

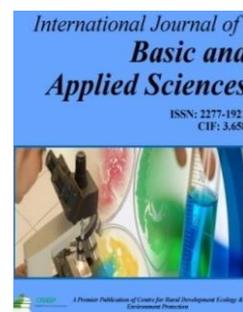
Vol. 10. No.4. 2021

©Copyright by CRDEEP Journals. All Rights Reserved.

Contents available at:

www.crdeepjournal.org

International Journal of Basic and Applied Sciences (ISSN: 2277-1921) (CIF:3.658 ; SJIF: 6.823)
 (A Peer Reviewed Quarterly Journal)

**Review Paper**

Application of Science and Technology in the Welfare of Humanity: A Review

Ganesh P. Pokhariyal

School of Mathematics, University of Nairobi, Box: 30197-00100, Nairobi, Kenya.

Correspondence Address: 69 Palm City, Patheri Bag, Dehradun, 248001 Uttarakhand, India. Email: gppokhariyal@gmail.com**ARTICLE INFORMATION****Corresponding Author:**

Ganesh P. Pokhariyal

Article history:

Received: 12-11-2021

Revised: 18-11-2021

Accepted: 25-11-2021

Published: 29-11-2021

Key words:

Sustainable development, healthcare, food security, education, housing, manufacturing

ABSTRACT

The welfare of human society has been achieved through adequate application of science and technology. The emphasis has been on the sustainable development, which ensures to meet the current needs without compromising the ability to meet the needs of future generations. This presentation describes and analyses the environmental, economic and socio-political aspects of sustainability. Food security, affordable housing, adequate healthcare and right to education are some of the basic components to ensure human welfare. Large scale manufacturing in different areas as well as building corresponding infrastructures is considered essential to achieve the basic components for the overall development and welfare of human societies. The innovative aspects of science and technology, derived from mathematical knowledge and concepts, are required to accomplish the objectives of human welfare. The available research findings on various aspects of human welfare are reviewed. This would be helpful in extracting results for applications. The aspects undertaken for welfare can then be practically achieved, with some local amendments.

Introduction

Mathematics has been instrumental in the development of basic concepts in science and technology, which are considered accurate as well as precise. Science and technology use some of these concepts and techniques to gather relevant information for understanding the real world phenomena. Mathematical models are then developed to represent the real world objects and phenomena, such that actions as well as consequences and solutions are simulated by executing formulas and equations mostly using computers.

Technology assists in providing basic human needs as well as desires by amending the existing processes. Development is a process or an act that creates something relatively new over the period of time and assists in the growth of peoples' self esteem by promoting human dignity and respect.

It has been stated that the material as well as spiritual growth and overall well-being of humans can be described as development, which in the physically measurable sense may be linked with proper nutrition and educational opportunities, adequate shelter, health care and social amenities (Pokhariyal, 2007). It is understood that sustainable development meets the needs of present time while ensuring that the needs of future generations are also met equitably and provides balance between the carrying capacity of natural systems with the social challenges faced globally.

The concept of sustainable development can be broken into three basic components of: environmental sustainability; economic sustainability and socio-political sustainability. Barbier, 1987, similarly proposed that the dynamic nature of development which is influenced by diverse social, economic and biological conditions involve in various tradeoffs that constantly keep on changing with time. By drawing a Venn diagram for these three systems, an alternative optimization for development has been suggested through the intersections of these sets.

United Nations Development Program (UNDP) proposed a set of 17 sustainable development goals that are more or less covered under the three (mentioned) basic components. The significance of the review paper is to make people aware of the factors necessary for the wellbeing of humans. The objectives of the undertaken study has been to let people understand the importance of the aspects of human well being in a sustainable manner.



Fig. 1 UNDP set of 17 Sustainable development goals. *Source: UNDP document, internet search, 21/9/2021*

Environmental sustainability

This is concerned with the human activity by using the nature's available resources at a rate at which they can be replenished naturally, so that equilibrium can be maintained over a long period of time. Otherwise, the long term consequences of environmental degradation would result in an inability to sustain human life, due to various types of diseases, some of them even of previously unknown nature. Such degradation on a global scale could result in great suffering to people as well as other living organisms and is likely to even cause extinction of the human race. Mathematical modelling tools are nowadays effectively used to maintain environmental sustainability.

Economic sustainability

This deals with effectively using and safeguarding material as well as human resources over a long period of time through recovery, recycling and optimum processes. This also involves using the assorted aspects of the units effectively to allow it to continue functioning in a more profitable manner over time and seeking durable growth outcomes. It is concerned with satisfying the diverse needs of inhabitants and at the same time, providing livelihood and services to people at the global level in an equitable manner. Econometrics (consisting of mathematical models, statistical analysis and economic theory) is currently applied to ensure economic sustainability.

Social-political sustainability

It a process of creating avenues for promoting wellbeing by knowing peoples needs as well as ensuring freedom of expression through various alternative modes. This is accomplished and ensured through the engagement, modification and advancement of institutional mechanisms. It seeks pathways to durable as well as feasible social enrichment and development through vibrant, healthy and equitable political processes of society (Pokhariyal, 2014). This would bring harmony amongst people, which would be instrumental in establishing political stability as well as peace in the societies. In a study Chen et.al(2021) explored the determinants for improving socio-political sustainability in the financial service firms through Fuzzy Delphi Method(FDM). The following nine barriers were identified in the study.

B₁: Difficulty of implementing corporate social responsibility (CRS). B₂: Antisocial consideration. B₃: Unemployment. B₄: Class system. B₅: Unstable political climate. B₆: lack of government regulations. B₇: lack of infrastructure conditions. B₈: Lack of government regulations. B₉: Lack of political coherence.

The influence relationships of the key barriers were assessed and the interrelationships and their dependence powers were analyzed using Interpretive Structural Modelling (ISM) approach and cross-input matrix multiplication applied to classification (MICMAC) method. The assessment results showed that among the study barriers B₂ (antisocial consideration) and B₅ (unstable political climate) were found to be decisive that affect the sustainability in the supply chain of the financial service firms. The knowledge in the understanding as well as reducing the impact of these barriers, particularly for firms with limited resources, is likely to enhance capability to undertake better planning and designing continuously effective improvement programs. This would result in winning over new customers as well as retaining the old clients through sustainable services.

In the search for sustainable growth, mathematical knowledge, science, technology, industry and decision makers would continue to explore the various contributions made by applicable science in advancing societal well-being as well as addressing the global challenges of shelter, healthcare, food security, education, ageing population and climate change.

The Organization for Economic Co-operation and Development (OECD) is an intergovernmental organization founded in 16th April, 1948 as Organisation for European Economic Corporation (OEEC) and reformed in September 1961 as OECD, to stimulate economic progress and world trade. It is a forum of countries identifying themselves as committed to democracy and market economy, whose main mission has been to promote policies that will improve the economic and social well-being of people around the world. The OECD is considered to be one of the world's largest and reliable source of comparable economic, statistical and social data. It collects data, analyses economic development, monitors trend and forecasts evolving patterns in a wide range of public policy sectors such as education, employment, cooperation; agriculture, science, technology, innovation, industry, trade and environment. The main mission of OECD has been to promote policies that will improve the economic and social well-being of people around the world. The OECD is considered to be one of the world's largest and reliable sources of

comparable economic, statistical and social data. It collects data, analyses economic development, monitors trend and forecasts evolving patterns in a wide range of public policy sectors such as education, employment, cooperation; agriculture, science, technology, innovation, industry, trade and environment

Infrastructure and manufacturing

Infrastructure can be defined as a long-lived and costly assets having a complex design architecture that are required for economic growth and development in public as well as private sectors. Alternatively, economists tend to define infrastructure in terms of the capital asset which is constructed and the flow of services such an asset is able to generate. Luger et.al (2013) considered the following sectors of the infrastructure: environmental (for water, wastewater and solid waste disposal); transportation (for roads, highways, bridges, rail, ports and airports); energy (for generation, transmission and disposal in gas, coal, nuclear and renewables); telecommunications (for fibre-optic, satellite, microwave and *last mile* access); civic (for town halls, libraries, hospitals and schools); other business related projects (like science parks, large commercial centres). All these sectors require planning, construction duration and management, project analysis, logistics, financing (including public-private partnership), procurement and regulation. The infrastructure may not be consumed directly in the economic activity, but supports economic process through the provision of services and is related to sustainability and economic growth for development. As a capital asset infrastructure has the following features.

**It is very long-lived, mostly exceeding its economic life and its design life.*

**It does not consume capital directly, but it does deteriorate through use as well as through exposure to the elements.*

**It is very difficult to adapt the redundant infrastructure to new use, with exception of some civic infrastructure and therefore represent considerable sunk cost. These are very costly to remove when they become redundant, Luger et.al (2013).*

The foresight definition of manufacturing is, "a system of value creating activities required to develop, produce and deliver goods and services to customers". The main aspect in this definition is a process of transforming inputs into finished products. Services supplied by infrastructure support manufacturing activities in a wide variety of ways and relative conditions of nation's infrastructure are considered as a component of its economic competitiveness. However, the importance of infrastructure alone is difficult to be compared with manufacturing competitiveness. Innovations in infrastructure also stimulate innovations in manufacturing. There are three different estimation approaches using production, cost and vector auto-regression functions, Luger et.al (2013).

Production function approach

One way to characterize the role of infrastructure in manufacturing is as an input of production, in the form of a function:

$$Q = f(K, L, G),$$

where Q is the aggregate private output; L represents the private sector labour force; K is the aggregate non-residual stock of fixed capital and G the composite stock of public capital. This function seems to have an engineering orientation.

Cost function approach

This aims at minimizing the cost, which is given by,

$$C(x_i) = g(Q, P_i, K_i, t),$$

where $C(x_i)$ represents the total private cost of buying quantities x_i at prices P_i , Q is the output, t is the state of technical knowledge and K_i is the public infrastructure capital available to the firm, which influences the firm's costs, as suggested by Berndt and Hasson, 1992. The private costs vary with the utilization rate of infrastructure and can be expressed in different forms.

Vector auto-regression (VAR) approach

This approach is more data oriented and uses a Granger-causality test to identify the causal directions between the study variables. The test is conducted by regressing one variable on its own lag and other variables and their corresponding lags. In addition this approach also utilizes impulse-response and variance decomposition analyses to know about the manner in which shocks affect the variables over time (Pereira 2001a). Through two-way causality, VAR approach relatively generates larger economic effects for public capital on private capital and employment, as well as feedback effects from private inputs and outputs as compared to the other approaches (Sturm, 1998).

In order to achieve basic components of human welfare, which include food security, affordable housing, adequate healthcare, and right to education, various sectors of infrastructure need to be developed by applying suitable scientific and technological techniques and making use of the corresponding manufacturing processes.

Strong and solid foundation of mathematics, science and technology is considered essential for almost all innovations in the manufacturing industries. The industrial development can be initiated and sustained through long term socio-political and economic policies ensuring (Pokhariyal 2007):

- Regular flow of raw materials.
- Stable administrative and judicial structure.
- Minimal legislative, political and government interference.
- Mechanism for continuous updating of technology.
- Opportunities for incorporating scientific developments (eg nano-technology) into manufacturing processes.
- Efficient and equitable distribution system for manufactured products.
- Deep rooted ethical norms and fulfillment of duty (dharma).

For the welfare of the citizens, particularly in the developing countries, all available raw materials need not be exported; rather the industries for secondary production should be established. In some cases, regional cooperation for setting up joint industrial ventures should be explored. This would also enlarge the local consumer market base for the finished goods. Under dharma, only adequate amount of raw materials will be extracted without exploiting mother earth and the environment will also be accordingly protected. The use of SMART Criteria should be undertaken to develop and accomplish industry's goals. The five characteristics objectives in SMART are Specific, Measurable, Achievable, Relevant and Time-based. Industries can foster a result oriented operation in which continuous improvement is considered as crucial to the industry's ability to meet and beat the competition (Wayne Chaneski, 2018).

Food security

Food security "exists when all people at all times, have physical and economic access to sufficient, safe and nutrition to meet their dietary needs and food preferences for an active and healthy life" (FAO, UN,2003). The four elements that build the framework of food and nutrition security are:

Availability which deals with various crops production, through efficient use of water resources, adequate stocks and fair trade. This ensures that every required item is freely available at every demand destination.

Access, which depends on the household income, prices of commodities that one consumes, markets and infrastructure, as well as proper distribution of food within the households, without gender bias.

Use and utilization, which requires food and nutrition knowledge, food preparation with nutrition value and cultural practices along with health status of individual members of family by maintaining high hygiene standard.

Stability, which ensures the constant supply of food items over a long period of time, by minimizing the external risks due to weather patterns, price volatility, epidemics(like the world is facing due to Covid-19) and other conflicts.

Things that are affecting food security in the current times include:

- *Global Water Crisis* - This is due to due to water table reserves are decreasing in many countries due to widespread pumping and irrigation.
- *Climate change* – this is a result of rising global temperatures that are beginning to have ripple effect on crop yield, forest resources, water supplies and altering the balance of nature.
- *Land Degradation* – This is due to intensive farming, excessive use of chemical fertilizer resulting in exhaustion of soil fertility and decline of agricultural yield.
- *Greedy Land deals* – powerful individuals, corporations and public sector institutions buy rights to millions of acres of agricultural land, mostly in developing countries to secure their own long term food and other consumable supplies at arbitrary price range.
- *Diseases, like Covid-19*- The pandemic has caused the closing down of various types of industries, which resulted in large scale unemployment. Different levels of governments and social organizations, all over the world, have started free distribution of food items to combat the starvation.

In order to ensure food security all countries (in particular, the developing nations) need to search for alternatives and one of which is the use of agro-minerals, as they release the nutrients at a relatively slower rate into the soil as compared to the chemical fertilizers. The best known agro-minerals available in sub-Saharan Africa and other countries are (Sanchez, 2002):

- Salt peter, the only naturally occurring nitrate mineral.
- Phosphate rocks, with apatite as the principal phosphate mineral.
- Guano minerals, complex P and N bearing compounds.
- Potash, mainly sylvite and complex K-bearing salt.
- K-silicates, such as k-micas, glauconites and k-bearing volcanic rocks and K-zeolites.
- Sulphur, sulphides (pyrite) and sulphates (gypsum).
- Calcium and magnesium carbonates and rocks.
- Various silicate minerals and rocks used to conserve nutrients (zeolite) and moisture (scoria and pumice).

The agro-minerals are used in crop production systems for several purposes, particularly for improving soil fertility, correcting the pH of soil and conserving nutrients and water. Thus, by conducting soil sample tests to determine what nutrients are lacking, the option of using agro-minerals, through right rocks on right crops can be implemented to improve food production by adopting the crop enhancement model shown as follows.

Table 1. Crop Enhancement Model (Pokhariyal,2007)

Agro-Mineral	Characteristic feature	Applicable in
Calcium	Assists in pod development	Corresponding plants
Gypsum	Reduce phytotoxicity in acid soil	All plants
Liming materials	Raise pH of acid soil provide Ca-ions decrease AI-toxicity	All plants
Micronutrients (B, Cl, Co, Cu,	In small amount	Cash crops and other plants

Fe, Mn, (Mo and Zn)	(for optimal growth)	
Peat	Good aeration and water holding	All plants
Perlite	Aeration in artificial growth media	Plants in greenhouse and Otherwise
Phosphate rocks	Direct application to acid soil	Buckwheat, kale or rape Phosphate rocks Direct application to acid soil
Potash	Water soluble and slow release of K	white lupins, cabbage, pigeon peas Bananas, coconut, rubber, palm oil, others
Sulphur and pyrite	Synthesis of proteins and produce acids to lower pH	All plants
Vermiculite and Zeolite	Store and release nutrients and moisture slowly	All plants

In order to have effective food security, the following further steps need to be taken;

- Development of new crop varieties, through research, that are resistant to the effects of climate change, diseases and give high yields as well as identifying species of plants that were not previously developed as food crops.
- Improving communication link, through the use of information technology and mobiles, between farmers and consumers as well as forming farmers' cooperative societies.
- Introducing integrated farming systems, such as mixed farms and crops that would enhance productivity of farm products.
- Combined effort of public and private sectors, through research, to improve existing agricultural systems.

Plenty(San Francisco's tech start up), is a collective of growers, innovators, engineers, scientists, artists, foodies and plant romantics, working on a mission to improve health of plants, people and our planet. In this vertical farm, perfect environment is created for plants by reducing the uncertainty changing climate. Neither bleach nor pesticides are used on the plants and pure food produced tastes like nature intended. These farms are designed to increase yield of crops many (350 to 400) times as compared to traditional farming and have huge efficiency scale where hundreds of acres of farmland condenses into the size of big retail store. Plenty vertical farms use 99% less water than conventional fields and produce zero fertilizer runoff. Plenty uses technology to monitor water usage, light and temperature of the environment in growing the plants. While working the Artificial Intelligence (AI) learns how to grow the crops faster and of better quality through the optimum combination of the input variables.

The production in the farm is managed by robots and AI.

Yes Health Group (a Taiwanese tech Company) use the vertical farm, developed by designing similar systems in Asia for many years, to help their global expansion in the area of sustainable food technology. The company developed the LED lights for ultimate efficiency and integrated hydroponic technology which grows plants with minimal water and without pesticides. Danish Company Nordic Harvest and Yes Health Group have paired to create a massive wind powered vertical farm to grow about 1000tons of food annually condensing into a single building that would have taken about 20 soccer fields of traditional land. This technique of condensing land and bringing transparency into the structure of food production may help the effort to restore Denmark's as well as other nation's forests and soon the produce will be economically competitive with traditionally grown crops, which would result in more vertical farms in future.

App Harvest is an American team of passionate people on a mission to feed the future by growing fresh, nutritious fruits and veggies for betterment of people and planet. They are building a sustainable home grown food supply system for every one, all year long with the following goals:

- * *Drive positive environmental change in agriculture.*
- * *Empower individuals in Appalachia.*
- * *Improve the lives of our employees and community in which we operate.*

The horizontal design takes advantage of nature's free resources of water and sunlight every day to maximize efficiency and sustainability. A study of life cycle assessment of different types of controlled environment agriculture systems showed that the approach of App Harvest's horizontal hydroponic farms are also less energy intensive than vertical systems due to benefits of passive solar. The collected rain water is used for irrigation. The 500 beehives each holding up to 125 bees and their queen are used to pollinate close to 0.75 million tomato plants. The growth substrates in place of soil are used to deliver nutrients directly to the plants. By using hybrid lighting with LED a higher level of light can be applied to plants with only 33% radiant heat, which reduces energy costs and by having AI expertise in house the overall efficiency is optimized.

Vertical farming, with Israel technology, is being used in India, to grow turmeric in poly house, which produces yield of at least 10000 quintal (wet) per acre as compared to 100 quintal (wet) per acre through conventional horizontal farming. Vegetables are also being grown soilless with hydroponic farming in the urban and peri-urban areas of India, which is picking in the other parts as well and its future seems good. Attempts are being made by using updated scientific and technological techniques in many countries to ensure food security to their people.

Adequate food storage facilities and efficient distribution system with effective mechanism need to be established to make food available to all people as well as to control food prices, so that exploitation of consumers can be prevented.

Affordable housing

Affordable housing can be described as the various sets of units for living that can be taken up by the section of society whose income is below the median household income in a country. It becomes a key issue, particularly in developing countries, where majority of the people are not in a position to buy houses at the market price. The value as well as features of affordable housing varies from country to country depending upon its economic status and environmental conditions. In order to meet the increasing demand for affordable housing many countries are opting for public-private partnership model for developing these units.

Wall Ties and Forms Inc. (WTF Formwork Systems) and The Tagos Group LLC (Tagos) in partnership have constructed low cost, mass housing across the continent of Africa (and some other countries around the world) to assist governments and private investors. Wall-Ties and Tagos have been committed to train and utilize local, unskilled labour and local raw materials in the construction process to further contribute to the development of the local economy. One of the techniques uses aluminium panels, steel, ballast, sand and cement to construct homes, without wood and building stones. The houses are built using aluminium panels, while the perimeter walls separating different units are being put up with patterned aluminium frame work from Wall-ties and Forms Inc (WTF) technology. The aluminium framework are fabricated to take the shape of the entire building, assembled on site. After laying the foundation, the reinforcement steel is tied, piping and wiring systems are done, the hollow space in between is then filled by pouring ready-mix concrete.

All the decorative features, whether structural or ornamental that are required on the external walls can be incorporated in the aluminium panel. This technique saves the cost by nearly 15 to 20 percentage and houses can be completed in few weeks. The entire fabric of steel reinforcement and concrete is interconnected both vertically and horizontally which makes it safer even in earthquake (for example, in Peru and other Latin American countries; Sub-Saharan Africa). There is no wastage of raw material on site and the walls are so smooth that they do not need plastering, with some skimming the walls are ready for paint work (Affordable housing- concrete issues, 2021). This project is being implemented in many developing countries all over the world.

In addition, architects have been planning as well as providing low cost housing all around the globe by using the locally available raw materials and suitable technology on the basis of prevailing local conditions and adequate space. Some of the examples are as follows.

- * *S House in Vietnam, by Vo Trong Nghia Architects.*
- * *Post- Tsunami Housing, Sri Lanka, by Shigeru Ban.*
- * *Bamboo Micro - Housing, Hong Kong, by Affect -T.*
- * *Prototyping UH, Japan, by General Design.*
- * *Pop-up Housing in Garages, United Kingdom, by Levitt Bernstein.*
- * *Casa Convento, Ecuador, by Enrique Mora Alvarado.*
- * *Happy Cheap House, Sweden, by Tommy Carlsson.*
- * *Empower Shack, South Africa, by Urban Think Tank and ETH Zurich.*

There are also several well designed Social Housing Projects being taken up around the world.

Smart Precast Technology

Precast construction is a cost-efficient, fast and sustainable building technology for large housing projects that does not compromise quality. Precast is a modular building system based on ready-made factory-manufactured components and intelligent connections. The most common precast products include: hollow-core slabs; wall elements from sandwich to gray walls; partition walls; building foundations with precast concrete piles; beams and columns for structural frames.

Precast is a smart and industrialized way to construct cost-efficient buildings. The competitive and proven precast solutions provide controlled quality, long service life, low maintained costs and flexibility in design as well as less use of productive resources. Most of the work is transferred from the construction site to a safe and controlled, automated factory environment, which results in improved productivity and minimal logistics. The production lines for precast are quite versatile with a nearly unlimited palette of options by just changing the type of the element or the surface material. Precast buildings are very suitable for hot climate. The thermal and sound insulation properties of precast are very advanced. Precast concrete buildings absorb the store surplus heat and slowly release it back into the air, which in future can possibly be converted into energy. Precast can also be effectively used for buildings in seismic areas by taking into account the local requirements at the design stage. This technology is currently used for affordable housing in many countries (www. Smart precast technology, 2021).

Healthcare

Science and technology have been at the forefront to improve the field of medicine, which is being reflected in better healthcare. Technology has improved almost every aspect of healthcare from the birth of babies to surgery and cancer treatment. Although there have been many scientific breakthroughs in medical research, but electronic medical records and clinical practice guidelines have significantly affected the way healthcare facilities are managed. Electronic health Record/Electronic Medical Record (EHR/EMR) software makes it easier for doctors to check the patient's details and then approve refills and provides quality care to patients. EHR also improves the doctor's job satisfaction and patient's customer satisfaction.

Through the use of evidence-based guidelines, doctors are in a better position to make a more accurate diagnosis and come up with more treatment plans, because they have instant access to a whole range of statistical information from their computers, so that treatment can be optimized. A central and standardized system throughout the entire healthcare industry can identify a viral or bacterial infection quickly. The analysis of this can give insight into how widespread an outbreak is, so that preventive

measures can be taken up much more quickly. EHR can automatically alert treating physician to potential issues, such as allergies or intolerance to certain medicine. Currently cloud computing allows, better and safe data storage, improved access to big data, telemedicine and mobility. However, sometimes there is a risk of medical records hacking (AIMS, 2021).

For developing countries, the use of hand-held molecular diagnostic tool can help unskilled health workers rapidly and accurately diagnose diseases, which will reduce healthcare costs due to delayed results and sometimes incorrect diagnosis. Recombinant vaccines can mitigate the risk of infection associated with live as attenuated vaccines, while needle-less delivery methods can help in containing the blood-borne infections (Acharya, 2007).

The Covid-19 pandemic has put huge pressure globally on the health care systems to deliver essential healthcare services, in particular, for the most vulnerable populations, such as older people, children and people living with disabilities and chronic conditions. Currently due to Covid-19 pandemic, most of the available resources have been diverted to combat it. Researchers in many countries, after analyzing the data to understand the dynamics of covid-19 infection, whose origin has not yet been confirmed, have developed different types of vaccines that are being used, as one of the most effective measure to check the spread of Covid-19. The Health Services Learning Hub (HLH) is a dynamic new knowledge platform, that supports cross country learning in maintaining essential health services during the Covid-19 pandemic as well as the post pandemic recovery phase, in the implementation of the operational guidelines provided by World Health Organization(WHO). Biopharmaceutical New Technology (Bio N Tech) is a German biotechnology company that develops and manufactures active immunotherapies for patient-specific approaches to the treatment of diseases. It develops pharmaceutical candidates based on messenger ribonucleic acid (mRNA) for use as individualized cancer immunotherapies, as vaccines against infectious diseases and as protein replacement therapies for rare diseases and also engineered cell therapy, novel antibodies and small molecule immunomodulators as treatment options for cancer. Bio N Tech, in 2020 partnered with Pfizer for testing and logistic, developed the RNA vaccine BNT162b2 for preventing Covid-19 infections, which is popularly used around the world.

The use of cloud integration has allowed for the data from different health systems to be shared, which will enhance prediction by analyzing a larger volume of data. AI is expected to be used in areas such as clinical interpretation of complex data sets, intelligent medical images, voice integration and real time insight of streaming medical devices and sensor data.

The importance of herbal and traditional medicine need not be ignored. More effort should be made to enhance research herbal (Ayurvedic) medicine, so that each treatment steps can be justified by scientific evidence. This would then change the entire dynamics of healthcare systems for treating various diseases at affordable level at all places. Ayurveda emphasise good health and prevention as well as treatment of illness through lifestyle practises such as message, meditation, yoga and dietary changes and use of herbal remedies. For example, many people may agree that use of herbal powder/paste seems to be quite effective in curing some of the dental problems.

The challenges posed by Covid-19 has provided an opportunity for the governments to take healthcare more seriously and create enough ordinary as well as Intensive Care Unit (ICU) beds capacity in the hospitals, provide adequate supply of essential drugs, oxygen and other critical equipments, as well as train various types of specialized manpower to effectively run and manage the equipments. In order to combat the high cost of healthcare all over the world, particularly in Sub Sahara Africa and some other developing countries, governments need to redraw their policies, which should include more government referral hospitals, having all up to date facilities, as well as controlling consultancy and hospitalization charges by private sector, to affordable levels.

Right to Education

Education may be described as a set of activities through which human groups transmit to their descendants the knowledge and skills as well as a moral code in order for the group to maintain itself at an optimum level. Education is considered the basis for development and empowerment of citizens of every nation and is the most powerful tool that can also be used to change the world around us. The right to education has been recognized as a human right in a number of international conventions, including in 2021 International Covenant on Economic, Social and Cultural Rights which recognizes a right to free compulsory primary education for all, an obligation to develop secondary and higher education equitable accessible to all. The 171 states were party to the covenant (UN, 2021).

The right to education act makes education a fundamental right of every child between ages of 6 and 14 and specifies minimum norms in elementary schools. In the exercise of any function which it assumes in relation to education and to teaching, the state shall respect the right of parents to ensure such education and teaching is in conformity with their religious and philosophical convictions. The human right act protects the right to an effective education within existing educational institutions in European Union (EU) and United Kingdom(UK).

The Right to Education Act, UN India has the following provisions:

- i. *Mandates* the right of children to free and compulsory education till completion of elementary education in a neighbourhood school.
- ii. *Clarifies* that compulsory education means obligation of government to provide free elementary education and ensure compulsory admission, attendance and completion of elementary education to every child in the 6 to 14 age group. Free means that no child shall be liable to pay any kind of fee or charges or expenses which may prevent him or her from pursuing and completing elementary education.
- iii. *Makes* provisions for a non-admitted child to be admitted to an age appropriate class.

- iv. *Specifies* the duties and responsibilities of appropriate governments, local authority and parents in providing free and compulsory education, and sharing of financial and other responsibilities between the central and state governments.
- v. *Lays down* the norms and standards relating inter alia to Pupil Teacher Ratios (PTRs), buildings and infrastructure, school-working days, teacher-working hours.
- vi. *Provides* for rational deployment of teachers by ensuring that the specified pupil teacher ratio is maintained for each school, rather than just as an average for the state or district or block, thus ensuring that there is no urban-rural imbalance in teacher postings. It also provides for prohibition of deployment of teachers for non-educational work, other than decennial census, elections to local authority, state legislatures and parliament, and disaster relief.
- vii. *Provides* for appointment of appropriately trained teachers, i.e. teachers with the requisite entry and academic qualifications.
- viii. *Prohibits* (a) physical punishment and mental harassment; (b) screening procedures for admission of children; (c) capitation fee; (d) private tuition by teachers and (e) running of schools without recognition.
- ix. *Provides* for development of curriculum in consonance with the values enshrined in the constitution, and which would ensure the all round development of the child, building on the child's knowledge, potentiality and talent and making the child free of fear, trauma and anxiety through a system of child friendly and child centred learning.

Education in most of the countries, including India and United States of America is not in the domain of central (federal) governments, but rather in the domain of states. This decentralized approach has its benefits as local government control their local schools and parents can more easily involve in the educational policy, through parents teacher associations. However, observers contend that, under this arrangement, funding as well as quality of education varies from region to region and often those regions that have greatest need for funding get the least. The other aspect is that some of the things written in the respective acts are not necessarily implemented and followed on the ground.

Technology has transformed education by changing how, when and where students want to learn as well as empower them at every stage of their journey. Technology assists students on the path of personalized learning, the ownership of how they learn, make education relevant to their digital lives and preparing them for their future. With technology and access to resources beyond class rooms, students satisfy their hunger for learning and are inspired to become critical thinkers, problem solvers, collaborators and creators. The skills in coding, programming, physical computing and computational thinking make students marketable in the workforce. Testing online the student performance can be evaluated instantly with technology and teachers can better track and understand students grasp of the subject. The study materials, including e-books, are available online or by U-tube. Students can have online contact with experts through WhatsApp or zoom calls to get their problems solved. Many institutions are providing free quality education through online learning systems and some universities are even registering for online diploma and degree courses and allowing access to all teaching materials. One of such institution is Khan Academy, which is a United States based non-profit organization, provides a free world class education to anyone anywhere. At Khan Academy emphasis is on personalized learning, the study material is created by experts and teachers can identify gaps in their students' understanding and to meet the needs of every student the instructions are made accordingly.

Conclusion

Food, housing, healthcare and education are identified as the basic factors for human welfare and people aspire to have them by proper use of science and technology.

Recommendations

In order to accomplish the welfare of human society, food security, affordable housing, adequate healthcare and the right to education must be provided, by developing the corresponding infrastructure using various manufacturing processes through the application of science and technology.

Use of scientific and technological knowledge should be encouraged to increase food production. Special seed varieties should be developed for semi-arid areas. The use of agro-mineral and manure has to be encouraged, so that soil fertility can be maintained for a relatively longer period. Water harvesting should be encouraged and mechanism for drip irrigation as well as affordable greenhouses needs to be developed to enhance productivity. Equitable land distribution system has to be incorporated with adequate land reform laws. People from all aspects of life (in particular, politicians, government officials and businessmen) must follow their respective dharma, in order to accomplish the desired development.

Many projects towards affordable housing are on the ground, but more projects should to be promoted by the state/county governments and the national governments of the respective countries, depending on the need. The slums can be upgrade with block replacement model, in which a group of small 6x6 shanties be replaced by multi stored buildings, with reasonable basic facilities.

For industrialization most of the developing countries, need to avoid export of all the available raw minerals, rather should promote secondary production in their own countries. Honest and transparent policies should be formulated in all sectors, with adoption of dharma, so that over exploitation of mother nature is prevented and we leave a better world for our future generations. Effective regional cooperation should be encouraged for setting up joint industries in the region. Free trade in the region, with increased number of consumers, would then automatically develop. In order to improve health care sector governments should promote public/private participation, so that health services becomes assessable as well as affordable. More hospitals, with adequate facilities should be build, following the WHO patient hospital wards ratio. Manufacturing of essential drugs and equipments should be encouraged. Serious research on herbal and traditional medicines needs to be done, so that these alternative treatment techniques can also be a part of the holistic treatment system.

Primary education should be done in the mother tongue, so that children can easily understand the basic concepts involved in various subjects. Equitable distribution of funds and equipments should be made to the educational institutions, so that rural and urban as well as regional imbalance in the quality of the education can be minimized. Avenues for vocational training need to be developed at every exist point from the educational institutions to make youths more employable. Industry and academia cooperation should be enhanced, so that curriculum can be developed to meet the demand of industries, which will improve employment situation as well as attract research funding from the industries.

Science and technology experts agree that application of machine learning, AI and cloud technology to food production, clinical, workplace, educational, and financial processes will have better and richer incorporation into the respective industries, for overall welfare of human beings. Specific recommendations for the welfare of a country or state can be developed by taking into account the prevailing situation and available opportunities for better outcome, which would automatically establish as well as enhance peace and prosperity at that place.

Acknowledgement

Author thanks Shuvranshu Pokhariyal for some useful suggestions to improve the paper.

References

- Acharya T (2007): *Global Public Health*, 2(1), 53-63.
- Barbier E.(1987): The concept of sustainable economic development; *Environmental conservation*, 14(2) 101-110.
- Berndt, Ernst R. and Bengt Hansson (1982): Measuring the contribution of Public Infrastructure in Sweden, *Scandinavian Journal of Economics* 94, Supplement.
- Managed Healthcare Executive (MHE) Publication: February 2019 Issue, Volume 29, Issue 2.
- Pereira, Alfredo M. (2001a): On the Effect of Public investment on Private investment: Wat crowds in what?; *Public Finance Review* 29,1,Jan261-277.
- Pokhariyal.G.P. 2007: Development Strategies for Sub-Saharan Africa; *International Joun. on World Peace*, Vol. XXIV NO. 1, March2007, pp83-101.
- Pokhariyal G.P. (2014): AGRICULTURAL AND SUSTAINABLE DEVELOPMENT MODELS: Paper presented at International conference at Pant Nagar University, 18-22b October, 2014.(Later in chapter in book).
- Sanchez, P.A. (2002): Soil Fertility and hunger in Africa; *Science* 295, pp 2019-2020.
- Strum, Jan-Egbert (1998): Modeling Public Capital Spending and Growth; *Public Capital Expenditure in OECD Counties: the Causes and Impact of the decline in Public Capital Spending*. Cheltenham UK: Edward Elgar, 49-79.
- Wayne Chameski (2018): Executive Director, Center for manufacturing systems, New Jersey Institute of Technology; posted on 9/1/2018.
- Wen-Kuo Chen, Venkateswarlu Nalluri, Man-Li Lin and Ching- Torng Lin (2021): Identifying Decisive Socio-Political Sustainability Barriers in the Supply chain of Banking sector in India, Causality Analysis using ISM and MICMAC; *Mathematics* 9(3),240.
- Michael Luger, systems, New Jersey Institute of Technology; posted on 9/1/2018.
- Jeff Butler and Graham Winch: *Infrastructure and Manufacturing: their evolving relationship* (2013); Future of Manufacturing Project: Evidence Paper 20. Assets publishing service, gov.uk
- Affordable Housing - Concrete Issues: Google Search, on 30/5/2021.
- www.smart. Precast technology; Internet Search on 1/6/2021.
- American Institute of Medical Services and Education (AIMS) 2018: The Impact of Technology on Healthcare[®]April 24,2018; Internet search, on 2/6/2021.
- FAO, UN (2003), Internet search, on 28/5/2021.
- United Nations Treaty Collections (2021): International Covenant on Economics, Social and Cultural Rights; retrieved on 8/6/2021.
- The Right to Education Act; United Nations in India; <https://in.one.un.org> retrieved on 8/6/2021.