INSTITUTE OF ADVANCED MATERIALS, IAAM

Advancing Materials for Health, Energy, and Environment

Sustainable Technologies for Net Zero Goals

www.iaam.se

ENTHUSIASTIC MIND DRIVES INNOVATION

Our leadership has the vision to transform high-end research and innovation

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Director's Desk

Practicing Sustainability with

'NET-ZERO' R&D

Our Priority of Decades

Dear Colleagues,

I am writing you the key reflections of our efforts at the Institute of Advanced Materials, IAAM (Org. nr. 559167-3883, VAT nr. SE559167388301, and PIC of European Commission. 891021534). We started this institute with the vision of advancing materials for new edge health, energy, and environmental applications. Over the years, the institute has been working to empower different industries and sectors with the help of translational research and innovation. The institute offers services that are highly focused on innovation and technology. As an organization, we seek to push the boundaries for enhancing benefits to the various sectors that are crucial to the existence of mankind.

Institute of Advanced Materials, IAAM is a home of researchers, students, and academic-industrial partnerships for collective objectives of translational research and innovation towards the welfare of society. Our work does not just include creating new tools and technology, we lay an emphasis on transforming the lives of people. We have a network of experienced researchers, scientists, and technocrats that is highly widespread. Our team consists of highly qualified professionals, who hold considerable experience in their fields and can participate in grant proposals, consortium and alliance, education and training program, and translational R&D projects.

Working for better healthcare is always our top-most priority. This is not only this year has brought a pandemic emergency, which underlined and heightened long standing imbalances in the world population, and increased challenges for our fellow citizens. We are thinking carefully about how to integrate AI, ML, data science research, and related technologies to enhance the quality of life and solve global challenges. The pandemic taught us to be together and need to be ready for high-tech solutions to tackle the upcoming natural calamities. Our healthcare research facilities are ranging from public health planning and management to devise fabrication, feasibility studies, field trials, and many more.

Over the past few years, in collaboration with the International Association of Advanced Materials, the institute welcomed talented researchers, fellows, students, and scholars who have the belief to leverage technological innovation in the sphere of cloud medicine, wearable devices, climate neutral technologies, waste utility, and net-zero R&Ds. We have created consortia and projects for academic and industrial partnerships that hold the potential to transform the green future. These consortia bring out the best possible solutions for different problems of translational R&D by mapping out the path for new technologies, materials, and products. During the post pandemic years, we look forward to offering several kinds of professional education, industrial training programs and will create consortia for the net zero R&D as well as partnerships for waste utility.

Together with our global research networks, we are set to be more responsive and alert in today's transforming climate neutral technologies. We can keep on creating a society where each person has the prospect to achieve their full capacity. Working with sustainable development and net zero goals will be knitting partnerships and collaborations for our decade's priority. It will allow us all to think deeper, achieve greater, and expand our perspectives. It will also improve the ability of our courageous and pioneering institution to be a stimulating partner to move across science, engineering, technology, medicine, and biotech for sharing and creating knowledge.

With "net zero" as the objective in both the "green" and "sustainability" disciplines, we will contribute towards the advancement of a sustainable society. Our organization has a strong and long-lasting approach in advocating sustainability but moving with the current scenario, we must do more with our R&D world links, international networking, and practicing policies for a green future. This is not a simple mission, but the possibility of achieving these objectives is much needed owing to the recent climate neutrality evolution.

As the director, I will be truly happy if we can become an institute that is truly inspiring to society by creating a sustainable and green culture. I would like to invite all of you for your constant support to pursue these endeavours of "net-zero" targets.

ABOUT US

The Institute of Advanced Materials, IAAM (Org. nr. 559167-3883, VAT nr. SE559167388301, and PIC of European Commission. 891021534) was founded in the year 2015 with collaborative attempts of International Association of Advanced Materials (IAAM) and VBRI Group. The institute has been working to empower industries and startups with translating research and innovation. We offer services that are highly focused on advanced R&D, innovations, and net zero technologies. As an organization, we seek to push the boundaries of the realm of technology and innovation and try to benefit the various sectors that are crucial to the existence of mankind.

Institute of Advanced Materials (IAM) is a renowned international organization that works to promote translational research & innovations in the sectors of health, energy, environment, and many more. The IAM provides high-quality consultancy in R&D, technology transfer, and infrastructure developments to ensure the transition of good quality of research into useful and significant products for the end-user. The institute has maintained its materials science, engineering, and technology outreach by forming healthy partnerships and collaborations with the best of researchers, institutes, and scientists from more than 125 countries.

The institute considers the consumer demand and intends to design, innovate, and optimize materials through its R&D world links and research of broad disciplines including physics, chemistry, biology, medicine, engineering, biotechnology, data science, mathematical modelling, nanoscience, and nanotechnology. The institute works to promote translational research and innovation for the welfare of society. Our work does not just include creating new tools and technology, we lay an emphasis on transforming lifestyles and making a difference to the lives of people. The IAM is specially focused on the research themes of advanced materials science, engineering, and technology and works to promote innovation and technology.

Driving Innovations for Strengthening of Climate Neutrality Goals

We leverage high-end innovation to stimulate sustainable growth for business.

VISION AND MISSION

Translating Research into Innovative Services and Products

IAM facilitates the transition of quality research into significant products, services, and growth of your organization

Institute of Advanced Materials, a growing organization, strives to promote translational research and bring it to different fields of businesses to help them grow in a positive manner. Our work is not just implementing translational research to build new technology and tools, it is focused on shaping lifestyles. IAM works extensively in the sectors of energy, environment, and health.

Vision is to implement knowledge and translational research to change and shape the lives of people around the world. We believe that new-age technology and innovations can be utilized to transform the human life to the greatest extent possible. Our vision is to continue the path to innovation in the sectors of energy, environment, and health. We believe that the biggest accomplishments of our research and efforts lie in the smallest of positive differences that we can make to the business and sectors that are crucial to the existence of humankind. We take pride in working in crucial sectors such as health. It is our vision to utilize the existing technology, work with the network of ours and our partner organizations over the world to come up with solutions that can refine the quality of crucial business areas and eventually the human life to the highest possible extent.

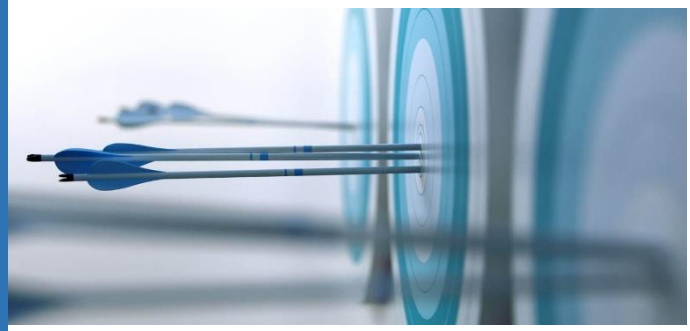
Mission of Institute of Advanced Materials aims to utilize its work with translational research and innovations, R&D, technology transfer, infrastructure development, and global consultancy to develop new tools and technology for society and number of business areas. Our network of technocrats and researchers is spread around the entire world. This network is primarily leveraged into coming up with research to improve the quality of services and functioning in the sectors of energy, environment, and health. Our work is committed to bringing about change with the means of innovation. We hope to utilize our network and experts to conduct translational research that sets some standards across industries, in terms of the enhancement of life. The IAM is guided by its vision in whatever it does. Our primary aim is to exploit the already existing technology and bring innovative solutions to the forefront of different business areas, especially the spheres of energy, environment, and health. We are dedicated to bringing our services, innovative technology, and high-end consultancy to the spheres of businesses that need it the most and the areas that hold true potential for development. It is our belief that the society and the entire world deserve new tools and technology. Institute of Advanced Materials considers its mission to use its network of technocrats and experts all around the world to develop new tools and solutions for society.

AREA OF FOCUS

Offering Quality Services Across Different Sectors

Get in touch with IAM to enjoy a range of critical services to stimulate the growth of your business

Energy | Environment | Health



Energy

Institute of Advanced Materials, IAAM, provides high-quality services like Materials Innovation, Translational Research, Technological Innovation, Training & Education, and Global Consultancy to companies working in the Energy sector. We help companies develop and deploy new technologies to provide sustainable, innovative, and cleaner energy solutions. Our services have proven helpful to revolutionize the way energy requirements are met. With our materials formulation and technological development services, we help our clients develop better functionality and stimulate growth of their business. We help our clients develop faster and more agile innovation and make it possible for them to react swiftly to changes in the market demand.

Driving Innovation in Energy Sector

IAM helps companies overcome the global competition and innovate faster to deliver better products and services to their customers. One thing that is constant in the Materials & Energy industry is the growing change. Our consultancy and innovation services are designed to make companies become more efficient and optimize the way they operate and create energy. The Energy industry is undergoing a transition with regards to the need to build sustainable solutions and mitigate the damages of climate change. IAM helps companies develop sustainable processes and energy systems to bring about sophisticated ways to develop energy. Our services are dedicated to improving the production of our energy industry clients and reduce the production costs.

Materials Services for Energy

Innovative and Advanced Materials are the rising demand to produce low-carbon energy technologies. Institute of Advanced Materials brings together research, industry expertise, and leverages its capability in Advanced Materials and Technology to help clients make some tangible growth in innovative energy technologies. We help companies build new processes for the development of sustainable energy and survive in the market. Our experts help you figure out the future demand of energy and the supply potential of your organization. We also offer our Materials restructuring, simulation, and Formulation Services to provide the ultra-efficient materials used in energy technologies based on new knowhow. Reducing the Carbon footprint and Decarbonization of Energy industry is the new norm around the world. With our Materials Innovation and Translational Research services, IAM helps companies overcome all the new and novel challenges related to materials in energy applications.

Industry-Specific Consultancy

Institute of Advanced Materials, IAAM, utilizes its experience of working in Energy sector to offer highly specific and effective consultancy. If you are looking for professional business consultancy specific to the Energy industry, our team of experts are more than equipped to help you. Having worked with a diverse range of Energy companies and organizations, Institute of Advanced Materials understands the global energy sector and its needs. Our team of engineers and scientists offer world-class consultancy after performing critical assessments and evaluation of your company's needs and business prospects. We help you make sure that your energy solutions are compliant, safe, effective, and line with global trends and demands.

Environment

At Institute of Advanced Materials, IAAM, we help our customers from the Environment sector meet all the current and future needs of the market. Our Innovation and consultancy services are targeted at helping our clients create thriving sustainable business processes and solutions. We are focused on working with companies looking to create a sustainable environmental future. With diverse services like Materials Formulation, Sustaining Innovation, and Consultancy, IAM helps its clients sustain in the market and develop sustainable products as per the demands of the circular economy. We bring together research, technology, industry expertise, we help our customers align their sustainability goals with business prospects. Our Research and Innovation services help companies develop smart solutions and processes to survive in the market while working along the goal of sustainability.

Materials Innovation and Environment

At Institute of Advanced Materials, we combine our deep knowledge of advanced materials with modern insights to help companies create meaningful green processes and services. Novel products are at the core of every modern eco-friendly innovation. IAM helps your organization address issues like reducing carbon credits, creating sustainable technology. We conceive and help apply advanced materials to boost your productivity and capitalizing on the potential for success. Over the past few years, materials innovation has permeated right into the environment sector and its processes. With our expertise of Advanced Materials innovation, we help you maintain an advantage over your peers in the industry.

Innovative Solutions to Drive Sustainable Growth

The Environment industry is undergoing rapid change. Companies around the world are in a race to adapt their services to mitigate the damage of climate change. There is a pressure on organizations to survive in the environment industry while minimizing their effects on environment. IAM provides innovative solutions and analytical insights to ensure your compliance with internationally accepted green practices while maintaining steady growth. We help your organization decrease the negative impact on environment while increasing your success by leveraging our expertise and experience. Our experts help make it possible for your organization to increase environmental monitoring and increase efficiency. Our work with academia and industry has equipped us to provide highly practical solutions.

High-end Consultancy

With our expertise about the industrial processes of the Environment industry, IAM helps its clients process efficiencies that are better for their businesses. We work with companies and help them to overcome all the challenges and reduce carbon credits and proceed in a sustainable manner. IAM helps companies and organizations get the best out of their businesses while protecting the environment. Institute of Advanced Materials also helps its clients solve all technical problems by providing high-end consultancy using our experience and problem-solving capabilities. Our consultancy services are focused on bringing about environment friendly commercial success for our clients working in the various sectors.

Health

Institute of Advanced Materials offers a wide range of services to its clients working in the health sector. With our Translational Research and Innovation services, IAM helps the clients answer all questions and improve diagnosis, treatment, and processes. We offer our deep expertise and research to support studies and improve the functioning of healthcare providers. Our materials science services help companies improve the procedures, devices and equipment used in their process and healthcare centres. With our expertise on Materials formulation and development and a rich network of experts, we prove to be the perfect partners for our clients to build medical devices that are highly innovative in nature. IAM also provides extensive consultancy services to its clients and generate results with insights and execution. Our eye for detail coupled with expertise of healthcare industry result in exceptional services for our clients and companies.

Materials Science Services for Healthcare

Materials Science is gradually permeating the Healthcare industry. It is a key element in the design and research for new medical materials and devices. Institute of Advanced Materials offers its expertise on Advanced Healthcare Materials and their formulation services to build appliances that can break the boundaries and help companies innovate. Our experts help companies working in healthcare with the applications of Biomaterials in medical applications. Smart Materials have extensive applications in the Healthcare sector. With polymers being used in medical devices treating heart valves, composite materials in hard-tissue applicants, ceramics in dental applications, and many more, Materials Science expertise is a must to survive in the Healthcare industry. Institute of Advanced Materials serves as the best partner for you and help you in the advancement of your process, equipment, and tools.

Quality Translational Research and Innovation Services

Institute of Advanced Materials acts as a trusted partner for your organization. With our heaps of experience and network of scientists, we provide answer to all your questions. Our research helps your company with highly meaningful and practical results. Our team of experts is highly equipped to translate research into practice for your processes. At IAM, we utilize our Research and Innovation services to eliminate all the obstacles in your productivity. We facilitate the smooth transition of high-quality research into health care advances and help you gain an edge over all the competitors in the industry. We connect laboratory research and the practical world of healthcare. Our focus is always on utilizing research to improve the functioning of our partner/ clients working in healthcare.

Extensive Consultancy to Help You Advance

IAM's consultancy for our clients is focused on delivering a great standard of excellence. We are known for providing high-quality consultancy on all healthcare facilities ranging from architecture planning, feasibility studies, nursing quality, field trial, and many more. Our network of experts works in close association with your healthcare organization to help you drive towards perfection. Healthcare sector is witnessing rapid addition of complexities. IAM leverages its experience and expertise to help you overcome these complexities and provide efficient healthcare consultancy. With our experienced team, IAM is more than equipped to make you overcome all the challenges in the Healthcare industry. Our in-depth consultancy drives innovation while reducing costs and improving quality of healthcare products and services.

How We Work?

Pave the Way to Provide Excellent Services

Helping Businesses Across Sectors and Industries Improve their Services and Processes

Institute of Advanced Materials (IAM) works in different fields and offers a wide range of services to support businesses and solve challenges that the business communities around the world face right now. Our services like global consultancy, Research & Development, Industrial Training, Technology Transfer, and innovations are targeted to help our clients enhance their business process and improve their prospects in the market. Our clients span across industries and our services have served clients all around the world.

Translational Research and Innovation

Institute of Advanced Material offers Translational Research and Materials Innovation services to businesses around the world. We help our clients enhance and optimize their business processes. Our Translational Research and Innovation services including Materials Formulation, Architecturing, and Development are focused on enhancing new tools and technologies. We leverage our expertise into solving critical business problems for our clients and get them results. The work that we do with translational research has not just created new technology and tools but shaped the way businesses and organizations work around the world. Our services span across various sectors, especially Energy, Environment, and Health. We give companies the impetus that they require with our highly focused and advanced innovation and research services.

Result-oriented and Specific Innovation Services

We help companies realize their potential with high-quality services. Our work involves leveraging our research activities into helping startups grow and scale up in the market. We help large-scale organizations grow further and gain an edge over their peers. With result-oriented Materials Innovation services, IAM acts as the perfect partner for your organization and help you with world-class innovation services. Our longstanding record and client base is a testament to the quality of work we do. Our network of technocrats and researchers are well-equipped with skills and knowledge to solve your business problems. IAM projects the future trends for businesses in the market and utilizes its innovation potential to help make significant technological advancement. We act as the bridge between idea and market for all our clients.

Perspective for Translational Research

Institute of Advanced Materials (IAM) has a huge network of technocrats, partner organizations, and researchers that is spread across the globe. Our research services and projects that we take on, are focused on substantially improving the businesses of our clients. Our team of experts and researchers utilize their experience and knowledge to conduct extensive research and studies and come up with findings that help us to enhance and upgrade the existing tools and technology in the sectors of Energy, Environment, and Health.

Our Innovation and Translational Research services are focused on the betterment of our clients' business processes. Our primary motive has always been to exploit existing tools and technology and try to build new ones that can help business function in a better way. We recognize the issues with your business processes and conduct efficient research to provide you solutions. Our research helps our clients get an edge over their contemporaries and peers.

Cooperation for Translational Research & Innovation

IAM offers Translational Research Innovation Cooperation and end-to-end collaboration services. Our cooperation services are aimed at facilitating resources and technology-gathering to accelerate Materials Research and Innovations. We support the ambitious program launched by Horizon Europe to promote a sustainable economy in Europe and lead the development of major emerging technologies. In line with this agenda, IAM helps organizations of all sizes with their consortiums. Our priority areas are

- Development of digital sectors and emerging technologies
- Managing Sustainable resources
- Making Europe a sustainable economy

We coordinate consortiums and projects that hold the potential to further the agenda of sustainability and development of the latest technologies. Our major services include:

- Consortium Coordination
- Innovation Management
- Project Writing
- Project Management

IAM supports researchers and organizations with their consortiums and gives them access to our international network of researchers and institutions. We collaborate with organizations and provide them a massive scale for their consortium projects to accomplish significant results for regional, domestic, and international sustainable development. Our partnership also offers a global platform for the consortiums and brings the expertise of scientists and researchers from all over the world.

Global Consultancy

Institute of Advanced Materials provides services and solutions that you need to help grow your business. We specialize in helping businesses tackle their challenges, face the strategic problems, and inducing the rise of entrepreneurs and startups. Our consultancy services are focused on providing businesses with the best solutions to overcome industry-based challenges. With our experts and smart research methods, we ensure that your business gets the required edge over others in the market. Our experience of having served business of all sizes from all parts of the world helps us to generate reliable solutions for all our clients. We provide you the best solutions and tested practices that suit your business and help you gain advantage of sustainability and circular ecosystems in the industry.

Practical Solutions and Consultancy

IAM is dedicated to helping startups and entrepreneurs gain the kickstart that they need. With our years of experience, we have generated tools and practices that help us provide you highly feasible and practical solutions. At IAM, we understand that the success of a startup highly depends upon the initial decisions. We assist you in these initial decisions and ensure that your business gets positioned for long-term growth and success. IAM helps you recognize the best opportunities for your business and capitalize on them to succeed. With our services, we project the roadmap for your organization and predict the problems and challenges along with the solutions for these issues.

Our Expertise and Your Goals

IAM has built up its expertise through knowledge acquisition and assisting organizations of all sizes from across the globe over the past years. We utilize this expertise and our network to help innovative startups and small-scale businesses. Our team of technocrats come up with innovative solutions to drive growth for your business. With our consultancy services, we assist our clients with everything from business planning, market strategies, product strategies to marketing management. Our services and solutions are focused on driving growth and success for entrepreneurs and startups. We bring the expertise of our network of technocrats and industry experts and utilize them with a vision to help your business reach its goals. We consider it a priority to help you reach new heights and survive in the cut-throat competition that the market puts up.

Driving Strategy for Your Growth

As part of our global consultancy services, Institute of Advanced Materials plans strategy for your new businesses and helps you tackle the challenges and problems. We provide you the best solutions and tested practices that suit your business and help you advantage in the industry. Our expert opinion and consultancy is based on a thorough analysis of your objectives, mission, and the industry. We come up with tailor-made solutions that are specific to your industry and business requirements. Our consultancy services are highly data-driven, analytical, and extremely focused on getting the desired results. With years of experience, Institute of Advanced Materials helps you forecast the future trends of the market. We help you craft a business plan that minimizes the problems and challenges. These carefully crafted plans poise your business and your organization for long-term success. At IAM, we focus on optimizing your business processes and generating the best results. With our global consultancy services, we help startups, low scale businesses, and entrepreneurs execute activities and practices that bring about growth. We consider it a priority to work for the success of our clients and the growth of their businesses.

Innovation and Startups

The Institute of Advanced Materials offers its services to help companies become more innovative in their processes. We help businesses around the world grow and move towards better functionality and adapt to the changing world. Innovation and translational research are the way forward for the world. Our innovation services help business, startups, and sectors around the world increase their innovation quotient and capitalize on opportunities. Our research programs are designed keeping in mind the latest trends and demands of the market.

Helping Traditional Companies become Innovative

We utilize our abundant experience to introduce traditional companies to the new technological revolution. We leverage our research experience and network of technocrats to help facilitate the transition of organizations into technology-oriented businesses. With our strong belief in the power of technology to bring about positive innovation, we connect businesses and organizations with the latest cutting-edge technologies and all the latest disruptive trends in the industry. With our experience, we help the organizations use the disruptions and turn them into opportunities for growth. Our services including consultancy, industrial training, industry research, and many more are specifically focused on helping businesses become better and more innovative. The industry research services that we offer are designed with an aim to help clients come over the obstacles and trace the path forward for them in their business sphere.

Partnering with Startups

Institute of Advanced Materials offers its innovation services and partners with startups across industries, especially the ones working in sectors such as energy, environment, and health. IAM considers it a mission to help its clients improve their innovation skills and get an edge over their peers in the market. We provide high-end solutions to startups and business that help them improve their business processes. Good startups are always in need for technological innovations. With our global network of technocrats and industry-specific research programs, we help your organization amalgamate with the disruptive technologies that have the potential to rule the concerned business sector. With our experience, we help the startups prepare for future and arm themselves against unpredictability. We make it possible for our partner organizations to foresee the technological disruptions that are about to hit the business sector. All our services are aimed at helping valuable startups grow and lead to the enhancement of the sectors of energy, environment, and health.

Innovation Sustainability

The prevailing business environment in the world has made it imperative for the businesses and startups to focus on innovation to gain an edge and advantage over their peer organizations in the industry. With the ever-increasing cut-throat competition in various business spheres, it is critical for both large scale organizations and startups to keep on bringing about innovations that can sustain in the market. At the Institute of Advanced Materials, we help companies that want to keep on developing and building on their innovation ability and quotient. We help organizations develop sustaining innovations that help them bring about great results and impact in their industry.

The Need for Innovation Sustainability

In this ever-changing world, large scale organizations and startups have no choice but to keep evolving to keep pace with the rapid changes in technology and businesses. Continuous Innovation is the key factor that has the potential for keeping companies afloat in the business markets around the world. However, it is important that the innovation made can survive the test of market over time. This need is what has given to what we know as ‘Sustaining innovation’. Each innovation or technology has a shelf life. With the rapid changes that the business spheres around the world and across industries are facing, sustaining innovation is the key to an organization’s success. This is the age where the innovation sustainability and the capability of an organization to keep on evolving derive its success in the market. Because of the short shelf life of many innovations today, it is important that the companies keep conducting R&D and keep on innovating without fail.

Assessing Contemporary Requirements

Today, it is critical for organizations to keep assessing the reliability of their product and the feedback of the customers with respect to the usability. It is necessary for the companies to keep assessing the standing of their products with the newest and latest technology in the market. With these inputs and parameters taken into consideration, companies can successfully build on sustaining innovations gradually over a period according to the requirements. Within no time, companies can find their products weakening in terms of fulfilling the contemporary requirements of the consumers. That is when they need to act and innovate to remain relevant with the business world. Institute of Advanced Materials helps companies realize this dream and continue to exist and flourish their businesses.

Industrial Training and Education

Institute of Advanced Materials is highly dedicated to supporting the careers of young graduates and upcoming professionals whose research interests align with the mission of the organization. As an institute deeply vested in research and education, we understand the importance of high-quality training for a young individual who is looking for an impetus in his career. We offer a wide range of training and education programs. We extend our support and training programs to professionals working in a diverse range of fields, including the sectors of energy, environment, health, and materials science. IAM's education and training programs are designed with utmost care and an aim to deliver top-quality training to the individuals in order to help them excel in their respective sectors. All the training programs that IAM offers give the individuals an exposure to the business and professional world. Our programs are designed to give the trainees a glimpse of the life that they have planned to lead in their careers. In addition to this, working on IAM's projects help the trainees get equipped with all the skills and knowledge that they are going to require on their way ahead in their careers.

World-class Opportunities

The industrial training programs of IAM offer world-class opportunities to individuals. As a trainee in one of IAM programs, you get to participate and work on live projects for our clients from around the world. By doing so, you gain quality experience. The modules of each of these training programs are set by industry experts to ensure that the students get the best possible training. Over the years, Institute of Advanced Materials has become a known name in the world of industrial training as the programs sensitize the young professionals with almost all the requisite exposure, skills, and knowledge.

Building Tomorrow's Innovators

The educational aim of the Institute of Advanced Materials is to prepare the innovators of the future. IAM is focused on helping and training professionals to enable them to work in resource-constrained environments. The goal is to prepare professionals who can produce useful, relevant, and effective solutions that can be implemented on large scale despite working with limited resources. By making professionals understand the steep challenges of an environment that offers limited resources, IAM prepare innovating minds for the future that can work with technology and come up with practical implementation plans for critical business problems. The opportunities that IAM offers to individuals through its training programs facilitate research partnerships between the trainees and experts from our networks. The programs that we offer are unique in terms of the exposure and extensive learning that they offer.

Why IAM?

Institute of Advanced Materials is known for the quality of its training and education programs. These programs and modules have been designed with the primary aim to help individuals transform into highly competent professionals who can overcome all the obstacles that the

emerging technologies of the professional world. IAM gives the trainees access to world-class facilities and the guidance of industry experts. IAM leverages its vast and global network of technocrats into availing the best possible guidance for the trainees. This is the reason why the trainees at IAM receive the guidance of experts of their respective fields. The trainees get highly enriching experiences at the hands of world-class faculties.

OUR OFFERINGS

- As part of IAM's intensive training programs, you get:
- A huge exposure of the business and professional world
- Opportunities to work on various live projects
- A chance to work and act on real-time scenarios
- Access to state-of-the-art infrastructure and facilities
- Guidance and mentorship of world-class experts and faculties
- Glimpse of all the latest industry trends and developments
- Chance to get equipped with all the required knowledge and skills

R&D World Links and Decentralized Facilities

Our world R&D decentralized initiatives are based on the belief that collaborations inspire translational innovation by enhancing new methods and technologies in materials sustainability, health, energy, and environment. With this belief, Institute of Advanced Materials has established a network of R&D labs and decentralized facilities that strengthen and facilitate interdisciplinary participation of global researchers and scientists in Translational Research & Innovation activities. The institute coordinates projects and brings together experts from diverse subject areas on these integrated experts' networks and facilities.

Aims and Objectives

Our network of decentralized facilities and R&D World Links is aimed at supporting innovative research projects and partnerships. Institute of Advanced Materials acts as the central coordinator and organizes number of consortia, experts' groups, and translational research programs for sustainable and climate neutral future. We ensure that the projects are carried out with the maximum level of interaction. We also utilize our global network of International Association of Advanced Materials to promote research and innovation programs with academic and research institutions as well as business organizations. Our primary aim is to allow the best minds from different scientific disciplines to come together on our R&D World Links and connect with their peers with the same interests and make major advancements in Translational Research and Innovations.

Networking

IAM consortia bring together network of experts, members of academia, and industry specialists.

Finding Solutions

The discussions are focused on finding solutions to the various problems of businesses and industries

Creating Collaborations

Our consortiums create the perfect environment for collaboration between different stakeholders from academia, industry, and businesses.

Intensive Discussions

IAM consortiums bring together experts from various fields and promote intensive discussions on various critical topics.

Mapping Out Future

We focus on identifying different technologies and mapping out their applications in businesses in different industries.

Generating Results

IAM consortiums are highly result-oriented and focus on improving the existing technology and adding value to businesses.

Action Plans for International R&D Links

We allow researchers with varied interests, especially the ones working for the Advancement of Materials to build a Sustainable World, to join forces and build long-term sustained partnerships through these comprehensive R&D World Links. Our decentralized facilities are part of a larger agenda with multiple action plans:

Action Plan 1. Facilitating partnerships and collaborations for actively working on Translational Research Initiatives, Joint Research Programs, Educational Activities, and Joint Supervision of Students.

Action Plan 2. Creating decentralized world-wide joint/network labs and experts.

Action Plan 3. Finding solutions to problems by providing the right network and strategies and ensuring that we create the optimum financial value out of your technology and research.

Action Plan 4. Constitute consortia and projects to transform research and innovation.

Action Plan 5. Coordinate the transition of projects and prototype products from research stage to TRL 6 or above in the sectors of Energy, Environment, Health, and many more.

Action Plan 6. Provide innovative solutions and analytical strategies to ensure your compliance with internationally accepted United Nation's Agenda of green practices through eco-friendly innovation.

R&D World Links for Interdisciplinary Research Programs

The decentralized Labs allow scientists from all parts of the world, each with a special expertise, set of resources, and data to collaborate efficiently and work on prolonged R&D projects. These projects result in the sharing of resources and promote clear communication among scientists and help them advance towards mutual sustainable development goals. They provide a simulated environment for Translational Research and Innovation activities, with a distinct focus on digitalization and sustainable practices. Our decentralized infrastructure successfully creates a global lab-to-lab link among experts that leads to the smooth functioning of experiments and research for translational innovation in areas of Health, Energy, and Environment.

Multi-Lateral Collaborations and Partnerships

Institute of Advanced Materials utilizes its decentralized facilities to stimulate global multi-lateral collaborations and partnerships among researchers and scientists from various areas. We create opportunities where scientists find their peers from across the world and connect with them over different R&D programs. Our decentralized facilities act as global interface centers and incubators for ideas to develop into products. By bringing varied expertise on one platform, Institute of Advanced Materials, IAAM's R&D World Links contribute significantly to promoting substantial advances in Translational Research and Innovations. We eliminate the need for researchers to get together every time an idea needs to be discussed. With our globally decentralized facilities, we are making it easier for scientists with similar objectives to connect and work together on a long-term basis for efficient multi-inter-trans disciplinary research programs.

Projects and Consortiums

Institute of Advanced Materials constitutes international consortia and projects for academic disciplines and business areas that hold potential to transform future.

- Flexible and Wearable Electronics
- AI-enabled Smart Healthcare
- Sustainable Battery Systems
- Energy Innovation and Technology
- Sustainable Materials
- Renewable Energy
- Portable Diagnostics & mHealth

Please contact us for enquiry & collaboration
E-mail: **research@iaam.se**

Training & Courses

Multidisciplinary Training Programs Focused on Advancements of Expertise

We stimulate education through intensive specialized courses meant for professionals at all stages

IAM offers a range of robust Training & Education programs to individuals and company resources in all stages of their professional careers. We offer adequate training programs with upgraded pedagogy, methods, and tools to help company and professionals upgrade in their professional journey. Our programs and collaborative teaching methods are jointly created by disciplinary experts with a focus on delivering sustainability related learning and education.

In line with our focus on Sustainability, our Training & Education programs offer resources, content, and training opportunities related to sustainability principles and education. IAM understands that there is a critical need for professionals to develop skills, talent, and motivation to work towards sustainability. Our programs are meant for policymakers, professionals, young researchers, students, and industry experts.

IAM offers continually evolving and customized sustainability education programs with carefully designed pedagogies. These programs are a method for IAM to break beyond conventional curriculum. We create interdisciplinary programs that combine multiple subject areas and subjects with a special focus on sustainability. These programs are designed and developed fundamentally to promote sustainability education and stimulate a deeper collaboration and partnerships among civil society, academia, and the economic structures of the nation.

The Programs

Our certificate courses help you to develop a better understanding of materials science, engineering, and technology and their extensive applications in health, energy, and environment. We offer topic-specific courses and training delivered through lecture series of multidisciplinary experts from academia and industry. The professionals, researchers, faculty, policy makers, and students can join our programs on the following topics.

- Biomedical Materials and Diagnostic Devices
- Graphene Materials and Sensors
- Advanced 2D Materials and Graphene
- Advanced Molecularly Imprinting Materials and Technology for Sensing
- Biosensors Nanotechnology and Nanomedicine Applications
- Advanced Bioelectronic Materials and Biomolecules
- Energy and Environmental Technologies of the Future
- Advanced Energy Materials and Renewable Sources
- Smart Materials and Interfaces
- Biotechnology and Sustainable Environment Management

Please contact us for enquiry & collaboration
E-mail: **education@iaam.se**

Partnerships for Grant Applications

Collaboration and Partnership for EU Projects

Institute of Advanced Materials is engaging in sustainable collaborations for EU projects funding. The Horizon Europe R&I strategy aligns with three of our crucial sectors (health, energy, environment). Therefore, we call for interest from those who want to engage in different sectors. We will jointly benefit from research topics, partnerships for consortia and international network.

The Network and Partnerships

Translational Research Innovation Cooperation (TRIC) Consortiums is our way to accelerate networks of cooperation to transform your research from TRL 3 to TRL 6. We have multidisciplinary experts' groups from more than 50 countries. The way to initiate building your project ideas further are by pitch session. This leads to participation in the future project calls, please join our TRIC Consortiums.

TRIC Consortium is developing opportunities towards projects, collaborations, partnerships, internationalization, career development for Translational Research. If you want to shape your idea and look for strong evidence-based partnerships, please join our world R&D links to apply for suitable grants of European Union, European Research Council - ERC, Marie Sklodowska-Curie Actions, M-era.Net, Vinnova and many more.

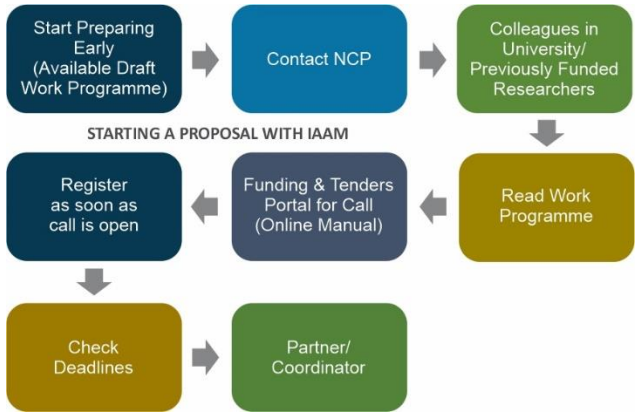
For more information, please visit consortium page, TRIC Consortiums and join following appropriate experts' group:

- Flexible and Wearable Electronics
- AI-Enabled Smart Healthcare
- Sustainable Battery Systems
- Energy Innovation and Technology
- Sustainable Materials
- Renewable Energy
- Portable Diagnostics & mHealth

In the TRIC meeting, our experts will support to define strategies for enhancement of your research, technology, and facilities.

Starting a Proposal with Us

IAAM is open to support your EU proposals, from writing the application to the completion of the project with its last report. Here it is crucial that you have identified your research topic that you want to grow to consortium and EU collaboration. Therefore, we advise to be agile and initiate the project as soon as possible.



Engaging IAAM for Proposal

IAAM is actively supporting its collaborators to forward a successful application, by screening project ideas, judiciously selecting the right call, rightfully fetching the right partners, and wisely helping the proposal. A brief application form and presentation are starting points. Collaborators are strongly encouraged to carefully follow the Horizon Europe Program and its application manuals.

Please contact us for partnership & collaboration at **research@iaam.se**

■ Net Zero and Waste Utility Alliances
■ Climate Neutrality Consortiums

AIMS

Transform sustainable business towards climate value chains

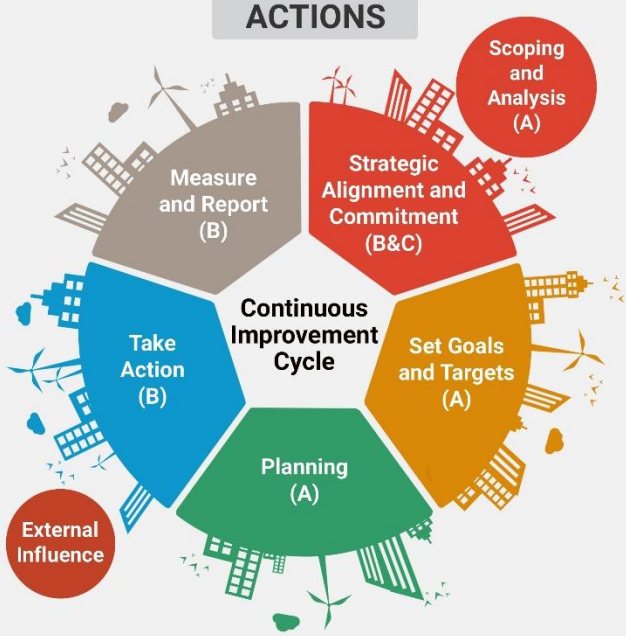
- Align organizational purpose, strategy and sustainable business models
- Set business goals and evidence-based targets, measure and report progress
- Embed net zero practices in operations and value chains
- Promote innovations and technologies for waste utility and pollution economy

Shape markets and operating context to transform sector and drive systemic net zero change

- Engage, collaborate and advocate for change across regions, sectors and markets

Promoting net zero industries, institutions, start-ups, and governments to set aspiring objectives that will drive the planet towards the climate neutrality.

ACTIONS



Please contact us for partnership and collaboration at
research@iaam.se

How to get involved with us?

Please contact us for collaboration and partnership with your innovation idea, pitch, and CV to our leaders:

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Build Innovation Capacity through Collaboration and Partnerships

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Translational Research Strategy, Field Trial and Commercialization

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R&D Projects Coordination, Innovation, IPR and Technology Management

The Emerging Global Trends in Hydrogen Energy Research for Achieving the Net Zero Goals

As the world is entering a phase of realization to mend ways to build a climate neutral, healthy, and sustainable environment all around and many prominent steps are taken to achieve the goal of net zero [**1,2**]. Advancement of materials used for energy and production purposes are being transformed and developed in ways which will ensure sustainable development without the harming of the ecology [**3**]. One such strong action brought is the use of hydrogen energy towards climate neutrality [**4**]. Hydrogen is now considered a very important product for aiming zero waste as it can make possible to remove fossil fuels usage and will play a very important role in the energy transformation of world to sustainable development goals [**5**]. It is very important to reduce the emission of carbon from industries and vehicles, and at the same time give a longer energy storage [**6**]. As the European Deal and the United Nations moves forward for attaining a net zero goals with introduction of clean hydrogen energy and its uses have been the showstopper for various conversions in various sectors which will ensure reaching the global sustainability [**7,8**].

The research in hydrogen energy is has become very popular since the past decades. From the search results of Scopus database with the keyword "hydrogen energy", above 15000 documents with 7000 patents are found (collected on 12 October 2021) [**9**]. If we go through the trend, we can find that the number published articles get steep increased from 2011 and reaches maximum in 2012, when 2261 articles were published. Then suddenly, there was steep fall, but after 2015, there is growing interest in the field (**Fig. 1**). This is mainly due to establishment of various hydrogen energy missions and policies for clean energy.

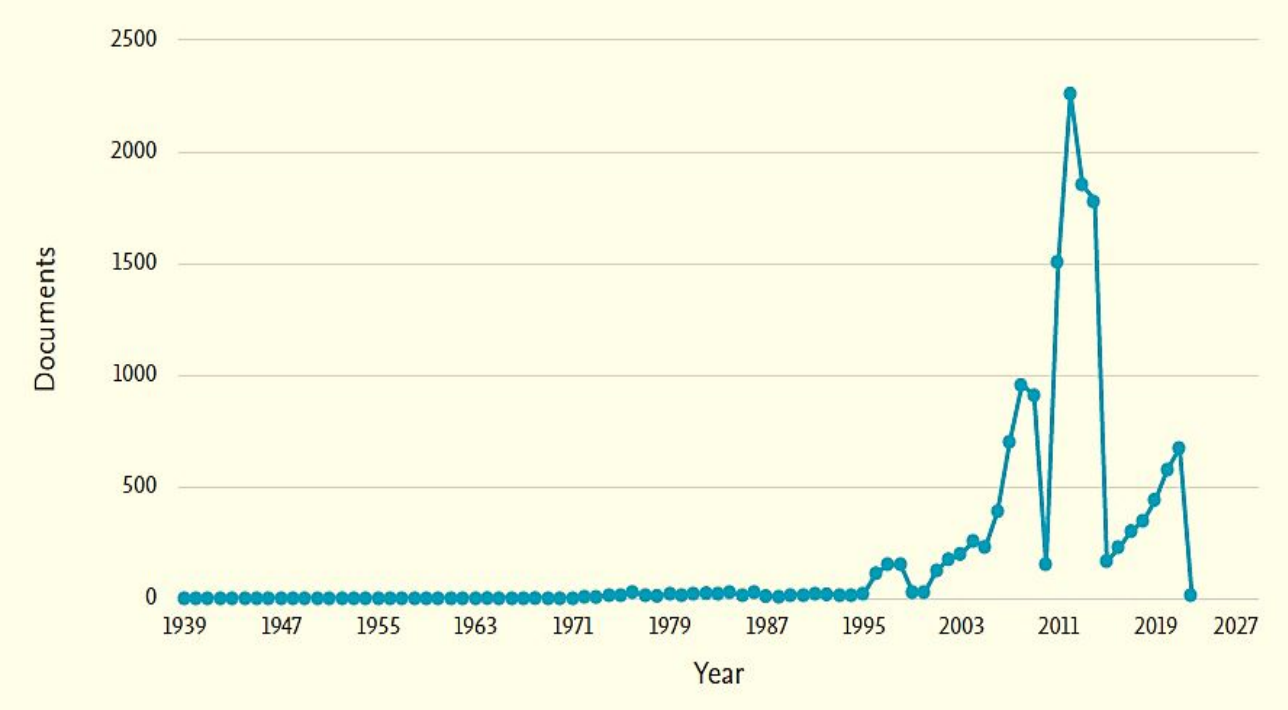

Fig. 1. Documents per year on keyword "hydrogen energy" indexed in the Scopus (collected on 07 October 2021).

Source Publication

Ashutosh, Tiwari; The Emerging Global Trends in Hydrogen Energy Research for Achieving the Net Zero Goals, *Adv. Mater. Lett.*, **2021**, 12, (10), 1-5. DOI: 10.5185/aml.2021.1666.

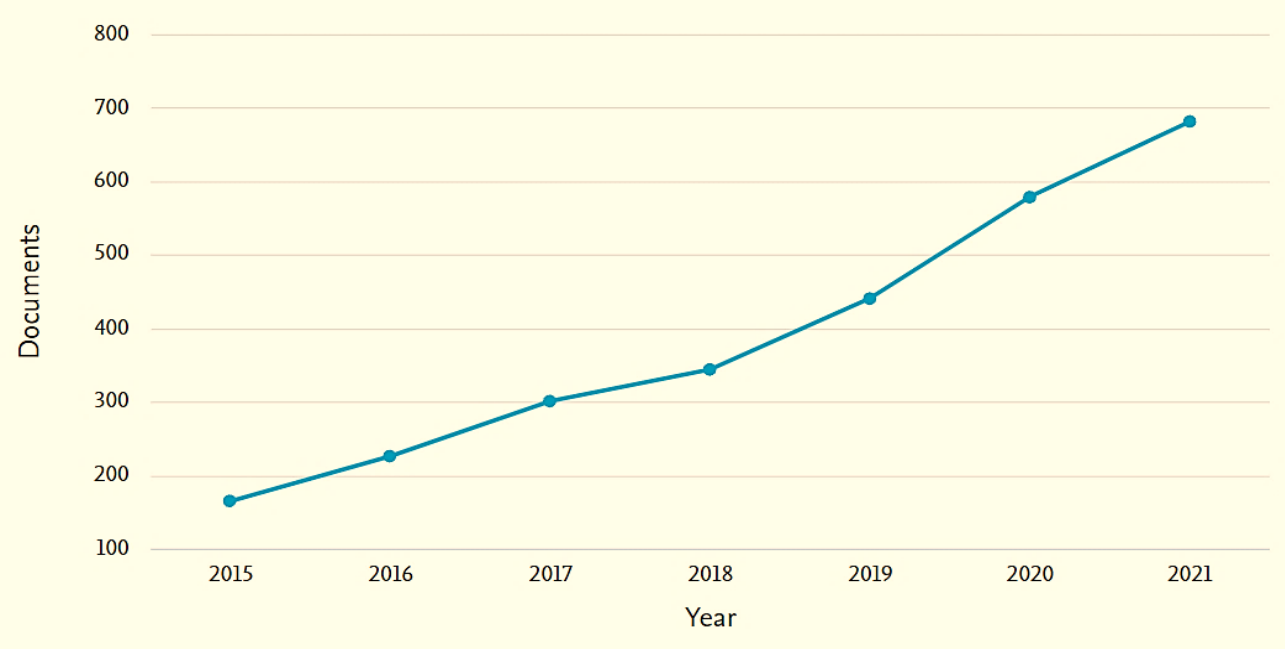

Fig. 2. Trend of documents published from the last 5 years on keyword "hydrogen energy" as indexed in the Scopus (collected on 07 October 2021).

Among the published articles, China is leading the race. Around 1250 articles have been published from China in the last 5-years. The 2nd position is taken by Japan with 234 articles, subsequently, 3rd ranked- USA with 195 articles, 4th ranked- India with 178 articles and 5th ranked- South Korea with 137 articles (**Fig. 3**). The Ministry of Education China, Chinese Academy of Sciences, Tsinghua University, Russian Academy of Sciences, University of Chinese Academy of Sciences and The University of Tokyo are the most popular affiliations can be found in the literature search (**Fig. 4**).

The green and/or renewable hydrogen constitutes the electrolysis of water powered by solar or wind. It has been mentioned in the European Deal in zero emission of green gas by 2050 [**4,10**]. Hydrogen energy can perform three things which are beneficial for reducing the green gas emission [**11**]. It is effective in replacing fossil fuels as a zero-carbon feedstock in chemicals and fuel production [**12**]. Renewable hydrogen has proved itself as an essential direction for the development of green and low-carbon energy in the future as the world leadership seeks to lower greenhouse gas emissions [**12**].

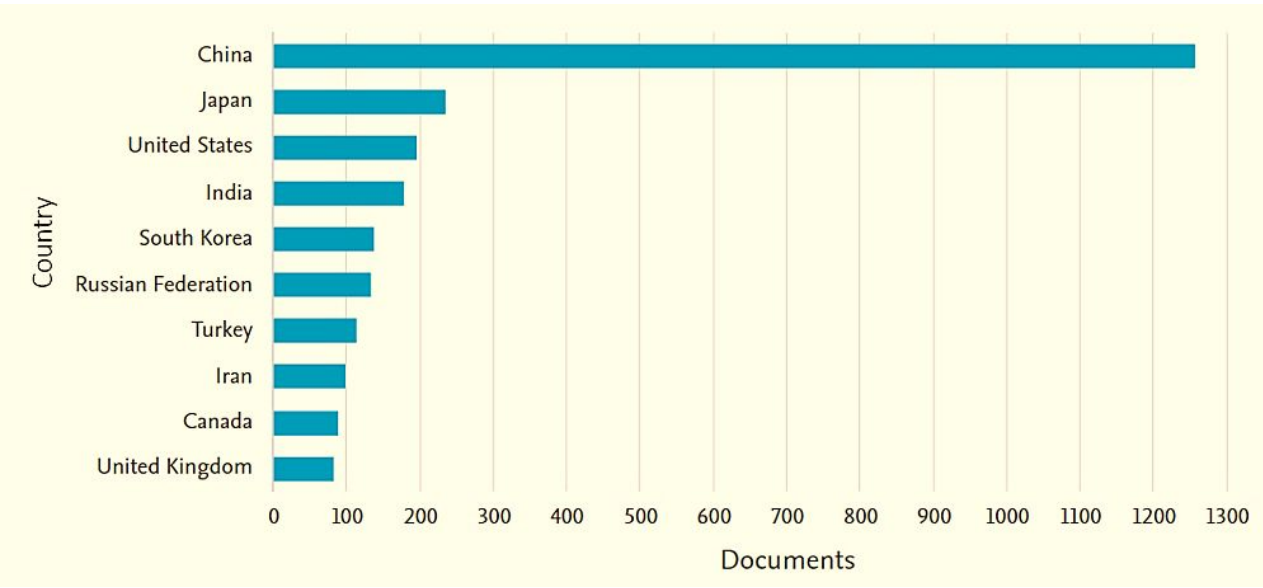

Fig. 3. Country-wise publication from the last 5 years on keyword "hydrogen energy" as indexed in the Scopus (collected on 07 October 2021).

The hydrogen energy is clean and storable with no tailpipe emission except water vapor after combustion [13]. It produces neither carbon dioxide. Hydrogen is an adaptable energy carrier which can be produced from a wide range of sources and can be used in many ways in the entire energy sector. Hydrogen proves itself as a good fuel in many cases. Its use for energy purposes does not cause greenhouse gas emissions [14]. It can also be used to produce other gases as well as liquid fuels. Existing infrastructure like gas transport and gas storage can be repurposed for hydrogen. On the basis of its properties, it has a higher density than batteries so can be used for long distance and heavy goods transport.

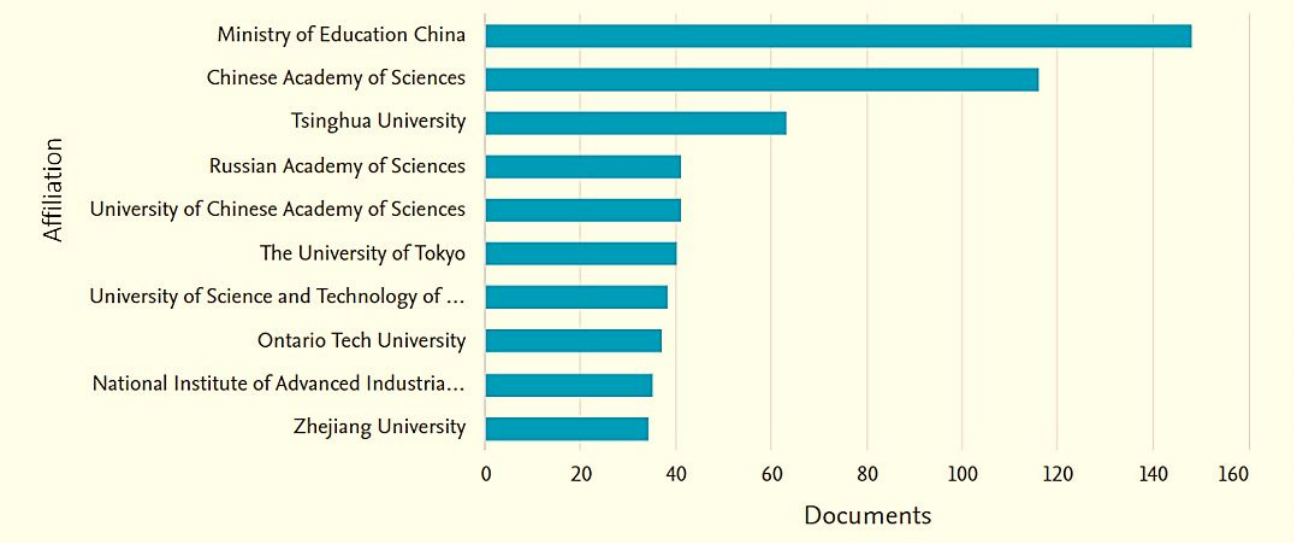

Fig. 4. Most popular affiliations from the last 5 years on hydrogen energy (collected from Scopus database on 07 October 2021).

The hydrogen produces neither carbon dioxide nor pollutants such as sulfur oxide and nitrogen oxide. Low carbon hydrogen can be a transition fuel which will avoid stranded assets and prepare the world to shift to a new way to deliver energy, which is environmentally friendly as well as economical [15]. If we analyze the popular authors in this field, we found that Prof. Kazunari Domen from Shinshu University, Japan published the most articles on hydrogen energy. The world top ranked author is followed by Prof. Ibrahim Dincer from Ontario Tech University, Canada; Prof. Takashi Hisatomi from Shinshu University, Japan; Prof. Tsutomu Minegishi from University of Tokyo, Japan; Prof. Masao Katayama from University of Tokyo, Japan; Muhammad Bilal Tahir from University of Gujrat and University of Sialkot, Gujrat, Pakistan, Prof. Tiejiang Yuan from Dalian University of Technology, China; Prof. Taro Yamada from University of Tokyo, Japan; Prof. Fatih Şen from Dumlupinar Üniversitesi, Turkey; Dr. J. Dufour from Instituto IMDEA Energía, Spain and so on (**Fig. 5**).

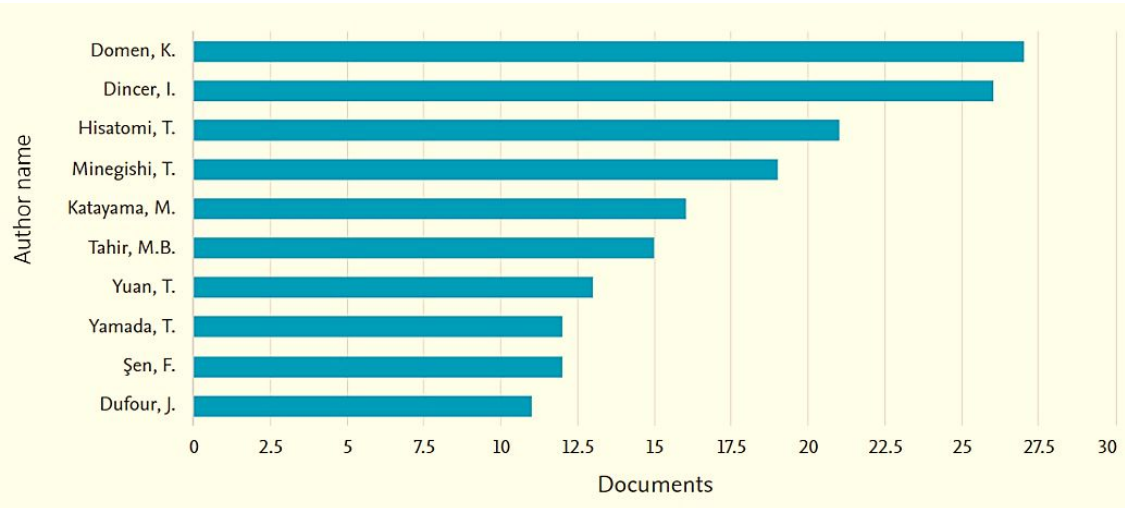

Fig. 5. Most popular authors published articles on the 'hydrogen energy' research from the last 5 years (collected from Scopus database on 07 October 2021).

Among the funding agencies, the National Natural Science Foundation of China has funded the greatest number of research and in top of the list with above 700 articles. If we look at the top five funding agencies, all of them are from China with National Natural Science Foundation of China, the others are Fundamental Research Funds for the Central Universities, Ministry of Education of the People's Republic of China, National Key Research and Development Program of China, Ministry of Science and Technology of the People's Republic of China (**Fig. 6**).

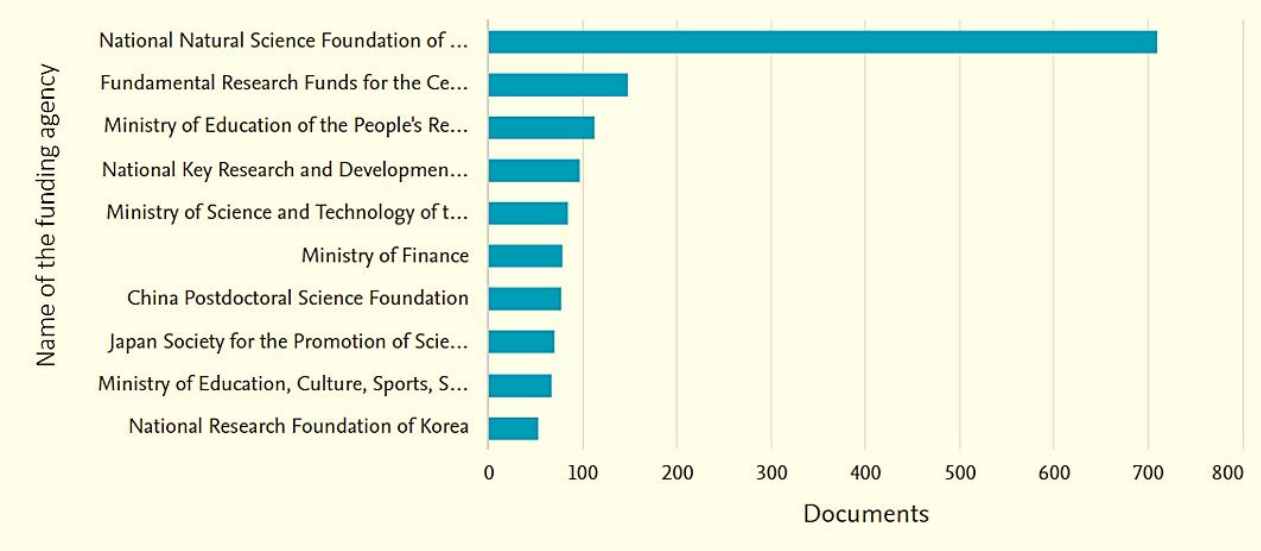

Fig. 6. Top funding agencies in last 5 years on hydrogen energy (collected from Scopus database on 07 October 2021).

The global leadership of all the advanced and developing countries are now focusing on the fact that clean hydrogen will play an important role in the saving of the environment and lower the emission of Green Gas and at the same time ensure a sustainable development all around [**16**]. The International Energy Agency of Europe acclaimed its high potential in its report on hydrogen in June 2019. Bloomberg New Energy Finance said clean hydrogen "can help address the toughest third of global greenhouse gas emissions by 2050" in March 2020 [**4**]. After the pandemic hydrogen economy has been termed as a priority for the European Deal's post-COVID-19 economic policies [**18**]. The European Green Deal has high emphasis on the use of clean hydrogen for achieving a climate neutral Europe by 2050 for which it has aimed for a 55% emission reduction target for 2030 [**19**]. The European Commission has embarked on ideas for using innovative energy carriers such as hydrogen, particularly coming from renewable electricity [**20**]. The People's Republic of China is also vouching for Renewable hydrogen as an essential direction for the development of green and low-carbon energy in the future and aims to lower greenhouse gas emissions [**21**]. Low carbon hydrogen is an important initiative right now for countries around the world. In 2020, the world's production of hydrogen was approximately 72 million tons [**22**]. The People's Republic of China produced about 20 million tons in 2019 [**21**]. One percent or less was renewable energy hydrogen with the remainder being hydrogen produced from fossil energy and from industrial by-products.

However, with all the plus points of hydrogen energy aiming for climate neutrality comes some limitations too [**23**]. It is very crucial on the entire process of how hydrogen is made which only can ensure its proper usage. Only the green' or 'renewable' hydrogen is made from the electrolysis of water powered by renewables will prove fruitful for the ultimate SDGs [**24**]. Clean hydrogen faces a paradox in its business case. Companies are reluctant to pay several times the price for a climate-friendly alternative in the form of green hydrogen. Most hydrogen energy still produces the carbon dioxide that contributes to climate change [**25**]. More than 95% of hydrogen energy is produced using fossil fuels containing carbon in all around the world.

As the world governance joins in a noble movement of achieving a climate neutral sustainable healthy environment for the future generation to come hydrogen energy is gaining maximum importance and its credits are worth settling for. Green hydrogen gives renewables a business case when the electricity cannot [**26**]. The hydrogen economy is an international project as cross-border cooperation can be seen in many countries like North Korea, Europe, North Africa, Middle East and even Australia and Chile [**4**]. The People's Republic of China's annual demand for hydrogen will reach 60 million tons by 2050 [**27**]. Japan has many important projects which includes Hydrogen usage [**28**]. Many countries including Australia, Saudi Arabia and Brunei are determining the best way to transport green or blue hydrogen over large distances by ship [**29**]. The Dutch government is aiming to broaden its low-carbon program [**30**]. These will all result

in the market-driven activation of blue hydrogen projects and, depending on the costs ii is hoped that green hydrogen projects in the near future will gain great momentum. France's own hydrogen strategy includes indicative targets for transformation of grey hydrogen to green hydrogen in industry which is only helpful in the saving of the environment [**31**]. The French government has set targets of usage of green hydrogen in industries to achieve the goals of sustainable development and clean and green environment. Germany also aims to organize combined auctions of offshore wind fields for electrolysis, which would imply connecting the value chain in one single tender [32]. The global garners up to bring hydrogen energy in the forefront with the aim of climate neutrality, a clean and net zero environment is definitely on the way.

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Transforming Energy Technologies for Climate Neutrality Goals

The world is facing major problems related to global warming, climate change, anthropogenic greenhouse gas emissions, and environmental degradation. They implicate a major worry to take immediate measures to rectify the ways and methods to build a clean world for the future generation to live blissfully. The technological revolution paves a way to combat the current terrible situation using numerous sustainable measures by the advancement of materials. The clean energy transition is mostly adopting in the transport and mobility sectors for reducing the emissions of vehicles. The present scenario of the global climate sets urgent needs to demonstrate country wise a long-term policy for clean, renewable, and net-zero waste power generation in line with climate neutrality goals.

European Green Deal and Paris Agreement

The range of climate policies have been taken up to ensure the reduction of the anthropogenic greenhouse gas emission which itself will help in climate neutrality being aimed by the organizations and countries. Climate change are an existential threat to counterbalance these challenges, the European Green Deal will transform the European Union into a strong economy by various strategies [**1, 2**]. The European Green Deal is set on the goal of changing the procedure of energy production and consumed to bring in sustainability for example to target cutting down greenhouse gas emission by 50% till 2030 and an inclusive climate neutrality by 2050 [**3**]. This ambitious project will create a very positive impact on the climate control in the European and neighboring regions. The European Commission also aims to reduce the dependence on fossil fuels by half of this decade.

The European Green Deal intends to reduce the dependency on oil and natural gas for energy requirement. Likewise, European Union (EU) has taken up the decarbonization of the EU energy system, which will benefit in attaining the goal of climate neutrality. The Paris Agreement is a historic agreement bringing all nations into a common cause and legally binding with international treaty on climate change [**4**]. Overall, it is helpful in a clean energy transition, means control greenhouse gas emissions and attaining carbon neutrality within targeted timeline [**4**].

The European Green Deal has also opened innovations, new investments, and job opportunities and at the same time plans at addressing issues like poverty, unemployment, tackling inequality and improvement of health and wellbeing in the society. Some of the main objectives aimed by the European Green Deal towards clean energy transition are integrated by building renewable energy resources. The European Green Deal have some major challenges to face such as reduction of fossil fuel demand, which is going to affect neighboring regions and oil and natural gas engulfs having a major part of exportation in the neighborhood's budgets. But this will be substantially compensated by diversifying its export product and market. For example, In October 2020, Russia has adopted hydrogen development scheme to substitute fossil fuel. Such national policy will also accelerate cleantech market for green investment.

Clean energy realisations and climate neutrality

Clean energy transition is one of the most important activity to be done which will help reduce greenhouse gas emission and give a healthy living planet to live (**Fig. 1**). The sustainable energy fulfils our requirement without compromising the requirements of future [**5**]. The European Commission promotes the growth of the market for zero- and low- emissions vehicles.

Moreover, adoption of common agreement on climate change through dominant countries representing 70 per cent of the world economy and more than 65 per cent of damaging greenhouse gasses have committed to accomplish net zero emissions by 2050. The global mission of carbon neutrality by middle of the century is taking shape with efforts of European goals and Paris Agreement [**4**]. The EU plan of climate neutral lies under the Paris Agreement and European Green Deal for fixed commitment of better environment [**2-6**].

Source Publication

Ashutosh Tiwari; Transforming Energy Technologies for Climate Neutrality Goals, *Adv. Mater. Lett.*, **2021**, 12(9), 1-5.
DOI: 10.5185/amlett.2021.091658

Fig. 1. Translation of clean energy technology to achieve climate neutrality goals.

Fig. 2 is listed the top 20 countries working in the clean energy R&D based on Scopus data taken on 4th September 2021. The major countries involved were China, USA, India, UK, Germany, Japan, Canada, Italy, Australia, South Korea, France, Spain, Iran, Malaysia, Turkey, Brazil, Saudi Arabia, Russian Federation, Netherlands, Saudi Arab and Taiwan.

The cleaning of the energy system is also aimed at by the European Green Deal for which it proposes to reconnect with exclusive integrated renewable energy technology. At the same time, it promotes for smart house schemes, buildings based on energy efficient utilization.

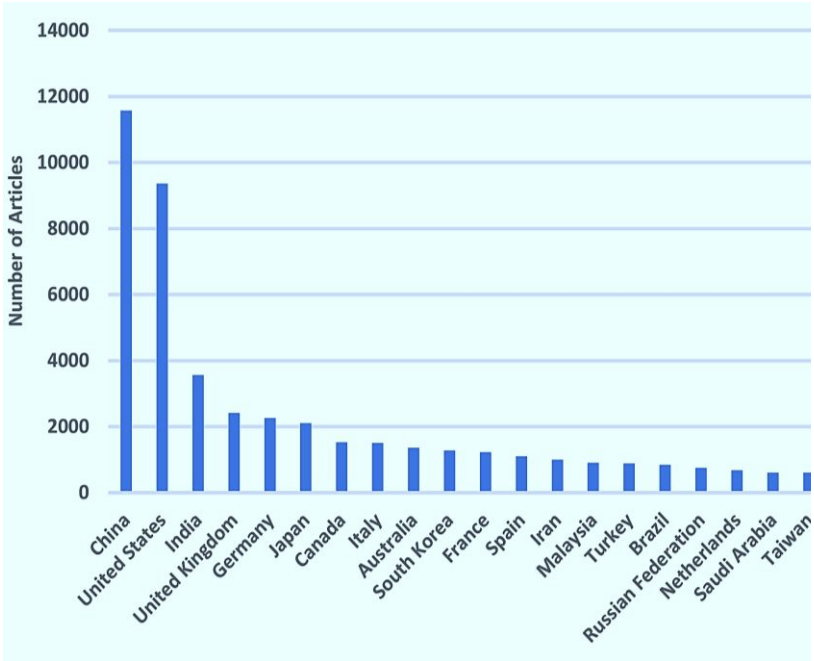

Fig. 2. Top 20 Countries in clean energy research items in Scopus at dated 4th September 2021.

Sustainable, secure, and cheaper energy system

Understanding impact of renewable energy (hydro, solar and wind power) for cost effective energy generation and adoptive policies for non-European countries allowing the world to shift properly towards sustainability goals. Study shows that extensive use of renewable energy effects in reduction of CO_2 emissions, while regional diversity exists across continent for energy research [**7**]. It indicates that both financial development and the renewable energy sectors in the Middle East and North Africa are still weak such as with respect to improvements in the environmental quality and economic growth [**8**]. On the other hand, sustainable economic growth in the ASEAN region is accomplished by moderating population growth with higher use of renewable energy [**9**]. It creates idea model having energy security with human growth as well as strong sustainable measures.

Hydrogen as a versatile energy carrier for various sectors and works as sustainable and secure paradigm [**10**]. We know, sustainable environment depends on a secure and cheaper climate neutral energy system. By adapting advance materials technologies in water, wind, solar, geothermal, bioenergy, hydrogen etc., we can move forward towards sustainable energy productions. European Union has proposed an efficient hydrogen strategy for the climate neutral Europe. This tactical roadmap offers a tangible policy outline in which the European Clean Hydrogen Alliance, European Battery Alliance (a teamwork among public authorities,

business, and municipal society) will develop a venture program and a pipeline of tangible plans [**11**]. Similarly, other countries like United States of America launched Department of Energy Hydrogen Program Plan [**12**]; China launched China Hydrogen Alliance, a government-supported industry group [**13**]; India launched National Hydrogen Mission [**14**], Japan builds a "hydrogen society" at the Summer Olympics [**15**] and other countries are also planning to utilize the hydrogen towards a climate neutral world. Energy innovations have created jobs, boosted economic and impact positively on green societal growth [**16**]. Gaining sustainability in energy sector needs more emphasize in transportation, manufacturing, buildings, and power grids fields, where innovation, digital integration and data analytics with government energy programs makes it reality before the time.

Energy efficient technologies and statistics

High Performance Computing, machine learning, sensor integration and data analytics technology with cloud system helpful in provide solutions for data processing and monitoring in clean energy. Advanced data management system in the energy sector including renewable and non-renewable contributes to performance, maintenance, distribution cost-effectively [**17,18**].

Science and technology in clean energy sector can be understand with **Fig. 3** in subject wise clean energy data. Engineering, environmental science, physics, chemical engineering, earth science, business, and management, etc. were on priority subjects in clean energy research. **Fig. 4** demonstrates various top resource journals publishing for literature and knowledge sharing.

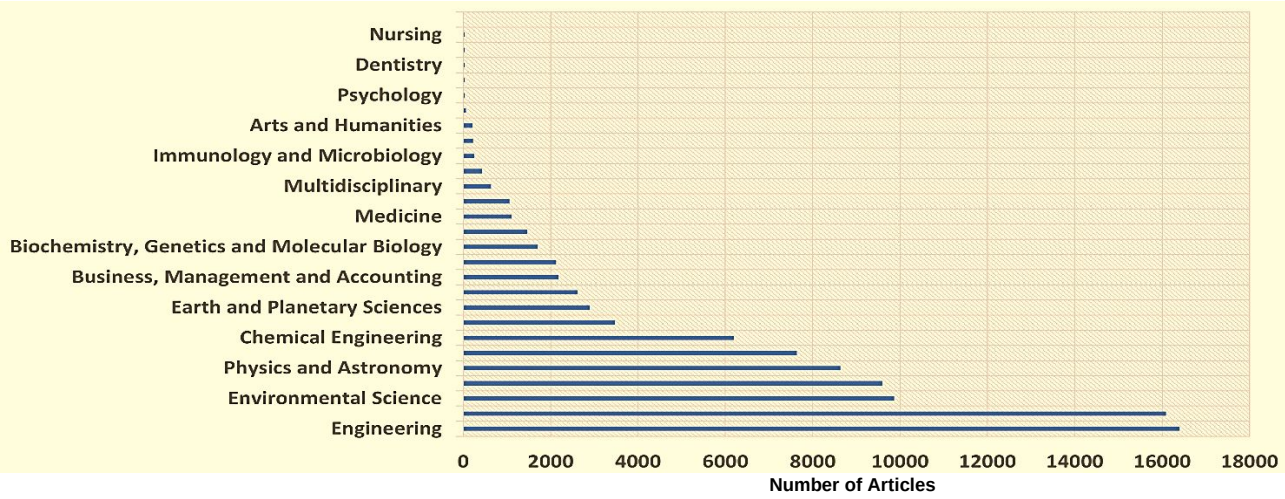

Fig. 3. Subject wise clean energy research items in Scopus at dated 4th September 2021.

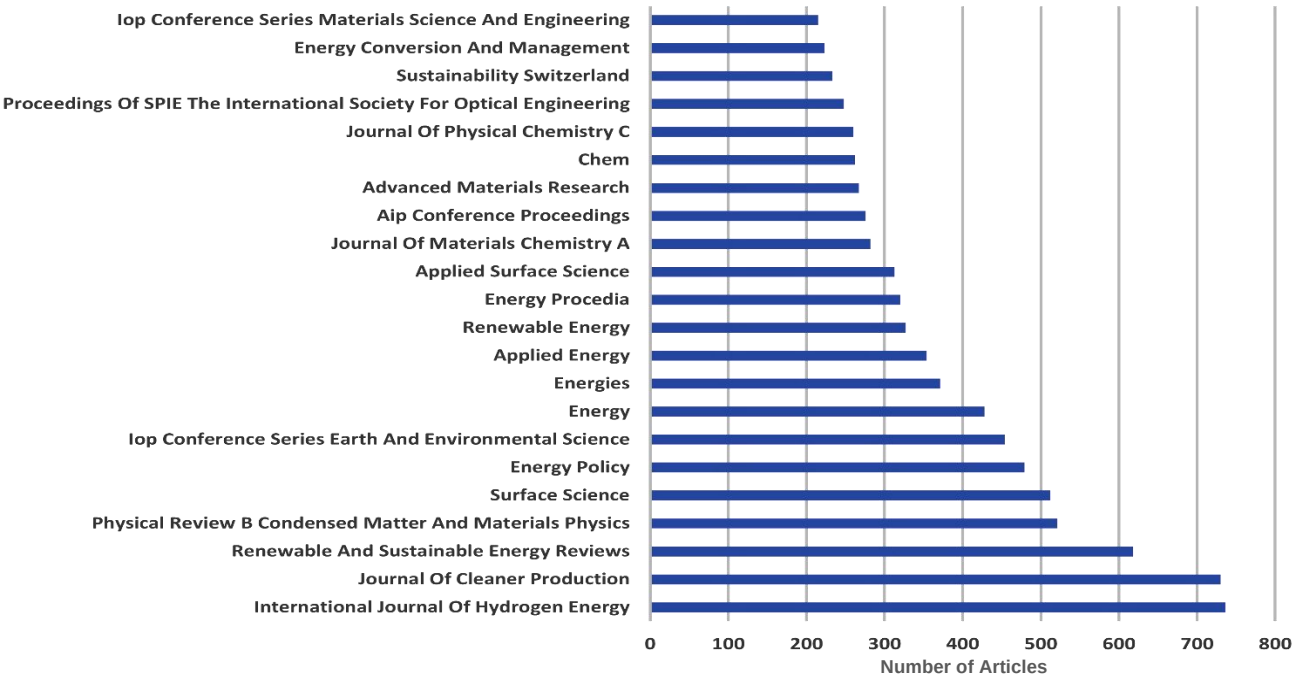

Fig. 4. Top resource journals having more than 200 Articles in clean energy research items in Scopus at dated 4th September 2021.

The energy production research with efficiency technologies integration and innovative move helps to take decision of investment and policies [**19**]. Renewable energy drivers impact through financial, policy and regulations. With the use of technology solutions customers can reduce costs, risks and contribute to carbon reduction goals [**20**]. The green technologies have role in job creation in renewable energy sectors, understandable by IRENA statistics on renewable energy capacity and power generation [**21**].

Organizational motives of attaining a climate neutral world

The various organizations from different countries and regions have independently set their goals to take forward the motive of making the environmental neutral practices. The International Energy Agency works for energy security climate change and air pollution, energy access and efficiency, and much more. Accurate and timely energy statistics required for making policies, planning etc. [**22**]. UNSD data analytics proposes energy statistics in four workstreams for better understanding of energy requirement and making strategies [**23**]. Understanding the European Union statistics on the renewable energy for four major i) electricity, ii) heating and iii) cooling, and iv) transport consumption sectors are meeting for making long term regional strategies and policies [**24**].

The United Nations, the European Commission, International Association of Advanced Materials (IAAM) and many other organizations are working towards the motive of attaining a climate neutral world with curtailing of greenhouse gas emission. IAAM has moved into the next decade by proclaiming 'Advancement of Materials to Sustainable and Green World' [**25, 26**]. This association is committed for Materials Research and Innovations to facilitate sustainable developmental needs by 2030.

The European Green Deal, the United Nations and the IAAM are working on the same line and for this they have adopted different set of proposals though syncing on achieving the healthier, sustainable, and clean planet. Under the EU countries intend to focus on five areas: (i) energy efficiency, (ii) renewables, (iii) greenhouse gas emissions reductions, (iv) interconnections, and (v) research and innovation. The EU seeks goals by 2030 in a fair, cost effective and competitive way.

The people realize that sustainable future is priorities with prioritised strategies of the zero waste, environment friendly and clean energy. The IAAM addressing the challenges of sustainability of materials research and innovation for climate neutral health, energy environment world R&D network [**27**]. **Fig. 5** showing the world top 25 organizations contributing to clean energy research and technology through their active performance.

One of the most important steps taken by the European Green Deal is to work with the nature for fighting against climate change by restoring forests, soils, wetlands, and peat lands. It becomes more resilient to climate change by improving health and wealth along with environmental balance. International transportation such as maritime and aviation should be more focused as well. In the latest development, the European Commission has adopted the first partnership agreement for 2021-2027 programming period to Greece, the first EU country to submit its strategic reference document for deploying more than 21 billion Euro of investments for its economic, social and territorial cohesion.

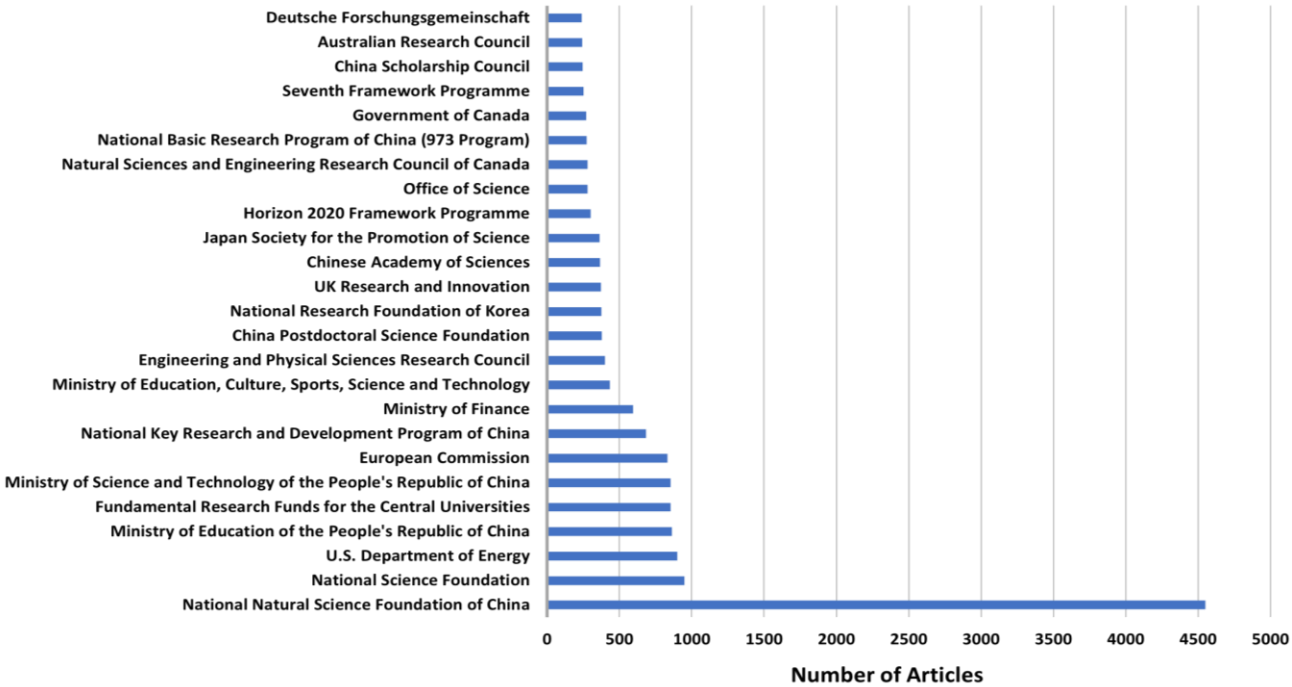

Fig. 5. Top 25 organizations contributing in Clean energy research and innovation items in Scopus at dated 4th September 2021.

Conclusion

The intending journey of the transforming energy technology for climate neutrality is a long term but it has achieved its initial milestones and looks forward to creating a better, healthy, and sustainable world. Realizing the United Nations' Sustainable Development Goals (SDGs) required excellence in materials via green synthesis, zero waste design, intelligent characteristics, and innovative applications. The objectives of climate neutrality inspire researchers to drive their efforts for contributing to the building a green and zero waste planet using sustainable energy technology. Overall, considering all facts, IAAM has committed to work with United Nations' SDGs and European Green Deal for the climate neutral new decade.

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Advancing Materials towards Climate Neutrality by 2050

In the new decade, International Association of Advanced Materials (IAAM) is committed with its 2030 agenda on "Advancement of Materials to Sustainable and Green World" working in line with the United Nations' (UN) Sustainable Development Goals. The IAAM also synchronizes its agenda with the action plans of European Green Deal which is aimed to making the Europe as climate neutral by 2050 for which they have taken a set of policy initiatives. The present scenario of the world climate shows that the climate change and the environmental degradation are a major cause of worry for the whole world and an immediate treatment into the situation is the utmost need of the hour.

The European Green Deal (EGD) aims at increasing the European Green Gas Emission reduction by 2030 to at least 50% [**1,2**]. It aims at economic growth being decoupled from resource consumption and no people or places are left out [**3,4**]. The major goals are aimed at three main objectives, and they are: (i) Economic Recovery, (ii) Poverty Eradication, and iii) Reduced Carbon Emission and Ecosystem Degradation [**5,6**]. International Association of Advanced Materials (IAAM) has been taking several initiatives to ensure advancing the materials for the achievement of the 'Sustainable and Green Goals'. Elimination of poverty, zero hunger, ensuring healthy lives, gender equality, quality education, affordable and clean energy, clean water, and sanitation are some of the set goals by IAAM where they are putting their best efforts to bring in the stakeholders and the academia together to work together for a better and healthy world [**7,8**]. IAAM has also been focusing on various green initiative to bringing the stakeholders from academia and industries together on its 'R&D World Links' and 'Project Consortiums' on green and recycle friendly materials to contribute for the sustainable society [**9,10**].

Likewise, climate change is the major problem that the whole world is facing now and the most important action that need to be taken up by any organization or any country revolves around the problem and how to solve it [**11,12**]. Advanced Materials and Nanotechnology have the synergy to make things organic as well as climate neural [**13**]. IAAM has been preferentially using advancement of materials as its preferential subject matter to deal extensively in mitigating climate change and other burning environmental issues [**14**]. The EGD has a definite action plan under which they aim to promote the efficient use of resources by switching to a clean circular economy and at the same time promote all possible measures to save the biodiversity and reduce pollution [**15**]. The EGD has tucked up various plans under its initiatives to reach its goals. It has set various strategic goals set in an entire timeline from 2019 till the date. It engulfs various fields like adoption of an EU industrial strategy to future proof the economy, adopting various strategies to make food systems more sustainable, chemical strategies for sustainability, zero emissions action plan and many more [**16,17**].

The EGD has taken under its wings various policies like biodiversity, from farm to fork, clean energy, sustainable agriculture, sustainable industry, etc. (**Fig. 1**) [**18,19**]. It would further need action in various sectors like supporting innovative industries, cleaner, cheaper, and healthier forms of private and public transport, decarbonization in the carbon sector and working with global associates to improve overall environmental guidelines [**20**]. The EGD is going a long way in bringing a revolutionary change in the entire climatic neutrality in Europe and will set a golden example for other countries to achieve the same [**21,22**]. From contributing financial and technical support to those most affected by the green transmission it has also been able to gain confidence among the commoners in setting the goals for a change that it required in the whole world now. With competence of green deal, IAAM has continuously been making attempts to establish active international networks on "Sustainable Research, Innovations and Technology" and has been arranging consortiums, training, innovations, and conferences to exchange 'green practices and protocols' at the global arena [**23**].

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A brief insight into the policies of Green Deal would give a clear view of how it is working in various fields to ensure its goals of 'zero net emission of greenhouse gases' and 'climate neutrality' are given below [**2,3**]:

Fig. 1. Action plans to promote the efficient use of resources by switching to a clean circular economy by adopting biodiversity and reduce pollution, and chemical strategies for sustainability and zero emissions.

- ***Biodiversity Strategy:*** It is a comprehensive, long term and ambitious project to protect nature and stop the destruction of the ecosystem. As a central part of the EGD, the strategy will also support a green recovery after the heavy destruction from the Covid 19 pandemic.
- ***From Farm to Fork:*** It aims at resolving the issue of food sustainability and ensure support to the producers i.e., the farmers and the fishermen.
- ***Sustainable Agriculture:*** The EGD aims to promote sustainable agriculture through the common agriculture policy (CAP), which will ensure Europe to be socially, economically, and environmentally sustainable.
- ***Clean Energy:*** Climate Neutrality is one of the main goals of the EGD to be attained by 2050 for which they have set a goal to decarbonize their energy system by aiming to achieve zero net emission of greenhouse gas by 2050.
- ***Sustainable Industry:*** The Industrial strategy aims to empower citizens, revitalize regions, which would be helpful in saving the environment and building a healthy atmosphere.
- ***Construction and Renovation:*** It focusses on the development of construction and restoration like increasing digitalization, weather proofing buildings, etc.
- ***Sustainable Mobility:*** It aims at the increase of implementation of sustainable and unconventional energies in road, air, and marine transport under one plan of "Single European Sky".
- ***Elimination of Pollutants:*** The "Zero Pollution Action Plan" aims to accomplish no pollution from every source like air, water, and soil.
- ***Climate:*** Climate Neutrality is one of the main goals of the EGD and all the plans and policies revolves around it to ensure a better environment and after the pandemic it seems to be the utmost need of the hour.

In the latest development of the EGD, the European Commission and European Industry are investing EUR 22 billion in new European partnerships to find major solutions to major societal problems [**24**].

To achieve the main aim of climate neutrality, IAAM has focused on bringing experts groups and technology alliances like sustainable materials, green innovations, translational research, and many more to focus Climate Neutrality. Moreover, UN has also described several policies that would not only encourage economic recovery but at the same time improve the sustainability of the world economy working towards attaining the main goal of climate neutrality [**25**].

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Transforming Paradigm of Artificial Intelligence for Scalable Clinical Healthcare

Artificial intelligence become useful technology with enormous capacity and performance. Although it's based on theoretical construct having extensive processing power for larger datasets. AI & machine learning algorithms strengthen the medical research and revolutionized the healthcare sector. In AI based system, prediction models are developed to identify key variables in any input datasets. Although, accuracy in the clinical healthcare is the major challenge for computer-based diagnosis and treatment process. Therefore, substantial improvement required for clinical identification due to risk associated with clinical complexity of the disease.

Numerous categories of AI utilized by customers and providers of care with functions consist of diagnosis, treatment recommendations, organizational actions, patient engagement and adherence [**1-3**]. Currently, use of the deep-learning technology, computing process and cloud storage with big data analytics enhanced the decision power in healthcare sector.

Convergence of Technologies

Revolutionize the healthcare ecosystem developed through several additional technologies such as Cloud, IOT, AI, big data & blockchain etc., which supplements building of electronic health records and services in easily pattern [**4-6**]. In medicine, AI impact at three levels: for clinicians by precise image understanding; for health practices, by enhancing workflow; and for patients, by allowing them to practice their own data [**7**]. Artificial Intelligence is steadily becoming a use-to technology in health care, from diagnosing to prediction performance. Some diseases such as cardiac, cancers and diabetes etc. found to be suitable for AI based technology due to clinical identification of patients accurately while, avoiding risk of critical care. How technologies and analytics can revolutionize the healthcare ecosystem, this can be understandable through market and business [**8,9**].

AI is Renovating Concept with Ascendable Offerings

Virtual technology allocates personal healthcare at next level through AI enable devices. AI is contest-transforming paradigm, where an intelligent device with information technology develop opportunity to profoundly change clinical medical science. AI tools deliver better healthcare related services with quality at mass level. Study shows that AI-based tools may enhance prognosis, diagnostics, and care planning, although risks should be tackled before its incorporation with regular clinical attention [**10**]. Several organizations involved in technical support to scale the healthcare field extensively. Cloud technology counterbalance deficit of medical expertise through building healthcare data [**4,5**]. Amazon based AWS presents the greatest set of machine learning facilities and aiding cloud infrastructure for the expert practitioner [**11**]. Google Cloud's goal for healthcare is universally accessible and useful system for healthcare management [**12**]. The roadmap to create zero distance between health infrastructure and patients ensured by adaptation of advanced technologies [**13,14**]. The quality healthcare depends on network of medical sensory devices, programmable nanotheragnostics to facilitate virtual and remote clinics [**15,16**]. AI transforming healthcare management with quality and quantity assurance comprehensively by healthcare data analytics. Assistance between the patient and the doctor in a caring environment beholds scalable via AI aided technologies. AI offers quality of care for patient during non-availability of resources through arranging information, consultation, analysis and cooperation among stakeholders.

Delivering Mass Healthcare with Socio-financial Attributes

Economical production needs for a more innovative switching to develop outcome-based commercial model. Study using a SWOT (strengths, weaknesses, opportunities, threats) analysis shows that AI involved in the acceleration of Sustainable Development Goal 3 (SDG3), to highlight socio-ethical implications [**17**]. Advanced healthcare device that tells us quick clinical

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Fig. 1. AI transforming healthcare management with quality and quantity assurance.

comparison such as real time organ function (heart in cardiac care), biochemicals monitoring of molecules (glucose in diabetic care) via digital electronics in a small setup is considered more useful today. AI based automation reduce labour demand and physical contact along with increasing productivity thus benefit broadly by growing inequality between employees and the holders of technology [**18**]. Medical devices can act as first line of testing through non-invasive method to save money. Although, such kind of devices not suitable for clinical decision in critical situation, however for mass healthcare monitoring its useful to segregate clinically ill and healthy subjects cost effectively. Later, clinically ill subject could move for laboratory-based disease specific invasive method examination. All such kind of integrated module-device with AI based functionality making monitoring of clinical features easy and cheaper. Several healthcare wearables (smartwatches, rings, bracelets etc.) used today as a fitness tracker. Such kind of devices able to handle mass healthcare issues such as epidemic or pandemic more easily. Recent COVID pandemic has risen the risk and increased the cost of healthcare services, as is especially noticeable in mass community.

Transformative Potential of Prognostic Decision in Substantial Dimensions

Artificial Intelligence based interpretation of the data; their analysis made available automatically. AI assisted image based state-of-the-art algorithms helpful in diagnostic judgment with precision. AI has played a decisive part in diagnosing diabetes and tuberculosis [**19**]. AI is helpful in expanding efforts towards sustainable development across the world (**Fig. 1**). The "virtual wards" supporting patients play key role in healthcare management [**20**]. Mobile technology, facilitating E-clinics and enable faster access to medical care [**21,22**].

- ***Implementation of Materials Modelling***

Improved algorithms and data manipulation methods helpful to develop theoretical and computational modelling to identify the geometry of a materials and related characteristics. Simulation perspective in different settings determine various interaction perspectives useful for nanomaterials.

- ***Nanotechnology and Imaging Realization***

AI can improve experimental imaging data accurately either in image or moving format. Identification of cancerous condition based on image analysis of histological data (cell type, shape and uniformity etc.) in real-time manner is one of diagnosis approach. Here, developed algorithm of machine learning spontaneously determines biological fate of disease.

- ***Pharmaceuticals, Device and Nanomedicine***

Discover point-of care device that connects the biology, information technology, nanotechnology and AI is being used efficiently for prognosis models. Technologies such as microfluidic channel, 3D printing and virtual simulations

used to develop diagnostic and sensors devices for precise targeting, identification and delivery systems.

Confronts with Indispensability

The part of AI in the advancement of a healthcare is perhaps more evident these than ever before. Robust technical accuracy for clinical evaluation is intuitive for patient care and required understanding of algorithmic bias, generalisability, improved machine learning predictions [**23**]. Although, artificial intelligence improves health services in resource-poor settings, however, require attention to ethical and legal issues including those related to data privacy [**24**]. Systematic literature analysis suggests more inclusive economic analyses to facilitate economic decisions for or against employing AI technology in health care [**25**]. In this article, we emphasize to adopt an AI technology in public health to create existential claims about sustainable healthcare environment even under burden. Smartphone impact through all-in-one healthcare delivery and indispensability of mobile hospitals enable faster access to healthcare [**26,27**]. To overcome a universal challenge of pandemic like condition, AI developed a competence in healthcare services through automation. Adequate information's are urgently needed for sustainable healthcare development, while AI potentially committed for secured future. Overall, AI based sustainable development is indispensable and vital for public health program.

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Advanced Materials Research and Innovation Priorities for Accomplishing the Sustainable Development Goals

Advanced Materials community has committed to work in line with the United Nations' Sustainable Development Goals (SDGs) for a green future. The International Association of Advanced Materials (IAAM) is stepped into the next decade by leading the 'Advancement of Materials to Sustainable and Green World'. The people understand that having a sustainable future should be the most important aim of humankind' priorities. With its accumulative sustainable development agenda, the association puts world-wide efforts with Materials Science, Engineering, and Technology across spheres of academia and industry towards potentially addressing the challenges of sustainability of materials research and innovation for a green world.

Role of Advanced Materials in Sustainable Development Goals

Advanced Materials are known to have the most improved popularity more in modern civilizations and considered as crucial element toward the economic growth and well-being of the society [**1**]. Advanced Materials have the probability to contribute to the Sustainable Development Goals in different ways. The fabrication of advanced materials has a particular ecological and social importance. Their use in modern-tech applications, healthcare, energy sector, environmental importance, transport & construction sector etc. reveals their important role for economic & sustainable development towards societal well-being. International Association of Advanced Materials (IAAM) has effectively taken several initiatives in this direction and hopes to contribute towards the accomplishment of these goals [**2**]. IAAM is dedicated to accelerating Materials Research and Innovations to facilitate resources and technology-gathering to address sustainable developmental needs [**3**].

Eliminate Poverty

The fields of Materials Science, Engineering and Technology are responsible for a fourth industrial revolution in which the world is witnessing how technology is merging digital, biological, chemical, and physical spheres of global human activities [**4**]. With this new industrial revolution, Advanced Materials are finding new and diverse range of applications across industries. Moreover, the enhancement that nanotechnology and materials research have made possible in Mining and Materials Extraction is widely known. As a result, it plays a vital role in creating wealth and prosperity globally and eliminating poverty, especially in the developing countries. IAAM plays its part to achieve this goal by creating a widespread awareness of Materials right at the grassroot levels and creating opportunities.

Zero Hunger

There are many ways in which Advanced Materials will help eliminate hunger. Materials Research leads to the formation of new materials which are at the core of development of new technology [**5**]. As a result, advances in Materials will lead to better protection for plants from infestations. It'll lead to improvement in equipment involved in the agriculture sector. The production of crops and the food distribution channels will see drastic enhancement. Moreover, nanotechnology can lead to better packaging of food and result in improving the shelf life of food products. An extended shelf life of food products will see the fortification of food and prove to be helpful in resource-deficient areas of the world. Overall, the nanotechnology applications on novel and advanced materials hold serious potential to facilitate technological advances that can help improve food security, supply, and production.

Ensuring Healthy Lives

Advanced Materials has abundant applications in the Healthcare sector and can help enormously in ensuring healthy lives for people around the world [**6**]. The advances in materials are facilitating progress for medical devices. With the help of new materials that have improved

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properties, the medical equipment and devices are functioning better and providing functionality that was believed to be impossible until very recently. It is the need of medicine industry that is driving the experts to engineer and create new materials. These new materials have better and enhanced physical, electrical, and chemical properties and stimulate innovation. Ceramics, Biomaterials, Composites, and Polymers are some of the many kinds of advanced materials being used for the enhancement of medical therapy, equipment, and devices. They have already resulted in innovations like implantable medical devices, forming new tissue parts, injectable gels, and many more. As a result, Advanced Materials will prove to be a key player in ensuring healthy human life globally.

Quality Education

Advanced Materials is a relatively new and constantly expanding line of scientific enquiry [**7**]. With the materials finding a wide range of applications in multiple industries and business spheres, there is a growing focus on Materials Research and Nanotechnology. As a result, there is a critical need to promote quality scientific education and train the next generation of materials scientists and professionals. IAAM runs several publication initiatives and international open access journals with an aim to make quality scientific education accessible. These initiatives work on the model of Diamond Open Access and allow people to access scientific literature for free. By doing so, IAAM ensures inclusive and equitable quality education for all.

Gender Equality

In today's age, Advanced Materials has become a critical field for the development of national economies. Yet, there is an imbalance when it comes to gender equality in this important industry [**8**]. Only less than 30% of the global R&D workforce is represented by women. Over the years, IAAM has constituted one of the largest networks of Materials' researchers, scientists, and professionals. The association works forward with without any discrimination and promotes gender equality in the Global Materials community.

Clean Water and Sanitation

Many recent developments in Advanced Materials have presented new approaches to deal with the challenges of water contamination and disinfection [**9**]. The field has shown great potential to help mankind satisfy the global demand of clean water. Nanofibrous membranes offer promising and improved efficiency in terms of purifying water. IAAM focuses on developing membrane materials and advancing technologies for water purification. In addition, IAAM congresses and events witness regular symposia on Clean Water Technologies. IAAM publications have also released full issues dedicated to use of advanced materials in water decontamination.

Affordable and Clean Energy

Advanced Materials are indispensable to fulfill the demand for clean energy and make possible a sustainable world [**10**]. Materials Science is facilitating the development of Photovoltaic materials and Thin Films to increase solar energy production and its efficiency. The turbines used in wind energy are also being made of polymer matrix composite materials. In the sphere of Geothermal Power, new materials technologies have become crucial for the success of Enhanced Geothermal Systems. With structural materials, advanced ceramics, and coatings for fuels, Advanced Materials can transform the Nuclear Energy sector as well and reduce the fuel consumption and greenhouse gas emissions in Fossil Energy. In addition, corrosion resistant coatings, Carbon Fiber Composites, Phase Change materials, and Optical Metamaterials are bound to play an important role in efficient energy transportation, storage, and buildings. IAAM works on the translation of new materials and collaborate with businesses and experts from the energy sector to make possible a sustainable future with clean energy.

Decent Work and Economic Growth

Materials Research and Development is a wide set of science & engineering disciplines that engages and employs researchers and professionals across industry, academia, and government labs [**11**]. Advanced materials and materials research is hugely responsible for technological advances that we need for energy, defense, IT, national security, consumer products, telecommunications, healthcare, and many more. The advances in the manufacturing techniques for these products give the global economy the required boost. Advanced Materials is at the heart of commercial products today. From computer circuits to military planes, they are everywhere and thus support economic growth of countries. IAAM takes cognizance of this and utilizes its research to advance the field of materials science and support economic growth.

Industry, Innovation, and Infrastructure

Materials are responsible for innumerable valuable innovations around us [**12**]. The advanced materials are used in everything from automobiles to the lasers used by Physicists. Moreover, these resources have become significantly relied upon and used in industries like automotive, aerospace, electronics, metals, energy, healthcare, telecommunications, chemical, and many more. With applications in so many industries, Materials Science and Engineering are making contribute to the economy and a nation's infrastructure. IAAM organizes consortium and symposia dedicated to bringing stakeholders from business and academia together. This leads to collaborations and improved business innovation.

Reduce Inequalities

Advanced Materials has led to innovations across industries and is facilitating the enhancement of economies and creation of jobs. Thus, the field of materials science and engineering is leading to reduced inequalities among people. International Association of Advanced Materials works with the same vision and utilizes science, engineering, and technology to reduce inequalities. With the aim to make knowledge accessible to all, IAAM runs Open Access journals that allow people to access important scientific literature and knowledge free of cost. We have also taken our flagship international networking, the Advanced Materials Congress to multiple continents, including Europe, Asia, Australia, and America with an aim to reduce inequalities in terms of scientific exchanges and find partnerships.

Sustainable Cities and Communities

With sub areas like structural materials, construction materials, lightweight cementious composites, and many more, Materials Science holds huge potential to help mankind realize the dream of sustainable buildings, and eventually cities [**13**]. Shape memory alloys, piezoelectric and magneto strictive smart materials are extremely important for developing smart cities. In addition to this, materials science has enabled efficient use of energy-intensive materials, retention of materials that are indispensable for modern technology. Moreover, by making possible the mitigation of corrosion and enhancing the processes of the Energy sector, advanced materials have made sustainability an achievable reality. IAAM has focused its research networks and consortiums on formulating recycle-friendly materials and green materials to contribute to building sustainable cities and communities.

Responsible Consumption and Production

Efficiency of processes is directly related to the consumption of resources. Advanced Materials have resulted in significant enhancement in the efficiency of energy production from fossil fuels [**14**]. Coal Power plants have reported improvement in efficiency by up to 42% with the use of new power plants. Development of advanced coatings has also led to reduced fuel consumptions. In other areas as well, advanced materials are responsible for the efficient consumption of resources. With the advent of advanced rubber composites, the life of tires has increased, and tremendous advancements have been made in energy efficiency because of low emissivity windows and green insulation materials. IAAM's work on the development of green materials, structural materials and collaborations with Energy experts is dedicated to reducing the consumption of natural resources. Our open access publication initiatives are also dedicated to aware people regarding their responsibility towards sustainability.

Climate Action

Climate change is perhaps the biggest problem that mankind faces in the 21st century. Advanced Materials and Nanotechnology are powerful tools that can help us tackle this impending global disaster [**15**]. Light-weight nanocomposite materials can reduce the weight of commercial vehicles which can result in a reduced fuel consumption. The nano-coatings have proven to be the best tool to reduce emissions and increase clean energy production. Moreover, nano-structured materials, like aerogels, can lead to reduction in heat transfer through building elements and also significantly reduce loads on heating systems. IAAM has taken cognizance of the role that nanotechnology can play to mitigate climate change and dedicates its research activities to the same.

Life below water

Aquatic and Marine pollution is another huge problem that the world faces as the seas are home to innumerable organisms and source of protein for 3 billion people. The advanced materials have made possible technological progresses to mitigate marine pollution as well. With green submarine cables possible now, the ocean floor can be monitored like never before. Also, designing and synthesis of carbon materials can lead to detection and removal of dyes, pharmaceuticals, and heavy metals from the ocean water. IAAM is focused with its international research networks and consortiums on the need to conserve different spheres of the environment, including the aquatic life. The association works with Materials research towards the same.

Life on Land

Materials Science and Engineering has effectively enhanced the efficiency of processes in various industries including Energy and Environment. Since these two industries are linked to the utilization of natural resources, Materials Engineering plays a significant role in the sustainable use of terrestrial ecosystems. By reducing the use of fossil fuels, advanced materials are contributing heavily to environment conservation. IAAM's work with Materials Science, Engineering, and Technology spans across the industries of Energy and Environment. Our research is dedicated to developing and synthesizing green materials and recyclable materials as well.

Peace, Justice, and Strong Institutions

Materials science, and by extension the whole scientific sector, is a major part of national economies. Thus, it impacts the level of prosperity in society in a major way. Materials science and its advancements is leading to new and innovative technological advents, which eventually boost the economy and make for a prosperous society. A prosperous society is where peace prevails, and strong institutions can be established. International Association of Advanced Materials works forward with the aim to advance

materials science and engineering and contribute to a society where everyone gets justice.

Partnerships for the Goals

There is a need for partnerships and collaborations to effectively achieve the dream of global sustainability. Materials Science has been a field that has enabled partnerships across business sectors, academia, and industries. Advanced Materials has effectively led to the amalgamation of technology experts with researchers. IAAM organizes consortiums and conferences that are aimed at creating an environment of high-end collaborations between the global leaders from academia and industry. The association has facilitated the IAAM Fellow Summit which will be an exclusive forum for the most accomplished global researchers, scientists, policy makers and representatives from government authorities [**16**]. This prestigious international forum will allow for discussions among the best minds of the world as to how the field of Advanced Materials can be utilized to achieve the goal of UN' Sustainable Development Global 2030 [**17**].

Advanced Materials' Support to SDGs

Although the Sustainable Development Goals do not outline a specific role for Advanced Materials, these resources are particularly important for the proper and effective implementation of the SDGs. In the modern world, Advanced Materials have already started becoming an indispensable part across industries and all sectors of the economy. With the use of newly developed advanced materials that are highly functional, effective businesses across industries have begun improving their processes and manufacturing methods. This rising implementation of advanced materials in areas like manufacturing processes across healthcare, energy, environment, and many more has led them to be incredibly useful and essential for achieving the Sustainable Development Goals laid down by the United Nations.

Materials' Flagship

IAAM utilizes its international researchers' networks to create interdisciplinary worldwide consortiums and experts' group on specific kinds of Materials Research and Technology that are focused on taking forward the agenda of sustainability [**18**]. These topical consortiums create opportunities for researchers, engineers, students, and professionals to discuss the formulation of novel kinds of workable advances to create new technologies and support the UN Sustainable Development Goals.

The IAAM' consortiums are extremely specific to themes that are indispensable to Global Sustainability [**19**]. From reducing carbon emissions to improving the functioning of the Energy sector to enhancing the quality of healthcare, Advanced Materials and Nanotechnology have applications in a wide range of important areas. The IAAM topical consortiums explore all these areas from the lens of Materials Research and generate novel ideas and solutions.

IAAM hosts its leading materials research and innovation hub, the Advanced Materials for all, in the unprecedented and unique format of 'Knowledge Experience for social change' [**20**]. This one-of-a-kind prestigious materials network puts together policymakers, entrepreneurs, researchers, and professionals from academia and industry and leverages their expertise to devise ideas for how advanced materials can be used to contribute to Global Sustainability.

IAAM is organizing the regular IAAM Fellow Summit is to develop action plans for 2030 sustainable development objectives, "Advancement of Materials to Sustainable and Green World" [**16**]. This summit will analyse how advanced materials contribute to the sustainable development goals and will be based on construction of action plans with expert opinion (**Fig. 1**). Furthermore, the summit will compare the indicators of the sustainable development goals framework and will discuss the challenges on achieving the results for end-users.

Fig. 1. IAAM organizes the regular IAAM Fellow Summit to develop action plans for 2030 sustainable development objectives, "Advancement of Materials to Sustainable and Green World".

Fig. 2. The IAAM' sustainability agendas and cooperation initiatives bring together policymakers, global scientific leaders, researchers and business colleagues to map out the path to propagate the idea of ownership of the waste lying with the creator of the product to minimize waste production for sustainable future.

R&D World Links

International Association of Advanced Materials makes efforts to create an international network on 'Sustainable Materials Research and Innovations' and offers a wide range of cooperation like High-end- expert consortiums, Research & Development, Industrial Training, Technology Transfer, Innovations, and events to exchange sustainable processes at the global arena (**Fig. 2**) [**21,22**].

The Translational and Materials innovation is focused on enhancing new methods and technologies in materials sustainability for health, energy, and environment [**23**]. For making changes that matter to sustainable research, researchers may join the activities of International Association of Advanced Materials. Our efforts include:

- Constitutes consortia for academic disciplines and business areas that hold potential to transform the future markets [**24**].
- Create decentralized multidisciplinary research projects beyond geographical outreach through engagement of world-wide joint/network labs and experts [**25**].
- Finding solutions to problems, by providing the right network and strategies in the sectors of energy, environment, health, & many more [**26**].
- Coordinates translational projects and prototype products to translational from research stage to TRL 6 or above to ensure that we create the optimum financial value out of your technology and research [**27**].
- Provides innovative solutions and analytical strategies to ensure your compliance with internationally accepted United Nation Agenda of green practices through eco-friendly innovation [**28**].
- To sign Memorandum of Understanding (MoU) for actively working in Translational Research Cooperation's, Joint Research Program, Educational Activity and Joint Supervision of PhD and Master Students, etc.

In this new decade, IAAM has included Global sustainability as one of the primary agendas and topics of discussion in all its cooperation initiatives. The initiatives are focused on bringing to focus specific areas like Sustainable Materials, Green Innovations, Translational Research, and many more. They bring together policymakers, global scientific leaders, and

researchers to map out the path for global sustainable development. The association is also making efforts to propagate the idea of ownership of the waste lying with the creator of the product in order to minimize waste production. The European Commission sets the research and innovation priorities under Horizon Europe for the next four years with strategic orientations of a sustainable future [**29**].

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Advanced Materials and Convergence Technologies for Sustainable COVID-19 Healthcare Model

COVID-19 risk spread rapidly with several clinical manifestation and public health challenges. Research and innovation in advanced materials should be focused on solving critical problems associated with diagnosis, treatment and control models. Important challenges of COVID-19 public health system indicated to need of solutions based on cost, quality and universal availability in sustainable model. Standard healthcare models can be achieved by advanced technology of Artificial intelligence, IoT, Database analytics and advanced materials more effectively for mass community. Next-generation ("smart") materials have capacity to contribute in theranostics models in better way with high accuracy in terms of performance and reliability. In summary, engineered nanoparticles and advanced technologies have translational potential. Being public health professionals, technologist and materials researchers involved in the prognosis research should develop certain priorities for the society.

In humans, COVID-19 risk spread rapidly with several clinical manifestation and public health challenges. On the basis of spread and severity, WHO characterized the COVID-19 situation as a pandemic [**1,2**]. Research and innovation in advanced materials in this prime time of COVID-19 pandemic should be focused on solving critical problems associated with diagnosis, treatment and control models. Most specifically stopping transmission and targeted drug therapy is major filed where materials researchers aims lie. Advanced technologies represent Nanomaterials more effectively in healthcare, for diagnosis and therapy [**3**]. The flexibility and compatibility of nano materials including quantum dots, graphene, silicon carbide (SiC) and carbon nanotubes etc.) and nanotechnology in public healthcare models, helps in its adoptability for medicine and industrial development [**3-6**]. The materials modified for the biosensor and bioelectronics field for better and unique performance in healthcare [**7-9**]. Technology make bridges between biological systems and electronic devices to monitor and control biological processes [**8**]. Therapeutic functional nanomaterials with combination of electronics demonstrates unconventional diagnostics capabilities [**10**]. Advanced technologies helpful to utilized materials in form of flexible battery, 3D integrated circuit, smart glass, biochips and G. fast chipset etc. for futuristic healthcare technologies [**11**].

The far-reaching implications of sustainable public healthcare models have so far been largely overlooked due to limitation in knowledge and resources at bottom level. Important challenges of COVID-19 public health system indicated to need of solutions for the diagnosis and treatment segment mostly for cost, quality and universal availability in sustainable model.

Sustainable healthcare model

Standard healthcare models can be achieved by advanced technology of Artificial intelligence, IoT, Database analytics and advanced materials more effectively for mass community [**12**]. The main agenda of standard and sustainable public health model is to understand and develop materials science and technology for different applications thus, realized that significantly different properties provide roadmap for nano-materials utilization and sensing mechanism for effective prognosis. Sustainability in advanced materials will always support any integration, which by conventional means connect materials to healthcare prognosis technologies by maintaining its characteristics at high efficiency. Integration of advanced technologies in materials field is most challenging in present time of COVID-19 pandemic, where difficulties in verifying their reliability, functionality and effectiveness judged. The efforts to build Sustainable healthcare model should take into account both what is available and what is required to control disease burden. **Fig. 1** described about sustainable healthcare model for standard healthcare practices.

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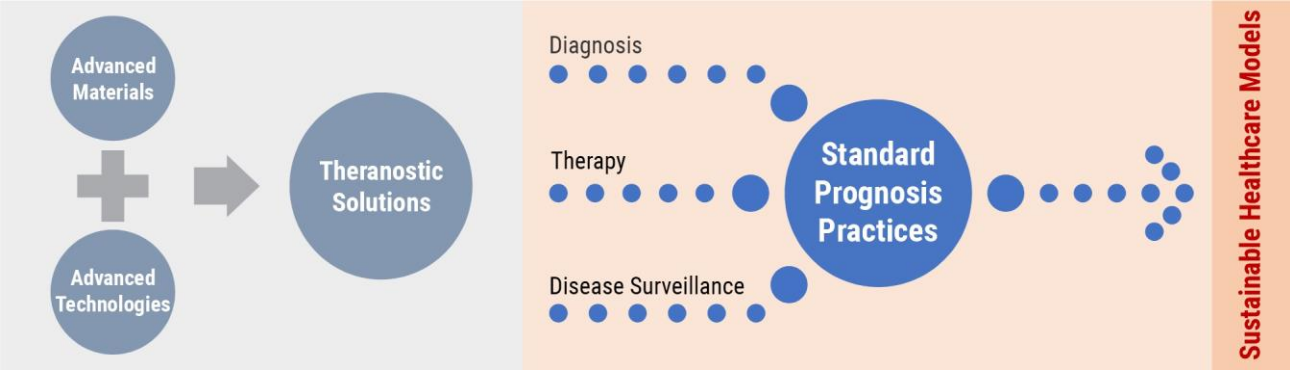

Fig. 1. Sustainable healthcare model for standard infectious diseases and healthcare practices.

Smart materials selection

Next-generation ("smart") materials have capacity to contribute in targeted diagnosis and treatment in better way with high accuracy in terms of performance and reliability [**10,11**]. While utilization of biomolecules (proteins, nucleic acids, and carbohydrates et.) for recognition and interaction with other bio components or biomolecules that are expressed in disease cells is helpful to make strategies for prognosis. Construction of quantum dots, nanoparticles, and 2D material platforms decorated with biological components such as antibodies, peptides, nucleic acid aptamers, carbohydrates, and folic acid are used extensively for prognosis model. The potential therapeutic candidates and materials bears potential mechanisms of action on COVID-19 [**13,14**]. Functional candidates and materials can be used for targeted therapy for COVID-19 upon validation and authorization. Further, materials engineering develop prototype and technologies based on streamline design and performance will be improved further with new materials to make better technologies with higher confidence in their properties.

Improvement in technologies

Advanced technologies are related to processing, optimization, manufacturing, refining methods will yield improved performance of healthcare products at lower cost. The emergence of artificial intelligence (AI) and its progressively wider impact on many sectors requires an assessment of its effect on the achievement of the Sustainable Development Goals [**12**]. Cloud healthcare and AI have major impact of healthcare practices, while handling large community [**15**]. The primary skills with the design, implementation, and evaluation of an AI enabled healthcare systems revealed the importance of data science. In **Fig. 2**, processes for creating, implementing, and evaluating an AI enabled system for healthcare has been presented. Most importantly, opportunities of better technologies lie in fabrication, integration, and designing of

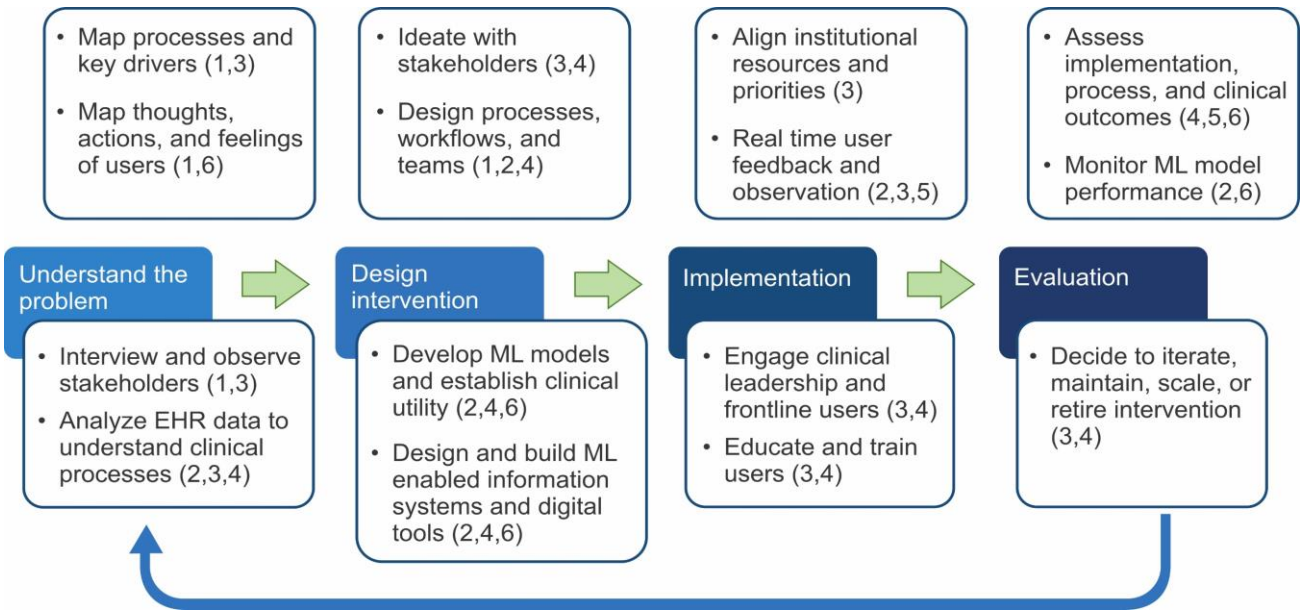

Fig. 2. Multidisciplinary process for creating, implementing, and evaluating an AI enabled system for healthcare (Adapted from [**15**]).

materials for various healthcare developmental projects under one roof.

On the other hand, surveillance for monitoring and understanding disease progress in region and population is must for making control strategies. Disease surveillance uses information-based technologies for the collection, analysis and interpretation of epidemiology data sets to evaluate the preventative health measures. Potential of disease surveillance helpful in early identification of the emergence of diseases outbreaks, which is further critical to the generation of timely responses [**16**].

Overall, improved and compatible technologies along with advanced materials research can better address public health challenges for mass healthcare.

Theranostic solutions

A theranostic agent is one which serves both diagnostic and therapeutic functions, a capability which will have obvious clinical advantages [**17**]. The theranostics, strategies are helpful in incorporating biomolecules with advanced materials via sensor-based technologies (image, light, sound or signal etc.) and used in diagnosis and therapy. Theranostic nanomedicines have promising intrinsic ability to confer imaging that may yield pharmacokinetic and biodistribution information for the presence of the exact molecular target before, during, and after therapy [**18**]. Multidisciplinary basic research with materials science, pharmacology, nanotechnology, medicine, biology, computational, IT, neuroscience and diversified expertise helps to frame personalized medicines for a broad range of diseases [**17-19**]. Finally, theranostic technologies have enormous potential to enhance current healthcare practices and contribute more in futuristic solutions.

Practical implications

Being public health professionals, technologist and materials researchers involved in the diagnosis and treatment research should develop certain priorities for the society. Since sustainable healthcare model for mass healthcare practices mainly drive by smart materials, advanced technologies [**16,19-24**]. So, designed and development of expanding materials field keep pace with advancement in technologies with in information technologies, cloud healthcare, digital medicine and artificial intelligence for theranostic and disease surveillance services of COVID-19. Engagement in training and development of healthcare products against pathogenic information's for the safety of the society is logical shift in pandemic era.

Conclusion

In summary, engineered nanoparticles and advanced technologies have translational potential. The hope is that these strategies can persuade and advise those that are interested in the advanced materials field of healthcare to rationally design and develop prognosis models.

Keywords

Advanced materials, prognosis, artificial intelligence, theranostic technologies, COVID-19 pandemic.

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Current Scenario of Coronavirus Pandemic

World Health Organization (WHO) is concerned about the pandemic of Coronavirus (COVID-19) and controls its spreading at the high end. The International Association of Advanced Materials (IAAM) intends to provide forum for high-tech healthcare. In the current scenario, IAAM called amulti-lateral consortium to developed medical technology to control the spreading of COVID-19 with the help of the interdisciplinary experts from multiple countries. This innovation is perpetuated to create multi-lateral cooperation in the area of 'healthcare innovation and technology'. Adaptation of advanced technologies and their logical integration according to contemporary healthcare measures could be a smart strategy for epidemic management activities. Establishing an advanced phenotype model for prognosis is an important step in the prevention of infectious disease management such as COVID-19. This article has overviewed the global situation, efforts, and prospective of coronavirus pandemic.

Introduction

The worldwide threat of Coronaviruses (CoV) based epidemics and the latest outbreak in China created several complications in current healthcare practices in terms of prognosis and prevention. CoV have been, characterized by enveloped non-segmented positive-sense RNA viruses, which belong to the family Coronaviridae and the order Nidovirales, identified since the 1960's as a human pathogen [**1**]. The CoV pathogens are common in many different types of animals including camels, cats, cows, bats, horse, and human. In humans, till now seven types of coronaviruses have been reported, out of which four types (229E, NL63, OC43, and KHU1) are causing mild to moderate respiratory infections, like the common cold. Another two types, Severe Acute Respiratory Syndrome coronavirus (SARS-CoV) and Middle East Respiratory Syndrome coronavirus (MERS-CoV), can cause severe respiratory infections, while, the seventh type (Novel coronavirus or COVID-19) is a new coronavirus recently discovered in China [**2**]. In humans, COVID-19 cause illness mostly through respiratory or gastrointestinal infections, where symptoms can range from the common cold to more severe lower respiratory infections such as pneumonia [**2**]. Mainly person to person contact can impart more disease burden [**3**].

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Human coronavirus outbreaks (SARS-CoV and MERS-CoV) have caused more than 10 thousand cumulative cases in the past two decades, with mortality rates of 10% for SARS-CoV and 37% for MERS-CoV [**1**]. In general, different types of human coronaviruses vary in the severity of illness, their cause, and how far they can spread. Although drug repositioning and large spectra therapies are under evaluation, at present, no specific treatment is outlined for COVID-19. Risk of coronavirus outbreaks spread rapidly due to its ubiquitous presence and zoonotic mode of transmission through various host species [**4**], which makes it further complex pathogen.

Ideally, disease-associated biomarkers should be needed to identify infections with high sensitivity, specificity, reliability with rapidness and cost effectively to detect viruses. Studies related to immuno-sensing of bacteria or biomolecules and electrochemical biosensing of molecules through use of advanced material science have already established the biosensor research at next level [**5,6**]. Bioelectronic research on molecular switching through dynamic function leads towards possibility of advanced virus research, which can strengthen more efficiently to the prognosis strategies [**7**]. The gradual decline in the cost of sequencing genomes in trend studies, diagnostics, and real-time surveillance is helpful for rapid detection of disease outbreaks and understanding its mechanism.

Digitalization due to advent of technologies will open opportunities for fast, accurate, distant diagnosis and delivery models. For mass level effectiveness, many precise wireless devices could be integrated to build the digital medicine type model for coronavirus [**8**]. Considering the recent technological advances, we have proposed to use an advanced technological model for better results. This model includes integration of latest technology of biosensors, Internet of things,

and artificial intelligence (IoT and AI) along with clinical phenotype models for various CoV phenotypes (SARS-CoV, MERS-CoV, COVID-19, etc.). If coronavirus infections are not properly controlled, public health management will decline and global trades along with economy will suffer. This article deals with hosts' adaptability and pathogens variability to counterbalance the challenges against prognosis and preventive measures and produce a fundamental model to combat disease burden and viral infections in the scope of human health.

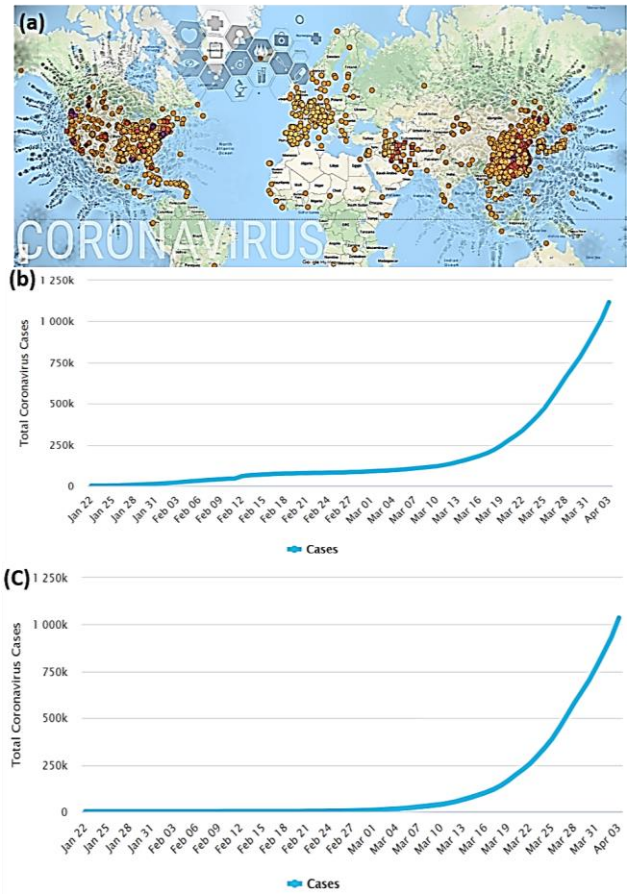

Fig. 1. (a) World map of COVID-19 pandemic, date wise (b) worldwide total cases and (c) total cases outside China as on 03 April 2020 [**14**].

Epidemics to pandemic journey

Coronavirus' worldwide distribution and epidemiological parameters supporting pathogen-human interactions are responsible for infection. The epidemiology of COVID-19 major outbreaks is shown in **Fig. 1**. The four major outbreaks across the world are responsible for approximately more than 10 thousand mortalities [**9-12**]. It suggests that more than 30 thousand infections were diagnosed in the last two decades. Current COVID-19 epidemics break the geographical barrier and challenge the mass healthcare managements [**11**]. As data on 03 April 2020, there are 1,026,974 cases and 53,975 people have lost their lives [**13**]. The COVID-19 infection has caused clusters of severe respiratory illness similar to severe acute respiratory syndrome coronavirus and is associated with high mortality across the world [**12,13**]. The major foci of COVID-19 have been in 21 countries having more than 5000 infections as of 03 April 2020. The major six countries, i.e., United States, Spain, Italy, Germany, China, and France belong to three different continents: Asia, Europe, and America respectively. The COVID-19 pandemic report shows these countries having more than 58,000 infected subjects. WHO has been assessing COVID-19 outbreak around the clock and as per observation, the number of cases outside China has increased about twelve-folds. The number of affected countries has increased eightfold as on 11 March 2020, and the situation was declared a pandemic. At that stage, 1,026,974 cases were observed globally with a death count of 53,975 in 114 countries, where around 80 percent of cases were in just five countries and around 60 countries had reported 10 cases or less. After the declaration of pandemic, within 23 days as on 03 April 2020 [**13,14**], cases were about eight times and number of countries about four folds, i.e., a complete global spread of infection.

Considering the current number of major foci, cases and deaths, declaration of pandemic situation is very timely and reasonable by WHO as this decision will alarm other countries and population to take preventive measures in advance. The 20 major foci having more than 5200 cases are shown in **Table 1.** It shows that Europe and North America are the epicenters of COVID-19, having major foci in Europe (Italy, Spain, Germany, France, etc.), America (USA, Canada, etc.) and East Asia (China, South Korea, etc.). Being world's biggest population center, any mismanagement in healthcare practices and control strategies can lead to massive outbreaks in several regions in South Asian countries such as India, Pakistan, Bangladesh, Sri Lanka, and Nepal. So as the 1st step, connection between South Asian and other countries (China, Europe, America, etc.) should be cut at first instance at each label (populations, business products, food items, etc.). As the 2nd step, research, technology and public healthcare related information should be exchanged thoroughly for effective disease control and preventive management.

The most adopted practice, social distancing through ban on international and local travels, and complete lockdown in big geographical area along with work from home model is the best strategy for isolation and stopping disease transmission. During epidemic to pandemic journey, various Asian countries of south and east regions (Japan, South Korea, Singapore, and India, etc.) have controlled the situation effectively till now. Adaptation of hygiene through technology, massive diagnosis and quarantine, complete lockdowns are the highlighted activities in these countries. There is an urgent need to understand their preventive public health models and adopt it as a policy.

Table 1. The epidemiology of COVID-19 major's outbreak (a) Top four major out breaks, (b) COVID-19 pandemic regions having more than 10,000 infection reported as on 03 April 2020*.

Top four major out breaks					
Year	**Disease**	**Country and Region**	**Total Infection**	**Total Death**	**Ref.**
2003	Severe acute respiratory syndrome coronavirus (SARS-CoV)	China and Hongkong	8096	774	[**9**]
2012	Middle East respiratory syndrome coronavirus (MERS-CoV)	Saudi Arab and Middle East	2494	858	[**10**]
2015	Middle East respiratory syndrome coronavirus (MERS-CoV)	South Korea and China	186	38	[**12**]
2020	Novelcoronavirus (2019-nCoV)*	203 Countries	1,026,974	53,975	[**13**]

COVID-19 pandemic regions having more than 10,000 infection			
S.No.	**Country**	**Total Infection**	**Total Death**
1.	United States	245,175	6,059
2.	Spain	117,710	10,935
3.	Italy	115,242	13,915
4.	Germany	85,269	1,111
5.	China	81,620	3,322
6.	France	58,441	5,380
7.	Iran	53,183	3,294
8.	United Kingdom	33,718	2,921
9.	Switzerland	19,106	565
10.	Turkey	18,135	356
11	Belgium	16,770	1,143
12.	Netherlands	14,697	1,339
13.	Canada	11,268	138
14.	Austria	11,129	158
15.	South Korea	10,062	174

** In 2020 COVID-19 outbreaks was pandemic with major foci having close to 10000+ infections data as on 03 April 2020 [**13**].*

Technologies for prognosis and preventive

Use of the latest advancements of materials for sensor technology may be one of the appropriate leads towards virus detection from broad level. Studies based on nanoparticles, graphene, aptasensors, and ratiometric fluorescent have found to be effective for pathogen identification and their analysis [**15,16**]. The novel and interesting researches on functional genomics, quantitative genetics, genomic prediction, and epigenetics are helpful for understanding emerging disease, while additional environment-based studies were helpful in predict risks earlier [**17,18**].

The development of artificial intelligence (AI)-based technologies in medicine has some practical issues in implementation related to clinical workflows, data sharing, privacy, transparency of algorithms, data standardization and interoperability across multiple platforms, which further have concern for patient safety [**19**]. Machine learning and deep learning are important analysis categories used in AI. IoT devices have become an essential part of the technology industry, as they can collect data and transfer it to research professionals via linked devices. Handling of data and inference of real meaning is quite challenging. The role of cloud computing is useful for gathering information, data exchange, connectivity and storage management.

Development of IT-based crowd management platforms for various markets, bus and train stations, airports, seaports will bring real-time monitoring of crowd for better control management. Registration of all the patients or subjects visiting hospitals through single mobile platform in the city by health authority. Through mobile phone sensing and being location/situation specific, we will get the information related to identical phenotypes together and monitoring them through coronavirus specific platform supports system. GIS Mapping and Spatial Analyses based health management will bring quick and flexible applications for advanced techniques.

The virus inactivation and filtration, by various strategies (pH, UV, filters, etc.) is a robust and effective control measure [**20-22**], and needs further consideration as an important virus clearance technology. Material science and technology research will bring forth latest advancements in therapy and control strategies of virus. Digital technology for mass healthcare has become more affordable, cost effective, and easy to handle in health care practices [**23,24**]. Interestingly, digital medicine is poised to transform biomedical research, clinical practice and the commercial sector. Integration of all interdisciplinary technologies in single platform is the need of the hour [**20-24**] for standard healthcare management for prevention and control of current COVID-19 [**11**]. All above advanced technologies were helpful to provide better solutions in prognosis and prevention of coronavirus epidemics and pandemic situation.

COVID-19 tests

WHO has recommended that all the countries should leave no stone unturned in the attempt to test their people for COVID-19 as much as possible. At this point, since no vaccine has been developed to counter this virus, the only way the human race can tackle this situation is by testing. If the presence of COVID-19 is detected early, then there are higher chances of the patient overcoming this dreadful virus. Therefore, it is really important that all the countries test heavily at this point of time.

Currently, PCR and immunoassay technologies are ideal for primary clinical decision. Correct diagnosis is must for final treatment. However, similar type co-infections or clinical phenotypes by other seasonal viruses such as influenza viruses and enteroviruses can make diagnosis complicated. The pandemic situation has been generated due to breaking of the barriers related to populations, regions, and environment. In such instances, misidentification or false positive results can affect proper treatment. The advanced genomics is helpful in point-of-care real-time RT-PCR diagnostic tests, as it's based on the genomic sequence of CoV. The genetic database is helpful in comparison and establishing link with other similar pathogens. The early detection of COVID-19 is critical to isolate confirmed cases and prevent further transmission [**25**]. Typically, it will reduce the time spent in isolation process. The study from swab samples in the epidemic area of China shows that chest CT had higher sensitivity for diagnosis of COVID-19 as compared with initial reverse-transcription polymerase chain reaction (RT-PCR) [**26**]. To avoid disease spreading, there is urgent need to shift research funding for diagnosis based on technologies, which can work with advanced genomics of pathogen and host interactions. Gene-environment interaction is an important aspect, which can cover emerging trend of pathogens and their pathogenicity. To understand the disease mechanism, developing fluorescent based real-time PCR kit is also useful to get results rapidly. Several test kits to detect monoclonal and polyclonal antibodies against COVID-19 in patients are important to detect the virus.

The important guidelines regarding methodology, epidemiological characteristics, disease screening, population prevention, diagnosis, treatment and control for the COVID-19 must be followed [**27**]. The diagnostics company Cepheid declared that it has received emergency authorization from the U.S. Food and Drug Administration (FDA) to use its rapid molecular test for point-of-care patients that can detect the virus that causes COVID-19 in 45 minutes [**28**]. The U.K. recently announced a £46 million aid package to fight the new coronavirus, including funding for a rapid diagnostic test and assisting health system preparation in vulnerable countries [**29**]. All the above-mentioned fast track-based initiatives are important to combat COVID-19 effectively.

Need of the Hour: Worldwide efforts for successful treatment

WHO announced a large global trial of the potential drugs for COVID-19 [**30**]. Several drugs, which received significant attention in many countries against the dangerous COVID-19 were used for effective treatment. The drug remdesivir stops viral replication by inhibiting a key viral enzyme, the RNA-dependent RNA polymerase, found to be one of hope in case report of COVID-19 [**31**].

Likewise, drugs chloroquine and hydroxychloroquine work by decreasing the acidity in endosomes, compartments inside cells that they use to ingest outside material and that some viruses can coopt to enter a cell. Researchers in China have published a study in which they treated COVID-19 patients with chloroquine [**32**]. French researchers also reported treating effectively with hydroxychloroquine [**33**]. Lopinavir inhibit the protease of HIV, an important enzyme that cleaves a long protein chain into peptides during the assembly of new viruses. The combination of drugs (Ritonavir/lopinavir), was also one option to treat COVID-19 [**34**].

How long until we develop the COVID-19 vaccine?

There are many vaccines in developmental stage across the world. In fact, one is under human trials. Vaccine development is related to animal than human trials to understand its efficacy for the safety and protection. Due to various human variant of coronaviruses and diversified affected populations, it is challenging to make it compatible for various populations of different continents. Various vaccines are either in 1st stage or waiting for human trial in coming months. The first dose of the mRNA-1273 coronavirus vaccine, developed by the US National Institutes of Health (NIH) and Moderna's infectious disease research team, was given to the first participant in their phase 1 study on March 16, 2020 [**35**].

Authorities in China granted approval last week for phase 1 clinical trials of a coronavirus vaccine developed by researchers at Tianjin-based CanSino Biologics and the Academy of Military Medical Sciences. Pennsylvania-based INOVIO announced the receipt of a new $5 million grant from the Bill & Melinda Gates Foundation on March 12, 2020 to accelerate the testing of its novel DNA vaccine for COVID-19, known as INO-4800 [**35**]. The European Commission has offered up to €80 million of financial support to CureVac, which plans to launch clinical tests in June 2020. German immunotherapy company BioNTech and American pharma giant Pfizer codevelop and distribute an mRNA-based vaccine against the novel coronavirus.

Another method is known as Plasma Therapy in which plasma of the recovered patient containing the antibodies that can fight against COVID-19 will be transferred to the body of the person who is struggling to develop their own antibodies [**36**]. This process for COVID-19 is also still under trial but the Chinese doctors have claimed and published their research according to which they were able to treat 7 out of 10 patients successfully using Plasma Therapy. Thus, the doctors of Britain and America have also started trials using Plasma Therapy. This therapy will only act as a stopgap measure until better treatment or vaccine is available.

Adaptation of hygiene

Ensuring the hygienic travel and transport is important for controlling any epidemic situation and stop it to become pandemic. In various infectious diseases, not only diseased but also asymptomatic persons play key role in disease transmission. So, health authorities should establish the best healthcare practices for person's disease carrier screening and document it in the health passport or other biological testing system and tools, which cover long term health history. This kind of adaptation will be helpful for defined decision for travel, which can be conducted through certain guidelines and ensure zero risk to others.

Identification of risk models

Controlling the disease transmission from one country to another is one of the key policies, which ensures to stop disease spreading within community or in countries. Specifically, transmission associated with public mobility such as travel, tourism, religious gathering spread more with the help of regional mobility, which further becomes dangerous due to community transmission. Therefore, it's important to work in dual frame of travel transmission in which one part is focused on international hygiene for travelers safety purposes, while another part is focused on stopping regional travels, where mobility was stopped for a while and start community based preventive healthcare management. Therefore, global lockdown and stay at home are the best prevention practices for COVID-19.

Initiative of scientific world

In the pandemic situation, scientific world has stimulated the process and management of rapid publication for knowledge sharing and research promotion through funding opportunities. In publication field, publishers have made coronavirus (COVID-19) content freely available and reusable. More than 30 leading publishers have committed to making all of their COVID-19 and coronavirus-related publications, and the available data supporting them, immediately accessible in PubMed Central (PMC) and other public repositories [**37**]. Elsevier has developed "Novel Coronavirus Information Center", where you will find expert, curated information for the research and health community on COVID-19. All resources are free to access and include guidelines for clinicians and patients [**38**].

The leading research funding organizations, NGOs, etc. are deeply concerned for the COVID-19 pandemic situation and have opened funding opportunities for public health. **Table 2** refers to various funding opportunities and data sharing information by world leading organizations.

In the current scenario, International Association of Advanced Materials (IAAM) has encouraged R&D consortium on COVID-19 by creating multi-lateral cooperation in the area of 'digital healthcare innovation and technology'.

Table 2. Appreciable and timely contribution of world-leading organizations for research and data sharing on COVID-19.

Funding Category	Name of call	Funding agency	Ref.
R&D	Coronavirus Disease 2019 (COVID-19)	NIH, USA	[**39**]
R&D	Urgent Competitive Revisions for Research on the 2019 Novel Coronavirus (2019-nCoV)	NIAID and NIGMS, USA	[**40**]
R&D	Development of therapeutics and diagnostics combatting coronavirus infections	European Commission	[**41**]
R&D	RAPID Research on Coronavirus (COVID-19)	NSF, USA	[**42**]
R&D	Rapid Response Call for novel coronavirus research	UKRI, United Kingdom	[**43**]
R&D	Novel Coronavirus (COVID-19) Rapid Research Funding Opportunity	CIHR, Canada	[**44**]
R&D	Rapid support for research into coronaviruses and their impact	SNF, Switzerland	[**45**]
R&D	Fast-tracking research into treatments for COVID-19	Health Ministry, Australia	[**46**]
R&D	Initiative to Speed Development and Access to Therapies for COVID-19	Bill & Melinda Gates Foundation	[**47**]
R&D	Fund for social cause	Seattle Foundation	[**48**]
Data sharing	Novel Coronavirus Information Center	Elsevier	[**49**]
Data sharing	Sharing research data and findings relevant to the novel coronavirus (COVID-19) outbreak	Wellcome Trust	[**50**]
R&D	Fighting COVID-19	TDB/DST	[**51**]
R&D	CSIR-NMITILI Proposal on Coronavirus	CSIR	[**52**]

Multi-end Consortium on COVID-19

International Association of Advanced Materials (IAAM) had organized the 4th edition of 'Translational Research & Innovation Symposium' with the theme: 'Translational Research and Innovation for Healthcare Technology' on 10 February 2020 at VBRI Innovation Centre, New Delhi, India (**Fig. 2**) [**53**]. The aim of this edition was to create consortium in the area of advanced research & innovation for digital medicine. This consortium had run with two sessions, where 1st session covered 11 important keynotes, invited and innovative talks. Then, the 2nd session had translational research and technology cooperation consortium for coronavirus research. This consortium was focused on current epidemic of a novel coronavirus affecting China, along with reported cases in 27 other countries at that time. Further it was assuming to spread

Fig. 2. Consortium to combat epidemic Coronavirus disease using digital medicine at VBRI Innovation Center, New Delhi, India.

beyond border across other continents, so making strategy in advance was one of the timely initiatives for prevention methods. This meeting brought together interdisciplinary scientists working in several fields like healthcare, biotechnology, IT, computational, nanotechnology, medicine, and chemical engineering for exchange of ideas and recognized effective research and technology for a healthy tomorrow. It was intended to form a network of collaboration for the utilization of various interdisciplinary scientific experts and valid healthcare solutions based on digital medicine were also presented. Finally, the scientists of consortium believed that the applications of integrated technology system will be transferrable to virus infected multiple hosts system including human as preferable.

Future prospects

The recent and future challenges of various virus species, due to complex diagnosis and ineffective control mechanisms, have attributed negative impact on human health [**54**]. The threat posed by COVID-19, can be overcome if as the 1st step, countries can identify, isolate, and treat cases immediately. At the same time, as the 2nd step, stopping population mobility and tracing asymptomatic cases is very important, as handful of cases can become source of community transmission. China and South Korea have demonstrated that this virus can be suppressed and controlled through better and timely healthcare management.

Efforts based on multilateral and multi-disciplinary approaches may lead to development of effective technology. Further, technology development will be continued together with our existing experiences gained with the sixth phase of a field trial of the mHospitals [**55-58**], cardiac cloud care at home. mHospitals is a revolutionary virtual hospital that utilizes cloud medicine, machine learning, and artificial intelligence to provide the best quality of cardiac care along with the ultimate convenience. This kind of integrated approaches with

biotechnology models may bring better solutions for current coronavirus challenges.

Conclusion

Virus infection globally affects the human health and is considered a limiting factor for further sustainable development. This editorial extensively highlights important technology parameters which can be used for effective prognosis and control strategies. VBRI demonstrated the preventive and prognosis model for coronavirus epidemic using AI-enabled wireless medicine. This model came to an end with the advanced technology through experts laying emphasis on the need and efforts of VBRI to form a multi-ends international alliance to develop world-class healthcare solutions based on AI and ML digital medicine. VBRI is committed to establishing parallel wireless healthcare technology, for the benefit of mankind. The consortium of coronavirus will be conducted to make worldwide network for sharing knowledge and technology beyond boundaries to combat all kinds of coronavirus challenges more effectively.

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Conflict of interest
All authors declare that they have no conflict of interest.

Keywords

Coronavirus, COVID-19, infectious disease, medical technology, healthcare management.

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Current Scenario of Healthcare

We are delighted to publish the 10th volume, 1st issue, 2019 of the Advanced Materials Letters with the editorial on the 'Current Scenario of Healthcare'.

Medical errors pertaining to health care has been growing over the last decade and some studies depict that they are quite difficult to manage.

Numerous investigations center around patients encountering damage and give a significant understanding of the extent of mischief coming about because of blunders.

The Different investigations, more constrained in number, center around the event of mistakes, both those that outcome in mischief and those that don't (now and then called "close misses"). It is found to get more faults the doctor's facilities than in other medicinal services conveyance settings.

Blending and translating the discoveries in the writing related to mistakes in human services is convoluted because of the nonappearance of institutionalized terminology. For reasons, in this report, the terms mistake and antagonistic occasion are characterized as pursues: A blunder is characterized as the disappointment of an arranged activity to be finished as expected or the utilization of a wrong intend to accomplish a point. An unfriendly occasion is damage caused by medicinal administration as opposed to the basic state of the patient.

An occasion owing to mistake is a "preventable unfriendly occasion". Negligent unfavourable occasions speak to a subset of preventable unfavourable occasions that fulfil lawful criteria utilized in deciding carelessness, i.e., regardless of whether the consideration gave neglected to meet the standard of consideration sensibly expected of a normal doctor met all requirements to deal with the patient being referred to.

Medical errors have been considered widely for a few reasons: it is a standout amongst the most well-known sorts of blunder, significant quantities of people are influenced, and it represents a sizable increment in human services costs. There are likewise methodologic issues: prescribed medications of doctors, are broadly utilized, so it is anything but difficult to recognize a satisfactory example of patients, who encounter antagonistic medication occasions; importantly, medication recommending process gives great documentation of medicinal choices, and a lot of this documentation lives in mechanized, effortlessly available databases; and passing's owing to prescription mistakes are recorded on death declarations.

There are more likely different territories of human services which are conveyed to be less concentrate yet may offer an equivalent or more noteworthy open door for development in security. Endeavours to survey the significance of the different types of mistakes, which are, as of now, hampered by the absence of an institutionalized scientific categorization for announcing antagonistic occasions, mistakes, and hazard factors. A predetermined number of studies center straightforwardly count around the reasons of these antagonistic occasions, yet activities to order unfavourable occasions as indicated by "main drivers" are entangled by the way that few interlocking variables regularly add to the fault or arrangements of mistakes that produce the result for the unfriendly occasion. Lately, some advancements toward a more institutionalized classification and scientific categorization has been made in the drug zone, yet much work stays, yet to be finished. There are adequate potentials to empower healthcare by the advancement of materials. This journal continuously intends to provide an global publication platform for the broad spectrum of issues regarding experimental and theoretical advancements in the science, engineering and technology of healthcare materials including biomimetic materials, molecular device materials, hybrid composite materials, supramolecular systems, functionalized polymers, energy-transfer and information materials, biodegradable, bio based and/or environmental friendly materials and other healthcare related fields including drug delivery, tissue engineering, biosensors, gene editing and delivery etc.

The journal has anticipated to become more popular with good impact factor by June 2019. As an editor, we aspire to welcome more authors, reviewers and readers in recent time. Your suggestions and opinions would be greatly appreciated for the progress of the journal.

Source Publication

Ashutosh Tiwari, Current Scenario of Healthcare, *Advanced Materials Letters*, **2019**, *10(1)*, 1-1.DOI: 10.5185/amlett.2019.1001.

Impact of Digital Transformation for Mass Healthcare

Mass Healthcare is prominent field and it must be noted that over the last couple of decades, the entire healthcare industry has digitized health care landscape. Digitalization conveyed moment access to data, made the sharing of data simpler among social insurance experts and enhanced the efficiencies of patient results. Automation has substantially changed the medicinal services industry and made it more savvy for associations to run everyday tasks.

Automation is the utilization of data innovation that lessens the requirement for human work in the making of results. The present mechanization advances are equipped for significantly more than human managers. For example, a decrease of managerial outstanding tasks at hand, enhancement of the consistency of patient consideration, end of waste, improvement of data trade, investigation of information, and checking of patients would all be able to be streamlined with information mechanization. There might be a piece of legitimacy to this stress; some social insurance clients essentially want to manage a human when they make arrangements or demand data.

In any case, more youthful patients skew the other way: they anticipate that information will be conveyed through the web on their favored timetable, and mechanization can help with conveying the sort of administration that medicinal services clients who experienced childhood with the web anticipate. Moreover, computerization builds the measure of time medicinal services experts have accessible for direct association with patients, and in addition, enables them to oversee more patients in the meantime.

So far, we've been discussing computerization in theory. How about we take a gander at a solid case of how computerization is expanding the effectiveness and efficiency in medicinal services associations. Planning arrangements are a piece of the regular day to day existence of a human services association. Staff invest their energy booking arrangements, noting calls from patients, and calling patients to remind them about arrangements. As opposed to squander valuable time with managerial work, human services gatherings can robotize the greater part of their planning. By computerization, patients can see when they can access the arrangements and book a space.

Human care associations profited by digitization and automation of medicinal services information. They work under stringent administrative necessities and can't simply rent any old server or introduce a site with the module and begin booking arrangements. The security worries of social insurance associations go past Health Insurance Portability and Accountability Act (HIPAA)-privacy rule. One of the less regularly considered advantages of automation is the capacity to improve the security of human services associations. Genuine information breaks and security bargains are regularly the consequences of human blunder. The probability of oversights prompting security vulnerabilities decreases considerably by removing the person from the circle and computerizing information sharing and handling assignments. Likewise, targeted mass healthcare structures with improved accessibility and quality due to digital transformation and significant innovations, actual impart transformed real-world health and foster affordable care in the mass framework.

Take care of yourself and stay healthy.

Source Publication

Ashutosh Tiwari, Impact of Digital Transformation for Mass Healthcare, *Advanced Materials Letters*, **2019**, 10(2), 79-79
DOI: 10.5185/amlett.2019.1002.

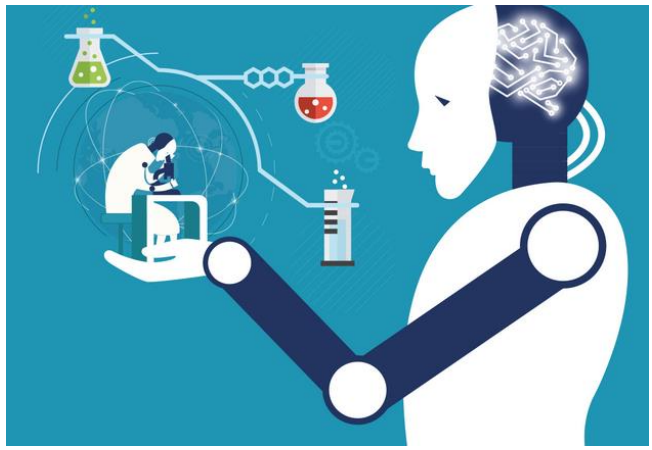
Intelligent Healthcare for Future Medicine

Healthcare technology continues to grow, in almost all usefully processes, involved from patient care to database management and from lab research to innovation in devices. Technological elevate in healthcare devices confer user-friendly services, while artificial Intelligence (AI) in machines and computational discipline acclaim overall sense of healthcare perspective. Today, there are many technological advancements and models that helps in Drug discovery connections, minimizing errors in Health system, Maternal mortality, Drug-interaction risks and relationships among genes, environment, diseases and other entities.

Researchers can produce new theories to utilize the subsequent unique representations and proof supported forecasts. Fuelled by intellectual stage, Watson for Drug Discovery conveys a psychological stage for the characteristic dialect to prepare in the existing area of Science This AI-based methodology gives Watson, for Drug Discovery, a chance to filter and break down the huge learning base more completely and quicker than straightforward enquiry instruments or unaided research groups.

As Life Sciences learning sources, are as a rule, always refreshed, you will remain contemporary with them. Continuously utilize the most recent adaptation of the item and its application improvements. Logical achievements, Pharmaceutical organizations, biotech and scholarly establishments utilize Watson for Drug Discovery to help with new medication target, distinguishing proof and medication repurposing. Associate your in-house information with open information for a rich arrangement of Life Sciences learning. Abbreviate the medication revelation process and improve the probability of your logical leaps forward.

Watson for Drug Discovery has seven modules that reflect the enquiries, steps and procedures that specialists follow in a medication disclosure process. Specialists begin with a competitor list, for example, a gathering of ailments, mixes, qualities, or medications they'd jump at the chance to limit for further testing. Watson for Drug Discovery predicts or characterize connections among them through the different modules. Based upon your



examination venture, you may utilize one, two or all modules at various occasions and in numerous ways.

The modules are unique, corresponding to the focal points on a centre of the focal storehouse of learning from a great many restorative articles, abstracts, licenses, medications, conditions and qualities/proteins. You may, likewise, associate your own restrictive learning stores to Watson Drug Discovery for examination. The IBM Watson psychological stage, prepared with social insurance and life sciences learning, utilizes regular dialect handling to comprehend logical implications in this abundance of information to distinguish associations.

This psychological stage can, likewise, help to create new theories by anticipating potential connections not definitely known. Results come as intelligent perceptions that demonstrate the associations and connections. These dynamic visuals enable you to comprehend vast volumes of information and identify the flag in the clamour to produce new bits of knowledge.

Thus straightforward, technological innovation with quality attributes in healthcare is perceive as a source of future medicine.

Keywords

Intelligent healthcare, future medicine, IBM watson psychological stage, watson drug discovery, artificial intelligence-based healthcare.

Source Publication

Ashutosh Tiwari, Intelligent Healthcare for Future Medicine, *Advanced Materials Letters*, **2019**, *10(3)*, 151-151.
DOI: 10.5185/amlett.2019.1003

Tech-Footprints for Virtual Medicine

The health care driven tools and solutions speed up the overall time for treatment as well as create better enduring experiences, which is the need of the hour, at the same time. It eventually raises the standards of the health care industry across the spectrum by understanding as well as responding to customers in a systematic and logical manner. Computational and information system that mines healthcare database with improve treatment cost-effectively, seeking opportunities for growth in industry regularly. Challenges and opportunities were counterbalance by artificial intelligence (AI), information technology, 3-D printing etc. in astounding ways to encourage healthy lifestyles. Besides that, these modern tech tools and solutions have the ability to create a wide range of AI-enabled medical models, as well as develop and analyze critical data, and bear in mind, all-in-one integrated medicine for streamlined care.

According to recent studies, the tech advancements not only provides key insights, but also integrate modern channels too such as emails, social media and more patterns to foster better relationships. They are designed to reveal invaluable insights of digital medicine from the current trends in real time, which has the ability to empower the entire health care industry.

An unfavourable/ error occasion is characterized as damage caused by restorative administration instead of by the hidden sickness or state of the patient. Not all, but rather a sizable extent of unfriendly occasions is the after effect of mistakes. Various investigations have taken a gander at the extent of unfavourable occasions owing to medicinal mistake. Due to methodologic challenges, far less investigations center around the full scope of mistake—in particular, those that outcome in damage and those that open the patient to chance however don't result in damage.

AI-enabled technologies are making great strides regularly, reflected by increasing virtual medicine start-ups. The intelligent healthcare systems are contributing effectively due to tech footprints, spread in hospitals and health industries through advanced devices which penetrated the human care systems at a deeper level. These tools not only curate intelligent data and systematize analytic asset discovery, and governance, but also improve the delivery model. It can empower industry experts to deeply analyze/study/break/ understand text to extract metadata from the extensive content; which may or may not include integral concepts, as well as entities.

The decade groomed with the cloud know-how, upgraded the healthcare system more and making it easier than ever before. The entire practice of high-tech healthcare can be revolutionized by intelligent technologies making wide acceptability to reduce world vulnerability towards the intelligent lifestyle.

Keywords

Digital healthcare, virtual medicine, all-in-one integrated care, intelligent lifestyle.

Source Publication

Ashutosh Tiwari; Tech-footprints for Virtual Medicine, *Advanced Materials Letters*, **2019**, 10(4), 230-230.DOI: 10.5185/amlett.2019.1004.

Artificial Intelligence and Machine Learning Empowering the Mass Medicine

Today, the world is witnessing great advances in the healthcare industry through technological innovations that will lead to a brighter future. Technology and Innovation is playing a major role in clinical training, robotics, drug discovery, disease management and e-medicine field. Recent advent of Artificial Intelligence (AI) and Machine Learning (ML) has led to massive developments in the healthcare industry. This advancement has enabled the mining of complex data as it is based on artificial intelligence and machine learning algorithms, that processes language and image recognition which can be done for a controlled study of patients.

Advanced technology is also playing a major role in drug safety through efficient drug manufacture. There are innovations with regard to mining medical records, and doing a controlled study, along with risk assessment in real-time systems, leading to a reduction in the cost of medical treatments and promising a healthy future.

Robotics is another field where massive platform of AI and ML is adopted. Advanced technology such as nanotechnology and genealogy are evolving due to robotic learning systems. There are robots that are assisting in performing surgery, heart sound analysis, non-invasive procedures & complex brain surgeries in a precise manner and helping in several other treatments besides providing clinical training too. In this way, medical research has become well-equipped to save people from health ailments. These robots equipped with knowledge-based systems, along with natural language processing as well as sentiment analysis even suggest the appropriate line of treatment that should be taken by the patient. Also, robotics will play a crucial role in safe drug manufacture to ensure quality control and perform drug marketing too. Their patient knowledge-based systems are set to ensure drug efficacy. Innovations in healthcare have led to quality control in the manufacture of drugs, including those for chronic ailments like cancer and cardiac diseases.

There are AI powered devices that can accurately diagnose diseases at an early stage to help medical professionals in providing treatment effectively. Advance technologies, helping in hospital management

to ensure effective utilization of its resources. Due to these breakthrough innovations in hospital management, painful surgeries and long treatment processes are being avoided. This is why governments all across the world are formulated national health policies to ensure that their citizens get access to healthcare at minimal costs in the remotest locations.

Presently, intelligent medicine contributing effectively in healthcare and their use progressing day by day through the incorporation of alternative, conventional medicine, modern medical technologies as well as nutrition, organic food, health supplements and wellness remedies. On the other hand, digital medicine revolutionaries the health sector by use of medication and sensor components. Today, pharmaceutical therapy adopted towards more patient adherence through digital medicine.

In the meanwhile, cloud computing systems revolutionaries the medical filed globally. It is providing big storage and processing capacity for unlimited data of various sources. Even world-wide networks can include many experts for real-time access and analysis and help in fighting disease research.

Still, artificial intelligence and machine learning are yet to reach its highest peak with regard to healthcare. Clinicians and hospitals are moving forward in this direction by ensuring healthcare in real-time for the safety of patients. The next steps will be e-healthcare implying technological innovation of artificial intelligence and machine learning in a single platform, which is going to play a major role in healthcare to ensure physical & mental well-being of patients.

Source Publication

Ashutosh Tiwari; Artificial Intelligence and Machine Learning Empowering the Mass Medicine, *Advanced Materials Letters*, **2019**, *10(5)*, 302-302. DOI: 10.5185/amlett.2019.1005.

Keywords

Artificial intelligence, machine learning, mass medicine, robotics, cloud computing systems, intelligent medicine.

Smart Healthcare Pulls up Clouds for Virtual Medicine

The field of medicine and healthcare services is one of those rare industries that are yet relatively unknown to the world of technology and cloud computing. It would not be wrong to say that the world of medicine has always been an ocean of paper trails, fax machines and hard copies. Due to these physical records and paper trails, the medical industry and healthcare services have always restricted to access privacy barriers and isolated data for each patient. For many years now, the industry has been screaming for a better system. There is no doubt about that healthcare services and medicine industry holds a number of flaws in terms of smart functioning.

The world has already started moving towards this new way of providing healthcare services. A decade before, in the year 2009, United States has already signed the HITECH ach, under which a $27 billion stimulus package was created to accelerate healthcare information technology in the country. Under this law, the doctors are supposedly paid to adopt electronic records. Moreover, the doctors who do not penalize electronic records are penalized under this act. The data standards are improving day by day and they are making it easier to share health information, software, innovation linked to mobile computing and the policies to protect patient privacy. As a result of these constantly improving data standards, the use of healthcare technology and cloud medicine has constantly improved and increased over the years. There are many other countries as well that have moved along the same path. In Netherlands, almost all the primary-care doctors already use electronic records. But most of the countries in the world are yet to reach this mark.

These questions are what is meant by unconnected data and privacy barriers in the world of medicine. Therefore, it is absolutely right to say that the industry needs a better system. It is imperative that a doctor has all the records of the patient he is treating, and that too, instantly, with him online. Cloud medicine is the way forward for the medical industry and the world has already started to move towards this relatively new way.

Cloud medicine or E-medicine is a concept wherein a cloud computing service is used by all the health care providers to store, maintain and back up the personal health information of the patients. One of the biggest benefits of using the cloud computing technology is that it is capable of storing way more data than a physical server. Moreover, the costs of using this cloud storage are just a fraction of what it costs to use the on-site physical servers.

Source Publication

Ashutosh Tiwari; Smart Healthcare Pulls up Clouds for Virtual Medicine, *Advanced Materials Letters*, **2019**, *10(7)*, 440-440.
DOI: 10.5185/amlett.2019.1007.

Cloud Medicine set to Revolutionize Doorstep Personalized Healthcare

The world is witnessing a huge growth in demand for healthcare services because of aging populations and the prevalence of chronic diseases. It is nothing short of a boon that the digital age has started too side by side with this increasing demand for safe and ameliorated healthcare services. The new-age technology has turned stones that were never even thought of. Ever since their advent, they have permeated almost every industry vertical that is even remotely important for mankind.

The healthcare sector too has opened its doors to the tools and platforms built with the incorporation of the latest technologies known to humans. Concepts like AI-based robotics surgery and telemedicine have been bosomed by the healthcare sector.

However, one element or technology that has made possible the enforcement of these new-age technologies across all the industry verticals in the world is 'Cloud Computing'. It is because of this technology that the concept of 'Cloud Medicine' has come into existence and the healthcare sector has reached new heights.

Cloud medicine - The concept and its benefits

The idea of Cloud Medicine is that hospitals and doctors share the patient records electronically and utilize the concept of cloud computing in the smallest of functions.

Cloud is the only weapon that the healthcare sector has against severe problems like lack of basic infrastructure & equipment, delay in delivery of medicine, and many more. The mammoth task of making sure that secure healthcare reaches all corners of the globe is possible only with CLOUD.

Source Publication

Ashutosh Tiwari; Cloud Medicine set to Revolutionize Doorstep Personalized Healthcare, *Advanced Materials Letters*, **2019**, 10(8), 519-519. DOI: 10.5185/amlett.2019.

Perhaps the biggest benefit of cloud medicine or cloud computing is that it helps in improving the functionality of the healthcare systems a lot. It offers the potential for broad integration and interoperability. The ability to share information easily and securely is a highly critical capability, and cloud services are the only form of technology that enables the medical service providers to do so efficiently. Cloud computing or cloud medicine has been developed in a way that it supports rapid development and innovation. Therefore, it satisfies the demands placed on healthcare IT systems by these new technologies like the Internet of Things (IoT) devices, Machine Learning, Artificial Intelligence (AI).

Another benefit of utilizing Cloud is that the health records of the patients can follow them everywhere. These records can be made available to the doctors through the internet. In fact, under this model of medicine, the doctors can not only exchange medical histories with each other, but it becomes easier for them to exchange the entire health-care dossier of the patients. Cloud Medicine is the best alternative for the healthcare sector to stop being a sea of paper-trails that it is now.

With a cloud platform, a patient can easily upload the vital information on medical devices for his doctor to analyse along with the already available electronic records. Once the analysis is done, the doctor can prescribe the medicines for the patient to order. In a nutshell, a patient can get personalized treatment while sitting in the comfort of his home.

For a layman to understand the importance of Cloud, this example is perfect:

Imagine you are a student living away from home and your mother needs an emergency operation. Your father takes her to the hospital but because of situational stress, he also felt chest pain and now both of them need medical attention. The only resort in such a situation that the doctors would have to call you and ask a thousand questions. They

would have absolutely no clue as to what are the medications your parents take, whether they have any allergies or not, do they have any medical history or not; and a hundred other questions. With the availability of EHRs, this entire situation can be completely avoided.

Moreover, one needs to understand that the medical industry was always working without the technology of cloud computing. The result was that the patients were treated by a trial and error method. With the availability of cloud medicine technology, the world is witnessing the model of personalized treatment. The doctors have with them all the records of a patient and therefore, they are able to perform personalized treatment.

Wearable Healthcare Devices

As the prevalence of chronic ailments and diseases increase among the rapidly aging world population, the healthcare sector is looking more and more towards high-tech medical solutions and devices. This is the reason the world has seen a proliferation of advanced wearable electronics in the recent years. These devices have emerged as one of the most effective ways to improve patient outcomes and reduce medical costs.

The market for wearable devices has boomed in the last few years and there are no signs of slowdown. Wearable Health Devices (WHDs) are proving to be extremely helpful for people to keep a check on their health conditions. People can actually monitor their status at a fitness level and also at proper medical level. The Wearable Health Devices can also provide more data to the doctors and help in earlier effective diagnosis and guidance of treatment. The world of technology has seen a revolution that has led to the miniaturization of electronic devices. As a result, the world has witnessed the birth of more reliable and advanced wearables.

Before the advent of wearable devices, an individual was required to visit a doctor for the smallest of medical questions. Today, people have turned their attention to wearable devices that can monitor their vitals and help them avoid these visits. The orthodox ways to perform the most basic of acts like checking blood pressure or blood sugar require physical, complex, and time-consuming procedures. Moreover, one does not even get the results of these procedures instantly. With medical wearables available in the market today, people are getting rid of these invasive procedures and achieving instant results. The need for visiting a doctor is decreasing gradually. Moreover, as the WHDs get more popular, they will replace many instruments in the clinics and diagnostic centers as well.

The WHDs targeting self-management are also helping the physicians in improving the diagnostic processes. The data recorded in these devices can be transferred electronically and thus, the doctors can easily gain important information and make informed decisions. There are devices that come equipped with sensors such as electromyogram (EMG) and electroencephalogram (EEG)

that can record muscle activity and simulations within the brain. Such critical data monitoring will soon lead to the end of the existing conventional monitoring systems. Moreover, the heavy adoption of WHDs will enhance the ability of a physician to diagnose the condition of a remotely located user virtually.

With products like Cardiac monitors, Smart watches, Diagnostic wearables, and Glucose monitors already on the market, the healthcare sector is already embracing the growing number and quality of Wearable Health Devices. The wearable fitness technology is finding its way into the deep circles of society and are beginning to be watched as mainstream. The future of wearable devices displays no sign at all of slowing down in any manner.

Big medical and pharmaceutical companies are adopting engineering simulation and connect patient modelling to begin developing devices that provide more reliable and secure answers. With already a number of smart products in the market and the surge in the implementation IoT and AI in healthcare sector, it is safe to say that the future lies in virtual healthcare and Wearable Health Devices are to play a huge and significant role in this future.

Source Publication

Ashutosh Tiwari; Wearable Healthcare Devices, *Advanced Materials Letters*, **2019**, 10(10), 675-675. DOI: 10.5185/amlett.2019.1010

Healthcare Informatics Driven Nanotechnology

Nanoinformatics has potential to accelerate advancement goals of nanomedicine for mass healthcare. Recent introduction of transformative adoption of information science and technology, machine learning and artificial intelligence for techno-community-wide best practices lead focused nanoinformatics. The new approaches to discovery and innovation for broader understanding of the medical science gaps via generating multi-scale simulations has articulated the key concepts behind complex problems related to cross-cutting issues of biomedical systems.

The translational research into the product developments is key model in identifying required technological approaches to solve issue in sustainable frame. However, additional prediction model of the relationships or decision support system via informatics have successfully contributed to these areas effectively and emerged as foci field of healthcare. This issue bring forth role of nanoinformatics in shaping healthcare sector through advanced computational approaches and nanotechnology research for accelerating healthcare field.

Nanotechnology and information science

Novel nanostructures have been developed and utilised in various applications in healthcare sector. Various physical and physio-chemical properties of nanomaterials have enabled their applications in diagnosis of diseases, clinical therapies, drug development and delivery, and development of biomarkers. The computational methods employed to model and analyse nanomaterial systems has led to the development of the branch of nanoinformatics. Modelling of novel nanostructures and studying their interactions with biomolecules has become an essential part of nanotechnology research. Information science and technology changed the knowledge sharing, storage, transfer and analytics extensively. Currently nanoinformatics primarily focuses on; data management, data curation and database development of nanomaterials, meta-analysis, data mining, development of QSARs (quantitative structure–activity relationships), nanomaterials-biomolecules interactions, computational simulation of these interactions and assessment of potential environmental and health risks of nanomaterials.

Data analytics and integrated technological models

First of all, medical decision support should be towards safety to people and the environment friendly. Health remediation and environmentally friendly healthcare

model and life safety related treatment, production, and consultancy are requirement of today era. The combination of computational tools like machine learning, artificial intelligence helps identifying functional properties of nanomaterials through studying their structural properties. Database management for mass healthcare and data analytics for understanding of real-time issues were adopted through integrated models. Emerging computational modelling in healthcare practice and clinical databases to create issue solving mechanism lies in upgraded cloud computing and artificial intelligence integration in trans disciplinary platforms. Informaticians can successfully contribute to healthcare extensively, due to recent advent in technological upgrade and increasing understanding in genomics and proteomics projects day by day. Overall, exchanging innovation data, results, modelling and simulation methods, data accessibility and computational tools for establishing clinical phenotype databases to contribute to improved products and understanding processes of diverse healthcare issues for mass healthcare is urgent need.

Nanomedicine and computational modelling

The concept of nanomedicine was introduced to improve the efficiency of medical and healthcare systems using nano-technology tools and techniques; though the development of translatable, environment friendly nanotherapeutics is still difficult and requires initial advanced computational studies to identify nano-biomolecules interaction mechanisms and other biological events triggered by drug release. Computational modelling and simulation techniques can help in identifying the suitable shape, size and surface of nanoparticle for better uptake and transport through the cells and also visualize their interaction and behaviour with cellular compartments. Modelling and molecular dynamics studies of nanomaterial interactions with bio-membranes or

Source Publication

Ashutosh Tiwari; Healthcare Informatics Driven Nanotechnology, *Advanced Materials Letters*, **2019**, 10(9), 610-610.
DOI: 10.5185/amlett.2019.1009

biomolecules and calculating their binding energies and other kinetics helps in developing better drugs and drug targeting systems. These models are then transformed into nanomedicines via experimental procedures.

Nanomaterials based targeted drug delivery system

Improper delivery of drugs or other therapeutic agents to the exact target sites has been a major issue in disease treatments and efforts are made to develop nanomaterials and it's applied devices for targeted delivery of more efficient and safe therapeutic agents with prolonged drug residence. Computational tools allow designing nanoparticles with optimized properties and predicting the drug delivery mechanism of nanomaterials. Carbon nanotubes have been efficiently used as drug carriers in various studies.

Nanobiosensors and other health devices

Biosensors and drug delivery systems are efficient mechanism under current scenario, although nontoxicity causes a major limitation to the applications in healthcare but a lot of research is being undertaken to reduce its effect. Nanomaterial based biosensors are developed for quick efficient diagnosis owing to their more sensitive and specific biomolecule detection properties. Other health devices for regenerative medicine, arrays, biomimetics and tele-interfaces have also been made using nanomaterials.

Nanoinformatics based methods have been found to be faster and better in performance; and there's an increased demand to develop new materials and strategies for their use in applied research. Computational tools help optimize nanomaterials and nano-based methods before performing actual experiments which is more cost and time effective. Nanomaterials have found various applications in health sector and nanoinformatics is helping with nano- data storage and analysis for development of new advanced methodologies.

Current Global Scenario of Electric Vehicles

The biggest challenge that the world stands across in the 21st century is environmental degradation. Terms like 'climate change' and 'energy crisis' have never been more familiar. One of the main reasons behind this are the conventional vehicles that work only on an internal combustion engine by consuming fossil fuels and emit harmful gases like nitrogen oxides, carbon oxides, and the hydrocarbons. With every passing day, the environmental issues are becoming more and more serious. Especially in the densely populated areas, the gas emissions from the conventional vehicles have become the main source of air pollution. These gas emissions are also the main contributor to the outdoor air pollution that eventually leads to as many as 6.5 million deaths around the world every year. In fact, the transportation sector is also the main contributor to GHG emissions that cause Global Warming. According to the International Energy Agency, the transportation sector contributes as much as 25% of the total CO_2 emissions annually.

In order to tackle with this growing energy crisis, Hybrid Electric Vehicles (HEVs) have been developed and applied in the recent years. The technologies used in HEVs help to improve the fuel economy and also ensures that they emit less emissions as compared to the conventional vehicles. Most of these HEVs work on a battery that converts chemical energy into electrical energy and help the vehicle run. Lead-acid batteries have always been the primary rechargeable electrochemical device for domestic as well as household applications. But in the transport sector, especially for the Electric vehicles, the Li-based batteries have been gaining prominence in the recent years because of their advantages such as light weight, high energy density, and zero environmental problems. Other electric vehicles that work on Fuel Cells, Photovoltaic cells, and the Plug-in Hybrid Electric Vehicles are also on the rise in terms of popularity and acceptance.

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Global scenario

Over the last half decade, electric vehicles have seen a steady development and growth. Thanks to the modern technologies like Artificial Intelligence and Machine Learning, there have been many advancements in the lives and durability of batteries and their efficiency. With each passing year, electric mobility is seeing new heights. According to the International Energy Agency (IEA), in the year 2018, more than 2 million electric vehicles started running on the road which is a record for a calendar year. With these vehicles, the total of Electric Vehicles on road reached 5 million. According to the agency, if the current trends continue, the number of electric vehicles that would be sold in the year 2030 could be as high as 43 million. By the end of last year, there were as many as 460,000 electric buses on the road. According to the forecasts made by the IEA, the number of electric vehicles on the road, including the two-wheelers and three-wheelers, could reach as high as 250 million by the year 2030. Politics also plays a huge role in this adoption of the electric vehicles. Countries like China, United States of America, members of European Union, and India, are leading in the adoption and production of these vehicles for a reason. These countries use a range of measures such as incentives for low- and zero- emission vehicles, fuel economy standards, and much more to reduce the difference in costs of electric and conventional vehicles.

The technology developments are also helping reduce the costs associated with EVs and this reduction is expected to continue. The developments in battery chemistry and the increase in the capacity of manufacturing plants is making the progress easier. The number of chargers has also shown a trend of growth. In the year 2018, this number rose to 5.2 million globally for light-duty vehicles that are complemented by almost 540,000 publicly accessible fast chargers.

Obstacles and future prospects

Despite all the advancements related to the electric vehicles, there are still many obstacles in the path of EV technology. One of the biggest obstacles is the short warranty of an electric car battery, which is, at times, way shorter than the other car equipment. Another factor that prevents the wide acceptance of electric vehicles is the extremely small number of charging stations coupled with the long time that the electric vehicles take to charge. The lack of charging stations limits the use of electric vehicles drastically. Moreover, in most of the countries, the electric vehicles run on the electricity that is produced by consuming fossil fuels, which in turn produces a lot of emissions.

Although this high dependence on fossil fuels to produce electricity in many countries is an issue, as the countries decarbonise electricity generation to achieve their environmental targets, the emissions will decrease for both the new and existing electric vehicles. This decrease coupled with the advancement in electric vehicle technology and the existing infrastructure will surely result in a huge increase in the adoption of EVs. The number of charging stations is quite low but the fact is that there are many countries working on expanding this number. Many research have also shown that in future, it would be possible to increase the efficiency of batteries and decrease the production costs. Thus, the vehicle costs will obviously decrease and the range of these vehicles will increase. Therefore, it can be said that it's only a matter of time until Electric Vehicles become the major source of transport.


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