

## **Introduction and Historical Antecedents**

### **What is Science?**

A way to propose answers about natural events.

Helps people learn and understand the natural world.

Based on observable events.

A method of discovery and understanding by using problem-solving.

### **Branches of Science:**

**Natural Science** – Biology, Physics, Chemistry, Earth Science.

**Social Science** – Sociology, Psychology, etc.

**Interdisciplinary Fields** – Biochemistry, Geophysics, etc.

### **Scientific Method (6 steps):**

**1. Make an Observation**

**2. Form a Hypothesis**

**3. Test the Hypothesis**

**4. Collect, Organize, and Analyze Data**

**5. Draw Conclusions**

**6. Communicate Results**

## **Science and Technology**

**Science:** Observing, studying, experimenting to know the nature of things.

**Technology:** Using science to make life easier.

### **Connection:**

**Science** is for **knowing**.

**Technology** is for **doing**.

Their relationship is **symbiotic** – each one drives and supports the other.

## **Historical Antecedents of Science and Technology**

### **Ancient Times – (TCSHAMAR)**

Transportation, Navigation, Communication, Security, Health, Architecture, Mass Production, Aesthetics, Record-keeping.

**Sumerians** – Cuneiform writing, wheel, plow, sailboat, irrigation.

**Babylonians** – Improved irrigation, Code of Hammurabi.

**Egyptians** – Pyramids, papyrus, ink, hieroglyphics.

**China** – Paper-making, compass, gunpowder, printing.

**Indus Valley** – Mathematics, astronomy, medicine (Aryabhata).

**Greece** – Philosophy, democracy, geometry, astronomy.

**Rome** – Engineering (roads, aqueducts), legal system.

**Middle Ages** – Heavy plow, windmill, watermill, three-field system, preservation of knowledge, Islamic Golden Age (Canon of Medicine).

**Modern Period** – Enlightenment, Industrial Revolution, steam engine, airplanes, sanitation, antibiotics, telephone, atomic bomb.

## **Philippines**

**Pre-colonial:** Banaue Rice Terraces, copperplate inscription.

**Spanish:** UST (1611), scientific institutions.

**American:** Agriculture, medicine, engineering.

**Contemporary:** PAGASA, exploration of atomic energy, Constitution emphasis on science.

## **Cradles of Early Science**

### **Mesoamerica**

**Mayans** – Astronomy, calendar systems, hydraulic systems, weaving, paints, hieroglyphics, math (base 20, concept of zero).

**Incas** – Roads, earthquake-resistant buildings, quipu (knotted record system), 12-month calendar, irrigation, suspension bridges, textiles.

**Aztecs** – Mandatory education, medicines, chinampas (floating gardens), canoe, chocolate, Aztec calendar.

## **Asia**

**India** – Iron manufacturing, metallurgy, Ayurveda medicine, Susrutasamhita, astronomy, math (Madhava's analysis).

**China** – Acupuncture, compass, papermaking, gunpowder, printing, astronomy to predict seasons.

## **Middle East (Golden Age of Islam)**

Common Arabic language, access to Greek writings, contact with India.

**Ibn Haytham** – Father of Optics.

**Al-Khwarizmi** – Algebra, algorithms.

**Ibn Sina (Avicenna)** – Canon of Medicine, clinical trials.

## **Africa**

**Geometry** – Preserving farmland boundaries.

**Alchemy** – Forerunner of chemistry.

**Astronomy** – Lebombo bone (oldest math artifact).

## **Role of Science and Technology in Nation-Building**

### **Pre-colonial Philippines**

**Indigenous knowledge:** agriculture, fishing, hunting, irrigation, trading with neighbors.

## **Spanish Period**

Formal education and scientific institutions.

Galleon trade introduced crops and technology.

## **American Period**

Public education system.

Engineering infrastructure, hospitals, health centers.

## **Post-War and Independence**

Nation rebuilding.

Focus on education, agriculture, engineering, medicine.

## **Government Programs**

### **1. DOST Scholarships**

Provides financial assistance for STEM students.

Includes undergraduate, master's, and doctoral scholarships.

Goal: strengthen human resources in Science & Technology.

### **2. Philippine Science High School (PSHS) System**

Established by RA 3661.

Secondary education for scientifically gifted students.

Advanced science and math curriculum.

Offers scholarships and dormitories.

### **3. Regional Science High Schools (RSHS)**

Operated by DepEd.

Science-focused curriculum in each region.

Admits students with outstanding aptitude in science and math.

### **4. Special Science Elementary Schools (SSES)**

Started in 2007 under DepEd.

Prepares elementary students with a strong science and math foundation.

### **5. Balik Scientist Program**

Encourages overseas Filipino scientists to return and help research.

Provides incentives, research grants, and financial support.

### **6. Science and Technology Parks**

Built near universities and research hubs.

Encourage academe-industry collaboration.

Example: UP Diliman National Science Complex.

## **Prominent Filipino Scientists**

**Ramon Cabanos Barba** – Developed mango flower induction using potassium nitrate and ethrel; revolutionized mango farming globally.

**Lourdes Jansuy Cruz** – Studied sea snail venom (conotoxins); advanced neuroscience and medicine.

**Josefino Cacas Comiso** – Used satellite data for climate studies; researched polar ice in Antarctica.

**Fabian Millar Dayrit** – Researched virgin coconut oil and herbal medicine.

**Jose Bejar Cruz, Jr.** – Expert in control systems engineering; officer in IEEE.

**Mari-Jo Panganiban Ruiz** – Mathematician, recognized for work in graph theory and education.

**Rafael Dineros Guerrero III** – Developed tilapia sex reversal techniques; improved aquaculture yield.

**Lilian Formalejo Patena** – Specialist in plant biotechnology and tissue culture.

**Gregory Ligot Tangonan** – Worked on satellite communication and electronic systems.

**Enrique Mapua Ostrea, Jr.** – A pediatrician invented the meconium drug test for newborns exposed to drugs.

## **Human Flourishing and the Good Life**

### **Hedonia and Eudaimonia**

**Hedonia** – Happiness from pleasure, comfort, enjoyment (“feel good”).

**Eudaimonia** – Happiness from purpose, meaning, and flourishing (“feel purpose”).

## **Human Flourishing**

Living a meaningful life guided by virtue and excellence.

**Phronesis** – Habit of making wise decisions for the common good.

## **Eastern vs. Western Views**

**Eastern** – Community-centered, self-sacrifice, Confucianism, Bushido.

**Western** – Individual-centered, Aristotle's eudaimonia as life's ultimate goal.

## **Techne and Episteme**

**Techne** – Practical knowledge (craft, applied technology).

**Episteme** – Theoretical knowledge (science, understanding).

**Connection** – Techne gives skills, Episteme gives theory; both needed for progress.

### **I. When Technology and Humanity Cross**

\* Technology: Derived from Greek techne (art) and logos (word); literally means a "discourse on arts."

\* Service Robot: A robot that performs useful tasks for humans or equipment, excluding industrial automation.

\* Examples: Domestic servant robots, automated wheelchairs, and pet exercising robots.

\* Asimov's Three Laws of Robotics:

\* First Law: A robot may not injure a human or, through inaction, allow a human to come to harm.

\* Second Law: A robot must obey orders given by humans, except where such orders conflict with the First Law.

\* Third Law: A robot must protect its own existence as long as such protection does not conflict with the First or Second Law.

\* Bill Joy's Warning: Argued that 21st-century technologies—Genetics, Nanotechnology, and Robotics (GNR)—pose a threat because of their ability to self-replicate, which could lead to a future that "does not need us."

\* Paul Gottlieb Nipkow: A German student who invented the "electric telescope" (with 18 lines of resolution), a precursor to the modern television.

## II. The Information Age

\* Information Age: Also known as the Digital Age or New Media Age; a period starting in the last quarter of the 20th century where information became effortlessly accessible through computers and networks.

\* Communication: Email has become the primary platform for personal and workplace interaction.

\* Information Overload: While accessibility is high, it often leads to difficulties in verifying the quality and truthfulness of data (e.g., "fake news").

## III. Biodiversity and Healthy Society

\* Biodiversity: From the Greek bios (life) and Latin diversitas (variety); it is the variety of life on Earth, including species count, genetic variety, and ecosystem diversity.

\* Evolution: A mechanism allowing organisms to develop favorable traits for survival, making them distinct from other species.

\* Biodiversity Hotspots: Regions with high species diversity and many endemic species (found nowhere else) that are also significantly threatened.

\* Health Connection: Biodiversity secures food, health, and livelihood. Many modern drugs (e.g., painkillers and cancer treatments) are derived from natural products found in various ecosystems.

\* Consequences of Loss: Biodiversity loss is linked to an increase in pathologic conditions like diabetes, hypertension, and cardiopulmonary diseases.

## IV. Genetically Modified Organisms (GMOs)

\* GMO: A living organism (animal, plant, or microbe) whose DNA has been transformed or changed through genetic engineering techniques.

\* Three Common GMO Crop Traits:

\* Resistance to damage from insects.

\* Resistance to plant viruses.

\* Tolerance to herbicides (weed killers).

\* Key Examples:

\* AquAdvantage Salmon: Engineered to mature faster than non-GMO salmon.

\* Humulin: A form of human insulin produced by genetically modified bacteria to treat diabetes.

\* GMO Cotton: Used in the textile industry for fabric production.

\* Environmental Impact:

\* Superweeds and Superbugs: Pests and weeds that have developed resistance to the poisonous substances used on GMO crops.

\* Herbicide Use: The use of toxic herbicides has increased fifteenfold since GMOs were first introduced.