



# **SCIENCE AS A DRIVER FOR ECONOMIC DEVELOPMENT AND SUSTAINABILITY**

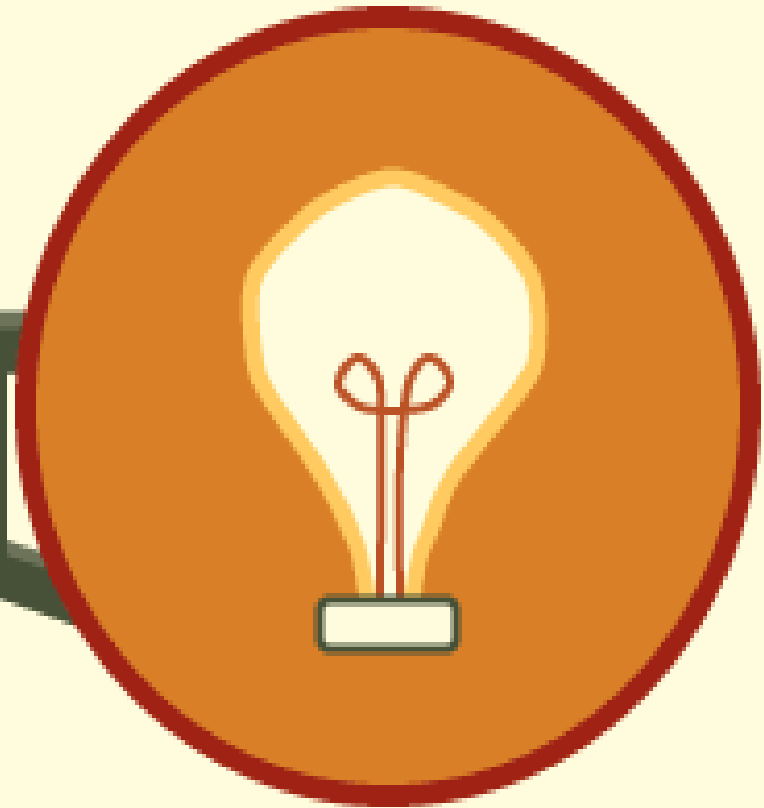
**PROF. M.A. BELEWU (GUEST LECTURER) PAPER PRESENTED AT THE 11<sup>TH</sup> INTERNATIONALs  
CONFERENCE OF THE SOCIETY FOR THE CONSERVATION OF PHYTOFUEL AND ALLIED SCIENCES**

data

hypothesis



evidence

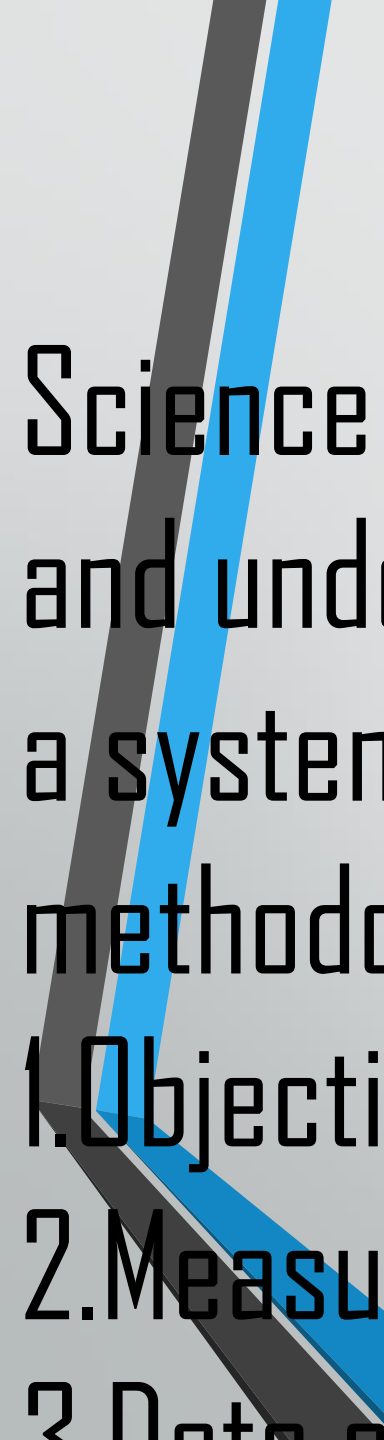


background  
knowledge



# WHAT IS SCIENCE?

- It is defined as the systemic study of the structure and behavior of the Physical and Natural World through observation, experimentation and the testing of theories against the evidence obtained (Oxford Dictionary)



Science is also the pursuit and application of knowledge and understanding of the natural and social world using a systemic methods based on evidence. Systemic methodology includes

1. Objective observation

2. Measurement

3. Data evidence



**Hence, Science has the following characteristics:**

a. Observation

b. Identification

c. Description

d. Experimentation

Theoretical explanation of natural phenomena (<https://explorable.com>)

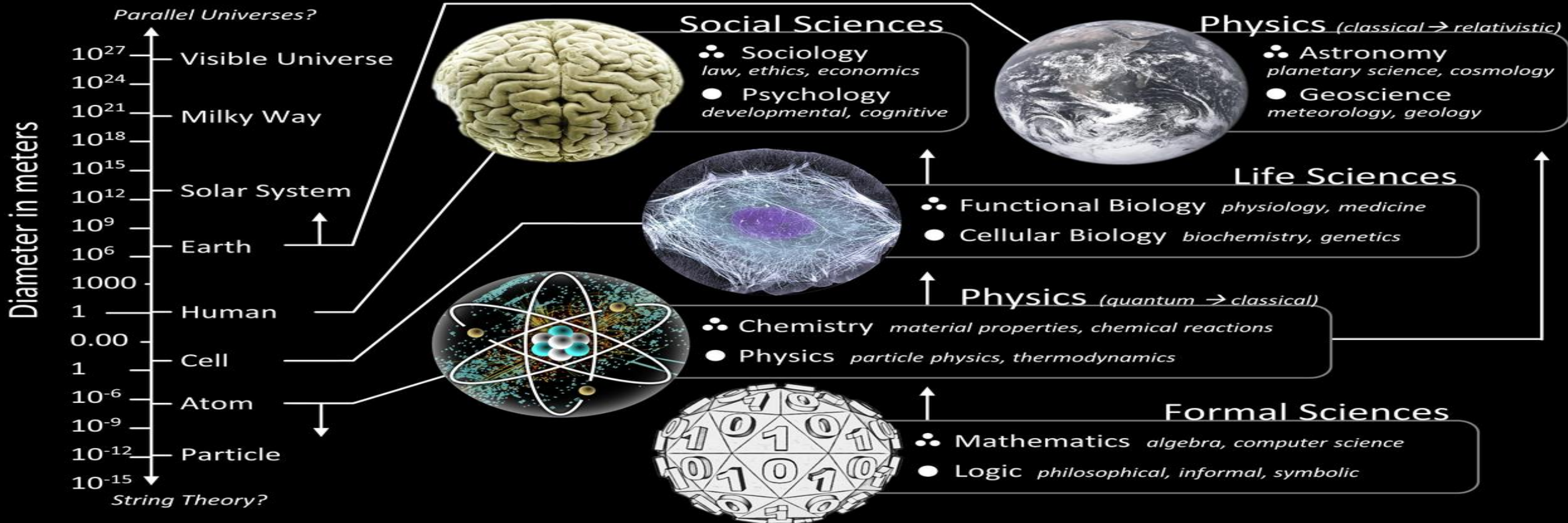
# What is the Original Meaning of Science?

- It is from the Latin word **'SCIENTIA'** meaning **KNOWLEDGE**

# Types of Science

## The Universe

## Hierarchy of the Sciences



# TYPES OF SCIENCE

- **Orthodox Science (Type 1)**
- (i) It describes unbiased experimental results
- (ii) Every observation is predictable and repeatable
- (iii) Everything is straight forward



# Interpretations placed on observation Science (Type 2)

- When there are two competing theories.
- History and many other Social sciences are close to Type 2 and Type 1. However, Scientists do not like Type 2 because it might not be repeatable).

# Fraud Science (Type 3)

- It is not a Science at all, it happens when Scientist take a shortcut and fabricate data to get faulty/ bad results.

# Fiddling Science (Type 4)

- It is testing half-formed ideas and hypothesis  
(Most Technologies started as Type 4 Science ---  
--Trial and Error variations to find the best
- Scientists in the category could not control the effects nor predicts what would happen in a given situation



**TODAY, NO REAL SCIENCE HAPPENS  
WITHOUT A LOT OF FIDDLING**

# Speculation Science (Type 5)

- This is a creative science, identifying, designing, and planning what to be observed.
- It is the most creative and enjoyable form of science
- It generates hypothesis

# **Polemic Science (Type 6)**

- It pays little attention to the **FACTS**, hence its marginally scientific (example, argument on cholesterol and heart disease is debatable)

# Pseudo-science (Type 7)

- Scientist of this Type take delight pointing out that their system 'TRANSCENDS' / SURPASSES the rules of science but it obey some higher Laws which they proclaim / assert
- This scientist accept most part of Orthodox Science but added some unrecognized Law.

# Creation Science

- This science fails to offer even one testable proposition/hypothesis but proclaim happily that it cannot be falsified. (<https://www.abc.net.au>)



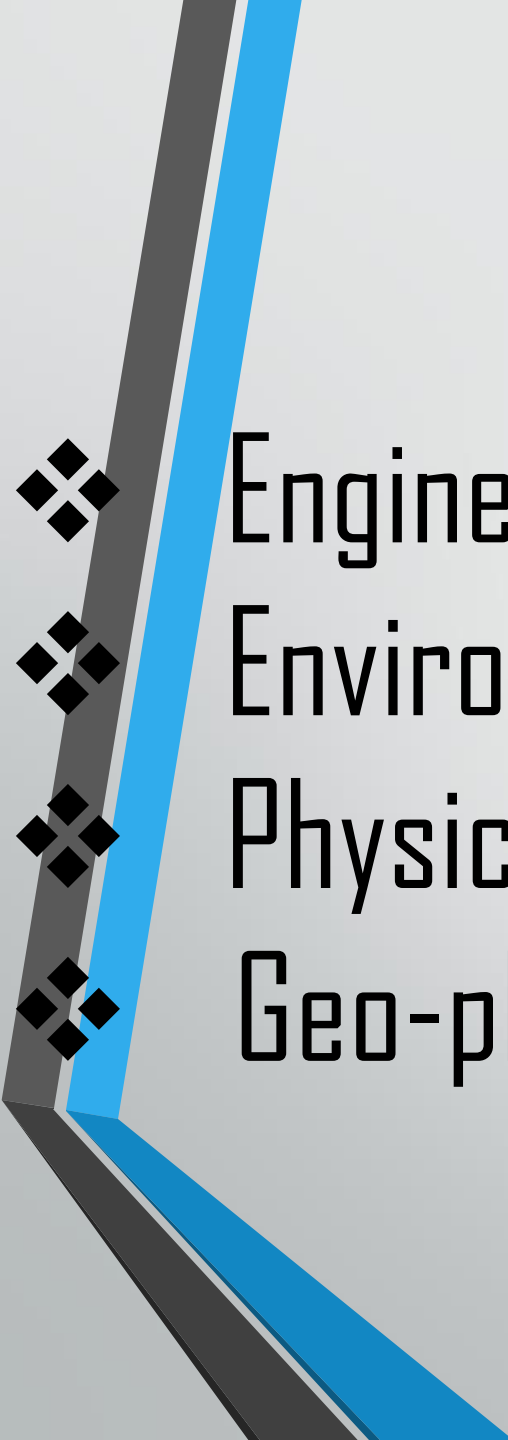
# BRANCHES OF SCIENCE

- Physical Science
- Earth Science
- Life Science
- Social Science (<https://www.indeed.com>)

# Physical Science

It is the study of non-living things / inanimate natural object

- - ❖ Anatomy and Physiology
  - ❖ Astronomy
  - ❖ Chemistry


- 
- ❖ Engineering
  - ❖ Environmental Science
  - ❖ Physics
  - ❖ Geo-physics etc

(<https://study.com>academiy >lesson>)

# Earth Science


- ❖ Geology
- ❖ Oceanography
- ❖ Astronomy
- ❖ Meteorology
- ❖ Astrophysics

# Life Sciences

- 
- ❖ Genetics
  - ❖ Microbiology
  - ❖ Zoology
  - ❖ Ecology
  - ❖ Botany
  - ❖ Physiology
  - ❖ Biochemistry etc.
  - ❖ Biology

# Agricultural Science

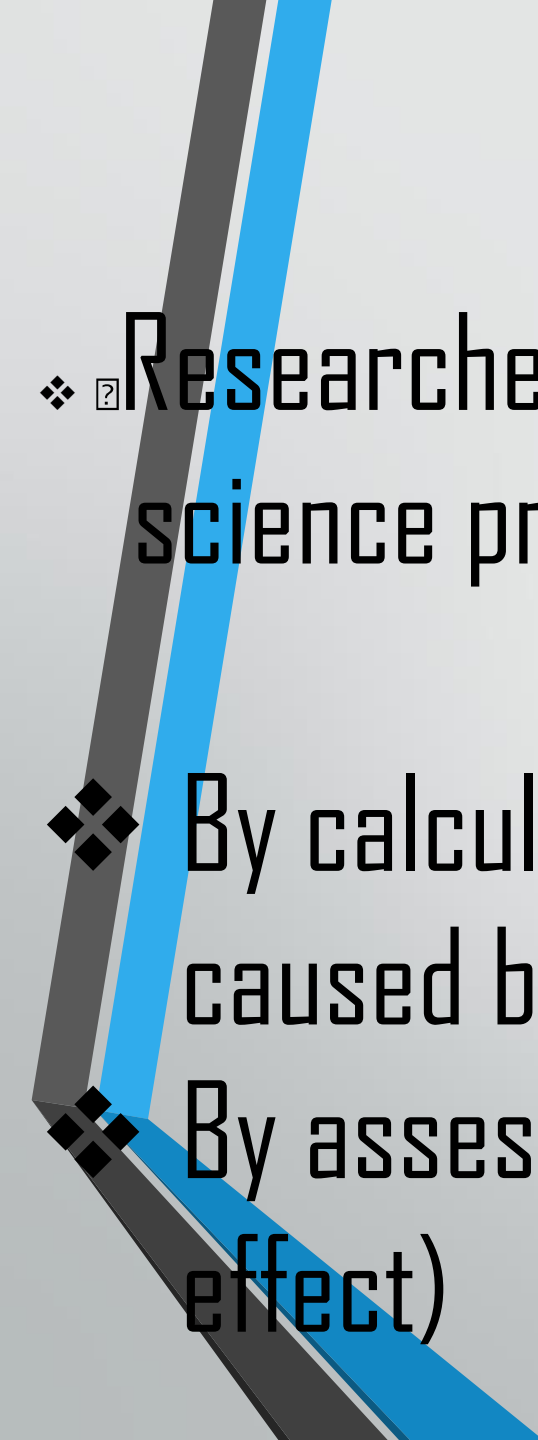
- ❖ Agricultural Engineering
- ❖ Agronomy
- ❖ Agricultural Economics
- ❖ Animal Science
- ❖ Soil Science
- ❖ Forestry

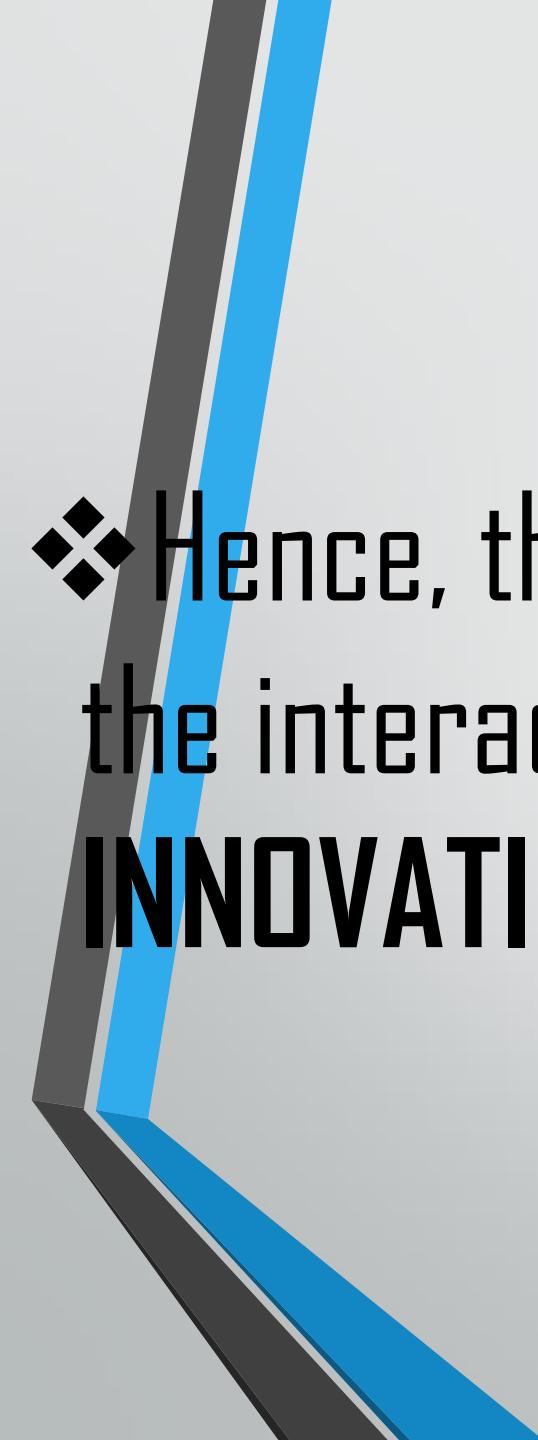
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- ❖ Agroforestry
  - ❖ Olericulture
  - ❖ Floriculture
  - ❖ Pomology
  - ❖ Fisheries

# Science (Knowledge) Exchange

- It is the multiple interaction between higher education (Science) and business, public service, charities, public engagement, communities, policy makers and government so as to create **societal and economic benefits.**
- It is noteworthy that Researchers/ Scientists make a huge contributions to the society and the economy **FAR beyond the LABORATORY**



- 
- ❖ Researchers/ Scientists may evaluate the impact of science projects by its primary economic effects (or)
  - ❖ By calculating the variation in demand (multiplier effect) caused by the expenditure of such scientific project (or)
  - ❖ By assessing the impact on externalities (secondary effect)



❖ Hence, this presentation aims to shine a spotlight on the interactions between **SCIENCE, TECHNOLOGY, INNOVATIONS** and **ECONOMIC DEVELOPMENT**

# MAJOR ROLES OF ECONOMIC DEVELOPMENT AND SUSTAINABILITY

- ❖ Business Retention and expansion (Enhancing existing Businesses )
- ❖ Business expansion (Attracting New Business)
- ❖ Business Creation (Encouraging New Businesses)

# Physics Vs Economic Development and Sustainability

## ❖ PHYSICS- BASED BUSINESSES

❖ Physics-based Businesses in the United Kingdom contributes about £177 Billion GVA (Gross Added Value) and about 16.1% share of the GVA generated by the whole of UK business economy resulting in about 10% of the GDP

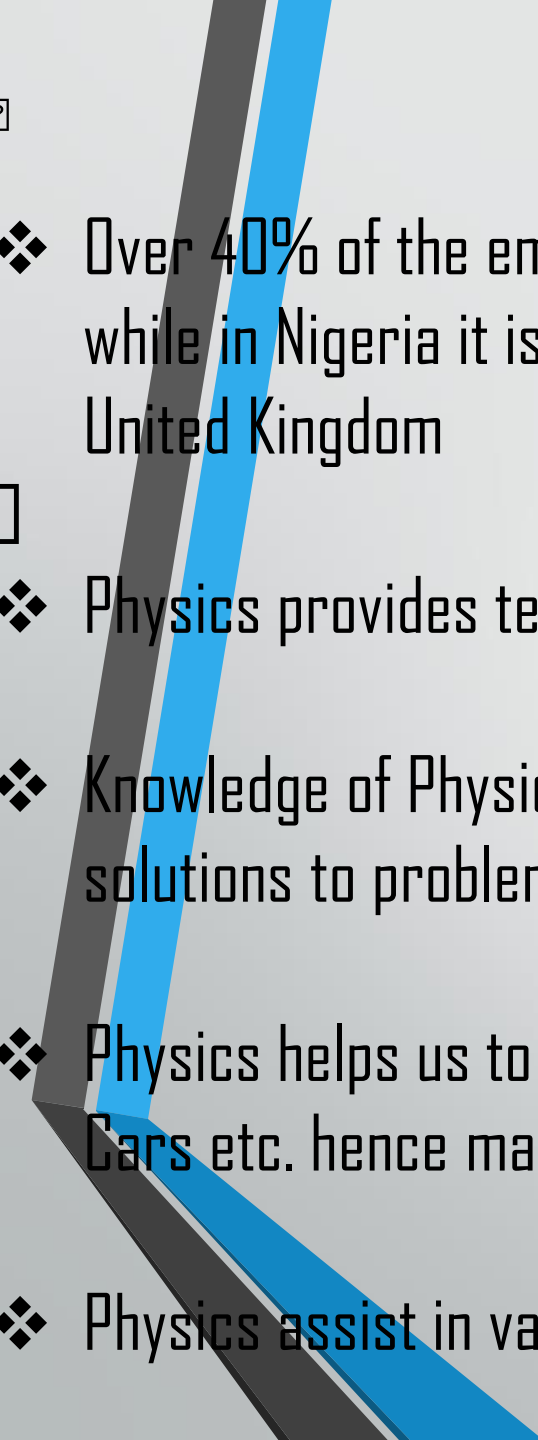
❖ GVA : It is the measure of the economic output of a sector ( i.e. . the value of what they produce)

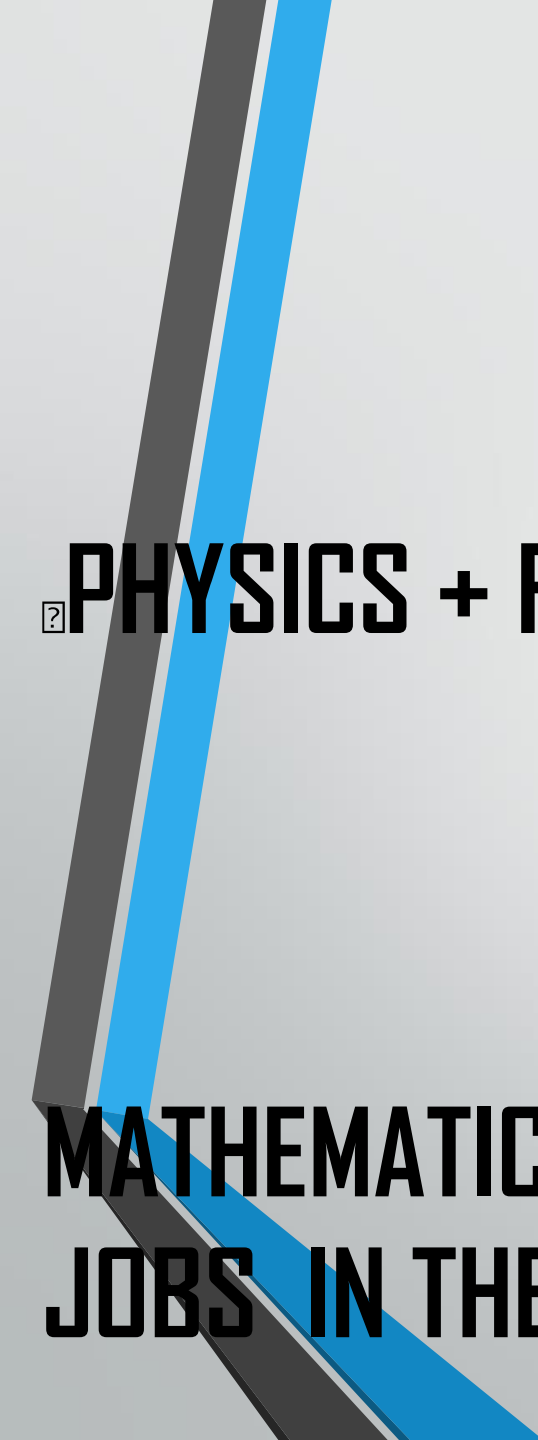
❖ □The growth of the GVA is about 3% per year in the UK

- ❖ **Employment** : About 2 Billion people are employed in Physics based Businesses which is equivalent to 6.7% of the total employment in the UK
- ❖ **Productivity**: A person employed in Physics based businesses contributes an average of £88,144 per year in value addition.
- ❖ **Skill Development** : Physics facilitates the development of quantitative skill which is essential in business for economic Growth.
- ❖ The skill gives the ability to analyze critical business data and draw conclusion that could lead to well informed business decision (<https://tuitionphysics.com>)

# □ Physics and Banking Job :

- ❖ □ The Institute of Physics noted that about a fifth of Physics Graduate entering the workplace every year get job in FINANCE
- ❖ □ This is due to the facts that Banks has become dependent on mathematical model and Physics graduate are best at it.
- ❖ □ They are using those models not to figure out how the universe began but to predict about which companies bonds/ complex financial products might begin making money for their firms.
- ❖ □ Banks demand a graduates of Mathematics and Physics since numerical methods developed for solving problems in Physics have direct application in Finance (<https://www.kenan-flagler.unc.edu>)
- ❖ □ Peter Harrison (Founder of Banking recruitment advisor) noted that many city jobs need Physics / Mathematics graduates else, you will not be hired.

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- ❖ Over 40% of the employment in the manufacturing industries in the United Kingdom is Physics based while in Nigeria it is less than 1% hence it contributes to productivity and economic growth in the United Kingdom
  - ❖ Physics provides techniques and equipment for Life Sciences advancement
  - ❖ Knowledge of Physics helps to tackle/ solve various subject from first principle and to find innovative solutions to problems where conventional approaches could not/ failed
  - ❖ Physics helps us to understand how the World around us works e.g. Cell phone, Light bulb, Cameras, Cars etc. hence many people are employed in these industries
  - ❖ Physics assist in value addition of products

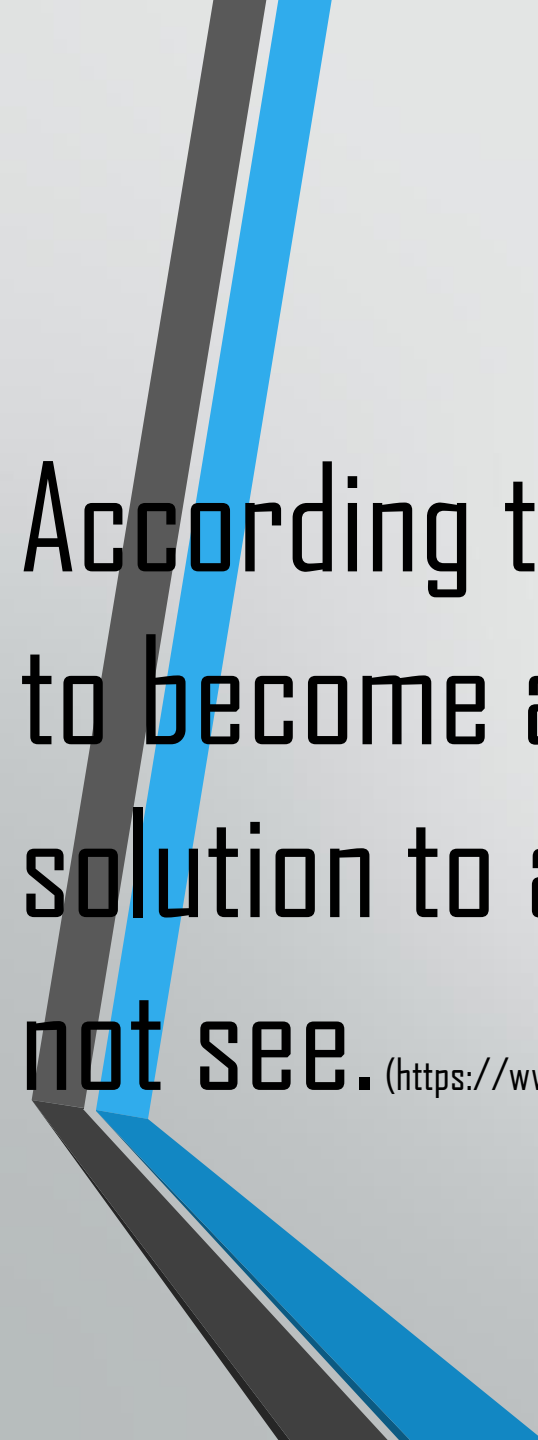


**PHYSICS + FINANCE = CAREER OPPORTUNITY**

**HENCE**

**MATHEMATICS AND PHYSICS GRADUATES ARE GETTING GOOD  
JOBS IN THE UNITED KINGDOM**





According to Martini "A Physics degree is a great way to become an Entrepreneur and it assist to ". "See a solution to a Technological Problem" that others might not see. (<https://www.usnews.com.article>)

# ANATOMY / PHYSIOLOGY Vs ECONOMIC DEVELOPMENT & SUSTAINABILITY

- Anatomy and Physiology can provide and influence the economy by searching for useful compounds that can be used as drugs, cosmetics and food for better livelihood.
- Anatomy and Physiology research will provide the knowledge for the use of high quality drugs to improve the quality of health of human-beings
- Anatomy and Physiology can influence the health status of the society which leads to peace and justice.
- Health is Wealth, hence Anatomy and Physiology will assist to know the best approach to understand how best to improve our ability to identify, harness and utilize natural resources
- The main income base of any country is directly / indirectly influence the level of support of Anatomy and Physiology

# CONTRIBUTION OF PHYSIOLOGY EDUCATION AND TRAINING TO THE UK ECONOMY

## Key Findings Report

Graduates of courses of which physiology is a core component add

# £22.6 billion

to the UK economy every year.



# Contribution of Physiology Education to the Economy

- ▶ Graduates of Physiology education contributes about £22.68 Billion in added income in the UK economy / year which is equivalent to supporting over 777,200 average salary jobs annually.

# Astronomy Vs Economic Development and Sustainability

- ❖ Astronomers have contributed to medical technologies like MRI scanners
- ❖ Astronomy generates over \$100million for Hawai'i economy
- In 2019 about 78% of the total farming output statewide or 21% from the private educational service.

# Earth Science Vs Economic Development and Sustainability

- Knowledge of Earth Science helps us to think globally and acts locally so as to make sound decision about issues important to our lives as individual and citizens
- The knowledge of Earth Science provides us with the knowledge to mitigate various societal environmental impacts caused by resource extraction and disposal of wastes
- To know the economic in managing and treatment of waste disposal
- There are many Earth materials that can be used for economic/industrial purposes e.g. **THREATRE MAKE-UP** needed in the Theatre industry was developed from rock by a researcher from the University of Ilorin, Nigeria. This was found to be cheaper compared to the foreign **Theatre make-up** without compromising quality.




Oil Mineral Foundation

# Agricultural Science Vs Economic Development and Sustainability

- Agriculture is the Engine of Economic Development and Sustainability
- Sources of food supply for all Nations , Nigeria inclusive. Failure to supply food will lead to decline in the economy
- Agriculture contributed about 23.3% to the GDP in Nigeria (Half year 2022)
- In 2021, it contributed about 30% of the total GDP
- Employment generation by creating jobs thereby solving socio-economic problem
- Supply of raw materials to industries , shortage of such supply will have negative effects on industrial production leading to high price of goods and poor economy
- Sources of foreign exchange ---cash crops (cocoa beans, sesame seed, ginger, soyabeans) thereby contributing to Nation GDP



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- ◆ Diversification of the economy and not depending solely of oil due to its price fluctuation
  - ◆ Export products structure have changed in the direction of diversification having high quality and meeting the standard of fastidious markets
  - ◆ Various Livestock products have expanded their access to the market
  - ◆ Labour productivity has moved up to 6.8%/year due to mechanization
  - ◆ The Agro-forestry / fishery industries have grown sustainably and stable in positive direction
  - ◆ Through Science and Technology, Nigeria was able to trade on International border, gain International recognition as well as collaborate with other Nations
  - ◆ An hungry man is an Angry man, through agriculture there will be food security , social security and enhanced income.




Contribution of Livestock to the economy development

# Contribution of Livestock to Economic Development and Sustainability

Table 1: Total Economic Contribution of Animal Production in Iowa, 2012

	<b>Jobs Direct</b>	<b>All Others</b>	<b>Total</b>	<b>Total Value Added (or GDP)</b>	<b>Total Economic Output</b>
<b>Cattle</b>	5,815	7,650	13,465	1,302,021,703	5,468,958,832
<b>Dairy</b>	1,399	2,640	4,039	563,296,096	1,502,241,503
<b>Swine</b>	38,196	21,649	59,845	5,278,742,602	10,745,244,772
<b>All Poultry</b>	467	4,835	5,303	618,867,680	2,271,495,593
<b>Sheep</b>	155	88	243	21,448,345	43,659,584
<b>Total</b>	<b>46,032</b>	<b>36,862</b>	<b>82,894</b>	<b>7,784,376,426</b>	<b>20,031,600,284</b>

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- ❖ Livestock and livestock products (LLPs) are estimated to make up over half of the total value of agricultural gross output in the industrialised countries, and about a third of the total in the developing countries
  - ❖ Livestock contribute to both intensification and diversification of income streams.
  - ❖ Livestock make a large and growing contribution to the nutrition of expanding populations, and contribute to the trade balance
  - ❖ Livestock production makes an important contribution to economic development, rural livelihoods, poverty alleviation and meeting the fast growing demand for animal protein in developing countries.



**ANIMAL SCIENCE IS THE ENGINE  
FOR THE RURAL ECONOMY**

# Contribution of Life Sciences to Economic Development and Sustainability

- ▶ Life Sciences employed over 66,000 people in New Jersey
- ▶ It generates over \$ 20Billion annually in New Jersey
- ▶ It generates about \$ 33,5Billion GDP in New Jersey
- ▶ It provides direct and indirect jobs in Nigeria and abroad
- ▶ Life Sciences helps in the creation of new products, new scientific findings and new commercial activities. All of these help in stimulating further commercial activities in Life Science



**Fig. 4:** *Textile design from Indigofera tinctora Dye*



**Fig. 5:** *Textile design from Jatropha curcas dyes*



**Fig. 6:** *Textile design from the mixture Jatropha curcas & Indigofera tinctora dyes*



**Make-Up Artist Applying Arabic Theatre Gum on another Artist**



# Table on the Contribution of Life Science to the Economy

Table 2: Contribution of the Life Sciences Sector to the New Jersey Economy

	Direct	Indirect	Total
Employment (Job years)	66,451	146,105	212,556
Gross Domestic Product (millions)	\$15,487.3	\$18,061.6	\$33,548.9
Compensation (millions)	\$9,860.6	\$10,458.8	\$20,319.4
State Tax Revenues (millions)			\$1,535.6
Local Tax Revenues (millions)			\$1,361.7
Life Science Employment			66,451
Life Science Establishments			1,064
Life Science Total Wages			\$9,860,576

Source: U.S Bureau of Labour Statistics, Quarterly Census of Employment and Wages

# Contribution of Social Science to Economic Development and Sustainability

- **Social science deals with human behaviour in its social and cultural aspect (Cultural, Anthropology, Sociology, Psychology, Political science and Economics)**
- **It is science due to the fact that it seek for true knowledge of man and his society**
- **It contributes to our heart and well-being thereby solving social and economic problems**
- **It can change the world for better**
- **It is concerned with the social and economic advancement of humanity at large**
- **It could influence the work of strategists, planners, teachers and programme officers in developing and growing economies**
- **It helps to guarantee democracy**

# Conclusion

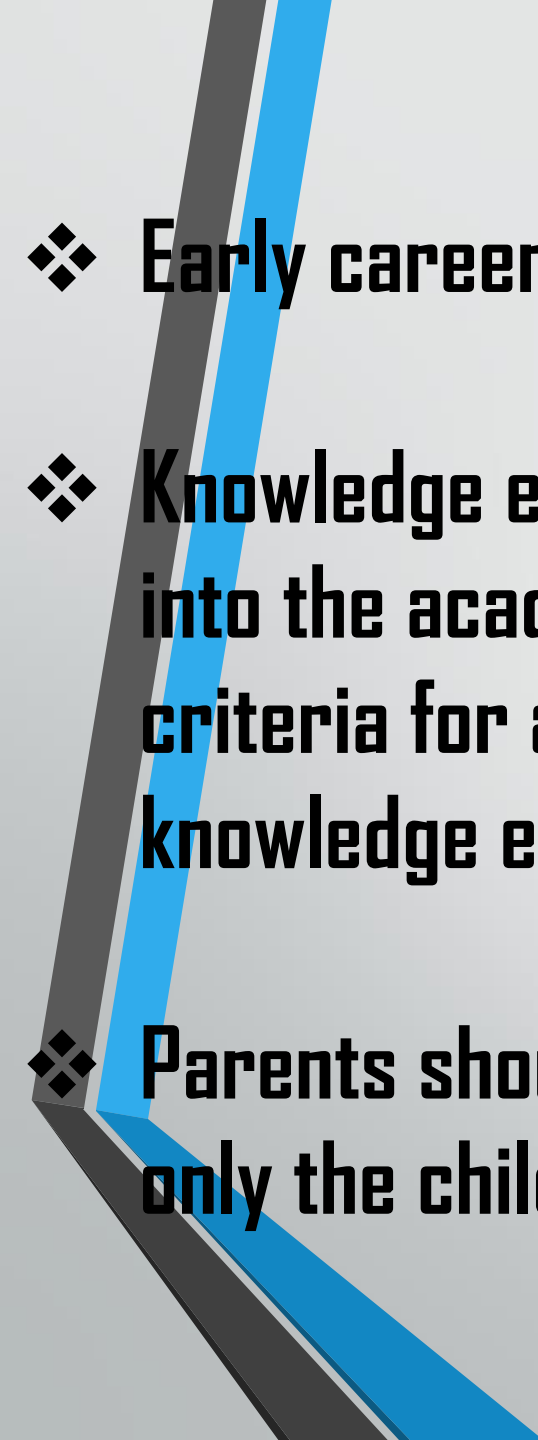
- In conclusion Sustainable Science as a 'Driver' will help to create, distribute and exploit knowledge leading to a Competitive advantage of wealth creation and enhanced standard of living of the populace

# Recommendations

- To the Government
- The Federal Government should increase investment on Science through **Higher Education Innovation Fund** to make Nigeria the best place in the World to conduct, commercialize and benefit from Science - Based Research.

# **Recommendations to Institutions / Society / Parents**

- ❖ Community Based- Research should be encouraged**
- ❖ Science Association of Nigeria (SAN) should work in partnership with National University Commission (NUC), TETFUND and JAMB to establish a NETWORK**
- ❖ Translational Funding should be formed between the BENCH and the Industry**
- ❖ Translational Research should be encouraged among Scientists / Researchers not just research for the sake of it**

- 
- ❖ **Early career Scientists / Researchers should be Mentored and upskilled**
  - ❖ **Knowledge exchange concordat / written agreement should be embedded into the academic culture of Tertiary Institutions and ensuring that criteria for academic promotion and reward, recognizes successful knowledge exchange activities**
  - ❖ **Parents should not force their wards to study any particular course, its only the children that knows his/her capability**



❖ To remain globally relevant producers must have access to new discoveries and adopt innovation

❖ There should also be Institutional change so as to have critical influence on the economic development

# SUPPORT SCIENTIST TO OVERCOME BARRIERS TO UNDERTAKING KNOWLEDGE EXCHANGE ACTIVITIES





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**THANK YOU.**

