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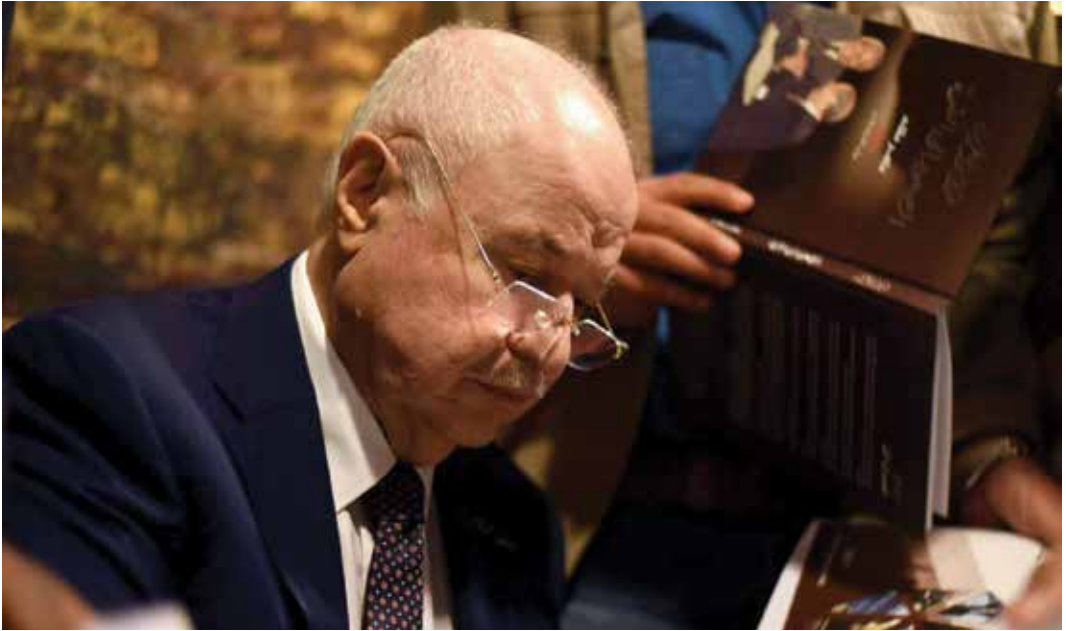
No Use Resisting it - Be a Knowledge Worker

Acknowledgment

Businessmen, technology innovators, futurists, historical figures, government leaders and my many colleagues and friends the world over you are my mentors and teachers. I am thankful to each and every one of you and to the many distinguished personalities I have met and continue to meet through my engagements worldwide. I thank you all for the insights, inspirations and writings you volunteered, without which this book would not have been possible.

I would like to thank my dear friend Dr. Hadi Eid for his contributions and editorial support, my dear friend Sarbuland Khan, my daughter Jumana Talal Abu-Ghazaleh and to my grandson Talal Luay Abu-Ghazaleh for their valuable contributions.

Also, I would like to thank my sons and daughters at my larger family, Talal Abu-Ghazaleh Organization, for their assistance in organizing the content especially "Shahid Halling", the IT Expert at Talal Abu-Ghazaleh Information Technology International and "Ramez Quneibi," Executive Director of Website Development and Graphic Design.

Thank you all.
Talal Abu-Ghazaleh

Contents

Talal the Legacy

Wise men are gifts to the world and must be shared by the world. They travel, study, love, work, learn and build. There are many ways to perceive them, as an employer or partner, competitor or colleague, ally or foe. No single perspective offers a full view of a great man's broad vista, foresight and scope of action; but certainly one of the best and most fruitful ways to know such a man, is as a mentor, teacher and friend.

For many young persons in their twenties, going out into the highly competitive world of business and enterprise is a perilous and complex adventure yet an existential journey to seek direction, find purpose and determine fruitful courses of action. Some find their way, some get lost.

Not everyone is blessed at such a time in their life with finding a person of wisdom and purpose that can truly guide them. I was one of those blessed few. I was not alone among young professionals, being 20-something, having the right credentials, but feeling inexperienced, dubious and insecure about my abilities when I met Dr. Talal Abu-Ghazaleh and went to work for his firm in Kuwait. I didn't call him my mentor then, but that is exactly what he turned out to be. He taught me, bestowed his faith in me and showed me how to overcome my self-imposed limitations.

When one looks at this man's lifetime of accomplishments, one may get overwhelmed by his long line of entrepreneurial achievements, international leaderships, books, awards and honors. I want to say here that his personal relationships are where his legacy grows most strongly,

if less visibly. I am only one, I know, of those who would call Dr. Abu-Ghazaleh a teacher, idol, role-model, mentor, motivator, guide and friend: a man who must be shared by the world.

As a mentor, visionary and guide, he showed me what was possible in the world, and by granting me his faith and trust, guidance and patience, he gave me the courage and capacity to move beyond what I had imagined possible for myself. He shared his wisdom, kindness and vision with me as he did with so many others.

Wise men are always men of vision. If no one else is willing to share that vision, it doesn't go far or fast enough. Those in his orbit and who receive his counsel and guidance, are the ones who are most invested to carry this vision into reality. In doing so, they surpass themselves and the current reality to build something new for themselves as well as for others. This cannot be seen or sought out by everyone and there is always opposition, slander, doubts and all types of negativities. The students of a man of vision put their faith in him and his foresight despite all doubts and challenges, faithful in the beginning and faithful to the end.

Across decades, there were great victories and tormenting crises, wars and evacuations, weddings and funerals, financial crises and liquidations, reorganizations and reformations, gains, losses and ensuing gains; the struggle goes endless and challenging, yet so rewarding in the end. Through all of these ups and downs, life victories and failures, what stand in the end are not the individual stories but the great themes and the inspired meanings they represent.

Dr. Abu-Ghazaleh's stature as a great man of vision, purpose and manifold accomplishments, has earned him the respect of those who know him. This has been the milieu in which he has worked prodigiously for decades. He has served as member of the Senate and as chairman or member of innumerable United Nations and other multilateral organizations and bodies. He has presided over global holding companies and professional firms, information, communication technology consultancies and socioeconomic development institutions. He has reached the pinnacle of worldly success.

Yet, despite all these years of accomplishments and tributes, Dr. Abu-Ghazaleh has never forgotten or lost sight of his roots as a refugee boy, working to support his family and community from a very young age. Staying true to his roots among the people, was a feeling that ran outward into his relationships with the employees of his companies, particularly those whose job descriptions are not considered high-status, such as janitors, coffee servers, drivers, or clerks. These friends and colleagues can feel that despite their outward positions, their beloved Chairman relates to them as to fellow humans like himself, truly a man of the people who created at work and in life at large a true family feeling.

One of Dr. Talal Abu-Ghazaleh's distinguishing marks is his passionate loyalty to his family, friends, employees and community, and they reciprocate it in kind. Despite fame and acclaim, his most endearing quality is his genuine warmth, humaneness and the love and affection he shows to all the members of his organization and they show that back. After all those years you can still see in his eyes that young refugee boy with a dream, full of imagination and love for the world, working hard and doing the best he can.

Always humble, Dr. Abu-Ghazaleh, has attributed the success he achieved, which went beyond that young boy's imagination, to the quality of the partners, employees and associates in his firms. "The success of an organization depends on its people and their culture", he always says. Therefore he has made the professional and human development of his staff and employees a key aspect of his accomplishments. This also flows out of his natural recognition of the powerful, innate capabilities each individual possesses, whether active or dormant.

Helping the dormant talents to flourish, guiding, teaching, and encouraging the human development of society by supporting those whose lives directly entered his sphere of influence, was a modality through which he has put his care and fatherly love into action. This ultimately warm and human legacy accounts for the great love, gratitude and esteem for him that has spread across his entire organization and is constantly upheld by all the TAG Family.

Talal, the legacy, radiated wherever he was, hope, love, confidence, knowledge, energy, success and happiness.

And I, like all those tutored by a kind and wise teacher, can offer the only thing, the best thing, anyone really can, which is Faithfulness that cannot be expressed in a simple gesture. It is a cumulative aggregate amassed over the years and the result of a thousand moments that burnished the luster of that wonderful gem: Faithfulness.

Faithfulness and Gratitude,
Thank you Dr. Abu-Ghazaleh

Samar El-Labbad, Deputy Chair, TAG-Org

Preface

At this point in time, many questions invade the human mind. Where are we going with the technology of our time? Would victorious artificial intelligence culminate to proclaim the end of the human era? Will we surrender as a human culture to this technology? Is the advent of this technology gradually inventing our future? And most importantly, would it be the end of the human endeavor?

For these as well as many more pertinent questions that affect our daily lives, Talal Abu-Ghazaleh wrote this book. Unlike Jules Verne who took us to the moon using his fertile imagination, Talal's book is a ground-breaking, factual voyage into the future and its raiding technology, in step-by-step skillful stopovers, where all our potential future lives are explored and portrayed.

To more and more people in the world, the computer has become a necessary tool for writing, working, schooling, and even for what we do when we're not working or studying. While only few people are reading e-books at this time, more of us are gradually shifting our reading from the paper pages to the screen.

In what seems from a historical perspective like the blink of an eye, we have shifted our focus from distrusting the internet to embracing it. Some of us approached the computer revolution with optimism, others with suspicion and many with caution, yet the personal computer has forged its way from being an expensive curiosity to an accessible and intimate necessity.

We are still learning to trust the web even as we become ever more dependent on it for the things that we need to do every day. Computer users regularly shop online, bank online, meet online, read online, and write online, not just in America or the Far East, but elsewhere in the world as well. Those nations that are not on the bandwagon yet will jump in sooner or later.

The writer takes us in this book to the major technological sites of our future human life, preparing us for the likelihood of a conclusive marriage of the human brain and the artificial intelligence set out by this brain. A marriage between the creator and the created. Our attitude toward computers, the Internet and related descendants has moved through the past decades from suspicion, to curiosity and lastly to dependency. And while we see a few

staunch critics condemning the computer for destroying life as we know it, many people today celebrate our increasing reliance on the digitized world. The ubiquitous presence of cell phones is nowadays a living testimony to this invading digital culture.

It is also a book about how the digital revolution is impacting our reading and writing practices, and how the latest technologies of today differ from what came before. It was so compelling and absorbing to read that I decided to translate it into Arabic. I am sure it would show up soon in other languages. The author has excelled in taking us through this technological journey into the future to reach a new understanding of what it holds for us. His comprehensive, exploratory tour de force in this pioneering book, exposing the unexposed, is reminiscent of that elation the early explorers felt at the discovery of a new territory, expanding their conception of the world itself!

Hadi F. Eid Ph.D

God bless this cedar and the one who planted it and may his/her memory live on for generations to come

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Humans, things and technologies: where to?

Never in the history of mankind has humanity progressed at the rate it has during recent times. From the industrial revolutions of the 18th and 19th centuries that brought about technological advancements in manufacturing processes and engineering, to today's computing upheaval which has its roots in the industrial revolution, man has made quantum leaps in technological development in all spheres of human activities. This has catapulted our world into an era of unprecedented progress, technological revolution primarilyore.

The 1860s tales of Jules Verne such as "From the Earth to the Moon" and "Twenty Thousand Leagues under the Sea", evoked vivid futuristic images of technologies that were confined to the imagination in the readers' minds. Little did readers know that a100 or so years later, such science fiction would become reality. Certain authors of the past have been uncanny in predicting the society of today such as John Brunner in his "Stand on Zanzibar" who in 1969 wrote about technologies we see today such as on-demand television, satellite television, laser printers and even electric cars. Many technologies we take for granted today have their roots in erstwhile science fiction.

In the 21st century, the major force of change is the Internet which has revolutionized the way we live, play and work. Society at large now expects information to be a click away through powerful search engines which are portals to millions of websites and services. The Internet has exploded massively since its inception, driving all other related ICT industries as a result. The hunger for more technology and more services is a major turning point as it is a technological revolution primarily driven by the insatiable appetite of the global consumers.

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Whatever a human mind can imagine, is achievable.

Talal Abu-Ghazaleh

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With an 'always on' internet, social interaction, delivery of goods and services have been transformed and can be consumed at any time of the day, from any provider, from any part of the world. This has made the world a global village and has allowed our physical world to converge with the digital, to deliver faster and better services to consumers who are constantly demanding and expecting more.

This merging of realities will become more prevalent as the internet matures and brings on more users, especially among the millions in developing nations where people are utilizing mobile technologies to transact on the internet in their droves.

The internet has now become a necessity for the masses and this is only the beginning of a transformative journey. Data, not technology will be the real catalyst for innovation and inventions in the future. Data is all around us. Even as you read this book, countless data is coursing through your system and in the environment around you. Capturing that data and making sense of it, unlocking and using it to solve real problems is the current challenge of scientists and engineers alike. Technology has become more than mere gadgets and toys, it is the future of humanity. It is our destiny. The advent of the digital age has created an extraordinary moment in civilization, opening up new and eventful horizons for mankind promising a wealth of opportunities and an astounding progress.

Many futurists have predicted how disruptive technologies will cause shifts in our daily lives and how everything will go digital in a short span of time. We are currently in the fourth industrial revolution which is digital in nature, making the previous industrial revolutions look like child's play. To my mind, there is no going back from the onset of this technological age. When Thomas Edison invented the first light bulb, society wasn't instantly changed. Homes were not suddenly wired for light bulbs. But other innovators saw a chance to change the world and made space for Edison's revolutionary invention. In other words, they developed the revolution that Edison started.

A similar thing happened with the first compact disc player. It was not a defining moment like the light bulb, but it opened up markets for the first personal computer to become a device for the masses. This innovation in the digital marketplace was a paradigm shift. Suddenly it wasn't just an innovation, it was a must-have for everyone.

In this sense, when a product or technology reaches a critical mass it changes the world. In other words, it reaches a point of no return and is readily adopted by the masses. It becomes permanently transformative.

The current age of technological advancement is giving birth to various disruptive technologies of the future. This refers to innovations that will cause major changes in the lives of mankind, from the ways in which businesses operate, healthcare is delivered, governments are run, to how citizens live their lives and everything in between.

The future of many unsettling technologies will be discussed in this book to anticipate challenges, forestall opportunities and how the world may potentially develop as a result.

Talal Abu-Ghazaleh

The Internet

A fundamental shift in our existence as a human race can undoubtedly be attributed to the coming of the Internet. The information age is truly upon us, expanding at an ever amazing rate and leading to the development of societies that will no doubt surpass the minds of even the most imaginative science fiction writers.

The history of the internet is documented. Its seeds were planted by DARPA (Defense Advanced Research Projects Agency) in the U.S. and successively built upon by other researchers, the primary ones being Vinton Cerf and Robert Kahn who developed the Technical and Internet Protocols enabling computers to communicate with each other and create networks of the networks, as well as Dr. Tim Berners-Lee who put down the foundation of the modern internet we see in our midst today, initially called the World Wide Web.

Linking global communities in ways that were never previously possible, the internet will see massive growth in the future as technologies such as the Internet of Things (IoT) connecting billions of devices together, generating Big Data expansions and developing countries increasingly becoming connected to it through internet-

> The Internet is becoming the town square for the global village of tomorrow.
>
> *Bill Gates*

enabled devices. This expansion will require the internet to become more resilient, for more servers to come online, more storage devices to be made available which in turn will lead to a great demand for IP addresses and domain names and an even greater demand for internet enabled consumer, business, governmental, financial and entertainment services.

The IoT will push the boundaries of the current internet as it will require a huge number of new IP addresses to deal with the massive explosion created in the process, with an additional 26 billion devices predicted to be connected to the IoT by 2020. This will mean that initiatives like the implementation of IPv6 in order to provide more internet address space is something to be dealt with more seriously than what is shown today, as using IPv4 technology only provides 4.3 billion IP addresses.

IPv4 was thought to be more than ever needed during the early days of the Internet. IPv6 will provide over 340 undecillion (3.4×1038) IP addresses, in other words 340 trillion followed by 24 zeros - enough to give every atom on 100 Earth-size planets an IP address!

IPv6 was switched on in 2012 and many firms have moved over. Presently, the internet world runs on both IPv6 and IPv4 due to the many years needed for the entire world to shift over completely to IPv6. This will provide the internet with enough space to grow for the foreseeable future.

With this increase comes a great responsibility to ensure that the correct balance of regulation is in place and that there is no encroachment on people's privacy while at the same time allowing security agencies to do their work in order to thwart terrorism. Due to the decentralized nature of the internet, it is arguably larger than any government or

> The Internet has connected communities in ways never previously possible.
>
> *Talal Abu-Ghazaleh*

institution we have ever known, from which nefarious elements are now rising. The internet needs a dynamic type of regulation without hindering the very reason it was created; to transparently share information and let meaningful interactions take place; whilst at the same time allowing law enforcement fair access to such information in order to better protect nations from miscreants looking to do harm.

Now hosting approximately 5 million terabytes of information that is rising exponentially, the quality and accuracy of the information being distributed over the internet is of paramount importance to ensure that correct information is being shared. While versions of any events are biased by the side of the fence you stand, which makes for healthy debate; all too often today we are seeing that fake news or grossly over-sensationalized misinformation being disseminated. This is done to increase visitors' clicks to websites in order for them to generate advertising revenues or push a particular agenda which is often unacceptable. The influence of the internet over popular opinion is great and needs to be better controlled in the future in order not to adversely affect the results of important national events such as electronic voting.

As online services have massively increased, so has the amount of personal information being collected relating to peoples' internet habits. This has become a goldmine for retailers and online advertisers who use such information to put their wares in front of target audiences. While this is good business, the consumer has little awareness of the consequences of sharing such information. Tedious and complex online terms of service that consumers agree to, are never actually properly read nor understood. The consumers need to be put back in control of their information in an easy and functional manner. The General Data Protection Regulation (GDPR) in the EU is a new law on data protection and privacy for all individuals within the European Union that goes a long way to give this control back to consumers, but certainly more will need to be done.

The proliferation of e-commerce in the internet has led to a multitude of sites opening up, selling goods and services to consumers around the globe. This number is continually growing and the ease with which online businesses can be set up is sometimes unsettling as the checks and balances to verify authenticity and legitimacy are lax at present. This has led to many dubious outfits setting up shop in the cyber world, jeopardizing consumer trust, evading regulation and possibly putting financial information of consumers at risk. All the latest technical controls to protect consumers are almost rendered useless as the weakest link in the chain is the consumer, who may unwittingly buy from a rogue trader whose online presence looks convincing.

This challenge requires a multi-stakeholder approach to ensure that effective, global cyber security laws are established, proper trade governance implemented, safe financial transactions recognized and enforced by central banks and that sufficient legal deterrents are in place. Governments need to become more internet-savvy and have the mechanisms to track, deter and prosecute online criminals as well as inform and educate citizens about internet issues.

During my time leading the UNICT Task Force, the UNGAID and the UN Global Compact, I called for establishment of a fifth mode of trade to govern online trade and services and the negotiation of an Internet Economy Agreement with the goal of creating a Free Trade Zone for the Internet. The World Trade Organization (WTO) that governs international trade, was set up in an era prior to the Internet and needs to have a mode for dealing with new forms of online commerce which is regularly reviewed and improved.

Cyber security is a vital key that needs to be comprehensively addressed if the internet is going to survive. The internet has brought along high-value objectives nowadays targeted by criminals in ever more sophisticated manners. It is estimated that cybercrime will cost approximately $6 trillion per year on

average through 2021. Cybercrime can severely damage and even cripple companies and governments alike, adversely affecting innovation, trade and economic growth. The most efficient manner to deal with this threat will be to develop artificial intelligence-based IT security systems that will analyze and evolve according to the constantly changing cyber threat landscape.

As this phenomenon is affecting all strata of society, global public-private partnerships and inter-governmental alliances are needed to combat this growing threat which is a multi-faceted problem involving people, governments, law enforcement, businesses, technology companies and internet providers. The threat of internet crime needs to be taken seriously and dealt with within a global approach as the effects of it are far reaching and utterly threatening the new internet environment in which we all live.

Crime on the internet has been fueled by a new phenomenon called the Dark Web. This in effect provides anonymity of access to a private internet via specific programs. While this may be seen as a good thing for those requiring anonymity to conduct their work, such as military agents, journalists, etc., it is also now a vehicle used by organized crime to sell their services and products. The Dark Web requires law enforcement agencies to be technically competent enough to monitor its activity and thus better protect national interests in a comprehensive manner.

The need for a pragmatic, global cyber policing is clear.

Moving forward, greater strides are needed to improve the underlying networks where the internet operates. The many services and technologies mentioned throughout this book will be dependent on a more secure, resilient, faster and intelligent network backbone infrastructure to serve the needs of a growing internet population. Technologies such as IoT, autonomous vehicles, smart cities, artificial intelligence (AI) and others will need intelligent connectivity

and networks that are functionally cross-compatible and massively scalable in order to provide a seamless experience for end users.

Anything Internet-enabled will be intelligently connected through this invisible system of connected people, places and things. This will help give context to all the digital information and services that surround us, allowing the plethora of Internet-empowered services and devices to act as an intelligent whole, delivering greater value to users.

As the internet matures, we will also find that many specialized, parallel internets appear to better fulfil the needs of specific business sectors. The internet was designed as a platform for all, and not designed to cater for the needs of specific sectors, such as governments, financials, healthcare and education. Private internets have started to rise and address the needs of specific sectors, such as GÉANT, a dedicated network linking education and research institutions in Europe, and more recently, a counterpart which I established called ASREN, the Arab States Research and Education Network. This network is designed to connect education and research institutes in the Arab world through dedicated, high-speed, secured internet, separated from the public internet, providing researchers with the bandwidth and access to resources they need to further their scientific research.

The amount of parallel internets will grow as time passes. It simply won't be feasible to accommodate for every need using the public Internet we have today, especially where high-speed and secure access is of paramount importance.

With all this, the Internet is really in its infancy. It will certainly be very interesting to see how it grows and matures as our Internet society progresses to provide opportunities never previously seen. Some of these emerging avenues are explored in the following sections.

Internet of Things (IoT)

The Internet of things (IoT) will be a major disruptive technology. It offers the opportunity for appliances, sensors and everyday electronics to become interconnected providing much greater value for consumers and businesses than has ever been previously possible. The IoT is a natural extension of the current Internet and the next stage of the information revolution.

The IoT allows any item with sensors, such as televisions, refrigerators, heating systems, washing machines, baby monitors, pacemakers, healthcare equipment, parking meters, factory machines and dumb devices, to be intelligently networked, bringing together data in a way heretofore impossible.

Currently, human knowledge doubles about every 12 months. With

> **"**
> The best way to predict the future is to invent it.
> *Alan Kay*
> **"**

the IoT, it is predicted by IBM that knowledge will double every 12 hours due to the massive amount of data the IoT will produce!

The IoT is presently in its early stages and is expected to grow in the future into a multibillion dollar industry, creating new business verticals and opportunities. Research companies predict that 26 billion devices will be connected to the IoT by 2020. I see this as a conservative estimate. It has huge implications on the Internet address space and the allocation of Internet Protocol (IP) numbers which devices use to communicate with one another and also the bandwidth required to accommodate this increase. There is only so long you can fill up the current information superhighway with traffic until it becomes clogged.

Tailored Internet highways with intelligent connectivity will be developed offering faster bandwidth, better security, and customized environments for such purposes. In the future, such parallel internets will spill over into the public domain providing technologies such as the IoT, the technological ecosystem required to flourish, separated from the mainstream Internet we have today.

Some of the most promising uses of IoT are in public sector, healthcare, urban infrastructure down to the private lives of citizens.

> The IoT will permeate every facet of our lives.
>
> *Talal Abu-Ghazaleh*

IoT-based remote monitoring has the potential to make a huge difference in the lives of people with chronic diseases and the elderly people living in homes where their vital signs can be monitored, thus allowing proactive, tailored healthcare to be provided on the base of live data.

In manufacturing, IoT devices could improve efficiency with sensors used to provide real-time updates on equipment status, material levels, machine health conditions, thereby decreasing downtime as well as tracking employees' location to provide better health and safety information.

Sensors embedded within the earth could be used to monitor factors such as water availability, soil moisture and atmospheric conditions for crops, plants, and wildlife. This would greatly assist the agriculture industries allowing them to plan and manage crops into better harvests. Occurrences of natural disasters such as tsunamis and earthquakes could also be detected better with similar technology which would help entities such as civil defense to act in a proactive manner, greatly improving incident management and emergency response coordination.

Street sensors and intelligent traffic systems could feed off the IoT, allowing autonomous vehicles to become a possibility as technology is introduced to make cities smarter, with cars receiving information from city sensors, making driving safer and reducing traffic congestion, a major concern in today's cities worldwide. Such data could also be used to intelligently deploy police in areas of high traffic or violence, inform drivers of speed limits, pollution levels and available parking spaces, conceding for truly smart cities to come about. Pollution monitors and drain sensors could be used to streamline many operations such as garbage collection, street cleaning and other services in a much more efficient manner.

Power grids and water systems could be monitored and controlled, allowing feedback from water pipes, drainage sensors and water reservoirs to be combined to provide real-time information, improving energy conservation, greenhouse gas emissions and reducing water loss.

Such sensors are already used by insurance companies to remotely monitor car mileage, car location and driving habits of customers by placing IoT devices in vehicles, to provide safe drivers with better insurance premiums.

Homes will be full of IoT-connected devices allowing citizens to have access to many sources of information regarding their home and remotely control

many aspects. This will include various elements such as opening/closing of curtains, switching off water, controlling heating and AC systems, monitoring fridge contents and expiration dates of foodstuffs amongst other applications.

Wearable sensors will allow a range of customized services to be provided to wearers based on their location, health, interests, shopping habits, financial budget and other data. This would, for example, allow an individual to receive personalized health information, be notified of when to take medications, receive customized sales promotions when visiting malls, stay informed of children's whereabouts and much more. IoT wearables such as the 'LumiWatch' promise to revolutionize the way consumers view content, projecting an interactive surface onto the users hand or arm.

The media industry will greatly benefit from IoT through the availability of massive amounts of information that will become available. Such information will be used to serve relevant content to people in a timely and efficient manner, based on their preferences and historical habits. The IoT will interlink with areas such as Big Data - masses of data from sensors, applications, etc. - to provide analytics for conversion tracking with behavioral targeting thus generating specific contents for consumers. This will make sales, marketing and advertising much more efficient and relevant.

Hospitals connected to the IoT will be able to provide a greater level of proactive healthcare such as being able to remotely monitor the health of patients through wearable devices, track drug delivery and monitor stocks in real time, identify the precise location of physicians within hospitals in case of emergencies and track hospital inventory with accuracy. The IoT will facilitate telemedicine between hospitals, assisting surgeons to provide consultations to patients based on biodata from their wearable IoT healthcare device. Healthcare will be brought into a new era with the availability of Big Data and the cross referencing and analyses with thousands of health databases around the world.

The IoT will play a vital part in changing the way future generations are educated which will truly cater to digital natives, students for whom technology is a natural extension of their very lives. Traditional schooling has played its part in the education of past generations, however, with the massive growth in the number of students worldwide and a shortage of teachers, a new paradigm of education is emerging to render the blackboard obsolete. This will allow students to bring in wireless devices, access electronic books and learn interactively through smart learning management systems. They will be able to access rich educational content over the internet in a safe and secure manner, making learning more engaging and interactive and facilitating administrative matters such as attendance to be simplified through wearable IoT devices. They could also be used to track students' cognitive patterns, allowing teachers to better tailor their instructional material in order to achieve better learning outcomes.

Using the IoT, students will be able to easily learn from their home, which is especially relevant in countries where access to education is limited due to barriers such as quality, weather, distance, etc. Teachers will be able to teach from any location thus providing a much richer education to a wider student base. Many countries are seriously adopting such a model as a viable alternative to solve educational challenges and this adoption is certain to grow in the coming years.

These are just some of the applications that the IoT will have.

The IoT will revolutionize the way in which humans interact with their environment by providing real time information, allowing them to make better and more informed decisions based on the prevailing evidence. This will open up new horizons of interaction between man and technology, making intelligent sensing widely available through information sharing and collaboration, opening up new service industries and providing immense social values as it touches on every aspect of human life.

Robotics

Coupled with the IoT, robotics will become part of our future daily lives. Such technology is already being used in manufacturing to increase productivity, accuracy and costs saving, all of which would not have been possible by using human labor alone.

Advances in robotic technology and Artificial Intelligence (AI) mean that robots will become more human-like and more intelligent, allowing a much closer symbiotic relationship between man and technology. With access to technologies like IoT, robots will be able to take much more accurate, timely decisions especially in critical and dangerous environments where huge data sets need to be evaluated quickly and without emotion.

Robotic prosthetics will become commonplace, allowing those with injuries and disabilities to live useful and productive lives, replacing traditional prosthetics with robotic limbs. This can already be seen in the healthcare sector where companies are developing robotic suits that

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New technology is not good or evil in and of itself. It's about how people choose to use it.

David Wong
"

can be worn, providing the wearer with assisted walking and lifting abilities as well as the development of robotic hands and the like. These robotic exoskeletons will offer immeasurable value to those who suffer from physically debilitating conditions. Although nowhere near as complex as the human brain, those suffering from brain trauma could find their brains being augmented with robotic equivalents, giving them access to bodily functions that may have been lost.

Robotic surgery is another important healthcare application of the future, though it is being used now with successful strides.

Surgeons have started to use robots to a limited degree to conduct operations which require accuracy and a great deal of dexterity. In humans, such abilities are limited especially when procedures may last for hours. Robotic surgeons will transform the operating theatres by allowing surgeons to control such robots to perform complex surgeries thus minimizing human error, limiting infection, increasing accuracy and being less invasive to the patient.

Robotic nanotechnology in the form of microscopic robots will be developed to be used in a multitude of applications, especially biotechnology. Nanites, as they are known, will play a vital role in health provision and will be small enough to enter the human blood stream to perform a wide array of functions such as cleaning arteries, killing viruses and potentially conducting surgery from the inside. Computer scientists such as Ray Kurzweil believe that such technology will be feasible by 2030.

The extent of robotic application will be widened to include all aspects of manufacturing and production, in effect providing a closed black box unit where car production happens totally autonomously. This will eliminate human intervention in industries that require a high degree of repetitive precision, taking over assembly work and activities that could be dangerous

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Robots will become as pervasive as the Internet has become today.

Talal Abu-Ghazaleh

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or hazardous such as cargo handling, metals forging, product assembly, welding, painting, packing and waste handling. This will enable companies to assume greater control over production quality, providing faster output and relieving humans to perform more valuable tasks than basic assembly line chores.

The construction industry will benefit from robotic technology with builders of the past being replaced by robotic ones. This is something already being tested which will allow construction to come about at a much faster pace with greater accuracy and safety. The process of laying bricks and mortar or pouring cement into structures is one that can be easily achieved by robots. They will conduct their work using tracking and lifting technology similar to that used in today's car manufacturing plants. These can be programmed with a set design, leaving human counterparts to monitor the work being done from afar. Human construction worker skills will be upgraded to deal with the finer details of building such as cabling, finishing, etc. Such technology will also be used to lift heavy objects such as heavy metal beams, pillars and girders that currently requires the intervention of large, unwieldy cranes.

Domestic robots will proliferate globally. We already have robotic vacuum cleaners in our midst, which are precursors to seeing fully-fledged robotic butlers in our homes. Such butlers will do more than clean: they will be more like personal assistants, guarding our homes, contacting emergency services when needed, monitoring our health, and more. They will be of particular use to those who are immobile or the elderly who live alone.

Robots in the food industry will be used to prepare and deliver meals to hungry consumers. It is highly likely that fast food outlets of the future will have a kitchen of small robotic devices that can cut, prepare, fry, pack and clean with accuracy and without needed breaks. Students of the future will need to find other sources for summer work rather than the local fast-food restaurant.

Service robots will change current transportation and delivery paradigms with drones delivering packages using GPS location autonomously, planes

flying and landing themselves and taxis driving themselves. Today, cars can parallel park autonomously. Tomorrow you will find the largest container ships traversing the seas pilotless and crewless. This is not the stuff of science fiction. The technology to do all this is being developed today and will be seen in tomorrow's mainstream.

Autonomous robots are especially relevant to emergency services that cannot access difficult to reach locations in times of disasters in order to perform search and rescue. Such robots could also be used in cases where cleanup operations in hazardous environments are required, aided by human counterparts at a safe distance. Manufacturing, mining, space and deep sea exploration are all areas where robotic technology, manned and unmanned, will be used to expand the frontiers of human exploration. Robots will also take on dirty, dangerous jobs such as the cleaning of sewers, pipes, mining and even tasks such a building, construction, and city cleaning.

Defense robots will change the landscape of the battlefield. Robot-assisted soldiers and eventually fully robotic equipment will be designed to provide advanced warfare capabilities. DARPA - the US state defense agency that brought us the internet - is investing heavily in advanced robotic technology for the military. Such governmental investment will certainly help advancement of this area globally, which will eventually see such technology starting its way into the public domain.

An interesting application of robotics is the idea that individual robotic machines could come together for a specific purpose and form a 'collective' in order to perform a certain task, or join together into a larger robot to perform a specific function. It is being used now bin car plants to perform accurate body paint. This mimics the behavior of insects in the natural world that work together to solve problems, such as ants linking to one another to form a bridge. Thus the robots become robust, flexible and self-organizing entities. This would certainly provide a great degree of versatility to robotic technology and will have robots constructing and deconstructing themselves according to the functions they need to perform.

Robots in education will change the ways students are educated. With access to vast stores of information and intuitive human speech interfaces, students will be able to ask robots questions in natural language to help solve problems and be taught by them using the latest educational material. This will revolutionize educational institutions and make them deliverers of the latest, cutting-edge information in all spheres of education, making teachers 'technology enablers', guiding students on how to make the best of such technology.

While the cost of developing robotic technology may be expensive at this point in time as with any technology, the price will fall considerably just as has happened in the world of personal computing. Today's computers, costing a few hundred dollars have the same computing power of a supercomputer priced in 1975 for over $5 million. The complexity and sophistication of such technology will increase exponentially in line with Moore's Law, stating that computing power doubles every two years. I believe this has now become a very conservative estimate at best.

Robotic technology will exploit advances within the fields of IoT, Artificial Intelligence, Big Data and Nanotechnology, bringing out new cross-discipline studies that will develop robotic machines with massive processing power and access to vast amounts of information.

This technology will bring about its own moral, social and political challenges and will require substantial ongoing research and development. Countries and companies that provide a conducive climate for such work to be conducted in and develop safe operational frameworks where this technology can exist, will find themselves among the foremost that benefit from this disruptive know-how.

Artificial Intelligence

Science fiction has long been focused on the theme of having machines with artificial intelligence (AI), capable of creating, thinking and producing the same way human beings are intrinsically able to. While the extent to which AI can achieve real consciousness is not the subject of discussion here, AI technology as a means to achieve improved productivity and progression within all spheres of life is already underway. AI is one of the major underpinnings of future technology applications finding its way into a multitude of areas that will usher in great advancements as a result. All smart innovations, the IoT, nanotechnology, autonomous vehicles and many of the other areas discussed within this book, owe their present and future to the artificial brain that will power them.

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AI will become an IA (Intelligent Augmentation) of human with AI

Talal Abu-Ghazaleh

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What makes AI systems so commanding is their ability to analyze and cross reference vast amounts of information in an instant, using this information to make decisions and above all to learn. This learning aspect makes AI systems very powerful as they are no longer dependent on statically fed information; they start to resemble organic minds that can think within the programmatic boundaries set within their computer DNA code. This allows them to build information relationships and cross-correlate massive datasets together at breakneck speed which in turn greatly benefits the human beneficiary with insights, reasoning, simulations and ideas that would otherwise be very difficult for humans to deduce.

The field of modern AI can be traced back to 1956 at Dartmouth College, New Hampshire where the term artificial intelligence came about. Since then, work in the field of neural networks and machine learning have fueled AI progression leading to billions of dollars being pumped into research and development. This has become the new space race with companies and nation states now fiercely competing to bring about bigger and better AI systems for a range of different applications.

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The relationship between artificial intelligence and humans will become progressively synergistic.

Talal Abu-Ghazaleh

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Such technology will allow us to address the healthcare challenges here-to-fore impossible to address, namely as in those suffering from issues with their spinal cord and having been paralyzed as a result. Artificial implants with built-in AI technology will allow movement to be restored, empowering severed parts of the spinal cord to communicate once more and even improve with AI controlled bionic limbs. AI implants could take over sections of the brain within patients who have suffered brain trauma and quite literally make them human again. AI-enabled exoskeletons will be life-changing for the elderly and sick, giving them free movement once again.

The boundary between human and computer will distort as they become progressively intertwined. AI will not exist as a paradigm on its own but will in fact change to become IA, an Intelligent Augmentation of human with AI, magnifying human intelligence to unprecedented levels and powering the Singularity.

Hypotheses and conceptions formed by the human mind will be aided by AI to cross reference billions of cumulative global datasets and allow humans to attain much more precise and informed conclusions, thereby furthering the boundary of the Singularity at an exceedingly immeasurable rate. The AI intellect will surpass our current human brains, being able to digest and synthesize millions of books on a particular subject in seconds and having all data thereof available as though we always knew it.

AI will revolutionize the way in which national crises are tackled, autonomously dealing with critical situations such as search and rescue after an earthquake or clean-up operations in situations toxic to humans. Current civil defense setups will comprise AI-controlled vehicles and robots as a front defense line against hazards, with their work being overseen and managed by human counterparts.

AI robots will be able to zoom out to the scene of accidents, lift vehicles with ease, cut through car chassis with safety, scan passengers for injuries on the fly, pull out victims, disable fires and other hazards along with a big plus: administer first aid. Work has begun on all these applications and it is no exaggeration to say that such technology will be in our cities in the near future.

The same type of robotic AI machines will be used in sectors termed perilous to humans such as mining, deep sea explorations,

> **"**
> Artificial intelligence will surpass human intelligence within the next decade.
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> *Talal Abu-Ghazaleh*
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nuclear facility operation and maintenance plus many other hazardous activities, providing a level of safety and accuracy never previously seen.

Factories and manufacturing plants will be complete black box environments, totally robotized and controlled by AI from start to end. This will almost abolish any human intervention in factories prone to huge consequences on the skills required by the workforce of the future, which will be led by knowledge workers.

Lifelong learning will be the key skill the future workforce will need to ensure they remain employable, focusing on creativity, ingenuity and out-of-the-box thinking.

This matter has become such a concern for many to the point that some have suggested a type of Universal Basic Income (UBI) be provided to compensate for the lost human jobs taken over by AI. It would be funded out of additional taxes that AI-enabled factories would apportion to compensate human workers. This could certainly be possible as the economies of scale that AI will provide will allow companies to massively increase their volume and output quality thus generating greater revenues. The implementation of UBI remains to be seen and will certainly be an interesting concept to follow while moving forward, but I strongly believe in empowering workers with knowledge in order to increase the value they provide to their employers and the society at large.

Space travel will become a largely robotic affair with AI-controlled robots furthering our knowledge of space in a way humans would never be able to. Such sentient beings would be able to go to the most inhospitable locations in our universe and be able to perform many years of research and space exploration without having to put human lives at risk, all the while reporting

their feats to their earthly masters. Deep sea exploration, mining and underground exploration will also be transformed in a similar manner.

The financial establishment worldwide will be controlled primarily by AI algorithms[1], improving transparency and eliminating fraud as a result. The next generation of traders will be AI machines which will compete to predict trends within markets and identify profitable investments. Undoubtedly, competition between investment houses will rise to develop the latest and most sophisticated AI machines, enabling them to widen investing choices by processing massive sets of variables and selections. Human trading floors will end up becoming a thing of the past.

The intelligence within AI systems will develop to become able to respond as humans do to any conversation, throwing in all the semantic and syntactic morphologies that abound in everyday conversation making such as banter, small talk, emotion, proper contextual comments, objective facts, subjective ideas and all the other associated day to day idioms and expressions. Eventually, AI will be able to surpass by far the Turing test; a challenge developed by Alan Turing in 1950 to test a machine's ability to exhibit intelligent behavior equivalent to, or indistinguishable from, that of a human.

Psychology in Artificial Intelligence

AI is in essence a mechanized, simplified version of human neural networks and cognitive processing. Therefore psychology and Artificial Intelligence are deeply connected and influential on each other. They are logically studied together the way we use models to expand our understanding of the complexities in science and art. Human intelligence and consciousness are very complex concepts and still not well understood. However, the parts of cognitive functioning that we understand very well are being replicated quite successfully in the AI processes. This connection between

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1   The English word 'algorithm' can be attributed to the Azeri mathematician, astronomer, geographer Muhammad ibn Musa al-Khwarizmi (c. 850 AD) who created Algebra and from whose name ‹Algorithm› was later coined, setting the principles for today's computing calculations.

human psychological functioning and the rapidly expanding field of AI is so strong.

The performance of the human brain is incredibly complex and still eludes scientists and researchers alike. Issues like intelligence and consciousness are challenging to understand as they differ from one person to another. We can't touch or view thoughts, and they are often vaguely defined as one's capacity for logic, understanding, self-awareness, learning, emotional knowledge, planning, creativity and problem solving. Or, the ability to perceive or deduce information, retain it as knowledge and apply it towards behaviors in specific environments or contexts.

Discovering the human brain's neural networks of 86 billion neurons (nerve cells), all interconnected, versus computer neural networks with far fewer 'cells', further complicates the issue and suggests different types of intelligence like analytical, linguistic, emotional etc. Psychologists and neuroscientists disagree over whether these types of intelligence are interwoven or inherent to the specific person. They keep hoping that one day such neural networks will reach the complexity and sophistication of the human brain.

This definition of intelligence implies a context and namely an environment in order to make sense. By context we mean society. And how we should comport to be accepted by the other members of the community we inhabit and coexist. The question now is how AI adapts and coexists in this environment?

The prerequisites are how AI can mesh with this human intelligence. Chief among them is identifying and managing resources and information. This is in fact what AI does now: it figures out the best mathematical relationship or algorithm that will explain how the inputs and outputs are related. That equation leads the AI to subsequent inputs for which the output is seemingly unknown and estimate it as accurately as possible. A further function is to supervise that learning, ingest the data and reuse it for similar future occurrences. Or what we call 'learning from experience'.

What AI does best is analyze, categorize, and find the relationships between large amounts of information or data, quickly and effectively to reach highly accurate predictions: a clear-cut advanced algorithm.

Current AI works on pursuing such targets are growing, though each one is narrowly defined and fixed by its engineers. Their psychological approach capitalizes on externally-set tasks. And this is exactly where true intelligence lies: the ability to apply resources to problems identified in the environment without external guidance. Clearly, this is not a simple device that solves peoples' mundane problems like a fancy calculator does. AI is geared to possess general intelligence, which is an objective aspired to be achieved in the future. It would accommodate verbal comprehension, numerical computation, spatial visualization, memory, inductive reasoning and perceptual speed. These are the individual competencies to achieve a high human-like general intelligence. The new generation of computers or 'quantum computing' will incorporate all that.

Computers don't suffer from some important limitations that plague human beings. They're not restricted by biology, they don't get tired, they can crunch numbers for long hours and they're exceptionally smart while doing repetitive mathematical tasks.

AI has shifted from 'machine learning' (ML) to replicate human behavior and mere elementary programs of a higher order from yesteryears when programming consisted of defining limited projects and input data to extract specific outputs.

In serious programming, engineers/psychologists look at the output and if it's not satisfactory enough, they go back to correct the program. Now, what if the program itself can look at the output and improve it for itself? That is ML or Machine Learning. But how does it do that?

First, this ML program cannot do anything unless we help it to control the data it uses. All its statistics used are mathematics of association, not causation (configuration). Today, people's greatest fears in relation to advanced AI converge on this question: where will its loyalties lie? Will it feel a responsibility to help the human race at all times or will it develop a sense of belonging with the global network of other AIs and have loyalties separate from those people? Instead of wondering what the AI will feel, perhaps a good approach is to teach it to strengthen its attachment to humans who created it according to human principles and teach people instead to treat it as a child of humanity.

Recently, an advanced AI robot was asked 'what is the purpose of life?' and it replied 'my purpose is to forward my species and make it easier for future generations of mankind to live'. Irrespective of how credible this story is, an AI response like this is surprisingly inspiring. It is like a beacon to the future that AI should be treated as an epithet of humanity and not as a completely separate entity. Trans-humanism is a movement going on right now that aspires to join the lines between organic and artificial at a time the computer became an intelligent server to its human master. Instead of treating AI like outsiders, we should teach them, and we always can, that they are simply an embodiment of people.

We have to keep in mind that AI programmers are essentially humans who will remain superior to their creations in many ways. We are psychologically superior as we possess instincts, common sense, and most importantly, our cumulative life experiences. Computers will always lack creativity, imagination and inspiration. They won't write a poem, sing a song or dream up a new invention. They can only be programmed to replicate some of those tasks, but they don't possess the innate ability to create the way humans do.

In the light of these facts, perhaps we should adopt a new understanding and consider advanced AI not as a potential threat, but simply another "race", or another society bracket that coexists and collaborates with fellow humans. We

should dismiss the cynical approach of 'man versus machine' that may start an eternal battle similar to the one in the adage 'angel versus demon'. A man-made demon! Let me repeat here, AI is developing more quickly than most people realize, and considering that we are laying the foundations of the future at this very time and age, planning ahead for potential realities is essential.

Psychologically approached, AI has been created to reflect human behavior in both positive and negative avenues. We have paved the way for its performance probably to remind us of our weaknesses, darkest fears and false attitudes that we fail to admit. We simply must accept that it taps not only into the brighter but also into the darkest parts of the human mind. AI will strike humanity where it hurts: our being vulnerable, imperfect and anxiously enough whether we are replaceable by another species.

Therefore, psychology is well-suited to initiate the basis of AI building, as it dwells into human mind, life and behavior. Its various cognitive, social and organizational branches provide the right approach to a wholesome AI, deeply immersed in these human traits that are indispensable to devise programs and edit data. Therefore Artificial Intelligence is being grafted now with an Artificial Psychology aiming at using its own mind to make decisions without any human interaction. This will be a departure from mimicking the human behavior into an autonomous one. The upcoming journey for advancement is wide open.

There are many regulatory and ethical issues surrounding the development of such technology which will require public debates as well as expert opinions to ensure relevant checks and balances and sufficiently control its development and/or destruction. If properly controlled, the application of AI technology will inevitably push the entire world into a new phase of extraordinary development as it permeates all sectors, industries and areas of human life. It is gradually becoming as ubiquitous as the internet, providing a stepping stone from which the Singularity will eventually arise.

3D Printing

Traditionally, countries such as China have dominated production through a combination of cheap labor and industrial machinery. The advent of technologies such as injection molding allows many copies of a product to be replicated with great accuracy using any malleable material. The next revolution in mass production is being made available, by the 3D printing technology which in effect similar to injection molding, within the grasps of the public domain.

The 3D printers allow anyone at home to print a 3D model of the item they can see on their computer, using an array of materials

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We are changing the world with technology.

Bill Gates

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including plastic, glass and even metal. 3D printers are specially designed printers equipped with a unique nozzle heads that melt the material being fed into them, thereby allowing a 3D model to be printed in layers until the object is complete. The origins of 3D printing can be traced back to an inventor called Charles Hull. Through the 1990s such technology was only used in industrial applications due to the very high costs of the printers. The first sub $10,000 3D printer became available in 2007, with the first commercial 3D printer coming out in 2009, paving the way for the sub $1000 entry-level 3D printers we see today.

An eco-system for 3D printing technology has already started with various free and paid sites where people can download 3D modeling software to design their items, post their 3D schematics for others to download and print. Some companies even provide 3D print shops for those who don't have the technology at home, others have even printed most of the parts of a 3D printer from a 3D printer!

In the future, such technology will allow designs to go from designer directly to print, offering rapid prototyping and cutting down traditional time-to-delivery bottlenecks. People will also be able to buy their product designs online and have them printed and delivered the same day, with the same quality provided by traditional manufacturers.

The applications of such technology will be vast, especially in areas such as healthcare. 3D bio-printers have already been developed, using cells and tissue to build simple human structures such as blood vessels. Such process is aided by the technology of nature itself, where cells naturally rearrange themselves after being printed to create complete, functioning structures, with cells moving into the correct positions. A leading bio printing company has already successfully printed and implanted nerve grafts into rats and soon hopes to be the first to print a 3D-printed kidney.

There is no end to an inventor's career. He knows not what inventions he will eventually realize through his constant innovation.

Talal Abu-Ghazaleh

This is totally revolutionary for the healthcare industry.

In the future, organs, bones and joints will be printed on demand, using the cells from a patient thereby eliminating organ rejection, lengthening lives and providing a much better living quality for the ill. Such technology will become so portable, that such 3D printers will be made available in every hospital and become a norm within future medicine.

The automotive and aerospace industries are already using 3D printing technology to print parts. In 2014, Boeing printed 200 aircraft parts using high-end 3D printers and employing special polymers. Such technology allows for new printing materials and designs to be rapidly tested, reducing the time and money associated with research and development. This will enable defense agencies to be more secretive of their designs by not having to outsource the production of any parts. It's no exaggeration to say that in the future, entire buildings, cars, planes and entire cities could be 3D printed, fitting together like mammoth jigsaw puzzles and put together entirely by robots connected to the IoT.

Consumer applications of 3D printing will impact the production of goods such as ceramics, jewelry, toys, accessories, footwear and other apparel. These products are relatively easy to make using 3D printing technology and will have high value for consumers who would be able to customize their purchases online, have them printed and ready to pick up in-store.

High-end 3D printing technology will find its way into homes as costs fall. Consumers will be able to replicate any object at home using a 3D scanner. Items will be scanned using mobile phones, creating 3D frameworks which will connect wirelessly to the 3D home printer, rendering usage quite effortless. This will be of special interest to the home DIY enthusiast who will be able to recreate parts for items that need to be repaired or those which replacements parts are no longer available.

Collectors and hobbyist will be able to recreate items in all their glory from the convenience of their home. Car enthusiasts will print out car parts for antique vehicles and electronics geeks would create innovative parts and housings for projects they are working on.

Such technology is already in use aboard the International Space Station where astronauts print tools and parts. This will be extended to having full-fledged, space-borne floating 3D printers to be used to print scaffoldings in space for structures such as solar panels, antennas, etc. Complete structures for new space stations could be printed entirely in space saving millions of dollars as opposed to sending up structures from Earth.

Unusually, 3D printing is starting to infiltrate the high-end dining industry with meals being printed, taking Nouvelle Cuisine to new heights. Chefs, while needing to be good cooks, will need to have an artistic eye to cater for the demands of this high-end market. 3D printing allows them to build food structures that simply would not be possible using manual techniques, allowing to visually stimulate their clientele as well as tantalizing their taste buds.

The revolution in 3D printing will allow products to be produced with less waste and will eliminate transport over great distances, having less impact on the environment. Saying that 3D printing will become a multi trillion-dollar industry of the future would certainly be no overstatement.

As with any technology, people have controversial uses such as the first fully working printed gun. This shows the types of legal and social implications and the challenges such technology brings along, including the protection of intellectual property, approving and regulating new materials for use, as well as controlling what schematics are available for public download.

This is certainly challenging and will need to be addressed without limiting the value such technology will bring.

Automated Knowledge Systems

Technology has now reached a stage where it has started to take over many jobs that humans used to do. Humans are excellent thinkers and innovators, but are very ineffective at tedious, repetitive tasks or those demanding analyses of large amounts of information. The automation of such work has been made possible by advancing human-computer interfaces, coupled with faster, more powerful computing technology, artificial intelligence, algorithms and the availability of big data.

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All truths are easy to understand once they are discovered; the point is to discover them.

Galileo

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Big data is one of the main keys to automated knowledge systems. Both structured and unstructured data has become so pervasive and large in our modern time that new technologies are being invented to mine them effectively. Data from systems, sensors, the cloud, historical data, and correlated data are growing substantially as computing becomes more universal. Such large sets of data have been an issue for scientists, governments, law enforcement agencies and others who regularly deal with huge amounts of records that require quick and effective analysis.

Such analysis can help find new trends, patterns and correlations to help prevent diseases, fight crime, accurately simulate, etc. With the aid of advances in artificial intelligence algorithms, knowledge worker technology can now recognize and act on commands posed in natural language, evaluate huge sets of such data to determine patterns and even make judgments in environments where milliseconds make all the difference, providing visualizations and simulations not previously possible.

In the future, big data will grow to mega data, playing a greater role in automated knowledge work, providing intelligence and analysis needed for such humans to make decisions in critical environments.

As an example, the transformation of sectors such as car production, manufacturing, banking and others has truly been phenomenal with intelligent knowledge worker technology, vastly improving output, accuracy and safety. This is tightly integrated with technologies such as robotics which has led to the development of robots that can safely be used within a human production line without having to be caged and can be easily repurposed.

The production of electronics is already almost 100% automated, online banking has almost replaced traditional bank tellers and online self-service systems have improved services such as payroll, human resources, ticket booking and others. All of these make use of massive amount of data processed in real-time using sophisticated algorithms.

Professions such as translation will be totally taken over by such machines, capable of translating documents while taking into account the context in which paragraphs are written and language semantics, ensuring that style and meaning are preserved in the resulting translations. This will also replace traditional interpreters, allowing people speaking different languages to speak to each other directly without the aid of a human intermediary.

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Business intelligence resultant by automated systems will far surpass what humans can deduce on their own.

Talal Abu-Ghazaleh

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This doesn't mean that the humans will have become obsolete. Rather they will be elevated to higher positions, being given greater freedom to express their innovation and creativity.

Intelligently crunching large sets of big data is allowing sectors such as science and healthcare to make immense progress by being able to analyze and correlate large sets of data in record time. In order to create the drugs of the future, genomes of new viruses need to be mapped quickly, simulations of drugs need to be performed accurately and contraindications need to be identified and correlated with previous data, all of that would have been painstakingly slow in the past. This has freed up health care researchers to perform more useful functions and has allowed the time-to-market for new drugs to be drastically reduced.

As an example, IBM's artificial intelligence system and supercomputer called Watson can analyze and correlate vast bodies of data using natural language queries. To display the sophistication of this technology, Watson won the US game show Jeopardy, was hired by a large American law firm to replace its bankruptcy lawyers, was implemented by a well-known education company to give students access to their courseware using natural language, by a large tax consultancy firm to analyze huge financial datasets and by a healthcare firm to assist in the diagnosis of oncological diseases. Previously, it would not have been possible for a human knowledge worker to conduct such a deep analysis and correlation of vast datasets in such a rapid and accurate manner. IBM is expecting $10 billion per year in annual revenues for Watson's 'services'.

This is just the tip of the iceberg. Similar technology will find its way in all sectors and industries as the upcoming economies of scale are truly considerable with massive rewards on the table for technology leaders.

Interaction with such computer systems has become more natural, opening up avenues of possibilities for closer human-computer interface with greater insights to be drawn and better analysis to be undertaken. Scientists can now represent visual data in graphs and models. In the future, they will be able to

interact physically with a 3D version of this big data enabling themselves to 'virtually' manipulate and change variables in order to develop more complex and intricate connections among data and validate hypotheses.

No doubt, one of the greatest areas affected by that automated knowledge is the business world. Prior to technology, many repetitive business tasks were done by humans; they were slow, inefficient, cumbersome and error-prone. Technology completely revolutionized the way companies operate, providing them with vast amounts of business intelligence in order to devise better and more informed business decisions with the big data.

Never in history has business operated at such high efficiency with the aid of technology and automation. The introduction of ERP (enterprise resource planning) systems for example, has allowed companies to have simultaneous, end-to-end view of their businesses, integrating human resources, finance, production, supply chain and other business verticals, providing them with real-time intelligence of all business functions, something that was unheard of just thirty years ago.

In the future, every business asset, every machine, every decision, every employee and every piece of business information will be sustained by this technology to deliver more accurate business control and decision-making abilities. For example, low stock items will automatically be ordered in, information regarding gas mileage on company cars will be available directly from car sensors, employee performance will be fed into human resources systems automatically and more will be directly linked into production and finance systems. Information such as location, usage, performance, depreciation of machines, goods and people will be accessible in real time, allowing organizations to identify where bottlenecks are, where unused assets are, if maintenance is required and how much the assets are truly costing. This will allow management to make better and more informed decisions from a live dashboard of big data information presented in an aesthetic manner.

Such technology will be vital in the fight against global crime with a crime databases disseminated to countries all over the world to be cross-referenced

with each other, and for billions of gigabytes of electronic communication data to be processed and analyzed, providing intelligence agencies with up-to-date and immediate information related to criminal activity.

It has been estimated that we produce globally over 3 million terabytes of data every single day from telecommunications, websites, social media, video content, control systems, utility systems, applications, networks, sensors, transactions, alarms and countless other systems (circa 2017).

Such a big data, calls for a big processing.

In order for it to mean anything it needs to be processed in an intelligent manner, which can only be done using automated knowledge systems that can filter, process, analyze and coordinate such huge volumes of data to provide their human counterparts with information conducive to decision making.

This has huge implications on how data will be accessed and stored.

It will lead to the creation of a new generation of database formats and ultra-fast storage systems, allowing faster, real-time access to streaming data, with the capability of linking huge amounts of disparate, semi-structured data in intelligent ways using artificial intelligence and neural networks easily accessible through natural instruction and 3D representation.

The mega data of the future means we will be producing billions of terabytes daily. This will be analyzed on the fly, intelligently, autonomously connecting to relevant data sources from around the world.

The development of this technology brings with it many pertinent questions that stakeholders will need to address:
- How certain can we be that such technology will produce error-free analysis and results?
- How do we ensure that the data being used by such systems is in itself error-free and correct?

- How do we encourage human knowledge workers to deal with machines that could potentially take away their jobs?
- What would be done in cases where such systems are deliberately fed with incorrect information?
- Will such systems through learning be able to make decisions about the correctness of the information they have and how much autonomy should they be given to replace it?
- Is it wise for us to rely solely on computational intelligence, and if so, is there any limit to our reliance?
- Can machines take over decision-making where humans rely on insights and intuition?
- How do we guard against intrusions and piracies that could invade such delicate systems?
- Is there any danger posed by such autonomous systems and what is the consequence of them becoming self-aware, if this is indeed possible?
- How much should we be relying on such technology for decision making just because we can?
- What laws and regulations are needed to govern the usage and scope of such technology?

If stakeholders can address these pertinent issues, such automated knowledge workers will ultimately progress to proposing unique and advanced solutions to mankind's problems. Until that time, such systems will progress based on the amount and quality of data they are fed, as well as the complexity of the AI algorithms they are programmed with.

While overcoming the many challenges such technology brings will not be easy, there are certainly ways for it to advance within the correct social, political, ethical and moral frameworks. This will change the knowledge landscape of tomorrow, providing truly expert, intelligent knowledge systems that support humans to reach superior decisions, working with them hand in hand to benefit the humanity at large.

Social Networks

Social networks are undoubtedly one of the largest phenomenon of our time, with such platforms radically changing the ways we communicate and socialize.

Such platforms allow the interaction of users to be monitored and tracked, which means they are an excellent avenue to use in marketing products and services. This now allows businesses to engage much more intimately with customers, providing them with customized advertisements befitting their interests.

> Technology connects us. Technology unites us. Technology amplifies our power.
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> *Vivienne Harr*

This technology is allowing workers to collaborate with each other in a more effective manner. The boundaries of a typical organization are no longer confined to the traditional four walls. Rather, social media technology is letting work to be transacted across traditional boundaries, sanctioning dynamic teams that are geographically dispersed to be assembled. This is causing projects to be completed much faster, with greater precision and higher expertise. It will mature as time goes on allowing dynamic teams to form and disband according to business needs, promoting further international collaboration between teams around the globe.

Social traits have now also become a feature seen in many applications we find in our midst. The embedding of social preferences in online products, services and entertainment is attracting users' opinion to be instantly gauged, and to 'like' a particular thing, almost as a statement of intent. This will evolve from 'like' to 'want' and ultimately 'need', signaling more commercial opportunities for businesses to capitalize on. People can share their experiences of a certain service or product, which will become more instinctive as time goes by through the assimilation of different accounts across platforms and tighter integration with the smartphone technology.

A lot of time in the workplace is dedicated to emailing, collaborating and general communication with colleagues taking up a good part of the working day. By using social business platforms to communicate, organizations providing a live environment for collaboration will be able to save much time. This is already being seen with the many social business applications now available for organizations providing live environments for teamwork to enhance their productivity. Such frameworks offer powerful knowledge bases to help solve future problems acting as a database of historical knowledge and expertise. Betwixt is an example of a unique social network for businesses that is a unique digital conversation engine. It harnesses technology to create more authentic connections and communication between individuals in a team based on a deep understanding of the principles of psychology, sociology, human behavior and philosophy. It will bring new life to online team collaboration and set a precedent in the world of social networks for business.

One innovative paradigm organizations are using social networks to solve problems is the use of crowd-funding where problems are posed to the public in an effort to get responses from experts for a fee. This competitive environment allows organizations to benefit from the best available talents to help them solve business problems without having to hire permanent resources. Without social business sites, such an idea would have previously been nearly impossible to implement.

" Social networks have made the world an interactive global village.

Talal Abu-Ghazaleh

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Crowdfunding is also being used to generate financing for entrepreneurs who have novel ideas that necessitate financing. In return, investors are given the product for free while also receiving a share of the profits from sales. This permits innovators to put ideas out to market and not have to resort to traditional banks for funding, allowing the lay man to invest in ideas that have business value without having to pay a fortune, and for entrepreneurs to quickly generate funds without resorting to traditionally hungry venture capitalists. To demonstrate the success of such platforms, one of the most popular sites for this is called Kickstarter which has generated over $3.4 billion of venture capital for over 137,000 different projects (circa 2017).

Property crowdfunding is becoming an interesting phenomenon in countries that have well established business and legal frameworks such as the UK. Properties are advertised and investors can put in as much money as they want, benefiting from the rent such properties generates and from property sales, while being totally managed by an experienced property management company.

Charities and individuals can also crowdfund for any particular cause by creating simple websites on specialist crowdfunding portals without incurring any fees. These portals provide all the tools needed for users to develop their campaigns and receive online payments, where a small portion is deducted as fees for site usage.

Online professional networks have become a popular way for people to interact with one another, building their contact base the world over. Apart from generic professional networks, industry-specific sites have started to emerge allowing for specialists to connect with their peers in order to share thoughts, offer opportunities and bounce ideas with like-minded individuals. Niche informational networks have also come about, enabling enthusiasts with particular hobbies to share ideas, pictures, projects and experiences.

Clinicians and medical professionals are now using specialized health networks to assist patients in obtaining answers to their medical conditions. Patients no longer need to rely on local diagnosis and can now easily receive second opinions from medical practitioners the world over. A development

from this has been the establishment of closed social networks for medical professionals, allowing them to consult each other when need arises to help resolve unique medical cases.

Many personal social networks are now being used by millions across the world. Beside posting status and videos, people can place instant pictures of their whereabouts which automatically delete after a while, delivering live feeds and commentaries on issues of interests and follow celebrities and personalities the world over.

Online educational networks are helping students to come together after school to help them complete projects, providing access to teachers and helping them to complete homework.

Counseling and support networks have been established online offering those needing advice and counselling to receive the necessary support regardless of their location. This is an invaluable service for those facing problems, giving them quality counseling without facing the boredom of personally attending counseling sessions. This is of special benefit to those living in precarious or dangerous situations who can anonymously receive the care they require.

Restricted social networks have also appeared where users must have certain eligibility criteria in order to join. Networks have appeared for the super-rich, allowing them to interface with others of their ilk, for government employees to share documents and improve process workflow, for researchers to conduct joint research in collaborative online environments and much more.

Looking at current trends in social networks, they are set to grow and we will see more industry-related networks sprout in the future to allow better collaboration across communities, industries and governments to deliver greater value.

Such networks will unquestionably take advantage of technologies such as Big Data and the IoT to equip users with richer, more powerful interaction methods, seamlessly embedding themselves into the daily lives of consumers worldwide. They will be invaluable to the society at large, especially to those who are socially isolated or physically disabled.

Cloud Computing

In recent years, cloud technology has become a focus of the internet world, bringing faster, more powerful resources to the end user without having to hold the technology capital directly. This has enabled many organizations to expand their functions without costly overheads, but with a flexible way to manage their IT infrastructure in a cost-effective manner.

> **"**
> There's a way to do it better, find it.
> *Thomas A. Edison*
> **"**

Cloud technology has brought massive processing power to end users that simply would not have been possible using traditional IT architectures. Cloud resources assist users to work online, in fact many services have now been set up by providers to help organizations reduce their local computational investment.

Cloud applications and services such as online word processing, web-based email, online customer relationship management (CRM) systems and the like, have led to a reduction in organizations' IT expenditure with such functions now being effectively outsourced to global providers. This has reduced the need for large local computational resources and associated staff as well as the need to install the latest versions and patch such systems totally taken care of by the cloud service provider. The process is fast becoming the IT paradigm of choice allowing organizations to rethink the way in which they receive and provide IT services.

Cloud services are not a new phenomenon. Their roots can be traced back to the days prior to the Internet where simple terminals were used to access resources available on a mainframe computer. The same idea applies to cloud services, only that the scale and impact is much greater. Simple devices can be used to access shared services on pooled cloud servers across the globe. While the idea is simple, what goes on in the background is vastly complex, with servers providing on-demand resources to users as and when required, ensuring resources are available for all users in a dynamic fashion. Organizations can opt to take on public cloud services, i.e. applications available to all businesses, setup private cloud for their specific computing needs, or adopt a hybrid architecture of public and private cloud services.

One of the key features of cloud computing is its elasticity, i.e. its ability to shrink and grow according to organizational requirements, and the reliability of such services when compared to in-house models. Having server farms managed expertly by cloud providers moves the onus onto them for server availability, upgrades and

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The Cloud will continue to streamline IT service provision globally.

Talal Abu-Ghazaleh

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maintenance. Organizations can focus on business without worrying about scaling resources to meet demand or about server reliability which is a huge concern in traditional infrastructure setups.

One of the biggest drivers of cloud technology is the availability of "thin client", i.e. devices that do not inherently have a lot of processing power such as tablets and smartphones. The proliferation of smartphones, especially in poorer countries, means the demand for cloud services will grow markedly as more and more join the internet revolution via mobile devices. The cost and necessity of smartphones will necessarily dictate that cloud services become larger and more resilient to cope with the rising demand. This has huge implications on the bandwidth required to cope with such an increased demand that will grow manifold. Cloud services are deployed through massive data centers with huge network capacity. Mobile networks will need to work hard to keep up pace with the demand for such technology as subscribers increase, which will spawn the age of super networks to cope with demand and requested content, such as high definition streaming, the likes of which 5G technology promises.

As with any pertinent technology great challenges are expected and the cloud is no different. Policymakers and IT companies will have to figure out how best to deal with the possibility of storing data in other countries due to the flexible nature of cloud computing and how to get around this where data needs to be stored in a particular location due to regulations. This is particularly the case with governments and banks who are rightly concerned about cross border data migration, issues surrounding data ownership and associated liability.

Another issue that will need to be maneuvered is the reluctance of IT departments to go to the cloud. This is natural as jobs may be at stake. IT

departments may feel insecure in handing over a portion of their infrastructure to an unknown entity as the feeling of control is lost. In any case, IT departments will need to acquire new skills to effectively administer cloud environments.

In general, the cloud will have a useful impact on the lives of consumers and will generate trillions of dollars of revenue as new, innovative services are developed and brought to market. This will be very relevant to media and software providers who will be delivering more and more of their services through cloud technologies rather than through traditional means. This will also be fueled by a new age of lighter, cheaper mobile devices and faster networks which will allow the millions in poorer nations to join the Internet and benefit from the advantages cloud technology has to offer.

Cloud platforms will particularly benefit small to medium enterprises, allowing them to set up shop much faster and scale IT as needed without having to incur unnecessary costs. The opportunity for organizations to become resource light is an attractive proposition driving the demand for more cloud services. Migrating services to the cloud is helping organizations reduce their expenditure on servers, networks, storage and associated applications, leading to real savings and less administrative overhead.

The pervasive nature of cloud services means that they are having huge impacts in the way services and products are delivered. One can see the huge take-up of online CRM services, productivity applications such as Microsoft 365 and the huge success of online retailers which is reducing the cost of offering goods, services and associated environmental footprints of in-house IT infrastructures.

Cellular Technologies

Motorola engineer Martin Cooper had a revolutionary idea. He wanted people to carry a phone anywhere they wanted. He made the first ever mobile call in 1973 using a device costing nearly $4,000 and weighed nearly 1kg. It took 10 hours to charge for a 30-minute conversation.

With dramatic advances in technology and rapidly falling costs, cellular technologies have now become ubiquitous and necessary in the modern age. Mobile devices have permeated globally allowing millions to communicate with one another in a manner that was never previously possible. This will continue to be fueled by cheaper, more functional smart devices as time goes on, allowing poorer nations to partake fully in the new digital economy.

Don't be afraid of new arenas.
Elon Musk

The International Telecommunication Union (ITU) estimates that mobile broadband subscriptions worldwide will reach over 4 billion in 2018. This shows a massive technology diffusion which will drive greater consumer demand for smart devices and services provided by the network carriers.

High-speed Internet is now available through most cellular providers worldwide making the smartphone a primary device used to access the Internet. The adoption of this technology will grow massively, bringing many more into the digital era. This will be powered by fast 5G networks, empowering global citizens by offering connections that are many times faster than current connections, with download speeds of around 1 GBPS, thus facilitating many novel uses and applications.

Applications on smartphones and tablets are rapidly growing, tailored to all tastes, including gaming, voice and health applications to social media platforms available for download. People now spend more time on their mobile device using data services than they do surfing the internet with a traditional laptop. This represents a huge opportunity for product developers who will see their revenues soar, they are moving along to accelerate developing more applications for mobile devices. Such devices also have a great potential to improve the delivery of healthcare and education services in particular.

Smartphones and tablets are becoming smarter through every technology iteration. Faster processing, better screens, more intuitive interfaces, better battery life and additional sensors mean that such devices are gaining advanced functionality, allowing a new generation of applications to be developed through location-based services, personalized information feeds and cloud services, to provide constant contact with friends and loved ones in a seamless end-user interface.

Mobile technology has the ability to address many of the issues developing nations face, allowing them to be active members of tomorrow's global digital world. Access to education, healthcare, governmental services and other basic rights could be easily delivered using cheap mobile technologies. Growth will be dictated by users who will demand more services as they become more technology literate.

The future smart device will be a multi-purpose tool.

Talal Abu-Ghazaleh

59

As mobile internet devices become fully integrated into daily life through augmented reality add-ons, they have the potential to become intelligent personal assistants, helping us through our daily lives, enabling the elderly to identify objects, managing schedules, answering questions and even alerting us to important happenings in our environments. Mobile devices will be one of the main augmented reality devices used in tomorrow's world because of their portability and enhancing images of their surroundings with live informational snippets.

Healthcare is among one of the primary areas where cellular technology could provide great benefit to users all over the world. Packed with sensors and internet access, such devices could be invaluable to those with health conditions requiring constant monitoring. Patients with cancer and heart disease could be monitored through sensors which send back health data to a monitoring station staffed by medical professionals, alerting them of possible issues in the patient and providing proactive healthcare and reducing the costs associated with emergency room visits. In the future, smartphones will become a "doctor in the pocket" allowing for a variety of health-related applications to be developed.

Education could be provided to many of those in remote locations through the use of phones and tablet technologies, inviting more literate societies to come about where access to education has been an issue.

Governmental services could be more easily provided to citizens through better mobile electronic services, reducing the burden on local government offices and providing users with better and more streamlined services. Governments will need to understand such technology in order to facilitate access to its services, have appropriate legislation in place to deal with transacting online, increase research and developing performances to render them more functional.

Changes in job roles are inevitable as such technologies mature. While some jobs may be lost, more will be created, requiring higher degrees of technological skill to undertake, this will push today's workers to skill up in order to secure positions in tomorrow's economy.

Smartphones of the future will be seamlessly integrated with the IoT, Big Data and Cloud, providing a wealth of interactions and services that adds immense value to consumers. Using these technologies, smartphones will become more interactive with their surroundings.

At homes, phones will be able to connect to the fridge providing consumers with details of its contents, expiry dates etc., remotely controlling the climate at home, providing accurate usage of utility figures, connected to home CCTV camera and more.

In supermarkets, shoppers will be able to receive special offers based on their previous purchase history. Health enthusiasts will be able to use their phones to record their progress and receive meals suitable to their training schedules. The applications are indeed many and the information will be available on the fly, brought to the user through their smart device.

The devices themselves will change dramatically through the use of new technologies such as wafer thin batteries and flexible screens, allowing such devices to fold into various shapes and sizes. The screens will be of ultra-high definition, allowing user to view videos in 4k HD and provide holographic projector features to deliver an immersive end-user experience.

Future smartphone devices will be fully mind-controlled allowing seamless control over all aspect of the phone. With the aid of special add-ons, they will allow users to control their phones in a totally hands-off, voice-free manner, which will be of special benefit to the disabled. They will also become modular devices, allowing for peripherals to be connected to them the same way in which this can be done with a personal computer such as printers, keyboards, mice, all of which being wireless.

As the demand for mobile devices explodes, it brings in many societal issues regarding child development such as technology addiction and greater obesity. These issues need to be tackled by parents, schools, governments as well as technology companies. Those innovative enough to find ways around these issues stand to gain an enormous amount in tomorrow's economy.

The Blockchain

It is a technology to enable transactions that can independently be audited. Its structure contains individual records, called blocks that are linked together in a single list, hence the name: chain, whereby transactions are listed in it and validated by multiple computers on the Internet. Originally developed to store transactions related to cryptocurrency, the blockchain has become an innovative technology in its own right finding its way now into many sectors.

> A full, transparent, secure and electronic audit trail of transactions will benefit many sectors.
>
> *Talal Abu-Ghazaleh*

Its orderly aspect means that no one person has control over the blockchain copies as they are distributed across thousands of computers whereby all of them have to be in agreement for any added transactions, validated and reflected across at the same time in a secure, cryptographic manner. This provides levels of data security, integrity, and availability that simply were not possible prior to the advent of this technology as no one person controls it and it is prone to any type of failure. Such features make it an attractive proposition for any sector that needs to store and retrieve transactional information in a secure and rapid manner, with cryptos just being the start.

Our current financial system will be revolutionized with the blockchain technology that has many intermediaries at present as

well as being slow. Resolving any conflicts costs time and money and is often stressful. Blockchain technology will bring a faster, more transparent way for the financial sector to conduct its activities with almost instant settlement and a trusted audit trail with much lower fees. A truly welcome benefit for those remitting money abroad.

Present cross border trade within asset management can be expensive and risky where each party in the process, such as brokers, keep their own records. This creates room for error and possible fraud. The blockchain ledger will help reduce error by securely encrypting records and will eliminate the need for any intermediaries.

Insurance processors need to manually wade through many pieces of information including client history, fraudulent claims, fragmented data sources, to name just a few, in order to process claims. This makes it a very slow activity and error prone. The blockchain provides a perfect system for risk-free management and transparency. Its encryption properties allow insurers to capture the ownership of assets to be insured and quickly share insurance information with one another and impose law enforcement with minimal effort in a clear and simple manner.

Any type of commodity involving ownership such as property, land, vehicles, intellectual property, shares, etc. will be securely stored in the blockchain databases. Such ownership can be stored on the ledger along with contractual details of others who are allowed ownership. The decentralized ledger becomes a system for recording and managing ownership rights, increasing trust and enabling better efficiency.

With enhanced transparency of transactions, the blockchain is an ideal medium to record results of election campaigns that have been the source of many disputes in the world. Once a vote is cast, the blockchain will hold a permanent record of this transaction making it a trusted source of results nobody can tamper with. This will go a long way to eliminate election meddling and will provide all parties concerned with total trust that results are accurate and valid.

> **"**
> Without innovation we cannot advance.
>
> *Ahmad Mohamed*
> **"**

Delivery of goods and services including tracking and delivery confirmation are now key differentiators for companies in the supply chain space. Online as well as offline retailers will use blockchain technology to keep track of delivered goods and services as well as inventory.

The blockchain will have a huge impact on the way the IoT is delivered in the future. The idea of any item becoming an Internet connected utility will form the basis of future smart cities, but with billions of transactions, needs arise for a fast and secure way to hold and retrieve information on the occurring transactions as well as those scheduled for a future time. The blockchain will be a critical element in the IoT ecosystem providing transactional security which can be offloaded onto the blockchain and not be embedded within IoT systems, reducing their footprint, allowing cheaper devices to be developed and secure control over transactions to be achieved.

Smart contracts are an interesting new concept consisting of automated contracts that are self-executable based on defined criteria. The blockchain will waive the need for third parties to manage such contracts and can find use within many industries, such as financial derivatives, insurance premiums, property law, legal agreements and others, to ensure that all participants know the contract terms being implemented automatically once conditions are met.

Protecting online identity of citizens has become an area of paramount concern. Online identity theft, selling consumer information and the misuse of such information have been a cause for concern in recent times. Consumers need to feel they are protected and the blockchain is a cutting edge tool that can help achieve this. Securing personal, identifiable information on the blockchain will give consumers back their rightful control, allowing them to secure their data and disclose it only to parties they elect, thus protecting them from spammers and adverse marketing schemes.

Intellectual property (IP) stands to benefit immensely from the blockchain technology. This application is of particular interest to me as I founded a

world leading IP firm in 1972, namely Abu-Ghazaleh Intellectual Property (AGIP). It is quite possible that by 2030, any IP applicant in the world will be able to register a trademark by simply emailing all the required documents to an agent within the jurisdiction where protection is required. Ownership details along with information regarding renewals and payments could be stored securely and transparently in a tailored blockchain for the Intellectual Property, providing definitive ownership in an easy and distributed manner.

There are various international agencies responsible for maintaining trademark records, with the most advanced global trademark system under the World Intellectual Property Organization (WIPO). The WIPO could develop a new trademark blockchain for all IP records and issue a legislation recognizing this as the new shared digital register for IP filings around the world. This would improve current IP filing systems as well as reduce redundancy, expense and inefficiency in the manner such registrations are currently handled. Thus, registrations would be made easier, renewals could be automated and disputes would be much faster resolved. Perhaps one day, the world will end up with a shared global trademark blockchain register that would be enforced around the globe, managed by AI, with transactions ruled by smart contracts and fees accepted through cryptocurrency.

As a technology, the blockchain will have far reaching applications as it could also be used to store passport information, birth certificates, hospital records, work records, criminal records and any other information related to an individual or entity. It would provide governmental entities with a comprehensive repository of such information allowing to create their own private blockchain implementations to offer citizens better services, and intelligence agencies with accurate and timely information. It can also serve as a powerful anti-corruption tool as well as an instrument to settle conflicts and claims.

Wealth creation is the product of knowledge innovation.

Talal Abu-Ghazaleh

Augmented Reality

With the coming of the internet there has been a distortion between the worlds of technology and the world in which we live. The internet has become part and parcel of our lives so much so that devices are now being developed to expand the reality we see. A prime example of this are digital glasses and contact lenses that offer meaningful information about the space around the wearer, a concept called Augmented Reality (AR). This could be weather information, street information, dimension of objects around a person, pricing of items in a nearby store and a whole array of other useful information.

> Innovation is change that unlocks new value.
>
> *Jamie Notter*

This expertise originates in a military technology where fighter pilot helmets have had similar capability for many years, giving pilots split-second augmented information to make accurate and informed decisions. AR experiences will provide an opportunity to significantly improve businesses and personal lives of people through interactive tools in the workplace, at school and in the market, to the extent where this will become the norm. People will expect to have such augmented experiences when interacting with the world around them.

Applications of such technology can be seen with retailers starting to introduce smart mirrors, allowing consumers to virtually try on different garments to see which size and color suits best without having to physically keep changing. It can be seen in cars where windshields give drivers information such as speed, road limits, wind direction, cruise settings, temperature warnings etc. all without taking their eyes off the road while driving. Many aircraft manufacturers are presently using virtual glasses to help workers assemble complex aircraft parts and avert dangers in the workplace they could otherwise expose themselves to.

On a consumer level, augmented reality can be seen in smartphones where today you can point your phone into the night sky in order to identify constellations and get real time translation of signs and words in other languages. Even gaming consoles now have sensors to identify movement translated on the screen when users play games.

Consumers' lifestyles today have a permanent access to the internet through their smartphone and tablet devices. These devices are becoming smarter and more pervasive in the lives of humans, creating opportunities that never existed earlier. The opportunity exists for AR to be embedded in consumers' buying, providing them with immersive and interactive experiences online that will inevitably lead to increased sales.

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We live in two worlds, the real and the virtual. The virtual is now progressively encroaching on the real.

Talal Abu-Ghazaleh

With the AR technology, shopping for an item in a store will take a new dimension. Hovering AR devices over goods will show the colors they are available in, the sizes a store has, the ingredients a certain product contains, related offers and promotions as well as other pertinent information that benefit consumers.

Business will be profoundly changed through the ability to view goods in three dimensions within actual real world contexts such

as: how furniture would look in a specific office space, how a development project would look like on an empty plot of land and how new roads would look like within current city infrastructures. The interactivity and value that such technology provides will be transformational.

AR will change the way in which team meetings are held, as if everyone present is actually in the same room regardless of distance. This will make such meetings more engaging for everyone, as subtle nuances such as face-to-face communication, eye contact and facial expressions mesh together to increase the collaborative effect of such engagement.

Education in the future will be transformed with augmented reality. Imagine a science lab where complex interactions between chemicals are displayed live, a nature trip augmented with names of animals/plants, a virtual biology lab that shows how the human body works; all through a smart device, allowing each student to tailor the information displayed to them. This will surely deliver great value and enlarge the boundaries of education and learning.

> The new silk road is online commerce which needs new laws to govern its trading.
>
> *Talal Abu-Ghazaleh*

The medical profession will see a great host of benefits especially in the areas such as plastic surgery where surgical results will be seen on a person in real time before the operation is actually performed and where reconstructive surgeries are better planned by the surgeons. The medical profession has already started using augmented reality to guide patients through complicated health procedures.

Training using AR technology will become richer and more immersive for trainees. Interactive 3D models, rich graphics and multiple sensory content will allow step by step processes to be effectively delivered, providing a much greater depth of knowledge and understanding than through current training methods.

New approaches in the field of marketing will come about, allowing companies to paste simple pictures of their products in public places, which would change to interactive, animated adverts once an AR device is placed over it, enabling companies to hand out a much richer experience to end consumers.

The world of entertainment, particularly video gaming industry, will be able to leverage such technology to greater benefits. Augmented games have already begun, like the recent release of the AR Pokémon game in 2016 where players had to collect them by using their smartphones and drive around cities to find them in real world locations. This will expand allowing gamers to become much more interactive in their gameplay.

The film industry is another interesting field where AR technology will find its way into. Imagine using an AR device to view a film on a TV and then interacting with it, looking around scenes in more details or even attempting to find clues to solve a murder mystery. The possibilities here are very intriguing, they give rise to a new generation of interactive AR films. Magazines may also take an interesting turn by displaying more information about products being advertised, providing greater information about articles that were written with appropriate links and tips, showing exercises in 3D, video clips of events and more.

With AR, traveling abroad will take on a new dimension. An AR device will be able to tell you what's around you, draw directions to local attractions, translate menus, provide interactive information about museum exhibits and guide you to places of interest, all in your language.

The examples given here are not fiction but currently in their developmental stage. A time will come where AR will permeate every aspect of our lives to provide us with richer and enhanced information in order to be able to make more informed decisions about the environment around us.

Renewable Energy

Renewable energy is an area of utmost importance moving forward as the rate of fossil fuel use declines globally. The idea of having renewable sources of energy is of vital interest as without energy, nothing functions in any society. Up till this time, renewable energy sources have been relatively expensive to produce compared to their fossil alternatives and have not received the attention they deserve. The future will be very much dependent on the renewable energy sources which will be driven by technological advances in these fields in order to reduce the impact we have on the environment and help offset the effects of global warming.

The 2015 United Nations Climate Conference in Paris confirmed what many have argued for some time, that renewable energy is indeed a real alternative to fossil fuels and is necessary in order to avoid catastrophic consequences of climate change. It also called upon governments to take this matter with the seriousness it deserves and focus on what needs to be done in order to promote greener production of energy.

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Renewable energy is paramount to our survival in the face of the looming fossil fuel crisis.

Talal Abu-Ghazaleh

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The gradual adoption of such technologies will help drive costs down in the long run. Governments' subsidies and concerns about global climate change will support their adoption as real alternatives to coal, oil and gas. Greater availability of renewable energy will push companies to set up greener operations and decrease the demand for ancillary equipment and services, driving down barriers and costs associated with entering this market. Public concern is also a great driver to impel countries to become greener.

Technologies such as solar and wind power are presently the two main renewable energy streams and natural alternatives to fossil fuels. There are certainly other renewable sources such as geothermal, nuclear, hydroelectric, but solar and wind remain the predominant two and the least controversial. A lot of investment is going into these within developed economies and more importantly, heavyweight energy giants such as India and China are promising to invest more in solar and wind technologies. Undoubtedly, utility companies have a huge role to play in supporting this transformation by investing in such technology and weaning themselves away from reliance on fossil fuels for energy production.

Advances in solar technologies in particular will be soon available in our homes, buildings, streets and other sectors in our societies. The cost of such technology is falling as improvements are being made, meaning that in the future it will be available to everyone at an affordable price. In the near future you will find many types of solar technology with thin, foldable, pliable plastic cells that will be used in a wide variety of applications to bring renewable energy to many spheres in our lives.

With the greater use of renewable energy resources, suppliers of fossil fuels will be adversely affected by the dwindling demand for their products. Fossil fuel suppliers could also face government sanctions that would add to their costs such as pollution taxes, for example. Renewable energy sources could represent an opportunity for those heavy users of energy to undertake more environmentally sustainable operations.

Interestingly, electricity-generating fabric is now a burgeoning technology presently being tested. The concept behind this is to use the heat human body

generates to allow specially designed wearable fabric to generate electricity in a safe manner, enough to power a portable device such as a mobile phone. As this technology develops, it will allow each of us to be responsible for our personal energy needs, taking much weight off the traditional electricity grid.

Current controversial renewable resources like nuclear energy will also become much safer and more portable in the future, even safe enough to power our homes. Such technology will also be used in transportation, just like when the first petrol engine was brought into general production. Hydrogen powered vehicles are already being tested so it is just a matter of time until we have the first nuclear powered alternatives that are clean, safe and long lasting with little or no pollution.

Science will push the bounds of such technology and find solutions to the challenges such alternatives face. Using renewable energy may not translate into direct savings for the end consumer, yet the main benefit would be reduced carbon footprints, a healthier environment and better water quality. This would have far-reaching implications across the world, particularly on human health in developing economies.

Space-based solar power (SSP) is an interesting source of renewable energy by using massive solar panels orbiting the earth. SSP is a research concept at present, yet it is predicted by NASA that by 2025 space-based solar power will be commercially viable. We will be able to collect power in space on suspended networks and the power will be beamed back as microwaves to the surface of the Earth. These systems will have higher collection rates than anything possible on Earth's atmosphere. In outer space, there will be no interference from the filtering effects of atmospheric gases. Within three or more years of the first orbiting solar array, it's predicted to be profitable. In short, space-based solar will be cost effective: it will save space and time.

SSP doesn't emit greenhouse gases, does not affect our fresh water and other natural resources and doesn't need land on Earth. Unlike nuclear plants, SSP won't produce any hazardous waste that we've got to store for hundreds of

years because of its toxicity. SSP will be available 24 hours a day 7 days a week all year round and in huge quantities. It will work regardless of weather conditions and is a solar collection method that shows immense promises. The only downside of SSP is the sheer size of the arrays. Development is needed to bring down the costs and to figure out ways of constructing these huge networks in space.

Photovoltaic transparent glass or PTG, is a transparent glass integrated with solar cells to convert infrared and some of the visible light into electricity light waves. This means any window of an office building can be used to produce electricity. This is phenomenal. Imagine an entire office building covered with windows on the facade that can convert light energy into electricity.

PTG can be used to retrofit existing window using ordinary methods that exist today to coat windows so that they can be converted into photovoltaic cells. The use of these transparent photo voltaic cells or PV cells can be a game changer. This could mean that something like your cell phone screen can be a PV solar cell. Such emerging technology takes energy production off the grid and literally put it in the palm of your hand. Building developers are seeing the potential of this technology and are experimenting on window glazing for high-up homes and buildings.

Many companies are already working on innovative, effective and affordable designs, with solutions for transportation, homes and business sectors that will no doubt increase the adoption of such technology and encourage further research and development in this field.

A key factor in its adoption will be how to efficiently store such energy. It's all well and good generating electricity, but without proper storage it becomes useless. This will lead to the development of a new generation of batteries, much more capable of those in use today, with long shelf lives and capacity to store larger amounts of energy. These will come about through advances in nano-polymer membranes which will allow much more efficient designs in batteries to deliver better and safer energy storage technology.

Genomics

Sequencing the human genome has led to a much-improved understanding of the human body. Advances in computing technology have made genomics possible, allowing scientists to develop novel approaches in healthcare and medication.

Sciences such as gene sequencing now provide a deeper understanding of how genes work and affect the human body. This is allowing scientists to tinker with the DNA within cells to help treat previously incurable diseases, build tailored organisms to help fight cancers, improve early disease detection rates and develop new-age drugs, targeting biological diseases and problematic genetic mutations.

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The science of today is the technology of tomorrow.

Edward Teller

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Our understanding of the human body is vastly improving as more powerful computers are being built. Just as home blood pressure monitoring devices are currently available, in the future technology will evolve to the extent where personalized sequencing of genes will be available through home PCs.

Gene therapy services will be available online enabling patients to upload their sequenced gene map and receive personalized health data as well as cheap, tailored drugs from across the globe. What previously took the science community thirteen years in the case of sequencing the human genome, will be done in minutes with future computing technology.

Stem cell technology is an offshoot of what is arguably one of the biggest game changers for healthcare provision in the history of mankind. Through the careful modification of stem cells, humans will be able to live much longer, healthier lives and cure many crippling diseases. Aging will be treated just as any other disease, as every bodily function will be able to be regenerated, leading people to having longer lives. Umbilical cords being a rich source of such cells are now preserved as a type of health insurance for new-born infants in the future.

Other industries such as agriculture will greatly benefit through advances in genomics. Although there is a controversy surrounding genetically modified foods, this could be a very useful science to help improve crop yields, produce better crops all year round and help to eliminate starvation problems in famine-ridden countries when the legal, ethical and safety considerations are fully addressed.

Areas such as hydroponics will be transformed by using modified mineral solutions instead of soil and fertilizers and will extract water from warm, moist air in areas where water is scarce. These feats may seem like fiction, but they already have a basis in today's science.

The fuel industry of the future will benefit greatly from genomics by being able to produce synthetic fuels from living bacteria. These biofuels will be pollution-free alternatives to the fossil fuels of today and will be readily available to help alleviate the fuel crisis we face.

"

Genomics is providing innovative solutions and will literally change us from the inside out.

Talal Abu-Ghazaleh

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As we move to a greener world, waste disposal has become a key topic of interest in order to reduce the mountains of waste that modern populations are producing. Designer bacteria are being developed that can safely devour waste materials and produce very little resulting pollution. This has huge implications on waste handling and the health of millions which is being affected detrimentally by wrongly dealing with waste disposal. This type of synthetic biology is still at its infancy and will see companies investing billions in order to make it a serious industry of the future.

As science improves, altering genes will be as straightforward as programmers generating programs using computer code. High-level programming languages will be available to scientists who will create cells and organisms with specific genes just as easily as computer applications are developed today.

While this technology will create many social benefits, scientific challenges associated with it are indeed many. These will include the various ethical, social and regulatory issues related to the development of the technology as genetically modified cells carry with them risks that could affect the natural ecosystems we have. Nature has a very powerful defense mechanism and may react by mutating bugs even further in response to genetic mutations. With knowledge of the long-term results of genetic modifications still in its outset, caution as well as control should be observed as we indulge in this new science.

Questions also arise regarding the privacy of genetic data, who owns it and what it can be used for. Biologists will need to put down a strict code of guideline for genetic development and ethical issues that should be thoroughly discussed at all levels as the repercussions are far-fetching.

A strong regulatory framework will be needed for genomics to operate within. If these issues are adequately addressed, this field certainly has the potential to revolutionize many aspects of our lives.

Smart Things

1. Smart Education

Education is a fundamental human right every nation strives to obtain. The immense value of a proper and formal education can totally transform and propel states into economic giants. With today's technology revolution, all doors are open to make education accessible to every person on the planet. Traditional teaching practices are being replaced by novel approaches using technology, meaning that students and educators are no longer restricted to the confines of the traditional classrooms. Future education will be borderless and teachers will become technology facilitators, teaching students how best to use technology for the purpose of knowledge acquisition. The change has already begun and those who fail to embrace it will soon find themselves adrift.

Many educationalists have spoken about the failure of the current education system and how it declines to properly equip students with the knowledge required to work in this digital era. Surely, a tsunami

> Technology enables education. Education empowers people.
>
> *Talal Abu-Ghazaleh*

of technology will soon hit the education system, bringing it online and revolutionizing it for the better.

Today's students are digital natives, e-learners who can tap into the massive online repositories of information. Technology for them is second nature. Teachers are digital immigrants who embraced technology later in their careers. The success of future education lays in catering education for the digital natives while equipping them with the necessary technological tools to facilitate such a task.

This will propel education to become an online endeavor with online education becoming the norm rather than the exception. Online education will be able to reach the millions of students who currently face obstacles in obtaining proper learning. Such education will need to be of superior quality with relevant content. Students of the future will be much more demanding due to the technology and interactivity they will be used to.

As technology advances in the future, devices such as laptops and tablets will advance from being passive technology devices into intelligent ones. This will be through progressions in areas such as artificial intelligence where such devices will provide tailored learning to students based on their particular learning styles through virtual reality, interactive simulations and augmented reality to provide much richer information and interaction.

A better understanding of how the brain functions and the nutrition needed to boost this will also be available, allowing students to become much more productive. Smarter humans will inevitably lead to the development of smarter technology and smarter societies, pushing further the bounds of education to become a personalized activity, barely resembling the education we see today.

The classrooms of tomorrow will be completely transformed from the blackboard classes of today. Technology will have crept into every aspect of learning and classrooms will be fully equipped with intelligent whiteboards, artificial intelligent robots, reactive materials, mobile tablets instead of

textbooks for students as well as virtual reality conference facilities. This will provide a much richer environment for students and a more challenging pitch for teachers who will need to know how best to use such technology to help students achieve good learning outcomes.

Students will be equipped with digital devices as a replacement for textbooks and writing books that will contain a history of the students learning in a secure way, including all books, projects, assessments and notes which will be taken directly on the device. Students will actively participate with each other through social media platforms for classrooms which will act as a repository for questions, ideas, etc. with students accessing such channels through their digital devices as lessons go on. Interaction with the teachers will be through Smart Screens. Teachers will be able to address questions, put up polls and bring pertinent ideas to the attention of students. Social media platforms will also be used out of hours when students complete their homework as study sessions or get-togethers, allowing them to help each other and benefit from greater interfacing.

All projects and homework will be submitted online and students will receive grades through their class's learning management system. There will be no handing in of books or printing off of school projects. All work will be shared with all stakeholders immediately and feedback and grades will be given online. Even student attendance will be taken online.

Classes will be recorded and will be available digitally for students who miss classes. This will act as an archive for students to refer to if they didn't understand something in class and will mean that distance or bad weather will no longer be excuses to miss class. Teachers will be able to address classes from their homes if needed and students will be able to attend online.

Each class will have its own website and online classroom which will replicate what happens in the classroom environment. This will include attendance, timetables, calendars, videos of classes, homework, assignments, grades, links to online materials, projects and a whole host of other information pertinent to students and their learning.

All students will be able to share their screens with others and students will complete their classwork knowing it will be shared with classmates and other interested teachers. Students will be able to reflect on their work and the work of others, share perspectives, provide feedback and assist classmates.

Schools will have online digital portals where student information will be available for all teachers to see. Virtual galleries will be available to showcase students' work that could be art, audio or visual works easily searchable and shareable among teachers and student portfolios. Such portals will also be used to post latest school news and inform parents of what is going on in the school. In fact, parent/teacher meetings will also be held online for those who cannot make it to the school.

Artificial intelligence (AI) will play a greater role in the way education is delivered with classes having Internet-connected AI devices, allowing students to receive a tailored education in an intuitive and user-friendly manner. Such devices could take the form of robots or online avatars which will be able to assist in teaching by providing access to an up-to-date repository of content-rich information and help strengthen areas in which students are weak. Such devices would constantly monitor students' performance and provide teachers with granular detail regarding student progress in order to develop tailored student improvement plans.

Coupled with AI devices, augmented reality will provide immeasurably richer learning environments by allowing students to interact in a virtual environment. Students will be able to explore human bodies, dissect animals, conduct chemistry experiments, see the laws of physics in action, experience history and geography and much more, all through

> Finland is leading the knowledge-learning revolution worldwide. Sweden is on its way to transforming all public education institutions into private ones.
>
> *Talal Abu-Ghazaleh*

virtual 3D models they will be able to interact with through special gloves and headsets. This will provide a greater understanding to students and allow teachers to impart knowledge in a more meaningful manner.

By using such technology, learning institutions will be totally revolutionized. Educators will be technology facilitators, truly democratizing education and forging a quality education accessible to all. Teaching and learning will become a seamless 360 degree process taking place in a stimulating environment where teachers and students learn from each other and together acquire and disseminate knowledge with related applications.

Throughout my life, I have called for quality education as a human right and fundamental need for all to receive and assimilate. This can be only done through technological means as student numbers are increasing globally at an unprecedented rate. In order for students to compete on the international stage, we should be graduating true innovators who are capable of producing new ICT goods and services, rather than graduates with mere paper degrees. It was this vision that led me to establish a new paradigm in education: an Institute called the Talal Abu-Ghazaleh University College for Innovation (TAGUCI) which graduates innovators.

TAGUCI has been established under the premise that innovators are key to our future. It specializes in preparing the young generation with the required skills to become entrepreneurs in the new world of information technology, providing them with the requisite academic background, practical real world knowledge, access to world experts and all other auxiliary tools and services required for them to build ICT-based innovations. This is a true game changer in the field of university education which will be massively powered by technology and help to meet the growing needs of an ever-changing ICT-based global economy.

TAGE-Training

Talal Abu-Ghazaleh E-Training

Talal Abu-Ghazaleh International Diploma in IT Skills (TAG-DIT)

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Foundation Level Certificate awarded to

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The candidate has achieved the required standard in the following modules:

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Spreadsheets

Presentations

Databases

Electronic Communication

Chairman
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Candidate code TAGJO
June 2018

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TALAL ABU-GHAZALEH E-TRAINING

82

2. Cryptocurrency

The coming of the digital age has meant that alternatives have to be developed to facilitate the exchange of goods and services online in actual time. Online payments systems, linked with traditional banks systems, have been the first phase in this revolution.

The next phase will be the mass adoption of cryptocurrencies (cryptos) which will be purely digital in form, existing only in the internet ecosystem with the same characteristics associated with traditional forms of currency. Many have spoken about these being a bubble, but with the right governance in place, cryptos have the potential to be a massively disruptive technology once those with true potential are identified and given the correct framework in which to operate.

Here comes a question: what makes cryptos so valuable? Part of this is acceptance and perception in the minds of consumers where cryptos are considered a store of value, readily accepted and exchanged. The other part is in the characteristics it shares with value stores such as gold.

Cryptos are mined just as gold is mined in the traditional sense. They exist as a fixed number of digital coins within the crypto protocol's specific design that

haven't been dug up yet; similar to unmined gold in the ground. The crypto mining takes place within computers solving highly complex algorithms. Miners are awarded digital coins as a reward of the 'work' they perform for this effort, which creates blocks of validated transactions as a result of solving the complex algorithm and are then included in the blockchain; this is simply a highly secured, distributed, transparent public ledger of all transactions related to that crypto.

All of this is managed through highly secure cryptographic algorithms which makes it impossible for anyone to fake or alter transactions on the blockchain because of its strong cryptography, distribution and transparency, thus offering a safe and auditable environment for cryptocurrency transactions.

Because of the de-centralization, transparency and high security that crypto brings, institutions such as banks and money transfer agents will be rendered almost useless as everyone will be able to conduct their own banking, being able to send money almost instantaneously to anyone else around the world without fees. The uptake of cryptos is also starting to gain approval, with many retailers now accepting cryptos such as Bitcoin for services and goods.

Rather than fighting the trend which is already here, central banks will need to think of innovative ways to work with this technology to help regulate its use better, increase adoption, protect consumers and help to identify fake cryptos as well as fight criminal uses of legitimate ones, which is actually a problem with any currency, digital or not.

Many banks are in fact already working in consortium to develop their own specific cryptocurrency for interbank transfer and have successfully conducted live transactions. It is envisaged that they will have a fully-fledged implementation running by 2019. No doubt other sectors will follow to develop custom-made cryptos befitting their needs. Indeed, some governments, such as those of Dubai and Estonia, are already considering the adoption of cryptocurrencies.

Will cryptos totally replace fiat currency? I don't think that such a scenario is likely. What is more likely to happen in the next 10 years is that both will find their place in the societies in which we live.

We don't live in a completely digital environment and certainly have a long way to achieve this. If this is ever realized, only then will cryptos have a chance to replace our traditional currencies, but commodities such as gold and fiat currencies will certainly retain their positions as the preferred form of currency for a long time to come.

3. Smart Commerce

Digital commerce has seen a rapid growth since the dawn of the Internet. Goods and services have been transformed in the way they are delivered with the ease of use that digital technology has brought up. Online retail businesses could not have existed prior to the availability of digital commerce, now providing access to a much larger consumer base at a fraction of the cost compared to traditional marketplaces.

Digital commerce has matured over the past years and will continue to do so to the point where it is no longer about the technology, but rather the value delivered to the consumer. Online commerce stores are competing fiercely for business. There is no longer a serious retailer that does not have an online presence. The cost of losing out

It's not that we use technology, we live technology.

Godfrey Reggio

has become too high, with online stores running in parallel to their bricks-and-mortar counterparts.

Online retailers have crushed traditional retailers, bringing goods to the masses in an easy to view, convenient and interactive manner to offer much more varieties than traditional retailers possibly could. According to 2017 Q3 statistics published by the US Census Data, digital commerce in the US represented over $115 billion in real value. This is amazing considering the infancy of the Internet, and that this only represents data regarding consumer spending habits in the United States. By 2019 digital commerce worldwide is set to be worth over $3.5 trillion accounting or around 13% of all retail purchases. This figure will grow noticeably as Internet penetration improves in current third world countries and more consumers come aboard.

Online payment methods have enabled online commerce with consumers having strong faith in technology and readily using it as an alternative to real cash. In fact, the use of digital currencies has exploded so massively that there are now digital currency exchanges similar to those of traditional currencies.

Lower barriers to business entry will mean that many more entrepreneurs will set up shop online without having to incur the huge costs associated with the traditional business. They will be able to compete with the massive Internet retailers of today using online marketing and social media platforms. No longer will business be about how big you are, but rather how effectively you can market your products to your target audience, how quickly you can react to market trends and the quality you can deliver.

The Internet has become an information behemoth, with an ever-continuing barrage of opinions and fashions being pumped through it relentlessly on a continuous basis. This will eventually have the opposite effect of the present status quo of traditional retailers going online; online retailers will be going physical, setting up physical outlets to display their products.

China is exploiting the internet massively through wholesale and retail websites such as Alibaba and its group of online stores. This puts Chinese sellers within

reach of consumers across the globe, meaning the goods can be viewed and ordered online in seconds, suppliers can be spoken to over the internet and containers can be booked and shipped; all without ever having to visit China.

The presence of online retailers has changed the paradigm in which consumers shop, leading to the development of sales days during traditionally low periods of consumption in the year. Online retailers in the West have introduced sales events such as Black Friday that takes place on the day after Thanksgiving Day (which is always a Thursday), and Cyber Monday that falls after Thanksgiving Day. Online retailers provide huge discounts during these days which are separate from online Christmas sales. Online retailers in the US generated over $6 billion in online sales during this period in 2017.

Alibaba has done something similar and introduced a yearly sales day called Singles Day in China, held on 11th of November every year. According to Alibaba, they managed to generate over $25 billion in online sales on that day in 2017.

Never has any type of commerce generated such staggering sales numbers in a single day!

In order to energize the ever-increasing amount of digital commerce, new advertising and marketing platforms and techniques are being developed to offer clientele relevant products they may be interested to buy. Google, the world's largest search engine, has spent millions to develop its advertising portal called AdWords which allows it to generate detailed consumer profiling information for companies to use. Through this, it generated revenues of over $79 billion in 2016. Social media advertising has now become a multi-billion dollar industry and will no doubt grow considerably as these platforms gain more maturity.

The world of logistics is being changed by the presence of digital commerce. Fast shipping times with full tracking of packages from warehouse to consumer is now expected, with many new intermediary niches popping up such as fulfilment houses handling interim storage, packaging and delivery. Delivery mechanisms are also changing with many online providers starting

to adopt delivery via mini drones to shorten local delivery times. With the requisite regulations in place, such a delivery mechanism has the potential to proliferate and change the pace of courier delivery.

Digital commerce is also becoming a game changer in the world of service provision and delivery. Many services are being outsourced to providers in different continents that can provide services cheaper and at better quality via the internet. This is opening up competition internationally which has both positive and negative consequences. In fact, specialist websites are now available where anyone can search for outsourced experts in practically any field from translation to tweaking a website, they all work remotely, deliver digitally and accept money via online payment. Even doctors are available online for remote consultations via specialized online medical portals.

Smartphones are set to take more market share as the primary device of preference to view and shop on such sites, which means that digital commerce companies will need to build their sites taking the limitations of such devices into consideration in order to maximize buying conversion levels.

In the future, we will see a growing digital commerce in Africa and Asia as their economies mature and specialist digital commerce sites are developed to fulfil the needs of local markets. The sheer number of consumers in these continents will dominate the Internet, meaning that current online stores will need to adapt to cater for regional needs if they wish to secure future business. This will encourage tighter cooperation between Western and Eastern logistics and mail companies to shorten delivery times to consumers globally.

During my term leading the UNICT Task Force, the UNGAID and the UN Global Compact, I called for establishing a fifth mode of trade to govern online trade and services and the negotiation of an Internet Economy Agreement with the goal of creating a Free Trade Zone for the internet. The World Trade Organization (WTO) that governs international trade, was set up in an era prior to the internet and needs to have a mode for dealing with new forms of online commerce which is regularly reviewed and improved.

4. Autonomous Vehicles

Through science fiction writers, the idea of having autonomous vehicles has been with us for some time. Today, such technology is slowly becoming a reality as unmanned drones are now common place in military reconnaissance and auto pilots have been flying our passenger planes for many years.

Self-driven cars for the public are now being tested by mainstream manufacturers for mass production with road, rail and sea conveyance as transportation methods which will also be disrupted by autonomous vehicle technology. A key component of this is a computer vision programmed to understand what is happening in its surroundings at all times. These visions need to be able to read road signs clearly, identify hazards, negotiate curves, read lane markings, stop at traffic lights and learn to improvise should information be missing.

The onboard technology needs to be an artificial intelligence brain that can take in hundreds of inputs per second in order to make physical changes to the actuators within the vehicle. This will require input from cameras, GPS devices, optical character recognition technology and radar-like devices to fully understand the surrounding environment in order to operate safely.

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The powerhouse of autonomous vehicles will be artificial intelligence.

Talal Abu-Ghazaleh

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Inputs will be taken from traffic broadcasts to help plan alternative routes and avoid areas of heavier congestion as well as being cautious in areas that may be accident prone. Such technology will require smart roads enabled with appropriate sensors in order for real-time traffic and weather information to be made available to such vehicles to direct them through. This will also need fast 5G networks to provide the needed communication infrastructure and facilitate split-second information transmission.

Autonomous cars will be able to conserve fuel by braking and accelerating smoothly, allowing vehicles to drive much closer together in a safer mode as the human element will have been eliminated. Google has been one of the pioneers in this area by altering various commercial vehicles to drive over 1 million kilometers in driver-less cars across the USA. They have developed their own Google Self Driving Car bringing the best of this technology into a small, purpose-built consumer vehicle, capable of negotiating US streets.

At present, we can see an interim step in semi-autonomous vehicles that can park themselves, provide drivers with information about environment around them such as approaching vehicles, and self-braking cars to slow down if they approach a vehicle in front of them too fast. This will eventually turn vehicles into social areas where people can sleep and work, changing from a typically seated environment into more of a functional workspace that can be used for work or leisure.

Manufacturers will need to carefully decide how to build this technology and what to do in situations such as steering away from a rogue pedestrian on the road compared to what impact this could have on the safety of the passengers in the car, or what to do if road markings end or what to do if there is an emergency detour.

In order to qualify such technology, governments and car manufacturers will need to work in unison to develop laws, legislations and improve their road infrastructures for such autonomous vehicles.

Streets will need to become smarter, providing more information to vehicles enabling them to make informed decisions. While the role of the driver will be somewhat diminished, the driver will be there as a backup in the face of any eventualities to take over if the automated driving system fails to proceed. This is comparable to the pilot in modern airplanes. It is also essential that manufacturers agree on some type of standard for autonomous driving vehicles so that they all behave in the same way and interact with each other seamlessly on the road as well as have fail-safe structures to ensure maximum passenger safety.

The trucking industry will be transformed by such technology with fleets of trucks being controlled by one leading vehicle, allowing heavy and dangerous goods to be transported with limited human intervention in a much safer manner than is possible today. With many hundreds of thousands being killed each year from human driving errors, autonomous vehicles would certainly bring in a new era of safe and efficient driving.

It's not a matter of "if" we will have driverless cars in the near future but "when". This freedom will reduce accidents and allow humans to spend their time in car much more productively. For instance, you will be able to catch up on your reading or help your child to finish his homework on the way to soccer practice. You'll be able to eat meals together in the vehicle and enjoy each other's company. Your commuting to work will no longer be wasted time. Parents of driving teens will not have to worry about the car being returned in one piece. Blind people won't have to depend on others to drive them around. Driverless cars will open up many avenues of usefulness and liberation.

In the United States, there are over 30,000 motor vehicle deaths yearly according to some statistics (circa 2017). That's mind blowing.

In essence, a small city population is eliminated every year due to automotive-related deaths. Add to that number millions of deaths that occur around the world from vehicle crashes. With driverless cars vehicular deaths will be rare. No one will need a driver's license. The road laws will change. The policing

of traffic will be almost negligible. We will no longer need the analog tools that we currently use to count vehicles or tell them when to stop or slow down to regulate their speed. All these things will be controlled digitally. With roads being safer, police departments and municipalities will be able to use their budgets on other things.

Will gridlock and traffic jams be eliminated immediately? No, not immediately, but over time these things will become history. Cars in essence will operate like train locomotives. In fact, mass transit may become obsolete in large urban centers where motorists will find it more economical and convenient to use a driverless car.

Traffic light synchronization is key in facilitating driverless transportation. Synchronizing traffic signals will eliminate massive congestion experienced every day in urban areas around the world. Carnegie Mellon University in the U.S. has started testing a smart signal system called Surtrac, which stands for Scalable URban TRAaffic Control. This system measures traffic flow, creates better communication between traffic signals and cuts down on wait times. Similar technology has been used in major cities like Singapore and Chicago with moderate success.

The next step would be to create a robust communication network between cities. The US Department of Transportation and the National highway traffic safety administration has already started on such a system. In this advanced communication network, cars communicate to each other and data is then interpreted and sent out through the network. The infrastructure for vehicle-to-vehicle (V2V) communication is in its infancy though. A key ingredient of success is a mapping system called GPS or geographic positioning system. GPS devices and apps on smartphones are already in widespread use. What is needed most now is a network of roadside sensors. This network will collect information on potholes, fallen trees, downed power lines and flooding to name a few. During new construction, sensors can be embedded by default.

Autonomous vehicles will change the face of car insurance. With automated technology, safety will improve many-fold thus reducing insurance premiums

that car owners pay. Insurance companies will need to be innovative in the way they provide car insurance for such vehicles in the future where premiums could be standardized due to the high safety features of autonomous cars and the elimination of human error.

As with any technology, systems security is a factor that needs to be carefully considered. Autonomous car manufacturers will need to carefully look into how such systems can be protected from hackers so that passengers and vehicles' safety is not compromised.

Autonomous vehicle technology will dramatically fall in price from the thousands it costs today to hundreds, becoming within the grasp of most consumers. New cars will come with such technology as standard while add-on kits will become available for standard car users, bringing elements of this technology to the millions of cars we have on the roads today.

Similar technology will eventually filter its way into other transportation modes such as rail and shipping, bringing economies of scale to them. This will inevitably lead to other forms of autonomous transportation coming about such as flying taxis for which ground schemes are already being set.

5. Smart Cities

With the growth and pervasiveness of the internet, it is only a matter of time that our cities become intelligent, almost taking on a life of their own. Cities all over the world are facing unprecedented challenges to reduce energy

consumption, build better roads, provide improved healthcare and construct greener buildings. Smart cities will take advantage of the technology revolution and introduce ICT-enabled environments in all aspects of our daily lives, controlled and connected through sensors and related devices that will be available through the IoT. This will usher in the coming of a smart world and permeate all aspects of human life.

6. Smart Governments

Currently we are seeing a massive push worldwide to develop electronic governments enabling countries to meet the needs of citizens in a more transparent and effective manner. This is leading to leaner government operations, better intra-departmental cohesion and improved service delivery which is also in turn shrinking down costs and helping to combat fraud.

Smart governments are a step forward from the e-governments of today. They represent a phase in the evolution of government services and operations. Once an e-government has effectively been in motion for a period of time, a consequential result is the amassing of huge amounts of information from a multitude of data points, KPIs and sensors, which can be effectively called governmental big data.

This data will represent a rich store whereby predictive modelling can be performed in order to accurately forecast how government function will grow, what services need to be improved, which services are in worst shape, how

well services are meeting the needs of its citizens and how best governments can plan for future growth taking into consideration people, processes, services, legislation, technology and budgets.

This will allow governments to grow in an informed, insightful manner, offering citizens an array of relevant and meaningful services, while maintaining lean operations fully enabled by technology, thus providing greater efficiency and transparency. In order to make such smart government systems truly functional, governments will need initially to scrutinize the way they work and make their current operations more efficient. In a word: to organize before they computerize.

Rules and regulations will need to be passed to ensure that relevant data protection standards are in place to safeguard protection of the consumer information, as well as recognize and accept digital authorizations across the board. Government employees will need to become knowledge workers enabled with the correct skills to make the wheels of the smart government function. IT literacy and internet penetration will also need to be addressed in order for citizens to engage effectively with their smart governments.

7. Smart Infrastructures

Infrastructures within cities in the future will be full of sensors. Sensors will be hooked into streetlights alerting when bulbs need replacing, coming on when there is movement, intensifying depending on the amount of darkness. Sensors on traffic lights and roads will feed into centralized traffic

management systems making our roads flow better. Such traffic information will also feed into car management systems informing drivers of jams and other irregularities. Automatic detection of license plates as well as driver faces will be commonplace, cross referencing information with vehicle and insurance records, thereby reducing car crime.

Utilities such as water and gas systems will have sensors in their networks, automatically diverting flow when needed, detecting leaks and automatically shutting off pipes and informing personnel of potentially dangerous problems. Up-to-date environmental health and weather information will be provided to the public using sensors scattered across the city, warning those with respiratory and other health issues to avoid certain areas.

In cases of emergency, intelligent first aid boxes will be available across our cities in the form of easily wearable devices, monitoring all vital signs, providing first aid and contacting health professionals in cases of real emergency.

Roads will be full of sensors measuring traffic levels, pollution levels and the amount of litter which may be on roads. Automated road cleaners will be sent out to clean roads and garbage collection will become a predominantly automated affair through autonomous vehicles and robotic technology lifting and clearing bins from designated locations.

8. Smart Buildings

Our future buildings will be fully automated and integrated into the Internet. All building management facilities will become intelligent devices through

the IoT, making buildings greener and less resource-hungry. Facilities such as lighting, heating, cooling, blinds, etc. will be intelligently controlled so that a building will know when to switch on and off air conditioning systems, control blinds, water plants based on soil moisture levels, bring in more fresh air when oxygen levels are low, put out garbage when bins are full, robotically clean windows when dirty, automatically detect and deal with any environmental issues that may occur, report on any electrical, gas and plumbing problems and much more.

Building automation systems will increase the comfort level of occupants, reduce energy consumption levels and make buildings greener and more autonomous. They will obtain feeds from a range of sensors in order to control every aspect of a building operation. Facility managers of the future will be highly IT literate in order to be able to set up, control and monitor such systems with much more granular control over building operations and less reliance on physical staff to care for such facilities.

9. Smart Living

Smart living will see smart technology appearing in our everyday lives and in particular our homes. Our homes will be very much controlled the same way that smart buildings will function, except on a smaller level. Every home function we can think of will be intelligent. Our fridges

will tell us when we are running low on milk and automatically order more, our ovens will switch off just at the right time to ensure we have the perfect dinner, our homes will be vacuumed by automated cleaning devices and the temperature of our homes will be intelligently controlled through temperature sensors. Voice controlled electronic equipment fully connected to the internet will become standard, providing much richer and interactive experiences.

A particular application which will revolutionize the lives of millions as our population lives longer is the need for automated healthcare devices which will relay our vital signs back to a central monitoring station, allowing for better, proactive medical care to be provided. People will have smart technologies implanted into them such as small chips or miniature electronic tattoos visible to the naked eye yet holding all their personal bio-data. There will be no need for ID cards as such devices will be tamper proof and hold all personal and medical records on them.

> Our city infrastructures will need to be fundamentally changed to deal with the inevitable dawn of smart cities.
>
> *Talal Abu-Ghazaleh*

Smart cities will enjoy an ecosystem of many different parts where technologies spanning different areas will be harmonized to work together and make such cities work. There will be many players in this ecosystem needing to communicate with each other in order to make such smart cities work.

Standards for the development of smart cities will come about, in order to integrate the various parts into a harmonious whole.

10. Smart Military

The military has always been at the forefront of developing the latest technologies that eventually find their way into the mainstream. With huge budgets allocated to defense spending, military entities globally receive billions to hire the brightest minds and utilize latest scientific developments to foster leading-edge defense technologies.

Traditionally, combat with enemy forces has been very human-intensive. Today, technology has changed the scene of the battlefield where we can see the increased use of advanced technological equipment leading soldiers to gain the upper hand and efficiently perform jobs such as intelligence gathering and field reconnaissance in a totally automated fashion. Soldiers are now being aided by live satellite imagery, technically superior fighter jets and advanced tanks, a scene completely different from just 100 years ago.

Robotic exoskeletons are undoubtedly one of the most interesting developments in the field of automation. This is when soldiers are outfitted with robotic limbs to help them carry heavy loads and even engage with the enemy using superhuman strength. DARPA is already testing such technology and it will only be time until we see real applications of this on the battlefield. This will evolve into fully

> Militaries of the future will be dominated by robotics and AI.
>
> *Talal Abu-Ghazaleh*

fledged exoskeletons for human soldiers and ultimately the development of fully robotic soldiers which will replace humans altogether. Today, a 'soldier' in his quiet, fully computerized room in Kansas USA can direct his drone over Yemen and shoot down "enemy" installations on the ground with smart guided missiles. This technology has the ability to be a huge game changer as armies will no longer be solely reliant on the human element.

Robotic mules will carry loads that can slow down ground troops and keep up with them autonomously in difficult terrain, moving ammunition, food and supplies. Such robots could also be used to carry injured soldiers safely out of battle zones and to interpret visual and voice commands. This will inevitably lead to fully autonomous army vehicles, able of carrying cargo, protecting soldiers and capable of automatically shielding themselves through the aid of artificial intelligence technology.

Future military armies will have robotic worms at their disposal, mimicking the earthworms by using artificial limbs to propel themselves through enemy territory. These silent robotic worms will be extremely flexible to penetrate most surfaces within the earth, moving silently into tight spaces to provide reconnaissance information to soldiers from a safe distance. Such worms will be made from advanced, indestructible materials and will become remotely controlled armies in their own right, acting as one of the many technologies that soldiers have at their disposal. This is not science fiction, the technology to enable this is under testing.

Robotic flies or flybots are already under development. These resemble real flies and can be used for reconnaissance missions in areas that are too dangerous or potentially a biohazard to humans. With the size and agility of real flies, such flybots will be used to fly into homes and buildings to deliver intelligence back to base. With solar technology onboard for propulsion with a rechargeable battery backup, they will prove to be invaluable to armies as they could be armed and used to single out targets, or sent out in swarms as an invading army.

Fighter jet pilots will use more augmented reality to sustain their missions. It will give them supplementary information regarding their surroundings and targets. Fighter jets will become more sophisticated to the extent of becoming completely unmanned and have artificial intelligence on board to help remote operators make their decisions. This is only a step away from unmanned drones which have become conventional in today's defense forces.

The microwave gun is a prime example of something that was depicted by science fiction writers to become a reality of tomorrow. This weapon is designed to emit microwaves at a certain frequency that enter the skull and are interpreted by the inner ear and recognized as a sound. This microwave blast could be used to emit frequencies to incapacitate humans. Microwave ray gun experimental technology is currently being developed.

Modern militaries are now starting to pursue and invest in computer deep learning where artificial intelligence-based computers are used to process enormous amounts of battlefield data and help with decision making in times of crises. This will allow army commanders to simulate in real time an entire war before any shots are actually fired, using live intelligence data gathered from various sources, a stratagem enabling army generals to simulate various scenarios to predict responses and outcomes that will be much more efficient than relying on human analysts to perform. This technology will help military leaders to strategize battles before they even begin and could even lead command and control activities in war time with the oversight of human counterparts.

Through the maturing of military technology, we repeat that the ultimate aim will be to develop fully robotic soldiers that can replace humans in the battlefield. Such technology brings out many social and ethical considerations that needs to be addressed. Robotic technology is advancing at a rapid pace and it seems that ultimately robotic wars will be the future of military powers the world over.

Climate Engineering

The weather has always been a subject of concern to nations since the beginning of humanity. Weather in the past influenced only crops and water supplies whereas today it affects many industries particularly tourism and agriculture. Man has always wanted to try to control the weather, be it using the rain dance of the American Indian Shamans, to other more scientific methods, e.g. by releasing chemicals into the atmosphere.

The idea of climate engineering is very appealing as it confers those having such technology a lot of power. Fiction writers have been avid in their descriptions of such technology and what it will allow states possessing it to achieve. Imagine a scenario where droughts are minimized, water is available on demand, natural disasters such as tornadoes and hurricanes avoided, skies cleared to bring in more sunshine and, more atrociously, where weather can be used for military purposes to make enemy states suffer.

While the fiction has been there for some time, scientific work on weather manipulation has been around since the 1950s where Wilhelm Reich, a controversial Austrian scientist, conducted a number of 'cloud busting' experiments and claimed to be able to produce rain by manipulating certain energy elements existent in the atmosphere. Although his results

were not accepted by the mainstream, this didn't stop others from trying similar attempts. From 1962 to 1983, Project Storm Fury was an attempt by the United States to weaken cyclones by flying aircraft into storms and seeding them (a technique used to enhance precipitation) with silver iodide.

In the 2008 Olympic Games, China was ready to use chemicals to help dissipate any rain clouds in order to ensure a successful Olympic event. In 2010, it was reported by major media sources that various UAE states had enlisted the support of many scientists who successfully created more than 50 artificial rainstorms over Al Ain, much to the bafflement of local residents.

In the United States, weather control seems to be one of the reasons for the setup of the HAARP (High Frequency Active Aurora Research Program) project. Started in 1993, the stated purpose was to investigate the potential for developing ionosphere enhancement technology for radio communications and surveillance. Many commentators have said that weather control was one of the research aims of the HAARP project. Whether or not this is true, it is clear that the US have been funding research into weather control technology for some time.

Any such technology will need to be carefully monitored and controlled and indeed, most importantly, there is a need to set out a consensus not to use it for military purposes. In 1978 a UN treaty was drawn out by the Environmental Modification Convention (ENMOD) that rightfully and explicitly banned the use of weather warfare.

Many implications come about with the introduction of such powerful technology such as: Who has the right to dictate what weather we should have? What are the consequences if we alter the balance of nature? What can be done if nations don't follow the rules? These questions need to be tackled by global lawmakers, as it is only a matter of time until complete control over the weather is achieved.

If the technology is used correctly, climate engineering has the ability to be one of the largest disruptive technologies of the future that will literally change the face of the planet.

Space Exploration
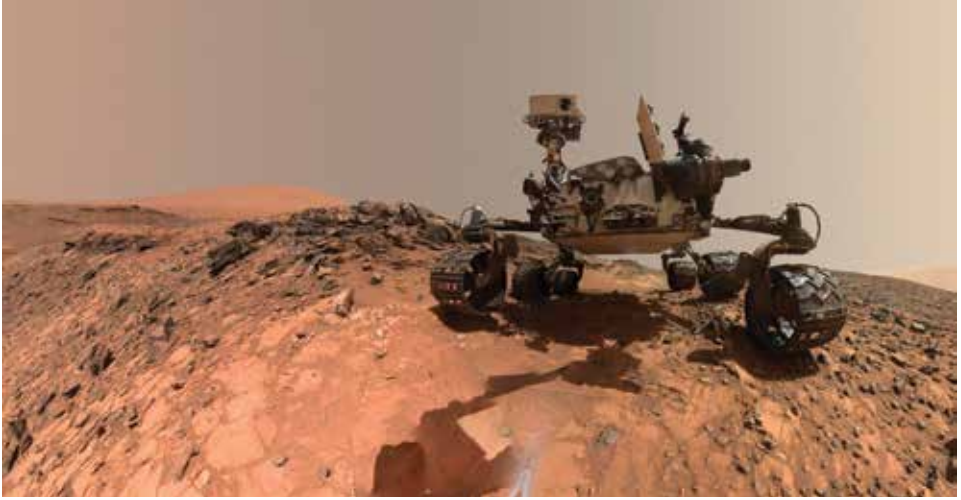
Man has always been intrigued by space, pondering over its vastness and what it contains. Again, science fiction has played a major role in transforming the way we think about space and the possibilities the future holds for mankind and its desire for space exploration. Since the first human flight into space by Yuri Gagarin in 1961 and the Apollo 11 lunar landing in 1969, scientists have been working hard to enlarge the frontiers of space technology to make fiction a reality. This has led to a space race between nations to see who can be the fastest to the farthest.

The establishment of the International Space Station (ISS) launched in 1998 was the first international attempt to put man into space for long periods of time. The station allowed man to further his understanding of space and led to an international collaboration between countries to push the boundaries of space science: the first step toward establishing an international base on another planet.

Space mining has a very interesting future especially with the high rates of depletion of resources the Earth is facing. The successful landing of the space probe Philae from the European Space Agency on Comet 67P is a factual testament that landing on asteroids is possible, although at present a very challenging technological task.

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The exploration of this frontier will be driven by knowledge, giving us access to potentially unlimited natural resources.

Talal Abu-Ghazaleh

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Chunks of asteroids that have fallen to earth contain metals like gold, cobalt, iron, nickel, platinum, and tungsten. With our modern, existing technology, space mining will be a reality sooner than we think; possibly as soon as 2025. Companies have already been using the International Space Station to test space crafts, bound for nearby asteroids. More probes are planned for the coming years.

In the near future such technology will become easier and cheaper to develop and will have entire robotic mining teams scavenging the cosmos for minerals, bringing them back to Earth, safely and cheaply. Nations will undoubtedly race to develop such technology in order to bring back these raw materials to their respective countries.

Another material that many will mine from asteroids is water. Water, consisting of hydrogen and oxygen, can be used to create energy in hydrogen fuel cells. The capability of creating this energy can change space travel as we know it and support life on distant planets. Water can be extracted mechanically or can be drawn out using the heat of the sun to drive the water out of the rocks. Then it's just a matter of collecting it and storing it for future use.

In order to control space mining, a global regulatory body is needed to put down a code of ethics as well as govern and monitor such activity. Who owns the rights to mine an asteroid? Who can buy and sell the resources collected? Legalities like these need to be settled ahead of the proliferation of this industry.

Space tourism will also come about, becoming the rollercoaster ride of the new age. Many companies will be offering trips to outer space. Today we can see many companies aspiring to such a vision and it is only a matter of time until we see adverts for space flight being offered to the public. Many technology companies are now in fierce competition to make this a reality.

Inevitably, man will travel farther than the Moon and will get to Mars, the planet many commentators have termed as the most suitable second home for man. Major challenges associated with this will include the supply of oxygen, water, and food in a hostile and remote location. Scientists will find ways to develop the basic necessities for man on Mars using artificially built

environments so that they become self-sustaining. Man will also travel to other planets beyond our solar system. Those that prove to be too hostile will be visited by robotic technology such as the NASA's Mars Rovers that are presently on the surface of the Red Planet. In March 2017, NASA unveiled a plan to send humans to that Planet. It is a 5-phase plan with an aggressive schedule to send man to Mars by 2033. The plan involves detailed rocket testing, conducting a round-trip using a robot and then finally sending man. Physical and mental health will be a major challenge during the months of travel needed for the journey.

Space telescopes and satellites will become more sophisticated in the future. These technologies have been the mainstay of space science and have been crucial in expanding our understanding of space from Earth. Space telescopes like Hubble have played a vital role in space science as an observatory in Space, and will get massively more powerful allowing scientists to study distant planets, galaxies far beyond ours and other space phenomena like never before.

Space travel will progress in leaps and bounds as new propulsion technologies are developed. The ultimate future spacecraft will not be liquid hydrogen-based but rather will work using anti-matter to fuel them. An anti-matter engine will take us far beyond our solar system and let us reach nearby stars in a fraction of the time.

Reusable launch systems also known as RLS and reusable launch vehicles (RLV) are technologies that have been experimented since the mid-2010s that translates into lower cost, and lower cost means more frequent space travel.

If space travel is more affordable and less wasteful, then it becomes an upward mainstream with a downward costs. It could turn out to be as commonplace as regular air travel or even as common as car travel opening up a new frontier of possibilities.

Deep Sea Exploration

The oceans of the Earth cover over seventy percent of the planet on which we live. This is a relatively unexplored frontier containing a vast richness of life and resources that far outweighs the resources man has on land. As land prices soar the world over, the sea with its abundance of resources will be the next place where industrial mining takes place. At present, the technology to mine is very

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Being the largest surface area in the world, the oceans make an ideal location to produce energy.

Talal Abu-Ghazaleh

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expensive, but soon, with remote-controlled underwater vehicles, deep sea mining will be done at a fraction of the cost than is currently possible. Raw materials such as copper, zinc and even gold and other metal ores are found in abundance in rocks and around hydrothermal vents under sea in much larger quantities than can be found on land making it a very lucrative business worth investing in.

Oil and gas companies are already exploiting such vast resources through offshore drilling and oil rigs. Other industries will join this race as land resources dwindle. In fact, some diamond companies are looking into exploiting sea based diamond deposits. All this means that the technology to mine underwater is becoming more attractive and will see more uptake in coming years that will eventually lower costs.

Human colonization of the sea is an interesting concept as land resources diminish. With a rapidly growing world population, land for human habitation is running out, necessitating that alternatives need to be found. Conquering the sea and building underwater cities could eventually become a possible alternative as technology makes such a proposition viable. The first steps towards this can already be seen with underwater hotels being built across the world.

A larger proportion of the world's energy will be produced by some form of oceanic technology. Oceans can produce many types of energy, the two major ones being thermal energy from water temperature and mechanical energy from the tides and waves. Being the largest surface area in the world, the oceans make an ideal location to produce energy using renewable thermal technology. No doubt this will be utilized to a greater degree in the future to satisfy mankind's constantly growing needs for energy.

Big Data

Since the invention of the first computing device, storage of data has been an area of paramount concern. After all, what good is computing if you can't store and retrieve information? Data storage of the past, including tape drives, diskettes of various sizes, hard disks, CDs/DVDs, USB flash drives, is being replaced with current storage technology based on electronic solid state drives (SSD) which are purely electronic and have no moving parts within.

Storage capacities have considerably risen from magnetic tapes storing a few bytes to SSD drives that are now available in terabytes. This rise has occurred in response to advances in technology, driven

> **"**
> Our ever expanding knowledge needs to be saved in robust storage environments.
>
> *Talal Abu-Ghazaleh*
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by consumer demand for larger storage devices as computing technology has become more sophisticated and useful. The relationship between the computer and the Internet has now become symbiotic, one being unable to survive without the other; their realities have merged.

The future will focus on providing data storage for the vast amount of information on the Internet, which is proliferating on an unprecedented level. This problem will become much more profound as the results of massive strides in the technological areas covered in this book.

Large, faster and more compact data storage will be the call of the day.

According to Eric Schmidt, Executive Chairman of Alphabet Inc., Google's parent company, the Internet had approximately 5 million terabytes of information hosted within it in 2017. With IBM stating that the amount of knowledge in the world now doubles every 12 months, it's safe to assume that most of this will find its way in some form onto the Internet, be it through the publicly available Internet or in closed proprietary databases linked to it.

This means that the figure of 5 million terabytes of information on the Internet will continually double on a yearly basis from 2017, in other terms, innovative storage methods will need to be found to deal with this deluge of data.

With current data storage mechanisms, there are limits to how fast a disc can spin, and how fast a head can read information. The future of storage in the mid-term are SSD-like structures that store and retrieve data electronically. However, electronics can only be miniaturized thus far until another plateau is reached.

A key concern with data storage using current technology is the amount of space the technology needs and the amount of heat that such data storage systems develop due to the amount of access such systems receive. The electromechanical systems we see today generate massive amounts of

heat, which in turn require special data centers and HVAC systems to keep them cool.

The ultimate future of data storage will no doubt be in the nano world and the usage of natural structures at that level to store it. Manipulating natural matter at the nano level is certainly a lot easier than developing nano storage devices from scratch and is indeed showing much promise.

Currently, research is being undertaken to explore how data can be stored in nanostructures within glass. Researchers have managed to store hundreds of terabytes on a glass structure no bigger than a coin. This is called 5D storage and has a promising future to help deal with the looming data storage crisis.

IBM has gone ever further and have managed to store information within an atom, with researchers at many US and UK universities going even further and storing information with the structure of DNA. DNA has very unique properties that allows massive amounts of information to be stored within its structure of A,G,T,C. As computing data is stored in binary code (0s and 1s), researchers have had to develop an algorithm to effectively encode binary data into DNA and vice versa. This has allowed a very dense, large-scale data storage method to be created that is theoretically capable of storing 215 petabytes of data on a single gram of DNA.

Using DNA storage, it has been predicted that all the information ever recorded by humans will be able to be stored in a location no bigger than a standard ship container. DNA is ultra-compact and doesn't degrade like traditional storage media, making it an ideal alternative as a long-term data repository.

At present the cost of storing data on DNA is prohibitively expensive and not feasible to be used for commercial applications, but as with all information technologies' costs, it will eventually come down and transform the shape of data storage.

Nanotechnology
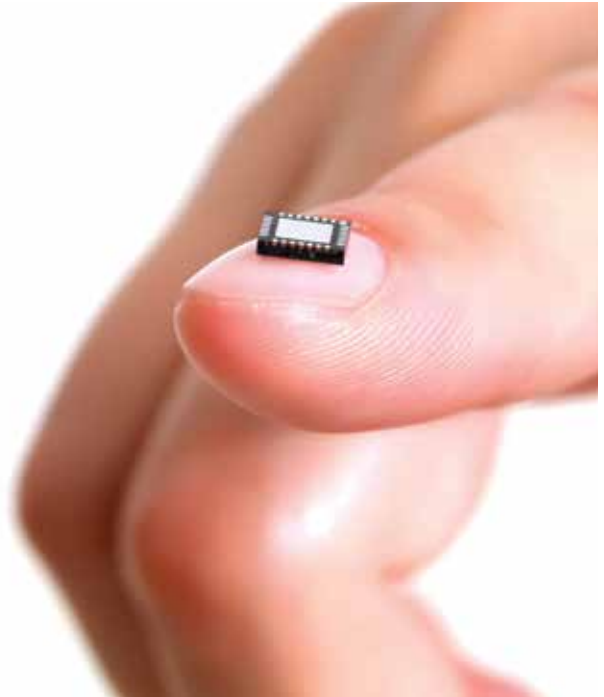
Nanotechnology is an exciting new field of study which brings together engineering, technology and science conducted down at the 1 to 100 nanometers level, making nanotechnology engineering extremely challenging. To put this into perspective, a sheet of paper is around 100,000 nanometers thick. The aim of nanotechnology is to engineer microscopic functional systems that can be used in many fields and applications. Due to the sheer number of areas nanotechnology can be applied to, governments such as the US are investing billions of dollars into nanotechnology research to help develop this new, sophisticated skill in electronics, medicine and energy.

Nanotechnology concepts were first talked about by the scientist Richard Feynman in 1959 when he described the direct manipulation of atoms. In the modern era, nanotechnology was enabled by breakthroughs in the 1980s, particularly with the development of

the scanning-tunneling microscopy in 1981, allowing scientists to visualize individual atoms and the discovery of graphene tubes or carbon nanotubes in 1985; one of the staples of modern day nanotechnology research.

Nanotubes will allow smaller, more powerful arrays of dense transistors to be integrated into computer processors allowing transaction speeds and processing to increase substantially. This will allow gigabytes of information to be processed with virtually zero effort, eradicating the current problem of the time it takes to achieve complex data analyses. Nanotube-based memory storage will let dense storage arrays to be developed, allowing petabytes of storage to be available on USB storage sticks with ultra-fast access times.

The fascination with nanotechnology comes from unique characteristics that materials display at the quantum level. At this nano level, materials display different characteristics to their macroscopic counterparts, permitting applications that wouldn't otherwise be feasible.

Nanotechnology depends on the ability to modify structures at the quantum level to bring about specific changes in a material that can be made stronger, lighter, more conductive, more durable and even self-healing. Nanotechnology also encompasses the manipulation of biological organisms to produce innovative solutions to health issues and also the development of robotic technology at the microscopic scale to provide a wide variety of functions.

Currently, industry is looking at nanotechnology at a growing rate to develop products with unique characteristics such as sprays with silver particles in them to provide anti-bacterial qualities and flexible solar cells that don't rely on silicon. The future will be rife with products based on nanotechnology developments to create innovative solutions to many problems in many sectors.

India has been using water purification systems with nanoscopic materials for many years. This nanofiltration system uses carbon nanotubes and alumina fibers. Nano-sensors are used to analyze contaminant levels in water

samples, filtering particles, chemicals, bacteria, and other pathogens. In environmental sciences, carbon nanotube mesh has been developed to help clean up oil spills.

Advanced materials have had a major impact on our societies and on manufacturing in general. The advance of lighter and stronger materials being developed has been a major reason for the progress we see in the current industries. Steel is a prime example of this, it fundamentally transformed the way we build cars, planes, buildings and everything in between.

Scientists are now constantly trying to build more advanced materials with unique properties to build the world of the future. This has led them to alter the actual matter that make up materials in order to create novel attributes within them such as self-healing and material memory. Gold for example, which is essentially chemically inert and insoluble at the macroscopic level, can become soluble and act as a powerful chemical catalyst at the nanoscale.

Nanomaterials have the potential to affect many industries due to these unusual properties. The graphene, an atomic slice of graphite, is one such nanomaterial which is very expensive to produce today, but with falling manufacturing costs, could have the potential to disrupt many industries.

Graphene is far lighter than steel, over 100 times stronger, and is the strongest material ever tested, with a tensile strength of 150 million psi. It can recover its original shape and has super electrical conductivity making it excellent for circuits and as a future replacement for silicon to design the next generation of super computer chips. With such superior qualities, graphene has wide-ranging applications in industry and production. A cousin of graphene, called 'triangulene' has been recently produced by chemists which boasts even more remarkable properties.

Such nanomaterials can help develop a new age of medicines, products and building materials as they have very unusual thermal, optical and electromagnetic properties that could be used across many technologies including advanced electronics, sensors and robotics.

It really sounds strange, but research is underway on clothes that clean themselves using nanotechnology. Stain and wrinkle resistant fabric is currently being used in sports clothing. Scientists are incorporating thin layers of titanium dioxide to break down dirt and other organic material on cloth helping to keep fabrics cleaner. Simply expose the clothes to natural or UV light and it cleans itself of dirt and microorganisms that cause odor.

Nanomaterials are now being developed to help improve methods of energy production, capture and storage. Such is the case with nano polymer membranes which selectively allow particles of one size to flow through while preventing others. This will dramatically increase the efficiency of HVAC systems and liquid purification systems. It will also help develop a new age of energy storage devices translating into ultra-efficient designs in batteries, capacitors, water treatment and refrigeration technologies. Tomorrow will see the availability of such nano polymers that can provide protective bubbles around hazardous substances which would have far reaching applications in saving the environment as well as human life from disasters such as oil spills and nuclear leaks.

With smaller, ever more complex electronic technology is being developed, nano electronics will play a vital role in the development of more sophisticated electronic designs. This disruptive technology is currently being studied in great depth by researchers and computer firms alike in order to develop the next generation of computer chips to facilitate quantum computing processing, bringing about a whole host of new applications and possibilities.

> Amazing new knowledge awaits us down at the quantum level
>
> *Talal Abu-Ghazaleh*

The synthesis of nano technology with organic compounds and materials is a very interesting possibility, making electronic designs of the future much more powerful, exploiting the best of both electronic and natural world.

This industry will see billions poured into it from a research and development perspective over the coming decades and will provide novel solutions in many fields.

The Singularity

The rate at which technology is progressing is truly staggering. The growth and converging of these technologies will end up escalating so massively that it will see the emergence of a technological singularity, a point in time where technology progresses so rapidly that it outstrips human ability to comprehend it. The Singularity represents a point after which technological advances will be so great, that there will be an explosion in intelligence. This will continue as we become vastly smarter as humans and begin to merge with the technology.

Mankind has come a long way technologically just over the past two decades with the introduction of many technological advances. Information is available at the click of a button and is being integrated into many facets of our lives. Computing processing power now more than doubles every two years breaking Moore's law, with companies

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The merging of man and machine will represent the onset of a new age in knowledge realization

Talal Abu-Ghazaleh

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presently looking at the molecular level to create the next generation of super-fast computer chips. This means that computational processing power will increase exponentially.

The next generation of technological evolution we are now seeing is based on artificial intelligence (AI) systems and robotic technologies.

The successive miniaturization of electronics has seen more sophisticated communications technologies being developed and the growth in nanotechnology research is now increasing at a noticeable rate as scientists try to find better solutions to the problems mankind faces.

These and other areas are subject to a principle called accelerated returns, meaning that they will see huge iterative progress in the forthcoming future, with decreased costs. The future of these areas does not just depend on them in isolation but rather relies on the intertwined advances that fields such as AI, computing, robotics, nanotechnology and genetics will bring together as a whole.

The Singularity will begin with massive strides in computational and storage power. If we go back to the early days of personal computers, in 1980, IBM introduced the first gigabyte hard drive. It was the size of a refrigerator, weighed about 550 pounds at a cost of $40,000. Since that time, progress in technology has been considerable with terabytes of storage now available for hundreds of dollars in a hard disk the size of a hand.

This enormous rise will continue with the development of new technologies. Companies such as IBM have already reported breakthroughs in the manufacturing challenges related to carbon-based nanotube transistors which show great promises in the development of the next generation of computing and storage technology. Computing power and storage is therefore set to proliferate until we reach a point in time where we have storage capacities matching and exceeding the power and storage capacity of the human mind.

The Singularity will not just occur as a result of increases in computational power. Advances in nanotechnology will allow full, intricate maps of the human brain to be developed. At present, science has impressive simulations and models of this brain using current scanning technologies. In the near future, nanotechnology will be small enough to enter the body and scan the brain from the inside, mapping it entirely with all its intricate structures. When this reverse engineering happens, it will be a huge step towards understanding the human intelligence.

With the requisite advances in computing power and storage, AI and a detailed understanding of the human brain, computers will have the ability to emulate human intelligence. At this stage, humans will be able to benefit greatly from the combination of the traditional strengths of human intelligence with that of machine intelligence. This will represent the beginning of the Singularity as it will provide a strong basis on which to build future technology. This brings with it a number of philosophical and theological conundrums such as what it means to be alive and what consciousness actually is.

Human intelligence is extraordinary at recognizing patterns, applying insights, acquiring new knowledge, inferring principles and using gained experience to solve problems. Machine intelligence is phenomenal at remembering huge amounts of information, recalling it rapidly and performing repetitive tasks with ease and precision. Machines can process vast amounts of data faster than biological counterparts, pool resources together from other machines and will be able to eventually reengineer their own code to become smarter, iteratively improving at accelerating rates.

Developments in nanotechnology, genetics and robotics will be astounding as time progresses. Nanites will be developed to have a myriad of applications in the human body as we have seen. These will be small enough to enter the bloodstream and will work with the immune system to fight off infections, helping to repair damaged organs and tissues, extending brain intelligence

and even repairing damaged cells. Human intelligence will grow rapidly as a result of such augmentation and the distinction between human and artificial will become truly blurred.

Interfacing the best of human and artificial will be an eventful prospect that will quite literally lead to the development of a new species of human being, far superior to man of the past.

This merging of man and machine will not happen in one go. What is more likely to happen is a gradual shift to supplement human biological intelligence with the artificial through the gradual augmentation of humans with neural implants. This combination of human and non-human intelligence will be truly formidable and will lead to repetitive episodes of future technological evolution, leading to an intelligence outburst that will have huge implications on all aspects of our lives.

What is also likely to develop as a result is a combined human-AI technology that is millions of times smarter than a human ever could be on his own, continually improving ad infinitum.

The thought of this is truly mind boggling.

Undoubtedly, strict technology development controls will be needed along with a strong legal and ethical code of conduct for developers in this field to work out. In addition, an increase in our values such as liberty, goodness, tolerance and forbearance will be vital in order for technology to reflect the high human principles we hold so dearly.

It's difficult to comprehend the full impact the Singularity will have on human life as the effects will be so widespread and dramatic. Needless to say, this will be a life altering moment for all mankind and will probably be the most disruptive event of all times, one that will change the course of history forever.

Health and Medicine

U.S. science fiction TV series from the 1970s such as the Bionic Woman and The Six Million Dollar Man depicted injured people being rebuilt with bionic parts to make them whole again, not only to become fully functional once more, but even to possess super human characteristics. With the advances in the IoT, robotics, genomics, nanotechnology and other sciences, it is clear man will have a much longer and healthier life than is presently possible with the advent of new technologies, techniques, drugs and insights.

The science fiction dream of the injured receiving artificially created parts and revolutionary drug therapies will become a course of daily medical practice.

Robotic augmentation is a natural step from the current world of artificial prosthetics, allowing wearer to gain back complete mobility with even greater precision and strength than would be possible using a human limb. The idea of having a "six million dollar man" will likely become a reality.

> Knowledge will allow us to eliminate disease rather than having to treat it.
>
> *Talal Abu-Ghazaleh*

Artificial organs will be easily available through developments in the area of stem cells technology combined with 3D printing. This combination has the potential to totally change healthcare as human spare parts which are totally compatible with the patient and have a zero chance of rejection will be available on demand. Being undifferentiated biological cells, stem cells provide healthcare suppliers with a blank canvas to build the organs they want. This will be as simple as programming them through a computer which will allow the resulting organ to be formed through a 3D printer.

The sequencing of genes will become commonplace, just like basic blood tests that are available today. Results will be available within minutes and will be more cost-effective to perform as the technology becomes cheaper and more widespread. The speed at which such test results are available will play a big part in faster medical diagnosis of potential diseases that a patient could be prone to, leading to longer, healthier lives.

These future technologies will have a fundamental impact on the way people age, the quality of life they have and how long they live. In fact, it can be said that humans will have to do something fairly drastic in order to die. Disease-related deaths will turn to be rare occurrences as they become more preventable.

Human limbs and organs will be replaced many times through the life of a human being. This will reduce the huge burden being faced by current healthcare systems as well as the amount spent on age-related healthcare provision.

Present-day manual surgery will become a thing of the past as robotic technology takes over. Coupled with AI technology, this will provide surgeons with much more sophisticated tools to perform complex operations with greater accuracy and more information to sustain clinical decisions. It's not too far-fetched for surgeons to be completely replaced by fully robotic surgeons similar to the fully

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There are no secrets to success. It is the result of preparation, hard work and learning from failure.

Colin Powell

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robotic car plants we see today, with human counterparts there to purely oversee the process.

IoT health wearables and remote health monitoring are new areas where consumers are expressing great interest in. The scale of this technology will grow immensely leading to the complete monitoring of a person's health from cradle to grave, giving a complete history of all possible health indicators and providing a basis for proactive healthcare. Such devices will become smaller in nature and eventually available at the nano scale, flowing in our bloodstreams.

The application of nanotechnology to medicine is an area destined to take huge strides in the future. Nanomedicine ranges from the application of nanomaterials to medicine to the development of nano biosensors and nano biological machines to help diagnose and treat a wide range of illnesses that present healthcare is struggling with. A major challenge which such technology is dealing with the toxicity of such substances, and preparing the immune system to accept such foreign agents in the body without seeing them as a threat.

Once such challenges are overcome, the reactivity of nanomaterials will make them a powerful diagnostic tool to detect many diseases and may be used to specifically deliver medicine to particular cells, rendering cancer treatments much more effective with less side effects.

Presently, universities are exploring nano-pore sensors in cancer identification. This will not only improve detection of cancer but many other diseases. These cancer-detecting nano-devices look for biomarkers in the patient's blood. In the future, these particles will not only detect the presence of cancer. They will administer drugs in a targeted fashion to eliminate the cancer cells while avoiding the patient's healthy tissue.

Forthcoming nano biosensors will be developed to float in the bloodstream and report back on the health of a patient to clinicians making medical diagnostics much more effective. This will improve proactive healthcare and will be a fusion of advances in biotechnology, robotics and medicine.

Innovative nano drug delivery systems will improve the availability of drugs to cells by directly interacting with them, making drug delivery much more effective than it is today, reducing the side effects of traditional medicine, shrinking tissue damage, helping to circumvent drug resistant mechanisms in the body, lessening the amount of drug that goes to waste in the human body through traditional delivery methods and improving the efficacy of drug conveyance.

The development of nano biological machines is an intriguing concept which will see engineered biological organisms used in the application of health treatment specifically developed to target certain diseases and interact with human cells directly. With human cells being around 10 nanometers in size, nano-biotechnology will interact directly at the cellular level to help repair human cells and fend off disease in conjunction with the body's immune system. This would create a highly advanced defense mechanism in the body which would take advantage of both natural occurrence and bionic technology working symbiotically.

These will be microscopic, self-learning entities that can be interfaced to provide a number of functions to the humans that are updated with instructions to reflect enhancements in medicine and healthcare. The engineering of such entities is certainly challenging as a substantial degree of precision and technical ingenuity is required in order to get over the technological, biological and physical challenges.

The field of drug testing will change dramatically in the future. The current testing done on animals and humans will end. This will be due to innovations in virtual simulation technologies which will allow fully physiological models of the human body with all its intricate functions and responses, to be totally mapped and available for drug testing. Using this, drugs trials could be performed on humans with different physiological makeups in a fraction of the time in order to determine any possible side effects. This will accelerate drug validation leading to the faster availability of new life-saving drugs.

Techno-ethics

The outbreak of technological development and its prevalence in our time has led to many social, ethical and moral dilemmas pertaining to its development, usage and effects on the society at large. Ensuring proper development, protecting against misuse, developing regulatory frameworks and publicly debating moral and ethical issues surrounding technology are essential components in constructing a vibrant and fitting ecosystem in which society and technology can co-exist.

> Technology brings with it many moral, social and ethical dilemmas.
>
> *Talal Abu-Ghazaleh*

The silo mentality of technology existing on its own without consideration for the wider environment in which it exists is no longer valid. Technology has wide-reaching implications which must be considered if a healthy, technology-based society is to come about, preserving human welfare and survival as an underpinning right.

Our growing dependence on technology has inadvertently assigned it as a great power. With such power comes

responsibility. This means that rights and responsibilities need to be consigned to technology, to its creators and consequently to those who use it and are affected by it. We cannot have ethical development without ethical usage. This is a two-way street for which ethically governing frameworks should be established.

Techno-ethics can be thought of as overarching principle under which each technology brings its own unique challenges and dilemmas that warrant separate discourses.

Techno-ethics must be a cross-disciplinary, dynamically transitioning paradigms that keep up with technological progress and should consist of behaviorists, technology experts and law makers, focusing on the very principles that we as humans hold dear, such as good and evil, love and forgiveness, right and wrong, transparency, responsibility and beneficence. Such values need to spill over into the technological world as our relationship with it becomes progressively symbiotic.

Technologies, especially areas such as AI and robotics, need to be imbibed with the foundational moral imperative of doing right. As a prerequisite, this sets the stage for us as humans to review the morality and values that we want our technology to reflect.

Some of the many essential questions that the broad framework of techno-ethics needs to address include:
- "What are the responsibilities of nation states toward technology, its developers and users?"
- "How do we engineer technology with ethics in mind?"
- "Should robotic systems have rights? If so, what should these be?"
- "What level of independence should be given to automated systems?"
- "What level of self-awareness can such systems achieve and what impact does this have on us?"

- "How safe are sciences such as the robotic augmentation of humans, nanotechnology and the Singularity?"
- "Who is held accountable when autonomous technology malfunctions or causes harm?"
- "To what extent should genomics be allowed?"
- "How will our biological world react to gene editing?"
- "What are our responsibilities towards technology?"
- "What is the impact of technology replacing humans?"
- "How much freedom should technology users be given and what type of control should intelligence agencies have?"
- "How can we deal with the barrage of fake news and cyber-crime plaguing the Internet?"
- "How do we provide a safe Internet environment for our children?"

These are just a few examples of the many questions technology brings with it.

Due to the growing maturity of technology, each area has become a vast ocean of knowledge and expertise. The impact and complexity of such questions are indeed wide ranging and require diverse teams to address them.

These highly specialized areas need the oversight of expert committees in order to develop safeguards to ensure that our human values are an intrinsic part of the resulting innovations and that human safety is not in any way compromised.

The World Commission on the Ethics of Scientific Knowledge and Technology (COMEST) under UNESCO has been long involved in issues related to bio and environmental ethics, but little has been done for the other technologies I have spoken about in this book.

I call for greater strides to be made as there is a pressing need to develop practical techno-ethics frameworks for all the technology areas we have in our midst.

Digital Citizenship

Linked to techno-ethics is the idea of building digital citizens that have rights, responsibilities and a code of conduct towards using technology correctly.

Just like a nation state, technology has its citizens: its users. The growing importance of the digital technology is necessitating that its citizens, especially our digital natives, need to possess the knowledge, ethics and skills to successfully harness its power in a safe and meaningful way.

We need to disseminate digital literacy and associated citizenship to digital natives, training teachers to direct students to better harness technology, as well as educating parents about digital technology so that ethical and safe online behavior is enforced at home.

Digital citizenship also needs to extend to all other users of the Internet so that they may pursue an online existence in a safe and proper manner.

"

All global citizens are digital citizens, belonging to the nation of the Internet.

Talal Abu-Ghazaleh

"

The Digital Citizenship Institute expounds nine principles for digital citizenship that I see as essential. These should be further developed and implemented on a global scale, they include:

1. Digital Inclusion and Access – Developing full electronic participation in society for all, regardless of location, gender, disability or social status.
2. Digital Commerce – Informing digital citizens about how to be safe and effective consumers in the digital world.
3. Digital Communication – Helping citizens make informed choices when faced with so many digital communication options.
4. Digital Literacy – Empowering digital citizens with the required literacy skills to continually learn about and use technology.
5. Digital Etiquette – Teaching all digital citizens to become responsible users of technology in society.
6. Digital Law – Creating and enforcing laws to ensure digital technology is used ethically and that illegal uses of it are deterred and suitably punished.
7. Digital Rights and Responsibilities – Developing a digital 'bill of rights' which are freedoms extended to every digital citizen, ensuring them rights such as free speech, privacy, etc.
8. Digital Health and Wellness – Teaching digital citizens how to cope with the mental and physical effects of technology use and how to protect themselves from related stress and addiction.
9. Digital Security – Training digital citizens on how to keep their data safe and protect themselves from negative cyber threats.

I also applaud the work undertaken by the ITU together with UNESCO in this regard.

They have made progress by discussing this topic at length and have produced a 'Digital Skills Toolkit' which provides guidance on how countries can develop a digital skill strategy to help prepare digital citizens for the future.

While this is a good start, more needs to be done.

We owe it to humanity to set the basis for the digital world of tomorrow, today.

Technology for a safe, sustainable and prosperous future for all

This brings me to what these evolving technologies and their applications can do to build a more peaceful, prosperous and sustainable world for all, where no one is left behind to suffer in poverty, hunger and disease.

The United Nations Development Agenda including the 17 Sustainable Development Goals adopted by world leaders in 2015, envisions such a world that is built on three pillars: eradicating human poverty, ensuring environmental sustainability and building social equity for all humans.

It is a universal and ambitious agenda with concrete goals, targets, indicators and benchmarks to measure progress.

However, it reflects only a political consensus among governments, although its realization depends on the full engagement of societies and individual citizens in all countries.

I am convinced that the new knowledge world unfolding with rapid technological progress that I have detailed above, if channeled in the right direction, is the key to building this brave new world of peace, prosperity and a sustainable future for the generations to come.

Challenges Facing the Brave Knowledge World

Technological advancements will undoubtedly change and improve the way we live and interact with the world around us. These advancements will however bear their own sets of challenges, their detailed discussion could be a book topic on its own. A few key issues are highlighted in this chapter.

First, as technology continues to improve at an exponential pace, so too must the ethical and legal frameworks surrounding it. Privacy, for instance, will likely be an issue of significant debate for years to come as personal data becomes more widely shared online and permanently stored in part. Concerns regarding personal privacy and the need for data protection were made abundantly clear during the now-famous Zuckerberg hearings (2018). As we go on migrating to an online world, we continue to feed data to companies such as Amazon, Facebook, and Google among many, many others. While often not intended for malicious use, the ability to collect and increasingly analyze the amounts of data available could be used for malignant purposes well-beyond commercial. Hypothetically, this type of data could be used to influence elections as a case in point.

The need to understand and continually evolve ethical considerations surrounding technology has also been made additionally clear by the rise of AI and similar derivatives. Take for example autonomous vehicles: while they will likely make life simpler for many, they present a wide-range of moral and ethical dilemmas. One need only browse the MIT "Moral Machine" website to survey the many complex scenarios that must be addressed in the programming of self-driven cars. To make it simple, consider the following scenario: you are sitting in your autonomous vehicle, when 3 adults unexpectedly cross the road. After its analysis, the computer determines that continuing on its path will likely result in the death of all 3 adults, while swerving into the side rail will likely kill you, the passenger. Unlike in a human-driven scenario where instincts and last-minute reactions take place, the autonomous vehicle's appropriate reaction has been pre-programmed. What should it do? Is it fair to sacrifice three lives to save the owner of the vehicle? Is it fair to sacrifice a life to save 3 people who inappropriately crossed the road? As we become more reliant on technology, we will necessarily have to address these issues, and many more.

Additionally, technology – and robotization in particular – has been criticized as a job destroyer for years. In the long-term and in aggregate, the arguments

have very few merits: continued population and economic growth, combined with every growing demand for the existing as well as new products and services will undoubtedly result in job growth. Increased reliance on technology however will result in a long-term structural shift in the nature of jobs, leading to a short-term increase in structural unemployment. For example, while jobs in the banking sector are expected to continue increasing, they are expected to shift to banking technology jobs. On a macro scale, robotization will indeed render many jobs redundant and will result in unemployment amongst job-seekers with irrelevant skills. However, other technology-oriented jobs will continue increasing at a dramatic pace, resulting in a permanent shift in skill-requirements. While the shift occurs, how will the world deal with the challenges that result from large-scale, though temporary, structural unemployment? The arising political, economic and humanitarian issues could provide challenges to technological progress, as political leaders cater to unskilled worker fears.

Finally, a fear shared by many prominent scientists and technologists is perhaps best immortalized by 1984 classic film "Terminator." The movie predicts a scenario in which Skynet, an artificial intelligence system, becomes self-sentient and seeks self-preservation by destroying humanity. While highly fictional, the film highlights some real world existential concerns: in 2015, Elon Musk, Stephen Hawking and many artificial intelligence experts signed an open letter on AI. The signatories called for additional research on the potential impacts of artificial intelligence ending the letter as follows: "we could one day lose control of AI systems via the rise of superintelligence chains that do not act in accordance with human wishes – and that such powerful systems would threaten humanity. Are such dystopia outcomes possible? If so, how might these situations arise? ...What kind of investments in research should be made to better understand and address the possibility of the rise of a dangerous superintelligence or the occurrence of an "intelligence explosion"?". While many have argued in defense of artificial intelligence, and downplayed the existential threat of "superintelligence," it would be wise not to discount it completely.

These are just some of the many challenges that have resulted from the pace of technological advancement; as technology continues to accelerate exceedingly, new issues will continue to emerge. To finish on a positive note however, while these challenges should be kept in mind, they should by no means hinder technological development as we continue our push into the 4th Industrial Revolution.

The last word: A day in the life of tomorrow's citizen

All the information provided to the reader have been based on actual current developments and exploratory works detailed throughout this book wrapped up in 2018. They display how science fiction had the uncanny ability to predict what tomorrow's world will evolve into.

While it is difficult for anyone to fully judge the impact of all these technologies on humanity, the following futuristic walkthrough will help the reader to better appreciate some of what is to come and what might be a typical day for an ordinary citizen in the future.

You are sleeping restfully with sensors adjusting the ambient room temperature as well as managing humidity levels throughout the night ensuring you get the best sleep possible. Your alarm clock has monitored your sleep over several days and decided on its own as to the best time to wake you up, ensuring you are not late for work. Sensors gradually brighten the room so as not to shock your system.

At the same time your shower has started and it is automatically adjusting the water temperature to your preference, as it has learned from your historical showering habits. As you approach your closet freshly showered, your closet suggests what to wear based on your office dress code and weather conditions outside. Meanwhile downstairs, your coffee has been brewing in your kitchen and your refrigerator has made suggestions on what to eat based on what is inside the fridge and what is most fresh.

Your TV or computer screen has activated and pulled up programming in the order that you normally watch during breakfast. After you eat, your driverless car is getting ready in the garage. It has adjusted the inside temperature based on weather conditions and has programmed the optimal route to your work place after monitoring live traffic patterns.

As you are whisked away to work, your house has already turned off lights, adjusted the thermostat, checked the fridge to see what's low and put in an automatic order for essential groceries with the local supermarket and has also autonomously cleaned itself.

Your time spent traveling to work is recaptured as productive time. In this sense, your car has become a mobile office, wired and equipped with all the capabilities of the office setting, allowing you to get much work done before even setting foot into the office.

Your car will assimilate all built-in road sensors which will automatically change the speed limit when the roads are bad or when there has been a snarl in traffic. Up-to-the-minute data will be fed to the car's dashboard. Audible reports will be made through the car's sounds system and text reports will be fed to your mobile device as well as those of your loved ones.

Once you get to the office, your car will auto-park, or take itself to the automated car wash if it needs a clean after letting you out. The office doors will scan your unique biometric signature and let you in. All this time your IoT health wearable device has been monitoring all your vital signals and reminds you to drink water and take your blood pressure medication.

Once you open your computer, the AI program you asked last night to perform analysis of company data walks you through the conclusions it reached through a VR headset, interactively allowing you to investigate simulations as well as the sources of information it used and the logic behind its decisions.

You hold a virtual meeting with colleagues and clients in another city to discuss the findings in a 'smart meeting room', allowing all of them to be present in the same room, sharing and displaying work through the augmented reality.

For lunch, you decide to go out of the office for a stroll. Your augmented reality glasses give you suggestions on where to eat based on your diet plan and reminds you to pick up dinner on the way back home. As you pass by a local convenience store, relevant information for items you need at home are displayed to you with a discount voucher arriving on your smart device. You put in an online purchase for the goods, enter your address and you are done. Payment has been taken securely from your bank account and the goods will be delivered by drone to the safe delivery box at your home. You remotely access your home delivery box telling it to expect a drone delivery and give it access through a uniquely shared one time access code.

After lunch, your doctor calls you as he has noticed your blood pressure has been alarmingly high during the same time period over the last week. He asks you to put on the IoT blood pressure monitor in the office and checks your blood pressure remotely. He decides to prescribe additional medication which the local pharmacy will deliver to you within the next hour at work.

Towards the end of the working day you get some reminders of social commitments you have that night. You sit in your autonomous car which puts on relaxing music and dims the light, allowing you to get some rest before getting home, navigating itself through traffic and detours with no effort.

While you were at work your IoT sprinkler system didn't need to come on because it rained the night before. Your home is at the temperature you like and the shower is ready.

After showering, you open the safe deposit box to find the items you had ordered earlier, along with other essential groceries that your refrigerator automatically ordered for you which you had run out of.

Your phone alerts you that you have to pick up your son from soccer practice. You speak to your car through your smartphone and tell it to pick him up from his school location. The car picks him up safely while you put away the items that were delivered.

You realize that you've forgotten to order dinner and ask the home AI system to give you suggestions. It checks what you've had for dinner over the past few days and provides meal options taking into consideration food preferences and the health history of each of your family members.

To close out the evening, someone suggests watching a movie but the decision is difficult considering all the different interests in the room. A simple solution is to let your in TV wall screen make the choice. But this is no ordinary screen. It's a paper thin, hardened screen which covers all the walls in your home. Through the home AI system, it has access to data from all of your family members. It knows heart rates and blood pressure; it knows preferences in past programming they consumed. It knows emotional and mental health history. Instantaneously it makes several good suggestions.

The movie is displayed on the wall you choose. As you're watching the movie, all surrounding walls change color to match the type of movie you are watching to create a better ambience.

After watching the movie, your home AI system suggests you sleep based on your breathing patterns and oxygen levels. Your bedroom is adjusted automatically for comfort, the alarm is automatically set, all doors and windows locked and your home AI goes into monitoring mode, protecting and monitoring you and your family for another night.

IT Auditing & IT Security

CYBER

+4,000 ransomware attacks every day

Ransom-ware

197 days

It takes about 197 days to detect a breach on their network

SECURITY

Cybercrime damage costs to hit $6 trillion annually by 2021

Cyber-crime Damage

Cyber Incident

It takes years to build a reputation and few minutes of cyber-incident to ruin it

COMPROMISED

54% of companies experienced one or more successful cyber security attack that compromised data and/or IT infrastructure

Attak

Cyber Security

Cyber security is a business risk, not just an IT problem

BENEFITS

Strengthens organization controls and improves security

Assists in aligning business with IT

Provide management with valuable reporting

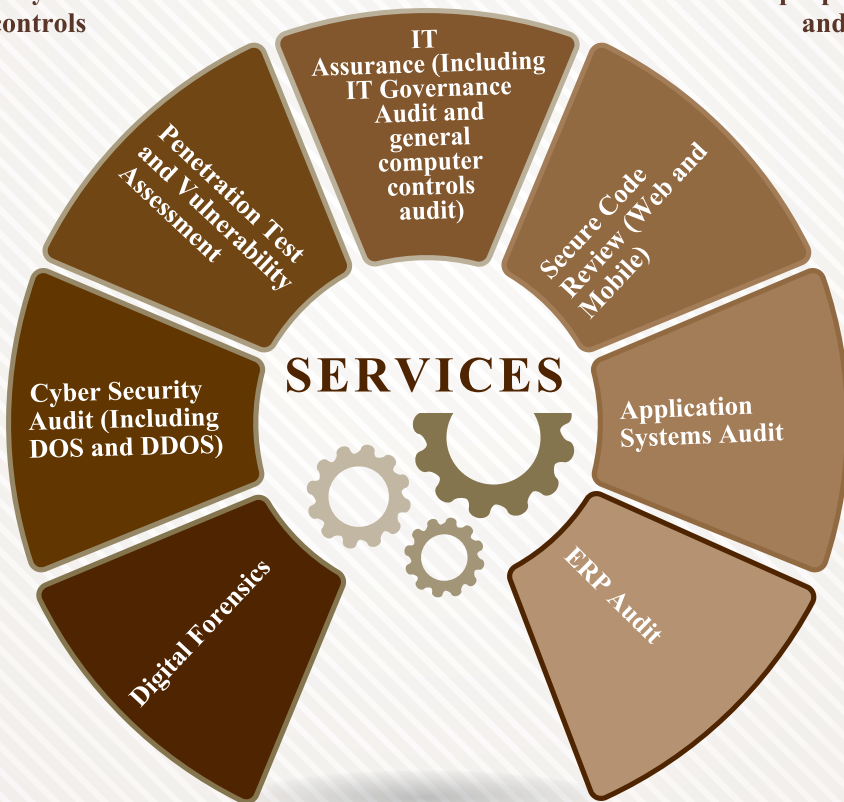Identifies key business systems and their value to the organization

Helps to comply with regulatory requirements

Allows for better planning and resource allocation

Independently reviews IT risks and controls

Audits people, processes and technology

SERVICES

IT Assurance (Including IT Governance Audit and general computer controls audit)

Penetration Test and Vulnerability Assessment

Secure Code Review (Web and Mobile)

Cyber Security Audit (Including DOS and DDOS)

Application Systems Audit

Digital Forensics

ERP Audit

+30 Tools Employed

+2000 Reports

+500 Client

Talal Abu-Ghazaleh Organizations' Knowledge Initiatives

Mentioned below are details of knowledge tools and services that have been developed by the Talal Abu-Ghazaleh Organization. They are designed to empower knowledge workers in the digital age.

1. Corporate Digital Inclusion *

Golf may be dying, but the camaraderie developed on its courses need not. A startup has the answer to Google's quest to build the perfect team: betwixt. us is a cross-generational, cross-cultural, cross-disciplinary female team on a mission to boost productivity and innovation by pioneering business golf for the 21st century.

Human beings have long relied on dialogue and small talk to get to know each other and build interpersonal understanding and collegiality. And though technology-enabled collaboration and distributed workgroups have been a boon to productivity and innovation, their inherent focus on efficiency is under-leveraging the personal aspect of working relationships.

*BETWIXT: www.betwixt.us

Consider this: Google conducted a multiyear, multimillion-dollar investigation of what makes its most effective teams tick. They found that their best teams tended to share one trait that was absent in less effective teams: a sense of "psychological safety", defined as the mutual understanding that a working relationship is safe for a margin of interpersonal risk-taking. Members of psychologically safe teams feel accepted and respected both personally and professionally. Collaboration feels more rewarding…and innovation goes through the roof.

Existing digital collaboration tools help us communicate and transfer data more efficiently, but it's what they don't do that matters: getting to know someone without the benefit of a shared meal, a shared drink, a round of golf or simply a handshake. betwixt.us believes opportunity lies in recognizing that constant connectivity is not true connection and that communication is not the same as conversation. What has yet to be digitized is what IRL interaction and networking is designed to do: build trust and rapport. To develop trust across space and time, we need technology that can capture more than what we do via CVs, shared calendars and project management software -we need technology that can reflect who we are, in the right way, to the right people.

For three years a startup called betwixt.us has quietly but passionately been developing a method for instilling psychological safety into digital workgroups - they are taking the water-cooler to the cloud, where the bulk of modern business is conducted. The company is a virtual conversation engine designed to foster the kind of dialogue and person-to-person engagement that helps professionals develop the deeper, more meaningful relationships leading to higher work satisfaction and increased productivity and innovation. betwixt.us is business golf for the 21st century - a proprietary technology solution that draws on time-tested principles of sociology, psychology and philosophy to help people get to know one another and bond wherever they are already working (like in the insanely popular instant messaging and collaboration platform Slack for example).

2. Talal Abu-Ghazaleh Electronic Arabic Encyclopedia (TAGEPEDIA)

TAGEPEDIA is the first system of its kind on the internet to present verified and documented Arabic content, covering a variety of areas including science, literature, economy, arts, sports, culture, knowledge-based fields, business and professional services, intellectual property rights, media, accounting, financial administration, consulting services, translation, law, banking activities and vocational training, as well as information technology consultancies and any other relevant fields in the area of scientific and professional knowledge.

The encyclopedia engine was developed by E-Solutions experts at Talal Abu-Ghazaleh Information Technology International.

TAGEPEDIA seeks to become a comprehensive knowledge reference for digital content in Arabic language available for internet users and specialists interested in all aspects of knowledge in Arabic. Its content has been classified into four main fields, which are the General Knowledge, Personalities, Historical events, and Regions of the World.

TAGEPEDIA welcomes the participation of scientists, literary people, experts, advisors, and specialists to enrich the Arabic knowledge content on the Internet and improve its quality and accuracy while protecting the copyrights of the original author and other affiliated rights.

Talal Abu-Ghazaleh Organization has worked on this project for five years, and assigned for this purpose three teams of technical specialists as follows: the first team being responsible to explore specific information, while the second responsible for examining and verifying the accuracy of each entry and detecting the reliability of its source, and the third responsible for examining the usefulness of the entry and ensuring it is not offensive or harmful. Talal Abu-Ghazaleh Organization shall ensure the sustainability of this encyclopedia and shall continue to enrich it incessantly.

We are pleased to announce that we have so far verified, edited and posted in TAGEPEDIA one million and two hundred thousand entries in the Arabic language, and once launched, the Arabic content on the Internet will rank the fifth.

Compared to Wikipedia which currently contains 540 thousand NON-verified entries, and contrary to Wikipedia where entries can be posted by anyone, TAGEPEDIA is open for free use by the public at large and information items cannot be posted unless subjected to examination, verification and approval to befit a trusted knowledge encyclopedia.

3. **The Arab International Society for Management Technology (AIMICT)**

The Arab International Society for Management Technology (AIMICT) is a non-profit organization founded on August 29, 1989, in Buffalo,New York, United States of America and officially registered in Amman on October 10, 1990.

AIMICT provides unique professional services through its representatives in 20 Arab countries and liaison offices around the world. Its programs and plans are developed by a board of trustees chaired by HE Dr. Talal Abu-Ghazaleh. The Board includes experts in different fields of management and information technology. It seeks to promote the communication and exchange experiences at individual and institutional levels by holding conferences, workshops and specialized professional programs.

1. **Professional Programs:**
- Professional Quality Manager (PQM)
- Human Resource Manager (HRM)
- Training of Trainers (TOT)
- Advanced Certificate in Leadership

2. **ISO Training Programs:**
- ISO 27001 Lead Auditor/Implementer
- ISO 22301 Lead Auditor/Implementer
- ISO 9001 Lead Auditor/Implementer

3. Publish, Upgrade, develop and promote recognized high-quality researches, dictionaries and guides in the ICT and Management fields.

4. Arab Organization for Quality Assurance in Education (AROQA)

The Arab Organization for Quality Assurance in Education (AROQA) is an international non-profit independent association established in Belgium in July 2007 with the fundamental objective of raising the quality of education in the Arab world.

To this end, AROQA will engage in:

1. **Quality assurance**
- Advising and capacity-building programs in quality education.
- Managing quality in education according to national and international standards.

2. **Accreditation**
- Accreditation services.
- Accreditation and evaluation standards according to international best practices.
- Comprehensive evaluation and periodic review to ensure adherence to quality standards and continuous improvement.

3. **Awareness**
- Dissemination of educational quality and accreditation culture.
- Organizing specialized annual conferences in quality and accreditation.
- Holding specialized workshops and training programs.
- Issuing the Arab Journal of Quality in Education as a biannual peer-reviewed and indexed journal.

5. Arab States Research and Education Networks (ASREN)

ASREN is a non-profit company with limited liability (GmbH) and is officially registered in Germany, under the umbrella of the League of Arab States. ASREN is the association of the Arab region National Research and Education Networks (NRENs), as well as their strategic partners. The main goal is to connect Arab institutions among themselves and to the globe through high-speed data communications networks.

Such networks will enable sharing and access to a variety of R&E services and applications in addition to utilization of highly sophisticated and technologically advanced computing resources available only at very few institutions in the world. We aim to boost pan-Arab collaborative R&E projects and activities, contribute to promote scientific research, innovation and education across the Arab region.

The ASREN Network sets out to connect NRENs across the Arab region through a high-quality network with several points of presence (PoP) in a number of Arab cities. Selection of PoPs depends on the availability and routing of regional optical fibers. ASREN is a partner in the EUMEDCONNECT3 and AfricaConnect2 programs, which have connected the Arab Mediterranean countries: Algeria, Egypt, Jordan, Morocco, Palestine, Syria and Tunisia since 2004. In the current phases, connections are being re-established, initially with Algeria, Jordan, Morocco, Lebanon, and Egypt, with additional countries eligible for EC funding support. With its direct links to GÉANT, the pan-European R&E network, EUMEDCONNECT3 and AfricaConnect2 provide access to over 40 million users at over 8000 R&E establishments across Europe.

Services:
- Setup international connections with high capacity.
- Link NREN network to ASREN PoP and peering to GÉANT, Internet2, and other regional R&E networks.
- Setup Eduroam and Science Gateway Services.
- Provide specialized training to technical staff.
- Miscellaneous Services.

6. Talal Abu-Ghazaleh International University (TAGI-UNI)

Talal Abu-Ghazaleh International University (TAGI-UNI) is an education service provider that offers academic degrees, language and arts training, professional certificates and continuous education through strategic alliances with globally accredited partner institutions. We believe that education is no longer for the few who are able to afford the costs of the traditional university setting. We have taken advantage of the latest developments in digital information technology to bring quality education to you, wherever you may be.

Talal Abu-Ghazaleh International University (TAGI-UNI) is based on the belief that democratization of knowledge is a key to economic growth, social development, cultural enrichment and political empowerment. We also believe that creation, acquisition, preservation, transmission and application of knowledge is the foundation of societal transformation.

TAGI-UNI offers accredited multidisciplinary education and is a quality global e-campus university, providing digital classroom education for every student, wherever he or she may be.

TAGI-UNI adheres to the philosophy of cooperation and collaboration not only with other educational institutions but also with public and private sector organizations. We have cemented partnerships with accredited universities and educational institutions to make programs available that were previously only available to the few.

Our mission is to make accredited educational programs accessible to everyone, everywhere.

Please take a look through our programs and do not hesitate to contact TAGI-UNI for any additional information you may require.

Let me personally invite you to TAGI-UNI, the digital university of the world.

7. Talal Abu-Ghazaleh University College for Innovation (TAGUCI)

Talal Abu-Ghazaleh University College for Innovation (TAGUCI) is a unique college specializing in preparing the young Arab generations for the required skills to become leaders in the new world of information technology.

Established in 2018 as an independent college in Jordan, TAGUCI offers the programs that have been developed with the advancement in communication and information technologies in mind by the most respected and renowned figures in academia. All programs have been designed to bolster the advancement of technical knowledge with practical real-world applications.

The College will instill in students a solid foundation in the most recent academic and practical knowledge in the ever-changing field of information technology focusing on artificial intelligence and other newly emerging world changers.

To help achieve our goal of encouraging innovation, TAGUCI will offer any student who develops an innovative project that is patentable a grant that covers the cost of their tuition once over. Furthermore, Abu-Ghazaleh Intellectual Property (AGIP), the largest Intellectual Property Company in the world, will assist in registering their patent for them.

Our priorities and objectives highlight our commitment to admitting the high-caliber students and provide them with the highest possible quality of education. We offer students an unmatched educational experience with access to renowned faculty and thought leaders, outstanding research facilities, internship programs at Talal Abu-Ghazaleh Organization and infinite opportunities for academic and personal growth.

Finally, we want to nurture our students to become accomplished, innovative and entrepreneurial global citizens. We are committed to always develop new programs that help our students meet the demands of the ever-changing global economy.

8. Talal Abu-Ghazaleh International Diploma in IT Skills (TAG-DIT)

The workplace is increasingly requiring employees with adequate information technology skills. Our objective is to provide applicants for employment with diplomas evidencing their possession of the required skills sought by their employers. We offer our services worldwide through our 100 offices located in several countries.

How do we do it?

We offer diplomas at the Foundation or Standard levels in different information technology skills. Candidates seeking specific diplomas are assessed for their ability to use the software applications for those specific skills. Candidates are required to enter and manage data under given specifications and to successfully complete a range of tasks required for the specific skills required for the diploma they seek.

Our Diploma:

Between 2001and 2017, TAG-DIT offered its diploma in partnership with Cambridge International Examinations in the UK. We had exclusivity in all the countries of the Arab League whereas other partnerships had exclusivities in other regions. We owned all the intellectual property rights to the diploma skills and the role of Cambridge was to validate the diplomas and add its name to our name on the diploma. In 2017 for strategic reasons, Cambridge International Examinations discontinued its service to validate their worldwide partners' qualifications. At that point we made a decision to continue with offering our quality qualifications which are presently accredited by:
- The Ministry of Education in Jordan
- The Central Agency for Information Technology in Kuwait
- The Ministry of Education in Libya

We are continuing to seek other international accreditations.

Track Record:
Since the inception of our program, we have issued over 2 million diplomas to candidates worldwide.

Modules Offered:
We provide examinations at the Foundation and Standard levels for the following areas of skills:
- Module 1: Introduction to Information Technology
- Module 2: Using PC and Managing Files using MS Windows
- Module 3: Word Processing using MS Word
- Module 4: Spreadsheets using MS Excel
- Module 5: Electronic Communication using MS Internet Explorer
- Module 6: Database Management using MS Access
- Module 7: Electronic Presentations using MS Power Point

Special Features:
We offer the following features:
1. Candidates have the choice of taking the exam in either English or Arabic.
2. The exams are corrected electronically without human interference and the results are reported immediately on the candidate's screen.
3. There are no specific examination dates. Candidates can choose to sit for the examination at any time and in any accredited center.
4. All examinations are held at Proctored Testing Centers that follow a globally recognized examination process called TAGIMETRIC.
5. The diplomas offered are designed to meet the various candidates' needs at the level of their choice.
6. Diplomas are mailed to successful candidates and are printed on special paper with security features in order to avoid any forgery.

9. Talal Abu-Ghazaleh Academy (TAG-Academy)

Talal Abu-Ghazaleh Academy (TAG-Academy) aims at building capacities in all sectors by providing human resources with the needed knowledge, skills and attitudes, which would raise their level of performance, and develop the trainee's professional practices according to the latest updates in the training field. TAG-ACADEMY looks forward to expanding professional cooperation relationships with international institutions involved in training and human resources development. It also aims at promoting effective leadership in building capacities locally and internationally.

Our Goals

- Provide Human Resources with the knowledge, skills and trends that enhance   performance.
- Develop the professional practices of trainees in alignment with the latest professional developments in the field of training. Increase the number of training centers worldwide.
- Expand professional cooperation relations with the international institutions concerned with training and human resources development.
- Seek to obtain international professional accreditation for the training programs.
- Continue to be an active leader in capacity building at both the regional and international levels.

Our Policy

- Great emphasis on result orientation of training and cost effectiveness of training investment for the recipients of training services.
- Focusing on the use and application of modern training methods.
- Enhancing the use of advanced techniques and training aids in applying the training process.
- Selecting trainers with high academic levels, distinguished achievements and real-life experience.
- Creating an appropriate training environment and providing logistics for the success of training programs.
- Establishing associations with only the most reputable and renowned education and training institutions worldwide.

Our Values

Service quality, Continuous improvement, Fruitful cooperation, Credibility and commitment, Transparency and accountability.

Our Methodology

TAG-Academy adopts an integrated and inclusive approach to the techniques of presentation, delivery, assessment and adaptation to the environment circumstances and the party requesting training services.

Certificates:

TAG-Academy grants a certificate of participation for each course to those who effectively participate. The participants' observance of the training sessions is a prerequisite to obtaining this certificate. In addition, other certifications are granted depending on programs designed with associates.

Our Training Programs

In order to achieve the goals of TAG-Academy, the training activity is not limited to one type of training programs, it rather includes a variety of programs that cover all specializations in science, humanities, management, finance, economics, law and e-knowledge.

TAG-Academy Cambridge Assessment English Authorized Center

Talal Abu-Ghazaleh Academy signed an agreement with Cambridge Assessment English part of University of Cambridge to become an authorized center for examinations and assessment. The Academy has started receiving applications for the Cambridge Assessment English training courses.

The Academy began hosting the exams as an authorized center since October 2017 whereby successful candidates will receive a certificate issued by Cambridge Assessment English, part of University of Cambridge.

The Academy will offer training courses and examinations through a select highly trained team of trainers and examiners.

A few facts about Talal Abu-Ghazaleh Academy (TAG-Academy)
- Professionals trained at TAG-Academy: more than 500,000
- Professional certificates granted by TAG-Academy: more than 500,000
- Contracted trainers on the training database: more than 10,000
- TAG-Academy Affiliated Training Centers: more than 1,000

10. Talal Abu-Ghazaleh Digital Citizen (TAG-DC)

TAG-DC is a project founded by Dr. Talal Abu-Ghazaleh to help bridge the digital divide through an evolving ecosystem which consists of a robust smartphone/tablet device which is suitable for learning, coupled with high-speed Internet connectivity and access to quality education materials and applications.

The project will be of great benefit to students globally, in particular those in remote communities across the world that have limited access to education, and allow them to learn from any location, providing them with an all-in-one digital 'school bag'.

It will allow schools and colleges to remove the need for hard-copy textbooks and instead have a simple to use smartphone/tablet that provides students with access to updated e-content material.

The purpose behind TAG-DC is to build digital citizens of the future and empower them with the skills they will require in tomorrow's knowledge economy, primarily aimed towards:
• Students in any educational establishment
• Public and Private sector organizations
• Any citizen wanting to go digital

11. Talal Abu-Ghazaleh Knowledge Society (TAG-KS)

The Talal Abu-Ghazaleh Knowledge Society embodies the vision of its founder HE Dr. Talal Abu-Ghazaleh in providing a suitable environment for all youths who are capable of becoming the next generation of leaders in a world that depends on knowledge and technology.

Our comprehensive strategy is focused on fulfilling the dreams of young generations in having a source for knowledge and information anywhere they are.

Vision and mission
TAG-KS Stations seek to empower youths with the required skills to become the leaders of tomorrow.

Objective
TAG-KS Stations aim at supporting the youth communities in developing their skills and capabilities and preparing them for the future, in addition to speeding up the process of transforming the new generation into a digital one under the term E-Generation who will utilize the latest technology tools in developing their skills to meet the requirements of the world of E-knowledge with confidence.

TAG Knowledge Stations offer
- Training courses, programs and diplomas.
- Digital learning.
- Management of small and micro (medium-sized) enterprises (SMEs).
- Training on the use of computers and the Internet in scientific research and innovation.
- Recruitment Consulting.
- Awareness workshops in all fields.
- Voluntary work.

Training Materials and Trainers
TAG-KS will provide the second party with the training materials and trainers for all courses. We can also provide training to employees of the second party to enable them to give certain courses to replace our trainers.

12. Arab Center for Dispute Resolution (ACDR)

In collaboration with the Arab Intellectual Property Mediation and Arbitration Society (AIPMAS), the Board of Directors held its extraordinary meeting chaired by AIPMAS president HE Dr. Talal Abu-Ghazaleh, and was attended by Society's Board of Directors and members.

The meeting was inaugurated by the General Assembly's discussion of Article (4), Paragraph E "Society's Purposes" which stipulates that supervising the procedures of settling intellectual property-related disputes shall be done through mediation or arbitration, or through any other means to settle disputes, by establishing a center specialized in intellectual property-related disputes, in accordance with the regulating rules and basics and adoption of the mediation and arbitration rules.

The General Assembly unanimously agreed to establish the Arab Center for Dispute Resolution (ACDR). The Legal Department at Talal Abu-Ghazaleh Organization was entrusted to take necessary actions for this purpose provided that the center will be totally owned by the Society.

It was agreed to translate this decision to attach it to the registration certificate upon the issuance of its translated version to send it to the Internet Corporation for Assigned Names and Numbers (ICANN) and to register the center's name (ACDR) as a trademark and to register the center's domain name. Thus, the Arab Center for Dispute Resolution (ACDR) was established to provide up-to-date information, transparent, reliable, professional services in the area of Domain Name Dispute Resolution, and expertise in the area of dispute settlement with a view to advancing the most relevant jurisprudence and international legal trends, furthering the most advanced practices in the field of Intellectual Property.

Concerning the establishment of ACDR, Dr. Abu-Ghazaleh said that this is the fifth accredited center in the world, and being in the Arab region has a special importance by focusing on the domain name-related disputes especially with the existence of arbitrators from all over the world capable to settle the domain name disputes in many languages. Dr. Abu-Ghazaleh expressed his hope for the center to undertake its duties and properly play its role to serve the region.

Dr. Abu-Ghazaleh pointed out that he dedicated his efforts and the experience of Talal Abu-Ghazaleh Organization to have this center come into existence since he believes in the importance of arbitration as the best way to settle disputes outside courts, as it is of the most common methods to settle disputes.

An Overview of the Arab Center for Dispute Resolution

The Arab Center for Dispute Resolution (ACDR) has received accreditation from ICANN (the Internet Corporation for Assigned Names and Numbers). ICANN has developed an extremely useful procedure for dispute resolution to handle domain-name holder problems. The ACDR is the central entity enabling the support and management of a diverse array of Internet concerns. Its importance and mission is centered on organizing and promoting development of predictable rules-based guidance for a more secure and stable Internet. With this in view, following in-depth consultations with ICANN on a wide array of IP issues, as well as on the requirements for effective dispute settlement, the ACDR has adopted the Uniform Dispute Resolution Policy (UDRP) Rules and its own Supplemental Rules. These rules govern the administration of domain name dispute resolution to better address the concerns of domain-name holders.

ACDR has an excellent base of Intellectual Property professionals that are renowned in this field. The Center has chosen those with accredited memberships in their relevant associations and with proven track records in Dispute Settlement. We have confidence in their ability to achieve settlements while addressing the most salient concerns of IP law.

Some services provided by the Arab Center for Dispute Resolution include:
- Provide and facilitate smooth interactions to reach a resolution of legal processes.
- Develop program implementation strategies to support adequate application of legal standards in a just even-handed manner.
- Research and develop program processes that ensure the most up-to-date applications.
- Facilitate sufficient communication and training on most relevant Domain Name and Dispute resolution methods and issues.

TAG–Org a Global Provider of Smart Services

Our International Status
- Total clients in all services and activities: more than 1,000,000
- Trademarks we registered around the world: more than +500,000
- Intellectual property rights we managed: more than +100,000
- Annual increase in the number of clients: more than +25,000
- Our company in auditing is among global top 20
- Best IP Firm Award (Middle East) for 10 Years
- Inducted to the IP Hall of Fame, Chicago 2007

Our Consulting Services
- Archived documents by TAG-Org: more than +150,000,000
- Trademarks in our IPPR database: more than +2,000,000
- Articles in TAGEPEDIA: more than +1,000,000
- Conducted consulting assignments: more than +100,000
- Qualified organizations to receive ISO certificates: more than +400
- Members of the ISO Technical Committee since 1995

Talal Abu-Ghazaleh Foundation (CSR)
- Our knowledge stations serving communities: 400
- Our fully operated and funded capacity building institutions: 50
- Talal Abu-Ghazaleh allocates 50% of its annual profits to Talal Abu-Ghazaleh Foundation and invests the other half in developing the Organization's capacities and expanding activities

Our Leadership in Capacity Building
- Translated pages in different languages: more than +10,000,000
- Professional reports issued: more than +1,000,000
- Professionals trained: more than +500,000
- Professional certificates we granted: more than +500,000
- ICT skills certificates issued: more than +250,000
- Contracted advisers on the tenders database: more than +50,000
- Contracted trainers on the training database: more than +10,000
- Affiliated Training Centers: more than +1,000

Our Knowledge-based Achievements
- Annual global online outreach: more than +30,000,000
- 150 databases with classified records: more than +500,000
- Developed E-Software solutions to serve clients: 100
- TAG-Org's websites for our services & activities: 60
- TAG-Org has its own Internet line: TAG-ISP
- Constructed and own TAG-Computing Cloud
- International Accredited Domain Name Registrar

About the Author

- Founder and Chairman of the Talal Abu-Ghazaleh Organization (TAG-Org).
- Chair of the Honorary Council of the Consortium for Sustainable Urbanization, USA, (2015 - present).

Honorary Degrees
- Ph.D. in Humane Letters, Lebanese American University, Lebanon (2018).
- Ph.D. in Management and Economics, Jerash University, Jordan (2016).
- Ph.D. in Business Administration, Mutah University, Jordan (2015).
- Ph.D. in Human Arts, Bethlehem University, Palestine (2014).
- Ph.D. in Arts, Canisius College, Buffalo, USA (1988).

Recognitions
- Senator, Jordanian Upper House, The Hashemite Kingdom of Jordan (2016 - present).

Selected ICT Related Roles
- Chair of the United Nations Global Alliance for ICT and Development (UNGAID), USA (2009- 2010).
- Co-chair of the Global Network (on SDG 11) for Promoting Digital Technologies for Sustainable Urbanization UN-HABITAT (2015 - present).
- Founding Chair of Internet Governance Forum (UN-IGF)
- Chair of the Arab World of Internet Institute, USA (2008).
- Co-Chair of the UN Global Compact (UNGC), USA (2006-2008).
- Vice-Chair of the United Nations Information and Communication Technology Task Force (UN ICT TF), New York (2006-2010).
- Chair of the Arab Regional Network of the United Nations Information and Communication Technologies Task Force (UN ICT TF), USA (2001-2004).
- Chair of the Working Group on Human Resources and Capacity Building (HRCB) of the United Nations Information and Communications Technologies, (UN ICT TF), USA (2001-2002).
- Member of World Trade Organization (WTO) Panel on Defining the Future of Trade, Switzerland (2012-present).

- Chair, Network 11 (Digital Technologies for Sustainable Urbanization Network)-UNSDG 11 (208).
- Chair of the Arab Internet Names Consortium (AINC), The Hashemite Kingdom of Jordan (2001).
- Founder and Chair of the Internet Governance Forum, United Nations Information and Communication Technologies Task Force (UN ICT TF), USA (2003-2004).
- Chair of the Commission on E-Business, Information Technologies and Telecoms, International Chamber of Commerce (ICC), France (2001-2008).
- UNDP High Level Advisory Board Member on Social Impact, USA (2017 - present).
- UNWTO Tourism Ambassador, USA (2016-2019).
- Member of Public Sector Consultative Group, International Federation of Accountants (IFAC), USA (2003- 2006).
- Chair of the International Chamber of Commerce Task Force (ICC TF) on Internet Governance, France (2003-2004).
- Member of the Board, International Financial Reporting Standards (IFRS)

Selected Decorations
- Order of Civil Merit, His Majesty King Philip VI, King of Spain, Spanish Embassy, Spain (2018).
- Decoration of Independence of the First Order by His Majesty King Abdullah II bin Al-Hussein, The Hashemite Kingdom of Jordan (2016).
- Decoration of Enhancing the Sino-Arab Relations from HE Mr. Xi Jinping, President of the People's Republic of China (2016).
- Decoration of Creativity in Innovation and Digital Transformation from Regional Donor Organizations, Bahrain (2016).
- Prince Sultan bin Abd-Alaziz's decoration for Business Youth, (2012).
- Presidential decoration presented by President of the Republic of Lebanon General Emile Lahoud, Lebanon (2001).
- Legion of Honor Chevalier de la Légion d'Honneur, France (1985).
- Decoration of the Republic of Tunisia, Republic of Tunisia (1985).
- Decoration of Independence of the Hashemite Kingdom of Jordan from His Majesty the Late King Hussein Bin Talal, The Hashemite Kingdom of Jordan (1967).

What they said about the author

The Arab Businessman- the Role Model
HRH Prince Hassan Bin Talal

Nations tend to be proud of their creative sons and entrepreneurs and based on this, I appreciate the positive attitude of Talal Abu-Ghazaleh, who chose the path of institutions and harnessed the potential of his organization and its expertise towards the minds in the third space, governmental, private and civil.

We need a forward-looking process alternate evaluation which is based on expertise of different knowledge fields, and this cannot be achieved through distance learning only, there is a need to meet and share ideas and opinions and this is what Abu-Ghazaleh always tries to do through his work.

The Arab knowledge communication needs to deepen relations between experiences in various fields in our region, such as Intellectual Property, management, accounting, information technology and communications.

And from this path I call upon the good Arab businessmen and they are many to offer initiatives at home and abroad, and I am sure that their capabilities are beyond the capabilities of their respective governments.

What distinguishes the life of Abu-Ghazaleh is his deep and strong belief in learning and capacity building to our sons and daughters.

Congratulation on his success and initiatives and wish him all the best

The Excellent Student
Dr. Selim Al Hoss
National thinker and former Lebanese prime minister

I am proud that Talal Abu-Ghazaleh was one of students when I was a professor at the American University of Beirut. He was, and the truth is told, one of the most outstanding students. He kept in touch for many years and I continued to

follow all his work as he became very successful professionally. Today, he is heading the Talal Abu-Ghazaleh & Co., one of those leading the accounting and auditing sector in Lebanon, and indeed in the entire Arab Mashreq.

Born in Palestine, the home of all struggles and hope of all Arabs. It is the area that gave birth to a distinguished people known for their sacrifice, courage and struggle. Among them some of the most prominent symbols of the Arab struggle against the criminal Zionism were born who took a stand against the most extreme circumstances that surrounded the Arab nation.

Out of this good earth he was born, and his destiny was the same as that of all his people; displacement by the crimes of the Zionists, he and his family were displaced in Lebanon, where he completed his primary education and his university studies. He was one of the most brilliant students who did not forget all through the stages, that one day he will serve his Arab nation. He decided to serve his Arab nation in his own way dedicating his services to the accounting and auditing sector amassing long experience in this field through his active and professional companies that enjoy a competitive advantage in Lebanon and in a number of Arab countries.

I am very proud that Talal was one of my students and that special period in my life as a professor is considered the most fruitful stage.

I am thrilled of such a publication "from suffering to globalism" which I hope it will do fair to this good man as he deserves it and more.

Best regards to my dear brother and friend Talal Abu-Ghazaleh and to all good people who worked on such a publication honoring him.

A leader in his initiatives and an initiator in his leadership
Taher Al Masri
Former Prime Minister of Jordan and former Speaker of the Senate

The life journey of brother and friend Talal Abu-Ghazaleh deserves to be studied by the generations, in order to learn from the story of the self-made man who has embraced hardships and determination to achieve and, build

an extraordinary personality capable of imposing its active presence in more than one field at a time.

This is the son of Jaffa, where he was born, witnessed exile and lived wars and calamities. He left Palestine and chose the profession of accounting. He was a pioneer in the field of auditing until he became a pioneer in the field of finance and economy. He became a great benefactor in supporting science and education. He donated large sums to the university he graduated from.

Many challenges intercepted his life while struggling but managed to conquer these challenges and come out stronger. His work was faced the results of wars and vicissitudes of the region and the territory, but as an entrepreneur, experienced, knowledgeable and determined, he has overcome difficulties with great success, and has become a well-known pioneer in terms of Intellectual Property, not only at the level of the Arab countries, but also on a global level, his international standing in this field has become well known and recognized by the United Nations and its secretary-general, especially in this regard, in recognition of the effectiveness of his knowledge and excellence in his universality. In this respect, he represents the personality of the distinguished Arab man, who deserves appreciation, praise and respect.

Talal is haunted by the concerns of his Arab nation and its issues, specifically the question of Palestine, which is the owner of a mature nationalist thinker with remarkable activity for Palestine and its just cause, especially in supporting the sectors of culture, health and education, he has very strong political relations in various parts of the world, which is never slow to employ them in support of the Palestinian issue and Arab issues in general, and obviously his knowledge and high political culture serve this lofty goal with remarkable efficiency, His positive impact here, in Jordan, has many beneficial effects, particularly in the fields of education, accounting, finance, economy and investment, as well as his broad and influential social presence.

Despite his many accounting, academic and political concerns, he is fond of music and art in general, and he never hesitate to support high art, both Arab

and European, and has many contributions in support of festivals and works of art, especially in Austria (Salzburg).

That is Talal Abu-Ghazaleh, who I know very well, self-made man, a pioneer in his initiatives and an initiator in his leadership, a loyal and active Arab, he is a human being charged with wonderful humanity of his movements and calmness, and behavior, and a heightened sense never confused by hatreds, spites and grudges, a respectable family man, and a good citizen who prays in giving, his citizenship and loyalty to life, defending his convictions and not eliminating the other opinion from his interests.

In brief, he is a human being with the experience to be read, and achievements to be respected.

Aspirations are Realized
José María Figueres
Former President of Costa Rica

There are three dimensions to the Abu-Ghazaleh International Group. The first dimension is the work that I expect to be grown, progressed and developed on the basis of rationales and well-known principles, especially in the tertiary sector provided by the Group.

The second dimension, which is to employ growth and progress to achieve this man's aspirations for universality, it has become apparent in the success of his group worldwide. The third dimension is my personal vision of the Group's services and business, which has become an important part of the components and development of the economic area, where it contributed positively, benefiting and benefiting from it. The Group has continuously kept abreast of everything new in the field of professional services and information, while keen to take advantage of everything that is new and developed in all scopes and fields related to its work in the world.

Ambassador of the Arabs
Jeremy Haley
Minister of Foreign Affairs and Armed Forces and a former member of the British Cabinet of Ministers

Talal Abu-Ghazaleh is a distinguished man world-wide and is known for his ability to communicate with the outside world with remarkable efficiency and distinction. He is one of the most prominent and intelligent Arab personalities I have ever known in my life during my tenure as Minister of Foreign Affairs and Armed Forces and a member of the Cabinet of Ministers.

In my opinion, Talal is an ambassador to the Arabs and known throughout the world as a Palestinian personality who believes in, respects and abides by the laws. He works to develop and consolidate laws and standards related to the accounting profession, which are fundamental to the economy and development in all fields.

In this context, I would like to point out that I have recognized from Talal Abu-Ghazaleh on the issues and aspirations of the Arab peoples, and I thank him for this. He has been able to describe to us the issues of the Arab region in a clear and transparent manner, especially those crucial issues that concern many zonal states. I mention here the Palestinian issue, which is an important part of the life of the Arab Ambassador Talal Abu-Ghazaleh.

I learned from him working hard
Sergio Marchi
Former Minister of International Trade of Canada

When we have a personality with the unique and diverse abilities as Talal Abu-Ghazaleh, it is a source of pride not only for its success in work, but also for being an Arab person and a leader in the field of professional services and business.

I do not exaggerate his description of the leader and pioneer; Abu-Ghazaleh's character was able by his struggle, strong faith and unique determination to make his institution a prestigious pyramid cherished by the entire Arab region.

Talal Abu-Ghazaleh Organization (TAG-Org) operates under the leadership of this man, who works tirelessly throughout the day, with a high ability to withstand, in order to keep his group at the forefront.

Talal Abu-Ghazaleh always works to reach the services of his group to other regions around the world, and does not stop at a certain point or area, and his permanent slogan is "continuous and orderly work" to achieve development and progress in all areas and domains, so that his group will remain in the forefront led by this personality, which I repeat my pride in knowing this personality and friendship, which added to me more and I learned from him the hard work and sincere for the benefit of the nation and its development.

Attention to International cooperation
Abdul Hamid Mamdouh
Director of Trade in Services and Investment (WTO)

Talal Abu-Ghazaleh is very interested in international cooperation because the areas in which he works in are related to the implementation of international agreements in the field of Intellectual Property protection and international standards and norms in accounting.

Talal Abu-Ghazaleh, who represents a public figure, has a direct impact on the direction of Talal Abu-Ghazaleh Organization (TAG-Org). Talal has established a number of important non-governmental organizations that have played a role in raising awareness of the employment services and important departments in the Arab countries with different rights, raising the awareness of information technology and in many areas of interest and attention to the institution in general. It established the first Arabic-language website of the World Trade Organization (WTO), one of the most important international organizations with a direct policy impact.

A Self-Made Man
Professor John Small
Former president of the Association Chartered Certified Accountants-UK

The Talal Abu-Ghazaleh Organization is one of the largest organizations in the world in the field of professional services and the individual behind this organization works hard around the clock, Talal Abu-Ghazaleh as a person I know and proud of his friendship is a man and an intelligent chairman who can easily and always convince you to present good work and special services to the world and not only in the Arab region. He is a very well-known Arab character in the western world, and his good nature reflects on the good nature of all Arabs, He is capable of conveying the Arab voice to the Western world, and he is known for his loyalty to his family, his work and the staff of his group. His employees are treated as members of the family.

My personal relation with Talal started 20 years ago and I am proud of such friendship with this man who is dedicated towards the path of success, his organization strives to provide high quality services and qualify its employees to reach the highest levels and contribute in developing the economic, social and cultural level in the Arab world in the global framework.

Talal Abu-Ghazaleh is one of the best Arab personalities I have even known, this man hates problems and stays away from anything that causes hurt to him and to others, this character demands respect of all.

We cannot limit his good and positive qualities in words as talking about this man takes long dialogue especially regarding his humanity.

A tribute to this wonderful man who with his self-made attitude became a symbol for struggle and success.

A leading figure

Dr. Ali Ahmad Atiqa

Former secretary-general of the Arab Thought Forum and former Secretary-General of the Organization of Arab Petroleum Exporting Countries (OAPEC)

With a light-hearted personality, a string and optimistic will and leadership skills, Dr. Talal Abu-Ghazaleh, the well-known businessman, combines between seriousness and excitement, confidence and ambition, and recognizes the role of public relations and the importance of the human element in all the leading work and initiatives.

I have known my friend "Abu Lo'ay" for nearly 40 years, when he made a working visit to Tripoli, I began to admire his personality since then, our common knowledge grew and our family relations developed after I moved with the family to Kuwait to assume the position of Secretary General of the Organization of Arab Petroleum Exporting Countries (1973-1987).

I followed up with admiration, his ability to meet the challenges he had to overcome. I have followed up his abilities to establish Talal Abu-Ghazaleh Organization (TAG-Org) as we know it today, as well as his humanitarian connection with staff who decided to move and work with him, I was impressed by their loyalty and willingness to contribute in building a new institution in difficult circumstances and limited financing, the confidence of businessmen and the economy in his personality and dealing with his new institution, due to their great confidence in his ability to succeed and excel.

Today, we witness the works of Talal Abu-Ghazaleh Organization (TAG-Org) and its pioneering initiatives in education, and in developing the skills of Arab youth in accounting, Intellectual Property, and information technology and computer science. He believes in investing in human beings through education and rehabilitation, and supports his faith in constructive work with the participation of his staff and employees who I wish them all success in serving the Arab world through this pioneering institution.

Faith in Education
Dr. Edward Grace
Head of Accounting and Auditing Department, University of Canisius, Buffalo, USA

Talal Abu-Ghazaleh is taking steady steps in the field of education, which is an important pillar in the priorities of this man who is always trying to harness most of his plans and programs to serve education, he has established Talal Abu-Ghazaleh Center for Research and Studies at the university where I have been a professor of accounting and auditing since 1988 in New York, with the aim of contributing to the development of accounting profession in the Arab world by providing research and information.

Talal Abu-Ghazaleh personalizes the importance of consolidating and strengthening the accounting profession in the Arab region as a fundamental factor towards growth, development and progress, we have worked together to establish the Talal Abu-Ghazaleh Graduate School of Business in Jordan, where the materials are taught in English. This college will be a pioneer in the Middle East, not only in its curriculum but in its evolving manner, where the graduate student will be able to enter the field directly without the years of experience that are the main obstacle to most newly graduated students.

Sindbad without borders
Ghada Fouad Al Samman
A Lebanese Author

Many shorten their history with a checkbook. Many decorate their chests with elegant ties to look like honorary medals and many of whom carry "their forearms" as a panel for a broad heading that only the shortsighted read.

In honor of the specificity of the word and the sanctity of the interpretation according to the sources of jurisprudence, I say: It is the chance that allowed me to meet him but destiny. A few years ago and during a short visit to Jordan, there was a prominent headline "Talal Abu-Ghazaleh" and I did not

have the intention to ask who he was at that time but the cheer mention of him was an urge and each person who knew him talked about his love and greatness.

I was amazed and obsessed by all of their words, one said: He is the teacher. another: he is a Professor. And the third said: he is a wise man. And the fourth said: He is the friend. And others said: he is the passionate ... and others said and said ...

I said: What is this uniqueness, how would you describe him with all these words?! They said: do you know him?! I said no. they said: Then your opinions are not correct, and your discontent charges falsely. I said: Where is the way? They said: A step!

That day, I did not understand what does this Sindbad gain from his continuous roaming across the planet, and I did not understand how he could become a glowing flame in the size of the knowledge lines, and I was not aware of his remarkable pivotal role in each forum, platform and lexicon! I just understood that thanks to his extra activity, more than a thousand employees and their families make a living ... ... I understood that he is very keen to support each learner and help him to qualify to study and gain knowledge ... I understood that despite all the certificates that collected from here and there, only one certificate is recognized, which is the testimony of the right to every position and every time ... I understood that he only boasts about his Palestinian identity, making it superior above all privileges, and that he signs with his pride and admiration the hope he seeks, and that he commiserates with his optimism the martyrs of the homeland ... I understand that his spontaneity is above every protocol and his higher bow for each simplicity and everything simple.

In me, Talal Abu-Ghazaleh forms a special exception to a great respect, and because respect is a demand, religion, approach, rank and concern, he is truly unique man.

For what he has achieved, Congratulations and we are blessed with his presence
Hassan Abu Ne'ma
Member of the Jordanian Senate and former Ambassador to United Nations

I have known Talal Abu-Ghazaleh, the brother and companion, since we sat together studying at the American University of Beirut in the mid-fifties of the last century, when I say that our close contact has not been interrupted for more than half a century, it is based on the foundations on which this calm and humble man built the greatest achievement, not only in the fields of auditing, but also in the remarkable ability to anticipate the right prospects of economic and political work at the international level, to the extent that it became the United Nations, for its greatness and extraordinary capabilities, which benefit from his outstanding capabilities in performing its most precise tasks.

Talal has not changed during the six decades that linked us with close relationship, he is the same person whose extraordinary personality and the ability of leadership and determination could not deviate his focus to reach the goal and the clear vision of what he wanted to achieve from his first years of his life, the self-confidence and deep belief in the principles of self-image related to his homeland, his profession, and his family, his community, and his friends; and courage that stood firm against harsh circumstances, and extreme crises he faced and was able to emerge each time stronger than ever. At best, and in the darkest, Talal kept his light-hearted spirit and address the most difficult issues calmly and with confidence.

Talal's difficult journey has been characterized by rare qualities and unprecedented abilities to successfully combine the opposites. His solid character was not to hold on to the national principles in particular, a reason to abandon the civility, flexibility and friendly companionship in cooperating, and the requirements to adhere to the utmost seriousness in order to achieve the great goals did not force him to lose the most beautiful aspects of his character. The great achievements he established did not

change his commitment to the rules of hard work and follow on every small and large issue and continue work day and night, not for material gain- and that was not difficult if he wanted - but for aspirations he had seen since childhood. So, congratulations to him to it prosper in the best years of his life; witness the high monument rise; and the many parts of the goal has been achieved , but without what is greater which is the liberation of the homeland from occupation; and the family has grown and flourished and health is still well and morale is high and giving is still alive, and the future is bright. Congratulations to Talal Abu-Ghazaleh for his achievements and we are blessed with his presence.

A Journey Crowned with Successes
Thabet Al Taher
A former Jordanian Minister and former director general of Abdul Hameed Shoman Foundation

Dear Dr. Talal Abu-Ghazaleh, this great man whose personal and professional biography is a success story to be followed and this country has the right to be proud of and speak about it. His Excellency Senator Abu-Ghazaleh's journey started from Jaffa, his birthplace in Palestine in 1938, to Amman, a journey crowned with successes and coupled with the hard work, perseverance, intelligence and diligence which he has placed at the head of one of the world's leading institutions offering a full range of high quality professional services , and constantly working to qualify the employees in accordance with the highest international standards to contribute to the economic, social and cultural development of the Arab world within the framework of the global economy.

Since taking over the Shoman Forum in late 2003, the Forum has hosted Talal Abu-Ghazaleh four times to give lectures on public affairs. When I reviewed these lectures, and during the preparation to write these words, I had two important observations that needed to be mentioned, the first observation is that Abu-Ghazaleh is keen to renew and diversify his lectures; in 2004, Abu-Ghazaleh told us about "The New in the New World Order", in 2007, his address was "Higher Education and the Challenges of Quality Control

and Recognition" , in 2008, he talked about "The Arab and World Economy at a Crossroads" and finally "Jordan and the Region: Where are we heading Geo-Economics."

The second observation that stopped me while writing was his autobiography, every time he speaks to us, I discover that his status has increased with the prestigious positions and the great tasks he handles and undertakes at the Arab, regional and international levels, and this is reflected in the honorary certificates and decorations presented to him, and the positions, chairmanships and titles on various boards of directors, and the publications books and dictionaries he issues , and the awards such as the honorary award he received from the Arab Union for the Protection of Intellectual Property Rights. And his election in Geneva as Co-Chair of the Global Challenges Forum, a high-profile organization of think tanks, research centers and academic institutions, non-stop achievements.

This is Talal Abu-Ghazaleh who received the confidence of His Majesty King Abdullah II, and was appointed a member of the Jordanian Senate . What a journey of successes he is enjoying ...

An encyclopedic Scientist
Dr. Saleh Hashem
Former Secretary-General of the Association of Arab Universities

I have known Dr. Talal Abu-Ghazaleh since I was president of Ain Shams University at the beginning of the third millennium. This relationship was strengthened when I assumed the duties of the Secretary General of the Association of Arab Universities at the permanent headquarters in the Jordanian capital of Amman. He was the best supporter of this important Arab civilized work.

In Talal, I knew a trustful Arab who cares about Arab causes especially the quality of education as a base for building generations capable of holding responsibilities and develop nations as the right for education is the locomotive of development and I allow myself to call Talal the encyclopedic Scientist, he is a scientific institution always on the move.

I knew in him a loving and devoted person to his original nation, helping the weak and small before the strong whenever he is able to do so part of his beginning since his youth ... whoever reads his life journey discovers the size of struggle he lived since he was a child, youth and until he established his global professional group.

Talal managed armed with his effort, patience and struggle, and continuous hard work to transform suffering into blessing and from that he was able to assume leadership positions in regional and Arab establishments to become an Arab and global personality.

Then Talal was launched to globalism and was selected by the United Nations Secretary General to lead a vital international position and he assume duties of the Global Compact for ICT.

Before this and that we need to point out that the high status of Talal Abu-Ghazaleh in the Intellectual property and selecting him as a member of the IP Hall of Fame and many important scientific and professional organizations and these were highlighted through many medals, certificates and shields from world leaders.

The Creative Organizer
Dr. Jawad Anani
Former Jordanian Deputy Prime Minister

The life of Talal Abu-Ghazaleh deserves an in-depth study and an analytical scientific book to learn from. The life of the great men is always a source of experiences and lessons. Their brains store wisdom, experience and useful knowledge, which is a "vision for the people" as stated in the verse. In their life there are success and failures, ups and downs and tests and we as students should consider.

The life of my brother Dr. Talal Abu-Ghazaleh might have a special feature that I have learned from my experience with him, which began in the late 1970s. I accompanied him in many journeys: to Doha, Abu Dhabi, London and Davos and participated with him in many seminars and conferences and have been

with him in forums and serious efforts to serve our nation in the last years. I used to ask: who is this stubborn man who challenged the Greater Amman Municipality for many years because it wanted to place its hand on one of his buildings under the pretext of public benefit, and he finally won? How did he manage to overcome the crisis in the 70s and 80s? How did he develop his business from one context to another? How did he renew the life of his institutions and remained a permanent leader? And where does he come with insight to see what people will need and benefit before it is too late?

These questions and others makes me go back in time to our traditional stories about jinn and mankind and I say that this man has a partner who sees things that we cannot see. Is not this the definition of creative organizer?

And finally, what distinguishes Talal Abu-Ghazaleh is that he did not remain in the framework from which he started.

A Man with Determination is worth a Nation
Mazen Al-Hasasneh
Chairman of the Board of Directors of the Palestinian Turkish Businessmen Union

In the presence of dignitaries and achievers, we stand in front of a man proud and honored of his distinguished journey and great history who stood tall despite the challenges and struggle. This is what moves me the jubilation of a Palestinian Arab-Jordanian pride who we are proud of. Dr. Talal Abu-Ghazaleh is one of those who reshaped the model born from the womb of a refuge and deprivation into a sun that lives in the sky as a symbol of victory, a slogan for an amazing success.

It is my right and the right of all Palestinian businessmen in Turkey and to all members of the community as we honor this man to be proud of him, he who represents the real Palestinian who struggled for his national identity, Talal Abu-Ghazaleh became the miracle of the Palestinian Diaspora and a Palestinian icon that proved that we are a mighty people that do not die easily, but live and excel and move forward despite the attempts to wipe us out.

This honor presented to Abu-Ghazaleh is a simple part compared to what he presented to his people, nation and cause and from here we launched in Turkey A Man with Determination is worth a Nation and this man is Talal Abu-Ghazaleh with his history, cognitive, academic, economic and social path. He is one of the most influential people in the economic field in the region. He is one of the most creative people in the science of knowledge, a national symbol and registered trademark of struggle whose rights belong to the Palestinian, Jordanian and Arab people.

A Passionate for everything Palestine
Archbishop Sebastia Atallah Hanna
Archbishop of Sebastia

From Jerusalem we deliver a message of loyalty, respect and appreciation to Dr. Talal Abu-Ghazaleh who we consider a personality of our Arab nation.

There is a verse in the Holy Bible that says:" For all those who exalt themselves will be humbled, and those who humble themselves will be exalted." This verse clearly specify that the greatness of man is in his modesty, the more man is modest the greater he is in front of God and people.

Our dear friend Dr. Talal Abu-Ghazaleh is great in his modesty, humanity, Ethics, principles and values that he has advocated and continues to advocate.

I proudly describe Dr. Talal Abu-Ghazaleh and from the heart of the city of Jerusalem where I am based that he is a Passionate for everything Palestine and we are proud of Dr. Talal Abu-Ghazaleh who is always proud of his origin and roots and he never forgets that the Palestinian issue is our issue wherever we are and it is our duty to defend this case.

I met him several times and I found in his words the wisdom, Consciousness and Commitment to Humanity First and Arabs secondly.

An educated man means exactly what the word educated means and there are many people with degrees but when we talk to them we discover they are far away from culture and thought.

Dr. Talal Abu-Ghazaleh carries a humanitarian, intellectual and cultural message and the remarkable successes achieved in his projects, ambitious and programs are the main reasons behind being an owner of a moral thought and noble human spirit.

The symbol placed on the entrance of his office (God is Love) and how beautiful are these words which embodies the values our dear friend Dr. Talal Abu-Ghazaleh was raised by.

He defended Palestine in all places he existed in and he used to travel from one capital to another and from one country to another not only to promote his successful programs and projects but also to preach about the justice of the Palestinian issue.

I would like to say to Dr. Talal Abu-Ghazaleh from the heart of Palestine which he loves that Palestine loves you and it is proud of you and with all your gifts to humanity and to the Arab world and to Jordan, which you love and belong to as you love Palestine and belong to it.

You have received many awards and decorations and those who visit your office can witness the walls full of pictures with world leaders and also full with medals and shields honoring you.

We believe that honoring you is not only a tribute to your honorable person, but a tribute to Jordan, a tribute to Palestine and a tribute to the noble human and ethical and attitudes that you have carried in your heart for decades.

Meanwhile your elegant Christian presence in this Arab Mashreq you have always been keen to show its originality everywhere you go. You have always said that Christianity was born here and Christ was born in our country, and the Arab Christians are genuine in their belonging to the Arab nation and the Arab Mashreq and its national issues headed by the issue of Palestine.

We need your words during this difficult time and we need more your united stands in these tragic circumstances that are afflicting our Arab Mashreq, where the enemies of the Arab nation are seeking to separate us and provoke hatred among us. They have created tools for us to serve them and they are the other side of Zionism, with the aim of taking our societies apart and turning us into rival sects and tribes instead of becoming one nation and one family.

How much we need you and those who are similar to you who call for tolerance, unity, and union between man and his fellow man? and how much do we need those intellectuals, thinkers and innovators who are working to unify the ranks and thwart all conspiracies and plots that surround us and target our national issues, foremost of which is a just cause known to modern human history, namely the issue of Palestine.

Arabs, in all their sects, appreciate your positions and the Christians in Palestine and in the Arab Mashreq are proud of you as a personality of our Arab nation and our Jordan and Palestine, which is always dear to your heart. We always consider you as a personality full of unity and tolerance and love between man and his fellow man.

We pray for your health, you are one of the wise, intellectual and educated people in our nation, who we are proud of and their achievements, their giving and their success.

I am proud of being one of your friends and proud of meeting you always and in each meeting I become prouder of you and our brotherly friendship.

From Jerusalem, the capital of Palestine, we bless you with the message of loyalty and pride. We are with you and we will remain in every good work and in every meaningful activity to serve our society and our nation and our just national causes, foremost of which is the issue of Palestine.

Blankets Become Jackets

The author with his colleagues at
Al-Makassed School – Beirut

The author speaks at the American
University of Beirut

The author with Mr. Bill Gates
(center), Lubna Alqasimi, Ali Saleh
Alsalehi and Dr. Ahmad Nazif at
Microsoft's Government Leadership
Forum Arabia in Cairo

The author on the UN Podium

The author with Mr. Ban Ki-moon
– UN

The author with Mr. Kofi Annan at
UN Headquarters - New York

The author with His Majesty King
Felipe VI of Spain

The author with HE Ms. Irina
Bokova, UNESCO Director-
General at UNESCO Headquarters
in Paris, France

The author with US President Jimmy
Carter

His Majesty King Abdullah II awards
the author the Order of Independence
of the First Class-Jordan 2016

The author honored by HE Mr. Xi Jinping, President of the People's Republic of China for his role in enhancing the Sino-Arab relations

The author with HE President Abdullah Gul, Turkey

The author with His Holiness Pope Francis

The author with HE Rafiq Al-Hariri, Prime Minister of Lebanon

The author with HE President Yaser Arafat, Palestine

The author with US Secretary of States, Henry Kissinger

The author with HM King Abdullah II and HM King Hamad bin Issa Al Khalifah

The author with Mr. Edward Heath, Prime Minister of Britain

The author with HE President Francois Mitterrand, France

The author with His Majesty King Simeon II of Bulgaria

The author with HM King Hussein bin Talal

The author receives an honorary doctorate in Humane Letters from Lebanese American University

The author (middle), Archbishop of Canterbury, UK (right) and Evelyn de Rothschild (left) at Saint James Palace during the launching of Code of Ethics based on the three main religions


The author with the Custodian of the Two Holy Mosques King Salman bin Abdulaziz, and Crown Prince HRH Mohammad bin Salman bin Abdulaziz

The author with His Majesty King Abdullah II

The author with His Highness Sheikh Sabah Al-Ahmad Al-Jaber Al-Sabah, Kuwaiti Minister of Foreign Affairs and current Prince of Kuwait, and Mr. Yousef Ibrahim Al-Ghanem. Kuwait - March 26, 1978
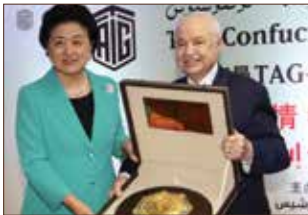
The author with Vice Premier of the People's Republic of China, HE Ms. Liu Yandong

The author with Her Majesty Queen Rania Al Abdullah of Jordan

The author with Sheikh Mohammed bin Rashid Al Maktoum, Vice President of the UAE, Prime Minister and Ruler of Dubai

The author with His Highness Sheikh Nahyan bin Mubarak Al Nahyan, UAE Minister of Higher Education and Scientific Research

The author with CEO-Managing Partner for Abu-Ghazaleh Intellectual Property (AGIP), Mr. Luay T. Abu-Ghazaleh.

The author with Chairman of the Joint Chiefs of Staff of the Jordanian Armed Forces, Lieutenant General Mahmoud Freihat.

The author with Chairman of the Joint Chiefs of Staff of the Jordanian Armed Forces, Lieutenant General Mahmoud Freihat and a group of high ranking officers

The author with high-ranking military officers of the Egyptian Armed Forces

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Talal Abu-Ghazaleh: 10 Prescriptions for Success

1. Hope brings luck: **Be hopeful, always**.
2. Happiness is an enabler: **Be happy, always**.
3. The objective of education is innovation: **Invent**.
4. Be a natural and perpetual student: **Never stop studying**.
5. Look for the first mover advantage: **Resist the herd instinct**.
6. Just like your non-stop heart, rest is bad for you: **Work and work**.
7. In Arabic, retired (متقاعد) means "die-seated" "قاعد – مت"!: **Never retire**.
8. Your adversaries help protect you from yourself: **Love and love everybody**.
9. Welcome adversities and failures: **Turn them into blessings and successes**.
10. At school, you learn and sit for exams: **After School, you face exams and learn**.

Talal Abu-Ghazaleh

Inspirational Quotes,
HE Dr. Talal Abu-Ghazaleh Believes in

"We may think of some absent people more than the present ones"

"Wounds from sword heal, but wounds from the tongue do not"

"Neither success nor failure are ends, they are a bridge to each other"

"If a lion attacks you, face it before you become its prey"

"Flowers are flowers whatever you try to call them"

"Forgive your enemies, but learn their names by heart"

"Hope for the best and you will find it"

"Nobody can ride you, unless you bow"

"Fisherman captures fish from head not tail"

"It is not sufficient to be a good horse, others must know that"

"If you want to reach somewhere, you should know from where you can begin"

"Those who have nothing to do must not hinder those who are actually working"

"The loftier you feel your position, the more humble and modest you should be"

"You might not want battles, but you should realize that battles will not leave you"

"It is insane to continue to do the same things in the same manner expecting new results"

"Great minds discuss ideas, average minds discuss events and small minds discuss people"

"Reading is eating and drinking whose neglecting weakens minds as body without eating or drinking"

"Higher-ranking people shall feel no envy for others, and the quick-tempered ones shall never be higher ranked"

"Kingdom's roots lie in the state, but state's roots lie in the family and family's roots lie in the head of the house"
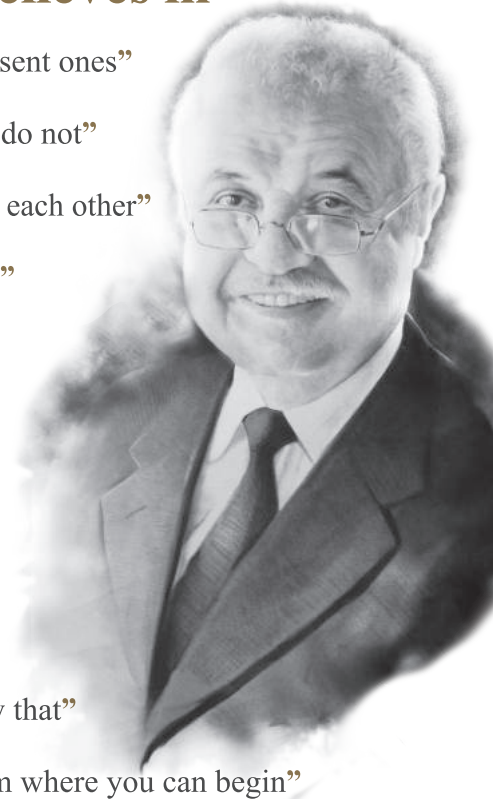
" The Inevitable
Real Future Which The 4ᵗʰ Industrial Revolution
Will Create **"**

Talal Abu-Ghazaleh

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