on earlier codes going back to the Sumerian city-states of the third millennium BCE.

Judges appointed by the king heard legal cases; in important cases, a panel of judges was appointed. Appeals could be made to the king. Indeed, it seems that one of the reasons for Hammurabi issuing his Code was to make it clear to all his subjects (who would have been accustomed to different laws in different places) on what basis decisions would be arrived at if appeals were made to the royal court. As well as criminal law, there was a well-developed body of civil law that covered everything from property rights to marriage and inheritance. Contracts, deeds and agreements had to be written on a clay tablet, witnessed on oath and placed in the temple archives, so that in case of dispute they could be referred to later.

Today, the law code of Hammurabi is still considered the basis for constitutions and law codes

Clockwise from above: Clay tablet; Mesopotamia Map; This rotating device of a potter's wheel was made of stone and dates back to the Old Babylonian period, 2000-1500 BCE.





all over the world.

TECHNOLOGY, MATHEMATICS AND ASTRONOMY

Numerous technological advances can be attributed to the Mesopotamians: irrigation, the plough, the sail, clay bricks, the potters wheel, metal-working (including metal armour and weaponry), writing, accounting, filing, glass and lamp making, weaving and the world's first postal service.

There is no agreement among historians who invented the wheel, but there is a good chance it was in Mesopotamia. The first wheels were used for pottery by 3500 BCE, followed by circular stones for milling, irrigation wheels for agriculture and by 3200 BCE on Mesopotamian chariots for transport. In 1922 archaeologist Sir Leonard Woolley discovered the remains of two four-wheeled wagons at the site of the ancient city of Ur, which are believed to be the oldest wheeled vehicles found to date.

The Bronze Age, our first metallurgical age, is also a Mesopotamian contribution. In order to make bronze, copper is combined with other metals to form a malleable and durable alloy. As Mesopotamia was poor in minerals it traded extensively, which later led to the first banking system.

Commerce demanded an effective system to count the goods Sumerians bought and sold. They devised a mathematical system

Clockwise from above: Iraq, Khorsabad, Relief representing bulls with human faces, reconstruction of the entrance to the throne hall of the Palace of Sargon II (circa 722-705 BCE); Babylonian Map of the World, a clay tablet from ancient Babylonia that's been around for more than 2,500 years; Diorite stela with Code of Hammurabi.

that was based on a sexagesimal (base 60) numeral system. This laid the foundations for the 60-second minute, the 60-minute hour, the 24-hour day and the 360-degree circle.

The Mesopotamians also developed theorems on how to measure the area of several shapes and solids, and came close to an accurate measure of the circumference of circles. They fully understood square roots and cube roots. This knowledge was not just theoretical. It was applied to the design and construction of large buildings, long aqueducts and other ambitious engineering projects.

These developments were also very significant in early map-making, which in turn boosted trade. The oldest map is Babylonian from around 2300 BCE, which depicted the Akkadian region of Mesopotamia (present day Northern Iraq). With time Greek and Roman cartographers went on to develop these map-making skills further.

Once the concept of a 24-hour day was established, the Mesopotamians started applying their mathematical and scientific





“Babylonian astronomy provided the foundation for a lot of Greek, classical Indian, Byzantine, Syrian, Central Asian and Western European astronomy. Babylonian astronomers were able to predict eclipses and solstices.”



theorems to astronomy. This enabled them to work out a 12-month calendar based on lunar cycles and they divided the year into two seasons – summer and winter – thereby laying the foundation for the modern calendar.

Babylonian astronomy provided the foundation for a lot of Greek, classical Indian, Byzantine, Syrian, Central Asian and Western European astronomy. Babylonian astronomers were able to predict eclipses and solstices by applying mathematical theories and their development of methods to determine planetary positions became a crucial chapter in the history of astronomy.

MEDICAL FOUNDATIONS

Even modern day medicine has its roots in the Mesopotamian civilization. The most extensive Babylonian medical text dating back to 2000 BCE is the *Diagnostic Handbook* written by chief scholar Esagil-kin-apli of Borsippa. It was the Babylonians who first introduced the concepts of diagnosis, prognosis, physical examination and prescriptions, some of the most crucial pillars of modern day medicine. Methods of therapy, etiology (the study of causation) and the use of logic in diagnosis were all derived from the *Diagnostic Handbook*.

The text contains an exhaustive list of medical symptoms, empirical observations and their diagnostic outcomes. Its basic premise stands on a set of logical assumptions, one of which is the modern day theory that by inspecting the symptoms of a patient it is possible to determine the disease, its cause, its future development and the chances of the patient's recovery. Esagil-kin-apli went on to discover a variety of illnesses, such as epilepsy, and documented their symptoms, diagnosis and prognosis in the *Diagnostic Handbook*.

From the above it becomes clear why Mesopotamia is arguably the most influential civilization in world history. All subsequent Western civilizations were ultimately built largely upon foundations laid here. Mesopotamian civilization deeply influenced societies in Syria, Palestine and Egypt. These in turn, especially via the Phoenicians, would provide the material, religious and cultural models on which the Greek, Roman and Islamic civilizations would later be constructed. A whole range of technologies and scientific advances were made in ancient Mesopotamia, which eventually found their way to Medieval and Modern European civilization. †

Left: Tablet used to record the movements of Planet Jupiter.
Right: Old noria are restored to running condition for irrigation purposes in Iraq.



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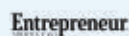
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but a journey. Each time that
you reach a summit on this
journey, you must look ahead
to the next one"

H.H. Sheikh
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