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Future The Future

November

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The image features decorative curved lines in the top-left and bottom-right corners. These lines are composed of three concentric arcs in dark grey, light grey, and yellow, creating a modern, abstract frame.

In the Name of Allah the Merciful

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Executive Summary

This scientific report concludes the discussions that took place during the Fifth ASBAR Forum 2nd- 4th November 2020, under the title “The Future of Future”. This Report includes eleven pillars highlighting the main points that were analyzed and discussed during the Forum’s sessions.

The first pillar addresses some Experiments and Models of Modern Technology as well as predictions of our world in 2050. In addition to a focused analysis of future cities and communities that are highly connected. There was also a mention of the Nanobot technology and how this may connect human brains directly to data clouds.

The Future of Work and Jobs was tackled through the second pillar. Defining expected needs, possibilities and opportunities. It was mentioned that future jobs are those jobs that respond to economic, social, cultural, and technical changes in conformity with the Saudi Vision 2030 aiming at achieving sustainable economic development, productive capacity, great competition and generation of new job opportunities.

The third pillar addressed the Developing Approaches in both fields of Energy and Water. The discussion highlighted combining traditional and renewable energy and the role of innovation in energy transformation. The future of energy was also mentioned whilst looking at the fast-urban expansion and increased demand for energy.

Digital Happiness was the discussion point under pillar four. While acknowledging that virtual reality has surpassed all expectations and is now playing a big role in different aspects of human lives, using the latest technology.

Pillar number five discussed the Role of Science in Foreseeing the Future and Mitigating Critical Transformations. In this regard, light was shed on the Science group (S20), that is one of Group of Twenty (G20) engagement groups, and its role in using science as a tool to guide humanity through a turbulent future.

Crisis Management in action was the topic of pillar six. A close look was taken at some of the experience of so-called “Flexible Cities” in dealing with the COVID-19 Pandemic crisis. The role of universities and research centers during the crisis was also central to the discussion. In addition to adapting the crisis management to large-scale and longer-term incidents. The seventh pillar focused on the Kingdom’s Technological Perspectives for the Future, by mentioning King Abdulaziz City for Science and Technology (KACST) and its role in enhancing the foresight of technology in the Kingdom.

Future Re-definition of Education/Learning was the topic of pillar eight. This re-definition stressed the fact that employing technology in Education/Learning has become a reality in all sectors. This re-definition of Education/Learning evolves briskly and unexpectedly from merely a simulation of reality to predicting the future.

Pillar nine presented the Future of Health in 2050, highlighting opportunities and challenges in future healthcare and the role ample “health data” can play within the health sector.

Under pillar ten the discussion included the Future of Digital Economy and the future of small and medium-sized companies. In an attempt to highlight the requirements necessary to face upcoming challenges, most importantly, digital transformation and organizational flexibility.

The last and final pillar addressed the Global Health Security issue and means of coordination to face COVID-19 Pandemic and other Pandemics. Pointing out that one of the main challenges in such a confrontation is missing data, sharing the data and the subjectivity of such data.

ASBAR's Fifth International Forum discussions around the Future of Future highlighted following recommendations:

1-Future Technologies.



Benefiting from International Best Practices in the domain of future technology and employing digital technology in a manner that meets Saudi Arabia's needs and context.



Supporting scientific research in the domain of Nano Robots. Improving Nano Robot Applications which hold the potential to change some concepts e.g. Learning, Communication and Therapy, highlighting the role of KACST in this support.

2-Future of Work/Jobs.



Benefitting from the experience generated through COVID-19 Pandemic to build a sustainable Remote-Working future that will ensure general wellbeing.



Continuous improvement of legislation and regulations that control the changes of the working environment and adapt fluctuating future jobs.

3-Innovative Approaches in the Field of Energy and Water.



Establishing a Fund that will finance Innovations in Renewable and Sustainable Energy Sectors (Water, Food, Environment).



Both the Ministry of Energy and King Abdullah City for Atomic and Renewable Energy to include the private Sector in designing a National Strategic Plan for Renewable Energy.

4-Digital Happiness.



Investing in Artificial Intelligence (AI), Virtual Reality (VR) and Augmented Reality (AR) to improve individual's wellbeing and society's happiness.



Supporting Electronical Sports that aims to rehabilitate Youth and enable them to live positive experience through digital gaming, maintaining culture and traditions in the digital age.

5-Role of Science in Foreseeing the Future and Mitigating Critical Transformations.



Putting in place practical plans that will execute the recommendations of S20 group, especially in suggestions pertaining to the future of health during COVID-19 Pandemic and preventing other potential Pandemics.



Investment and utilization of technological solutions and AI in developing the health sector resulting in a qualitative shift in Medicine and the assistance of Doctors to detect and treat diseases.

6-Crisis Management.



Creating a common strategy for crisis and risk management between the different research centers, maximizing the usage of research results, data and health plans in prioritizing research to face Pandemics.



Establishing a consultative entity to predict the crisis. This entails creating jobs that specialize in risk and crisis management.

7-Kingdom's Technological Perspectives for the Future.



Investing in the scientific foresight and making-use-of the fourth Industrial Revolution to promote the national economy.



Establishing an Innovation Incubator that will provide digital solutions in the areas of electronic and mental Mathematics.

8-Re-defining Education/Learning.



Expansion in the use of remote Learning terms and techniques in a manner that compliments traditional learning to create an advance and sustainable learning model.



Establishing and developing Science and Technology Parks, to transform scientific research and innovation into knowledge and economic products which will enhance income-generating diversity, grow national economy and improve competition.

9-Future of Health in 2050.



Promoting the benefit of modern technology in Genetic Engineering and Personalized Medicine to treat diseases and manage health problems.



Local and regional cooperation and coordination to establish a Big Data base that includes the genetic patterns, biological patterns as well as clinical data to assist in making a sound medical decision based on accurate data and early detection of many diseases. Sensitizing individuals and health care givers to the importance of Big Data within the health sector and serving both Diagnosis and Treatment.

10-Future of Digital Economy and the future of small and medium-sized companies.



Analyzing the structure of small and medium-sized businesses/facilities in the Kingdom as per each sector while considering how it functions. In order to suggest a program that will enhance its performance, secure its existence and promote its development.



Supporting small and medium-sized businesses that are functional in the domains of AI, VR and AR, especially the ones used in the fields of Medicine, Education and Entertainment.

11-Global Health Security.



Supporting Primary Health Care
in a manner that enables societies
to face Pandemics.



Promote international
cooperation in the area of
research to secure data and
share it between countries for
explicit coordination and a unified
response to COVID-19 Pandemic
and enhance preparedness to
face futuristic health crisis.

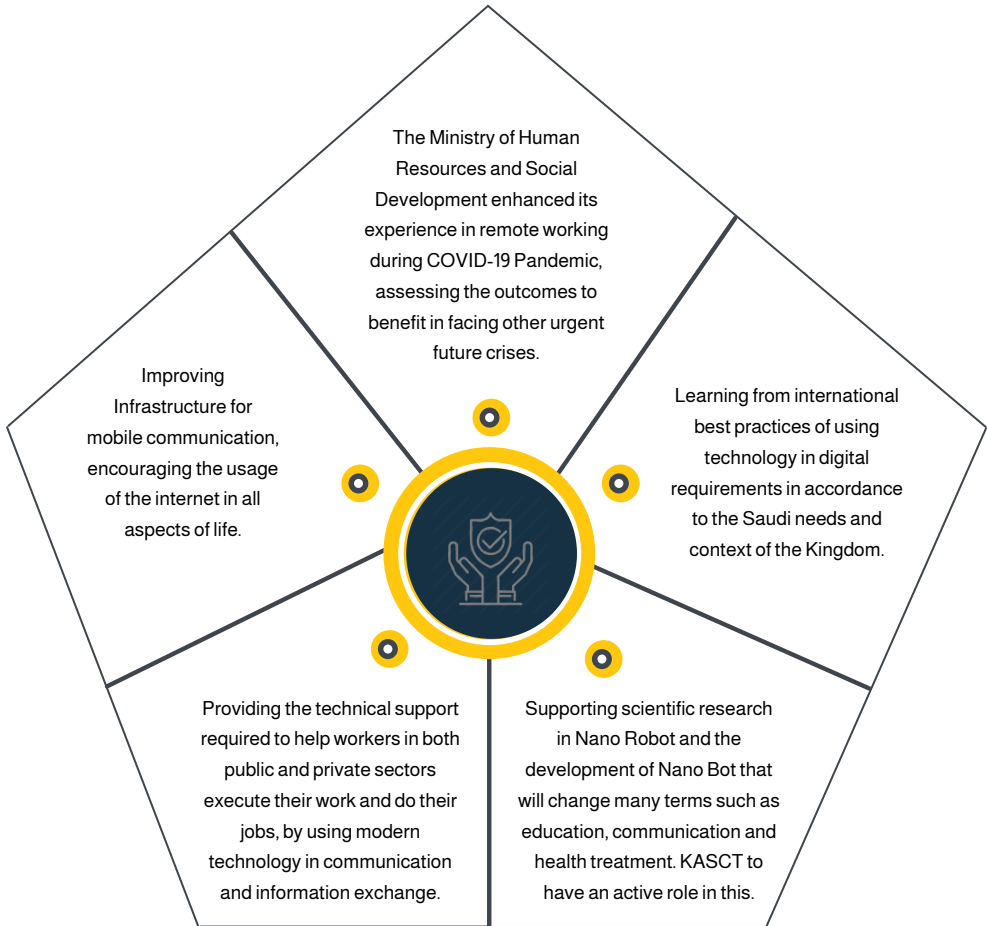


Chapter One

Future Technologies: Predictions for our World 2050

- Recommendations.
- The experience of the Ministry of Human Resources and Social Development in building a model that measures remote work productivity.
- Technological Centers – the Experience of PTN
- Highly communicable future cities and societies.
- Nanobot, how will it link our brains to the data cloud.
- Resources and References.





The experiment of the Ministry of Human Resources and Social Development (HRSD) in building a model that measures workers' remote working productivity.

The HRSD worked on enhancing the remote working environment during COVID-19 Pandemic by providing the technologies necessary to assist employees of both the public and private sectors, in conducting their daily tasks. This experiment was meant as a pilot for other public sectors.

Remote working and flexible hours are part of the continuous attempts to implement best practices in the area of managing and developing human resource. Throughout the COVID-19 Pandemic, both remote working and flexible hours have resulted in social, economic, and administrative benefits for employees, organizations and society. In addition, it created new job opportunities particularly for females and persons with disabilities. As the latter were able to work from home without having to commute to work or requiring assistive devices at their working place, maximizing their integration into society.

The process of selecting the human resources for remote working:

First – Nomination: different directorates are requested to nominate 20% of their employees to work remotely, keeping in mind their titles, the efficiency of the nominated employee. This is followed by the preparation of nominees list, revising those lists and collecting data about the nominees.

Second – Distribution, is done into 3 categories based on job description and tasks:

- Working remotely at a 100% rate
- Working remotely at a 50% rate
- Field work 0%

Third – Set up, which includes:

- Preparing a 'Remote Working Guideline'.
- Defining the performance measurement methodology and framework.
- Ensuring preparedness and efficacy of systems that support remote work.
- Providing the requirements needed for applying remote work.

Fourth – Preparation, this phase includes:

- Equipping employees with the Guideline for remote working, while explaining the nature of remote working, its objectives, and ethics.
- Standards of Governance and Cyber Security.
- Introducing technology and its use.
- Answering enquiries to achieve transparency and clarity.

HRSD applied the remote-working experiment during the COVID-19 Pandemic outbreak, as of 28/6/2020. The elements that were part of this experiment were:

- 1-Measurement: measuring technical preparedness to switch to remote working.
- 2-Set up: setting up the technical requirements.
- 3-Building: which includes preparing training manuals for technical tools. Also having the technical equipment ready for its application and the availability of internet connection.
- 4-Evaluation: evaluating the preparedness of employees to execute their tasks remotely and estimating the related costs.
- 5-Partnership: building a partnership model with a strategic partner.
- 6-Activation: providing technical requirements to facilitate access to working environment and internal communication between employees and their supervisors and enable them to conduct their daily tasks.

Categorizing employees in accordance to their functions

Managerial employees

Those employees whose most functions depend on meetings and phone calls and whose work does not rely on internal systems.

Employees who operate on technical platforms

These are employees whose work requires their presence at the office to Work on internal systems.

Multi-tasked employees

These are employees whose functions require meetings and phone calls in addition to working on internal systems.

Measurement tools

- Auto-generated reports on the numbers of meetings and phone calls.
- Reports on system use.
- Electronic evaluation of employees.
- Commitment.

Target groups



Employee



Supervisor

Employees who are targeted as part of the Remote-Working Initiative

According to the function required	Managerial	Operating on a Platform	Multi tasked
	57%	12%	36%
Those employees who have benefitted from the technical provisions	Total	Men	Women
	65%	52%	48%

The methodology of measuring employees' performance:

1-Performance measurement: designing a system that measures employees' performance while remotely working. This system was built on objectives and individual competencies, to guarantee proper measuring. This system would also facilitate communication between supervisors and employees. Performance conduct was designed to score 70% for objectives and 30% for competencies.

2-Processes on e-services: monitoring operations other electronic services that are executed on HRSD's systems. And measuring remote-working employees' interaction and productivity.

3-Commitment to being present: as part of the performance, questions related to assessing the availability of the employee who is working remotely were included. This was also checked by supervisors who would confirm direct supervisees were available during working hours. One of its objectives was to achieve equality between employees.

4-Various tools that included:

- Counting internal communication interactions via:(phone calls, direct messages and meetings).
- Observing the daily entries of employees through the entrance gate.
- Participating in the survey on this experiment by employees and supervisors.

Performance indicator of remote-working employees

The Equation of calculating remote-working employees' performance				
Employees' functional categories	Performance measurement	Average of employees' commitment	Measuring the work done on e-services	Interacting with the other tools and evaluating the experiment
Managerial employees	60%	25%	5%	10%
Employees who operate on technical platforms	35%	20%	35%	10%
Multi-tasked employees	45%	25%	20%	10%

Measuring employees' performance		
Managerial employees	Highest score	Lowest score
Very high	5	4.2
High	4.19	3.3
Average	3.29	2
Low	1.99	1
Very low	0.99	0

Performance indicator of remote-working employees

Employees' performance	Employees' specific functions			
	Managerial	Operating on platforms	Multi-tasked	total
Very high	10%	1%	1%	12%
High	30%	3%	24%	56%
Average	9%	6%	10%	25%
Low	2%	2%	2%	6%
Very low	1%	0%	0%	1%

Overall experiment index: 3.42/5

Overall result: High

Employees' specific functions			
Employees' functional categories	Average	Percentage	Employees' performance
Managerial employees	3,62	53%	High
Employees who operate on technical platforms	3,01	11%	Average
Multi-tasked employees	3.26	36%	average

In general, HRSD's experiment generated good results, particularly during the Pandemic, resulting in benefits to the employees themselves and the management. But it would require re-organization in order to achieve the anticipated results.

HRSD's mechanisms to improve future remote working experience

Establishing a unit that supports employees who work remotely from an administrative perspective as well as supervising their performance.

Developing operational procedures (technical/administrative) for remote working. Starting with the selection process of employees and their interest in doing so and ending with evaluating their performance.

Building a working model in managing tasks and performance that are suitable to the working environment from a technical and functional perspective.

Sensitizing and raising awareness about the remote working culture.

Technical Centers - PTN experience

What is PTN?

Digital technology has many privileges, collecting special and graphical significances to compliment objective and context, resulting in reproduction of visual knowledge through quantitative and qualitative data. Leading to the results that can be presented in a comprehensive manner.

Within this context, Senegal is aiming at being the first and largest digital platform, through working on the 'Digital City' project which includes PTN. The PTN's objective is updating and enriching economy, improving private sector, and enhancing overall growth. This project is being funded by the Senegalese Government and the African Development Bank (AfDB).

The PTN will be compromised of platforms and areas that are stand-by to be used for attracting investment to diversify economic growth resources at an estimate of 70 Million Euros, which is expected to generate around 100,000 in/direct job opportunities.

Expected implications of PTN:

- Creating infrastructure at a level that would attract global and regional companies in the Information Technology (IT) and Communication sector, as well as the research and innovation sectors.
- Establishing an innovative problem-solving platform for the e-Government which would improve efficiency in all development sectors such as Health, Education, Agriculture and Industry...etc.
- Transferring IT and telecommunication companies that improve innovation and contribute to the Government revenues (improving the Trade Balance).
- Improving Applied Research and leading Business in the area of IT and communication.
- Creating jobs and improving the Human Capital in the innovative sectors.
- Creating job opportunities in the digital services sector and all economic sectors.
- Encouraging new business incubators.

Final outcomes of PTN:



Highly Communicable future cities and societies

Future cities and societies depend highly on IT and communication. Increasingly, mobile phones have become more important as means of communication in intelligent cities. In fact, mobile phones are the most used technology device ever throughout history. Yet, as consumers we still demand more; broader coverage, better connectivity, higher data processing abilities, all of this at a cheaper and affordable cost.

Therefore, when researchers and communication engineers began exploring the spread of 5G technology worldwide, they started planning and brainstorming what a 5G technology should entail. As it took them

Ten years during the last Four decades to design, develop and spread one generation of wireless networks.

Ten more years was needed to operate the developed networks intensely which then led them to developing the next generation. Reaching 2050 we need to be talking about 8G.

at this point, there are some general global problems and limiting factors:

i. Obviously, the world is becoming more structured. Large cities that have a population between 10 to 20 Million are surfacing, creating a bigger need to manage and operate larger cities in order to effectively serve its inhabitants. Some relative indicators to this context:

- World population will reach 8.5 Billion by the year 2030 and 11 Billion by the year 2100.
- As of 2018, 55% of the world's population live in urban areas, this percentage is expected to rise to 68% by the year 2050.
- By the year 2030 it is expected that the world will have 43 gigantic cities with a population exceeding 10 Million.

ii. Looking at the map of the 4G network distribution worldwide, it is clear that there is a dangerous gap of connecting to the internet at a global level. Half of the world's population, which is about Three to Four Billion people, are not connected to the internet. Based on the initial stages of the 5G expansion this gap seems to become bigger, reflecting the so called "Mathew effect" where rich people are becoming richer and poor people are becoming poorer.

World map (at a global level there are serious gaps of accessing the internet)

Distribution of internet connectivity at a global level

4G network at a longer term

COVID-19 Pandemic has also showed one aspect of the deep-rooted economic and social inequalities between those who possess and those who do not possess.

As for the next generation of communication, which should be about connecting those Three or Four Billion people to the internet, this is much about removing them from their economic and social isolation to be able to live the experience of digital transformation that the internet connection provides in the different aspects of remote health care, education, smart agriculture, direct banking services and new potential jobs and economic opportunities.

So, how can those be people be connected to the internet? Keeping in mind that this goal is not a human goal but rather an opportunity to achieve important economic activities and a step towards stronger connection at the bottom of the global economic pyramid.

The pyramid base model

Pyramid base as a strength

Potential huge market – creating new markets for unmet needs

Strong innovation – incubating new scattered technologies

Pushing the marker up – providing growth through reflective innovation

Connectivity as a main facilitator

A cloud-based platform – possible solution to overcome high costs related to vast distribution

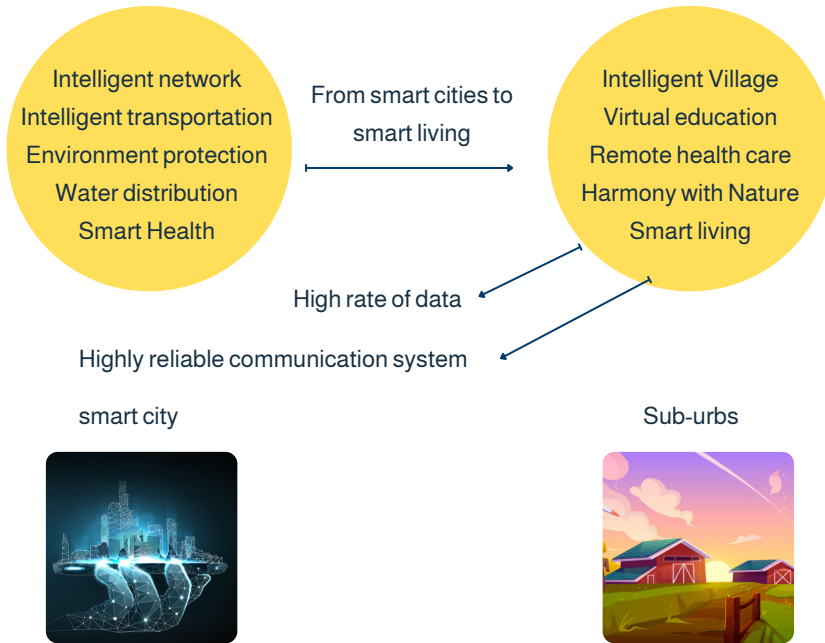
A huge market of visible consumers, producers, and innovators

Largely excluded from formal markets

Fast growth of un-used production sector

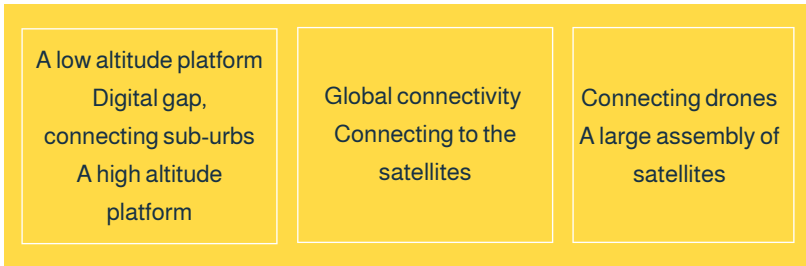
As a matter of fact strengthening connectivity, at the Pyramid's base, towards the social and economic weak groups, which includes non-connected individuals, will lead to creating a market with high potential of consumers and producers who are currently off the formal markets. This will then lead to narrowing the economic and social disparities between those who possess and those who don't, paving the road for a huge market. All of these outcomes translate in theory the massive attention and involvement of the world's largest companies i.e. Google, Amazon and Facebook, in improving global connectivity; These companies are currently leading large communication projects. The minute a qualitative global connection can be made, this is when the gap between rich and poor can be filled, where rich societies can share their knowledge, and strengthen the economy of the more vulnerable, poorly populated societies.

This takes us from understanding the so-called "smart cities" to a broader understanding of what is called "smart villages" and smart living. This would also be possible in a less populated, less crowded environment and a less polluted one. Quality of life can improve without having to migrate to large cities, this transformation is very likely to be witnessed in the next few decades.



Global connectivity does not only rely on an expensive infrastructure but in fact depends on establishing a 3D comprehensive network that entails ground and space stations and satellite communication. The matter at hand is precisely a self-regulating network, which relies mainly on a ground station, on drones flying at an altitude of 50 – 115 meters. And on Balloons and spaceships that fly at an altitude of 500 – 1000 meters. Such networks also rely on space platforms at a 20-kilometer height and large clusters of traditional and non-traditional satellites at the altitude of 36,000 kilometers.

A comprehensive aerial and ground network



An obvious connection lies between the innovative solution of communication and networks for non-connected people, together with the recent-emerging concepts of network box or internet box. Such networks provide an array of portable and self-regulating means, that enable communication from the air to a range of users such as; emergency calls, or those required during peak times or research missions to the Amazon forests or to mobile cells such as: Airplanes, Ships, Boats and Trains.

Global communication can result in many benefits whether under the sea or on the surface of earth or up in the air. As such, this global communication can contribute positively to smart agriculture and meteorological observation. It can also connect different solutions of areal and special communication and modern trends in transportation. The invention of transportation means has enabled humankind to use cars, trains, or planes for daily mobility. But the increasing demand on the different means of transportation as a result of, increasing rate of population led researchers and transportation engineers to look into the unused special area to make room for suggestions such as the “flying Taxi”. Such suggestions could be ultimately more efficient and cost effective to be used to transfer goods but also to solve the problem of heavy traffic in crowded cities. Moreover, it could be used to access remote areas that are difficult to reach.

It is suggested that these means of transportation are connected amongst each other and enable travelers to remain connected during their trip.

Meteorological observation using Internet

Under sea internet, observing changes in: Salt levels PH levels Sea temperature	Space internet, observing changes in: Cloud cover Solar radiation Ocean and Land surface	Underground internet, observing changes in: The soil Earthquake activity Gas leakage
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Data analysis and modeling
the global climate

Pool of global internet
(Climate data)

Communication in future transportation

Urban areas	high altitude transportation	On ground and
Sub-urban areas	flying taxis	water
Storage and maintenance amenities	second generation of transportation	transportation Underground transportation

It is anticipated that these expectations will become reality by the year 2050, as predicted by the inventor (Nikola Tesla) who lived between July 10th, 1856 and 7th January 1943. Who said:” when wireless is fully applied the earth will be converted into a huge brain, capable of response in every one of its parts. We shall be able to communicate with one another instantly, irrespective of distance”. (N. Tesla, 1925)

How will Nanobot connect our brains directly to the data cloud

The meaning of nanorobotics

Nanorobotics is a technology made to create machines or robots whose components are at or near the scale of a nanometer (10^{-9} meters). More precisely, nanorobotics refers to nanotechnology engineering of designing and building nanorobots and devices that range in size from 0.1 – 10 micrometers. Devices that are being created using this technology are also called nanobots, nano aids, nanites, nanomachines or nanomites.

Nanorobotics and future lifestyle

In an imaginary attempt of life in the year 2050, here is an example: remember a day waking up with a severe headache, taking pain killers but nothing works. Heading to the office, being reminded by your assistant of your days' schedule, pointing out meetings that you have totally forgotten about. Later that day you head to the doctor to do a health check-up, spending about Four hours between diagnosis and medication prescription. At home finally, feeling very hungry yet extremely tired, so you go straight to bed after a long day at work and at the clinic. So, let's imagine it is Sunday morning 2050, you lie on bed, staring at your phone's clock, you feel a severe headache, but you know your diagnosis and you know what medication is required. You remember you entire agenda and don't need an assistant to remind you, all of your thoughts are organized. You cannot speak Chinese but within Two minutes you speak Chinese fluently ready for your next meeting. You drive by a restaurant looking forward to having your favorite dish which ready to be picked up without having to make an order. You head home, everything has been set up for a nice break. This beautiful scenario is almost happening!

The previous scenario makes us wonder: how is this possible? This can be actually made real through nanorobotics that are made from nano material made for specific goals. Nanorobot technology makes it possible for nanorobot to interact with the human body, specifically the brain. Massachusetts Institute of Technology (MIT) Media Lab has started exploring this technology in the health care field. By knowing all what needs to be known about the human brain and different body parts, reading the signals, and interpreting the signs. Have you ever thought of involving the brain into our technological life? The idea of nanorobotics will include tiny robots that could be microscopic and can be them implanted into the human body through the blood stream. The inventor behind the nanorobotics is Adriano Cavalcanti, who is considered a pioneer in the nanorobotics field inventing practical devices depending on this technology, mainly in the health care domain. His research paper was published in 2004 in the Nanobiotechnology Journal.

Ray Koziol has predicted that in the near future (over the next decade) we will be sending one robot to the brain, which will connect the brain's Cortex to Cloud networks. The cortex is responsible for higher functions such as: perception and sensory perception, movement, and language. So, imagine how you may be easily able to learn a new behavior and new languages.

There is a misconception that we only use 10% of our brain or very little of it, where in fact our brain is constantly active. So, the idea is not to activate the brain but activate the structure itself and make changes to this structure to enhance changes in the neural network. For example, Connections can be made to enable us to draw maps as a new skill.

It is expected, in the field of nanotechnology, that artificial intelligence and mathematics will develop brain cloud interface which can support this revolution in the nanotechnology. Nanotechnology devices can move inside Human blood vessels to place itself within the brain. Coded data will transfer wirelessly and create a computer network based on the cloud to monitor the brain's status and extract data. It becomes weirder when you think that this could allow to download information into the brain.

If data could be transferred to the brain and its structure changed, this means any program, new skill or new language can be downloaded. The brain's cloud interface will enable us to establish future global brain network. Human brain and Artificial Intelligence can create a cell brain, one can increase abstraction through technology, to be able modify through connecting our brains to the cloud. Therefore, increasing a Personal Computer's intelligence or that of a smart phone by connecting them to the cloud is very similar to connecting multiple brain networks to the (Thought's internet).

Humans interact with technology, and it is well known that Radio Microchips can be implanted in the human brain to connect to the data cloud. The same idea enables us to connect our thoughts to a data cloud. Prediction will actually help us navigate towards the goal, while exploring great ideas and revolutionary technology along the way. Pretty funny, that soon we may be able to swallow the Physician! Which could be the next nanorobot that will replace the Physician and health care.

Nanorobot technology will benefit society in different aspects, in particular it will solve some of the main problems in applied health care. In 2017 scientists invented nanorobots that would target and kill cancer cells. This year in 2020, researchers actually designed a nanorobot made of DNA parts that can destroy disease-causing RNA. Elon Musk, who is the CEO at Tesla Company, succeeded in implanting a nanorobot device into a pig. A brain scan taken in 2020, showed that the pig was in a good health and its brain activity was read wirelessly.

This will contribute to economy and politics, creating new job opportunities in many other sectors, most importantly in research, engineering, and technology.

Looking closely at the emerging Nanorobot technology, it is clear that it is in line with KSA's vision of 2030. This vision aims at developing digital infrastructure, considering it to be a main element in building advanced industrial activities. this element would draw international investment, hence, improve economic competition. This increased the demand of relevant specialties and engineering, opening opportunities for engineers.

The University of Business and Technology (UBT) qualifies its graduates to meet the market's needs which is also in line with KSA's 2030 vision. UBT enhances the national identity through the outcomes of its education, leading individuals to success and creating a generation that harmonizes with the economic and political values of the Kingdom, focusing on improving learning outcomes for graduates within a vibrant community.



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Chapter Two: The Future of Work: Requirements, Potentials and Opportunities

- Recommendations.
- The future of work, income and gender equity: investing in talents and capacities “Post Covid-19 Future Vision”.
- Future jobs: expected transformation and sought wellbeing.
- Requirements to keep up with future jobs within the Saudi context post COVID-19.
- Necessary skills for future job market.
- The future of entrepreneur and big companies.
- Social and psychological dimensions of changes at the work environment.
- Refences and Resources.

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Recommendations



The future of work and gender equity: Investing in potential and talents “Post COVID-19 Futuristic Vision”

Work from a linguistic perspective means job or career; from a contextual perspective it is every physical effort executed by the mankind to achieve a beneficial objective. Jeremy Rifkin has said that: “The technological mutation will gradually minimize the human factor participation in labor, therefore it is expected to have increased rates of unemployment and poverty”.

It is definite that the future of work is changing. In the past, the discrepancy in skills and education created inequality in accessing jobs thus, income inequalities. It is anticipated that people with more passion for work and emotional intelligence will be able to grow in their work, while skills will be replaced by machines. This is actually evident in today's jobs, almost anything one does is replaced by a computer. However, certain jobs that involve caring about other humans such as caring for patients, older people and children will still require the human element and cannot be replaced by a machine. To minimize income inequality in future jobs, one must support today's students, business leaders and workers to know more about managing their own emotional intelligence to improve compassion with others to expect their needs. This is an element of customer satisfaction that will help create a more humane society with equal opportunities, closing the gap of income inequality. As caring for others could be something that anyone can do, increasing chances to take on jobs that provide services to other human beings, building further skills and wealth in this domain.

The increasing trend of unemployment rate was indeed confirmed in the past Ten years through the world's global financial crisis in 2008. Ever since a lot of the industry and job opportunities were filled with machines instead of humans. The resulting inequality from this, which is problematic from a social perspective, will limit people's access to services. One example is public service distribution in some of the countries. Countries that have followed a Neoliberal model throughout the past 30 years and have minimized public services are actually doing much better in their service distribution. Still, the public and private inequality poses a big challenge.

Post- COVID19 brought the following transformation in the Working Environment:



25 Million people lost their jobs, compared to those **23 Million** who lost their jobs back in **2008** during the global financial crisis.



The pandemic still threatens around **1.6 Billion** workers in the global informal economy. This is half of the total global working force which is **3 Billion** people.



The ones who have kept their jobs will wonder about how their jobs will be done in the future.



The Pandemic will cause a massive loss of working hours equal to around **160 Million** full time jobs.



Following the Pandemic, the work environment required quite investment in talents and potentials, where a talented person would be one who has innate disposition and is shaped by the suitable environment. Such environment would attract talents and would be equipped with what is needed to use talented people in the best possible way.

However, the future work post the Pandemic entails many social and administrative challenges such as:

- 1-Organizing working relationship between the different parties.
- 2-New legislative and organizational systems.
- 3-The effect on laborer's' unions.
- 4-Establishing ministries or entities for Artificial Intelligence (AI).
- 5-Dedicating budgets to support new transformations.
- 6-Laws and legislations to support developing AI.

On the other hand, the Pandemic resembles a good opportunity to reorganize the future of remote work and achieve equal opportunities when it comes to gender roles even around domestic and familial responsibilities. The current crisis caused through the Pandemic has revealed the importance of gender equity in the roles and responsibilities of both genders and working towards achieving that. Otherwise, there will be an increased number of women dropping out of the labor force. The remote working enabled a closer look to the productivity of employees regardless of their gender. It is the time where, technically speaking, one could look into equal compensation as both genders carry the same responsibilities.

Future jobs: anticipated transformations and sought wellbeing

Future jobs within the current context are jobs that respond to social, economic, cultural and technical changes and are in line with the Saudi vision of 2030 aiming at achieving economic sustainable development, high productivity and competition as well as the generation of new job opportunities.

It is expected that jobs related to: Information security, AI, cyber security, data analysis, managing virtual stores will be in high demand in the future. In addition to those related to sustainable energy such as solar and wind power engineering. The development and design of robots and the design of digital programs and Apps are also jobs with a future-high demand.

Some of the main sectors that will create job opportunities as a result of future transformation are: Government sectors that are linked to the 2030 Vision, the sector of Telecommunication and Information Technology. Banking sector and financial entities. Transportation sector, Tourism and entertainment sectors too.



As a result of economic transformation and continuous technology revolutions, in the light of increased competitive abilities between productive and service providing facilities and institutions, making room for the emergence of Free Labor Economy. This type of economy is increasingly becoming dominant introducing the patterns of remote work and flexible hours.

One future model of work allows to insert changes to working places to make them more entertaining and create open spaces. This model shall increase the employee's efficiency and using smart systems to program such spaces and add changes according to the practical needs and the employees ability. The system used is an HTC production.

Remote working and flexible hours contribute to the wellbeing of employees and improve the work environment, increase employee's productivity and minimize late arrival at work. It also enhances talents and can strengthen family ties by achieving work-life balance. It also minimizes costs on both employees and employers and decreases traffic jams.

The digital gap impacts meeting the demands of remote work, while the world enjoys internet connectivity there is some 5 % who are not connected which resembles the digital gap that exist especially during Pandemic times. This gap impacts the ability for everyone to equally execute their work remotely. While many jobs will be replaced by AI, new jobs will be created through remote work balancing the loss in job opportunities.

Even though technological change is ongoing and needs to be accepted and embraced in a positive manner to improve the level of living for individuals, digital gap needs to be looked at. Take New Zealand as an example; its banking and monetary sector is highly digitalized and supported by AI, which serves a big slice of the society.

On the other hand, this poses a challenge for elderly as they do not possess the ability to be connected to the internet as other people are. Besides them having gotten used to physically visit a bank to finish their required monetary operation such as depositing a cheque or paying bills. This challenge has left them behind and caused a gap in some banking services, since the banks pulled out of some of the areas realizing that for cost efficiency banks do not need to operate branches where most of its clients use online banking services. This gap example urges us to deal with the digital gap, for example unifying local councils could be an option to keep a place where people could still go to.

Another example, also in New Zealand, back in 2019 when the world's first "Entertainment Budget" was announced by the New Zealand Government. It imposed that when ministers submit their budget for a certain project, they do not only have to explain the outcomes of this project in terms of infrastructure and benefiting the citizen, but they also need to explain how the outcomes will achieve wellbeing for the served population. This specific notion needs to be considered amidst the speeding technology changes, also consideration given to those who may be left behind by such changes.

§ Keeping up with the Saudi future jobs in post Pandemic times

Increasing worker's productivity at remote working depends on: selecting the suitable jobs in accordance to the nature of remote work. Setting specific rules for the remote work experience and increase the contribution of private sector. Global best practices need to be considered as well as the need to train employees to ensure quality of work, hand in hand with the provision of necessary tools and systems that enable the success of such an experience.

Some of the solutions suggested by scientific research in order to keep up with the future of work within the Saudi context, are:

- 1-Encourage and develop entrepreneurs and emerging businesses.
- 2-Twinning Saudi Universities with other Universities advanced in technology to keep up with the latest developments.
- 3-Establish applied collages that would enhance the technical abilities of students.
- 4-Using innovative teaching methods.
- 5-Virtual visits to global smart villages and the Silicon Valley.
- 6-Using simulation models to explore technology such as robots and AI.
- 7-Granting scholarships in qualitative specialties.
- 8-Providing intensive educational program in the economy sector that are certified by accredited universities.
- 9-Establishing education and training facilities that meet the new job aspects of the future.



Required skills for the future job market

While the reliance on technology to accomplish routine tasks increase, employees will have to advance their abilities and skills to adapt to such changes.

Companies will also expect people to learn skills of future jobs in a faster rate. Therefore, this would be very challenging for people who cannot self-learn or self-teach, this will cause elderly to fall behind.

The main skills required for future jobs needs to be:

- Data management and analysis.
- Technical innovation.
- Brain Storming of ideas.
- Creative thinking.
- Time management.
- Task management.
- Prioritization.
- Management of crowds.
- Strong communication skills.
- Cyber security related skills.
- The ability to solve problems and innovating solutions for complicated matters.

The Fourth industrial revolution under the current Pandemic circumstances created a new reality with novel opportunities and challenges. New jobs will be created while other traditional jobs will be lost, this requires the acquisition of new talents to overcome the new challenges and keep up with the rapid developing technology that is happening globally.

Digital illiteracy is a big challenge that implicates the working environment, because most corporates are introducing virtual reality technology, AI and Augmented Reality at their working place, forcing their employees to learn new techniques to keep up with these changes or else they will potentially lose their jobs, making it imperative for individuals to learn how to deal with the latest technologies.

The future of Entrepreneurs and Corporates

Entrepreneurship indicates an activity that is done when a business or businesses are set up, while undertaking calculated financial risk hoping to make profit. Entrepreneurship has a big role in economic projects globally, as it is considered one main source to support the economy. This explains the interest countries have in supporting their entrepreneurs.

Entrepreneurs are required to be able to adapt to the changing work environment in the future, which is becoming vaguer.

As for corporates, the future imposes that the proper work environment within those companies are suitable to preserve talents aside from hiring the right people to do the required job. Post COVID-19 Pandemic it has become significant that companies adapt and show flexibility to overcome the losses they had because of discontinuous chain supply and flowing cash. This creates a need to manage crisis within a company to mitigate possible future risks.

Companies need to manage career development for their young employees and provide them with the guidance required as part of their companies' policy.

In addition to, providing the different competition-based benefits to the young employees, companies need to involve those young employees in decision making, support them with flexible working arrangements and create opportunities for them to grow professionally. This comes at a time, where the new norm is remote working which has starkly reshaped the job market around the world.

Social and Psychological aspects of changing work environment

Some of the Pandemic's impact was the changes caused within the work environment, especially the remote work, which is a new idea that has proved to be efficient when applied correctly.

Despite its initial success, this method of work may not suite all individuals. Its added values are working-hours flexibility, the freedom to choose the place of work, saving travelling costs and time, minimizing disruption, and avoiding stereotyping and redundancy which can kill creativity.

The negative aspects of remote work are related to job security, the feeling of isolation which can impact individuals' psychic negatively, as it minimizes their social interaction and affect their different relationships with people in general and with their colleagues.

Mental and physical exhaustion was also a result of remote work, where work time interfered with personal time and the absence of clear "Working Hours" caused some to work for longer hours, especially those who never did remote work before.



Adding to that, human communication that is comprised of body language, facial expression and the meaning of words said, was replaced with virtual communication which increased chances of miscommunication and negative thoughts within one team.

Because of all the negative aspects of remote working, it is important to consider social elements in future work and not only the element of productivity presented in equations within economic researches conducted in Chicago university, MIT and Harvard university.

To build a vital society and a vital economy it requires to consider non-visible elements such as the social one. This can be accomplished through a lot of innovative thinking towards achieving better living and wellbeing for everyone, to decrease their stress levels and increase their productivity and decrease rates of crimes and other societal negative phenomena.

Within this context, it is expected that there will be increased demand on social workers at an approximate rate of 16% by 2026. This confirms the need to prepare for dealing with social and psychological implications as a result of changing work environment.



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Chapter Three: Modern Approaches in Energy and Water sectors

- Recommendations
- Blending Energy – from conventional to renewable. Highlights on smart solutions
- The role of innovation in energy transformation
- The future of energy: can we live outside the network?
- Connection between water and energy: a futuristic vision
- References and Resources

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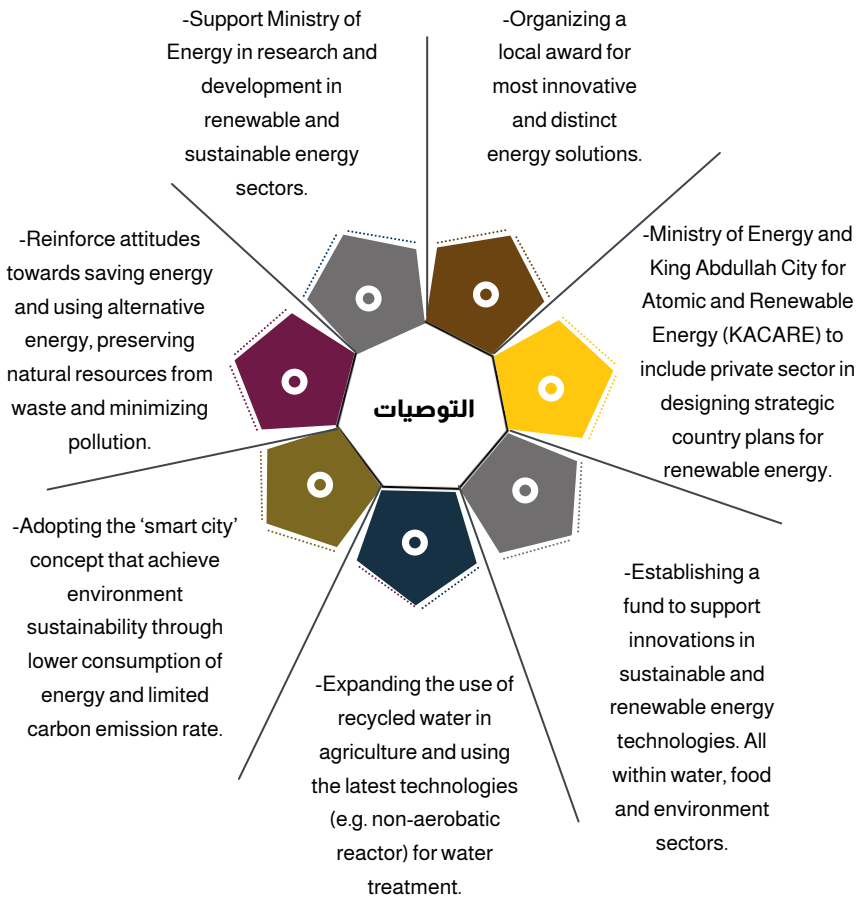


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Recommendations



Traditional and renewable Energy, highlights on smart solutions

Renewable energy is the kind of energy that is naturally self-generated and sustainable, and abundantly available in nature. It is also considered clean energy as there are no polluting emissions produced as a result of using it. Such kind of energy includes Solar energy, energy created through Wind, Tide, Ocean, Water Falls and Geothermal heat.

The use of renewable energy is one big move towards a sustainable energy system that has increasingly acquired attention, especially in the field of Electricity generation. As the access to electricity is one of the Three anticipated outcomes of the Seventh Goal of the Sustainable Development Goals (SDGs) as part of the 2030 Sustainable Development Plan that was endorsed by the UN in September 2015.

The world's energy sector is witnessing brisk changes that lead countries to invest and expand in different energy forms. Mainly: Solar energy, energy generated through Wind and Nuclear energy. Such examples are considered clean and low-costs resources of energy. It is proving itself to be more efficient in comparison to fossil fuels. The entire world is heading towards clean energy and low Carbo emissions in the light of the global Climate change.

Prior to the Pandemic renewable energy was growing, although its growth has been somewhat suppressed by the Pandemic, at least in the near future, but the advantages of the renewable energy and its economic feasibility in comparison to fossil fuels remain strong over the long term, in light of the climate change being a center point on the global agenda.

Latest Geostrategic Information

The Lebanese Government engaged recently in a dialogue with Israel over common borders. Between both parties there are no relationship except a lot of hostility, but both agree to enter negotiations under American backing. These negotiations are all about energy and not territories under dispute.

Such attempts to negotiate date back to many years when the American administration sent special envoys to the region to define the Energy Map. The talks were stuck but seem to be moving forward now. The United States believe that an early solution to the Energy Map will lead to security and improve the Israeli economy, something that seems to be one-sided.

From the above example it is found that the importance of energy supersedes politics. Even if the

relationships between different parties are turbulent, the cooperation in Energy field remain intact and unaffected by political circumstances.

Another example would be the Emerati-Qatari dispute, while the Emerati gas export to UAE continues at its normal rate. This is, again, evidence that energy overcomes politics. Despite of the huge amounts of natural gas explored in the UAE, it is still committed to importing Gas from Qatar until 2032, which covers third of UAE's needs of natural gas.

The eastern side of the Mediterranean has large amounts of natural gas resources, that maybe one of the biggest secured reserves worldwide. According to the political map, Israel invests tremendously in its gas fields, Lebanon has quite a share and so do Turkish and Greek Cyprus. Egypt is also participating in excavation work exploring Oil in the same area. The Israeli drillings in the east Mediterranean are extremely close to Gaza shores, hence the excavated gas is called "Gaza Gas". Gaza could actually be the main beneficiary of this gas which can hold a lot for the Palestinian future. However, the gas is being exploited by Israel who controls Gaza shores.

Talking about Nuclear energy, many middle east countries thought or even supported considering nuclear energy as main element in its quest for energy resources. The UAE was the first country to operate a Nuclear power facility but is not longer to expand in this project. Indeed, the nuclear power option is not easy but rather a consuming and expensive one. By analyzing the situation, it turns out that both KSA and Iran have the necessary requirements to have Nuclear power. China also invests in excavating Uranium ore in Northern of the KSA in Tal Asfar. Because of the high cost related to producing Nuclear power, countries would have to carefully consider its financial situation to support it. Iran, for example, has succeeded in blending its Nuclear program with its national identity and is now opening door for foreign investments in an unprecedented step. Egypt, Jordan, and Turkey also provide sovereign privileges for Nuclear technology providers.

Financing Nuclear Power models; Arab Institute for Security Studies (ACSIS)- Stanton's research Project

The arrangements for external financing can put any country at risk, allowing it to be under the grip of Nuclear investors, this may be considered a form of Technological colonization. Today, Russia, China, and Korea (who use innovations made in the states) are considered the modern providers for the developing Nuclear technology who are seeking to dominate further the region of the middle east.

Being dependent on renewable energy saves cost and preserves the sovereignty of the country while also being Echo-friendly. However, the countries in the middle east will increasingly rely on its natural resources of gas in the next coming decade.

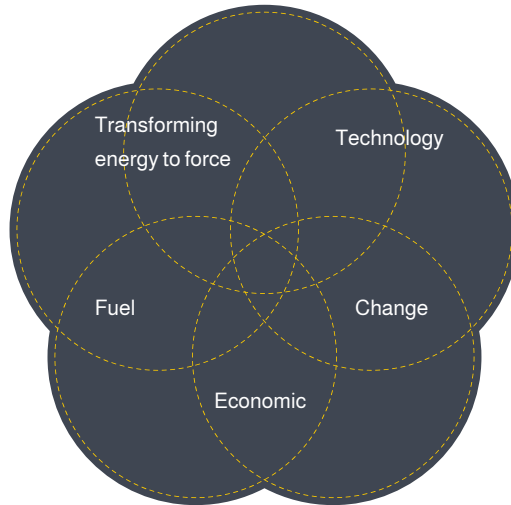
The new formation of the middle east shows which country or countries will be under control of others, therefore, many of the middle east countries including Egypt, Iran, Turkey and Jordan are looking for investors who will invest and finance their nuclear power projects. As mentioned, recently the head of the Iranian Atomic Energy Agency has announced opening the door for foreign investment in Iran's nuclear program. Should this be true, this resembles a huge turn in Iran's official policy.

Bottom line is nuclear energy is extremely expensive. It can undermine the sovereignty of countries and deplete their financial resources which is very much needed nowadays amidst the COVID-19 Pandemic to increase the private sector's investment in renewable energy.

Learning from this, the Saudi Government has launched the "National Program for Renewable Energy" which is a strategic initiative under the 2030 vision and as part of the national transformation. The programs aims at increasing the sustainable energy portion from the total energy needs within the Kingdom reaching 9.5 GW by 2030 which is about 10% of the Kingdom's total energy production. Following this the size of investment that is expected in similar projects is SAR 59 Billion.

Innovation and Energy Transformation

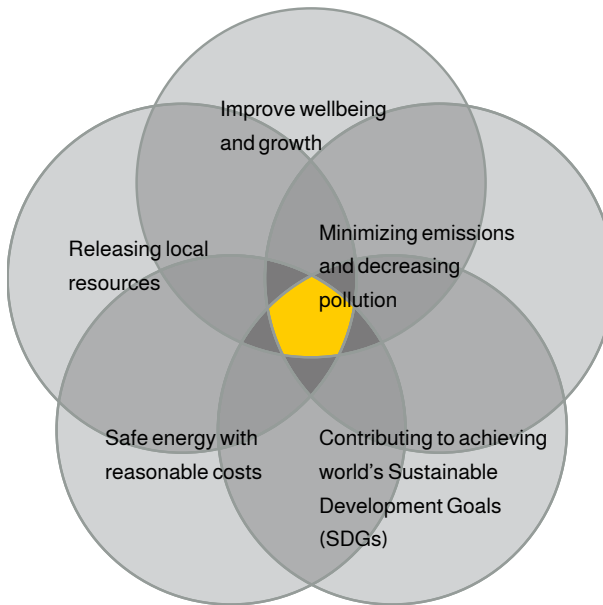
A report prepared by Cambridge University and Price Waterhouse Coopers (PwC) around the future of financing energy and the opportunities of financial services in the Gulf countries has summarized that the world's quest for energy resources is growing and meeting those demands will pose a real challenge in the future. The fast development of the Gulf Cooperation Council (GCC) countries similar to the rest of the world, where the demand on energy is expected to triple within the next 15 years, which is much higher than the supply. In order to meet the high demand, massive amounts of money need to be invested in projects that generate energy and improves its efficiency.



As of today, there are 940 Million people worldwide who don't have Electricity. Which means they live in poverty and suffer problems in education, livelihoods and health. They are also deprived of technology and don't even have access to drinking water. This is indeed a big problem on our planet, which requires that the entire world to cooperate to make change in those people's lives.

Transformation of energy is required within the current system, that also means transformation in fuel from fossil to renewable energy. This combination of energies resembles 19% of renewable energy and is expected to raise up to 50% globally. The transformation will entail change in technology too, for example electric cars. By 2042 the expectation is that half of the world's vehicles will be electric ones.

Why the transformation in Energy?

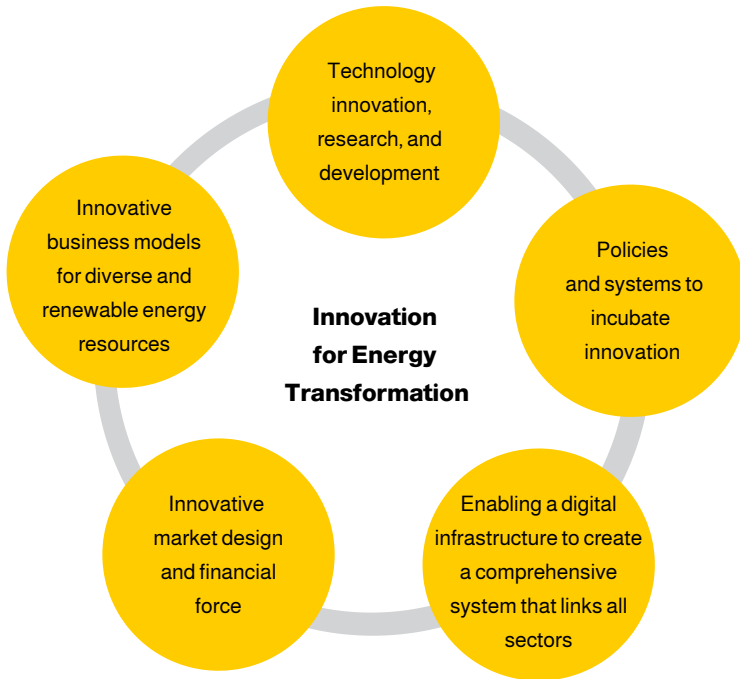


It is anticipated that wind power will exceed Hydraulic water by the year 2031 in the technology development and investments. This means the change in infrastructure and generators as well as changes in the economic system and policies. The economy will rely increasingly on diversifying energy resources, this is obvious through the policy of the 'unified custom tariff's which enables rise of the renewable energy, and other policies related to market share.

Now, why head towards energy transformation? Multiple reasons encourage this transformation, one being Government resources. For instance, the KSA, which is the largest exporter of Oil, should not solely rely on oil as a resource but should integrate renewable energy and consider nuclear power too. This is actually happening as part of the 2030 vision. Also, in other countries that don't have resources of fossil fuels, they need to be moving away from importing all needed energy resources and should rather rely on free existing energy such as solar power and wind energy. The other reason is to secure energy at a reasonable cost for all. Through energy transformation more solutions and technology that connect more people to the available resources will be available. The third reason is achieving the SDGs, as it has become a necessity that all countries and entities cooperate, whether Governments, Corporates, Companies, Public and Private Sectors to achieve the sustainable energy goal. Besides, the energy transformation helps decrease emissions and air pollution that ultimately effect global warming. This transformation would also improve people's wellbeing, provide knowledge transfer, and create new job opportunities.



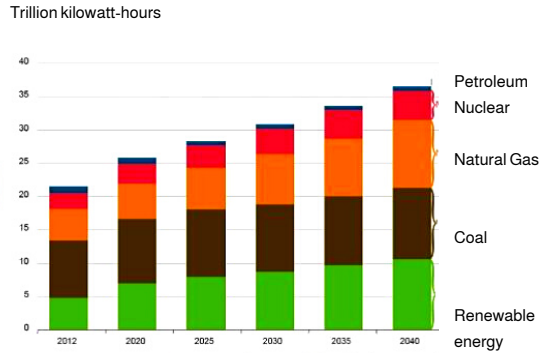
Innovation needed for Energy transformation



Source:IRENA.All rights reserved

Looking at electricity generation in the next graph 2012 through 2045, the year 2021 shows that there is Electricity generation at about 26 trillion KW/hour, this figure keeps increasing as a result of annual increase in demand.

Total electricity generation globally 2012 – 2040

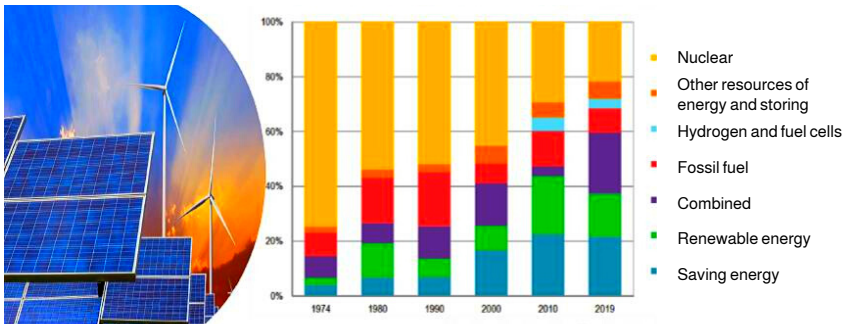


Resource: International Energy Agency. All rights reserved

In fact, renewable energy is on a steady rise, which gives a good indication about sharing renewable energy in the future. Coal and natural gas are also highly reliable even in the future. Renewable energy resources are indeed trusted and cheap resources which make them reliable and allows for energy storage.

Innovation allows energy transformation through policies, enabling infrastructure, entrepreneur, designing market and financial tools and business model of renewable energy. The technology innovation relies on the role of research and development centers as well as universities, the government and companies in finding proper cheap solutions that allow to use available resources.

Research and Development in general energy by International Energy Agency



Resource: International Energy Agency. All rights reserved

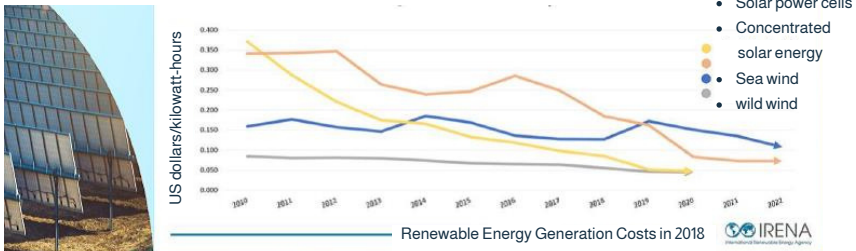
By reviewing the general energy for research and development through technology since 1974, nuclear power was occupying around 75% of all energy, encouraged by study and research to develop this technology back then. In 2010 renewable energy emerged. By 2019 there was a huge investment to support research, innovation, and technology. Saving energy became a matter of utter importance, which also help transform energy. Over the last 10 – 15 years Hydrogen as a resource of energy emerged, as well as storing energy. It is expected that both will be areas of investment.

What was the impact of research? And what was the impact of innovative solutions?

In the next graph, the past Ten years show the costs of some of the renewable energy resources, i.e. Solar-photovoltaic (PV), Solar power, concentrated solar power and Wind power, where the prices have fallen significantly over the past Ten years. This supports the use of more Solar PV at a global level, hence building more Turbines for using wind energy.

The development that has taken place during the last decade has actually helped establish solar and wind power turbines in the KSA, which is considered the cheapest in the world at 8.7 KW/hour.

By 2020 Sea wind and Solar power cells will be a cheaper resource to generate electricity



The innovation of energy relies on the compatibility between the different renewable energy resources, as there are solutions to decrease Carbon Dioxide (CO₂) emissions, storing energy, saving energy, electric vehicles, and electronic counters.

Therefore, it is highly recommended to establish independent Innovation Funds, especially for startup companies. These funds will support the continuous work of innovation within the energy sector. The research and development center plays a role in implementing the technology development plan by linking public and private sectors. In entrepreneurship within the sector of energy technology, setting up an innovation that grants a national prize for the most innovative and distinct solution would also support the continuous work of innovation in this sector.

The Future of Energy: Is it possible to live outside the Network?

The term 'Modern Energy' is relevant; as it differs from one geographical area to another, depending on what energy methods have been introduced in that area or not. The term also differs from one period of time to another even within the same geographical area.

Modern energy is a wider concept than renewable energy, as it indicates both renewable and non-renewable energy, for example, tide energy and nuclear power.

The question, whether we can live outside the network while living in an Era where we are part of the electricity and energy network, depends on the meaning of the network.

In the early 90s in the US West Kennedy who had a wooden house in a remote place and chose not to be connected to the Electric network. Instead, he generated electricity using Photovoltaic panels and battery charge.

The rapid need for energy and growing urbanization exceeds the growing population. As an example to keep up with this demand, Tokyo, which is the biggest city in the world today with more than 37 million inhabitants, switched back in 1945 from the use of coal to the use petroleum for improved control over energy resources and nuclear power in the later years. In 2019 generating Electricity out of Fossil fuels was less than 9 Terawatts (Tw) compared to the levels in 2010. Nuclear power was also decreased by more than 220 Tw following Fukushima incident. Japan has had its lessons and succeeded to improve the efficiency of its renewable energy, expand in the use of solar power, and decrease its reliance on fossil fuel and nuclear power.

Another example is Dubai, that has witnessed a dramatic change transforming from a small fishing town in the first decade of 21st century to a world trade and financial center, exploring Oil in the 60s.

One must not wait for catastrophic incidents to take place in order to move away from depending on Oil, but we must be looking in the near future for safe and sustainable resources of energy outside of the network. NEOM project in the KSA would possibly be one example of an alternative.

While population is growing, the only available option seems to be expanding up to add more people rather than occupying more land horizontally. This enforces also finding alternative resources of energy to meet the demands of a growing population who may be concentrated in very hot areas which then would have an increased demand of energy.

To meet such demands, specialized regional solutions and combined sustainable resources must be sought within the relevant geographic area and based on the available sustainable resources. Within KSA and the Gulf region, the sustainable energy to move away from the traditional network would be the solar power.

In 2019 the Solar Power became the fastest growing renewable energy resource on the planet, supported by semiconductor technology. Similarly, Silicone technology makes the use of solar power very efficient, as the silicone is highly absorbent of the light in all its visible and non-visible spectrum which makes it highly efficiency but has some restrictions to its use in the future.

When picturing future cities, it is distinct with the freedom of design using a lot of glass to use day light. Such cities are connected and responsive through the use of the Internet of Things (IOT). Making use of a smart sustainable environment using glass that allows the passage of sunlight to generate electricity. This was a new technology that has been explored over the past two years in KAUST.

Using infrared radiation that passes through glass windows to generate Electricity is an advantage over Silicone, as it also contributes to heating the buildings from the outside. This combination of technologies is evident in building materials, such as the double-glassed windows that allow converting the buildings into somewhat independent energy-generating stations that allow the relative independence from the network.

The use of this technique to generate and save energy can decrease the energy demand in buildings up to 30% without changing the design of the building and improve the health and productivity of the employees who serve the big commercial buildings. Through the transparency of such windows electricity can be generated and energy saved, allowing 70% of the natural light to enter. The advantage of transparency links also to agriculture. The choice needs to be made whether the land should be used to produce food or fuel.

As the light coming through the windows suffices enabling plants growth then this could be used simultaneously with generating electricity. Green houses could be built on the exact same area of living making the most of the same available space turning the cities into smart ones.

Focus needs to be made on sustainable resources to serve mankind using solar power as the oldest green energy we have while also saving the planet from climate change.

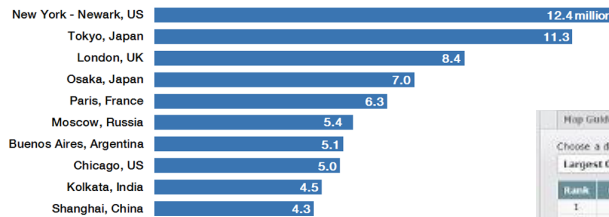
Link between Water and Energy – a Futuristic Vision

Water and energy are always compatible elements in various ways. Using sustainable energy would help secure water by saving required energy needed to produce water and operate related activities to water such as its distribution and Wastewater Treatment.

Looking at this correlation in the Arab countries, it turns out that water production consumes a lot of energy since water is scarce in most countries except in Egypt, for example, that have surface water available. Gulf Countries that rely on Water Desalination or pumping underground water require enormous amounts of energy in the water sector.

These were the world's biggest cities in 1950

Population, in millions, according to the UN World Urbanization Prospects, 2014 revision



Source: UN World Urbanization Prospects, 2014 revision

WORLD
ECONOMIC
FORUM

Map Guide Analysis

Choose a data query to select city groups:

Largest Cities 2030

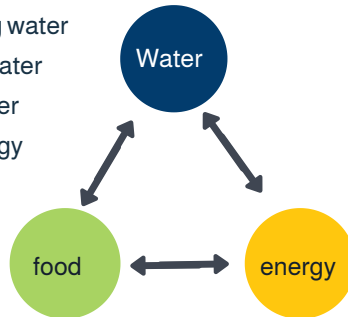
Rank	City Name	Population 2030
1	Tokyo	37.2 million
2	Delhi	36.1 million
3	Shanghai	30.7 million
4	Mumbai	27.8 million
5	Beijing	27.7 million
6	Dhaka	27.4 million
7	Karachi	24.8 million
8	Cairo	24.5 million
9	Lagos	24.2 million
10	Mexico City	23.9 million
11	Sao Paulo	23.4 million
12	Kinshasa	20.8 million

Our world is growing rapidly and facing the growing population is a must and realities such as highly populated cities will become real as well as the fact of people moving towards coastal cities.

Water will always attract population, hence the growth of cities on the coastal areas. As water plays a vital role in our live, not only for drinking but for growing the food that we consume. When water is provided for urban or sub-urban areas one must consider that it is not only water that is being provided for drinking or agriculture but there is also the matter of the consumed energy needed to make this available. Such considerations should be made when discussing any policies for water and energy.

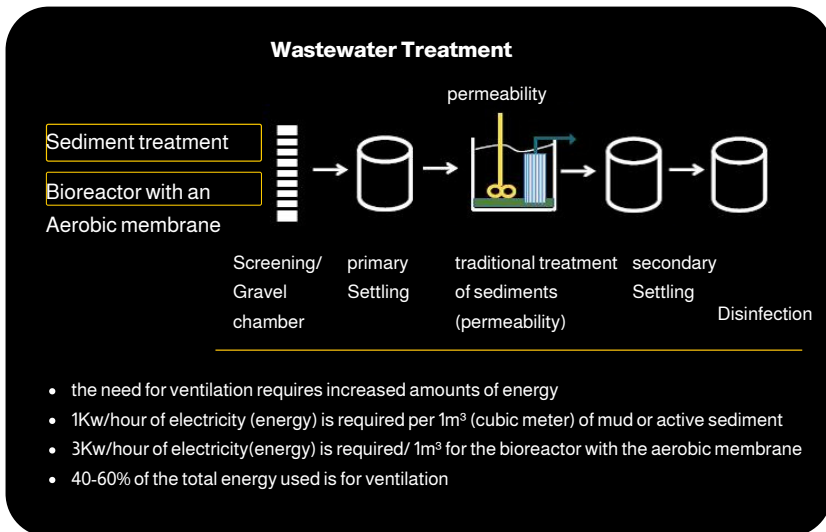
Climate Change

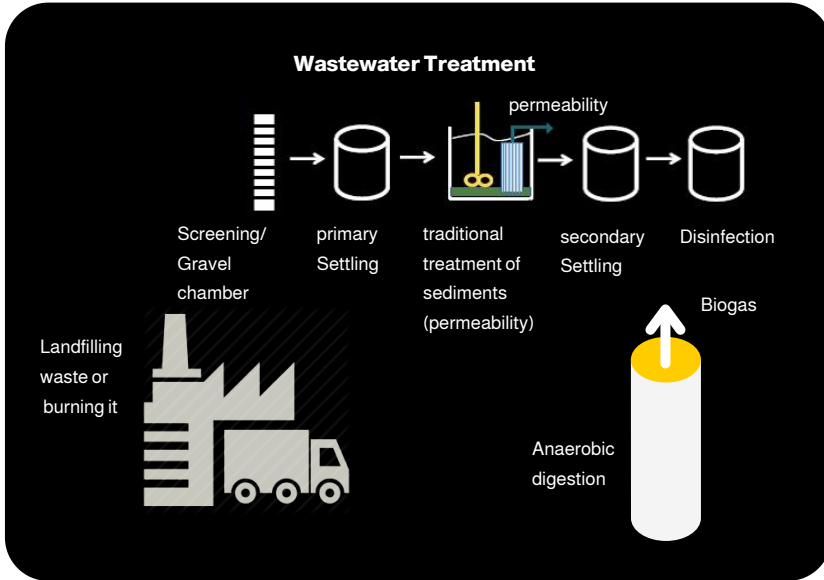
- Treating drinking water
- Treating wastewater
- Transferring water
- Generating energy



- Agriculture and irrigation
- Water consumed by Cattle

It is important to focus on what Water-Saving-Systems and attain an effective way to manage water and wastewater to generate energy to create sustainability for the next generations to come. Currently wastewater is not being used efficiently, while it could actually generate energy and be used as clean water to produce food.



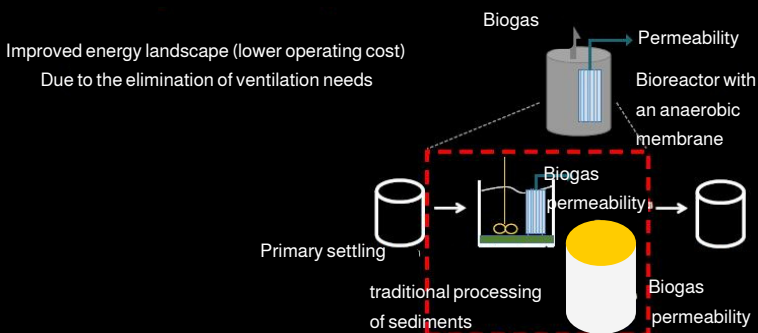


The former drawings show the current and traditional method of treating wastewater, where most organic Carbon and nutrients are removed through constant airing so the microorganisms can benefit from the organic carbon. In certain instances, a membrane can be added to improve the quality of sludge so it can be reused. Regardless, whether this process is aerobic or anaerobic it requires immense amount of energy, raising the costs as a result of pumping oxygen or the so called 'Separation' process.

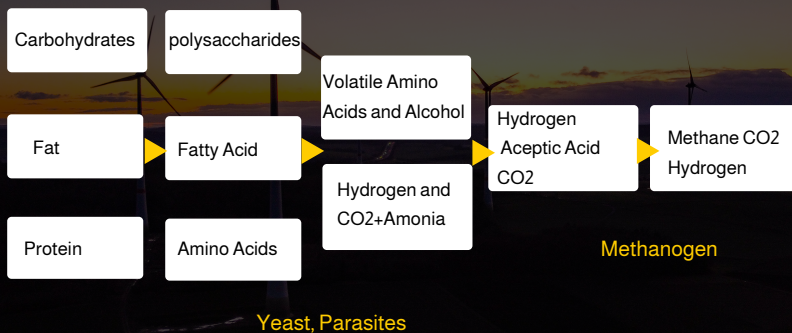
The traditional way for treating wastewater uses about 1Kw/hour of electricity (energy) for every 1m³ (cubic meter) of wastewater. This amount is tripled when an aerobic membrane is added. So, 40-60% of the total energy used is for ventilation. This burdens the need for energy, that is also amplified when disposing solid waste (Sludge) requiring around 0.002 – 0.04 Kw/jour for every 1m³ of Sludge.

The smart option would be putting the sludge in a Sludge Digester to produce Biogas that can be again used to generate Electricity. Yet, the generated energy compared to the used one in this process of treating water waste is very little and unable to cover costs of energy used. Therefore, researchers at KAUST are suggesting adopting changes to the entire system.

New Approaches: Bioreactor with anaerobic membrane



Anaerobic fermentation receives back Methane as a source of energy



For waste water treatment the anaerobic membranal bioreactor is used, where ventilation is not needed, saving the 40-60% of energy needed for this step. The anaerobic membrane used a total different set of microorganisms, which are Yeast and Methanogens. So, instead of removing Biocarbon from the mass to increase the amount of produced sludge, it actually converts the Biocarbon into Methane gas which can then be burned to produce energy.

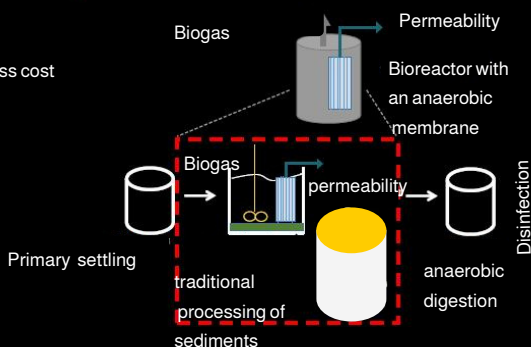
Methane has a thermal value of about 8Kw/hour of energy per 1m³ of Methane gas. Using the above-mentioned technology, the Thermal energy of Methane can then be converted into electricity at about 32-40%, harvesting about 3kW/hour of energy. The amount produced would possibly be increased when new developments are done to this technology.

Theoretical use of Methane can be estimated at around 0.365 L of Methane for every Gram of O₂ needed. This means that the more organic carbon existed in the wastewater, the more the production of Methane gas, hence the production of energy. This may mean that no additional energy is required for operating the wastewater treatment and it is self-sustained.

Wastewater could then be in itself a source of energy for treating wastewater or to be directed elsewhere. The advantages of the anaerobic membranal bioreactor is high production with a low cost, this is mainly due to the different microorganisms that exist in this kind of reactor. While the aerobic kind requires the solid waste to be exposed to air for a duration of 20-40 days, the anaerobic kind only requires 3 days for the solid matter to be treated. This means that more sediment or sludge could be produced as an end result.

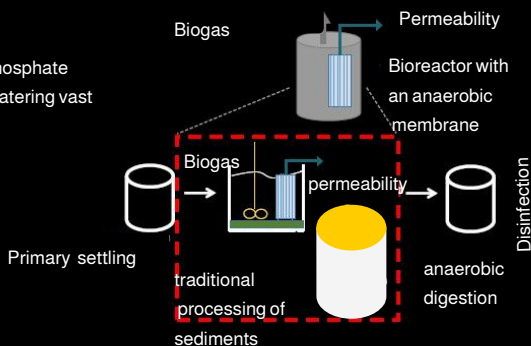
New Approaches: Bioreactor with anaerobic membrane

Producing less sediment (less cost to dispose of the sludge)



New Approaches: Bioreactor with anaerobic membrane

Keeping Ammoniac and Phosphate (suitable for agriculture or watering vast areas)



At the end, this means that more savings could be done to dispose of the solid waste of the big wastewater treatment plant.

One of the advantages of the Anaerobic membranal reactor, when it comes to Ammonia and Phosphate, which are some of the nutrients that exist in the wastewater, both elements remain even after the anaerobic membranal reactor stage, the concentration in the liquid waste is not 100% in line with the standard regulations for anaerobic treatment of waste water. In fact, we should be committing to those regulations.

It is suggested that the Anaerobic membranal reactor could be part of the natural purification systems that exist in urban areas, where plants are grown in sand pillars and watered with the remaining of liquid that results from treating wastewater. The plants and the sand itself could be very useful and considered a good way to process waste. This method can also be used to increase green surfaces in urban areas, this would indeed be an option for the cities of KSA, to sustainably treat wastewater and use the outcomes efficiently. In KAUST work is done on expanding Anaerobic membrane to be merged with renewable energy systems such as Solar power, in addition to the disinfection strategy.

The objective is to show that we are able to treat wastewater in a very sustainable and positive manner while preserving energy.

One must realize that there is a cost related to the water cycle and the energy cost must be reduced to create a sustainable and smart water system. Techniques that reduce energy cost do exist, for example: the Anaerobic wastewater treatment, what remains is to bring such techniques into the market so they can be actually used to achieve sustainability.

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Chapter Four Digital Happiness

- Recommendations.
- Virtual and Augmented Realities and the Future of Human Happiness.
- Happiness from an integrative perspective of Humans and Machines.
- E-sports, reality, and Future Development.
- Leti-Arts' experience in Digital Game Development.
- The organization and Governance of Artificial Intelligence and the Future of Digital Happiness.
- References and Resources.

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Recommendations

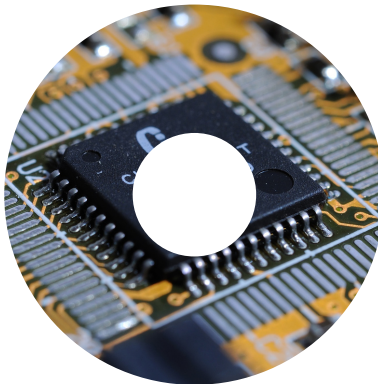


Virtual and Augmented Realities and the Future of Human Happiness

The regional center for programming development shows that the technologies of both Virtual Reality (VR) and Augmented Reality (AR) have exceeded all expectations and has now a significant role in different aspects of life. By using wearable technologies that provide a physical interaction with 3D and 4D objects, sensory reactions are reinforced. This is considered a key for future technology in the fields of: Education, Industry, Building, Oil and Gas, Aviation, Health, Safety and Security.

Scientific studies have shown that there is a confusion in terms and applications between VR and AR, although they are technically distinct but have many properties in common. As VR shows a completely virtual while AR shows the material world with virtual element included. AR enables the combination of real and virtual things, while using information from a real environment in a digital one, this has attracted the attention of researchers and designers in areas of interaction between man and computer.

AR actually aims at simulating real environment and augmenting the latter with virtual elements that are in fact not part of this real environment, to enrich this new environment.



The distinct difference between the two Realities, the VR and AR are basically that the VR takes the person and allows them to experience a complete different virtual world, while AR just changes the reality. Both combined are called: XR, which is a fairly new term. Surely, VR and AR techniques will play a role in allowing people to experience digital happiness. The first ever VR headphones were actually in 1986. Those were just the beginning and whoever worked on that surely did not expect the advancement this has made to this date. Although the happiness brought about by VR and AR may not be quite clear, but it actually shows signs of turning into a huge platform where people can communicate, cooperate, learn and invent things on their own or collectively. This explains the interest of investors globally in these techniques and the user experience that comes out of this.

These are the main differences between VR and AR and the basic current systems that pioneer companies are getting ready to use. This would be the biggest change that will add human happiness, which makes it a great opportunity. Examples of the VR include games, movies and entertainment which makes people happier in both VR and AR.

Another example to use would be Simulation for training Police Officers, Fire Fighters, Pilots and Factory Workers. This will allow for quicker learning with lower costs and less health problems and less risks.

VR is also used in the field of Medical care, as there are a lot of experiments currently that uses VR and AR techniques to treat Emotional and Mental Problems, this is directly related to the Digital Happiness of Humans. Within the same field the use of VR and AR includes the training of Doctors and Nurses, who use the techniques to perform surgeries and simulate procedures without having to practice that on a real patient.

VR and AR also serve the Interior Designing, Art and Architectural Engineering. Imagine if you were to buy a new house or apartment or even new furniture, VR and AR will enable you to see the setting of the furniture and the design as if you were inside the furnished house, which differs a lot from only seeing the furniture pieces on their own, or seeing some pictures of the furniture through the internet.

Education is another field where VR and AR could help teach medical students Anatomy, for example. Where the student maybe able, through a VR Headphone to see the entire Human Body will all its layers and parts. The experience of course would differ a lot from using models or study objects.

In the future, VR could be used to draw symbolics of the different Stars. In addition, tomography of our Faces and 3D drawings that resembles our bodies, making us sit in front of each other although we are each in a different country.

AR can help decrease the feeling of loneliness and boredom, imagine if you had to exercise on a stationary bike, within 20 minutes you will feel bored, while if you had a VR Headphone while exercising you could be in a Game collecting coins and avoiding obstacles as part of the Game's design.

The disadvantage to the VR and AR is the fact that they remain tools. So, it very much depends on the creator of the content, whether it is useful and achieves happiness or contains risks and dangers. For example, creating an addictive game that separates people from their reality. Therefore, it is extremely important to use these techniques correctly.

Happiness from an integrative perspective of Humans and Machines.

The quick and qualitative development in the technological revolution especially in the 20th Century in the Information Technology (IT) field has led to creating new Applications and Programs that are diverse and innovative. This has raised the competition on global market level. The recent applications have headed towards using Artificial Intelligence (AI) and smart systems in many fields especially entertainment and digital games.

During the year 2020 AI has developed in; robots, vehicles, drones, medical equipment, and industrial ones. All of these operate in varying levels of capacity and intelligence. It is expected that more development will reach closely to Human's ability in taking decision, comprehension, and learning. The new technologies will contribute in creating a happier world, due to the highly intelligent machine that compliments human's work and contribute to his entertainment.

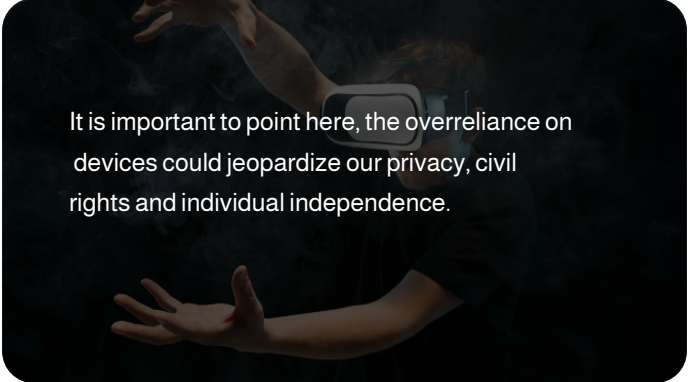
Developing intelligent machines has become one main pillar of AI, as it is completely normal nowadays to have smart devices and use smart programs. The science of smart machines is not in itself a new science but because it was democratized, the concept has changed. This has led to the widespread of digital devices and massive data. Even people who are specialized in IT are talking about AI and relate that to the innovative devices, yet not innovative enough to do self-thinking.

Future changes fast, it may be faster than we think and to a different form. Games are a good resource for happiness and a changer of our behavior. The interesting part when it comes to operating AI in the Game-making is that AI and Artificial Learning systems have won against Human competitors. This has started in the 90s, in the Pin Pong game in 1994. Ten when IBM won against Kasparov in 1997. This is the case as well in interactive games such as Starcraft and others. This reflects that the AR system has become really strong. Games are being used as a testing field to generate a broader concept of AI. If you have the idea that you are measuring a system against a game and found general concepts for AI that could be merged in Robots, then it may be possible to see intelligent robots that may be smarter than humans. This is an open question which makes us wonder when this will actually happen?

Simultaneously we have witnessed a change in the biosphere, starting from the Human Genome sequencing. The Genome is a complicated program that produces the different types of cells in our body, cardiac cells, neural cells and dermal cells. Nowadays, we have strong tools to know a lot about these cells by gathering huge amounts of Data, using learning techniques. This enables us to get a full plan of something similar to a periodic system. If we possessed a periodic system of atoms, then a lot can be done from a geometrical perspective. Similar to this when having a periodic system of cells, we could reprogram the cell using Stem-Cell Technology. Then we can edit the reading on the DNA sequence that makes up the Human Genome or even modify the Genome. This can make us look at living being as if they are information that can be modified, making very interesting interactions between technology, and Nanotechnology.

If this merging can be made, then we will have a Revolution in the Biosphere making it possible to link these systems with the AI of machines. So instead of using these smart devices, such as phones and computers as external devices we could have them directly connected to our bodies. This development work has been going on for some time, for example we could then be reading Brains' Signals through the scalp without needing a device for that. In the engineering this is done on a deeper cellular level, where we could, for example, also be seeing producing organs in the lab. All systems could be connected to digital devices. Yet we won't know how happy we would be with this advancement, but this vision is very close, when we don't have to rely on developing general AI.

This should create a new world of opportunities and challenges in the future. Similar to games, one cannot distinct between VR and reality within the game, and when our bodies are connected to digital devices it becomes challenging maintain our own identity and control ourselves. Many questions arise; how can we develop in hacking other beings? How can we be saved from cyber-attacks? How can we be made happy? All of this is expected to become reality before we have smart Robots. This resembles a good opportunity for economic growth by investing in work to overcome the challenges.



It is important to point here, the overreliance on devices could jeopardize our privacy, civil rights and individual independence.

E-Sports, Reality and Future Development

The term E-sport is: “a form of competition using video games, that takes the form of organized, multiplayer video game competition on a local or International level to win trophies while competing behind screens. This kind of sport has developed immensely as a result of technological development and has attracted a wide range of audience of different ages. E-sport has even exceeded traditional sport in its popularity and became one of the main interactive sources of entertainment especially during the lockdowns that took place throughout the world during the spread of COVID-19 Pandemic.

Tommy Ingemarsson the founder of Ninjas in Pyjamas, CSGO Svenska Elitserien, that 20 years ago things have changed very fast and because of infrastructure a lot of people had access to the internet and were competing against one another. This explains people’s interest in this kind of Sport as it has a lot in common with the traditional sport, except that you do not exercise physically while playing E-sport as you do in the traditional sport. But other things as playing within a team, preparing strategies and practicing having good reflexes are the same. 20 years ago, when this was a new Phenomenon it was thought that E-sport is all about Nintendo games or Super Mario Bros. but it is actually about more than this where you make your own story, and limitless strategies, in a more open world, where you need to take your own decisions, practice until you become better and play within a team.

E-sports used to take place in basement with minimal audience, but this has changed 10 years ago when it became a sport that could actually be seen by audience who enjoyed watching others play, breaking world records and beating traditional Sports. Let's take the Superbowl as an example, last year there was 101 million viewers, while the game "Legend" had 102 million viewers at the same time watching. Worldwide there are about half a billion viewers who watch E-sports but don't play themselves. And about 250 million active players. Active players are those who play more than 2 hours twice/week. There is an increase in number of viewers but also in the money that a player can win in these competitions, and the view as well as the income percentages are growing annually.

e-Sport is considered innovative, as it enables the learning of skills and sets you up for the future work environment, by learning leadership, communicating with other group members, solving problems and computer knowledge. E-sport is considered a creative tool that helps human adapt to the new digital age.

How can e-sport help digitalize the environment? Tommy Ingemarsson says that, the problem of e-sport today is that everyone is focusing on the higher level, the big teams, the big companies, world cup. But no one is trying to build a healthier environment, integrated learning courses that have links to e-sports, where one can work with the younger generation, having trainers who can support players which is not available in the e-sport.

Leti-Arts' experience in Digital Game Development

Digital games are no longer considered only an entertainment tool, but became an important Industry supporting the economy of IT. Leti-Arts is a game developing company that was established in Africa in 2009. It has many strategic partners worldwide who also develop games and serve other companies. The company's offices are in Ghana and Kenya, it has a rich content that presents the African culture through the 'African Legends'. The company is considered one of the pioneers in the video-gaming industry across Africa, as it has its own local team of enthusiastic players who develop the games. The company builds on Legends of Africa, Afro comics and negotiations on using its own developed technology by other companies.

There are 55 countries in Africa and more than 3,000 trainers and more than 1 billion people. (Leti-Arts) is trying to contribute to the emerging video-game Industry but faces many problems that usually relate to the existence of small fragmented markets, rare talents and limited available resources for developer. And the biggest problems are those related to the culture around the emerging Game Industry in Africa. Where many individuals do not consider that playing videogames is the same as learning. Around this problem Eyram Akofa Tawia, the CEO and co-founder of Leti-Arts says that when you study and chose a book, your parents will say that you are learning but when you play games they won't consider it learning and you would probably get punished.

How to make the Videogames related to the Continent in a fun way? How can both worlds be fused? and can the African culture be introduced through this fuse? By benefiting from the different African cultures that exist, African Legends were introduced and the famous historical characteristics presented as super heroes through imaginary stories in the fables and Comics across Africa like; Shaka, Zoloo, and big legends that talk about Child Soldiers, Kidnapping, Greedy Presidents and the Corruption that is in Africa. Characters are created and then games are made, which can then be found in App stores. The introduction of the famous African characteristics in a distinct manner is very attractive on a global level.

We are thinking to create an innovative 3D game that introduce the corruption and the sanctions that are imposed on the African Continent. This game can be played through SMS, and smart phones aside from the computer. We are aiming at only launching it since the smart phones resemble only about 32% of the total phones throughout Africa.

The process of developing Videogames is very interesting, where Art-Games and Science are being combined. On the Art side, we work with artists and story tellers, then we the technicians combine the game together with the story to create dialogue, fighting and so on. We draw, and dry (technically speaking) then you have a game. Actors begin to awake, looking for trainers who can design those characters. Some more examples on characters that we have are 'Anansi' from Ghana, the beauty of the character can be seen while creating a superhero. All of this needs a lot of technical and designing work. Villains are also made based on evil people. Through science and AI, we can also include disabilities into our characters, this makes it all fun. Through this not only an Industry is made in Africa but a total new industry that will provide many job opportunities for people through videogames.

The organization and Governance of Artificial Intelligence and the Future of Digital Happiness

AI is known as: “Simulating Human intelligence through computer systems, in an attempt to copy human behavior, their way of thinking and their way of making decisions, this is basically giving the machine the ability to think and act like a human being”.

Reaching happiness is the ultimate goal, which means first we need to meet daily activities. This is sought by having a file for ‘Enabling Technology’ especially simulation techniques in industry.

The growing population and increasing demand on services as well as its quality shows the real beauty of technology that has no borders or limits, which can reach to a high number if people, only through the internet.

The study prepared by Dr. Husain Jahdali, Dr. Riyadh Najim and Dr. Hamed Asharari) on Regulating and Governing AI, that was presented during the 20th Summit held in Riyadh in 2020, concluded in the need to govern AI. Results presented were drawn from answers collected through a survey done by Think Tanks and Research Centers globally, to come up with Worldwide accepted recommendations.

The study results recommended establishing a global team under an International umbrella to work on Ethics related to AI to resolve any Bias in this area and maintain the Cyber Security of its systems.

The main tasks of this team would be:



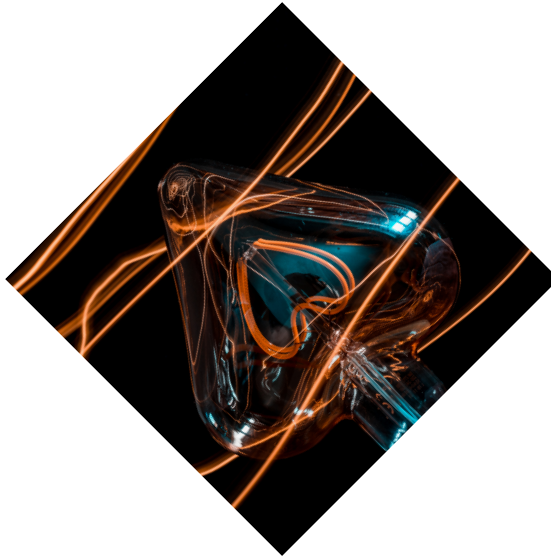
To present Guiding Principles that are non-abiding to countries to organize its Digital Global Platforms.



Making International Principles about the housing of Data. Based on differences, between Strategic and non-Strategic Industrial data and Personal Data.

At a later stage AI can then be organized by an Independent International Committee that is made of Governments, Academic Institutions, Private Sector, Independent Experts (such as Think Tanks). This Committee will then be responsible for supervising the efforts done by countries to gain membership to this committee and defining the sectors that should have AI. Focus is on the crossing sectors that were surveyed: Health, Security, Financial Services and Military Sector.

This step can be done initially under the G20, that could later include more countries that are interested in governing the AI. Although future technologies look very promising, they won't be able to reach their maximum capacity without being Governed to serve Humankind and improve life.




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Chapter Five The Role of Science in Foreseeing the Future and Overcoming Critical Shifts

- Recommendations.
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Recommendations



Introducing S20 and its priorities.

The Science Group S20 is a subgroup of the G20. That played an integral role under the leadership of KSA for the G20 summit. It Aims at presenting how science can be used as a human tool in a turbulent future.

S20 is resembled of national Academies for Science in the G20 countries. This is a fairly recent group that was established in 2017 during the presidency of Germany for the G20 summit. Ever since, the S20 continued its work during later presidency, while being under Argentine, Japan and then KSA. The main goal for the S20 group is to develop and advocate Science and Policies that are based on evidence and recommendations around main global issues. This mainly targets decision makers, especially the leaders of the G20 countries.

The S20 groups chose the title: “Foreseeing the Future”: the role of science in overcoming critical changes”, as a main topic for the year 2020, while focusing on the main pillars for KSA Agenda as a president of the G20 summit in a global dialogue model for topics that deeply affect the economic, social and environmental stability globally.

The presidency of G20 has confirmed during 2020 the importance of S20 group through its recommendations about the COVID-19 Pandemic and in an attempt to reinforce policies and make decisions based on scientific evidence. The S20 al enhances the cooperation worldwide and coordinates procedures as well as gather global funding for main and practical researches that are related to COVID-19 Pandemic.

The S20 teams have reviewed the three main priorities for the S20 group and how relevant and connected they are as well as their impact on a system’s level. As these priorities do affect, individually and collectively, the economic, social and environmental stability. These priorities include: the future of Health, the circular economy, digital revolution, and the co-relations between them.

S20 is trying to focus science to deal with priorities of the G20 group to save the planet and enable people to form new borders. The current focus on foreseeing the future based on evidence draws the plan to move forward which is expected to reactivate work. This forecast that is based on science leads to solutions or mitigations of the expected future turbulences, that prepares and supports decision makers to better prepare future policies.

There are a lot of shifts that were the main focus of S20 group, such as the Environmental shifts that relate to climate change, pollution, exhaustion of resources, the loss of biological diversity and the population shifts due to migration and the reduction of birth rate, population aging, urbanization and increase of digital gap.

Some of the S20 main recommendations in spite of the existing challenges are:

1-Upgrading the preparedness of dealing with COVID-19 Pandemic towards an international cooperation framework to monitor emerging diseases while rapidly responding to those and dealing with any future Pandemic.

2-Reinforcing advanced medical treatment researches to enhance personal care, in a way that goes with an improved technology and improved cost and access to medication.

3-Activating Policies taken to face emerging challenges that resulted from Demographic shifts.

4-Dveloping a comprehensive and efficient method to extract natural resources, distributing, consuming, disposing and recycling them.

5-Strengthening recycling systems for materials and energy through applying: decreasing, reusing, and recycling. In addition, adopting renewable energy that produce zero emissions.

6-Closing the digital gap to ensure all people around the world get digital technology and internet access and ability to use the later while maintaining privacy, flexibility and network security.

7-Improve the digital infrastructure sustainability, including the devices of the end user, and improving the use of smart-city technology in creating cleaner environments.

8-Adopting a multi-sectoral methodology to plan the future society around the human being and enabling the later digitally, making the digital infrastructure inseparable from the social, education, political, commercial and cultural scene.

9-Supporting Future Forecast researches that rely on solid science and a methodology that can be reapplied. Sharing researches and data openly to include the recent development in analyzing complex systems and the science of connectivity.

10-Establishing a platform through which execution and enhancement of international cooperation is possible. This platform provides building trust in researches and activities of future forecast.

The future of Health: Mitigating Pandemic and Increase the Personal Health Care.

There are a number of important shifts that have recently happened all over the world that have affected our society, some of which affect the future health of humans. The role of scientists within the future Health working group within the S20 is, defining these shifts and challenges that we may face to be able to face them and suggesting recommendations for decision makers which could decrease the turbulences that affect our health.

The first shift that has been defined is the shift that we are currently experiencing during global Pandemics similar to COVID-19 which can happen in the near future. Long-lasting Pandemics can burden and ruin health care systems, therefore we need to respond quickly to such shifts. The challenges that we face are related to the awareness about diseases and the lack of new treatment and international cooperation. We still don't have enough data sharing or non-unified ways of collecting data that are scarce. Therefore, decision makers need to quickly work on establishing an international framework for cooperation for Pandemic preparedness or a plan to identify any emerging dangerous diseases that are responded to quickly.

The scientific network is enabled to connect and share reports, data and best practices and any knowledge that has been acquired throughout the response to this pandemic. KSA has played a vital role while heading the G20 to encourage cooperation and coordination between countries worldwide to respond better to this or any other Pandemic.

The second shift that the Health working group defined under S20 links to health care providing advanced personal health care. The recommendation was to promote advanced treatment in line with Omix techniques, which is a technique that is designed in accordance to the genetic file of the individual.

There are yet some challenges facing the development of such treatments, the scarcity of scientific talents, lack of funding and lack of special investments for health researches and the low number of employees with high skills. More needs to be invested in training programs that lead to developing better techniques. Regulations also need to include new technologies in health plans.

The Third shift is that a lot of countries are going through Demographic changes because of a decrease in birth rate or urbanization and most importantly the aging of the population. The UN has estimated the global age average expectancy to be 72.6 years in 2019, while the global average in 1950 was only 65 years, in 2050 it is estimated that it will reach 85 years. this demographic change will increase the expenditure on medical care and increase the demand of health care services. it is important therefore to issue policies and interventions that will face the emerging challenges of this demographic shift. We need to focus more on resources of prophylactic care and plan especially for old aged. This change is needed as soon as possible.

As for the Personalized Medicine and its future, the idea has actually begun following the “Human Genome” Project that was completed in the year 2000. This project was one of the international scientific researches that aimed at drawing a map for all human genetic strands that exist in the Genome. In KSA the “Saudi Human Genome” project was launched in 2013, which led to early diagnosis of genetic disorders and the documentation of the first Saudi Genetic Map. KAUST has recently announced that the first phase of this huge project is completed successfully.

The Personalized Medicine that appeared 20 years ago, follows one methodology that is suitable for everyone for purposes of diagnosis and prevention, unlike the traditional medicine that has challenges related to privacy. The individual personal genetic file is used in the Personalized Medicine, which includes information and details that are obtained from the Human Genome Project in the first place. Many technologies have emerged over the past 20 years that are based on this project, to that are Genetic treatments, Immune treatment, Nanomedicine and any treatment that is dedicated to the patient's genetic file.

The genome's technology includes CRISPR's Technology that easily changes the DNA series which changes the gene's function. For example, cancer patients who usually have a mutilation in one gene can use CRISPR's technology to remove this mutilation, as such, using this technique allows the treatment of many diseases and even their prevention. Yet, the big challenge is the high cost of such techniques.

Another example of a gene-related disease is a rare dysfunction of Atrophying back muscles, which are affected because of nerve damage due to this gene. Individuals who are born with this gene do not live longer than 2-3 years. scientists have found a new treatment for this dysfunction by using a virus that is genetically modified carrying a healthy version of the specific gene, replacing the mutilated one.

This has been already approved by the American Drug and Food Association (DFA). The treatment of this disease costs around 2.1 million USD, which makes such treatment unavailable for the regular patient. The CRISPR technique is a powerful one, but we need to explore more the mistakes and fix them over few more years so it can be a unified and conducted in health clinics. Also, the investment in the research related to this field remains very little and so are the scientists who work in this sector. Causing an institutional debility. Regulations that include this technique as part of the health plans need to be developed. But also, the social acceptance of this technique to prevent its abuse, as some patients as well as their doctors are afraid of using this technology. More investment needs to be done in the training programs that improve the skills of employees and more innovation is required in the field of Personalized Medicine.

If Policies and Regulations are implemented within this new framework, surely this technology will be a unified way of treating a lot of critical diseases in the few coming decades.

A healthy response to the digital transformation in the medical care field uses the best available tools, as such benefiting from AI and other operating systems to enhance the work of medical teams. This will give them a new perspective and speed inventions and Human knowledge.

Circular Economy: Comprehensive Solutions for our Environment

Circular Economy became popular during the last few years, where it presented a model that could improve end-result and benefit our environment. Circular economy depends to principles of elimination of waste and pollution. Maintaining products and used material by reviving Eco-systems.

Circular economy is considered a result and a motivator of the Industrial revolution, that used raw material to produce goods that were in demand.

The UN defines the circular economy as a: “Share and exchange system that allows social progress whilst maintaining the capital and economic growth. Its end goal is to separate economic growth from exhausting natural resources by making products and producing services in a way that they could be reused, remanufactured, recycled and recovered as long as possible”.

S20 group have focused within the Circular Economy on understanding the economic challenges. The fact that the traditional economic activity focuses on linear processes that generate a lot of growth and economic development but also generates a lot of waste and Environment pollution. The duration of this linear short-term economy was 10-20 years.

On the contrary, the Circular Economy focuses on reducing waste throughout the production process, reusing, recycling and recover resources. Car's old Batteries are one example of resources that are recycled and reused. This should be regulated over many sectors, as this method supports sustainability and is in line with the Environment which is actually circular and so do, we live within circular systems of water, Carbon, Nitrogen...etc.

There are a few challenges over the few coming years within the 21st Century, if we want to grow in a sustainable way by achieving a healthy population growth and reducing poverty around the world, then we will be using resources more than we have at any point in History, in effect, our consumption of fossil fuels will be much higher but simultaneously we are not picking up CO₂ from the atmosphere at the same rate. If we could increase the rate of picking up then we would achieve a circular growth and produce a big amount of materials that could be recycled, we would also be using chemical material in better way that enables us to recycle it too.

Within this context “Boston Input” did a survey of National Science Academy in the G20, but the working group has admitted the many challenges that are facing the realization of Circular Economy; finding applicable techniques that either provide reuse or remanufacture of products. Also, innovating economic incentives that are in line with market force towards circular economy. There is also the need to develop indicators that assess the quality of circular economy throughout the different countries and different sectors. There is also the need to spread awareness everywhere, starting at schools with children, within Governments and private Companies. It is also important to strengthen cooperation between Public Academic Institutions and Private Sector, and across countries. More investment needs to take place to achieve sustainability. Most importantly, data about the latest technologies available and the market or consumption patterns need to be collected and used to achieve the ultimate goal of circular economy.

Based on the above challenges, the S20 came up with final recommendations; developing a wholistic, closed system to produce vital products. The second recommendation is to enhance the circular design of material and energy through developing the application that will use resources and use recycling projects, this includes costing studies and assessing the lifetime of new technologies, for example, electrical batteries, solar cells and Carbon detention.

Achieving circular economy is an important thing in the 21st Century as it preserves a strong economic growth and provides a better living for people around the globe and reduces poverty and helps keep a healthy growth of the population. To keep up with the world's economy we do require a tremendous amount of resources such as energy, food and water. And in order to maintain a healthy environment and live a life in line with the environment and available resources, we need to achieve a circular economy for us, our children and the next generations to come.

One great revolutionary example of circular economy would be Electric Batteries. There is an increasing need in both the transportation and Solar Power sectors for electric Batteries that are cost efficient to reduce emissions that come from vehicles and energy generating activities. The need is in Cars and Trucks, possibly Airplanes in the future, and in the ability to store energy during the night or when there is no sunlight. It is expected that within 10 years, more batteries will be used in both sectors at a rate of 100 times more than what is used now in the electric cars, electric devices (watches, smart phones or computers). As for electrical vehicles it is expected that the use will increase 10 times more in the future than today. If the sale growth reaches 25% in the next 10 years (2020-2030), so today if we have to recycle a battery of 1GW/hour, then in 10 years we would have to recycle more than 100 times to meet the need and save 100GW. Half a GW is the average of electrical energy generated by a typical Electrical Station. Big economies like that of KSA uses a general energy that is less than 100GW. Ultimately in the next 10 years the batteries coming from electrical cars need to be recycled at about 100GW.

Decision makers in both public and private sectors need to consider how to guarantee recycling important products such as solar power cells to be as friendly as possible to the environment through the use and remanufacturing to have an environment-friendly industry.

Digital Revolution: Achieving Global Communication and Smarter Societies

Products and industries nowadays use more Information and Communication Technologies (ICT) to improve our lives. Current developments indicate that we are going through a new ICT phase that is essentially a mix between ICT and multiple ways that is called “Multiple Mode Communication” or “Interactive Communicative Technology”.

The digital revolution and electronic knowledge blast changed every way of life and has even become a standard where everything before this era is called ‘traditional’ or ‘old’.

S20 has closely looked at challenges related to digital revolution and has thus, worked with different Academies to discuss related problems and overcome large transitions and shifts that the world is currently going through. During this process the main interest was how to come up with recommendations that could enhance the digital revolution and help maintain a strong society.

The first recommendation was to close the global digital gap that exists to achieve better chances for everyone, from a qualitative and quantitative perspective. Quality is a big factor that needs to be considered to make sure that more people are communicating. We have seen how people with better access to the internet had better chances of learning, while learning should be an equal right. Therefore, we need to ensure that better equipment and better coverage and better speed is available for everyone. All of this requires more resources, more ability to transfer data to enable better technologies. All which needs to be met to achieve enhanced digital development.

The second recommendation was the multifaceted specialties of the digital revolution and how the need to have a multi-expert team to work on AI, Data, Communication...etc.

The last recommendation was to improve sustainability of our societies and cities that are a changing factor if they were smarter. This is of course dependent on technologies that are integrated within the infrastructure of those smart cities. The problem is that those technologies work perfectly for the first two years but then deteriorate afterwards and pose an obstacle for further development.

Foreseeing the Future: from Science to Work

The political shifts are becoming increasingly complicated, so the main task for the S20 group was to follow up on the work of all the subgroups and collect the topics and recommendations that were common in those groups and come up with the right recommendations that were endorsed through surveys and working groups.

The main recommendation for the S20 group in the future Forecast relied on the fact that we humans have the ability to imagine the kind of future we want and we are able to predict, to a degree, some of the outcomes that result from a political stance of some of the Economic institutions or certain technologies that we will use. These new recommendations that should result from a participatory approach need to have practical goals that are in line with the future that we want. Governments have realized the importance of having some kind of forecast activity.

The level of Government participation in this forecasting process differs than other operations where Governments, Think Tanks, Public Institutions and Corporates had. On an international level, Horizon Scanning Team in the UK is one example or the Office of the Prime Ministry. In some cases, the forecasting happens outside the range of Government, like in India.

By looking at all forecasting activities, there are big restrains and great gaps, that is due sometimes to the complications as there are many challenges and many decisions that happen in today's world in different areas and with different perspectives which requires decision makers to consider at different levels.

That being said, most forecasting activities saw that Science is an element for a special process and not as a main element for the entire process of forecasting. In this regard, S20 came up with two main recommendations:

One: supporting the forecasting research that is built on repeatable methods and open sharing and integrating advanced development in the complicated systems and AI.

Two: creating a platform based on which international cooperation can be achieved in order to operationalize a connected system and gain confidence in the forecasting methods.

Many country actually conduct some kind of forecasting activity to predict the future or even to plan for gearing development, but these methods lack the basic level, especially when we think of the critical shifts that happened as a result of COVID-19 which started as a local thing but soon its affects extended to all other sectors than Health Care. It impacted our responsibility towards circular economy and the impact on global supply chain and how it forced us to switch towards manufacturing masks and sanitizers to meet the huge demand. It also impacted the digital revolution through the misinformation that spread. These quick changes in a relatively short time has led to a learning process to forecast influences before happening and to better prepare for those.

Today, having gone through Data Revolution, which provided a huge amount of data which is not being used effectively, neither for planning for the Future. We need to have the ability to take correct decisions based on proper forecasting, which can only be achieved through merging all perspectives, advanced technologies, AI, calculation methods and complicated sciences.

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Chapter Six Crisis Management...Experience and Effective Practices

- Recommendations.
- Flexible City Experience and Managing COVID-19 Pandemic.
- The Role of universities and research Centers in Crisis Management by applying this through COVID-19.
- Adapting the Structure of Crisis Management to Broader and Longer-term Incidents.
- The Integration of Government's Roles during COVID-19: The Experience of the Ministry of Information (MoI) as a Model.
- Crisis Management, experience and Lessons learned in Change making.
- Resources and References.



Recommendations



Flexible City Experience and Managing COVID-19 Pandemic

According to the World Bank the definition of Flexible Cities is: “ a group of cities that entail characters through which it can absorb turbulences and adapt to climate changes, economic, social and Environment challenges that the world is facing today”.

Planners aim at applying the standards of Flexible City in their designs, such as smartly using the available landscape in an integrative way to facilitate access to all parts of the city using different means of transportation, and facilitating pedestrian movement using all available means. Reducing pollution and waste, using clean and renewable energy in a sustainable environment and strengthening Societal cooperation while maintaining society's identity.

All over the world, cities are facing the COVID-19 Pandemic. Its health systems have suffered, and the social, economic and environment pressures are unprecedented as a result of the Pandemic. Economy is stumbling, transportation system in cities is suffering, cities also suffer to provide access to water and wastewater, this is also the case in developing cities across the world. Daily Laborers and Poor people are the most to be affected by income loss and by scarcity of city services and social safety network that could provide them with the safety when needed. It is very obvious that urban cities lack any flexibility that affect the most urban poor people.

How can improve the response of cities to CVID-19? Data and useful information that are easy accessed and can be used by societies is a first quest. When this is available correct decisions can be made about resources and operations. This leads to support provision for people where it is of most importance. During emergency response open communication and sharing information becomes key for ensuring the safety of citizens.

There are five specific lessons learned from the successful encounter COVID-19 by the flexible cities:

1-Dealing with COVID-19 Pandemic as a civil and humanitarian problem that is multi-faceted and not only health related. The impact of this pandemic Include health social environmental and psychological effects we need to Find solutions in policies to decrease the negative effect of this pandemic.

2-In order for cities to be ready to deal with this pandemic They need to be proactive and prepare plans to react to the pandemic once it happens, and deal with the negative impact and risks resulting.

3-In order to manage crisis and deal with it successfully, we need to rely on data from multiple sectors Health, economic, education and psychological. Such data need to be provided through universal research centers. In addition to the provision of data for each city Separately in order to estimate the size of the pandemic and ever Forecasting its impact and suggesting solutions.

4-Defining the multiple living systems in urban areas, Such as transportation system, health system Local economy system and educational system. We also need to know the gaps within the multi sectoral system to be able to identify proper solutions to deal with the health crisis.

5-Dealing with COVID-19 pandemic in a comprehensive manner in the multi sectoral approach, Defining the governmental entities that relates to each sector. Procedures between these sectors need to be governed for ease of flow. By this focus should be beyond the health sector and health aspect of the pandemic.

Overall, we are learning from the successful experience of flexible cities dealing with such a pandemic.

Role of universities and Research Center in managing crises by applying this through COVID-19 pandemic.

Consecutive crises that are taking place nowadays have many challenges many problems in addition to create opportunities and forces yeah. Universities and Research Center became one of the most important fronts to deal with crises in the future and nowadays. The definition of a crisis differs according to the industry or activity in addition to the decisions made, generally a crisis is defined by being a sudden incident that results from natural or man-made disasters, the interference of human element taking decisions based on correct data may lead to loss of lives.

The goals that are part of crisis management which should be dealt with by universities and research centers in the current and future are of three types:

Goals that are pre-crisis or pre-disasters:

- establishing a database and information on crisis and potential disasters.
- Improving monitoring mechanisms.
- Putting scenarios to deal with crisis and disasters.
- Training human resources.
- Defining fitness financial resources.
- Increasing awareness of risk and risk culture.
- Taking preventive and prophylactic procedures.

Goals that are during the crisis and disaster:

- executing the best plans and scenarios prepared to manage the crisis and disaster.
- coordinating between different entities that are mandated to deal with the crisis.
- The provision of urgent emergency services for affected parties.
- providing material and logistical support to contain the size of the disaster.

Goals that regain balance and rehabilitation:

- Counting the loss resulting from the crisis and disaster.
- Providing the proper compensation for affected parties. Evaluating the confrontational phase and defining strength and weak points.
- Taking proper procedure to deal with weak points.
- Recommendations that prevent the happening of such disasters in the future.
- Constant review of the procedures puts in place for prevention.

In order to achieve the abovementioned goals, the university has to work with other parties to:



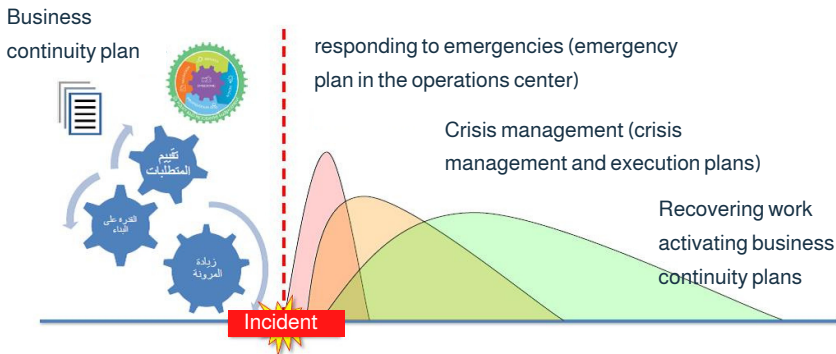
Within the social responsibility of universities for having qualifications in difference fields

The role of the Saudi University and Research Center in the crisis management is, through the establishment of a national center for crisis management. Related to that center is a sub center that should exist in each university the center we'll study the crisis and disasters that are potentially happening in the geographic areas where the universities are this aims at predicting the disasters before it happens, to plan on managing it and providing the needed financial resources for rehabilitation recommendation, and taking the necessary measures to prevent it from happening again. To facilitate the role of university in coordination, between the different parties of crisis management, the importance is to establish a database electronic information that are central, linking all entities together for a unified management. This increases the exchange of information, hence the procedures and decisions that should be made to deal with the crisis and decrease the size of Los. It will be also important to design monitoring and alerting systems, that will increase the capacity to forecast and predict crisis before happening. Within this context universities and research centers have a strategic role through crises by providing scientific information that help to deal with such crises and find the best solution.

UN reports show that in order to decrease the devastating effect of COVID-19, governments have to cooperate with universities and other entities to implement some procedures re-imagining education, quick change in learning, building systems that are able to adapt a fair and sustainable development, while encouraging scientific research and enforcing its importance in facing crisis.

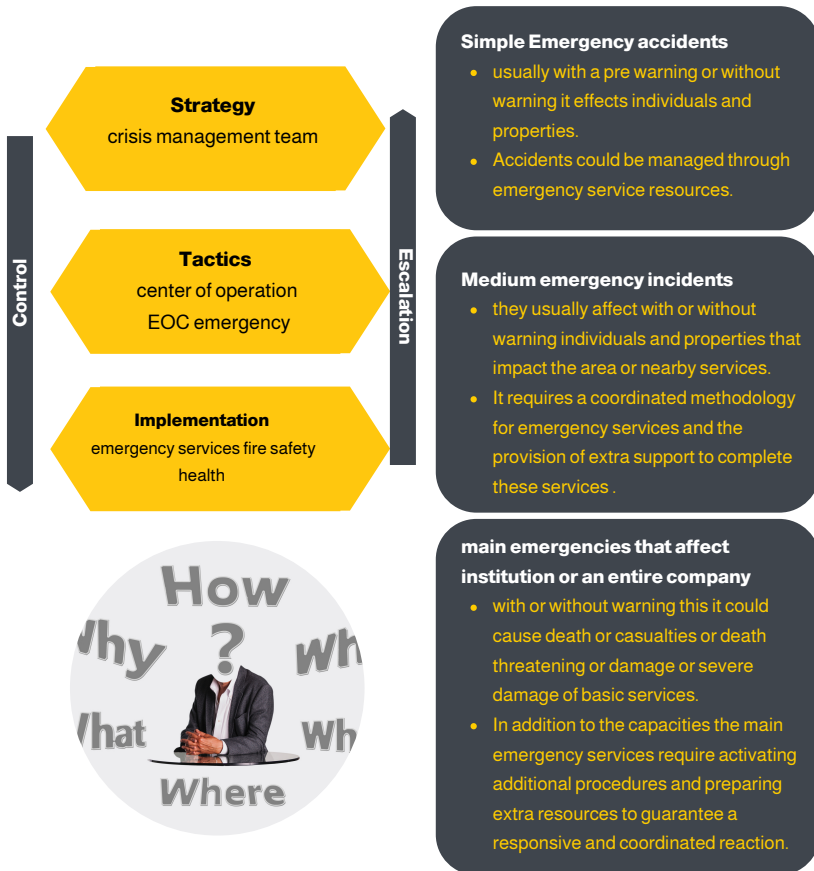
Adapting the Structure of Crisis Management to Broader and Longer-term Incidents

Since avoiding emergencies and natural disasters is something impossible, it becomes very important to identify the crises especially those vast ones to reach to a point where we are able to deal with it and decrease its devastating impact. The planning process includes all preparatory work for dealing with different kinds of emergencies, whether they were exercises, developing plans, as evaluation of risks and so on. And this happens after the incident takes place, it may be a leak of dangerous material, fires, big floods or similar. As soon as this happens there are three different phases; the first one is the responding to the emergency itself, where response teams are sent that deal with most of the accident or incident to eliminate it completely. Then transition is done to the crisis management phase, where higher management considers financial risks legal risks and reputation risks. It is also necessary to be communicating with different government agencies and non-government agencies outside of the society to ensure procedures are in place for dealing with emergency. The last phase is the institution or societal recovery.



Emergency incidents are categorized into three main activities, small incidents that are local which can be handled by the concerned entity. Medium incidents which takes some specialized form. Huge incidents, this type expands and effects a bigger number of population similar to the COVID-19 pandemic. For each of these incidents there is a suitable way in dealing with and managing as follows:

Traditional Emergency Management system



For sure ,COVID-19 is considered one of the biggest events that gave us lessons to learn in all aspects of life, and made us think in a different manner of how to overcome the challenges of this crisis by using innovative and quick methodologies in the light of limited resources and limited strategies. The next picture shows the experience of KAUST in managing COVID-19 crisis:

COVID-19 crisis center



What can be drawn from the experience is, that we need to change our entire style of thinking outside the box and how to respond to COVID-19. This requires integration of all procedures together with the emergency ones, through the experience of cost in facing COVID-19 we can be sure that universities and research centers need to work on finding technologies that could provide KSA with proper solutions that could be used to face any future pandemic.

The Integration of Government's Roles during COVID-19: The Experience of the Ministry of Information (Moi) as a Model

The Kingdom of Saudi Arabia has put a lot of effort in facing the COVID-19 pandemic through the integration of its government roles it was noticed that coordination and role distribution were done in a very professional way between the different entities, and under the specialized committee that was formed to follow the recent updates on COVID-19. The political leadership has also supported the efforts of the government entities that worked within this framework; by focusing on the experience of the Ministry of Information as a model to coordinate and integrate Saudi government efforts, we find that the Ministry of Information has done some excellent media efforts during the pandemic that went through phases all the way from its start through slogans 'we are all responsible' until our current time slogan 'we go back carefully'. Five teams using seven different approaches have contributed in making media messages that were invested well to deal with the audience successfully.

This beautiful scenario is almost happening!

Media operational room



this room was established since the very first days of the crises, after it was ordered to establish an immediate coordination committee. Which included many government members in order to unify the media work under the supervision of the ministries of media and health.



Mutual government work



24/7



35 plus government entities



Five teams and seven approaches

Roles of the operational Room



To unify in coordinates the government media efforts



Launching media and awareness campaign



Awareness raising unified awareness raising messages



Building plans and developing media messages



Producing media products to support the government efforts

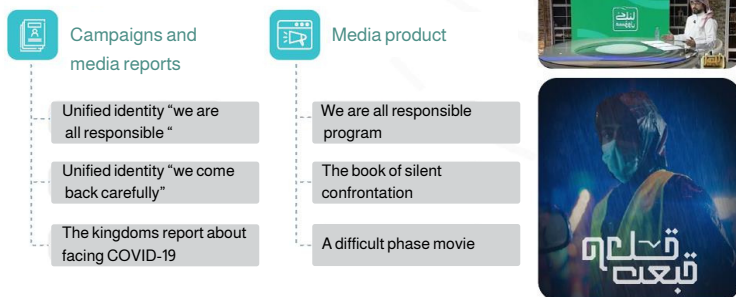


Monitoring and the general management of public impression about the crises

Media tools



Media tools



The stages of media work to confront the COVID-19 pandemic.



Crisis Management, experience and Lessons learned in Change making.

Risks and crisis are one fact of life requiring the preparedness of organization and rehabilitation to manage the crisis by putting in place suggested methodologies that deal with these risks and reduce their impact. For sure COVID-19 pandemic has proven that a lot of countries in the world are not interested in managing the crisis in spite of the fact that it is important to reduce the risks.

Crisis management is defined as: “the science that is concerned with overcoming crisis using scientific and managerial tools in a manner that helps avoid its negative aspects and use its positive aspects”.

Risk management to stay in front

“Risk is a fact of life, preparing for it and developing abilities to manage it is the only way to acquire competitive advantage”



Overall factors

Overall economic Riyadh facts
Economic factors
Geopolitical factors



Technical

Artificial intelligence, machine learning, robots
The Internet of Things
Development of new technologies
Analysis of huge data



Organization and supervision



Global regional and local systems
Regulations in systems dealing with governance

Modern risks



Type of risks Unclassified risks and responsibilities Contagious increasing risks, that are formed by the interaction of different approaches

Specifications of an effective risk management and lessons learned

Factors that affect the entity's ability to achieve its goal and effectively manage the risks



All crisis regardless of its form or its resource lead to the fact that organizations need to have effective strategies to be able to deal with those risks, resolve them or reduce its negative impact. Those strategies need to have suitable methods to overcome these risks and reduce their impact.

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Chapter Seven Horizons of Technical Future for the Kingdom of Saudi Arabia

- Recommendations.
- Introducing technology and its future development.
- KACST and enhancing the technical forecast in KSA.
- Forecasting the technical future of the health sector.
- Enhancement strategy for communication and information technology in KSA.
- Space Future technologies in the Saudi reality.
- The future of innovation and technical development in the private sector.
- References and resources.

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Recommendations

- Investing scientific forecasts and benefiting from the 4th industrial revolution to develop national economy.
- Setting special framework to govern artificial intelligence, its ethics and use in different sectors, encouraging its organization and governance on a worldwide level.
- Create an incubator to develop and innovate digital solutions in E-sports. To improve life quality and combine literature with science. To be a main motivator to change behavior while creating competitive between universities and the Saudi Federation for E-sports and Mind Sports. In addition to setting frameworks to face Cyber Risks in this Domain.
- Using e-Sports to be a main motivator to change behavior while creating competitive between universities and the Saudi Federation for E-sports and Mind Sports. in addition to, setting frameworks to face Cyber Risks in this Domain
- Improving wireless infrastructure of Broad-Band and encouraging the use of the Internet of Things in all aspects of life. Issuing legislations and By-Laws that are required to quickly develop this industry while taking care of the necessary infrastructure in the areas that don't have Internet reach, keeping in mind the education process.
- Support scientific research in the Nano-Robotic and develop its application, which shall change a lot of concepts, education, communication and health.

Introducing technology and its future development

Technology has played a significant role in achieving a big move and the development in human life, it has also helped overcome many challenges that has faced humankind over the past few centuries.

Technology can be defined as:” the practical application of science, in another word it is the activity through which Science can be translated”. The technological advancement will continue solving problems that face humans, it will be a tool for humans to benefit from and adapt the nature to serve the wellbeing of Humans.

In fact, the worrying state about the future that humans live because of fear from the future and the anticipation to see new things and will to change life, this state requires a lot of thinking and efforts to come up with new ideas and solutions for today's challenges to draw a better future, that everyone of us aspires to live. Therefore they need to study the future emerged; in 1970 the book :The Future shock” written by Alvin Toffler, mentioned; that there are three types of future that the world would need: first is; the signs of future, where one could talk about the possibility of things happening. The second is; the art of future , that enables us to explore what can be done what could happen in the future through imagination and the possibility policy that would choose the best of what could happen in the future amongst many possibilities. What most futuristics have focused on over the past few years was to develop the first part, the science part and inventions parts technologies and devices, what is called “envisaging the technical advancement”.

The world of today witnesses accelerating technical shifts in many aspects that require the enhancement of international cooperation to decrease the impacts the possible impacts that these shifts will leave in the global economy especially the digital economy.

What does the future technology hide?

Mecca

The technological development is considered one of the quickest changes that tap the most the most impact on changing the future shape of the world. Even though the future of this development is difficult to predict, as it is based on moving sand, which means it is more likely to collapse and change suddenly at any time.

Futurism site has collected some of the technological innovations that are expected to emerge in the future.

2019

Technologies that are controlled by the Eye The technological development in facial recognition has allowed the innovation that could be controlled by eye movement.

2020

Diagnosis paper A cheap tool that can quickly diagnose many diseases, such as Ebola, Tuberculosis, swine flu and Zika disease.

2023

Designed antibiotics the progressive development over this technique to build a macro lid to help design antibiotics in a recommended and non-costly Manner.

2024

Robots Innovating biological robots that can be consumed to fix internal trauma within the human body.

2026

Smart clothes Clothes that are made of nano fabric pores and electronics that react to touch and can change color and shape according to the need.

2029

Carbon operated batteries
They are made from electrochemical cells that absorb CO₂ to generate electricity, so it solves pollution and the energy crisis at the same time .

2032

optical genetic science
Following a whole decade of engineering and research in this science it will be possible to treat diseases such as Parkinson, Alzheimer's, autism, and schizophrenia .

2034

Internet network Satellite network
that is safer and cannot be hacked, due to the use of interlinked photons in the quantum cryptography, to document safety in data transmission

2035

Biological material New material
that is inspired by the behavior of microorganisms, such as self-cleaning and self-repairing buildings.

2037

3D printers in every house
These printers provide and unlimited experience through downloading all needs such as; electronics, food, medicine which can all be printed.

2039

Genetic modification
First temporary legislation that will allow the “designing of babies” will appear in the global legislations.

2041

3D pets Innovating websites with the technique holographic Imaging of animals, that can interact and express themselves.

Overall technological development is considered one of the quickest changes of the world shape, even though this future development is hard to accurately predict.

KACST and announcing the technical forecast in KSA

KACST has prepared a research development and innovative strategy as one of its requirements for developing national industry and logistic services periods the strategy was based on a comprehensive study for the possibilities and the interactive and targeted sectors to develop and complement. The research development and innovation structure include expenditure, manpower, infrastructure and a regulating framework. The interactive entities include institutions of research and development, mediators of technology transfer, local companies, government entities, and global producers of technology. The sectors that are targeted include the sector of energy, industry, mining, and logistic services. The strategy also aims at putting maps road maps and strategies for research development and innovation.

KACST had prepared the fourth industrial revolution strategy that is one of the capabilities of developing national industry and logistics services and coordinate the work between the different entities.

This strategy has defined the potential methodologies and suggested strategic pillars and Main initiatives that's enabled to build this industry in the Kingdom and execute the kingdom's plan for the sectors under this program.

And innovative center was established , this center has the Fourth industrial technologies, while currently the plan is to establish similar centers in the kingdom's different areas in cooperation with the Saudi committee for industrial cities and technological areas (Mudun), together with the industrial complex program.

The Technical Support for research and developing the Internet service through the Saudi network for research and innovation program marine and the technical services and safe electronic archiving. The city provides adapt to a scientific database that is national for researchers in the scientific areas. KACST provides many initiatives that are born out of the concept of supply and demand for job markets. The initiative aims at rehabilitating human resources to develop a system of research development and innovation in the Kingdom, to increase the percentage of Saudi researchers from around 1150 to 3000 researchers for every million population. The initiative also aims at rehabilitating local manpower maintaining them through different training programs, youth science program, technical leaders' program, in addition to provision of incentives to attract foreign talents and encourage them to work in the area of research and development within the Kingdom.

Through its institutions and national centers and the technical leader program KACST implements research and development projects in many development sectors within the Kingdom, especially the sectors of energy, water, mining, oil and gas, advanced materials, building, health, communication, information technology, agriculture, environment, transportation and logistics services, nuclear sciences , aviation and space. When it comes to technical investment, cost encourages innovation in its entire phase. Through its program of technical investment KACST established a partnership with an international technological company that aims at investing in technological companies and startups that work in the area of technology. Partnerships were made with companies such as CARBONICS, PANASIA NANO and VTL. The program also invested in some of the technological companies that support the plans through looking for companies to own shares in those companies, Such as SOFT MACHINES company, SOLAR JUNCTION, AAT and NH2 company.

During 2018 the technical program has invested in new companies such as, SI WIRE SYSTEM company specialized in developing, chips and wireless applications, the IOT and smart cities. The program has also gone into partnership with the SOLID POWER, an international specialized company in the field of technology of high temperature cells and hard oxide fuel cells. Generally

Generally, KACST provides its services to support research and technical development through the national transformation program, based on the kingdom's 2030 vision. The services include scientific support for universities, and scientific communication. In the field of supporting universities and research centers, KACST supports the activities of research and development in the institutions and National Research centers, both private and public. It contributes to developing the research activity to achieve vital objects that's half social importance and economic importance which serves the Kingdom towards enhancing and diversifying the national income resources.

In the domain of scientific communication KAUST inaugurated several initiatives that are concerned with educational awareness through, publishing and translating international journals, such as the British (Netshare) journal, the French (Life and Science) Journal, and other solid scientific journals.

In the domain of preparing technical leaders to support the local content, KACST aims at expanding in the establishment of specific centers that are linked with several universities and research centers. In the Research Center and development program KACST aims at strengthening the scientific researches that are related to the industry, to facilitate achieving outputs and products. And accessing the market through establishing a startup company that is based on these outputs according to the kingdom's vision 2030.

The National Center for technical development which is part of cost seeks to nationalize technology and establish such projects in KSA. Therefore, incubator programs and technological Oasis are being implemented, which aim at working with diverse national sectors including, Universities, Research Centers and companies to improved technology. The program also contributes in establishing technological incubators, helping establish development projects in the industry, and helping researchers and investors in developing opportunities for technological projects. Assisting the 'Technology Transfer' to be adopted to investors and researchers, providing information about technology and businesses. KACST's programs also work on facilitating partnerships between business Owners and investors.

As for the forecasting studies KACST works on a program that forecasts the technological future and its impact on KSA it also specializes in forecasting studies for different technologies and the feasibility of the research results conducted by KACST. The program also covers the different methods of financing technological projects.



Forecasting the technical future of health sector

The report that has been prepared by KACST around technical forecast in the health sector is focused on using digital technology in reducing the high costs of the health care sector that is considered one of the most expensive government sectors in KSA, while maintaining a high level of patient care.

Among the report's methodology is a big 'List of technologies' that are related to medical care and medicine that have been identified through scanning some of the reports belonging to ihealth care organizations on an international level such as WHO. This list has been then verified by sector experts. It included 32 technological areas, and five sectoral needs that were identified for health care and medicine based on interviews and workshops with experts in the field.



Result: increase the efficiency of the services and procedures and products of health care.



Cost: decrease continuing costs of health care services.



Scope: expand the scope to reach a more accurate health diagnosis.



Preparedness: prepare better to combat infectious diseases.



Staffing: solving the problem of qualified staff deficiency, the results of the list has identified seven technological areas around the health care and medicine topic.



High priority technologies: remote treatment gene, genetic sequencing, drawing a map and treatment, advanced genome vaccine technology, wearable health devices, remote patient monitoring techniques, artificial intelligence diagnosis systems, clinical decision support systems.

In the forecasting path, the results of the summarized technology risk lists identified seven different promising technologies that's are being prioritized: (Medication-Genetic Testing technique, Human Strengthening techniques, genetic sequencing, drawing a map and treatment, Care point Testing techniques, remote consultations, Wearable Health, advanced genome vaccine technology).

Health technology sectors sector has become one of the most growing sectors in the world, despite of all economic sectors being affected by COVID-19 pandemic, the health sector was not affected. On the contrary, it grew thanks to the approach of official world governments and their support, next to big corporates that have also contributed in the support.

Modern technologies that are being used in the healthcare sector, similar to database, producing wearable devices, developing applications that provides tons of information for patients and doctors.

The past few years have witnessed huge investments in digital services and the big activity in disease diagnosis application market and the explanation of these applications.

One example is, the purchase of startups specialized in converting smartphones into medical equipment that gather data, by Google company.

Remote healthcare application have also flourished, as the digital revolution provides an opportunity to develop these applications to provide more complex health services, while a big development is done within the AI to manage huge amounts of patient's data and reduce human error.

Recent technologies have forcefully entered the health sector, reaching a better health future and the more realistic one; Smart technologies and artificial intelligence, virtual reality and augmented reality, 3D printer the Internet of Things , robots, nanotechnology, designing medical products, designing hospital rooms to improve patients well-being. Gulf country council has encouraged specialists within the medical sector to cooperate fully with these new technologies in order to convert the non-sustainable health care systems into a sustainable one.

Digital revolution has also coordinated the relationship between workers within the health and patients it has provided treatments that are less in cost faster and more efficient, in facing diseases all over the world such as, Aids, Ebola and currently COVID-19 to reach to healthy societies.

Providing special medication comprises a big part of health care services, medicine currently uses one methodology that 'fits all' in terms of diagnosis and prescriptions, which means that 90% of traditional medication is suitable for only 30 - 50% of patients. The role of AI is to contribute in exploring new medication and making the right clinical and diagnostic decisions.

Innovative technologies also promote remote healthcare, KSA has launched an electronic health care project over the past few years, this project should last for the next 10 years to digitalize health care services and link the Ministry of Health staff to their patient through a unified central platform using products of the US BMS company for programming.

Digital technologies should also improve the patient's experience through services, such services would include; sending test results, examinations, medications and reminding us digitally of our appointments through a phone application. It seems that the health care sector in the Arab world will be witnessing a move to keep up with new technologies and an improvement in the health care over the next coming years.

This path of keeping up with life changes using wearable technologies will push personal health care forward. Tools such as, Fitbit and other personal monitoring tools enforce our abilities to monitor our physical activities, patterns of sleep, blood pressure, and our intake of food which creates a healthier and more accurate experience. In today's world where humans are aware of health, the traditional doctor-patient relationship changes, end users are participating more in controlling their own health and well-being. Virtual consultancy allows a contact between patients and doctors in suitable places and this can be done by expanding the health care platforms resulting in less costs related to doctor's traditional visits. Providing wearable technologies, health service providers will need to become data scientists to be able to respond to patient's request of keeping up with technology .

Some genomic accomplishments were not possible 10 years ago. There are 10 bold predictions for the human genome science that could be made real in 2030. Although mostly they cannot be achieved, but achieving one or more of these predictions requires seeking something that sounds realistic in today's world periods these predictions were designed to be inspiring and ambitious, something that brought about discussions about what's possible in the pioneering genome science over the next decade.



Generating and analyzing human DNA will become a routine procedure for any lab, it would be as simple as blood scan or blood test.



The biological function for every human gene will be known, non-encrypted human DNA. Except in few cases.



General features of Epigenetic Landscape where the transcription of the genes will be merged routinely in predictive models for the effect of genotype on phenotype.



Searching for a gene in the human DNA will have exceeded the total number of human beings and will rely on social race such as race.



Studies that include the analysis of the DNA and apparent information of millions of human beings.



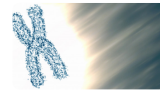
The regular use of the genetic information will transfer from botic to dominant in all clinical preparation. Which will make the gene test as routine as having a blood test.



Clinical connection to all change genetic changes that will be faced can easily be predicted, which makes the diagnosis the VUS and old methodology.



The DNA chain for a person would have comments and enough information that would be safely and easily accessible for individuals on their smartphones



Explorations advanced explorations will lead to treatments that includes genetic information and genetic modification for 10s of genetic

The emergence of COVID-19 virus has provided a strong lesson for the world of how a small chain of DNA could cause worldwide Havoc. In fact, understanding the way the virus is transmitted the viral infection and getting rid of it in addition to physiological responses that are strong and catastrophic, in some instances, provide a rich soil for the genomes research. Genome science took on crucial roles in COVID-19 research and clinical care such as:

1- Dispatching the techniques of the DNA chain and RNA for diagnosis and isolating viruses and environmental monitoring.

2-Using artificial DNA techniques to study the ferocity of SARS-COV-2 interested it ate the development of a vaccine, to examine the effect of the human gene variation its impact on the illness severity, deficiency of the vaccine and the response to treatment .

3-Commitment to principle and open science ethics, the exchange of data, and the cooperation that is based on federations. Help provide genomic data tools to study the ill-causing Physiology of COVID-19. As the increased adoption of genome technology, during the universal response to COVID-19 is another clear example for a comprehensive understanding for the importance of genome science in research and modern medicine.

Enhancement strategy for communication and information technology in KSA

Digital economy is growing double the times the traditional economy is, thanks to the huge technological development that took place. Following COVID-19 pandemic modern vision need to highlight the importance of digitalization in economy to avoid future crisis and avoid big economy losses.

The Saudi vision in the field of communication and information technology is for the Kingdom to be the pioneer in the world through the improvement and development of different activities, that will raise the efficiency and performance of both public and private sectors by digitalizing both. This requires developing the kingdoms' digital abilities in this sector of communication and information technology, to be invested in a way that will facilitate its growth to meet the kingdoms vision 2030, to serve individuals and societies, to keep up with national requirements and global developments, in addition to attracting foreign investments for technology, this shall mark the path for the future of the Kingdom in innovation and digital economy.

The communication and its Saudi strategy includes an ambitious plan that attracts pioneer international companies in the domain of developing technologies, and increase the local share in the IT sector, improve technical skills for the local workforce, strengthen knowledge and digital awareness, push technical innovation through strengthening research and development as part of the startup companies mandate inside the Kingdom. It also includes enhancing the development of big projects, supporting the coordination between the different entities in both private and public sectors. The sectors that will most benefit from the communication and strategies are digital trade, digital education, digital health, the fourth industrial revolution, smart cities, national data and e-government.

Other complementary efforts done by KACST are the initiatives of the following projects: IT and communication transfer, the satellite communication system, the reduction of water leakage through a monitoring system of water pipelines, a low cost communication network for Internet applications, highly safe memory device for the storage of data and digital signature for safe electronic processes, manufacturing an encrypted tablet (K-TAB) for the use of government, one-dimensional electrons using carbonic nanotube materials 3-axis rotation sensor with micro electromechanical technology, reversable flexible nanoelectronics, lithography and microscopy below wave length, multi-dimensional quantum communication and the study of changes on the Earth's surface.

Space Future technologies in the Saudi reality

Space technology has played a vital role in improving and inventing new applications that had helped improve human lives on earth, it had also improved many sectors such as the food water, and sustainable energy.

It's part of the kingdom's 2030 vision KACST executes a number of projects related to space technology:



The project of the Development of a new Generation of Photoelectric sensors



High Resolution Optical Sensor Satellite Project



Dual Frequency Radar Sensor Project



The first Saudi communication satellite (SGS1) Project



The Project for supplying Satellite Images and detecting Changes in Urban Areas in the Kingdom



Geospatial Data Services for feed Farms in the KSA Project



Spatial Inventory of Municipal Property Project



The Project of Developing Geographical Information Systems (GIS) for Mosques



The Project for advanced guidance, Navigation and control for Autonomous Space-based systems



The Project for upgrading the Infrastructure and Laboratories for Satellites



Chang-E 4 Project for exploring the Invisible side of the Moon

The future of innovation and technical development in private sector

Private sector is considered vital for the development process throughout all economies as it activates the production in creating job opportunities and is responsible for the export and investment attraction, which contributes to a growing Gross Domestic Product (GDP).

The role of innovation within the private sector is to improve business processes to achieve a bigger impact and reduced costs, to create job opportunities and develop skills; to contribute on a worldwide level, to achieve self-sustainability in many fields, to create models of modern businesses. The Organization for Economic Cooperation and Development (OECD) defines Innovation as: Improvement of products to a big extent or introducing complete new products to the market, or a new marketing way or organizational way in trade procedures or to organize working place or external relations.

The kingdom's vision 2030 indicated that small and medium businesses are amongst the most important factors in economic growth, as they create job opportunities and support innovation and exports. It also encourages the privatization of government services according to increase the long lasting contribution in our economy we will be opening new investment opportunities , facilitating investment, encouraging innovation and competition, and removing all obstacles that prevent private sector from playing their role in development.

Governments then need to encourage innovation through preparing Policies that are supportive and organizational, to allow the access of innovators to the technological infrastructure that they need to improve the products and networks. The financing of new establishing new sectors for innovation to be financed and then work as a helping partner in adopting successful innovations to expand and sustain their impact in addition to adopting innovations.

There are some challenges that prevent private sector from its innovative role such as lack of financing of early phases of the projects, the lack of solutions that develop products, the lack of development advocates and market facilitators. It remains necessary to enforce a mutual cooperation environment with pioneers of industry and establishing an early investment fund to develop solutions that improves products and involves market facilitators.

Business development platform



On the other hand, companies in the private sector need to enforce their ecological systems, through innovation and initiatives such as the internal thinking program which attracts specialists and enforce their creation amongst its working force. It needs to establish business incubators to use their experience in industry sector; support and finance startup companies and youth projects it is also necessary to enhance innovation within the private sector.



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Chapter Eight Re-Defining Education

- Recommendations
- Education through COVID-19 crisis
- Digital Education as a Necessity and not as Entertainment.
- Remote Education and AI systems.
- Evaluation process is in electronic education nearline
- The role of university in building the 21st.century
- References and Resources

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Recommendations

- To expand in applying the term and technologies of remote education, relying on advanced technology, which enhances the compatibility of this type of education together with traditional education resulting in a sustainable, advanced education model.
- Provide a bigger area for private sector and nongovernmental organizations when redefining education, this definition should reflect onto different practices to move away from one definition of Education as in the past.
- Create science and technology parks to identify weak points to convert scientific research output into knowledge and economy products, which diversifies income generation resources and national economic development.
- The necessity to educate and train all parties of the education process on the meaning of remote education and E-education. This includes policymakers, developers of curriculum, planners, educational supervisors, school leaders, teachers, administrators, students, and their parents.
- To provide all necessary support for low and middle-income families for those with many children, by providing devices, tools and Internet connectivity that is free of cost or at a very low cost. It aims at minimizing the technical and educational gap between those who possess and those who do not possess.

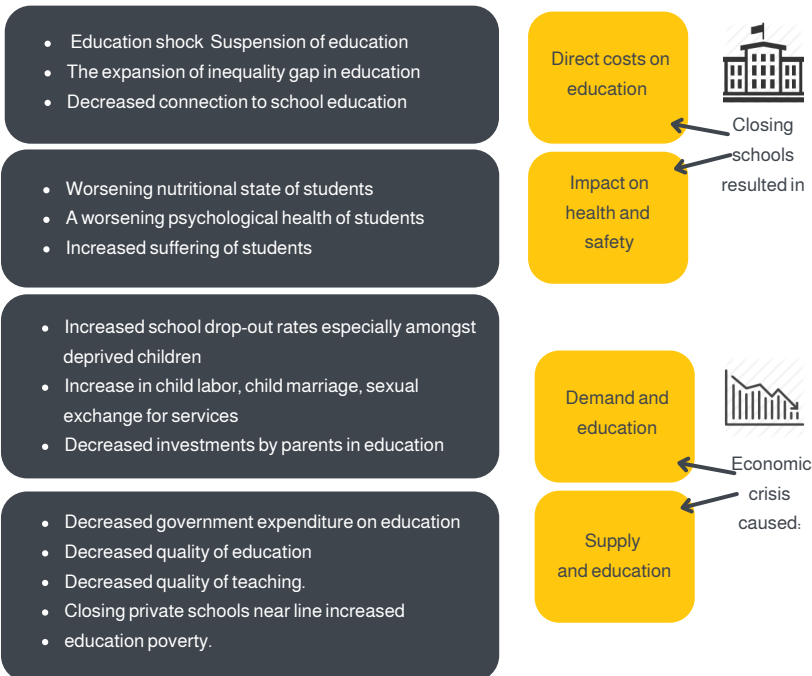
Education through COVID-19 crisis

Education is one of the sectors that benefited from technology during COVID-19 crisis, especially after learning was suspended in schools and inside classrooms.

With the development of the health crisis, that caused social and economic confusions, education systems responded and adapted quickly worldwide. Governments ensured that the education continued while maintaining safety of students by closing schools and universities. However, the inequality in access to education would likely cause parities over a long term.

Graph 1-1

Education shock



- Decreased human capital
- Increased general poverty because of out of school because of school dropouts
- The increase of the gap of inequality
- The increase of social turbulences
- The expansion of poverty across generations and the decrease in human capital



Costs on the longer
term

The aforementioned long-term impacts of COVID-19 are not definite, although education has suffered a lot in the short term but if governments work towards providing continuous support for education, the negative impact could be decreased. This could also be achieved through proper planning and wise policies that could utilize crises, to create new chances for more comprehensive education systems.

Such comprehensive systems can only be achieved by, three phases that are interlinked:

Phase One: Adaptation. This should be the priority of countries as they adapt to sudden closure of schools and universities to protect the health of students and their families to reduce costs. KSA, similar to other countries has launched Emergency remote education programs.

Phase Two: Continuation management. While the restrictions are eased for social distancing, schools need to be reopened in a safe manner to reduce school dropout as much as possible and slowly regain education. Reopening schools and universities is a complicated process, as it needs to be reopened over several phases with the possibilities of having some closed amidst another outbreak. Systems have to start planning for this and acquire lessons-learned from other systems.

Phase Three: Improving and accelerating. As the crisis provides a good opportunity for rebuilding stronger and fairer systems than ever.

The objective: Using opportunity to make education more fit, more effective and more resilient than what it was prior to the crisis.

Adaptation	Continuation management	Improving and Accelerating
<p>While schools are closed:</p> <ul style="list-style-type: none"> -Protecting health safety and nutrition -Prevent education losses through remote education -Benefit from the legal remote education 	<p>When schools are about to reopen:</p> <ul style="list-style-type: none"> -Prevent the increase of school dropout -Protecting health and safety inside schools -Preparedness to reopen schools partially over phases -Rehabilitating teachers to assess education loss and fill in the gaps -Providing the proper financial resource for recovery needs especially between deprived student children 	<p>Using opportunity to improve the system over a long term:</p> <ul style="list-style-type: none"> -Expanding the effective methods in facing COVID-19 crisis such as integrating remote education, following up on students of High drop-out rates -Focusing on the establishing rebuilt education systems -Preserving financial resources that support education

Digital Learning as a Necessity and not as Entertainment

Integrating technology within learning has become inevitable as it moves from simulation to predicting the future. As technology develops very fast, most likely e-learning will be become an adventure in itself that the student will participate in, while conducting self-learning and self-development activities.

The term 'Digital Learning' means: providing digital {electronic} educational content through the computer and Internet, which enables active interaction of this content with a trainer or educator as well as with peers, whether synchronous or asynchronous. Being able to complete this learning at the time and place and speed that suits the learner's circumstances and abilities, besides the ability to manage this learning as well. Currently, there are several methods of digital learning; there is:

Direct Digital Learning:

That is all about the methodologies and educational techniques that depend on a World Wide Web aiming to connect the educational content to the learner at a real time for learning or training.

There is also Indirect Digital Learning:

This resembles learning through a group of training courses and regular classes; this depends on circumstances that prevent a real time presence of the learner.

There's also the Digital Blended Learning:

This type of learning combines the former two types, where everyone can be present at the same time in front of the computer and actually participate; and in case this was not possible the learning content can be reviewed at any time.

The importance of digital learning as a solution especially in times of crisis is considered an active and efficient tool to face the challenges that is imposed by the crisis , as such many countries are targeting the education to be going in this path , and so do a lot of studies emphasize the importance of digital technology in providing better opportunities for students to learn. Despite the development that takes place as a result of digital technology the main task that the teacher does remains indispensable in guiding and following up student's growing talents.

Studies also show that digital learning will change in the future as there will no longer be a teacher teaching student face to face, or giving individuals a lecture, instead students will be sitting in front of screens. Universities and educational institutions as well as vocational ones are increasingly providing this service of remote learning and are increasing in numbers yearly on a global level. This comes after decades of traditional learning. It is utterly important that these changes in learning happen through phases and effect curriculum so objectives of learning can be achieved.

Within this context KSA witnesses today digital transformation plans in all their public and private sectors under the vision 2030. The need to convert to digital learning becomes apparent through the challenges that the traditional education faces. This requires a reconsideration of the implementation and development of the education process, while solving its problems and its management, as education is one of the most important pillars to develop the Saudi community.

Remote Education and smart systems

Within the past technological changes, the education system faced challenges related to increased learning opportunities without increasing budgets. A lot of educational institutions overcame this challenge by developing remote learning programs as well as implementing highly smart systems in the Education process.

Remote education is defined as, transferring knowledge to the learner at their location or work instead of having the learner come to the educational institution. It is based on communicating knowledge, educational materials and skills to the learner through different medias and methodologies, where the learner is separate and away from the educator. Technology is used to fill the gaps between both parties and take over the communication that usually happens face to face in traditional learning.

The transformation to remote education actually supports the education process and shifts it from only receiving information to interaction, innovation and skill development process.

With this situation one should consider that remote education is not the solution, but it was only an outcome to deal with COVID-19 pandemic and continue learning. We should not be relying on remote education as a road map to reach 2050.

Redefining education is a new concept that differs from the virtual reality education, and is rather a concept of interesting and attractive educational environments through designing a simulation model for scientific experiments, where students can actually learn comprehensively without the need to have their traditional scientific tools , this saves cost and enables it's used by a lot of schools or universities at the same time.

It is expected that classes will move soon from the traditional learning to using a blend of robots and artificial intelligence that are designed according to the need to educate big number of students these robots are flexible. As for the class itself, the specialized services that AI will provide should help improve the Student's experience throughout classes and improve their degrees simultaneously. Trained robots should also compliment teacher's role in providing special or remedial classes to strengthen and develop student's skills, the blended learning is also expected to solve the problem of lack of teachers in certain courses.

Evaluation process is in electronic education

Evaluation is considered one of the main elements of the E-learning process, as it helps teacher evaluate their students and have solid results based on quantitative and qualitative data related to the studying. This is done Through different technologies such as Internet and electronic libraries, search engines and local networks and computers. Evaluation is not necessarily resulting in numbers or percentages as there are also qualitative aspects in the education process.

COVID-19 pandemic has put e-education in the front, This would not have been possible without the pandemic , most of us in most of the students who have switched to the e-education will no longer be going back to the traditional education. Because of this new shift to remote education the evaluation process will be one word where big changes will be made as educational habits have changed than previously within a regular classroom. We must realize that this phase is a turning point for schools for the entire education and learning system that requires rethinking the evaluation.

Qualitative evaluations such as MCQs and correct multiple-choice questions are used more often in evaluation maybe because they are easier to use, however they are less subjective. Within the e-education the focus will be and more realistic approaches that will measure how much students are able to comprehend and apply their knowledge.

Such qualitative evaluations will be the most common between teachers through the Internet, in addition of course to other kinds of evaluations. Although they are hard to execute in the meantime especially with this shift that we have, in the year 2050 these options will be more practical so, instead of practical presentation and simulation, the idea is to test the student's knowledge at a deeper level. The current challenge with simulation and learning through the Internet is about the technological restrictions and budgets that universities require to finance, each subject or course that allows the student to conduct the simulation. Practicing will be also very hard to conduct through the Internet especially with a limited education or learning management system that the different universities use. In the future the simulation of augmented reality that would require little intervention or none from the teacher, will be the future of evaluations and electronic learning.

The simulation will allow the student to conduct physical tasks inside a lab for example, without having to be present. Students' evaluation that will be based on simulation prior to the program and at the end of the program, will reduce the time needed to conduct the evaluation.

Another evaluation is interviewing, reading by teachers consumes a long time and evaluation is completely personal, but articles are a perfect method to evaluate the depth and the amount of knowledge students have. Therefore, in the future hey IA could provide a more subjective methodology to assess articles briskly and efficiently.

Vignette or case studies are great learning tools, as it links students together, and the real scenarios enforce learning the theory linked to the case studies, in an attempt to teach students how to solve problems, to analyze, and maybe to increase some of the classroom discussions. Case studies in the future will not be merely an article that the student reads and provides notes on but it will be more like a movie where the student has to impose or suggest what happens in the last scene using virtual reality

Devaluation or the result will be evaluated within the program.

The discussions that take place through the Internet are also qualitative evaluation, however the discussions increase the student's interaction together and the student-teacher interaction and it allows students to participate and present ideas and improves their understanding of a subject. In the meantime, this is considered an option that is a waste of time for trainers, if they wanted to conduct discussions through the Internet with students. This is considered a waste of time but if there is a possibility for the E-learning to read all the discussions that are taking place and then using AI to evaluate the participation of the students through their discussions.

Education through the Internet will be the dominant methodology for students around the world to study even before the year 2050, because of all the techniques that include artificial learning, virtual reality and artificial intelligence that will be used in different evaluation process. All of the technologies mentioned will help registered students in certain courses or in the Universities become smaller in size and the area will be less for lecture, there will be a need to hire specialists in information technology as we need To implement and manage technology. Generally, students need to be involved more in the future, while we are heading towards learning through Internet.

The role of university in building the 21st.century

Universities are institutions of scientific innovation and a tool to support communities advancement, therefore they cannot be rigid systems but have to be flexible, continuously developing, upgrading and improving so their sustainable roles serve develop society's knowledge.

Times Higher Education journal mentioned that there is a disconnection between what's going on and what we need to do in the future. It is related to the evaluation but of course to the learning in general. By taking a quick glimpse of the interesting possibilities that are in the education today, and comparing those to where we could reach in the future, trough remote education and smart systems electronic, education could be a huge industry in the near future within the 21st century.

As for manufacturing spaces, thinking about things such as, machine workshops, 3D printing and all other environments that support developing innovative ideas for products, this kind of initiative leads to creating universities all over the world , especially in the US to reconsider the basis for university acceptance while giving high priority for innovation and individual thinking.

The important question remains, how could we hold on to these things that have successfully worked within a normal development throughout COVID-19 crisis? And what does it take to build a national environmental system that is supportive for education, learning, research and innovation? It is found that we could easily work through the Internet, and this leads to new thinking about the future of education (learning) through the Internet.

Looking at the population's composition in KSA today, we find that there is about 50% under the age of 25, this is a strong motivator for the exciting developments in the future towards achieving goals of 2030 vision. Where the thinking process within a vital society, a flourishing economy, meets a young generation generations aspiration. Those are the people who would lead to these initiatives, achieve success, therefore the kingdom's priority would be to reach a developed and flourished research environment, focusing on talents, entrepreneurship, and innovation.

In KAUST, which has reached an advanced ranking in computing, a virtual Academy for young talents has also been established and there are over 500 students who Are doing their undergraduate level in the US. A hypothetical founding year will also be launched for talented Saudi students in addition to the virtual lab that Has been already around for several years.

Cloud can be done, it is important to benefit from technology and digital environment, most importantly to provide suitable resources. Focus should also be put on developing talents, early identification of those talents, and enhancing those talents through educational programs.

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Chapter Nine Health 2050 – A Human-based Health

- Recommendations
- Future health applications: human genome project and Saudi genome.
- The Era of big health data and biotechnology: opportunities and challenges within the health care future
- Future of technical surgery, robotic surgery.
- The role of artificial intelligence in improving the quality of life and health care.
- References and resources.

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Recommendations

Using technological solutions and the activation of AI in developing health sector. Causing a quantum leap in medicine and helping doctors diagnose and treat.



Expanding the areas of benefit from modern technology such as; Gene editing and personal genetic medicine in treating diseases and dealing with health problems.

-Local and regional coordination and cooperation to establish big database that includes genetic pattern, biological pattern and clinical data that help make medical decisions based on accurate and clear data. It should also serve early diagnosis for many diseases and raising the awareness of individuals and health practitioners of the importance of big data in the health sector and the extent of its use in diagnosis and treatment.



To provide required funding for scientific researches in the field of genetics and developed human capital and link big data analytics and the AI specialists with genome researchers.



Big data collection and distribution requires the acceptance and contribution of society members. It requires their protection and education, it also requires collecting, analyzing and using the data quickly along with putting policies and moral research principles.

Future health applications: human genome project and Saudi genome

Specialized studies point out that results of clinical experiments to modify human DNA will be reality in the near future. This ensures this requires working on the best possible way of managing this technology that's called human gene editing, which includes all chromosomes and jeans of the DNA.

Genes are small elements inside the DNA, inside the chromosomes that exists in the cell nucleus which forms. Cells combined form tissues, tissues combined to form organs, organs combined form the human being. Therefore, the gene is a very small element inside human body. The way these jeans are ordered, defines the color of the skin, color of the eyes, color of the hair and the allergies that the person has. It also defines some of the artistic skills such as voice or sleeping patterns. It also defines the possibility of becoming bold when aging, curly hair, chronic diseases, autism, cancer, and many other things. These genes are distinguishing marks to some extent as soon as some genes are found this may imply to a certain behavior or pattern within the human being.

There are many trials to count the number of chromosomes that we humans have; some estimations say we have more than 50,000 to 300,000 basic pairs of chromosomes. Genes and data comprise of Four chemical units and Amino Acids, therefore when genetic sequencing is done, it is an attempt to move through the DNA strand to find these amino acids and analyze the way they are structured. The way they are structured impacts the way they are analyzed and the way they behave. Such are very important information, so if all 300,000 chromosomes are monitored, this is an immense amount of information. This information could be very useful and there are indeed many people trying to benefit from such information.

The human genome project started in 1990, it has completed in the year 2003 where around 2800 researchers from 6 different countries have worked on. They were able to define over 20,000 human genes of people inside these countries. Next step would be to match these Genes with human features to get to know normal and abnormal genes, hence wanted and unwanted characteristics. If we know the responsible genes that exist within a certain community and started to match these genes with the features then we could define responsible genes for different things by also depending on electronic health files working hand in hand with this technology.





Saudi Genome

The Saudi genome project is considered one of the biggest projects that could result in a quantum leap, putting the Kingdom at the fore front of countries with the most advanced scientific development.

The project also aims at warning from potential Pediatric diseases inherited from parents. And finding the road map or genetic distribution within the Kingdom, to define modern ways of diagnosis and treatment and prevention from diseases.

The central laboratory of the Saudi genome project was endorsed by His Royal Highness Prince Mohammed bin Salman in 2018 to become one of the strategic projects that aim at improving the health and living conditions in the Kingdom.

The project aims at confronting the latest in genetic diseases and defining the genetic basis using most advanced laboratory and computer technologies, which help in developing modern diagnostic accurate and quick diagnostic and treatable methods.

It also helps identify disease genomes by identifying vital signs throughout age progress in life, considering the genetic sequencing.

There are 8 research centers and universities that are part of this project. The goal is to define the genes that are related to the population within the KSA and define the genes that are responsible for inherited diseases.

By identifying the genome and the health characteristics, an electronic health record could be prepared, where individuals and their pattern of disease and patterns of health life can be recorded.

This is the future of health that starts with matching health habits and the development of health together with the Gene development. Over the next 65 years there will be big data that may enable us to get a genetic sequencing and link that to human health habits. This will enable us to get a different perspective around peoples' health and later genes could be edited in many ways. The goal of genetic editing or modification is to remove the unnatural parts inside the Genes, inside the DNA and replace those with wanted ones. This is all about the health future 2050.

This approach is not quite practical yet, which means that we are not there yet, but we are on the right track. We have developed medication that will prevent allergies that appear in the individuals' DNA. The treatment of some of the chronic diseases can be done through direct genetic modification. All this sounds possible and there are a lot of already existing ways.

Talking about mutation, mutation is a change in the DNA and editing genes is considered a form of mutation. The genetic modification may require many years to appear, no one knows exactly, as mutations leading to cancer and other dangerous diseases may not appear in the individuals themselves but appear in the next generations. This is not an easy task and nothing that could be done easily, therefore, people would need to ensure that modification does not result in negative mutations that could harm the individuals or their children in the future. Moral guidelines need to exist in this manner, the world is heading towards gene restructuring and linking health habits to the information that exist in the genes. Specialists working on gene modification use CRSPR's technique which has proven to be successful in Gene editing, this is already happening, in plants. Within the next few years people will start talking about doing this to human beings. Therefore, ethical guidelines need to exist around gene modification. Even with gene sequencing it shouldn't be available for anyone to do or store this and strict laws should exist to prevent sharing genetic sequencing with public in general.

Despite this being risky, there is a good chance to cure diseases that have to do with genes by editing these genes and by the personal genetic medicine. Allocating research funding and developing human capital is required, also linking big data analytics, artificial intelligence specialists and genome researchers is very important as they will link the genetic sequencing to health habits and other habits on an individual level. So, if a genetic sequencing of a person is known, then the habits will be known, and those habits could be linked with these sequences based on previous knowledge of the genes that represent a certain disease and a certain characteristic. More information would be known about an individual, predicting their diseases in the. Medications and personal treatments that are designed for the individual can then be offered to prevent these predictable diseases from happening. In general, this is a very promising area went when talking about the future of health 2050.

The Era of big health data and biotechnology: opportunities and challenges within the health care future.

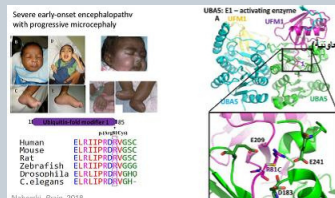
Big data is not restricted to a certain area, but the first according to the use and to the end user of such data. Big data in the health sector is used to improve diagnosis for instance, to improve medication and treatment and to decrease financial costs.

Big data that is shared through social media, Tele communication and search engines can help predict and identify COVID-19 pandemic and suggest better ways two come up with the treatment for the virus. Big data analysis technique that was used through the COVID-19 crisis, has provided real cases and experiences of dealing with this pandemic and other potential future pandemic in order to take precautionary measures.

Over the past four years or so, hundreds of variables from within the Kingdom have been analyzed, this would not have been possible without the availability of database that contain big data. Especially the protein data bank that has over 170,003 of dimensional structures that have been experimentally identified. Therefore, being able to conduct work at the current pace depends on agreements of data coordination and data sharing that were done many decades ago. The main point here, is the need for the big data which requires being open and putting agreements between all stakeholders to be able to bring these data together.

Data format and data exchange depend on current agreements:

- Fozan AlQaree' (king Faisal specialized hospital) and Research Center Steven Harold, Nahor Skee, Brain 2018 Since 2016 hundreds of Saudi variables were analyzed (20 cooperative issues)
- Combining structure biology and clinical data
 - Establishing a molecular basis for a genetic disease
 - Understanding the disease and personalizing treatment
- There will be no possible way to continue such efforts without big mutual data
 - Protein bank data (more than 170 3D composition).
 - Uniport protein sequencing database and the National Center for bio technical information, (around 200million sequences for each).
 - The general archive for Kleanvar report (around one million clinical patients).

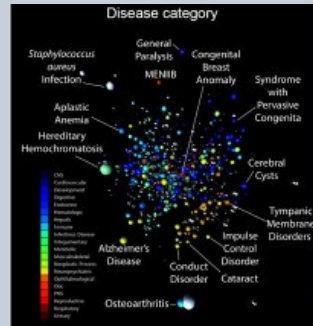


Another example on mutual cooperation was done between members of the biological Research Center and professors and representatives from Chicago university, where the team used AI on more than 150 million medical records from the US to produce, what they called; “The Danger of Multi Gene Disease”. The significant thing here is, instead of looking at a disease at once, the team merged all 600 diseases into multiples and then turned them into multi-dimensional factor. Then, they were analyzed all at once. Through this methodology the team was able to discover hundreds of genetic relations and they were able to show that in few cases they could predict future diseases through the genetic variance of the patient.

Databased Successful medical care depends on national commitment

150+ million American Medical record to have a special knowledge about the Disease Risks

- X, Gao, T, Gogeobry (computerized Bio Science Research Center), D Kays , KAUST, Iyeh Risizcky, (Chicago university) unpublished data .
- 600 diseases have been analyzed by multiple entities simultaneously, 116 genetic relationship were discovered, genetic relationships can predict future diseases through genetic variances of the disease.



Big data, producing your own data or you are out of the equation

A longitudinal study that has started in 2006 for big data that exist in the British bio data bank, aimed at providing the genetic composition of more than half a million citizens. Using This data, a prediction can be done about type 2 diabetes in addition to the other genetic and demographic factors. this also applies onto some types of cancer. This opens up quite interesting opportunities, as our personal genome cannot be changed, at least not for now. But we could change the lifestyle and environmental surrounding through policies and behavioral change. If we understand in detail how exposure and lifestyle affects the risk of getting some diseases, then we could convene this understanding to executable factors. For example, exercising for 30 minutes every day will lead to lower risks of diabetes. If these procedures can be monitored using different devices, can they then be prevented? For example, if a person does not exercise for 30 minutes daily then this person will need to pay higher insurance fees. So many questions will arise those that we did not have in the past.

It is important to emphasize that medical care that depends on data relies on national wide commitment, but what is also important that every area produces their own data. Genes of course are not everything, many diseases include other factors as well for instance, demographic or environmental factors. Taking all of these into consideration requires monitoring and linking different data; for example, measuring air pollution that is coming from medical equipment, or medical records and vital signs and so on.

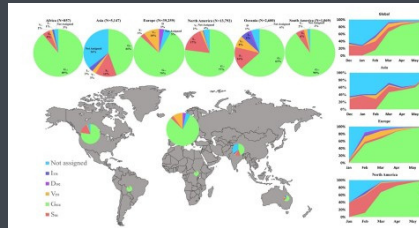
Medical care that is based on data requires individual's contribution and protection of their data. Most diseases are distinct through multiple factors multiple genetic demographic and environmental factors, which requires monitoring different data and linking them together for example, data related to the population, wearable techniques, medical records, and bio vital signs. Although working in the health sector that is based on data requires in sharing the data by the individuals it also requires the protection of these individuals. That's why the world needs advancing in setting up protective policies within this framework.

One cannot talk about health care in the meantime without talking about COVID-19, indeed, to combat pandemic we need to be sharing data openly and quickly. This has been acknowledged by the global society in a very early that time. Virus genomes and discovering different kinds of local and foreign COVID-19 mute mutation fingerprint and the scientific results have now become available routinely on pre-printing servers. Where results are available for everyone. On the contrary of having journals that are revised and published only 6 to 12 months after. With these new resources we can do many things and there are lots of opportunities not only for COVID-19 but generally to speed up innovation.

While the scientific opens new areas it also gives individuals additional responsibilities to analyze those data carefully. There's another important aspect of big data which is looking into social media and using those as big data.

Covid-19 transformed science to become immediate, immature and uncensored

- The quick and open exchange of data is considered very necessary to face the pandemic.
- The genetic sequence of COVID-19 and scientific results are immediately available on preprint servers
- both medical and biological
- Available material provides and direct monitoring over the viruses spread
- Establishing an Electro genetic tape
- Monitoring the virus in real time and place
- Appearance and dominance of mutant G 614 of COVID-19
- Ayah Ben (KAUST), Stephen Arold, international John, Infectious diseases journal 2020



Opportunities: open science facilitates speeding accelerating innovation to face COVID-19

Challenges: no confirmation on the quality of research can affect the shared information with the public and the reputation of Science.

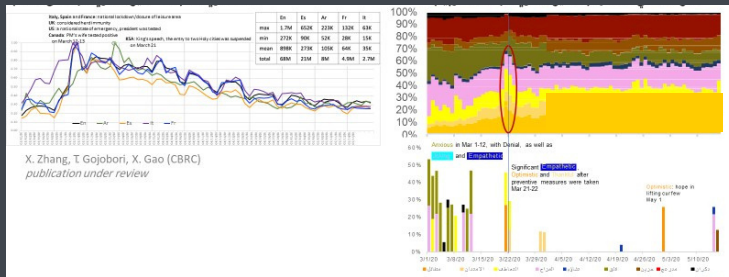
Open Science: new authorities and responsibilities for the individual

Assessing social media for people's attitude provides direct feedback

Deep analysis of 105 million tweets provided attitudes for international discussions about COVID-19

-Number of tweets 105 million tweets in five languages

-Attitudes reflected by 8 million Arabic tweets



Opportunities: analyzing situation helps policymakers measure direct impact on their procedures

Challenges: improve processing information in non English languages, are social social media the correct measure

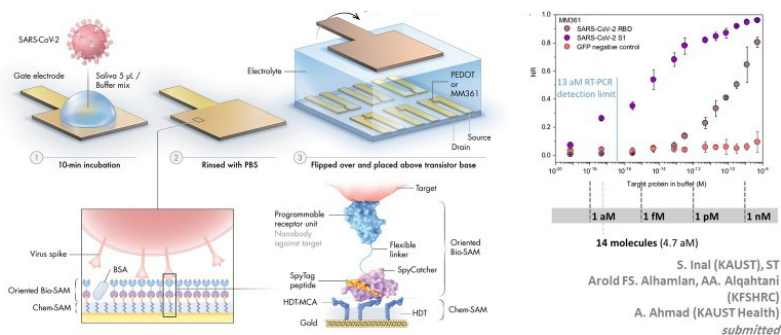
The need for local analytical developments and correct measure

The big question is whether social media were good indicator, while the analysis of social media provides a lot of direct feedback, it also needs to improve in the analysis of course and directing the right question about the right answer.

Currently research teams use Tomography while using artificial intelligence and augmented reality as they could reveal something that wasn't possible before. They were able to show how COVID-19 patients have lung damages, even months after apparent recovery. But it is important that artificial intelligence technology application requires constant sharing and cooperation of health care practitioners and scientists. If this is done in the right way, surely artificial intelligence will not take over the role of doctors but doctors who use artificial intelligence will replace those who don't.

Second generation of sensors leads to a quick, sensitive and cheap diagnosis.

Nano electrochemical organic transistor. SARS diagnosis. Covered 2 minutes in minutes through saliva, no need for laboratory processing, RTPCR sample with the quickest Lateral flow immunoassays, sensitive and able to be reprogrammed to discover other vital signs



Sensor devices that are based on transistors can replace other clinical and non clinical diagnostic tools

One can say that health care underwent irreversible quick changes because of AI, big data, biotechnology, and COVID-19 pandemic. Along with these new developments, unprecedented levels of diagnosis and monitoring such as developments in the CT scan technology, Biosensors, direct monitoring of emotional repercussion of society. Time in is considered the most important factor in longitudinal studies where big data are analyzed temporary published and used.

Full use of the health care force in the future requires cooperation of all stakeholders, as there is also a need for a regional or local unity come out and openness and mutual understanding to establish big data that represents local society. Not doing so may lead to taking a decision in a model that does not suit the local community. Using the latest technology requires the availability of health care practitioners and openness towards their training through tight cooperation with scientists. Big data collection would also require the acceptance of contribution of people their protection and their education and the gathering data quickly analyzing and using them within with the same pace in policymaking.

Future of technical surgery, robotic surgery

The health care sector has witnessed a noticeable development as soon as medical robots were being used , those would assist doctors in diagnosis treatment and conducting a lot of complicated surgeries with a bigger accuracy and better flexibility and more control than the traditional techniques, those development consider using robots in surgery.

The start of using robots in surgery began in the 90s, it were defined as: “being a surgical robot that can be controlled by a computer using a synthetic sensor, that could be reprogrammed to move tools in order to conduct a safe set of movements”. The new definition of robots is completely different, it is:” an information system that has eyes legs and hands”. Looking at the robots’ journey starting from 1985, in 1998 robotic surgeries were done on humans. Then in 2001 specifically, on September 7th, 2001 professor Marescaux conducted the first cross-Atlantic while he was sitting in New York and the patient in France. In spite of this, no big progress was done because of lack of medical technologies technology, there were some other surgeries, but little were reliable.

Some of the advantages of using robots in surgery is supporting 3D instead of endoscopy, eliminating tremor and giving a good space for surgical work as work measurement can be reduced from five to 10 centimeters down to 1 centimeter. One can also enjoy turning at 360 degrees using a mechanical arm this is something that a human being could not do. Other advantages are the accuracy, flexibility and decreasing any side effects such as infection bleeding in addition to causing less scars. Robotic surgery also allows doctors to conduct many complicated surgeries with a more with a bigger accuracy and better flexibility and control than traditional techniques.

Despite the fact that robotic technology is expensive the training is not as expected as well as preparing a robot requires a lot of time, the technology that we have now enables the surgeon to sit in the controlling units and two move the robot through the assistance of his nurse and team. It is expected that more accurate robot can be developed that will not require any human assistance, robots that will be developed for every part of the body , her robots, Vertebra robots, joined robots, blood vessel robots and many others, more than 88 companies from 16 different countries around the world are aiming to produce those.

There are two things connected to the increased use of robots in health sectors and surgical purposes , the first is the availability of the safety and security factor, the other factor is linked to the economic state of the country that produces robots . The efficiency the accuracy and the lot of positive forces, negative forces exist too, especially when it relates to the cost of the device or machine, the training and marketing.

The hope is that technology companies would have the soft side of robots that are able to improve, such as Google Pay; in the future maybe this would be an app that you could download and you could play against potential robots, some of them actually exist in the market such as Google and they will be produced in the year 2023 in cooperation with jianzhi their specialized robots periods it is also important to create a picture prior to the surgery and interact in order to guide the surgeon, and remove more precisely the sick parts with the possibility to integrate The simulation a virtual reality which could allow training on complicated procedures prior to the surgery.

By focusing on the next step in robot surgery, the possibility of conducting a CT scan prior to the surgery and conducting surgery based on the results of the scan after inserting this information into the robot machine, the robot machine could be able to conduct the surgery without the existence of any human inside the surgery room. All of this will happen when moving towards the interactive simulation, Surgical preparation prior to the surgery as well as training. Although all of this already exists in the market, we do have and more advanced robotic machine that looks like a pill which you could swallow which could take a picture of the entire digestive system. These capsules were already manufactured but still under improvement to be controlled externally, they own small wings that could be moved in different ways such pills would be diagnostic and treatment treat mental in the future.

Researchers are exploring a device with multiple fingers and are exploring the natural orifice surgery; their surgeries could be conducted through the mouth or through the vagina without any abdominal scars for the removal of the infected organ. Having the current technology with multiple devices, 3 or four machines could be used Simultaneously through one channel such as endoscopy. Planning is being done for a human free surgery room, as the surgeon sits on a chair and controls the mechanical surgeon while nurses hands machines exist, this will be the first time work will be executed without having to look or touch the patient but through the incision 1st and then a screen will be looked at by the human surgeon together with a mechanical surgeon. Previously this was thought to be impossible but in reality, it has already taken place in a research lab. There should also be smart beds that contain the patient's information.

Closet looks like a pharmacy that the mechanical nurses can rely on, while that I'm a surgery takes will be 11 to 17 seconds only by an accuracy rate of 99.97% more than humans. Through the linkages of genetic science, it is hoped that there will be genetic surgeons. with the development seen in the nanotechnology we will be hearing about genetic surgery again, as work will be inside the cell under what's called a protective or prophylactic surgery that could fix the problem before it happens i.e. prevent the disease or symptoms before they happen . All what all we need is matching the healthcare with technology and business. The challenge remains the costs and financial restrictions it is expected that within 20 to 30 years from now robots will be coming home to conduct the necessary surgery for the patient.

The role of artificial intelligence in improving the quality of life and health care

Most sectors were affected Except the technical health sector that grew, thanks to the approach of world governments, to support next to big companies and startups that have gone in the forefront of fighting the pandemic. Investing in database, intensifying the production of wearable devices, and developing applications that provides patients and doctors a big amount of information.

Healthcare can benefit largely from artificial intelligence and mechanical learning because of the big amounts of medical data and other information that the health entity collects and keeps.

Artificial intelligence uses algorithms and complicated programs in healthcare, in another way it simulates the way humans think and do things. Are these programs analyze explain and do things in a comprehensive way. Medical care was chosen as one of the priorities especially in KSA as well as all over the world for different reasons, the kingdom's vision 2030 has given a lot of attention to big data, artificial intelligence, and their connection to the health care. There are three main responsibilities put on the health care system that are interlinked largely, these missions are the regulator, the legislature, the service provider, and the donor.

The challenge that is facing health care is the same in every country and all over the world, therefore everyone is fighting for easier access to health care because of different things. We always have restrictions when it comes to getting the care, especially in the geographical abundance and in funding. One of the main challenges is how to improve the quality of care. Today we are spending double the expenditure double the GDP on health care, but if this expenditure was compared to the percentage of improvement in health care as a service, it does not reflect much this remains a big challenge because we do not want to keep spending more money and expect a change in the quality of service. We want to move away from treatment to more prevent prevention and using big data and artificial intelligence to improve the preventive side of medicine. This could happen when many data resources are put together. Looking at the priorities of the health care sector in the Kingdom, some possible instances for the use of artificial intelligence can be defined, as the open Saudi AI center that shows the importance of open and innovative cooperation.

AI is considered a big factor and player to help the health care system in planning and identifying proper resources at least in the current time. To use virtual consultancies that could be integrated in artificial intelligence to ease and facilitate the triage of patients, so patients could only go and talk through their phone to be diagnosed and referred to special services. Looking at healthcare from a clinical perspective, there are many non-clinical activities that occur inside the health system.

If we look at the time the nurses spend to document it resembles more than 40% in the Intensive Care Unit (ICU). The same thing for a Doctor Who does a lot of documentation, AI could support a lot of non-clinical activities that could accelerate these tasks within the healthcare sector.

This ought to improve the health care quality by looking at the diagnostic tools which can work using AI and big data to help doctors do the right diagnosis and support robotic surgeries. If we were to use AI especially in the medical imaging and the diagnosis and discoveries of certain diseases, some think that are medical our health system has answers for all our problems unfortunately it is not so. If we look at the amount of data doctors deal with or base their decision on it does not resemble more than 15% at its best, sometimes even less. Most of the data are outside the reach of the health system, therefore researchers are working to guarantee the genomic equation, the health lifestyle and the consumed information and all of that data to help enhance the prevention equation.

It is important to think from a national perspective on how to enable a comprehensive environment, as such a genome specialist and the bio information specialists as well as the clinical and health data altogether. Some other data related to lifestyle or consumers could be collected such as Google but knows a lot about public and their lifestyle better than anyone else periods if all of these are collected and combined and the data the big data collected then we could find solutions to many health problems nowadays, using that national initiatives can be developed together with distinct programs. Benefiting artificial intelligence technology as a supporting factor, In China for instance, family doctors see around 7000 patients daily and conduct their diagnosis and prescribe medication the work of the family doctor is enhanced with the AI doctor who actually used to review doctors recommendations , at the ends the doctor only revises and insurance the health care plan or the diagnosis is correct.

AI is considered a strong tool but raises some concerns in the healthcare sectors, so we need to have AI that is being used for the advantage of society. KSA works currently on data and AI systems to become one of the best 15 countries worldwide in the year 2030. A national strategy for data and AI has been actually launched as well as the health care sector activated and prioritized.

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Chapter Ten Digital Economy and the Future of Small and Medium-sized Companies

- Recommendations
- Innovation in small and medium sized companies, concept and importance.
- Companies facing future challenges, necessary requirements.
- Digitalization and the future of small and medium sized companies.
- Digital economy and increasing the competitiveness of small and medium sized companies.
- Group financing, entrepreneur support and provision of investment opportunities in KSA.
- References and resources.



Recommendations

Supporting entrepreneurs in dealing with challenges that face their startup projects, while benefiting from available opportunities from a technical organizational and managerial perspective. Develop their ability to plan economically and financially.



Support small and medium sized companies that work in the area of AI VR&AR, that is used in many areas, health, education and others.



Improving the level of supply chain and putting in backup plans to ensure their continuity.

studying the structure of small and medium sized companies, looking at their operational perspective and suggesting ways to secure their existence and their development.

Spreading the culture of innovation and adopting initiatives that support innovation in multiple sectors and on a national level.



Innovation in small and medium sized companies, concept, and importance

Innovation in companies is: the development and application of new ideas, Can you wait if ideas move to successful applications of those ideas within a company. According to the economic concept of Joseph Schumpeter:” Innovations are basically about drastic technological innovations that lead to deep changes in productivity, incentivizes economic growth, establish businesses in industrial and service sectors and improve social well-being. Innovation is considered the basic and first motive for the success and continuation of small and medium sized businesses, as it as a real competitive characteristic stop distinguish entrepreneur projects than traditional ones.

Companies are in an increased need for innovation to be able to meet market requirements and keep up with customers changing aspiration and life circumstances that are dynamic more than before. To use technology and change markets, structures, and dynamics. Innovation resembles the modernization process in any company to ensure its survival and sustainability.

For companies to remain successful it is no longer relevant to rely on innovation and creative methodology alone, but, at the same time, it has to think of ways to measure innovation. It is not enough to come up with an innovative or modern idea but measuring the benefits of this idea is as important.

Companies facing future challenges, necessary requirements.

During the beginnings of the current century many technologies that has shaped the profound digital economy where, accessing Internet through fixed and mobile broadband, the Internet of Things, the huge abilities of computing in data clouds and in smartphones, big data, advanced data analysis and E learning. Such technologies have the abilities to change the way people live and work, the way companies conduct their businesses, the way governments and public authorities provide their services to the public and how the latter interacts with those. In addition to its social and economic characteristics, digital economy can also generate challenges if not managed properly.

Companies should complete digitalization, as this is considered and economic necessity nowadays for companies to keep up with future challenges, while having the needs to diversify economies to decrease its impact in markets. It also aims at enhancing productivity and competitiveness, by focusing on economic sectors that could benefit from the accelerating technical development in all Arab countries , this shall increase the flexibility and the ability to achieve a quantum leap that is speeding in the economic performance. There is an urgent need to adopt strategic planning for small and medium sized companies, it is important that's the strategic planning for companies is a continuous process and not a one-time-event. There should be a clear vision for companies to define methodologies of their accomplishment over short and longer term.

Companies need to guarantee a bigger amount of structural flexibility that reflect its ability to change to shift quickly. Being an important resource to acquire competitive characteristic which could be considered a tool to manage continuous changes and the ability to change within the company's internal environment. Flexibility is considered one of the important characteristics in the strategic planning and the definite factor to adopt strategic planning of the companies to a competitive environment that is changing indefinitely. Entrepreneurs and owners of small and medium projects needs to be empowered to become pioneers in the digital economy, in order to enhance their abilities and enhance the culture of the knowledge economy.

Digitalization and the future of small and medium sized companies

Digital economy is an activity that is set on introducing technology to work through the shift from a traditional model of making business two new digitalized pattern that could be used to complete worked and gain new Market advantages and gains.

Digitalization has an important role during COVID-19 pandemic, prior to this crisis we had an evaluation for a clear understanding of the need to digitalize but the pandemic has reinforced this idea and this need. This was a unique experience as we had hundreds of million people who work remotely at the same time and hundreds of million students who also study remotely at the same time, and this not in five or ten years but within three months. The pandemic had made us go through an enormous experience and it became reasonable to question can any person imagine how this crisis could have gone in an UN digitalized world? Without working remotely or learning through the Internet without e-commerce? The consequences of this pandemic would have been much worse.

On the other hand, digitalization is considered an effective technical revolution, not because of technology, as technology is a factor that enables digitalization, but the reason is that digitalization results in social change that affects the way we do things. This is something that happens on all levels, and all countries and all economics. Rich countries will no longer be the countries considered to have raw material, or in advanced infrastructure and so on, but will be the countries that can face the challenge of digitalization.

As for the importance of digitalization for small and medium sized companies, we have to go back first to the needs to meet the demands of new customers that such companies have to serve. Second, because digitalization affects everything, it affects all economic sectors including the traditional economic sector. Third, digitalizing small companies and medium ones is not a problem in technology, it is a problem that goes beyond technology, where the important factor is the social change that comes with digitalization. One of the ideas you have to convey to small and medium sized companies is, that digitalization is not a risk. This decision represents a big chance for small and middle-sized companies as there are companies that face new customers, i.e. digital customers, whose needs very more than before.

Digital economy and increasing the competitiveness of small and medium sized companies

Digital economy plays a big role in increasing the rate of acceleration and growth of small and middle sized companies , especially under current circumstances that the COVID-19 pandemic has caused and entrepreneurs are heading towards digital platforms to promote and introduce their products and businesses. With the spread of the crisis, E-commerce has grown, e-stores became one of the most important windows of purchasing amongst consumers worldwide, which pushes expectations for flourished sales on the E-stores within the next coming face.

COVID-19 has proven that it is a strong accelerating factor for many things, which predicts the entry of the world into a digital economy era, however, this is happening at a faster pace that is not seen before, and ways that were not necessarily expected.

Trade, for example, and our region especially, we feel shocked when one of the most famous retailers in the Middle East and North Africa region announces a decrease on their quarter year revenue at a 95% because of COVID-19 virus. On the other hand, Amazon share in the market has become lower instead of rising, which could be confusing due to group migration of consumers to E-trade. Second degree effects as a result of COVID-19 have indeed achieved some balance in some aspects, these effects have completely changed the power dynamics between different relations in the worst chain in these markets and it has opened opportunities that are priceless for small and medium sized companies.

So, what are the differences between digital economy and old economy? Which should be cared for by small and medium sized companies to stay and flourish? besides decreasing the cost of starting business, it is now extremely easy to establish a digital store and start selling consumers all over the world.

On the other hand, the successful entry into digitalized economy, acquires increasingly something that money cannot buy, which is very basic efficiency but hard to master. It requires an open mentality free of old traditional restrains, mentality that will offer a clear value, we have seen how AMAZON does that. There is another difference which is this changing infrastructure, the value change itself is completely different, this represents many opportunities but new threats as well. In the old economy for example, rent represented the highest cost a store had to pay. Today, if we look at the startup companies, 10% of the operational cost goes to the cloud, while 20% of expenditure goes to digital advertisement, to Google, to Facebook and other digital players.

On Economic platforms, the assistance of startup companies to find workers is an active operation, remote working also allows globalization of workforce. Advertisement takes a new form that is extremely important, therefore the growth of influencers and the change of the distribution operations is one distinct characteristic. All of this requires a new way in handling the market for the small and medium sized businesses that are not necessarily available for everyone. Even distribution channels have changed, the old ones are no longer active, nowadays having a smartphone connects the market and the multi-use channels.

New risks within the digital economy requires small and medium sized companies' preparedness on the physical security level, as security and the protection of client's data could either flourish the business or ruin it. There are different competitors who could exit from certain sectors and move to others as technology reshapes boundaries between sectors, we have seen for instance what happened to Nokia and BlackBerry. Even platforms that enable small and medium sized companies to reach its customers Kim dismantle the work of these businesses. And often those platforms actually compete over the clients of these companies, this was only enabled through digital transformation.

Customers preferences have changed, now customers are no longer looking for interactions only, but they are looking at an expert digital economy. They are looking for specialization, something that changed from before. Even getting workforce and running the workforce is completely different, many things a company used to need before can now be digitalized, reliance on AI, and on remote working models to reach employees that are geographically remote. There are flexible working platforms and free business economy, where companies can reach experts in different fields. Therefore, there is a different way to looking into digital economy and the old one, and this is also how two different groups of investors would look for opportunities in these markets. Let's take for example, Warren Buffett and mark Anderson. Warren Buffett represents private stocks and the way they deal with the business successfully. Mark Anderson represents new investment capital that's based on technology. Both succeeded but the way they are thinking is completely different. In Warren Buffett's case what they betted on is the current situation , they're not looking for workers they are looking for businesses that can maintain the current situation whereas capitalists are betting on change , they're betting that's technology will change the competition rules and new players will come as they usually look for successful companies with a history. So, they care and bet on the past, wireless the investment capital looks for new players with no history, or what they're thinking when they evaluate these companies because they depend on the future. This is another way of looking at those differences when speaking on about the different qualifications that are required to keep the companies alive.

Group financing, entrepreneur support and provision of investment opportunities in KSA.

Getting the required funding is a main obstacle in the face of the growth and success of small and middle sized company sector, any deficiency in this causes national economy to lose a lot of gains whether on a competitive level or on the enhancement of growth opportunities.

Group financing or group funding is defined according to Oxford dictionary that it is: " financing a project or an investment through collecting money from a big number of people, where each one of them contributes to a relatively small amount, this is usually done through the Internet". This is similar to the stock market where money is collected from the public through the Internet, but is not officially announced as a stock, a stock is more structural and does not support new ideas compared to group financing.

Traditional financing



Big amount of money
from one source or few sources

Group financing



Big number of small
amounts from many individuals

There are different types of group financing explained in the table below, by focusing on the financing related to the stocks, we find that investors can get stocks in different businesses to support businessmen and maintain the continuity of business. There are different platforms to support these types of group financing in different countries around the world.

Type	Contribution	Return for backers	Famous platforms
Donation crowdfunding	Donations	Intangible rewards	GoFundMe, JustGiving
Reward crowdfunding	Donations or pre-purchases	Tangible rewards	Kickstarter, Indiegogo
Lending-based crowdfunding	Loan	Return of the load with interest	Funding Circle, Lending Club
Equity crowdfunding	Investment	Shares in the business	Crowdcube, Seedrs

different types of
Group financing

platforms Group financing International



One of the actual examples for successful group financing around the world is the Co M3D, it is a company that was established by two friends to produce 3D printers. David Jones and Michael Armani collected around \$3.4 million for their 3D mini printers on the financing on the group financing website in 2014. The small printer that comes with a variety of strong 3D inks available on Amazon website, Staples, Buxton and others. The company made sales ranging between 10 to \$15 million. In April 2019 a weekly direct game that appears on a table's surface, incorporating the voices of famous actors made \$4.7 million within 24 hours, none of the companies had this kind of money made in 30 to 60 days.

The biggest group financing values around the world for 30 countries ordered according to the country

Country	order	amount	market share	annual growth rate
China	1 (1)	215,396,387,848	70.73%	-39.88%
US	2 (2)	61,134,356,480	20.07%	42.93%
The United Kingdom	3 (3)	10,367,889,408	3.40%	32.04%
the Netherlands	4 (10)	1,806,298,624	0.59%	480.72%
Indonesia	5 (30)	1,451,228,928	0.48%	1711.43%
Germany	6 (8)	1,276,201,472	0.42%	92.90%
Australia	7 (4)	1,166,546,048	0.38%	1.57%
Japan	8 (9)	1,074,756,864	0.35%	208.26%
France	9 (7)	933,132,928	0.31%	26.98%
Canada	10 (6)	909,255,296	0.30%	4.80%
South Korea	11 (5)	753,380,992	0.25%	-33.32%
Israel	12 (New)	725,827,200	0.24%	145.21%
Brazil	13 (12)	672,192,768	0.22%	149.30%
India	14 (13)	547,428,160	0.18%	103.82%
Italy	15 (15)	532,583,424	0.17%	99.16%
Singapore	16 (18)	499,653,248	0.16%	162.12%
Spain	17 (20)	419,040,224	0.14%	134.99%
Finland	18 (16)	379,191,529	0.12%	73.44%
Poland	19 (23)	333,293,184	0.11%	110.55%
Sweden	20 (17)	298,038,528	0.10%	36.58%
Chile	21 (22)	289,255,456	0.09%	91.95%
New Zealand	22 (14)	276,205,248	0.09%	5.57%
Latvia	23 (26)	254,535,808	0.08%	148.45%
Mexico	24 (21)	233,390,656	0.08%	54.47%
Georgia	25 (19)	193,016,992	0.06%	0.25%
Columbia	26 (New)	192,467,200	0.06%	280.15%
Armenia	27 (New)	184,032,032	0.06%	8227.24%
Estonia	28 (28)	159,526,080	0.05%	76.72%
Peru	29 (New)	158,461,440	0.05%	441.40%
Denmark	30 (New)	144,745,360	0.05%	232.98%
The size of the total market for all countries		304.531.530.000		-27.32%

One of the initiatives of the Saudi vision 2030 in the finance sector development program that has established a financial technical laboratory why the stock market committee , in July 2018 the stock markets committee announced and for the first time the approval on licensing a group financing platform for the stocks of the two finance companies; Scooper and Manafi'. One of the two platforms, which is Manafi', has proved its success as it made the highest contribution for all suggested investments. Manaf' has achieved four successful campaigns and is looking into more opportunities of investment. The four campaigns aimed at getting the money to expand an already active trade and not to finance a startup company which resulted in decreasing the risks to a big degree.

It is hoped that there is a clearer structure and more authorized platforms for group financing as well as the awareness of investments and businessmen to be a channel and a platform where everyone meets, to support the economy.

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Chapter Eleven Global Health Security: Towards A World Free of Pandemics

- Recommendations.
- The evolvement of pandemics throughout history the possibility of reaching a future that is pandemic free.
- The role of the individual and society in achieving a free pandemic world.
- Cooperation and coordination between research institutions in times of pandemics, COVID-19 pandemic as a model.
- References and resources.

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Recommendations

-  Supporting Primary Health care to enable more resilient societies when facing pandemics.
-  Solving the problems within the healthcare sector and working on its development through its technical abilities to be able to face world crisis while giving special attention for society primary care services.
-  Enhancing global cooperation in research, two provides data and share amongst countries leading to a higher coordination and unified response against COVID-19 pandemic. This should lift up preparedness level for future crises.
-  Investing in digital health data and reviewing the strength of health care systems and their resilience.
-  Creating efficient Mechanisms to provide an effective universal response to facing pandemics and achieving universal health security in a just and comprehensive manner.

The evolvement of pandemics throughout history the possibility of reaching a future that is pandemic free.

Although the world was surprised when COVID-19 virus had spread in most countries, the human history witnessed many pandemics that were even stronger and then elated hundreds of millions of people and caused disasters.

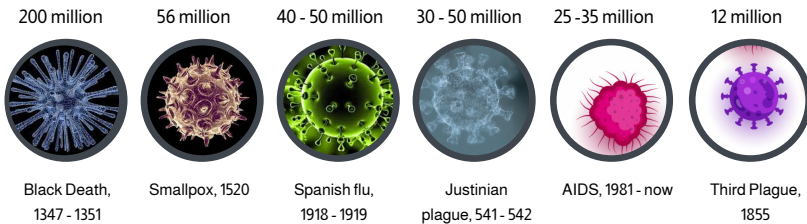
By going back to the 14th century for example, specifically between the years 1347 in 1351 we find that the so-called Black Death pandemic had caused the death of more than 200 million people worldwide. It is thought that it started in China or near it then moved to Italy and then to the rest of Europe and the remaining world countries.

Smallpox pandemic has caused the death of around 5 million people when it appeared in 1520, Spanish flu that appeared After World War One has caused the death of 40 to 50 million people worldwide.

AIDS has caused the death of 35 million people since the year 1981 until now, the pig flu pandemic in the year 2009 that resulted in a new chain of virus H1N1 appeared in Mexico in spring of the year 2009 before spreading to the rest of the world. During one year the virus infected over 1.4 billion people worldwide and killed between 151,700 and 575,400 people.

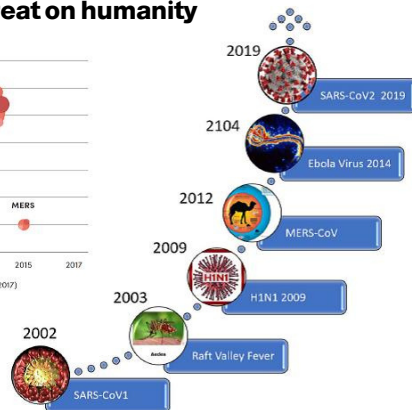
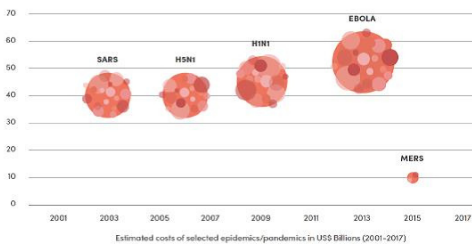
In the current time although we live in a very advanced world, with all these medications that are anti- virus, but we lost till today approximately 1.3 million because of COVID-19 virus. By looking at these different pandemics and asking a question, what is the common thing between pandemics? We find that most of these pandemics are related to an animal source, diseases of animal sources are diseases that move that transmits from a non-vertebral animal to the human beings to cause the disease. At the same time we continue to live around animals either is animal products or agriculture or while invading animal's natural habitat we increasingly are exposed to animals this of course increases the risk of getting infected with a disease of animal origin.

The deadliest pandemics in Human history



Several years ago , specifically in 2015 Bill Gates who owns Microsoft company, said in a technology, Entertainment and design conference (TED) in Vancouver that: " if anything would kill more than two million people over the next few decades, it will most likely be a high contagious virus not a war, not an missile but microbes" . He continued by saying: " part of this reason is that we have invested a lot of money in the nuclear deterrent but we have invested very little in a system to stop pandemic , we are not ready for the next step (pandemic)". This is what he was saying about the end of Ebola pandemic in West Africa.

Pandemics are a continuous threat on humanity



Today we are witnessing one of the most important challenges that our modern world is facing i.e. COVID-19, which threatens the international health security and causing severe damages to the world's economy paralyzing different aspects of life. The question here is, how can we do what is best to get ready to decrease pandemics risks in the future? There are many suggestions and ideas within a framework of four main goals, the first one is about effective cooperation between human health sector and animal health sector. There should be a big cooperation between both. The second goal is continuous monitoring to identify as early as possible any pandemics, as this is important since pandemics don't spread at once. As in the case of COVID-19 pandemic, we need to have controlled monitoring to be able to identify the signals ahead of time, this can only be done by owning laboratory diagnostic abilities for Pathogens. Such abilities should be available all over the world not only in BRICS countries, this of course means huge investments. The third goal, as we live in a very connected world which is technologically advanced, we need to use these abilities and technological innovations to contribute in facing pandemics in the future. The fourth goal is related to developing the abilities of response to deal with pandemics more effectively.

Ø The role of the individual and society in achieving a free pandemic world. COVID-19 crises had pushed governments and care health care organizations around the world to invest more in this sector to achieve global health security, and to coordinate for a global response to face this pandemic. As dealing with the pandemic is a responsibility of everyone, where the individual has a main role in combating this virus, every person should feel the responsibility towards themselves and towards their community by committing to the prophylactic health instructions, staying away from rumors and getting news from formal channels. Preserving lives in public health is a must for everyone.

The role of the individual and society to reach a pandemic-free-world is through, focusing on the matter of health as a priority, good and early preparedness for health security on a national and international level. The investment in health care to achieve comprehensive health care, in addition to providing the necessary knowledge for humanity and society that is based on improving scientific research and data. Also, the best use of research and data results in health planning.

The results of one of the studies has shown that building flexibility in our behavior and systems in the fields of work and education is of private and public benefit. As the quick spread of the virus has shown the ability the local ability to build and sustain facing different threats ranging from, pandemics two extremism and Climate insecurity. The pandemic represents a chance to remind us of the skills that the next generation would need to be able to better handle the unpredictable and reach the correct decision and come up with innovative solutions , most importantly to be able to adapt.

Cooperation and coordination between research institutions in times of pandemics, COVID-19 pandemic as a model.

Research activities play a significant role in times of pandemics, similar to what we have witnessed during COVID-19 pandemic by knowing the causes of the pandemic and helping track the spread of it and its development. Generally, pandemics or mysterious and has a high degree of uncertainty with the societies that they face. Naturally many societies and countries had to research and find more about the causes of these pandemics to come up with solutions that help combat them.

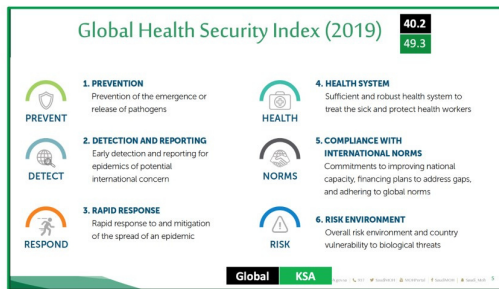
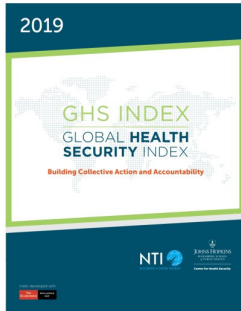
The role of individuals and society in realizing that dream

1. "Health" 1st

- Individuals
- Those around us
- Targeting high risk people
- Environment
- Healthy planet

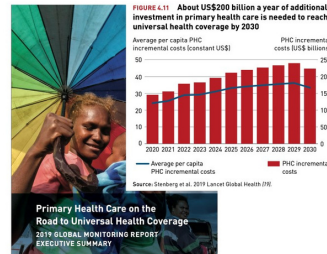
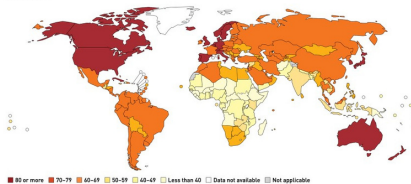


2. Establish a national system for health security (leading to GHS).



3. Investing in primary healthcare (PHC) for achieving universal health coverage (UHC).

FIGURE 1.4 Country-level UHC SCL values in 2017 varied – often substantially – within WHO regions
UHC SCL 2017



4. Generating knowledge essential for societies and humanity.

5. Effective use of data and research evidence in health planning.

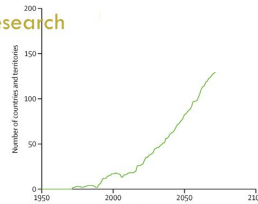
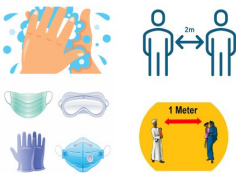


Fig: Number of countries and territories with negative natural rate of population increase, 1950–2019, and in the reference forecast scenario, 2020–2100
The Lancet 2020 396:1135–1159 DOI: [10.1016/S0140-6736(20)31404-5]

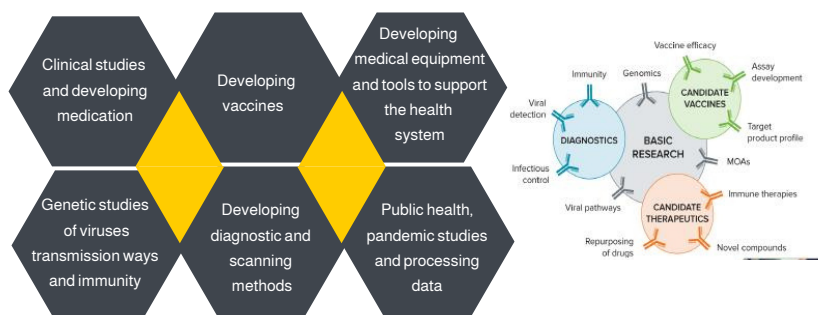


One of the biggest challenges appearing in facing current pandemics in an arrow that has achieved digital revolution, whilst heading towards electronic governance, the problem of data its availability, subjectivity, and ability to be analyzed accurately and quick. As the spread of data resources had caused increased ambiguity around the quality of those statistics and their credibility which caused a data crisis and the problem in its sharing on a worldwide level.

In fact, there are principles requiring commitment when sharing data during pandemics:



Pandemics impose non-traditional research priorities as a response, which was clear during the COVID-19 pandemic. The pandemic became one of the priorities in research centers, universities on a global level, which has alerted everyone to try and find a treatment for this pandemic. There are several research priorities worldwide that are connected to pandemics starting with public health, pandemic studies and processing data, ending with clinical studies and developing medication according to the structure below:



As for the Saudi context, it is not noticed that COVID-19 pandemic has shown the importance of research activities development and innovation. Using those to face the changes international challenges. It has also showed the societal ability of Saudi research to help the country face the pandemic and come up with the best results.

References and Resources

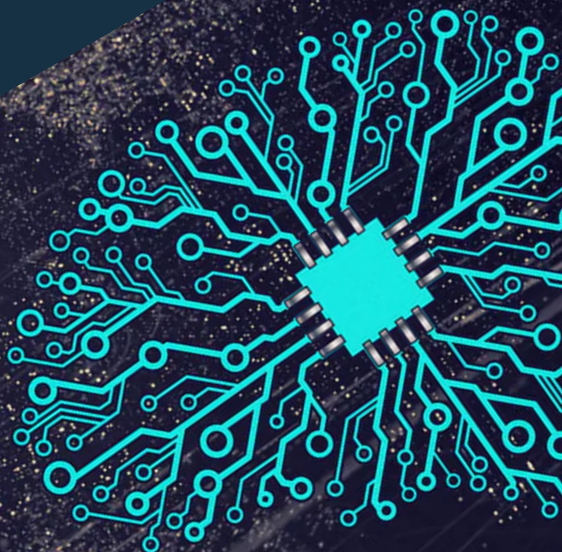
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