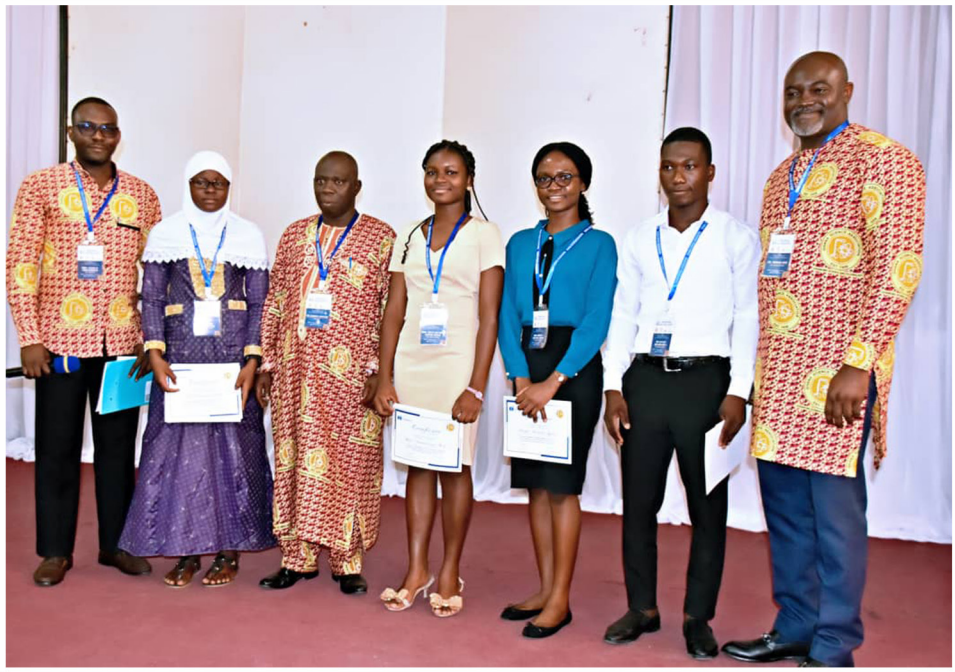
Everyday SCIENCE For Schools

Volume 11, Number 1, 2023

"GSA offers opportunities and awards young scientists in various categories.

ESS Magazine is distributed to various schools and stakeholders."



SPECIAL EDITION ON YOUNG SCIENTISTS CHALLENGE, 2022

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TABLE OF CONTENTS

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Editorial Disclaimer:

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Ghana Science Association

Introduction

The Ghana Science Association (GSA), a voluntary, non-profit making and multidisciplinary organisation of scientists, technologists and mathematicians was formed in 1959. The Association traces its origin to the West African Science Association (WASA) which was formed in 1953 at the University College of the Gold Coast. WASA was formed to provide West African scientists the forum to advocate the importance of Science and Technology as a necessity and bedrock for national development. The formation of GSA broadened the scope of activities from reading of scientific papers to involvement in national and international affairs. The Association was placed on government subvention under the Ministry of Education as far back as 1961 by a Presidential Fiat. Hence the Association is supported through a budgetary allocation from the Ghana Government. Other sources of income include membership dues and proceeds from workshops and conferences. The GSA was mandated to promote, popularize and demystify science and create a scientific culture in the country. The Association has made tremendous contributions to National Development, Health and Economic Growth through scientific interventions. The Secretariat is a point where scientific and technological information and research findings are obtained by individuals and corporate bodies.

Membership of the Association is drawn from the Universities, Research Institutes, Industry, Government and Persons interested in the promotion of Science and Technology.

Vision and Mission

Vision

To become a dominant voice in Science and Technology advocacy by promoting and popularizing Science and Technology to meet national developmental needs.

Mission

Advancing Science, Technology, Engineering and Mathematics (STEM) through interaction and cross-fertilization of ideas of all interested people to: -

1. Popularize, promote and disseminate scientific information and technology transfer for national development.
2. Contribute to the development of National Science and Technology policy.
3. Collaborate with industry to set national research agenda.
4. Establish linkages with industry to promote the transfer and application of Science.
5. Seek affiliation and foster cooperative links with other national and international organizations.

Activities

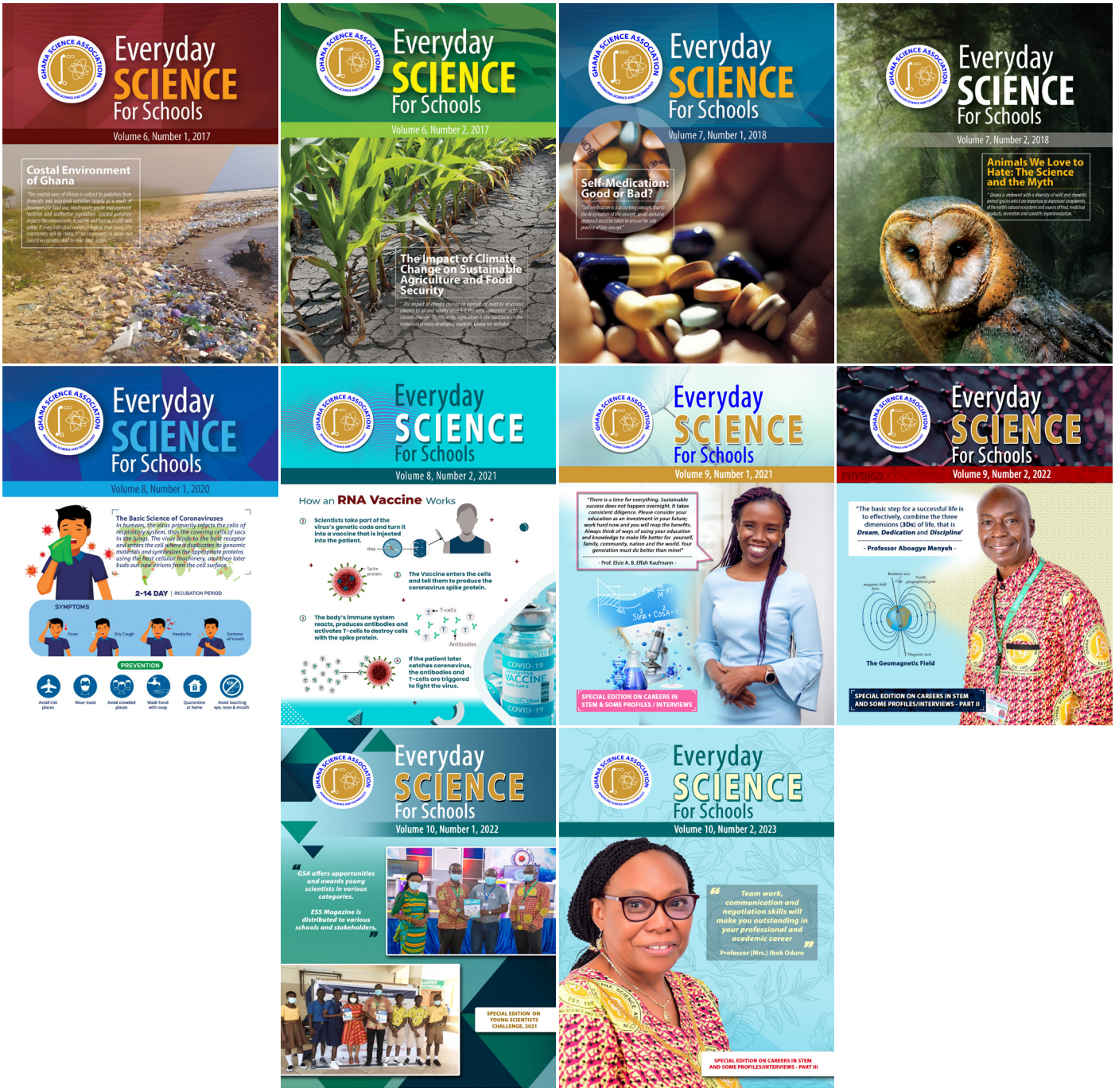
1. Organization and participation in scientific conferences, workshops, seminars, symposia, public lectures, quizzes and science fairs.
2. Promotion of carrier development of scientists in Universities and Research Institutes in Ghana and elsewhere.
3. Publication of the scientific journal, magazines and books (e.g. Journal of the Ghana Science Association and Everyday Science for Schools magazine).
4. Training programmes for mathematics and science teachers to improve the teaching and learning of these subjects in Schools and Colleges of Education.

Contribution to National Development

Issues of national importance have been regularly and consistently highlighted at biennial workshops, conferences etc. Communiqués had been submitted to Government and other stakeholders on very topical themes to help shape national policies.

About ESS Magazine

ABOUT EVERYDAY SCIENCE FOR SCHOOLS (ESS) MAGAZINE



The ESS magazine is supplementary reading material and one of the publications of the Ghana Science Association (GSA). It is published in two volumes annually.

Aside from the regular contributions from scientists/ lecturers, researchers, SHS tutors and students, etc., on science, technology, engineering and mathematics (STEM) related topics and careers, the content of the Magazine also includes crossword puzzles and quizzes.

Special contributions from an eminent Ghanaian scientist/ mathematician, particularly in the industry; a short essay for an issue about how they became a scientist and why the chosen field in science. This will motivate students to work hard and strive to excel in the sciences.

The Editorial Board is made up of committed, hardworking and inspirational members of the GSA who ensure that the articles published are relevant, high quality and educative to readers, especially young people in Senior High Schools and Tertiary Institutions.

GSA believes the supplementary magazine goes a long way to motivate students to work hard and strive to excel in the sciences.

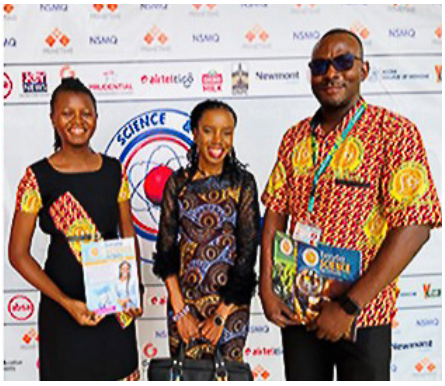
GSA aims to distribute the ESS Magazines to various SHS and stakeholders (such as tertiary institutions, Ghana Library Board, British Council Library, and Community Libraries, among others) in the country.

DONATION OF ESS MAGAZINES

No	Branches/Institutions	Copies Donated
1	Accra	320
2	Kumasi	320
3	Tamale	260
4	Koforidua	260
5	Cape Coast	260
6	Sunyani	200
7	Navrongo	140
8	Asante-Mampong	240
9	Ho	150
10	Winneba	60
11	ESS Editorial Board	60
12	National Maths & Science Quiz (NMSQ)	800
13	Ghana Science Olympiad	200
14	GOIL Company Ltd	200
15	Zoomlion Ghana Limited	60
16	Junior Science and Maths (JSM) Quiz	200
17	Women in Science, Technology, Engineering, and Mathematics, Ghana (WiSTEMGh)	200
	Total	**3,930**

A total of four thousand (4,000) copies of the ESS Magazines were printed and 3,930 were donated to schools across the country through GSA Branches. A total of 70 copies were kept at the National Secretariat of the GSA.

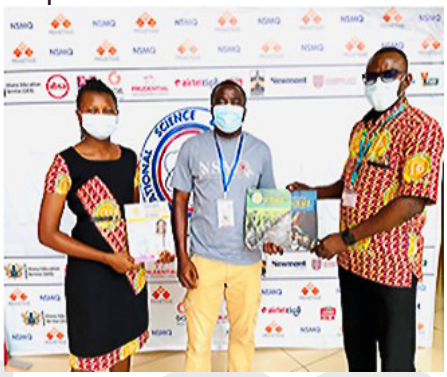
National Science & Maths Quiz (NSMQ)



The Ghana Science Association (GSA) has demonstrated its commitment to promoting science education in Ghana presented Eight Hundred (800) copies of ESS Magazine to Eighty-one (81) schools that participated in the National Science and Maths Quiz (NSMQ) held at the Kwame Nkrumah University of Science and Technology (KNUST). The donation was made on behalf of the National Executive Committee possible by the Kumasi branch of the GSA, namely Prof. Jacob K. Agbenorhevi (Kumasi Branch President/Editor of ESS Magazine), Miss Antoinette Gbordzor (Post Graduate Student Representative of the Kumasi Branch of GSA), and Prof. Elsie Effah Kaufmann (Deputy Editor of ESS Magazine and Quiz Mistress-NSMQ).

The ESS Magazine has created a platform for students, teachers, and researchers to exchange ideas and stay up-to-date on the latest developments in science and technology. The NSMQ is a highly popular and competitive quiz competition that aims to encourage students to take an interest in science, technology, engineering, and mathematics (STEM) subjects.

The presentation of 800 copies of ESS Magazine to eighty-one schools that participated in the NSMQ 2022 held at KNUST is a significant step towards promoting science education in Ghana. The magazines will provide students with a valuable resource for learning about the latest developments in science and technology, as well as inspiring them to pursue careers in STEM fields.



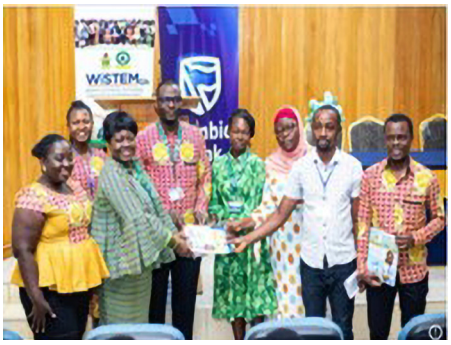
The donation also demonstrates the commitment of the GSA to promoting the development of

science and technology in Ghana, and the importance of collaboration and partnership in achieving this goal.

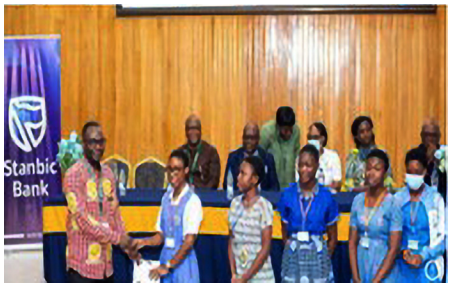
Generally, the presentation of ESS Magazine by the GSA is a commendable initiative that deserves recognition and support. Through the efforts of Prof. Jacob K. Agbenorhevi, Miss Antoinette Gbordzor, and Prof. Elsie Effah Kaufmann, the GSA has demonstrated its commitment to promoting science education in Ghana and inspiring the next generation of scientists and researchers. The impact of this donation will be felt by many students across Ghana, who will now have access to valuable educational resources that will help them to succeed in their academic pursuits and prepare for future careers in science and technology.

WiSTEMGh

The Ghana Science Association (GSA) has once again presented 200 copies of the Everyday Science for Schools (ESS) magazine to schools that participated in the Women in Science, Technology, Engineering, and Mathematics, Ghana (WiSTEMGh) KNUST STANBIC Girls camp program organized by the KNUST College of Science, Kumasi.



The donation was made possible through the efforts of Prof. Jacob K. Agbenorhevi, the Kumasi Branch President/Editor of ESS Magazine, and supported by Miss Antoinette Gbordzor, the Post Graduate Student Representative of the Kumasi Branch of GSA, and other members of the GSA.



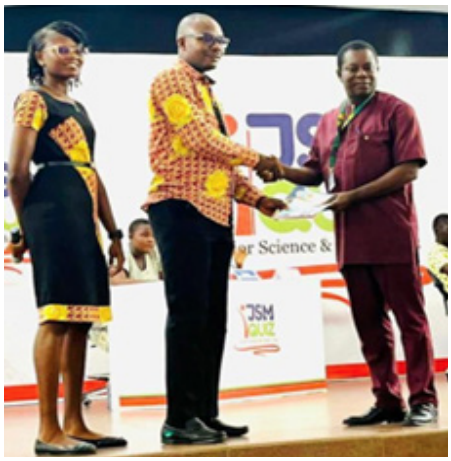
The WiSTEMGh program was aimed at promoting interest and participation in science, technology, engineering, and mathematics (STEM) subjects among young women in Ghana. The program provided participants with the opportunity to interact with female role models in STEM fields, learn about career opportunities in STEM, and participate in hands-on learning activities that inspire creativity and innovation.

The presentation of 200 copies of ESS Magazine to participating schools in the WiSTEMGh program was a significant step towards promoting science education among young women in Ghana. The magazines provided participants with a valuable resource for learning about the latest developments in science and technology, as well as inspiring them to pursue careers in STEM fields.

Through its various programs and initiatives, the GSA has been able to contribute significantly to the promotion of science education in Ghana. The association has organized various educational activities and outreach programs aimed at inspiring young people to take an interest in science and technology. By collaborating with other organizations, such as the College of Science Kumasi and the WiSTEMGh program, the GSA has been able to reach a wider audience and make a greater impact on the development of science and technology in Ghana.

Junior Science and Maths (JSM) Quiz

GSA donated 200 copies of ESS MAGAZINE to schools that participated in the Junior Science and Maths (JSM) Quiz. The event was hosted by KNUST, Kumasi. The donation was done by the Kumasi Branch President/Editor of ESS Magazine, Prof. Jacob K. Agbenorhevi, and supported by the Post Graduate Student Representative of the Kumasi Branch of GSA, Miss Antoinette Gbordzor.



The Young Scientist Challenge Entries

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THE ROLE OF BASIC SCIENCES FOR SUSTAINABLE DEVELOPMENT

INRODUCTION

While science alone cannot solve all problems in the world, it cannot provide complete solutions to non-physical aspects of life, love, relationships, spiritualties, music, and literature. Science cannot also force a person to live on its principle nor create moral rules, laws, or judgments (Cheprasov, 2022). However, the understanding of the origins, effects and characteristics of global problems depends highly on the efforts of scientific findings. Science helps in finding viable solutions, exploring the effects and feasible ways to break through known and predicted links between current and future problems. For instance, there is no denying efforts of basic science to the vaccination of the current covid-19, invention of automobiles, automated systems, and genetically modified foods to feed the growing population, and many more.

Nevertheless, things outside the epistemically attitude of science towards contents of best theories and models, recommendation of beliefs in both visible and invisible characteristics of phenomena occurring in the world (Chakravartty, 2017), often turns to create a barrier for scientific solutions.

WHAT ARE BASIC SCIENCES?

International Science Programme (ISP) (2022), basic sciences are defined as the scientific disciplines of mathematics, physics, chemistry, and biology. They provide the basic understanding of how natural phenomena occur and transformation of natural resources. Mathematics forms the building block of mental rigor, discipline, and logical reasoning. Physics on the other hand, provides the fundamental knowledge required for present and future technological advancement which serves as the drivers of the world economic engines. Chemistry also provides chemical technologies which seek to solve real world problems in energy, health, and materials. The understanding of chemistry is vital to the processes that involve producing our basic needs, thus nutritious food, clean air, cloth, and shelter. Biology helps us better understand the macro and micro living world. Our understanding of the biological world in medicine, biotechnology, agriculture, and other biological aspects have improved quality of life.

WHAT IS SUSTAINABLE DEVELOPMENT?

The form of development that seeks to meet our present necessities without altering the potentials of the future generations to meet theirs is term as sustainable development (Sustainable Development, n.d.). The rapid economic growth activities in industrialized regions are worsening ecological problems, climatic change, ozone layer depletion, and loss of vegetation cover. At the same period social conditions continue to worsen in many developing countries. World Health Organization report (2019), more than 500 million people in Asia are undernourished, Africa and Asia take the greatest account of all forms of malnutrition. The energy requirement for humanity is constantly going high over the years.

Nevertheless, physics is playing a significant role in providing humanity with alternate sources of energy with lessor emission of greenhouse gases. Innovative ideas of generating electricity from renewable sources such as solar, wind power, tidal waves, and the battery technology of storing energy generated from the new sources. Biology promotes sustainable use of the aquatic and terrestrial ecosystem, halting the loss of biodiversity. Chemistry aims at making energy more efficient, producing products with minimal usage of natural resources, not excluding the innovative ideas of waste recycling and manufacturing of environmentally compatible products. Mathematics, however, provides a logical framework of systems to solve real-world problems without compromising the needs of future generations.

Lastly, all the four fundamental aspects of science lay foundation require alternate methods, solutions, and technologies to sort out, analyze, and confront future global challenges. They help in addressing societal constraints in all countries. For example, access to adequate clean water, clean energy, affordable and nutritious food, and quality healthcare delivery.

REFERENCES

Chakravarty, A. (2017, April 27). *Scientific Realism*. Stanford Encyclopedia of Philosophy. Retrieved October 16, 2022, from https://plato.stanford.edu/entries/scientific-realism/

International Science Programme (ISP) and the basic sciences. (2022, February 18). UPPSALA UNIVERSITY. Retrieved October 16, 2022, from https://www.isp.uu.se/basic-sciences/

Sustainable Development. (n.d.). International Institute for Sustainable Development. Retrieved October 16, 2022, from https://www.iisd.org/mission-and-goals/sustainable-development

Cheprasov, A. (2022, September 30). *Science: Power, Limitations & Ethics*. Study.com. Retrieved October 17, 2022, from https://study.com/academy/lesson/science-power-limitationsethics.html#:~:text=Limitations%20of%20Science&text=It%20is%20up%20to%20the,from%20science%20but%20nothing%20more.

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THE ROLE OF BASIC SCIENCES FOR SUSTAINABLE DEVELOPMENT

INTRODUCTION

Global change is creating enormous challenges for humanity. The world's population is expected to grow from nearly 6 billion to day to 8.5 billion by year 2025. Global energy requirements will continue to increase. The newly industrialised countries of Asia and Latin America are experiencing very rapid economic growth that is bringing modern society's environmental problems including air and water pollution and waste problems, to wider areas of the globe. The ecological problems caused by human economic activity are worsening and taking on global dimensions, climate change, ozone layer depletion and loss of forest cover and important examples. At the same time, social conditions continue to worsen in many developing countries. It is estimated that more than 1 billion people now live in poverty without sufficient food, adequate educational opportunities, or any possibility of political participation.

Although, financial and economic markets are becoming more and more interconnected and we like to think in terms of "global village", our efforts to enshrine environmental protection and development as the common task and responsibility of all countries have just begun to make a headway. The key aim of the 21st century is "sustainable development", which the international community embraced at the 1992 UN conference on Environmental and sustainable development. Sustainable development seeks reconcile environmental protection and development; it means nothing more than using resources no faster than they can regenerate themselves, and releasing pollutants to no greater extent than natural resources Can assimilate them. If we are to move towards sustainable development, the industrialised countries will have to accept special responsibility not only because of their past ecological sins but also because of their present technological know-how and financial resources. Yet, one must keep in mind that sustainable production and consumption involve not merely technical progress, but also cultural patterns of individual behaviour and values.

The German government has chosen the socio-ecological market economy as the framework for shaping production and consumption in keeping with sustainable development while at the same time encouraging innovation in industries and societies. The key is to server the traditional link between economic growth and consumption of resources, which increasingly threatens the natural basis for life and the preservation of natural and landscape diversity. There are several possible compatibilities in lifestyles and economies. Technical and scientific innovation provide excellent prospects for environmental protection. As we approach the end of the 20th century, industrial society is becoming knowledgeable-based society. It is vital that we use our growing knowledge and capabilities responsibly, and that we use them in the interest of environmentally appropriate development. Science must play an important role in the pursuit of sustainable development.

To sum up everything; Sustainable development continuously seeks to achieve social and economic progress in ways which will not exhaust the Earth's finite natural resources. Thus, we must all develop ways to meet these needs so that our future generations can inherit a healthier and greener planet.

Thank you.

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THE ROLE OF BASIC SCIENCES FOR SUSTAINABLE DEVELOPMENT

Introduction

The basic sciences are defined as **the scientific disciplines of mathematics, physics, chemistry, and biology**. They are called basic sciences because they provide a fundamental understanding of natural phenomena and the processes by which natural resources are transformed.

Basic sciences are the sine qua non for sustainable development. Agenda 2030 for Sustainable Development is the ambitious program that the Member States of the United Nations have agreed on to ensure a balanced, sustainable and inclusive development of the planet.

Basic sciences have an important contribution to make to the implementation of this program. They provide the essential means to meet crucial challenges such as universal access to food, energy, health coverage and communication technologies. They enable us to understand the impact of the currently nearly 8 billion people on the planet and to act to limit, and sometimes even to reduce it: depletion of the ozone layer, climate change, depletion of natural resources, extinction of living species.

Applications of technology are easy to recognize. On the other hand, contributions of basic, curiosity-based, sciences are not well appreciated. They are nonetheless at the basis of major technological advances that stimulate innovation, as well as essential for training future professionals and for developing capacity of populations who can take part in decisions that affect their future. UNESCO is well aware of this: its Recommendation on Science and Scientific Researchers, revised in 2017, recalls the importance of bringing together politicians, scientists, diplomats, international organizations, entrepreneurs and every goodwill person.

The International Year of Basic Sciences for Sustainable Development, that we organize in 2022, focuses on these links between basic sciences and the Sustainable Development Goals. This is a unique opportunity to convince all stakeholders that through a basic understanding of nature, actions taken will be more effective, for the common good.

The 2030 Agenda for Sustainable Development is the ambitious program set by all member countries of the United Nations to ensure a balanced, sustainable and widespread development of the planet.

The basic sciences, based on curiosity, have an essential contribution to make to the implementation of this agenda. They provide the means to address vital challenges such as access to food, energy, health, and communications for all. They allow us to understand the impact on the planet of the more than 8 billion people living today and to act to limit and sometimes even reduce it.

The basic sciences are at the same time the basis of major technological advances that stimulate innovation, essential for the training of future professionals and indispensable for the development of populations capable of participating in the decisions that affect their future.

The International Year of Basic Sciences for Sustainable Development, proclaimed by the United Nations General Assembly, is a unique opportunity to convince all stakeholders that a basic understanding of nature will lead to more effective actions for the benefit of all.

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THE ROLE OF BASIC SCIENCES FOR SUSTAINABLE DEVELOPMENT

Introduction

Basic sciences, such as physics, chemistry, and biology, play a crucial role in sustainable development, which is defined as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (World Commission on Environment and Development, 1987). These disciplines provide the foundation for understanding and addressing the complex environmental, social, and economic challenges that must be addressed in order to achieve sustainable development.

One key area where basic sciences are essential for sustainable development is in the field of renewable energy. The growing demand for energy, coupled with the need to reduce greenhouse gas emissions, has led to a need for new and more sustainable energy sources. Basic sciences play a critical role in the development and improvement of renewable energy technologies, such as solar panels, wind turbines, and biofuels. For example, the efficiency of solar cells can be improved through the application of physics principles, while the feasibility and sustainability of biofuels can be evaluated using biological and chemical principles.

Basic sciences also play a vital role in the field of environmental protection and conservation. The increasing pressure on natural resources and ecosystems due to human activities has led to a need for more effective strategies to protect and restore the natural environment. Basic sciences can provide the knowledge and tools needed to understand and address environmental issues, such as climate change, air and water pollution, and loss of biodiversity. For example, the principles of chemistry and biology can be used to develop new technologies for cleaning up contaminated sites, while the principles of physics can be applied to understand and mitigate the impacts of climate change.

In addition to their role in renewable energy and environmental protection, basic sciences are also important for addressing other key challenges related to sustainable development, such as public health and food security. The principles of biology, chemistry, and physics are essential for understanding and addressing the complex issues related to human health, including infectious diseases, chronic conditions, and the impacts of environmental factors. Similarly, basic sciences are crucial for improving agricultural practices and developing new technologies to increase food production and reduce food waste.

Basic sciences also play a role in the development of new materials and technologies that can support sustainable development. For example, the principles of chemistry and physics can be used to develop new materials with improved sustainability, such as biodegradable plastics or lightweight, energy-efficient materials. These new materials can be used in a variety of applications, such as transportation, construction, and consumer products, to help reduce the environmental impacts of these sectors.

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THE ROLE OF BASIC SCIENCES FOR SUSTAINABLE DEVELOPMENT

Science is a body of knowledge about the physical world acquired through systematic enquiry and considerable mental effort. It is also the study of nature through careful observation, suitable experimentation and extensive analysis and validation of facts.
Sustainable development refers to the process of ensuring that development of a project is kept functioning effectively for a very long time. It refers to the process in which the living conditions of a group of people in a particular country is improved over a long period of time.

To set the ball rolling, sciences have played a major role in the exploitation of many countries' natural resources. For instance, Ghana recently past discovered crude oil in commercial quantities deep in the ocean. Science has helped many countries around the world to tap into resources hidden deep in the earth for their benefits.

In addition, sciences have improved genetic in animals and plant species. Sciences had led to cross breeding resulting in the genetic improvement in animal and plant species. Through cross breeding, disease-resistant and pest resistant animals are produced. In the production of crops, those that use shorter period to mature and are able to withstand pest and diseases are produced. In the production of livestock especially cattle, disease resistant breeds can be crossed with high milk producing ones to produce high performing breeds.

Also, sciences have improved upon fishing techniques. Through science, there have been improved methods of fishing which have boosted the fishing industry. The fishermen now use modern fishing vessels such as canoes fitted with out-board motors and trawlers with modern refrigeration system which enable them to spend more hours on the sea without their catch going bad. And they do not go through stress.

Again, science have developed the application of fertilizers. Science have helped the agricultural sector to benefit from the introduction of better performing fertilizers which improve the crop yield. The application of theses fertilizers to the soil has led to the increase in crop production. Now leftover foods are used for fertilizers. The agricultural sector has been given a tremendous boost through the improvement in the quality and management of the soil for agricultural production. The Ghanaian farmer is now thought to use both organic and inorganic fertilizers to improve the quality of the soil. On the other hand, he or she has done away with farming practices that led to the loss of soil nutrient.
Science has introduced us to modern agricultural machinery. Through science and technology, the agricultural sector has benefited from the introduction of modern agricultural machines such as combined harvesters, tractors, ploughs, ridges among others. These modern machines have increased agricultural production and have saved some farmers from using simple farm tools such as hoes, cutlasses, and earth chisels, which delay the time of planting. These outmoded practices even decrease the quantity and quality of harvest.

Science has greatly and wonderfully helped develop appropriate feeds. Science has made it possible for the poultry industry to import or develop and improve their own feeds which makes poultry and other livestock grow faster and healthier. It is noted that a broiler chicken at a poultry farm which is fed with these poultry feeds grows faster than the local birds and become ready for the table within a short period. These kinds of birds do not mate before laying eggs. The feed they eat help them to lay eggs and even hatch when the time comes.

Furthermore, science helps in construction of irrigation schemes. Science has led to the improvement on the techniques for irrigation and management of water. Through science, the construction of dams and irrigation schemes have made it possible for the agricultural sector for example, to conserve and constantly supply water all year round to crops and

livestock. This has reduced the country's dependent on rain-fed agricultural activities with its attendant problems. There is a man I know, when it gets to the rainy season, he would not cultivate crops because everybody will harvest, and the commodities will be cheap. So, he farms in the dry season. In this way, he is the only one who sends abundant crops or commodities to the market and makes good sales by the help of science.

Science has greatly led to the improvement of health care delivery systems and the quality of life of people all over the world by manufacturing various antibiotics and other new drugs which help to control many hitherto incurable infectious diseases such as tuberculosis, cholera, and typhoid among others. Through science, men with erectile malfunctions and other fertility problems can have their own children likewise women are not left out as invitro fertilization are possible for women with fertility challenges. Even the invention of life saving machines is a major breakthrough in science: the x-ray, ultrasound and the cardio-vascular machines. These machines have enabled quick and accurate diagnosis of diseases. In the days of old, when a person has a fractured bone, they pull and press to diagnose the problem but that has been made easier by x-ray scan.

In fact, science has contributed to the efficiency of manufacturing industries. Science has led to the invention of powerful machines and equipment which reduce human effort in production. This equipment has also contributed to high productivity in all sectors of the economy. Cocoa is processed into milo, biscuits, chocolates, etc. fruits are also processed into drinks and, many more, which have all added up to the roles played by sciences for sustainable development.

Sciences have helped for sustainable development by contributing to transportation and telecommunication. Through science and technology, vehicles, aeroplanes, trains, and ships are easily manufactured helping to improve transportation of goods and services. One does not have to walk long distances by foot again. Also, it contributed to the development of good roads, highways, bridges, overpass, inter-changes, and railway lines to facilitate the movement of goods and people from one place to another. It enables us to receive information from television, radio, internet, and telephone. One can be in Ghana and talk with someone in Dubai, UK, USA, and other nations without stress.

Science has also helped in effective control of pest, diseases, and weeds. The introduction of agrochemicals has made it possible for farmers to control pests and diseases that attack their crops using pesticides, fungicides etc. Weedicides are also available to control weeds. By so doing, man hours are saved at the same time improving efficiency.

Basic science play roles for sustainable development by helping to improve our indigenous technology. Indigenous technology is any technology peculiar to a group of people. And in this practice, we use our local resources such as the clay to mold or make earth ware bowls, cooking pots, flowerpots etc. We are also able to understand and handle our local resources with care and protect them from misuse. Science provides alternatives; I mean something that you can choose instead of another.

Basic science play roles for sustainable development by creating employment. The combine harvester mentioned earlier is operated by someone who is employed to do so. Also, the Xray machine among many others is operated by trained personnel serving as a job opportunity through which he/she earns income.

Conclusively, science is the drive and a continuous sustainer of development to which all the above stated points have emphasized.

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THE ROLE OF BASIC SCIENCES FOR SUSTAINABLE DEVELOPMENT

The role of basic sciences for sustainable development cannot be overstated. From understanding the fundamental principles that govern the natural world to developing new technologies and innovations, basic sciences play a critical role in ensuring that our planet can meet the needs of the present without compromising the ability of future generations to meet their own needs.

One of the most important ways in which basic sciences contribute to sustainable development is through the development of new technologies and innovations. Many of the challenges we face today, such as climate change, pollution, and resource depletion, are largely the result of our reliance on non-renewable resources and technologies that are not sustainable in the long term. By developing new technologies that are more energy efficient, environmentally friendly, and sustainable, we can reduce our impact on the planet and pave the way for a more sustainable future.

For example, advances in renewable energy technologies such as solar and wind power have the potential to significantly reduce our reliance on fossil fuels and reduce greenhouse gas emissions. These technologies are not only more sustainable in the long term, but they also have the potential to create new economic opportunities and improve living standards for people around the world. In addition, developments in fields such as material science and biotechnology have led to the development of new materials and products that are more sustainable and environmentally friendly. For example, the use of bioplastics, which are made from renewable resources such as corn starch or sugarcane, can reduce our reliance on fossil fuel-based plastics and reduce pollution.

Basic sciences also play a crucial role in our understanding of the natural world and the impacts that human activities have on the environment. Through the use of scientific research and experimentation, we can gain insight into the complex interactions between different parts of the natural world and use this knowledge to inform our decision-making processes and policies. For example, understanding the impacts of climate change on different ecosystems can help us develop strategies to mitigate its effects and protect vulnerable species. In addition, research in fields such as ecology and conservation biology can help us understand the impacts of human activities on biodiversity and the importance of preserving our natural resources for future generations.

In addition to their practical applications, basic sciences also have an important cultural and societal value. They help to stimulate curiosity and critical thinking and can foster a greater appreciation for the natural world and our place within it. By encouraging a greater understanding of the scientific principles that govern the natural world, we can build a more informed and engaged society that is better equipped to tackle the complex challenges of sustainable development.

One of the key challenges we face in achieving sustainable development is ensuring that the needs of the present are met without compromising the ability of future generations to meet their own needs. This requires a long-term perspective and a willingness to make sacrifices in the short term for the benefit of future generations. Basic sciences can play a crucial role in this process by providing the knowledge and tools we need to make informed decisions about the direction of our society and the use of our resources.

For example, advances in the field of environmental economics can help us understand the trade-offs associated with different policy choices and the costs and benefits of different courses of action. This can help policymakers and decision-makers to make informed choices about the allocation of resources and the direction of development.

Basic sciences can also help us to better understand and manage the risks associated with natural disasters such as earthquakes,

hurricanes, and tsunamis. By studying the underlying scientific principles that govern these phenomena, we can develop more accurate prediction models and early warning systems, as well as better preparedness and response plans to minimize the impact of these events on human lives and communities.

Overall, the role of basic sciences in sustainable development is multifaceted and essential. From driving technological innovation to informing our understanding.

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THE ROLE OF BASIC SCIENCES FOR SUSTAINABLE DEVELOPMENT

Nature is science; thus, science is around us. Both plants and animals have benefited from the fruits of science. Many scientists, from the fourth century BC down to the twenty-first century has discovered, observed, and evolved brilliant inventions and laws which have help developed balance in the environment and human living through the creation of technology and its use.

In the health sector, the study of biology and chemistry in conjunction with research development aids both physicians and doctors in the addressing of biological interferences of the normal functioning of the human body by diagnosing, treating, and preventing diseases and varieties of ailments using medicines and medical equipment such as x-ray, MRIs, ultrasound, CT scans and many others. This improves the standard, quality, and life expectancy of humans especially the labour force of a nation which, however, reduces absenteeism to enable them work efficiently thus, improving productivity and sustainable development of the nation.

Furthermore, the education sector has greatly benefited from basic sciences because pure science has been generated into technology i.e., practical science. In the education sector, modern technology such as, computers, mobile phone, laptops, and others is generally used together with the internet and multimedia applications specifically educational software like, Encarta kids, Britannica, and Encyclopedia. This boost teaching and learning, enables research and also allows students to learn at their own pace. It also enhances audio-visual and online or distance learning.

Again, science improves productivity in the agricultural industry through the use of complex equipment such as, combine harvesters, mowers, tractors, sprinklers and many more. Farmers also use soil profile to determine the fertility of soil and also adopt good farming practices like, crop rotation, afforestation, re-afforestation and creation of fire belts to prevent bush burning through scientific knowledge. In addition, science enables farmers to preserve their foodstuffs in silos to reduce post-harvest losses and also process these foodstuffs into semi-finished or finished goods which when exported, adds value and earns a country foreign exchange for development.

In conclusion, science plays a major role in the sustainable development of a nation. It is essential to all living organisms, and it provides great knowledge about our environment, the universe, natural phenomena, cycles, and the life processes. Through science, there have been great inventions such as electricity which facilitates our work through modern technology such as, electrical gadgets. Some areas of basic science which has been developed into applied science such as engineering and medicine have also helped in the development of nations through the provision of infrastructures such as road, transport systems and buildings and also enable us to prevent and treat ailments of the body respectively. It also makes us think in a logical way by eradicating superstitious beliefs.

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THE ROLE OF BASIC SCIENCES FOR SUSTAINABLE DEVELOPMENT

Introduction

The knowledge gained in science has always been an improvement and causes a change in the surviving systems for centuries. In the years of the dark, walking for hours and carrier pigeons, etc. Science invented light, transport systems, and telecommunication to address them respectively in making life easier and better. **James Burke** said in one of his publications – **The legacy of Science**, "Change is one of mankind's most mysterious creations. The factors that operate to cause it came into play when man produced his first tool. With it he changed the world forever, and bound himself to the artifacts he would create in order, always, to make tomorrow better than today**…**"(Russell and Sluckin, 2016) and isn't that what we see in our world today?

Science is always on the run to invent things to transform life or help address problems in our world daily. Either relying on the old tools or making new ones. Many of the science inventions rely on resources available – air, water, stone, plants, animals, fossil fuels, and sunlight. Is there a pattern to **Sustainable Development**? Is the science of invention creating diverse needs for different communities to create a better life now and future? Considering the 3 major pillars of Sustainability Development – **social, economic, and environmental** (Kongoli, 2016), I would highlight some inventions/applications of science in today's world to see whether it fits the three criteria mentioned above.

Sustainability of Meat from plants

Science has combined research and knowledge to invent plant-based meat that mimics the look, and sensory properties of meat from animal sources. These plant-based meats are healthy, tasty, and vegetarian. They are designed to replace animal-based meat which comparatively has more health benefits and sustainability(van Vliet, Kronberg and Provenza, 2020). As part of the environmental benefits, plant-based meat produces less greenhouse gas and uses less water and land. Though it may threaten jobs within the primary and processing sector, it reduces agriculture's footprint economically and creates better subsistence conditions and living standards for the populations (Good Food Institute, 2013).

Sustainability of Reutilization / Recycling Waste management,

a technique for monitoring, controlling and regulating the production, collection, transport, treatment, and disposal of waste and prevention of waste production in process modification, recycling, and reuse has involved science that emphasizes producing products that are reusable and can be recycled(Chen *et al.*, 2022).

Gone are the days when waste products are usually taken to landfills. But today science has made possible fertilizers, plastic chairs, boots, and carrier bags through recycling of the waste produced in all fields of man's activities. Oil galloons are now reused to store water, and fuel and to contain other liquids. This reduces the quantity of waste that is carried to the landfill sites which prevents the emission of many greenhouse gases and other factors that can cause water pollution in our environment. It adds value to the feasible technologies used, promotes the creation of jobs in the economy, and also increases living standards and profit distribution in society (Amasuomo and Baird, 2016).

In recent news, undergraduate students around the world were invited to come together and produce engineering solutions to some of the problems of this generation. The world's first **World Engineering Day Hackathon 2022**. The second and third-place winners developed a sustainable **Mobile Rainwater Harvesting Unit** and a **HyaPak**-a sustainable packaging solution respectively, that I would like to discuss herein.

Sustainability of Mobile Rainwater Harvesting Unit

This unit was made with recyclable high-density

polyethylene which is durable and has a larger surface to collect rainwater. It has ceramic filters to filter the water into the barrel. This harvesting unit has no pollution effect as the parts used are environmentally friendly and has created and maximized an add-on value to increase productivity, efficiency, and the quality of water in their economy. It has also replaced the normal routine and time-consuming duties individuals had to do by boiling water from the dirty ones available and has freed space for more quality of life.

Sustainability of HyaPak

HyaPak is a pack designed from plants that block their boots on river and other plant weeds found in their school gardens. This was used to grow plant seedlings and was realized it gives good yielding rate to the seedlings, and when eventually planted, adds up nutrients to the soil to enhance grow of plants. This project was geared toward innovation but has also in the long run promoted green environment. It is environmentally friendly, biodegradable which adds nutrients to the soil, instead of the usual plastic bags used which are sent to the landfills after use, using the **HyaPak** will reduce the amount of waste produced from the agricultural sectors as a result of planting from plastic bags than the biodegradable one.

Many years ago, houses were built with clay and with a heavy down pour, they are washed away leaving us in weeks/months of struggle to securing another home. Science saw the need for sustainable buildings hence invented **cement** a good binding agent which helped in putting up structures to stand the test of time without causing harm to the environment. Today one can sleep at home without bothering about how fast he/she will get her things to safety during heavy down pours. Structures are well built to save us the time of reconstructing new buildings, with the old traditional methods, it has increased the living standards of individuals and saved money which could be used to invest into other important things (Cankaya *et al*., 2019).

Sustainability of Liquified Petroleum Gas (LPG)

The science of invention led to the discovering of Liquified Petroleum Gas – an alternative for the traditional custom of cooking using firewood. Firewood as obtained from cutting down trees from the forest, exposes the land to the sun, enhances erosion and leave the land bare and contributes greenhouse gas. It also leads to extinction of some animals due to the distraction caused by individuals who go out to fetch for firewood. Science saw the need to protect wildlife, preserve the land and other problems which may arise from the act of fetching firewood for cooking and other household applications. LPG with its numerous uses and importance – flammable fuel to help run household and industries worldwide, good energy source, efficient cooking fuel, spaces heating and drying etc., has helped to increase energy security, reduced air pollution and environmental impacts from firewood, and has provided a convenient on-site fueling economically and mitigated climate changes environmentally (Murshed *et al*., 2021).

Conclusion

The vital of Science for Sustainable Development is unquestionable. The impact of science on green environment, living things, climate change, living standards, wildlife is notable in our world today. Science has contributed significantly to the three criteria – economic, environment and social designed to answer sustainability bringing to us an easier, faster and better ways of doing things.

Reference

Amasuomo, E. and Baird, J. (2016) 'The Concept of Waste and Waste Management', *Journal of Management and Sustainability*, 6(4), p. 88. Available at: https://doi.org/10.5539/jms.v6n4p88.

Cankaya, Simge, and Beyhan PEKEY., (2019). "A comparative life cycle assessment for sustainable cement produciton in Turkey. Journal of environmental management, 249, p. 109362.

Chen, M. *et al.* (2022) 'Co-incineration effect of sewage sludge and municipal solid waste on the behavior of heavy metals by phosphorus', *Waste Management*, 152(October), pp. 112–117. Available at: https://doi.org/10.1016/j.wasman.2022.08.010.

Good Food Institute (2013) 'Plant Based Meat Fact Sheet Environmental Comparison', pp. 1–4.

Kongoli, F. (2016) 'Role of Science and Technology in

Sustainable Development', *2016 Sustainable Industrial Processing Summit and Exhibition Plenaries*, pp. 1–14.

Murshed, M., Alam, R. and Ansarin, A., (2021). The environmental Kuznets curve hypothesis for Bangladesh: the importance of natural gas, liquefied petroleum gas, and hydropower consumption. *Environmental Science and Pollution Research*, 28(14), pp. 17208-17227.

Russell, B. and Sluckin, T. (2016) 'The impact of science on society', *The Impact of Science on Society*, pp. 1–103. Available at: https://doi.org/10.4324/9781315624785.

University of Bath. (2022, July 29). Plant-based 'meat' 'healthier and more sustainable than animal products'. *ScienceDaily*. Retrieved December 16, 2022 from www.sciencedaily.com/releases/2022/07/220729173204.htm

van Vliet, S., Kronberg, S.L. and Provenza, F.D. (2020) 'Plant-Based Meats, Human Health, and Climate Change', *Frontiers in Sustainable Food Systems*, 4(October). Available at: https://doi.org/10.3389/fsufs.2020.00128.

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THE ROLE OF BASIC SCIENCES FOR SUSTAINABLE DEVELOPMENT

Across the world, most schools and communities seek to put up measures to ensure Sustainable development. Science studies the structure and behavior of the physical and natural world through observation, experimentation and testing of theories against evidence obtained, understanding the natural phenomena and process by which natural resources including physical, earth and life sciences are transformed. The basic sciences also called 'pure sciences' are defined as the scientific discipline of mathematics, chemistry, physics and biology helping us to answer fundamental questions about life and how it works. Sustainability is the ability to provide a healthy satisfying and just life for all people on Earth now and for generations to come while enhancing the health of ecosystems and the ability of other species to survive in their natural environments.

In 1987, a UN report defined 17goals of sustainable development as means to meets the needs of present without compromising the ability of future generations to meet their own needs, that is to help protect important natural resources for ours and future generations. Also, is a process of ensuring that development of a project is functioning effectively which does not happen in a day but takes years or months. In order to achieve this, there should be holistic approach involving all the fundamental pillars of Basic sciences such as mathematics, chemistry, physics and biology to assist the 17 goals of Sustainable development such as gender equality, stable economic growth, decent work, quality education, no poverty, zero hunger, life on land, etc and all these are an urgent call for action by all countries, developing and developed in a global partnership.

The Role of Mathematics

Mathematics is the light of all creations; without it the world cannot move an inch. Be it a farmer or seamstress, carpenter or a mechanic, doctor or lab technician, an engineer or a scientist, a musician or a magician, everyone needs mathematics in their day-to-day life. Even insects use mathematics in their everyday life for existence. Mathematics is a major tool for global understanding and communication that order our lives and prevents chaos. Mathematics aid us understand the world and brings an effective way of building mental discipline which boosts our critical and creative thinking, logical reasoning, spatial thinking, problem-solving ability, good communication skills as a mathematician called Benjamin Peirce described mathematics as "the science that derives essential conclusions."

Mathematics recrudesce from counting, measurement, computation and then methodical study of the shapes and motions of physical objects through abstraction and logical reasoning, and these have helped humans to engaged in practical mathematics**.** Mathematics has been used by the earliest and most basic cultures and even for every civilized community, mathematical discoveries has been forefront since the beginning of recorded history. The need for mathematics evolved as a result of the increasingly complicated demands made by global cultures, which called for more sophisticated mathematical solutions, as outlined by mathematician Raymond L. Wilder in his book "Evolution of Mathematical Concepts".

The only language we have to describe every phenomenon on Earth is subject to mathematics, hence it plays a crucial role in understanding these phenomena in order to sustain our earth planet that is to say any strategy used by humanity to tackle these problems or sustainable growth such as climate change, biodiversity preservation, pollution reduction, pandemic prevention, ocean sustainability, and the prevention of both natural (such as volcanoes, earthquakes, etc) and man-made (such as fire outbreaks) disasters must take into account mathematical equations. Also, to understand mantle and the crust of the planet, the atmosphere, and the life it supports and how they all undergo dynamic processes call for mathematical models, the majority of which are incredibly complicated. We can achieve this

by constructing models that replicate real processes as closely as possible. Mathematical science is therefore essential role to the sustainability of planet Earth.

Mathematics does not propel us to understand natural phenomena only, it also permits us to support the majority of human activities on the planet. Transport networks, life on land, life under water, the Internet and business transactions are all practical applications of research, graph, and number theory. Mathematics helps in analytical thinking while solving mathematical problems.

Therefore, the knowledge of mathematics evolved when humans felt the need for the daily and long planning of life and its sustainability and also sustainable development and betterment of the world as a whole.

The Role of Biology

Biology is the study of life. The word "biology" is derived from the Greek word "bios" (meaning life) and "logos" (meaning "study"). In general, biologists study the structure, function, growth, origin, evolution, and distribution of living organisms. As the name implies biology helps us understand how living things work and how they function and interact on multiple levels. Advances in biology has equipped scientists to come up with things such as develop better medicines or drugs and treatments for diseases and has also helped them to understand how changing the environment might affect plants and animals. It has also helped in the production of food for growing human population and predict how eating new food or sticking to an exercise regimen might affect our good health and wellbeing.

As a field of natural science, biology helps us understand the living world and the ways its many species (including humans) function, evolve, and interact. When we breathe in and out; each cell receives oxygenated blood and releases carbon dioxide. How do our heart's function and work so hard? What variations exist in how people perceive things? What exactly is awareness? Biology has got us covered in the search for solutions to these questions.

Advances in medicine, agriculture, biotechnology, and many other areas of biology have brought development in the quality of life. Fields such as genetics and evolution give brainwave into the past and can help shape the future, and research in ecology and conservation inform how we can protect and develop this planet's precious biodiversity. However, biology also deals with other living things than humans by studying how it works or function. Through biology, scientists can figure out potential threats to the environment and explore more environmentally friendly solutions.

Although the fields of biology are connected by fundamental principles, they are divided into different branches for easy study. Although it is a usual practice to divide the study of plants (botany) from that of animals (zoology) and the study of an organism's structure (morphology) from its function (physiology), all living creatures, nonetheless, share some biological phenomena in common, such as different forms of reproduction, cell division, and the transmission of genetic material. These divisions provide information about various life forms. Additionally, biology includes various areas of study concerned with the sustainability of life, such as the study of the human body and the environment, the ecosystem, the quality of food, the causes of disease, and the discovery of new medications. The study of life has influenced how the world is today. It has also provided a multitude of reliable and credible explanations for why things occur more scientifically.

Modern medicine shares a close relationship with biology, and pharmacology, a branch of biology, is fundamental to modern medicine and healthcare. Pharmacology deals with a wide range of activities, from production of painkillers to depression medications. Pathology examines diseases, their causes, and the effects they have on the human body.

Humans benefit from biology in everyday life for instance, to produce the best harvest, farmers should be completely cognizant of crops to use, including how to raise them, how much water and nutrients to feed them, and how much fertilizer to apply. The same is true for animals, which must be bred, fed a certain amount of food, given veterinary treatment, etc. Biology provides answers to these widespread problems that might have an impact on people all over the world in order to sustain development in nations and these answers might even be able to solve environmental issues.

For example, biology may be used to create efficient and long-

term plans to increase food production in nations experiencing food shortages to prevent poverty and sustain zero hunger. Another problem is the existence of contaminants. This area of research might be able to offer solutions to this environmental problem. The ability of humans to conduct new scientific research, crucial for making discoveries through the scientific method, is one of biology's most important contributions.

The professional scopes of biology include those of medicine, nursing, pharmacology, science, and research. Professors, lecturers, and other educators are additional vocal sources. Innovation, infrastructure, numerous industries, including agriculture, medicine, genetic engineering, and the food industry, use biology practically.

Various medications are made from ingredients found in both plants and animals. For example, a variety of medicines are produced from herbal plants. The seeds of hybrid plants are genetically engineered (GM). Crop productivity can be duplicated using GM seeds. Organic fertilizers enrich the land without polluting the environment. Other living things like earthworms and microbes (like nitrifying bacteria) enrich the soil and boost crop yields. The use natural resources as sustainable industrial raw materials, biology helps in the production of goods. Personnel with biological expertise are required to controller various enterprises, including the dairy, fishing, agro-industries, and the various waste products come from different industries. Therefore, studying biology helps control pollution risks and the development of solutions in order to sustain development in the world.

The Role of Chemistry

The scientific study of matter's properties and behaviour is known as chemistry. It is a natural science that studies the elements that makeup matter, as well as the compounds, made up of atoms, molecules, and ions: their composition, structure, qualities, and behaviour, as well as the changes that occur when they mix with other things. Chemistry is a discipline that go down somewhere between physics and biology in terms of scope. It is mostly known as the "core science" since it provides a basic framework for understanding both fundamental and applied scientific approaches. Chemistry, for instance, elaborate the aspects of plant chemistry (botany), the formation of igneous rocks (geology), how the ozone is formed and how environmental pollutants are degraded (ecology), the properties and composition of lunar soil (cosmochemistry), how medicines or drugs work (pharmacology), and how DNA evidence at a crime scene are collected (criminology) (forensics).

Chemicals form the basic components of everything. These chemicals molecules make up all food, including carbs, vitamins, lipids, proteins, and fibre, which are all safe and often desirable. Chemicals play a major role in the manufacturing and preservation of food such as cans of food, additives, flavourings, and nutritional supplements can all contribute to improve the quality and quantity of meals. Chemistry has always been the core to supply the globe with vital fertilizers, herbicides, insecticides, and fungicides to assist the farmers in the production of healthy and nutritious crops, fruits, and vegetables. Urea, calcium superphosphates, ammonium sulphate, and sodium nitrate are all the kinds of fertilizers obtained through chemistry. Isn't it chemistry wonderful? And this tells us why chemistry is helping to sustain development in the various nations.

Chemistry has made significant contributions to good health care and wellbeing by production of medicines or pharmaceutical drugs to treat diseases and pain relievers such as analgesics that are used to treat a variety of ailments and tranquilizers are medications that are used to treat mental illnesses. Take, for instance, antiseptics are also used to destroy or prevent the growth of microorganisms on the skin, wounds, and cuts. Disinfectants and antibiotics are also chemicals that destroy microorganisms but are dangerous to humans. Chemistry, for example, aids in the manufacture and application of surgical materials (sutures, artificial skin, and sterile materials) and the production of antacids which are used to eliminate excess acid from the stomach and increase the pH to a healthy level.

In our daily lives, we use lotions, fragrances, talcum powder, and a variety of other cosmetic products. All these items are developed in laboratories using chemicals for our health and skin. All cosmetic items, from infants to adults are made up of chemical compositions. As the

matter of fact, chemistry is important in maintaining the pH of our skin, keeping it healthy, and removing any marks or spots.

Green chemistry contributes to environmental protection by monitoring, protecting, and enhancing the conditions in which we live, such as air, water, and soil. Many methods and techniques have been created to ensure that all types of pollution in the environment are measured and prevented from depleting. To make the air cleaner, many non-polluting fuels and compounds that can easily absorb contaminants from the air are being researched and tested. The replacement of CFC in refrigerators is one such example. For interpreting health impacts, controlling emissions, and creating pollution-reduction devices, chemistry gives a complete understanding of contaminants.

Wool, silk, cotton, glass fiber, polyester, acrylic, nylon, and other raw materials are used in the textile industry to create useable items such as clothing, bags, carpets, furniture, towels, nets, and so on. Raw materials go through a number of chemical procedures during which cleaning and smoothing reagents are employed to clean and smooth the fabric. Other chemical processes including dyeing, bleaching, scouring, printing, and finishing are also involved. In addition, chemists seek to increase a product's quality. Items such as bricks, cement, pipelines, and other building materials all are chemicals, and these play an essential part in the quality of construction. Floor and wall tiles are constructed of heat-resistant polymers that also add strength to the structure. Chemistry enabled the use of all these goods for the development of structures and people's lives.

Production of fuels are the sole thing that allows us to travel by land, sea, and air nowadays. Petrol, diesel, LPG, kerosene, oils, and other fuels are all obtained through sophisticated refining procedures found beneath the Earth's crust. Petrochemistry is a discipline of chemistry concerned with the study of petrochemical processes and how to use fuels in a way that is both pollution-free and long-term. Batteries supplies electronic devices such as watches, laptops, mobile phones with power. Chemistry teaches us the electrochemistry concept governs the operation of batteries, how chemical energy is stored inside a battery and is transformed to electric energy through electrochemical processes all for affordable and clean energy.

Gun powders used in bullets and other explosives used in conflicts are all chemical compounds. It was the chemistry that allowed these chemicals to be used during the war. Nuclear weapons are also chemicals. Chemists test the water and soil for contamination on a regular basis and offer pollution results as well as long-term prevention for clean water, good sanitation, wellbeing, human health and ecological balance. These are few roles played by chemistry to ensure sustainability in our natural and physical world.

The Role of Physics

Physics is the study of matter, energy and their interactions. Physics is the most fundamental of the physical sciences which is concerned with the most basic building blocks of all things from ants to antennas, from quarks to quasars. Learning of physics means trying to figure out what the universe is compose of, and how these things move and interact with each other. As a result, all the other sciences are formed on the knowledge acquired through the learning of physics. From chemistry and geology through to biology and cosmology, we agree science in terms of the concepts developed in physics. Not only this, but many of the tools on which the advances of science and technology depend are all product of physics. The wiliness and concerns of physicists have always formed the basis of future technology. The help of physics education across the continents is important in a way that physics is an exciting intellectual event that motivates young people and expands the frontiers of our knowledge about nature.

Physics and technology must work hand in hand to resolve the need for new technologies that will minimize the damage to our earth planet that is techniques to ensure that the people of developing countries are gaining the necessary tools to progress, the need for solutions to deadly diseases that seem to be a threat and the need for solutions to the increasing demands we place on our resources before they are destroyed. The role of physics in our modern world is more significant than in any other time in history.

Physics generates the most basic knowledge required for the future technological advancement that will continue to drive the economic engines of the world. Physics contributes to the technological infrastructure and provides trained personnel

needed to take advantage of scientific advances and discoveries. Physics is the most basic element in the education of chemists, engineers and computer scientists, as well as practitioners of the other physical and biomedical sciences. Physics improves our quality of life by providing the basic understanding necessary for developing new instrumentation and techniques for medical applications, such as computer tomography, magnetic resonance imaging, positron emission tomography, ultrasonic imaging, and laser surgery. Physics extends and enhances our understanding of other disciplines, such as the earth, agricultural, chemical, biological, and environmental sciences, plus astrophysics and cosmology a subject of substantial importance to all people of the world.

In medical technology, the Positron Emission Tomography (PET) help neurologists to see how energy flows inside the brain to see where problems could be occurring, and this is a hand work of physics. The telecommunications industry, including the development of the internet, has benefited from physics research in telecommunications from radio waves to fiber optic cable. The computing industry also depends directly on physics research in order to produce semiconductors and magnetism to build processors and disk ever smaller and denser. Physics research benefits the transportation industry in everything from what materials to build cars of to how to build efficient engines to navigating using the global positioning system. Physics is used in environmental science to both detect problems and to build systems that are better for the environment with technologies such as solar power and plasma physics.

Many consumer goods are developed from physics research. CDs are possible because of refinements in laser technology. Many household gadgets have microprocessors such as microwaves and phones. Research in materials physics has led to many innovations in the substances from which products are made. One now-common material is Teflon. Other substances are now used to make many items from sports equipment to earthquake-resistant buildings. The defense department started the Global Positioning System (GPS), which uses about 24 to 26 satellites, and this was possible because of the atomic clock. Now GPS technology has many uses from being in road maps in cars to perceiving shifts in the tectonic plates.

This might seem like a strange statement. The study of all subjects teaches you to think. But because physics deals with the most basic concepts, the application of such techniques as "Separation of Variables" and "The Scientific Method" are never clearer than they are in the study of physics. Once mastered you will find that these methods can be applied to all subjects, including the business world and just coping with everyday life.

You can look a rainbow and say "Wow, pretty colors!", or you can marvel at the amazing interactions between photons and electrons that come together in that particular way when light from the sun strikes spherical water droplets in the sky, and that you perceive as a multicolored arc suspended in the air. Now that's awe!

Without physics, cars wouldn't have been developed to take us to our various destinations. TV's Light will not have been invented. We would not have known about space, computer games, how water boils, model financial market, shape futuristic buildings and structures and this is turning many pioneers in molecular biology to be trained as physicists e.g. Francis Crick. A large number of astronomers also learning physics as at now and this should tell us how these basic sciences (physics) helping to maintain sustainable development across the world**.**

Conclusion

Science is likely the best bet to achieve the 17 Sustainable Development Goals. There is very little time left to do away massive global challenges like growing poverty and hunger, and the triple threat of climate change, biodiversity loss and pollution. Basic sciences (mathematics, chemistry, physics and biology) provide the means to address vital challenges such as access to food, energy, health, and communications for all. They allow us to understand the impact on the planet and the people living today to act to limit and sometimes even reduce it. The basic sciences are at the same time the basis of major technological advances that stimulate innovation, essential for the training of future professionals and indispensable for the development of populations capable of participating in the decisions that affect their future.

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THE ROLE OF BASIC SCIENCES FOR SUSTAINABLE DEVELOPMENT

The basic sciences are defined as the scientific disciplines of mathematics, physics, chemistry, and biology. They are called basic sciences because they provide a fundamental understanding of natural occurrences and the processes by which natural resources are transformed. Sustainable development refers to development that meets the needs of the present without compromising the ability of future generations to meet their own needs. The role of the basic sciences for sustainable development is not obvious but they indirectly play a key role in social advancement, problem-solving and in equipping the next generation of leaders.

The basic sciences are the bedrock of innovation and societal advancements. Basic sciences are the fundamental of all other fields of science. They describe the nature of things and the mechanisms of processes. They form the fundamentals of Research and all other interdisciplinary fields. Deep understanding of the nature of things allows scientists to apply and innovate. For example, the principle of conservation of angular momentum employed in the bicycle was possible because scientist first understood basic things like friction and centrifugal force. This basic understanding allowed scientists to combine these basic principles and to innovate leading to the invention of the bicycle. At the core of every innovation is the basic sciences. They provide the starting point for research and product development leading to human advancement. For instance, aeroplanes and cars have shortened transportation time, the computer has created jobs and increase productivity. There are more resources available for managing and treatments of diseases than ever before. Without research and product development the world would be stagnant with little or no progress and without basic research and innovation would be impossible.

Secondly, they are essential for tackling socioeconomic and environmental issues of our time. The biggest global issues of our time include food insecurity, climate change crisis, pandemics, children health and education. The basic sciences are helping in tackling these issues. Basic sciences allow us to revolutionize different sectors of our lives solving more problems and creating better social systems for people. This revolution of sectors comes about through understanding the fundamentals of these sectors and exploring how we can capitalize on those fundamentals to solve problems through research and innovation. Take the COVID -19 pandemic for example, scientists had to first understand the morphology of the SARS- COV - 2 virus. They had to understand the various constitutes of the identified structures leading to the understanding that the virus genetic material is an RNA. This basic understanding followed by further research eventually leading to the development of mRNA vaccines to fight the pandemic. The basic sciences therefore play a significant role in helping to tackle the world's most challenging problems. Think of green technologies for reduction of climate change crisis, Genetically Modified Foods for fighting against food insecurities. The basic sciences allow us to understand nature and understanding nature is vital to our ability to manipulate it to solve our pressing needs as our society.

Furthermore, the basic sciences are essential for the training of the next generation of global leaders. Leaders are the ones that drive social change through problem solving. They solve these problems through policy making, research breakthroughs and innovation. Problems evolve and some solutions outlive their usefulness. The problems of today will differ from that of tomorrow. We will need people who will find novel solutions to emerging problems. Understanding of the basic sciences is central to preparing young ones for such crucial role in the future. A deep understanding of the basics will allow people to innovate solutions that they face. It will also allow them to invest in research areas of potential usefulness to the world.

In conclusion, sustainable development is attained when we can constantly discover new ways of doing things and have the capacity to always find solutions to our problems. Without the basic sciences, our development as a society would be stagnant if not regressed. The basic sciences help us to achieve this by being the core of research and innovation. Thus, allowing us to train individuals who are curious, critical, and creative thinkers and are ready to tackle the challenges of their time.

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THE ROLE OF BASIC SCIENCES FOR SUSTAINABLE DEVELOPMENT

To practice the concept of sustainable development it is very important to understand what a sustainable development is. Sustainable development is the development that meet the needs of the present without compromising the ability of the future generations to meet their own needs.

Some examples of sustainable development are harnessing the solar energy to reduce pollution, crop rotation, afforestation, wind energy usage etc.

Basic sciences are the scientific discipline of mathematics, physics, chemistry, and biology. Basic sciences and applied sciences complement each other. They are termed as basic science because they provide a fundamental understanding of natural phenomena and processes by which natural resources are transformed. The main focus or objectives of sustainable development is to bring stability to our social economic and environmental requirements in order to reduce poverty and further lead to welfare and availability of resources for future generations. Sustainable development teaches us to use our resources in the correct manner. listed below are some points which tell us the importance of sustainable development:

1. To prevent degradation of the environment.
2. To prevent over exploitation of resources.
3. Maintaining the ecological balance.
4. It improves the quality of human life.

Science is universal, it does not only bring about progress on the way towards a more sustainable world, but it is also a way of crossing national culture and thus help lay a foundation for sustainable world. Therefore, we must put the following eco-friendly or green technology into practice in order to maintain our environment for today and forever.

To begin with, the installation of hand and head shower in our toilet and bathhouse are very efficient and do not waste or leak water. Water is essential for us and conserving every drop is important. We must always remember the saying that "little drop of water makes a mighty ocean". Spending lesser time under shower and filling water shortage tanks at a time, rather than opening the tap frequently is also a way of sustainable development and conserving water.

Secondly, recycling and waste management (reduce, reuse, recycle): Minimization of resource use, reusing polybags or jute bags instead of throwing away and recycling materials help in achieving the goal of sustainability. The government and non-governmental organization (NGO) can create awareness and promote a mass education on re-using and re-cycling of materials. Avoid products made from or packaged in plastics such as straws, plastic bottles, and polythene bags. Rather select unwrapped product at the grocery store, shop local and cut down online shopping. A new technology used by the Danish company allow unsorted household waste to be divided into plastic fractions that can be used for recycling. The main product, however, is a liquid where all the nutrient from the waste have been dissolved. This can be used to make biogas. Chemical recycling for example is also an innovative process that uses chemical to breakdown post-consumer plastic waste into its valuable chemical products.

Thirdly, by harnessing solar energy. Solar energy is the most abundant energy on earth. scientist have been able to overcome a design flaw of solar panels which can be used anywhere. The weather solar panel allow any home, no matter the geographical location to produce electricity for their home.

Most importantly, using wind turbines; a technological equipment which reduces carbon dioxide emissions into the atmosphere by providing an energy source that does not burn fossil fuels. Also, artificial trees, which is an emerging technology removes carbon dioxide present in the atmosphere.

Lastly, using light emitting diode (LED). New eco-friendly LED lighting bulbs of 160 watts is able to produce the same or a greater amount of light as a 400 watts lamp. These light bulbs can produce a 90% reduction in energy consumption, causing an

enormous amount of energy savings.

Sustainable development will be achieved if the above suggested eco-friendly technologies or green technology are put into practice.

Some efforts made by the government and some institutions towards sustainable development are as follows.

On June 2019, the voluntary national review (VNR) report on the implementation of 2030 agenda for sustainable development was written and presented by the government of Ghana. The agenda towards sustainable development are.

- Planting for food and jobs
- Establishing a new fund to support the energy sector.
- Widespread use of solar power among others

In conclusion, sustainable development continuously seeks to achieve social and economic growth in ways which will not exhaust the earths finite natural resources. For this reason, sustainable development has become the need of the hour. We must all develop ways to meet these needs so that our future generations can inherit a healthier greener planet.

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THE ROLE OF BASIC SCIENCES FOR SUSTAINABLE DEVELOPMENT

It has been the desire of individuals, groups, communities, countries and the world at large to see development and growth; not just any type of development, but one which is sustainable. It is for this reason that many individuals, countries and the world have employed science and technology as a way of initiating, supplementing and facilitating development in various years of life.

Science, as defined by the Oxford English dictionary, refers to the systematic study of the structure and behavior of the physical and natural world through observation and experiment. Etymologically, the term 'science' is derived from the Latin word 'Scientia', which means a body of knowledge or to know something, thus, the meaning of science. Basic sciences are defined as the scientific disciplines of Mathematics, Physics, Chemistry and Biology. The particular reason why they are referred to as basic sciences is the fact that they provide a fundamental understanding of natural phenomena and the processes by which natural resources are transformed. These basic sciences have existed for over 1,000 years. These sciences, throughout their over 1,000 years of stay in the world, have been manipulated in several ways to benefit humankind and the world at large. This manipulation is what is referred to as technology. Thus, technology may be defined as the application of knowledge acquired from science for practical purposes.

Since the introduction of the very first technological gadget: the stone tools, many other inventors have continued to dazzle the minds of the worldly population by creating other devices that benefit man in one way or the other. Among such technologies are printing machines; which help people to obtain documents in hardcopy, cars; which help faster transportation, and the internet; which help people to acquire information worldwide at a faster and easier rate. It is important to note that the terminologies: science and technology, are synonymous but neither the same nor totally different. For instance, one may argue that the technologies mentioned earlier are the works of technology and not science. However, it ought to be well understood that there could be no technology without science because technology is only obtained by practically applying scientific knowledge. Therefore, these amazing inventions are technically scientific.

For years, many people, especially students, have considered these basic sciences as something above one's head and completely unnecessary to be studied. For instance, many people shy away from the study of Mathematics because, it deals with a lot of calculations, which they find difficult to learn. Consequently, very few people appreciate the study of these basic sciences and sometimes dare not even venture into science related industries. Despite the unwelcoming attitudes of some students towards the study of these basic sciences, their importance is so enormous that they deserve global attention. Thus, these basic sciences are extremely beneficial and serve as the foundation for national and global development. Unknown to many, if developing countries focused more on the study and application of the basic sciences, they would be fully developed in no time.

According to the Oxford English dictionary, to develop refers to the process of becoming or making larger and more advanced. Therefore, national development refers to making the state or condition of a country more advanced and improved. In order to obtain national development, there is the need to ensure efficient participation of all citizens in the various chapters of the country. This involves the active participation of citizens, selfless leaders in government and effective checks and balances. When all citizens and the incumbent government co-operate to ensure development, the role of basic sciences cannot be swept under the carpet. Thus, basic sciences provide the foundation for national development.

Another crucial component of development of every nation is sustainability. To sustain, according to the Oxford English dictionary, means to keep something going over time or continuously. Therefore,

sustainable development can be described as maintaining the state of an improvement in a country. This implies that sustainable development of a country should not be a nine-day wonder. The development of a country should be progressive and persistent. Thus, the dictum of Osaagyefo Dr. Kwame Nkrumah, "forward ever, backwards never". Sustainable development cuts across every tier of the life of a country. For instance, in the area of infrastructure, ensuring sustainable development requires the usage of quality materials and regular maintenance, as well as using science and technology to improve upon the existing infrastructure. This requires a practical usage of the basic sciences: Mathematics, Physics, Biology and Chemistry.

Mathematics, Physics, Chemistry and Biology have been extremely beneficial to the human race and all other living things since their introduction into the academia. One of the typical ways by which these basic sciences help the human race is by serving as the foundation of knowledge for their respective applied sciences such as Engineering, Nursing, Medicine and Meteorology, just to mention but a few. Through the study of the basic sciences, humanity is able to obtain in-depth knowledge about the physical realities of the world. The knowledge from the basic sciences is processed into what is referred to as applied science and these applied sciences are what are actually used by people in their daily activities.

The importance of the basic sciences is so immense and contribute directly or indirectly to sustainable development of every country. In a very direct way, the basic sciences provide job opportunities for people across the globe. For instance, there are teachers who directly depend on the teaching of these basic sciences as their job. For instance, there are Science teachers, Mathematics teachers and Biology teachers across the globe. In some countries, these basic sciences provide greener pastures as some of the teachers in these fields are sent to other countries to deliver services. It is an undeniable fact that high unemployment rate is a threat to sustainable development. Consequently, with the provision of jobs by these basic sciences, one of the major threats to sustainable development is eliminated, paving way for a better sustainable development. This not only provides money in the form of income for the individual, but also generates revenue for the country, which is utilized by the government to provide the basic amenities needed by the people and this eventually helps in developing and sustaining the development of the country. Once people are able to secure jobs, as provided by these basic sciences, it results in high standard of living. When the standard of living of people are enriched, they are psychologically enhanced to effectively discharge their duties in their respective ways of enhancing sustainable development.

Secondly, basic sciences help the human population to understand the various crises that befall humankind as well as their respective impacts in order to either prevent these crises or limit their impact. The study of these basic sciences is one of, if not the only reason why the world is able to comprehend what brings about crises such as droughts and famines and how to solve them. In a similar way, these sciences also help us to understand the effect of rapid population growth on a country and the world at large. Due to this, people are aware of the measures and precautions that are to be taken to prevent this and the problems it brings. These sciences are also the means through which population censuses are undertaken to help a nation know how much it should produce to feed its people and give them a quality and comfortable life. They also help the people to know the rate at which to develop and how to successfully sustain the development with the help of the labour force.

Also, basic sciences help to sustain the growth of the national economy and improve its efficiency. The particular reason for this circumstance is, Mathematics, which is the branch of science suitable for calculations, is one of the basic sciences. Therefore, if basic sciences are learnt efficiently, one's Mathematics skills will improve. This will help in the preparation and utilization of the national budget. It will also help to maintain the economy in a good state for the good and comfort of the entire nation.

Apart from all the above mentioned, basic sciences also prove to be the backbone of sustainable development by helping in the growth of business. To elaborate, these basic sciences help to decrease the cost of production. For instance, farmers can now use tractors and fertilizers on their farms instead of using cutlasses which would delay production and labour, whom they would have to pay. This implies that, basic sciences have improved

the business of these farmers. The workers in question will in turn sell their products and this will give them income, a fraction of which they will pay to the government as tax. The government uses this money to build and develop the country, thus, promoting national development. The presence of the money will also help to maintain the good state of the development provided by the government.

Basic sciences also provide national and social security by aiding the people to learn new cultural practices and beliefs which will help in developing a new society. In Ghana, for instance, before the introduction of science and education, child marriage, giving off young girls to fetish priests, which is referred to as "trokosi", and female circumcision were the order of the day. However, after the introduction of science, the people began to think scientifically, and these outmoded practices died down. Also, scientific education has led to the employment of immigration officers to protect the borders of the country. Without technology such as guns and other protective devices however, the protection would be futile since the officers would be unable to ward off the intruders. This implies that basic sciences and technology, which as explained earlier, is also a science, help in national protection and sustainable development, because no nation can develop successfully and smoothly sustain its development without protecting itself from external attacks.

Promotion of urbanization, which explains as the growth of towns and villages into cities, is also one of the many ways by which basic sciences help in sustainable development. This is because, through the application of scientific knowledge and technology, industries are built in various towns and villages of countries. These industries are used to manufacture goods and services which aid the smooth living of citizens of the country. The presence of industries in towns and villages also makes them grow gradually into cities. The industries also serve as a source of employment for the youth and labour force, providing income, revenue and sustaining the growing development of the country.

Basic sciences also play a vital role in sustainable development by promoting technological advance. This refers to a change in the way a product or service is produced or delivered that reduces the resource input requirements for production or delivery. This is mainly because, basic sciences provide knowledge, which provides ideas for the invention of new technological devices and tools which help to produce better goods and improved services. For example, lately, people are able to place orders for food and other materials to delivery companies through the use of mobile phones, telephones, computers and such others, instead of going all the way to various shops to purchase these items. Such improved conditions of service help in the development of a country. The idea to create such a system was acquired only through scientific knowledge. This clearly indicates that, the more science and technology present in a country, the faster it develops. These sciences and technological devices also help the people to sustain the development.

Basic sciences help to improve the health of the people of a country, and that of the world at large. This is because, the study of applied sciences such as Medicine and Pharmacy, help in treating patients efficiently, and also help to manufacture drugs to cure various diseases and illnesses. For instance, with improved science and technology, doctors are able to diagnose and treat sicknesses like cancer and tuberculosis; diseases which in some time past, claimed many lives as a result of lack of treatment. A typical proof of the use of basic sciences in the health sector is what took place in the year 2021: The United Nations Educational, Scientific and Cultural Organization (UNESCO)'s toolkit *Mathematics for Action: Supporting Science-Based Decision-Making* recalled that Mathematical methods were used during the COVID-19 pandemic to design vaccines more efficiently and to model vaccine hesitancy as a social phenomenon.

In conclusion, the role of basic sciences in sustainable development are not far-fetched. They are obviously seen in every facet of life: they provide employment, promote growth in business, help in dealing with the crises of the human world, provide national and social security, help in urbanization and also, provide quality health service. This shows that, the study of Mathematics, Physics, Chemistry and Biology should not make the world have their hearts in their mouth. Instead, humanity should embrace their study, as its benefits are abundant. Consequently, nations and the world at large, should help in promoting the study of these basic sciences.

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THE ROLE OF BASIC SCIENCES FOR SUSTAINABLE DEVELOPMENT

Over the years, basic sciences have played significant roles in all aspects of life. Basic sciences sometimes called "pure" or "fundamental sciences, have helped researchers understand living systems and life processes. Just imagine how the world would have been like without the invention of mobile phones. Our mobile phones would not exist without material sciences that enabled the invention and miniaturization of the transistor, and mathematics that are the basis of all software. Basic researches have led to important discoveries that have yielded not only new technologies but even entirely new fields of science. Moving forward, basic sciences have an important contribution to make to the implementation of Sustainable Development Goals (SDGs).

The term Science comes from the Latin word *scientia,* meaning "knowledge". It can be defined as a systematic attempt to discover by means of observation and reasoning, particular facts about the world and to establish laws connecting one with another and, in some cases, to make it possible to predict future occurrences. Science is simply defined as the knowledge gained through observations and experimentation. The basic sciences are defined as the scientific disciplines of mathematics, physics, chemistry, and biology. Basic sciences are the scientific disciplines that provide a fundamental understanding of natural phenomena and the processes by which natural resources are transformed. In the evaluation of ISP's operation 2003-2010, it was concluded that basic science is a necessary condition for technological improvement and productivity increases in agriculture, manufacturing, and the service industries including health sciences.

Without basic science, there would be no science to apply. As said by Max Planck (1925), **"Knowledge must precede application, and the more detailed our knowledge, the richer and more lasting will be the results we can draw from that knowledge"** Science plays a key educational role. The critical thinking that comes with science education is vital in training the mind, understanding the world, making choices and solving problems. Science literacy supplies the basis for solutions to everyday problems in uncontroversial ways, reducing the likelihood of misunderstandings and furthering common understanding. Science literacy and capacity-building should be particularly promoted in low- and middle-income countries, where both the appreciation of the benefits of science as well as the resources for science are lacking. This situation creates dependence on countries that are scientifically more literate and resourceful. Basic sciences help to identify mechanisms to adequately use knowledge and transfer technology. Basic Sciences lead to knowledge and offer new approaches which, in turn, may lead to practical application. Science is a powerful driving force in the success of any nation, contributing to its economic well-being and the individual fulfilment of its people. Science is critical to tackle complex challenges for humanity such as climate change, biodiversity loss, pollution and poverty reduction, as it lays the foundation for new approaches and solutions. Basic Sciences promote cross-disciplinary approaches to advance the understanding of human-environment interactions and systems, and how these interactions affect the challenge of sustainability. Basic Sciences produce valuable knowledge for a better understanding of process that promote or hinder sustainable development. Basic Sciences develop research approaches, tools, methods, prediction models for recording positive and negative development trends. Basic Sciences in one or the other way help in attainment of all the 17 SDGs. Science is the foundation for understanding how our live are impacted by climate change and what we can do to slow or reverse changes. Scientific studies document that, as surface and water temperatures rise, human, animal and plant life respond. In

the early 1960s, scientists recognized an emissions increase in carbon dioxide into the atmosphere has grown beyond their expectations. Later they discovered that methane, nitrous oxide and other gases were also rising. Because these gases trap heat and warm the Earth, as a greenhouse traps heat from the sun, scientists concluded that increasing levels of "greenhouse gases" would increase global warming.

Sustainable development is generally defined as using the earth resources in such a way that meets the human needs at present times without prohibiting future generations of the same opportunity. Sustainable development is considered one of the most important policies reliable for the continuity of different human activities that use natural resources and sustain these resources for the next generation.

Basic sciences have an important role in the pursuit of sustainable development, especially in the following categories;

Utilization of energy

New energy and propulsion technologies that will aid in lowering emissions of climate-damaging greenhouse gases are among the key technologies of sustainable development. We will need to cut current global greenhouse gas emissions by more than 50% just to stabilize atmospheric greenhouse gas concentrations at levels twice those of preindustrial times. Improved thermal insulation in buildings, the use of heat/power cogeneration, and effective support for the use of renewable energies must all be prioritized in order to accomplish this goal. The field of wind energy is currently making the most progress; however, over the medium term, the usage of solar energy, specifically photovoltaic technology, will continue to gain importance.

Creation of eco-friendly products

Additionally, contemporary microsystems and control technologies are opening up new possibilities for designing environmentally friendly industrial methods. Although wastewater-treatment and filter technologies have significantly improved the quality of the air and water in recent years, they are only ever the second-best option and have been surpassed by integrated environmental technology, which maximizes the use of resources such as materials and energy. This entails the use of resource- and energy-efficient production techniques as well as the creation of environmentally friendly products, particularly those that produce little waste. The advancement of such "clean" technologies is also encouraged by tools like eco-audits, which may be used to determine the potential savings from expenditures in environmental protection.

Biotechnology

Biotechnology, the use of biology to solve problems and make useful products. Biotechnology is expected to bring important advances in medical diagnosis and therapy, in solving food problems, in energy saving, in environmentally compatible industrial and agricultural production, and in specially targeted environmental protection projects. Genetically altered microorganisms can break down a wide range of pollutants by being used, for example, in bio-filters and wastewater-treatment facilities, and in the clean-up of polluted sites. Genetically modified organisms can also alleviate environmental burdens by reducing the need for pesticides, fertilizers, and medications. (Merkel, 1998)

Conclusion

To conclude basic sciences are vital to attain sustainable development and to improve the quality of life for people all over the world. Basic Sciences are not only for technological advancement, but also for global sustainable development. As said by Michel Spiro (President of IUPAP), "Basic Sciences provide the essential means to meet crucial challenges such as universal access to food, energy, health coverage and communication technologies". Basic science is a major stakeholder in sustainable development. Sustainable Development Goals can never be achieved without the basic sciences.

References

Merkel, A., 1998. The role of science in sustainable development. *Science*, *281*(5375), pp.336-337.

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THE ROLE OF BASIC SCIENCES FOR SUSTAINABLE DEVELOPMENT

The role of basic sciences in sustainable development cannot be denied. As the world continues to face a growing number of environmental and social challenges, the importance of good scientific knowledge and research cannot be ignored. It is important that we understand the fundamental role that basic sciences play in creating sustainable solutions for the future.

Basic science helps us understand how the world works and how everything is connected. This is important when we are trying to make the world better because we need to think about how our actions will affect the environment, economy, and people for a long time. This knowledge is needed to solve problems like climate change and not having enough clean water. It can also give us a better idea of what will happen in the future if we do something. Basic science gives us the facts and evidence we need to make sure our solutions are good and will last. For example, understanding the fundamentals of physics and chemistry can help identify the best technologies to reduce pollution, while biology and ecology can help us better understand and protect the environment. Basic science also ensures that our solutions are the right fit.

Additionally, by understanding basic sciences we obtain the knowledge we need to make good decisions about how to grow and change. Basic science helps us understand how to make our world better and fairer for everyone. Scientists use research and facts to give us ideas about how to use energy and other resources in a way that would not run out or cause problems. This knowledge is very important because it helps us make sure that the way we develop is good for the long-term and includes everyone.

Using basic science, we can measure how well we are doing and make sure we are working towards a better future in the right direction. We can also use basic science to make theories about how to make the world better and test them to see if they will work. Finally, basic science can help us put all of the information we have about the world into a form that is easy for people to understand and use to make decisions.

In conclusion, basic sciences are important for sustainable development. Scientists use basic science to study the world and figure out the best ways to make it better for everyone. They use evidence and facts to come up with ideas that will work in the long term and are fair for everyone. It's important to understand how important basic science is for making the world a better place and for making sure our solutions are sustainable.

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THE ROLE OF BASIC SCIENCES FOR SUSTAINABLE DEVELOPMENT

Sustainable development depends heavily on the application of basic sciences including biology, physics, chemistry, and mathematics. These fields provide a comprehensive foundation of understanding that is needed for addressing some of the most important issues affecting humanity, such as poverty, environmental degradation, and climate change.

The creation of new technologies and inventions is one of the primary ways that basic sciences contribute to sustainable development. These technologies can help in solving environmental and social issues in a more sustainable manner since they usually depend on a solid understanding of the underlying research. For instance, improvements in physics and engineering are essential for the advancement of renewable energy sources like solar and wind power. Likewise, technological innovations have the potential to change agriculture and food production, making them more efficient and sustainable.

Understanding and reducing the effects of climate change rely heavily on basic sciences. To predict and lessen the consequences of rising temperatures, one must have a thorough understanding of the underlying physics, chemistry, and biology of the Earth's climate, which is a complex and dynamic system. This includes being aware of how greenhouse gases function in the atmosphere, how land use affects the carbon cycle, and how vulnerable certain ecosystems are to climate change.

In order to solve the difficulties facing global health, basic sciences are equally important. Diseases and pathogens, which are organisms that spread illness, are best understood through biology and chemistry. Examples of these diseases include malaria, TB, and HIV/AIDS. This understanding is crucial for the development of effective treatments and prevention strategies. Furthermore, developments in medical technology, such as diagnostic procedures and vaccinations, mainly depend on basic scientific ideas.

In order to solve challenges of social and economic inequality, basic sciences are crucial. For instance, mathematics can be used to analyze and understand complicated systems, as well as to identify patterns of injustice and inequality and take appropriate actions. Similar to how mathematics and statistics form the basis of economics, these two sciences may be used to guide policy decisions that encourage more sustainable outcomes.

Overall, basic sciences play a significant role in achieving sustainable development. These sciences offer a vital foundation of knowledge that is necessary for tackling some of the most serious issues confronting mankind, from the creation of new technologies to the understanding of complex systems and the discovery of inequity patterns.

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THE ROLE OF BASIC SCIENCES FOR SUSTAINABLE DEVELOPMENT

Sustainable development is generally defined as using the earth's resources in such a way that meets the human needs at present time without prohibiting future generation of the same opportunity. The sustainable development goals adopted by the United Nation's general assembly in September 2015 consist of 17 goals to be achieved by 2030 to make the world more sustainable and equitable society for all. The 17 goals integrate all three dimensions of a sustainable development; economic, social, and environmental and focus on the 5Ps; thus, People (wellbeing of all people); Planet (protection of the earth's ecosystem); Prosperity (continued economic and technological growth); Peace (securing peace and Partnership (improving international corporation). The SDGs was developed through consultative process that brought national government and millions of citizens from the globe together to negotiate and adopt this ambitious agenda.

The basic sciences guided by curiosity, are a perfect model for a development that is sustainable. Through their scientific curiosity, each generation increases the pool of knowledge built by their predecessors, bringing more resources for future generations to seek solutions to problems. Science is critical to help meet the challenges for sustainable development as it lays the foundation for new approaches, solutions and technologies to identify, clarify and tackle global challenges for the future. Science provides answers that are testable and reproducible, and thus provide the basis for conclusive decision-making processes and effective impact assessments. Both in its scope of study as well as applications, science spans from the understanding of natural processes and human impacts there on to the organization of social systems, the contribution of science to health and well-being, and ways to improve subsistence and livelihood strategies to meet the overriding goal of poverty reduction.

Basic sciences can be explained as the scientific disciplines of biology, physics, mathematics, and chemistry. It also means 'thinking outside the box.'' It leads to new knowledge and offers new approaches which in turn may lead to new ways of the practical use. They are called so because they provide a fundamental understanding of natural phenomena and the process by which natural resources are transformed. Most of the leading breakthroughs in development that several benefits have science at their core, that is, basic science serves as the key drivers of sustainable economic growth in the globalised world. It also provides the evidence- base for responding to many of the most basic challenges facing low and lower-middle income countries. Basic sciences have important contributions to make to the implementation of the program, thus the 2030 for sustainable development. They provide the essential means to face crucial challenges such as universal access to food, energy, and health coverage and communication technologies. How could we fight the SARS-CoV-2 pandemic without the contributions of basic biology, physics, chemistry or mathematics accumulated for the decades? Below are few ways basic science is paving way to sustainable development.

Having capacity in basic sciences is in the interest of both developed and developing countries, given the potential for application to foster sustainable development. For example, a growing number of people around the world suffer from diabetes. Thanks to laboratory studies, ways in which genes can be manipulated to make specific protein molecules, scientists are able to engineer genetically, a common bacterium, Escherichia coli, to produce synthetic human insulin. Invented in 1983 by American biochemist Kary Banks Mullis, the polymerase chain reaction (PCR) is a technique used to copy tiny segments of DNA. PCR acts like a magnifying glass, making it easier to analyse these DNA segments. PCR has a wide range of applications. It can be used to detect the presence of bacteria and viruses, such as in food, water, or patients. Over the past two years, PCR has been used countless times to test

individuals for infection with Covid-19. PCR can also be used to detect a genetic disorder or to further our understanding of evolutionary relationships between different organisms. In forensics, PCR can be used to identify a criminal based on a sample left behind at a crime scene, such as a hair follicle. This and many more that help sustain the development goal number 3, which emphasizes on health and wellbeing. Banks Mullis won himself a noble prize for chemistry in 1993 for his revolutionary discovery.

Faced with the challenges of climate change, science has already contributed to providing solutions for a secure and sustainable energy supply. One key challenge today is to transition to clean forms of energy. Hydrogen is already being used on an industrial scale, but hydrogen energy is almost entirely supplied from coal and gas. Converting water into hydrogen using artificial photosynthesis; by splitting water (H_2O) into hydrogen and oxygen molecules could offer a 'green' method of producing hydrogen energy. A growing number of households are turning away from oil or gas heating towards solar, geothermal, and wood pellet options. Biomass produced using the floating mangrove technology could provide an alternative to cutting down existing mangrove trees illegally to make wood pellets for charcoal production.

The improvements in weather prediction accuracy are an example of scientific success, with current 5-day forecast being about as good as a 1-day forecast were four decades ago. Nevertheless, there is still a need for longer predictions and for more regional applications and dissemination of the forecasts of extreme weather events such as heavy rain, flash flood, and storm surge, which particularly affect the most underdeveloped countries in Africa and Asia.

The critical thinking that comes with science education is vital in training the mind, understanding the world, making choices, and solving problems. Science literacy supplies the basis for solutions to everyday problems in uncontroversial ways, reducing the likelihood of misunderstandings and furthering common understanding. Science literacy and capacity-building should be particularly promoted in low and middle-low-income countries, where both the appreciation of the benefits of science as well as the resources for science is lacking. This situation creates dependence on countries that are scientifically more literate and resourceful.

The confusion that exists in the definition and perception of sustainability was clarified. In one hand, the sustainable development is that development that achieves simultaneously three criteria; economic development, environmental protection, and social development. On the other hand, is one of the three composite actors that can achieve or undermine sustainable development; basic science; can also be referred to as the pillar of sustainability. In this context, the modified central paradigm of science was presented. The role of as a pillar of sustainability was analysed and it was concluded that the winning formula is a close and strong cooperation between them in equal levels and as equal partners. As such, generous financial and human investment in scientific research is the best long- and short-term solution to the sustainability issues we face today.

References

Jeffery D. S., The Age of Sustainable Development (2001). Columbia University Press.

World Commission on Environmental and Development (1987). Our Common Future. Oxford: Oxford University Press. p. 27.

Micheal A., Masahi Y., Martine C., Basic Science (2021). Karger Medical and Scientific Publishers.

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THE ROLE OF BASIC SCIENCES FOR SUSTAINABLE DEVELOPMENT

"The more I study science, the more I believe in God." - Albert Einstein

Ghana, like many developing countries, faces unique challenges in achieving sustainable development in its education, health, and research sectors. However, the basic sciences play a crucial role in overcoming these challenges and driving progress. From understanding the fundamental principles of disease to developing new technologies and innovations, the basic sciences provide the foundation for addressing some of Ghana's most pressing issues. With insights from leading scientists and policymakers, we hope to shed light on the vital role that the basic sciences play in shaping a brighter future for Ghana and beyond.

The term 'sustainable development' has become an increasingly prominent part of the global development agenda in recent years. This is because sustainable development aims to meet the needs of the present without compromising the needs of future generations. According to the United Nations development program, sustainable development requires that society "conserves the environment and its natural resources, respects the cultural identity of its people, and values social and economic progress" (UNDP, 2011). While there is broad consensus on the importance of sustainable development, achieving this goal remains a significant challenge due to the complex, interrelated problems associated with global economic, political, and social systems.

Basic sciences such as physics, chemistry, and biology play a critical role in advancing sustainable development, from the understanding of basic principles to the delivery of practical solutions. Physics provides us with the foundation for understanding energy and the efficient use of energy resources. Chemistry focuses on understanding the behavior of matter and the environmental effects of pollutants. Biology teaches us about biodiversity and how to sustainably manage wildlife and other natural resources. In addition, advances in biotechnologies, nanotechnologies, and information technologies are crucial components of sustainable development. For instance, nanotechnologies can be used to develop better sustainable energy sources and water treatment systems, while biotechnologies can be used to create better forms of renewable energy and improved agricultural production. Information technologies can be used to facilitate collaboration towards sustainable development goals and help people make informed decisions about their behavior and its potential impact on the environment.

Basic sciences play an essential role in addressing many of the challenges currently facing Ghana and the global community. For example, an understanding of the fundamentals of biology is critical for the development of effective disease control strategies, while a deeper understanding of chemistry will be vital for the development of new energy sources in a time of intense climate change. Moreover, greater advances in the physical sciences are crucial for the development of state-of-the-art technologies which could be of great benefit to the country and its people.

Nevertheless, basic sciences provide a framework to facilitate effective policy making and public engagement. Quantifying the potential risks and benefits of certain policies, as well as communicating these findings to the public, is critical to creating an informed and engaged society. The basic sciences are important in providing the necessary evidence and information for informed decisions, as well as providing practical solutions for sustainable development.

In the 21st Century, global development goals have changed from tackling the overarching issues of economic stability to the more inclusive

and holistic concept of sustainable development. In pursuit of these goals, countries around the world are increasingly seeking to promote actions that benefit not just the present population but also future generations. One of the fundamental principles of sustainable development is the need to seek a balance between ecological and social, as well as economic aspects of development.

Ghana, as a rapidly developing country, is increasingly implementing measures to help it achieve the Sustainable Development Goals (SDGs). The country has identified basic sciences as one of the key areas to explore to jump-start its development efforts. Basic sciences encompass fields such as biology, chemistry, and physics, and are deeply rooted in the understanding of the natural world, providing us with the information we need to make informed decisions about the environment and its resources. Moreover, Ghana has been investing heavily in getting students interested in the sciences, especially the basic sciences, right from the primary to the tertiary level. The government has also developed a national science policy and is actively exploring the possibilities of investments in research and development.

Several initiatives were launched to promote scientific literacy and appreciation of the sciences in general namely the National Science and Maths Quiz (NSMQ), The Ghana Science Olympiad (GSO), and The Junior Science and Math Quiz (JSM) to name a few. Also, STEM-inspired organizations such as the Ghana Science Association (GSA), African Institute for Mathematical Sciences, STEM Girls Foundation, and among others have gone a long way to contributing to the promotion of STEM education in Ghana being it through literary magazines, symposiums, research papers, and competitions. Additionally, collaborations with regional and international partners are also being pursued to bring more resources and opportunities for Ghanaian students. These comprehensive efforts will surely lead to a brighter future for Ghana and its citizens, as well as contribute significantly to the achievement of the 2030 Sustainable Development Goals. In conclusion, the importance of basic sciences cannot be overstated when looking at the sustainability of Ghana's education, health, and research sector. Having access to adequate training and research tools is crucial to ensuring that the future of the country is bright, with well-educated citizens who are equipped and capable of tackling the challenges it may face. While there is much work to be done to improve the quality and range of basic sciences for these sectors, the potential for development is huge. With a comprehensive understanding of the basic sciences, Ghana can make strides toward achieving the UN's Sustainable Development Goals and building a brighter future for its citizens. The basic sciences play a crucial role in sustainable development in Ghana's education, health, and research sectors. From a scientific perspective, understanding the fundamental principles of biology, chemistry, and physics allows us to tackle complex more effectively and efficiently.

I'll end with another quote from Albert Einstein, "The important thing is not to stop questioning. Curiosity has its reason for existing." It is through this continuous curiosity and pursuit of knowledge that we can continue to make progress toward a more sustainable future for Ghana. Therefore, it is essential that we continue to prioritize the basic sciences in our educational system and research endeavors to foster a more sustainable and thriving society.

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THE ROLE OF BASIC SCIENCES FOR SUSTAINABLE DEVELOPMENT

Science is a subject of academic study that has several definitions. It may be defined as a body of organized knowledge that constitutes the current findings of the natural environment and the continuous process whereby the established body of knowledge is repeatedly revised and advanced. The definition of science may also be stated as, a body of organized knowledge that has been acquired and being acquired through observation of the natural environment, based on which an experiment is designed and conducted, collection and analysis data from the experiment and drawing of conclusion. Science aims to explain and understand the natural world. Science is interconnected. It needs physics, chemistry, biology, and mathematics. Science is a systematic endeavour that builds and organizes knowledge in the form of testable explanations and predictions about the universe. Science is both a body of knowledge and a process.

Basic sciences are defined as the scientific discipline of mathematics, physics, chemistry, and biology. They are called basic sciences because they provide a fundamental understanding of natural phenomena and the process by which resources are transformed. There are 4 branches of basic sciences. They are physics, chemistry, biology, and mathematics.

Physics is the natural science that involves the study of natural science, nature, properties of matter, energy, and the relationship between them.

Biology is a branch of science that deals with the study of living organisms and their natural environment.

Chemistry: is the study of chemical reactions and properties of matter.

Mathematics: is the use of arithmetic for calculations. All the branches of basic sciences help tremendously in sustainable development.

Basic sciences used in agriculture is very productive. So, taking the sector of agriculture, the following are the roles of basic sciences. The role of physics, chemistry, biology, and mathematics in agriculture.

Firstly, physics has helped in agriculture a lot. Through physics, the production of silos is made to preserve food crops to prevent waste of food. Again, through physics, seed lasers have been made and invented to store seed for a long time till the farmer plants them. Physics has led to farming efficiency due to the production of electric motors which is very useful in the irrigation of large plantation of plants, the production of harvesters at a goal which makes farming efficient.

Due to chemistry, food processing has been easy. It has made food packaging nice for export which in turns generate revenue for agriculturists, farmers, chemical industries, and other industries. Through chemistry, the chemical industry helps in food production by producing fertilizers, crops have been yielding at a very high rate. Therefore, increasing the production of food.

Through biology, farmers and agriculturists gets knowledge on how to maintain crops. Again, biology gives provisions of food for animals in case of pastoral farming. Biology also helps farmers to know the type of beds to raise plant on.

Mathematics is also very important in agriculture. Mathematics is used by farmers as a system of organization to effectively utilize their time and manage their money. They use mathematics to convert units and measurements of area. Mathematics is also used by farmers to grade and describe seeds. Lastly, farmers use mathematics to measure moisture and soil acidity which helps to know the kind of crops to grow and types of fertilizer to be used.

The main role basic sciences in agriculture have helped to generate novelties that allows us to produce more with less. Chemistry, biology, mathematics, and physics has helped to produce more with less.

Moreover, basic sciences have helped and has also played an important role in the health sector. The following are the roles of basic sciences. The roles of physics, chemistry, biology,

and mathematics in the health sector.

Physics has proved to be very useful in the health sector. Physics has helped to make sure equipment operate correctly and are often involved directly to the patients' diagnosis and treatment. Through physics, machines have been invented which can detect early stages of deadly diseases which enables doctors to treat diseases early to prevent the disease from advancing.

Chemistry also play an important role in the health sector. Chemistry contributes to the preparation and use of materials for surgery. Chemistry also provides medicine for the treatment of diseases.

Chemistry helps in the diagnostics for the detection of diseases through the development of improved means of diagnosis and through optimizing the development of effective drugs. Chemistry is helpful on improving the health of human beings by providing antibiotics, painkillers, penicillin, tetracycline, vitamins, enzymes, and minerals which promotes human health diseases and building the immune system.

Mathematics is also needed in the health sector. Mathematics helps in the prescription of drugs which prevent overdose and under-dose of medications. Mathematics is used to draw statistical graphs of epidemics or success rate of treatment.

Biology is used by medical officers to use knowledge obtained for diagnosis and treatment of many diseases including various surgeries to save lives of peoples. Biology gives knowledge on the kinds of food to eat and what not to eat. Biology gives knowledge on how some disease spread has been applied to reduce the incidence.

Again, basic sciences are very important in the transportation sector. In transportation, physics, chemistry, biology, and mathematics all play an important role.

Physics plays an important role in transportation. Because of knowledge gained from physics, cars have been invented. Apart from cars, machines like trains, ships, airplanes etc. have been invented to make transportation easier and faster.

Chemistry has also played an important role in transportation. It is so because, through chemistry, fuels have been made to power up machines like cars, ships, trains, airplanes etc. to enable them to transport goods and people from one place to another.

Mathematics also plays a role in transportation. Mathematics contributes most to operational planning problems to allocate and schedule vehicles and crews. Mathematics also optimizes traffic lights to prevent accidents.

Basic sciences have also play an important role in the communication sector. Physics and mathematics have played a very important role in the communication sector and in communication.

Physic is very useful in communication. Physics allows us to understand the electromagnetic radiation we use to transmit data with fiber optics and satellites and to build computers that interpret those signals and transmit data on the internet. Physics gives knowledge to investors and scientists to invent mobile devices, computers, televisions, watches, radios and many other modern technologies to enable them to operate in an automated manner which makes communication efficient and effective. GPS would not have been possible without Einstein's theory of general relatively and quantum physics. This would not have happened without knowledge from physics.

Mathematics is also important and plays a very important role in the communication sector. Without maths, communication services would not be able to calculate the amount of data to be given to people. People will not be able to calculate the amount of airtime they would need as well as call credit.

These are all what **basic sciences** have played in our lives. Without science, our lives will be meaningless. Science is our life. Basic Sciences helps in sustainable development because the knowledge gotten leads to better ways to predict, prevent, diagnose, treat diseases and many more. Through basic sciences, researchers try to answer fundamental questions about how life works.

Science is everything and all our lives rotate around science. Thus, science has played a very important role in the sustainable development.

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THE ROLE OF BASIC SCIENCES FOR SUSTAINABLE DEVELOPMENT

Just take a second. Imagine life at home without electricity supply for only three days. Horrible!! Frozen fish sellers, party organizers, corn millers, etc., and even patients on admission in our various hospitals will bear the brunt of a basic science product - electricity generation.
So, you see, we all need the basic sciences to enjoy our lives and to develop as a country. But before we discuss any further, lets first get to know and understand some basic terms.

Science is the systematic study of the structure and behavior of the physical and natural world through observations and experimentations. Development is the event constituting of a new stage in a changing situation. Scientific development is therefore an interdisciplinary scientific field that synthesizes perspectives from biology, psychology, and sociology to understand behavioural and psychological aspects of human development. Hence the basic sciences are defined as the scientific disciplines of mathematics, physics, chemistry, and biology. These have provided the foundation of knowledge for the applied sciences. For purposes of our discussion, let's say, an applied science is the discipline that uses existing scientific knowledge to develop more practical applications. Through basic sciences, we have come to know the use of technology, invention and innovation which make life easier and comfortable. For instance, we no longer use earthenware nowadays but rather we make use of blenders. We no longer use clay pot for keeping our water cold, but we rather use fridges. All of these are the products of basic sciences. Below are the roles of basic sciences play for sustainable development.

To set the ball rolling, basic sciences provide the means to address vital challenges in agriculture, energy, health and in teaching and learning.

In agriculture for instance, the knowledge acquired from studying the life cycles of some insects can help to determine the most effective intervention to control any group of pests that may invade a farm. The development of better crop varieties that are resistant to diseases, produce more yields and short duration to harvest can be achieved through better cross breeding. Assume for a moment that our cocoa farmers have sufficient understanding of the life cycles of the pests and disease pathogens that afflict their farms. Am sure there will be no longer needed to destroy entire farms because of widespread pest or disease invasion. This singular act of awareness and knowledge of pest and disease control will save the farmer, as well as the country significant revenue. So, with the knowledge of basic science, improved varieties can be produced, to increase cocoa yield, resist pest and disease attacks, and increase harvest within relatively short period.

The knowledge of basic science (computer science and technology) can lead to the manufacturing of drones which can be used to manage large farm sizes. These drones can irrigate the farm, spray the farm with insecticides, pesticides and weedicides which will take many months to finish that with human labour.

In the generation of energy, Ghana as a country has been depending heavily on hydroelectricity. But the knowledge obtained from sciences can lead us to explore other sources of electric power generation. Wind energy from our beaches, and solar energy from our location in the tropics, should be easily taken advantage of with some knowledge from basic sciences. This will take a lot of pressure from our over-dependence on hydroelectric-power generation, thereby guaranteeing the nation a more reliable and stable electricity.

A lot of people have realized how the knowledge of basic science is so crucial to our development as a country when we were hit by COVID–19 pandemics. A lot of people succumbed to this disease globally. And in Ghana, some of our important figures also suffered the same faith. The

only way out was to come up with a vaccine to save the lives of people. Coming up with a vaccine depends solely on the knowledge of basic sciences. The knowledge acquired from basic sciences helped scientist in the other part of the world to come up with some vaccines such as: Astrazeneca, Moderna and J & J vaccines. Nowadays, in some hospitals, surgery doesn't require a surgeon with sharp knives on the patients. Robots have been developed to do the surgery while the surgeon sits on his computer commanding the robots to work. This has helped to eliminate a lot of human errors observed after the surgery. This is because of the high accuracy of robots as compared to humans.

Lastly, the knowledge obtained from basic sciences can help to drive both teaching and learning effectively. Most of the things we learn as a country is either fact finding, memorization and rote learning with little or no application at all. This is a serious challenge for development of our country. So, the knowledge in basic science has brought teaching and learning materials that aid teachers to teach well and students to also learn, understand and apply what they have learned. Practical kits are available for most lessons taught, images, 3D models and videos are also available. When all these tools are utilized in teaching and students are made to practice and apply what they have learned, the students will understand the lesson very well and link what they have learned in real life situations. This will help the development of the country.

Elon Musk, we all know didn't offer rocket science nor electrical engineering. But rather he had his first degrees in computer science and economics and PhD in material science. But today he had come up with a lot of electric cars, spacecrafts, AI robots. When interviewed how did he manage to do that, he replied he read books on these subjects and immediately applied what he learned into use. He also said he interacted with people in those field for further explanation and applied all that he had learned into real life. This is what he did, and he became the richest man in the world.

To conclude, these are few of the ways basic sciences play a key role for sustainable development.

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THE ROLE OF BASIC SCIENCES FOR SUSTAINABLE DEVELOPMENT

The earliest roots of basic sciences can be traced to ancient Egypt and Mesopotamia in around 3000 to 1200 BCE, which has contributed a lot to the development of nations, continents, and the world up to date. Basic sciences have provided the fundamental understanding of natural phenomena and the processes by which natural resources are being transformed for the benefit of human race. One may ask, "what is meant by basic sciences"? Basic sciences are the scientific disciplines of mathematics, physics, chemistry, and biology. Basic sciences provide the means to address vital challenges in the world today by meeting the needs of the present without compromising the ability of the future generations to meet their own needs. The role of basic sciences in sustainable development are being addressed in the subsequent paragraphs.

First, basic sciences provide the means to get access to health. The growth of healthcare sciences has made patient care far superior and more reliable in most cases by providing medicines and treatments that save lives and improve the chance of recovery of many. This is because basic sciences are the key component of most medical curriculums. They underpin medical students with knowledge and understanding of the human body, diseases, and associated therapies.

Again, basic sciences play a role in getting access to communication for all people. The growth in information technology training has helped in building confidence for media interviews with the help of technological products such as, mobile phones and personal computers etc. People now learn how to prepare their key talking points for communication with the help of the internet by the use of smart phones, tablets, and personal computers. Basic sciences have played a role by turning the whole world into a global village.

Furthermore, basic sciences provide the means of getting access to energy. One may ask "what is the meaning of energy"? Energy is said to be the ability or capacity for doing work. It is basic sciences that we get to know various forms of energy – kinetic energy, potential energy, electrical energy, solar energy – and how it can be transformed from one form of energy to another. Basic science also brought about how these energies can be used for development of nations, continents, and the world at large. For example, electrical energy is used to generate electricity which is being consumed by our electrical gadgets at home, in the streets and at many workplaces, which is making life easier than the olden days.

Last but not the least, basic sciences play a role in food. Basic sciences allow us to make the best use of our food resources and minimize waste, since food science draws from many disciplines, including biology, chemistry, and physics when it comes to production and preservation of food. How food materials behave in harvesting, processing, distribution, storage, and preparation is a complex predicament that cannot be tackled at once, therefore the awareness of all-important aspects of the problem requires broad – based training which is being given to us through basic sciences.

I hope with all the above stated roles of basic sciences in sustainable development, people especially the science students will come to know the importance of basic sciences in our communities and put more effort to study hard for a sustainable living.

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THE ROLE OF BASIC SCIENCES FOR SUSTAINABLE DEVELOPMENT

As part of my school's 75th Anniversary celebrations there was an exhibition show. Most students were able to create a lot of items using materials from their locality. One of them that really caught my attention was the craft that processed fresh tomatoes into puree that could last several weeks. She explained that she learnt things rot easily when they contain more water, so she only tried dehydrating the fruits and adding little salt to preserve the puree. Such a simple application of basic science ideas could go a long way to save the local economy so much from always losing their farm produce to rot. Through science she gained knowledge by observation, by performing experiment and drawing conclusion from the pieces of information. Science would develop our country through agriculture, communication, education, and sanitation.

To set the ball rolling, the most contributory factor of basic sciences for sustainable development is through agriculture. The knowledge of basic sciences aided in the provision of farm equipment such as tractors and combine harvesters which are used in large scale farming as compared to the traditional farming. The knowledge of basic science has led to manufacturing of different varieties of inorganic fertilizers for crop normal growth, pesticides for controlling pest on the farm and weedicides which is used to control weeds on the farm. All these products from basic sciences have shortened the duration of farming as well as saving the farmer a lot of energy, time and resources. This leads to bumper harvest.

Another contributory factor of basic sciences for sustainable development is through education, teaching and learning process in schools. The knowledge from basic sciences has led to creation of modernized teaching tools such as electronic boards, computers, 3D structures modes, multimedia content which has made teaching and learning very easy for both teachers and students. Another important tool for learning brought about by the basic sciences is E-learning. This tool has made students to learn at the comfort of their homes while receiving lessons from their teachers.

Lastly, one important knowledge obtained from the application of basic sciences is communication and technology. Through technology, a lot of products have been invented which have contributed positively to lives on daily basis. These products are numerous. Some of these are the invention of mobile phones, electric cars, high speed personal computers, the internet, Facebook, WhatsApp, and some digital platforms for meeting such as zoom. The invention internet has made the world to turn into a global village.

To conclude, these factors mentioned are the roles of basic sciences for sustainable development.

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THE ROLE OF BASIC SCIENCES FOR SUSTAINABLE DEVELOPMENT

The 20th century saw a swing between pessimistic and optimistic perspectives on the advancement of humanity. The optimism expressed in projections made at the turn of the century, of nearly limitless possibilities emerging as a result of scientific and technological advancements, was broken by economic unrest and deadly world conflicts over the first half of the century. However, after World War II, beginning in the 1950s, when it appeared that the dominating Western culture was ready to collapse, an unparalleled economic boom opened the door for fresh hope on the prospects of growing living standards globally. However, it was at this time of industrial and commercial progress that environmental issues began to loom bigger on the horizon, compelling people to re-evaluate their fundamental beliefs about growth and development.

After two world wars, it became clear that while scientific and technological advancements had brought about material advancement and made life simpler, there was a drawback as well: these advancements were also wreaking havoc on the environment. The attraction that older generations had for the concept of unending progress was waning by the 1970s. People became conscious of the hazards that rapid population increase, pollution, and resource depletion posed to the environment and their own existence as humans during the time of unheard-of industrial and commercial expansion that followed World War II.

The fear that the economic expansion would imperil the survival of the human species and the earth led to a sharper and more dramatic rise in environmental concern. In expectation of an imminent ecological catastrophe, this alarmist mood spurred a new way of thinking about development and paved the way for sustainable development as an alternative to unrestricted economic growth.

Therefore, the idea of sustainable development came into being as people became more conscious of the impending ecological disaster and worried that they might not be able to continue their quality of living. Meeting human development goals while preserving the capacity of natural systems to deliver the natural resources and ecosystem services that are essential to the economy and society is the goal of sustainable development. It is a development that satisfies the requirements of the present without endangering the capacity of future generations to satisfy their own needs. This was stated clearly during the first in a series of international conferences on the looming ecological crisis at the United Nations Conference on the Human Environment held in Stockholm in 1972. In its declaration, it was stated that, "A point has been reached in history when we must shape our actions throughout the world with a more prudent care for their environmental consequences. Through ignorance or indifference, we can do massive and irreversible harm to the earthly environment on which our life and wellbeing depend. Conversely, through fuller knowledge and wiser action, we can achieve for ourselves and our posterity a better life in an environment more in keeping with human needs and hopes...To defend and improve the human environment for present and future generations has become an imperative goal for mankind".

While sustainability may seem like a noble goal, without knowledge of the fundamental sciences, it is hardly possible, and it was for this reason that 2022 was designated as the International Year of Basic Sciences for Sustainable Development. Basic science, also referred to as "pure" or "fundamental" science, is the foundation of scientific knowledge. It generally comprises the scientific disciplines of biology, chemistry, physics and mathematics. The development of applied sciences and understanding of living systems and processes begin with the knowledge of basic sciences, making them the most significant component of science.

Since February 2020, the COVID-19 pandemic brought on by the

SARS-CoV-2 virus has been causing havoc. But how much worse would the situation have been without the findings of scientific investigation motivated by curiosity? Basic research has given us knowledge about the virus that caused the infection, its appearance, genetic makeup, and possible mutations. To get a clearer picture of the link between the fight against COVID-19 and the basic sciences, viruses were discovered at the dawn of the 20th century, the first electron microscope was constructed in the 1930s, and DNA sequencing began in the middle of the 1970s. Even more, we owe the discovery and study of electromagnetic waves and optical fibers in the 19th century, as well as the development of algorithms and computer codes in the 20th century, to the high-speed, long-distance communications that enable us to coordinate the fight against the pandemic and minimize disruptions in education, economic activities, and even the practice of science. The COVID-19 pandemic serves as a reminder of how important it is for basic sciences to continue to advance in order to ensure a world that is developed in a way that is fair, sustainable, and inclusive.

Basic sciences make a significant contribution to a sustainable world for all on a variety of other challenges. They offer the necessary tools to address pressing issues including ensuring that everyone has access to food, energy, healthcare, sanitation, and communication technologies. They make it possible to solve issues like water crisis, infectious diseases, ocean deoxygenation, climate change, thinning of the ozone layer, depletion of natural resources, and loss of living species. They make it possible for us to comprehend the detrimental effects of the eight billion people who currently inhabit the earth and take action to restrict and perhaps lessen them. We can only research and use science in areas like medicine, engineering, computation, and more by having a solid understanding of the fundamental sciences. For instance, sophisticated algorithms helped create the World Wide Web (WWW); molecular studies helped create vaccines (the Covid-19 Vaccine being the most notable), research into retroviruses helped extend the lives of those with HIV/AIDS; Einstein's theory of general relativity and quantum physics helped create the Global Positioning System (GPS); and the material sciences and mathematics that form the foundation of all software helped create the digital age.

We simply cannot overstate the impact that basic sciences are having on the world today and how important they are to sustainable development. For example, artificial intelligence, which has various effects on how we live our daily lives, uses theories and techniques created in mathematics, statistical physics, and signal processing; due to advancements in DNA sequencing made possible by biomathematics, chemistry, and physics, modern medicine is currently moving toward more effective treatments (particularly against cancer); the production and storage of renewable energy has been improved through developments in physics, chemistry, and materials science; fundamental biology is assisting in the fight against non-communicable diseases like diabetes, obesity, and hypertension, which are escalating globally; while green chemistry also has led to a reduction in pollution as well as sustainable and healthy nutrition.

In conclusion, it is quite apparent that the basic sciences are essential to sustainable development, much as the foundations of buildings, which give buildings their general lateral stability. However, despite all the aforementioned, basic sciences frequently receive little, if any, recognition for their critical significance. To achieve the sustainable development that the world aspires to, greater awareness of the crucial role of basic sciences must be developed among relevant stakeholders and the general public.

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THE ROLE OF BASIC SCIENCES FOR SUSTAINABLE DEVELOPMENT

In the first place, Sustainable development is defined by the United Nations (UN) as a development that meets the needs of the present generation without compromising the ability of the future generations to also meet their own needs .Thus; it's a development that meets the current human needs without damaging the environment and also preserves the resources for the needs of the future generations due to the limited resources on the planet earth and rapid human population as well as the increasing demand for resources.

Sustainability dates back to 1730s and emphasizes on two kinds of balance: first with the current generation and second, with the future generation. The main challenge of sustainable development is to simultaneously fulfill the basic human, social, economic, and environmental needs. Sustainable development has three actors whose actions help achieve sustainable development and they are:

i. Science, technology, and industrial practice
ii. Governance and management
iii. Education and civil society.

However, the ball in our net is how basic science helps in bringing sustainable development into fruition.

Hence, basic science can be defined as the scientific disciplines of mathematics, physics, chemistry, and biology. They are basic sciences because, they provide systematic and fundamental understanding of the natural phenomenon happening around us and the processes by which resources can be transformed. It's Cristal clear that sustainable development is impossible without the crucial role of basic sciences which leave foundations for new approaches, solutions, and technologies to identify, clarify, simplify and checkout global challenges.

Sustainable development in recent times has its goals colloquial known as agenda 2030 which were proposed by the United Nations including 193 countries in a summit in New York on the 25th of September 2015. This was a global collaboration to be achieved as a global society. The sustainable development goals (SDGS) were seventeen (17) with 196 targets and 304 indicators. These seventeen 17 goals are:

1. To end poverty in all its forms
2. Zero hunger
3. Good health and wellbeing
4. Quality education
5. Gender equality
6. Clean water and sanitation
7. Affordable and clean energy
8. Decent work and economic growth
9. Industry innovation and infrastructure
10. Reduce inequalities.
11. Sustainable cities and communities
12. Responsible consumption and production
13. Climate action
14. Life below water
15. Life on land
16. Peace, justice, and strong institutions.
17. Partnership for the goals.

Basic sciences play functional roles in realizing these goals in variety of ways such as.

I. It helps to decline the poverty line by empowering people from all walks of life especial those in the rural sectors to expand their Skill set in areas like soap making, tie and dye making, bread baking, making of ointments among others which can be a source of income and improve subsistence and livelihood and hence, goes on to meet the overriding goal of poverty reduction… SDG1.
II. It equally makes it easy for people to have access to high nutritious meals and to secure food security through the use of different brands of fertilizers and hybrid of seeds to improve crop yield and also, weedicides and pesticides to combat diseases or food competitors… SDG2.
III. It helps in eliminating diet related diseases such as kwashiorkor, goiter rickets among others and also, vaccination, which is based on the understanding of fundamental biology, are used to eradicate early childhood diseases and even the widespread of epidemic

like Ebola or pandemic like COVID -19. Also, new approaches and methods of treatment based on fundamental research has been used these days just to improve human health and wellbeing… SDG3.

IV. It again assists in achieving quality education by training the minds of students to understand the world and to make relevant choices and provide solutions to everyday problems in uncontroversial and unambiguous ways. It makes teaching and learning materials like computers, projectors and even goggle which was contrived in 1998 are invariably at the doorstep of learners.

V. Basic sciences seek to provide clean and portable water through the extension of pipelines and the manufacturing of chemicals like chlorine and chloramine that kill microbial water borne pathogens.

Also, with regards to energy, basic sciences have done appreciable well for instance, scientist in China are now producing solar panels that produce energy from rainwater, also, an Australian firm also puts underwater buoys which tap ocean swells and convert sea waves to energy and easily native water.

Basic science has really worked to attain sustainability for instance, HIV and Aids treatment have extended the lives of many people through the understanding of how retrovirus work. Also, Global Positioning system (GPS) will not have been possible without the Einstein theory of general relativity and quantum physics. Our mobile phones also existed through mathematics and material science.

Basic sciences in the future include artificial intelligence which is based on the theories and methods of developing mathematics, statistical physics and signal processing, pollution reduction, which is based on green chemistry and sustainable chemistry, also, progress in DNA sequencing which is based on biological chemistry and physics are now guiding medicine for effective individualized treatment of cancer.

Basic sciences have abundantly helped sustainable development for example, weather forecasting has increased our resilience against climate crisis, Also, through sustainable farming and forestry we get healthy soils, wildlife, safe natural environment among others.

Sustainable development is, therefore, extremely momentous as it.

i. Balances our human, economic, environmental, and social development
ii. Allows prosperity now and for future generations.
iii. Allows and triggers the development and achievement of goals set by the society.

In conclusion, it is abundantly clear that through basic sciences We can save the soil, save our future and save future generations.

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THE ROLE OF BASIC SCIENCES FOR SUSTAINABLE DEVELOPMENT

Have you ever wondered why every student right from basic school through to secondary school is made to study integrated science and mathematics? You are right! These subjects are indispensable tools for the intellectual development of any individual. Integrated science, which is a holistic approach combining the three major aspects of science namely physics, chemistry, and biology. Not even a single developed country has been able to achieve what we call sustainable development without advanced sophistication in these three areas including mathematics. What do we mean by sustainable development? It is the development that meets the needs of the present without compromising the ability of future generations to meet their own needs.

To begin with, one role of basic sciences that addresses a vital challenge that people in the world are facing is that it has made access to food very easy. How? Science has brought crop rotation into existence. Crop rotation is the practice of planting different crops sequentially on the same plot of land to improve soil health, optimize nutrients in the soil and combat pest and weed pressure. If a land is to be used to grow only one crop, it is either going to affect the crop or the land, so there is the need for crop rotation where when a crop is grown on a land, another different crop is grown on that same piece of land the next season, which prevents depletion of the nutrients in the soil. Always the land is still fertile to grow another crop which helps us to get more food. Knowledge on these systems of farming is provided by our basic sciences. If each and every farmer is able to apply these techniques, there is no doubt that there is going to be an increase in the quality and quantity of food produced annually.

In any part of the world, healthy individuals are required to ensure effective workforce. This can be reached if there is a quality healthcare system. Without the basic sciences, there is no other way that skilled medical practitioners would be produced. One main reason why Ghana has not been able to cater for the healthcare needs of the people is due to brain drain of skilled medical doctors because of low conditions of service. Initially, women were dying just because they could not have safe delivery hence causing an increase in mortality rate of fetus and also pregnant women which was reducing our human resource. But science has been able to come up with an alternative where women who are not able to deliver safely are operated on with machines to bring the babies out through a process known as the cesarean section. This, in the end enables the preservation of human resources assuring the nation a better tomorrow. Another way basic sciences have contributed to the health sector is the production of antibiotics. In the year 1928, a great scientist called Alexander Fleming serendipitously discovered penicillin at St. Mary's Hospital, London that greatly reduced the number of deaths from infection. The discovery of penicillin changed the world of medicine enormously. With its development, infections that were previously severe and often fatal, like bacterial endocarditis, bacterial meningitis, and pneumococcal pneumonia, could be easily treated. Sir Fleming discovered penicillin at the time when he was experimenting with the influenza virus in the laboratory of the inoculation department at St Mary's Hospital in London. Even though Sir Fleming stopped studying penicillin in 1931, his research was continued and finished by Howard Flory and Ernest Chain which has really contributed to achieving sustainable development.

Science has also led to the introduction of radioactivity into the world. In the year 1896, a French physicist known as Henri Becquerel discovered radioactivity which has really benefitted people today. Marie Curie and her husband Pierre Curie also came out with radioactivity. Curie was studying uranium rays when she made the claim that rays were not independent on the uranium's form, but on its atomic structure. Her theory created a new field of

study, atomic physics, and Marie herself coined the phrase radioactivity. She defined radioactivity at the time working with pitchblende. What is this pitchblende? It is a mineral that is the crystallized form of uranium oxide and is about 70 percent uranium. In 1903, Marie Curie and her husband won the Noble prize in physics for the work on radioactivity. What is then this radioactivity? It is the emission of ionizing radiation caused by the spontaneous disintegration of atomic nuclei. Since its discovery in 1896 by physicists Henry Becquerel, Pierre Curie and Marie Curie, radioactivity has provided clues to the laws that govern nature. Today, to benefit humankind, radiation is used in medicine, academics, and industry as well as for generating electricity. It has led to further discoveries and to advances in instrumentation, medicine, and energy production. It has even increased opportunities for women as well.

Basic sciences have also played essential roles in the communication sector. Some years ago, messengers and letter writing were the only means of communicating which was very stressful. But due to science, we now have phones, even the phones are evolving. Initially it was the telephone that was used for communication, then came the mobile phones with the keypads, then we now have smart phones. We can now communicate with others at a far distance with these phones without stressing ourselves. Even microphones and speakers also came into existence just because of science which helps to amplify what we say making communication very easy.

To sum everything up, basic sciences are very interesting subjects. It tries to explain why and how things happen. What causes day and night? How are rainbows formed? Why do objects thrown in the air fall back to the earth? One may be easily misled to believe that it is the work of the gods. However, Sir Isaac Newton's work on the dispersive property of light formation dispels any doubt on the subjects. Science has undoubtedly made our lives easier and has given us so much in our present time. It is now the backbone of the world and without it, the world would be paralyzed.

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THE ROLE OF BASIC SCIENCES FOR SUSTAINABLE DEVELOPMENT

Basic are undoubtedly the backbone that aids effective comprehension of nature especially how natural phenomena occur and evolve with time. Basic Sciences which include Chemistry, Biology, Mathematics, and physics are the initial catalysts that aid the exploration of other aspects of life. The integration, understanding and implementation of the knowledge provided by basic Sciences helps to pursue durable projects and also take appropriate decisions and measures which promotes Sustainable development. Sustainable development is the ability of human beings to provide their needs without diminishing the chances of unborn generations to also cater for their needs. Sustainable development ensures development now and in the future. Development in every part of the world depends on the extraction of nature therefore there is the need to integrate Basic Sciences in order to aid Sustainable development. Basic Sciences is vividly a tool for promoting sustainable development when given much attention and investment. The purpose of this essay is to elaborate readers on the role of basic Sciences in sustainable development. The main role to be discussed in this article is that Basic Sciences helps mankind, Organizations, economies, firms and other bodies to put up goals that ensures development now and, in the future, (Sustainable development). (i.e., Focus will be centered on Sustainable development goals). A minor role to be discussed is that Basic Sciences prevents the over exploitation of natural resources and also creates room for inventions and technology.

Basic Sciences helps mankind, Organizations, firms, economies, and other bodies to set up goals that aid development now and in the future. The insight and knowledge gained from basic Sciences through experiments reveal to the nature of our environment thereby helping us to develop goals that will not harm the environment and the planet. The United Nations' sustainable development goals which are geared towards the creation of a sustainable development and a resilient world were out of the knowledge of Physics, Chemistry and Biology (Basic Sciences.). The physical, chemical, and biological nature of ecosystems, climate, biomes, and other terrestrial features helps us to determine how such places should be treated. A scenario on how the setup of sustainable development goal thirteen which is 'Climate Action' be is elaborated – The biological (Biology) nature of our planet reveals that fossil fuels are found in the Earth's crust. Fossil fuels are burnt in vehicles and contain carbon dioxide which is a greenhouse gas. Chemistry tells us the effects of carbon dioxide on the atmosphere therefore physics also makes it clear that hybrid and electronic cars can limit the dominance of carbon dioxide in the atmosphere therefore there is the need to set up a goal that says 'Climate Action' in order not to abuse the state of the planet. The scenario enlightens us on how basic Sciences have been adopted to ensure sustainable development. Basic Sciences encompass every aspect of life and are also the core to other complex disciplines therefore, understanding and implementation of knowledge in basic Sciences helps us to ensure sustainable development in every aspect of life.

Furthermore, Basic Sciences prevents the over exploitation of natural resources and creates room for inventions and technology. Basic Sciences helps us not to exceed the carrying capacity (the maximum load an ecosystem can carry or bear) of ecosystems. Humans will definitely farm, mine, fish etc. therefore basic Sciences provides us a pool of technological tools, equipment and methods that will keep our land and environment in their carrying capacity. For example, Kofi's mother solely depends on farming to cater for him. In order not to cause her farmlands to exceed their carrying capacity, Kofi's understanding from Basic Sciences in school can educate his mother to practicing land and crop rotation in order to sustain her farmlands thereby not halting food production for the

country. Kofi can further on convince her mother to buy into the idea of using only organic fertilizers sustain the environment. In areas such as the mining and fishing sectors, governments like Ghana's through the understanding of basic Sciences are gaining consciousness of the effects of mercury and DDT on the environment and are therefore taking directives to end those acts. Basic Sciences provides a pool of inventions and technology to aid in the sustainability of the environment.

Wrapping the role of basic Sciences for sustainable development in a nutshell, there is no doubt that basic Sciences helps the promotion of sustainable development. Making reflections on the discussed issues above, we are enlightened that Basic Sciences help firms, organisations, and other agencies to set up appropriate goals to ensure development also reaches generations yet to be born. We are also aware of how basic sciences creates a pool of technology that prevents the over exploitation of the natural environment and resources. I'm a believer that if anything can aid Sustainable development, basic Sciences is no exception.

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THE ROLE OF BASIC SCIENCES FOR SUSTAINABLE DEVELOPMENT

Basic sciences are taught for about twelve (12) years in the Ghanaian educational curriculum, yet the primary importance of this education is lost here. These sciences are taught to instill the principles of every new and emerging technology in the world in students. For instance, the development of Tesla batteries in electric vehicles (EVs) has its core in physics, where students are educated on batteries and series/parallel connections, and chemistry, where the various electrochemical reactions of batteries are studied. Yet, the educational system does not expose students to the severity and importance of this education. Students are instead engaged in the renowned 'chew and pour' act. Instead, attention should be drawn to the crucial role of basic sciences as a foundational tool in understanding and addressing many of the challenges related to sustainable development; and equipping students to find ways to use natural resources in an economically viable and environmentally responsible manner. Though the educational system delves theoretically into basic sciences such as physics, chemistry, agriculture, and biology, it has failed to recognize the role of materials science as a basic science. Materials science is a crucial aspect of sustainability. Without knowledge of material science, we compromise the ability of future generations to meet their needs. This is why science, Technology, Engineering, and Mathematics (STEM) education is highly advocated as a university major. In subsequent paragraphs, I will pitch how essential and crucial the role of basic science is in sustainable development.

Basic sciences are applied in the development of EVs, is the design and optimization of batteries. Batteries are a key component of EVs, as they store energy that powers the vehicle. To be sustainable, EVs must have energy-dense, long-lasting, and environmentally friendly batteries. To achieve these goals, basic science researchers use chemistry, materials science, and physics principles to design and improve battery materials and architecture.

In addition to batteries, basic sciences are applied in motors, inverters, and EV charging systems. For example, physics is used to understand and improve the performance of electric motors, while materials science is used to design and develop new materials for use in these systems. Overall, the sustainable development of EVs relies on a solid foundation in basic sciences, which provide the knowledge and principles needed to design and develop that make EVs a viable alternative to traditional fossil fuel-powered vehicles, which deteriorates the ozone layer, have adverse effects on the climate and our wellbeing.

An exciting field in sustainable development is solar cooking. Solar cooking uses the sun's energy to cook food without using fossil fuels. The basic sciences, particularly physics and materials science, play a critical role in designing and developing solar cookers. Physicists use their understanding of the properties of light and heat to create solar cookers that can efficiently convert sunlight into cooking heat. Materials scientists use their knowledge of the synthesis and processing of materials to design and prepare the materials used in solar cookers, such as solar panels and insulation, to ensure that they are efficient and durable. By using the basic sciences to design and optimize solar cookers, it is possible to develop a clean and sustainable alternative to traditional cooking methods that rely on fossil fuels.

Another example of the role of the basic sciences in sustainable development is carbon capture in rocks. The carbon cycle is the core of this technology and is mostly undermined and thought of as not having future technological prospects. The carbon cycle is a critical aspect of understanding the global movement of carbon and how it is exchanged between the atmosphere, land, and oceans. Understanding the carbon cycle can help inform the development and deployment of carbon capture technologies, which are designed to reduce the amount of carbon dioxide (CO_2) released into the atmosphere from industrial sources.

Carbon capture and storage (CCS) is a process that involves capturing carbon dioxide (CO_2) emissions from power plants and other industrial sources and storing them underground in geologic formations, such as deep saline aquifers or oil and gas reservoirs. The basic sciences, particularly geology and geochemistry, play a critical role in understanding the properties of different geologic formations and determining which ones are suitable for CO_2 storage. For example, chemical engineers might develop new solvents or processes for capturing CO_2, while geologists use their knowledge of the structure and composition of different rocks to identify formations that can safely and securely store CO_2 over the long term. Geochemists use their understanding of the chemical reactions that occur in rocks to predict how CO_2 will behave once it is injected underground and to ensure that it will not leak out or have any adverse impacts on the environment.

The basic sciences play a role in waste management. With commodity plastics heavily pollute our waterbodies, causing harm to aquatic lives and humans. Through basic sciences, chemists study the chemical structure of these plastics and seek to redesign the structure to that of fuel through carefully monitored chemical reactions. Physics brings into play the principle of light and density (Archimedes principle) to classify various plastics according to their resins for efficiently recycling these plastics. Materials scientists develop new plastic processing technologies based on their structure-property relationships. Biology then introduces the use of microorganisms, especially bacteria, in the biochemical decomposition of waste, as biology centers on the study of living organisms and their interactions. Indeed, waste management in sustainable development is implemented through the knowledge of all the basic sciences, making the world a better place.

The basic science that has played a significant role in sustainable development is catalysis. Catalysis is the process by which a substance, known as a catalyst, speeds up a chemical reaction without being consumed. Catalysts are essential in many industrial processes, such as producing chemicals, fuels, pharmaceuticals, and environmental remediation. The basic sciences are used to understand the mechanisms of chemical reactions and the properties of catalysts and to design and optimize catalysts for specific reactions. For example, chemists use their knowledge of chemical reactions and the properties of different materials to design catalysts that selectively catalyze certain reactions. This helps to reduce the energy and resources required for these reactions, making them more environmentally friendly and economically viable.

Sustainable development cannot be addressed without referencing the UN Sustainable Development Goals (SDGs). The SDGs explicitly spell out the fields that should be targeted to achieve sustainability. But much effort would not be made with the 17th goal, which talks about partnership. For instance, the Paris agreement, which aims to reduce carbon emissions by 45% in 2030, is a collaborative effort by European countries. Likewise, sustainability cannot be fully realized in Ghana without the partnerships and collaborative efforts of everyone. Local government, engineers, pharmacists, and teachers contribute to sustainable development. The local government offers its contribution by taxing companies that flare gases consisting of greenhouse gases and investing in clean and reliable energy businesses. The pharmacists ensure that drugs are made from simple reactions consuming less energy and safe disposal of the effluents.

The basic sciences continue to play a vital role in sustainable development by providing the knowledge and tools needed to understand and address the challenges related to this goal. Through the basic sciences, it is possible to find environmentally responsible and economically viable solutions, such as more efficient catalysts, effective carbon capture and storage systems, and sustainable solar cooking and waste management technologies.

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THE ROLE OF BASIC SCIENCES FOR SUSTAINABLE DEVELOPMENT

What is sustainable development?

The first thing that comes to mind when I think about sustainable development is the proper care of the resources that come together to bring quantity and quality of life to the inhabitants of the earth, that is; humans and animals as well, for effective use now and in the future.

Talking about now and the future brings my mind to one very important factor of life, in fact, it is life, SCIENCE. When I think about science, the many wonders of life flash through my brain, igniting many ideas. Let us go to the foundation, where everything starts, the basic sciences.

From my point of view, the basic sciences are Biology, Chemistry and Physics. They come to play in every part of life including sustainable development. They provide understanding to the on goings of the world and the processes by which resources are transformed.

These are some simple explanations to these basic sciences. Biology is basically the study of life; chemistry also deals with matter and its properties in terms of reactions and physics also deals matter and energy.

Starting with Biology, we have a method known as crop rotation. Crop rotation is a farming practice by which different types of crops are cultivated on the same piece of land in successive seasons. This farming practice does not only help increase the fertility of the land but also helps prevent soil erosion due to the fallow periods involved in the system. A fallow period is a time range during which a piece of land is uncultivated to allow the land to regain its nutrients. Thus, crop rotation helps sustain lands for present and future use, aiding in sustainable development.

Irrigation also helps in sustainable development under Biology. The right amount of water is delivered to the crops at the right time. This boosts productivity since the crops grow at the right rate and the land stays fertile for the cultivation of the same crop or different crops. These practices contribute immensely to reducing hunger in our world since more foodstuffs will be produced for all. Aside that, the practices are not mind-boggling or rocket science meaning that every human on planet earth can learn and use these methods to their benefit and that of the future inhabitants as well. We just need to get up and start something.

Also, with the help of Biology as a basic science, humans can live good and healthy lives. As the popular saying goes, "you are what you eat", therefore, if our lands are fertile and our crops are growing well, when we consume the food, we also grow healthy and the rate of deficiency diseases as a result of the absence or insufficient amount of some specific nutrients in our diet reduces.

Again, Biology as a basic science saves the lives of not only humans but animals as well and in this case, marine or aquatic animals such as fishes, snails, and crabs. Some farmers cultivate their crops along or close to water bodies and in the process, may overuse chemical fertilizers in growing their crops. This does not only damage the crop and the micro-organisms that makes the land fertile but the lives of the aquatic animals living in the water body as well. This occurs when rain falls. The rain washes the fertilizer into the water body rendering it unsafe for the animals living in it. Therefore, with the proper farming practices such as crop rotation, irrigation, contouring, mulching and many others, the use of chemical fertilizers will be on the low since the land will already have the required nutrients for the crops to be grown. Therefore, when rain falls, whatever will be washed into the water body will not be harmful to the animals living in the water body. This also keeps our water bodies clean and safe for consumption by humans and other land animals as well. For example, cows.

Biology as a basic science can also help stop depletion of the ozone layer. With more plants being grown on land, more oxygen is produced, which reduces the carbon dioxide concentration in the atmosphere

and keeps life on land safe for a longer period of time.

Now to the center of all Sciences, Chemistry. With this, I delve into the human mind since the mind is the center of our being. Education, an enlightening experience that opens the human mind to places unimaginable. When the human resource attains quality education, not only does it want a better life, meaning the human resource tries its best to eradicate poverty, but it looks at how it can bring unity, a Chemistry amongst all inhabitants. The mind looks to forming strong bonds, partnerships with institutions just like covalent bonds, they share electrons, that is peace and justice in this case, and try to push aside anything that is not right for the present as well as the future. Hence, ensuring sustainable development.

With the way the Chemistry of our mind works, we are open to more facts and information on how to protect our environment, manage our environment and be one with our environment, all for the effective use of today's generation and the future generations too. One may ask how this works. It is quite simple. Chemists have created and are still creating chemical appliances that have the sole purpose of monitoring environmental issues. These appliances communicate to we the inhabitants when there is a shift in our environment or when a problem arises. Let us take climate for instance. Over the years, there has been a few changes in what we knew as the normal weather pattern. Now, we have rain falling at random times and sun shining also at random times. We may have noticed the change even before the appliances created may have informed us but still, these appliances can give more information as to why the weather pattern has changed from how it was to how it is now. This prepares we the inhabitants for anything. For example, the right time to cultivate crops, when there is going to be famine, when there is going to be rain and many more.

Chemistry as a basic science also helps conserve our lands and gives us a healthy and safe environment. With the up rise in the use of chemicals, our lands stand a risk of degradation. This will be very dangerous to we the present dwellers of planet earth as well as the future dwellers of the planet. Therefore, with Chemistry, we are able to test our soils for the presence of dangerous chemicals and treat these lands through methods like liming, which is a practice used to reduce the acidity of soil to keep its nutrients for efficient plant growth and development by maintain the soil living organisms. Hence, promoting sustainable development.

Finally, we tackle the basic science, Physics. This basic science deals with a lot of laws from various scientists, but the one we are looking at is, Newton's third law of motion. How does Newton's third law of motion help with sustainable development, one may ask? What role does it play in sustainable development? I am ever glad to take your mind on a quick educational spin. Newton's third law of motion states that, "to every action, there is an equal but opposite reaction". It is in this same way that when humans consume, we are expected to produce again to promote sustainable development. For example, if we store food and we decide to consume the food without producing more food to replace what we have eaten, we will end up starving. Starving also derails the process of sustainable development since we will have to find other means to survive through the resources that have been stored for other purposes or for future use. This does not only affect we the current users but the future users as well. That is why we must pay attention to and take into consideration Newton's third law of motion and apply it in our lives to enhance sustainable development.

Physics as a basic science has also brought about affordable energy through the creation of cheap and quality products that cut down the cost of living for all its users. As time goes on, new ways of doing things are coming to light and most of these methods involve cheap materials. Therefore, the prices of the finished products are affordable, and everyone can access the product for both present and future use as these products tend to last for long periods of time. The use of these products also brings about productivity in the workplace as well as economic growth and stability. For productivity to prevail, work must be effective and one of the best ways for efficiency in work is through the provision of quality tools. With all these factors, the economy will grow well and there will be high standard of living. Everyone will live a comfortable life with low cost of living and things can get much better as we learn more ways to maintain the good standard of living for now and the future.

Another way the basic science, Physics helps in sustainable development is through the infrastructure around us. A lot of buildings have lasted for long periods, and this is only because the brains behind the creation of these buildings sat down and thought well about them. They weighed the pros and cons. They brought all the laws of gravity into play to make buildings that can stand storms and hold large numbers of people back then when they were built, now and in the near future.

From the aforementioned, we can see that the basic sciences do have major roles to play in sustainable development but what if there are other basic sciences? For example, Mathematics. I have always heard the saying, "Mathematics is everywhere". I therefore believe that Mathematics is a basic science. If not a major one like Biology, Chemistry and Physics, a minor one, and it is involved in sustainable development, and it also plays a very important role as a basic science since it is considered to be everywhere.

Measurements are taken during our day-to-day activities. We calculate the approximate cost of items as well as the exact number of items needed at a particular time. We also measure the right amount of medicine to be dispensed and a whole lot of Mathematics related stuff. They all help in sustainable development, one way or the other. For example, the calculation of the exact number of items needed at a particular time. We cannot just use everything just because we have it. We must think about what we will use later on in the future and use our items sensibly. We cannot just wake up in the morning and do anything. We need proper planning of our time and to-dos, so we do not end up wasting such a precious resource.

In a nutshell, Biology helps in sustainable development through farming methods such as crop rotation and irrigation which makes the soil more fertile for plant growth now and in the future. Chemistry also helps by providing the human resource knowledge to make decisions regarding sustainable development and by also giving us understanding to power our machines which monitor and give information about our environment. Physics also helps through the numerous laws available. It also helps in sustainable development by making the work field easier and by bringing affordable products and tools for efficient work. Mathematics also helps us use our resources in the right quantity.

Therefore, this points us to the fact that science is sustainable development because just as sustainable development looks at the well-being of all, so does science. Science is not wasteful because wastefulness disrupts sustainable development. Science looks to the happiness of all just as sustainable development. Science provides a bright future in the same way sustainable development does. Science is life and science play a lot of roles in sustainable development but at the end of it all, science is sustainable development.

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THE ROLE OF BASIC SCIENCES FOR SUSTAINABLE DEVELOPMENT

I have been following with keen interest on the progress of the Sustainable Development Goals (SDG's)-Agenda 2030. In 2015, leaders from 193 countries of the world came together to face the future. What they saw was daunting. Famine, poverty, drought, floods, wars, plagues-among others were pictured in the future. These things were not just in some faraway country, but in their own, towns, cities, and villages.

These leaders knew we had enough food to feed the world, but it was not being shared, they knew we could get medicines for HIV and other incurable diseases, but it was going to cost a lot, they knew that floods and earthquakes were inevitable but that death tolls could be avoided.

In an attempt to solve these impasses which are very necessary measures for development, these leaders came out with a 17-goal strategic plan which imagines a future, fifteen years from now, to get rid of hunger, famine, poverty amongst others which would make the world a better place to live in.

But then, there is ample evidence already that these goals could be achieved for sustainable development given that in the last fifteen years, the international community (UN) has been able to cut down extreme poverty into half. Based on this, I am overly confident that the introduction of basic sciences would be very helpful in achieving these important goals for sustainable development. How could this be done?

Generally, science is critical to help meet the challenges for sustainable development, as it lays the foundation for new approaches and technologies to identify and tackle challenges for the future. Science can thus significantly contribute to sustainable development.

Considering the fact that science is universal, basic and applied science complement each other, just like two sides of a coin. Science does not only bring about progress on the way towards a more sustainable world; it is also in itself a way of crossing national, cultural, and mental borders and thus helps lay the foundation for a sustainable world.

Furthermore, SDG 1 seeks to eradicate poverty and all its forms everywhere. Acknowledging the significant role of basic science for poverty eradication as well as taking into account its comprehensive role for the achievement of the SDG's beyond being a means of implementation. Basic science in a broader sense should be understood as the science of technology and innovation, ranging from natural science and social science as well as humanities geared towards creating jobs through infrastructure and capacity building.

Moreover, faced with the challenges of climate change, basic science has already contributed solutions for a secure and sustainable energy supply. Nevertheless, there is need and room for further innovation: for example, with regard to the deployment of storage and energy efficiency, basic science is heading towards creating clean and convertible energy as well as the manufacture and deployment of electric vehicles which would take urgent action to combat climate change and its impacts. Additionally, the transformations needed cannot be tackled solely by relying on engineering technological sciences. The social and humanity aspects of science also play a very vital role in the successful realization of combating to the fullest the issue of climate change, in the sense that psyching the minds of people through basic science education on the negative effects of climate change, would help realize the sustainable development goal 13-Taking urgent action to combat climate change and its impacts.

Basic science and applied science as stipulated earlier are two sides of the same coin, thus, interconnected, and interdependent with each other. Just as Max Planck said, "Knowledge must precede application and the more detailed our knowledge, the richer and more lasting the results we draw from that knowledge". Consequently, Basic research is driven by curiosity about the unknown

and not oriented towards direct practical application. Basic science as we all know requires thinking outside the box. It leads to new knowledge and offers new approaches, which in turn, may lead to new ways of practical use. This requires patience and time and a long-term investment but also a prerequisite for breakthroughs and big leaps forward for mankind and serve as a progress of a sustained developed world.

Also, considering how numerous the transformational ideas of basic science are, the health sector development is one that cannot be left out. In medical history, the discovery of the bacterial origin of diseases allowed for the development of immunization methods thus saving a lot of lives. Additionally, the acceleration-based particle physics is another example of the transformational impact of basic science for a better world. The acceleration-based particle physics; initially developed for basic research only, major medical centers now use accelerators producing x-rays, protons, neutrons and other heavy ions for the diagnosis and treatment of diseases that are cancer related. All these geared towards achieving sustainable development goal 3- Ensure healthy living and promote well-being for all at all ages.

In sum, the sustainable development goal 6- Ensure availability and a sustainable management of water and sanitation for all. This I believe could be achieved with basic science knowledge on the six R's of sustainable development- Being retrospective of the products that pose environmental threats, refusing to use products that are environmentally unsustainable, fixing or repairing items rather than throwing them away, limiting the use of resources that have a lot of waste, finding new uses of old objects instead of throwing them away and recycling what can be recycled into different useful products- thus, Rethink, Refuse, Repair, Reduce, Reuse, Recycle, would in a broader sense ensure good sanitation as well as eradicate global warming and its accompanying problems.

Conclusively, while the achievement of many sustainable development goals will depend on basic science, science in its own right needs to be part and parcel of the post 2015 development agenda. Also, given the transformative power of science, it needs to be anchored prominently in a preamble to the sustainable development goals.

The international community should aim at establishing a national minimum target investment for science, technology, and innovation, including special allotment for the promotion of basic science education and literacy for sustainable development to rescue the world.

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THE ROLE OF BASIC SCIENCES FOR SUSTAINABLE DEVELOPMENT

Basic sciences are defined as the scientific disciplines which fundamental understanding of natural phenomena and the process by which natural resource are transformed. It provides essential means to meet crucial challenges such as universal access to food, energy, health coverage and communication technology. Sustainable Development is an organising principle that meets the needs of the present without compromising the ability of future generations to meet their own needs. Science has shattered barriers and expanded human potentials. The link between science and human progress is not indirect. Basic science can be applied in ways that generate new inequalities or exacerbates existing ones. Basic science provided essential means to meet conditions for technological improvement, increase in productivity in agriculture, the manufacturing services and industries including health.

First, we must equitably share the gains of science. The distribution of the very vaccines that were developed from research driven by decades of public and philanthropic funding remains vastly unequal. Unless the remedies generated are shared and applied everywhere, problems will still persist and even multiply. Basic science increasingly extends to behavioural science as well, which have no less profound relevance for health. Basic science addresses medical issues from a simplistic approach including discovery and analysis of genes or genetic markers of diseases or sequencing and manipulating genes. Science can evolve quickly when the stakes are high and when people come together to face the challenge. This was observed in real time during the COVID-19 crisis and basic science have been instrumental in fighting the pandemic. This was attained when the flow of information and the pace of the action matched the urgency with the discovery of the virus which caused the infection, what it looked like, it's genetic sequence and variations and the development of the new vaccines on an unprecedented timeline. With this, we can conclude that vaccination has been strengthened and developed through the identification of the viral origin of the many diseases such as COVID -19 which is still fresh in our minds. Another example is the treatments of HIV/AIDS which remarkably extends the lives of people infected through an understanding of the nature of retroviruses. kudos to basic science, progress in DNA sequencing is now steering medicine towards more effective intricate treatments against cancer and diabetes for example. Poverty is a serious economic and social challenge that afflicts a large population of the world's population and clear-cut itself in disparate forms such as inadequate income and produce assets to ensure sustainable livelihoods, hunger, and malnutrition, diseases, lack of access to clean water, lack of quality education, low life expectancy, social exclusions and discrimination and the like. Because poverty has adverse effects on human well-being, its eradication has been identified as an ethical, legislative, and fiscal imperative of man. The fact that agriculture is the dominant economic sector in most poor communities implies that efforts to combat extreme poverty needs to be directed towards increasing agricultural production and productivity. Some concrete ways for achieving this overall goal include prompting the adoption of high yielding crop varieties and use of interdependent inputs such as fertilizer and pesticides; intensifying the use of land through technological improvements such as increased use of irrigation where water is a compulsion to agricultural production; and adoption of post-harvesting methods that reduce the loss of agricultural produce. However, these measures are costly and are likely to be unaffordable to poor households. Their increased adoption requires the provision of cheap credit on terms that are flexible and are aligned to the unique circumstances of the poor. How credit programs are designed is critical because it can have a significant impact on poverty reduction and livelihood

outcomes. Thanks to soil chemistry, there's a better understanding of plant nutrients status in the soil conditions which is helpful in the development in the field of agriculture.

Furthermore, good roads reduce transportation cost and generates diverse economic benefits that include increased ease of transporting agricultural produce to market, ease of accessing agricultural inputs, and increase in the profitability of income -generating businesses. In light of this, there is scope for the road research group to tackle many problems of vital importance to the road engineer. Providing electric power to improvised areas not only results in improved standards of living but also stimulates the establishment of small-scale industries that process agricultural produce and thus contribute to value addition. This will help combat destitution and in addition create much needed jobs.

Moreover, a large population of the world's total population do not have access to safe and affordable drinking water and perhaps twice that they may lack adequate sanitation service. Food production may soon be limited by water availability. Agricultural water use is not sustainable in many locales around the world for reasons that include soil salinization, ground water overdraft, and the overallocation of available surface water surface water supplies. This situation raises questions about whether there are sufficient water resources to support the existing population on a long-term basis, to say nothing of the significantly larger population that will be fed in the remaining decades of this century. Remedies to combat these problems will only evolve from basic research and existing knowledge on water treatment thanks to basic science. Provision of safe, good-quality water is vital in reducing incidences of debilitating water-borne diseases that are expensive to treat and saving time to be employed in more productive activities.

Technology is a crucial enabler of sustainability from accelerating Net zero transitions to creating more sustainable value chains. Applications of technology are easy to recognise. On the other hand, contributions of basic, curiosity-based sciences are not well appreciated. They are nonetheless at the basic of major technological advances that stimulate innovation. The success of frontrunner companies is depending on leveraging technology from the very beginning through advanced technologies such as AI, IoT, or chain companies are analysing, reducing, or optimizing their environmental impact. New research revealed that companies with most comprehensive sustainable technology strategies execute better across the board. The role of technology in sustainable development like AI is essentially changing the way we think, live, work and relate to one another and the external world. Business operation can be optimised with such AI to augment efficiency and output and lower energy costs, training AI demands a lot of energy. Hence, to sustain an enterprise's efforts to mitigate its environmental footprint, it must also look at decreasing the carbon outputs of its AI/ML models. However, organisations are also using the power of AI to simultaneously reduce their carbon footprints and mitigate material risk. One of the prominent examples of ties between basic science and societal change is the transistor. Today's atmosphere use millions of minuscule transistors to perform complex processes which is the fruit of basic science. Flattening of television screen and phones was also made possible through the discovery of liquid crystal. Thanks to basic science polymerase chain reaction can be used to identify a criminal on the basis of a sample left at a crime scene such as hair follicle.

In light of this, we can come to a conclusion that basic sciences have contributed greatly to the development of the world as a whole directly or indirectly and has shattered barriers and expanded human potentials. Application of knowledge in basic sciences has been and will be the driving force to attaining sustainable development goals.

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THE ROLE OF BASIC SCIENCES FOR SUSTAINABLE DEVELOPMENT

Introduction

People have different ideas about what they need, but to survive, humans require food, water, energy, and shelter. The term "development" implies a never-ending process of change. To be meaningful, any development must have social, political, cultural, and other dimensions. Development is a process of self-realization and contentment. It is aimed at raising living standards. It is the process by which individuals, groups, and communities gain the ability to be responsible for their own well-being and future. Economic growth is commonly understood as development. Economic growth necessitates both good investment and know-how. Projects with high financial returns and low risk are more likely to receive the necessary funding.

The long-term impact of industrialization was exploitation and environmental damage. It has resulted in vast inequalities, with nearly three-quarters of the world's population living in less-developed countries and one-fifth living below the poverty line. Most of the population in Many developing countries are simply trying to make ends meet. This has made us more aware of the long-term consequences of the development. The issues are complicated, and the choices are difficult. Sustainable development refers to a change process that promotes the principles of sustainability. Sustainability requires finding balance among four main objectives:

•Sustainable and increasing levels of economic growth and employment

•Careful and considered use of natural resources

•Protection of the natural environment

•Social progress that takes everyone's needs into account

The most frequently quoted definition of Sustainable development is from Brundtland Report. "Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs."

Today's complex economic, societal, environmental, and cultural challenges require Science. The term Science is an effective process that we use to help us understand the world. By making.

testable predictions and then observing what happens, we are able to explain the underlying systems of nature with increasingly accurate models. We can then use these models and explanations to help us predict the likely effects of our choices so that we can make our decisions wisely. While applied science in fields such as technology, engineering, and medicine has a much more direct impact on economies, the 'pure' or basic sciences (such as some strands of mathematics, physics, chemistry, and biology) can also play a critical role in building and sustaining knowledge economies, as well as constantly updating the theoretical basis on which much applied research will later be founded. Even years after the research has been completed, a wide range of theoretical scientific work can contribute to our understanding and ability to solve problems.

Basic sciences are driven by curiosity, but they also play an important role in our lives. They provide the means and tools required to address global socioeconomic and environmental challenges such as the water crisis, infectious diseases, ocean deoxygenation, and climate change. The transistor is one of the most visible examples of the links between basic science and societal change. When the first transistor radio was released in the early 1950s, it was the result of nearly 50 years of basic research in government laboratories. The computer chip, the first integrated circuit, came next. Since then, miniaturization of integrated circuits has enabled the production of ever-smaller mechanical, electronic, and optical devices: today's smartphones use millions of tiny transistors to perform complex processes.

The world has been disrupted by the COVID-19 pandemic caused by the SARS-CoV-2 virus since February 2020. But how much worse would the situation have been without the results of scientific research motivated by curiosity? Because of basic

science, we know that the infection was caused by a virus, what this virus looks like, and what its genetic sequence and variations are.

Viruses were discovered in the early twentieth century, the first electron microscope was built in the 1930s, and DNA sequencing began in the mid-1970s: fundamental research is at the heart of countless tests, treatments, vaccines, and epidemiological modeling exercises. We even owe high-speed, long-distance communications, which allow us to coordinate the pandemic response.

and reduce disruptions in education, economic activity, and even scientific practice, to the discovery and study of electromagnetic waves and optic fibers in the nineteenth century, and the development of algorithms and computer codes in the twentieth. The COVID-19 pandemic reminds us how much we rely on basic science research to ensure the planet's balanced, sustainable, and inclusive development.

Basic research in chemistry is laying the groundwork for 'green' applications such as non-toxic substitutes for toxic chemicals and solvents, more energy-efficient chemical processes, biodegradable chemicals, and waste, and so on. Graphene is one example of a new material that has emerged from basic science research; it has numerous potential applications in industry. Graphene, discovered in 2004, is ultra-light, much stronger than steel, and extremely flexible. Graphene could be used in rubber soles, for example, to make shoes more durable.

Did you know that your television or cell phone's flat screen is as a result of basic science research? Once it was realized that liquid crystals could be used in display devices, the discovery of liquid crystals in 1888 would make it possible, more than a century later, to flatten the screens of televisions, computers, and cell phones. Liquid crystals were first used in optical imaging devices in the 1960s. The liquid crystal does not generate light but rather draws light from an external source, such as the backlight on a television, to form images, resulting in low energy consumption. Liquid crystals were discovered by accident, as is so common in basic science research.

We can learn so much from observing nature. We can learn how to mimic these coping mechanisms in industry by studying how animals and plants have adapted to their environments. The structure of lotus leaves, for example, is designed to keep the leaf's surface clean and dry in damp conditions. Rainwater, unable to penetrate the leaf, simply runs off the surface, carrying any dirt with it. These properties have inspired aircraft cabin coatings that use less cleaning fluid to remove fingerprints and spills left by hundreds of passengers.

Have you ever wondered how migrating birds can fly hundreds, if not thousands, of kilometers without touching down? These birds use warm, rising air currents, known as 'thermals,' to fly and gain height without having to flap their wings, saving energy. We do not yet have a good understanding of how birds find and navigate thermals because the landscape of these currents is complex and constantly changing. Using a trial-and-error learning strategy that combined numerical simulations of atmospheric flow with reinforcement learning methods, scientists have identified navigation strategies that could cope with, and even exploit, turbulent fluctuations. This type of basic science research could aid in the development of long-distance autonomous gliders that use less energy.

Mathematical models can also assist in addressing the interconnected crises of climate change, biodiversity loss, and water insecurity. They can quantify the value of large estuaries' ecosystem services and biodiversity, for example, and allow us to explore multiple "what-if" scenarios to inform decision-making. Climate models, in conjunction with storylines, are used by scientists to generate scenarios of plausible alternative futures. This approach is used, for example, in the Intergovernmental Panel on Climate Change reports to inform policymakers about the science behind climate change and their options through plausible future scenarios.

Atmospheric sciences can make a significant contribution to long-term development. Scientists have created an algorithm that can estimate real-time precipitation globally. This algorithm has enabled them to extract local and regional cloud features, such as coldness and texture, from an international satellite constellation in order to inform hydrological services on the ground about the risk of flooding, drought, or storms, and thus improve emergency planning and management. This

system is now available as the iRain mobile phone application.

Conclusion

Basic sciences have a significant role to play in advancing efforts to create a sustainable world for all, as outlined in the Sustainable Development Goals, on a variety of other fronts. They offer the crucial tools needed to address pressing issues like ensuring that everyone has access to food, energy, and sanitary facilities. They enable us to understand the impacts of the nearly 8 billion people currently living on the planet, on the climate, life on Earth, and on aquatic environments, and to act to limit and reduce these impacts.

References

Transforming our world: the 2030 Agenda for Sustainable Development". United Nations

Sustainable Development knowledge platform available at https://sustainabledevelopment.un.org/post2015/transformingourworld

Science should feed into 2030 Agenda available at https://www.scidev.net/global/sdgs/opinion/ scence-sdg-2030-agenda-sustainability.html

Science, technology and innovation for sustainable development -UN Economic and Social Council available at https://www.unescap.org/sites/default/ files/E7232E.pdf

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THE ROLE OF BASIC SCIENCES FOR SUSTAINABLE DEVELOPMENT

It was Albert Einstein who posited that discovery is the fruit of curiosity (or research if you will). By Einstein's reckoning, one only has to be curious enough in order to discover something. And discovery is basic science. Just know that, as you are reading this, if you check on your phone, laptop, or television, you will realize that the flat screen on there is basically the fruit of basic research. It was the 1888 discovery of liquid crystals that made it possible many years later to make flat screens for computers, televisions, and phones as you use them today.

Then a magnifying glass I owned taught me an important lesson, that a small thing can cause enough harm if care is not taken. This realization shaped my perspective in so many ways, the chief among them being conscientizing myself to understand that there is a special relationship between a man and his environment, that there exists a mutually beneficial relationship between man and his environment, that the destruction of man's environment is the doom of the man, and that the truism that says the last tree dies, the last man dies, holds much water. It is my understanding of the basic principles that shaped my perspective on resolving to be responsible for the environment, made possible by my understanding of science.

History gives us ample evidence of the role basic science has played and will play, especially in relation to sustainable development. From the "fire-mist and the planet, a crystal and a cell, a jellyfish and a saurian, a cave where the cave men dwell, then a sense of law and order," from the discovery of fire and the conquering of it, from the building of the pyramids of ancient Egypt to the discovery of gunpower in China, to the invention of 0, 1, 2, 3, 4, 5, 6, 7, 8, and 9 in India, From Archimedes to Newton's Eureka moments to Tesla's discovery of alternating current to Einstein's $e=MC^2$, the common denominator is science, basic science without which the world would still be a parchment of soil.

Basic science has led the world to some major breakthroughs and has ushered the world into new fields, an example of which is genomics. One would wonder why something that has "basic" as a prefix will have countless deepened definitions. But that is the thing about science. It is basic but peel an extra layer off it and you find that it is nowhere close to basic. Basic science, also known as "fundamental" or "pure science," will be no small measure aid researchers and all people in general in their understanding of living systems as well as life processes. To add to it, the knowledge we gain from basic science helps in predicting, preventing, diagnosing, and treating countless diseases. Again, through the same knowledge, as one writer puts it, we are able to answer the age-old question, "The chicken and the egg, which came first?" and "from whence came this, and to where goes this?"

Basic science basically hinges on the scientific disciplines of pure mathematics, pure physics, pure chemistry, and pure biology. Marriam Webster gives a rather expansive definition. By Miriam Webster metrics, it is defined as any of the sciences such as anatomy, physiology, bacteriology, pathology, or biochemistry, all of which are key to the study of medicine. Basic science rests on research, and research is basically driven by curiosity. These studies are trailblazing paths to sustainable development. The tenets of sustainable development spread across organizing principles that have been couched to meet human development goals and at the same time sustain the ability of natural systems to provide natural resources and ecosystem services. The human economy and society's progress revolve firmly around these principles. It is important to also explore the four pillars of sustainability. There is human sustainability, which strives to improve and preserve human capital in society. Social, economic, and environmental sustainability are all important considerations. By the metrics of the Brundtland report, from which sustainable development traces its umbilical cord, we can place society's progress at the feet of reducing extreme poverty, ensuring global gender equity, and ensuring wealth redistribution. Sustainable development helps us in managing our resources, enhancing them, and shaping our future endeavors by

promoting our rights to meet our basic needs, such as employment, food, energy, water, and sanitation, and our extra rights to enjoy healthy, safe, and clean environments.

Basic science provides the means to address vital challenges such as access to food, energy in its totality, health and its related fields, and communications in the expansive sense of the word. It is science that has exposed us to the knowledge of the impact of the planet's 8 billion people today and has gone on to devise strategies that could significantly reduce the negative impacts and, in some cases, limit or prevent them. Let's take diabetes, for instance. Today, so many people suffer from the disease. But thanks to basic science and, by extension, laboratory studies finding ways by which human genes can be manipulated to make specific molecules of protein, scientists have been able to engineer a genetically made bacterium called Escherichia coli that produces human insulin in real time.

Another example of the role basic science plays in sustainable development is how a technique invented in 1983 by an American biochemist, Kary Banks Mullis, the polymerase chain reaction (PCR), could come to play a vital role during the COVID-19 pandemic era, testing individuals for COVID infection out of kind courtesy and using basic science. Another striking example is the advancement of energy, which is clearly one of the most concerning aspects of our modern world. Science helps in the diagnosis and treatment of diseases, ailments, and conditions. It has helped break down the molecular mechanisms of diseases, making us understand diseases, and it contributes to the development of drugs. There is no gainsaying the fact that science provides the foundation upon which advances in global health are built.

It is basic science that has ensured the option of exploring other cleaner forms of energy to help reduce harm to our environment and lessen the giant waste that clean energies release into our earth's atmosphere. Through the efforts of science, an increasing number of households are shunning oil and gas and embracing solar, geothermal, and wood pellet options. Basic science has made research investigations into the physical, chemical, and biological components of food very easy, spearheading the ways foods are grown and processed. Science makes it possible to test for yeasts, bacteria, and molds that make products unsafe. Science tends to reduce the shell life of these bacteria, making food products well-preserved and protected.

Mathematical models are being used to help tackle climate change, biodiversity change, and water insecurity. Scientists can now quantify the value of ecosystem services and the biodiversity of large estuaries. Again, scientists can now use climate models to create alternative futures, helping them find new creative and innovative ways of solving our climate challenges. Food science allows us to make the best use of food resources in order to minimize waste. In the complex maze of harvesting, processing, storage, and preparation, food science has been able to permeate the maze. Not only that, but it has provided us with useful knowledge and insight into educating consumers and encouraging new ways of thinking about how and what we eat, driving important questions and creating healthier competitions. Given the hectic pace of modern life, science has made people more aware of their surroundings, and modern technologies are making food more nutritious and delicious. A perfect example is how milder processes use high pressure or steam to better preserve the taste and nutrients in food.

In agriculture, basic science has resulted in different ways of farming such as green houses, aquaponics, hydroponics, agroforestry, etc. Different ways of cultivating land without having an adverse effect on the environment testing ways of preventing the extinction of plant and animal species. Basic science has driven the production of plant-based meat and created a mutualistic relationship between different ecosystems without creating harm.

To talk about international relations, science and technology shape or influence international affairs on many tangents. Advances in science and technology alert the international community to new risks. The COVID era validated the impact of technology and its role in international relations. All in all, science has made life easier and facilitated progress.

"Lean not on your own understanding," says a religious quote. I believe this expression was referring to the fact that relying on science rather than our own understanding helps us understand nature better, opening up more creative ways to interact with nature and the environment. That exact thing basic science offers, helping us become more knowledgeable of our environments, more conscious of them, and eventually more responsible for them, is the exact aim of sustainable development.

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THE ROLE OF BASIC SCIENCES FOR SUSTAINABLE DEVELOPMENT

Science is an important part of our daily living, from the basic things we find in our homes to farm implements, skyscrapers, airplanes and even drugs and equipment for the treatment of diseases. It is no doubt that the sustainable development of every society has its bearing in science. To be able to appreciate the importance of science to sustainable development, there is the need to understand the basic sciences at play.

Basic sciences can be defined as the fundamental scientific disciplines of physics, biology, mathematics, and chemistry. Sustainable development is defined in the Brundtland report as development that meets the needs of the present without compromising the ability of the future generations to meet their own needs. Issues of climate change, pollution, food security, health, biodiversity loss and species extinction are being experienced globally. These issues can be tackled effectively when basic sciences are harnessed.

With the world's population expected to grow from the current 8 billion to 9.7 billion by 2050, the available resources for use will be stretched. Demand for space for settlement and farming will lead to more forest cover being lost, demand for energy coupled with industrialization will lead to more pollution if eco-friendly methods of energy generation and industrialization is not discovered and implemented. If better and more efficient agricultural practices are not used, there will be increased instances of food insecurity. These problems among others will ultimately exacerbate the rate of climate change and its impact. Inasmuch as these problems paint a scary picture of the future, basic sciences have proven to be the bedrock in finding solutions to the problems and ultimately put us on the path of sustainable development. The subsequent paragraphs will focus on some key areas in the development of any society and how basic sciences can contribute to the sustainability of development.

Agriculture: Agriculture can be touted as the backbone of most emerging economies considering the numerous employment it generates along its value chain. It provides food needed to sustain life, and the raw materials for most industries. However, rapid population growth has led to the increase in demand for food while climate change on the other hand is wreaking havoc through floods, drought, pest attack among others. Through the basic science of biotechnology, crops can be engineered genetically to become resistant to environmental factors such as drought, diseases, insects, and pest attack. Genetically engineered crops have a shorter maturity period, higher crop yields, are nutritious and overall reduce the cost involved in agriculture.

Energy: Energy has become the wheel that drives development. Transportation, industry, construction, and other critical sectors that champion development heavily rely on energy. Since the early 1700s, fossil fuel has been the main source of energy. The many derivatives and uses of fossil fuel makes it one of the most important natural resources. However, its negative impact on the environment cannot be overlooked. Land, water bodies and the air have been polluted through the exploitation and use of fossil fuel. The release of CO_2 and other harmful gases from plants that operate on fossil fuels have led to global warming and the depletion of the protective ozone layer. It is also worthy of note that fossil fuel is a non-renewable resource, which makes it irreplaceable when used up. Other traditional sources of energy such as firewood pollute the air, cause respiratory problems, and also contribute to the huge loss of forest cover in the world particularly on the African continent. There is therefore the need to find other sources of clean and renewable energy. Through basic sciences, biofuels, hydroelectric power, solar and wind energy have been discovered and are being used. These new energy sources are renewable and have little or no emissions. When effectively

harnessed, energy will become cheaper making it accessible to all, pollution associated with fossil fuels and the use of firewood will be reduced if not eliminated entirely, also related health complications will become a thing of the past.

Health: Globally, public health is threatened by numerous health issues. Diseases, pandemics, epidemics, malnutrition, genetic disorders among others increase mortality rate, reduce the quality of life and life expectancy. Sustainable development can be achieved with a healthy population that works to contribute its quota. Basic science plays a vital role in ensuring a healthy population. The emergence of the Covid-19 pandemic is a clear case in point. With a global pandemic at hand, the health service community all over the world relied on the knowledge in biology, immunology among others to manage the outbreak and develop vaccines. The situation also necessitated the development or use of innovations such as virtual meetings and "working from home" which reduce the emissions associated with travels. The development of x-ray machines, MRI, ventilators among others for the diagnosis and treatment of various diseases all have their roots in science. The delivery of quality health care saves lives, improves the health of the individuals and populations who are key for sustainable development.

From the above paragraphs, it is evident that basic sciences are already playing a crucial role in development and with the necessary funding, research and innovation, sustainable development can be attained sooner than later.

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THE ROLE OF BASIC SCIENCES FOR SUSTAINABLE DEVELOPMENT

Science, the disciplinary behind proving hypothesis, theories, and laws to generate facts that can stand the test of time, in fact the brain behind most technologies today. Science can be boldly associated with the main reason why humans live longer than expected today, and this is no fallacy but a testable fact. The role science plays in our development as a race is huge and a list cannot bring all to light. Foremost, the impact of science in our health sector cannot be overlooked while looking at the role science plays in sustainable development. Science has led to identification of various diseases, their causative organisms, and how to treat them. These diseases were previously associated with witchcraft and curses from the "gods" but today science has opened the way for technology to come into play to develop instruments and equipment for disease identification and treatment. For instance, cancer one of the deadly diseases had only one association, that is "curse from the gods" in the primitive times with no chance of survival hence many lives were lost, but today science has provided us with many options of survival which include chemotherapy, radiation therapy and surgery. To add to the list of examples, is the recent COVID-19 pandemic which almost wiped out the entire human race if not for the intervention of science. Science stood out during the pandemic period with various treatment, through test, and experiment to find a cure for the disease which put fear in us all. Today we are on our way to the life we knew before the pandemic, which include free social gatherings and no must of wearing nose masks.

Again, science also plays a major role in the development of our agriculture. We all know how important food is to our survival, and what happens without food. To give a familiar situation in our history as Ghanaians is the 1983 famine, a dire experience which we will never forget as a nation. Science has taught as that we can always produce without depending entirely on nature, and indeed it is true. Today most people have shifted from rain dependent farming to irrigation farming which is more promising, and also from primitive farming tools like the cutlass and the hoe which demand large human labor for large production. Currently one can produce large amounts with the use of fertilizers and can even increase the rate at which foods mature and ripe. As human diseases and spread has come under control, so has crop pest and diseases come under control, to enable abundant yearly produce for even some to be stored for future use. Science has made it possible to store foods through canning, bottling, freezing, drying and many other durable ways.

Furthermore, science also has a major impart in the communication and the transport sector. Today the world is a global village because of science and technology which move hand in hand. The world use to depend on letters which took months for their arrival, for messages to be spread across the world, so imagine situations of urgency in that same era and what would happen with such late deliveries. Travelling across continents was nearly impossible but today science has led to the creation of technologies which can carry you from one continent to another in just a day or less to the extent of even travelling to space. Fiber optics, which operates on the principle of total internal reflection, is one of the technologies which has made communication across countries possible. Today we see aircrafts, spaceships, ships, and cars carrying humans and goods instead of horses and camels all because of science.

In conclusion, science is a focal point in sustaining development. As said earlier, a list cannot bring all the roles science plays to light, how the suns energy is harnessed, how the wind is used to produce electricity, how water is used to produce electricity, how bombs and nuclear weapons are made, how channels are made under the ocean, how buildings are made on water, how various organ transplant are made, how flights are made to space, and the list goes on and on. In all we see that science is the brain behind the quality healthcare we enjoy, the healthy foods we take, the comfortable and safe journeys we make the beautiful infrastructures we see around and the world we are striving to maintain and create.

WONDER ABLORDEPPEY

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THE ROLE OF BASIC SCIENCES FOR SUSTAINABLE DEVELOPMENT

Basic research, also known as fundamental research, is a category of inquiry meant to advance knowledge of a certain occurrence, field of study, or natural law. This kind of research investigates data to uncover the unknown and pique interest. These often ask "how," "what," and "why" questions to explain events. Basic research examines how ideas or processes operate. A foundation for applied studies is frequently built on information from basic research. For example, an investigation on the effects of alcohol on the brain, a project to identify the components of human DNA, A research examining whether increased stress leads to aggression, and a research project looking into the causes of cancer. Basic research focuses on searching for knowledge instead of commercial applications driven by curiosity. This has introduced numerous new technologies in various sectors such as health, education, energy, and many more.

Sustainable development is the notion that human societies must exist and satisfy their needs without endangering the capacity of future generations to satisfy their own needs.

Specifically, Sustainable development is a strategy for structuring society in a way that ensures its long-term viability. This entails taking into account both the immediate and long-term imperatives, such as social and economic equality or the preservation of the environment and natural resources.

The following are a few areas that basic science research continues to play pivotal roles in sustainable development. These include health, energy, and agriculture.

Health Sector

Capacity building in research discovery is the interest of developing and developed countries that provide its application to encourage sustainable development and allows for improvement in standards of living. For instance, the Polymerase Chain Reaction (PCR) was invented by Kary Banks Mullis, an American biochemist, to make a copy of tiny DNA segments. The PCR works just like a magnifying glass proving a larger view of the object (organism under study). The PCR can also be applied in the investigation of crime using samples left behind at the scene. Also, the discovery of drugs such as Velcade (bortezomib) was based on the knowledge acquired through basic research: It was found that cells employ an internal device called the proteasome to disassemble and eliminate damaged proteins as well as regulate cell proliferation. Other clinical researchers hypothesized that a substance that slows the proteasome's activity would also delay the breakdown of vital proteins that support cancer cell resistance. Currently, a medicine called bortezomib is used to treat multiple myeloma, a kind of bone marrow cancer.

The application of basic research has resulted in Nuclear magnetic resonance (NMR) imaging production. To analyze the physical, chemical, electrical, and structural details of molecules, scientists created NMR devices that utilize magnets. Magnetic resonance imaging (MRI) is now performed using the same method in hospitals. The brain, heart, and kidneys are just a few internal organs and tissues that specialists can see using MRI. Numerous problems, ranging from malignancies to torn ligaments, can be diagnosed with it.

Energy Sector

The contribution of basic research in the energy sector cannot be underestimated. One of the major challenges in the energy sector is the conversion of the unclean form of energy to a clean state. Thus, the commercial use of hydrogen is obtained largely from coal and gas. This involves the conversion of water into hydrogen through a process known as artificial photosynthesis. Thus, the breakdown of water, chemically represented as H_2O into hydrogen and water molecules as a green method of hydrogen energy production.

Moreover, many households are gradually moving towards solar, wood pellets, and geothermal energy instead of the oil or gas form of energy. The production of biomass through the

application of mangrove technology could substitute the indiscriminate deforestation of mangrove trees to make a wood pallet for the production of charcoal.

Agriculture Sector

The agriculture sector employed millions of populations in many countries, thus reducing unemployment. While generating revenue to safeguard their economy. The contribution of basic science research to the sustainability of the agricultural sector cannot be overlooked across the globe. The application of knowledge acquired through basic science research has led to the generation of novelties that empower the production of more livestock and food with less land and less effort. It is through basic science research that, there are improved varieties of crops and bleeds of livestock helping to feed millions of populations globally. The effort of basic science research in the sustainability of the agricultural sector has been spectacular.

Finally, the contribution of basic science research in sustainable development cannot be ignored in this 21st century thus, knowledge acquired through basic science research can be applied to establish standards of practice in various sectors (health, energy, education among others) and also in the development of new technologies. In addition, to ensure the sustainability of basic science research, there is an urgent call for the government, stakeholders, and individuals to adequately invest in basic science research projects to enable scientists to come out with quality research for better innovation to enhance productivity in all sectors.

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THE ROLE OF BASIC SCIENCES FOR SUSTAINABLE DEVELOPMENT

Sustainable development is generally defined as 'development which meets the needs of the present without compromising the ability of the future generation to meet their own needs'. According to the World Health Organisation, sustainable development is a broad term used to describe policies, projects, and investments that provide benefits today without sacrificing environmental, social, and personal health in the future. Basic sciences among many others play a major role in sustainable development. The relationship between these two has been studied for many years with different people coming out with various hypotheses. As Ghana develops, the need to identify the factors involved in its development and seek solutions for sustainability becomes paramount. A major factor concerning the country's development is the application of basic sciences. Therefore, the role of Basic Sciences for sustainable development is being highlighted in this article, while also taking time to explain the points to the reader's satisfaction.

To commence with, having a capacity in basic sciences is in the interests of both developed and developing countries, given the potential for application of basic sciences in fostering sustainable development and raising the standards of living. For example, a growing number of people around the world suffer from diabetes. Thanks to laboratory studies of how genes can be manipulated scientifically to make protein molecules, scientists have been able to engineer genetically a common bacterium, *Escherichia coli*, to produce synthetic human insulin. This has gone a long way in improving the lives of people with diabetes and other sicknesses that are not talked about much. It has also improved the state of the health sector and is encouraging a lot of the younger generation to offer science-related courses at the secondary and tertiary education levels.

Basic sciences have been very instrumental in fighting the recent pandemic that took the world by surprise, the COVID-19 pandemic. It was basic sciences that empowered microbiologists to identify the cause of the infection as a virus, what the virus looks like and its genetic sequence. These enabled microbiologists and medical doctors to come out with possible ways to reduce the spread and contraction of the virus. Currently, the cases of the COVID-19 pandemic have drastically reduced in the country as a result of the research conducted.

In conclusion, basic sciences help researchers understand living systems and life processes. This knowledge leads to better ways to predict, prevent, diagnose, and treat diseases. Professor Dorothy Yeboah-Manu, a microbiologist and Professor at the Noguchi Memorial Institute for Medical Research said, "If you look at the countries that are doing well, it is because they have invested heavily in basic science. They have been able to apply them in their life activities which have yielded them a lot of economic freedom". This is to say that without basic sciences, our beloved country, Ghana will stay stagnant in its fight for development.

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THE ROLE OF BASIC SCIENCES FOR SUSTAINABLE DEVELOPMENT

Science is a systematic process that creates and organizes knowledge into universe-related explanations and predictions that can be put to the test. A concept of human growth known as "sustainable development" strives to meet human needs while protecting the environment so that they can be addressed not only for the current generation but also for future generations.

Some of the basic sciences' transformational objectives center on sustainable development. This includes, among other things, eradicating poverty, ensuring that no one goes hungry, promoting excellent health and well-being, ensuring that all children receive a quality education, and promoting gender equality. A better quality of life for both current and future generations is one of the benefits of sustainable development. Through a reduction in soil and water pollution, sustainable development lessens its negative effects on the environment.

There is a claim that there won't be any applied science without foundational sciences. How accurate is this? People do not always understand how the fundamental sciences have led to the discoveries and technological advancements that are constantly changing the world in which we live. When choosing your smartphone, keep in mind all the researchers who labored in open labs for nearly 50 years before creating the first tiny electronic circuit. The transistor radio may thus be created thanks to this. The first integrated circuit, a computer chip, was created after this. Since then, ever-smaller mechanical, electrical, and optical devices may be produced thanks to the miniaturization of integrated circuits. Millions of tiny transistors are used by today's smartphones to carry out intricate tasks.

We are aware that the fundamental sciences and the promise they hold are essential at a time when humanity must develop new methods of production, transportation, and heating. In order to research, investigate, and experiment, we must now more than ever allow the basic sciences to grow in every direction. Science must be able to invent, develop, and discover in order for us to be able to meet the major issues of our day. Basic sciences can support sustainable development in a number of ways. They include broadening open sciences, boosting education and scientific training, and encouraging inclusive engagement in science.

As a conclusion, it can be claimed that the contribution of basic sciences to sustainable development promotes stability in the environmental requirements. It makes the resources accessible to the next generation. Indeed, the application of the knowledge in the basic sciences is a fantastic way of achieving sustainable development in our world today.

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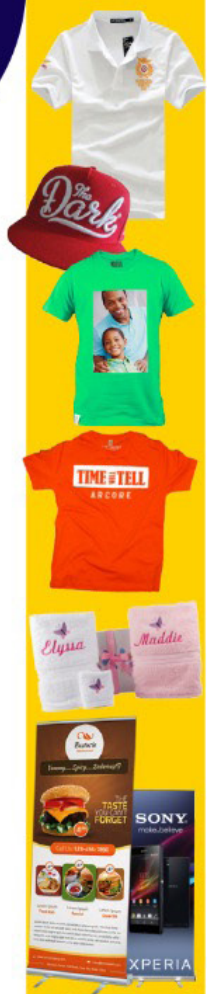

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