STS

PRE-COLONIAL SCIENCE AND TECHNOLOGY:

Early Human Settlements:

Arrival of homo sapiens in Palawan and Batangas around 50,000 years ago. Stone and Metal Tools: Transition from stone tools to metal tools (copper, gold, bronze, iron) by the Iron Age (2nd century B.C. to 10th century A.D.).

Agriculture:

Cultivation of lowland rice and terraced farming in the Cordillera. Use of irrigation systems. Pottery: Advanced pottery making, competing with Chinese porcelain.

Boat-building:

Development of caracoa, a plank-built warship used for coastal trade and inter-island raids. Filipino expertise in seamanship and boat-building was recognized by the Spanish.

Trade Relations:

Trade with China (10th to 15th century), Vietnam (Champa), and Borneo. Exchange of goods like beeswax, cotton, true pearls, and porcelain.

Technological Skills:

Early Filipinos developed skills in weaving, smelting iron, and pottery. Building of fortifications (Mindoro's stone wall) and artillery production in Manila.

Simple Living:

Technological development was simple, driven by subsistence economies and the abundance of natural resources.

Scattered, Autonomous Communities:

The Philippines had many self-sufficient communities (barangays) before the arrival of the Spaniards in 1521.

Simple Technological Development:

Early Filipinos had a basic level of technology, which was sufficient for their needs compared to neighboring countries like China and Japan.

Stone and Iron Age:

Around 3,000 B.C., they were using adzes, seashell ornaments, and creating pottery. By the Iron Age (2nd century B.C. to 10th century A.D.), Filipinos were producing iron tools and were engaged in smelting and refining iron.

Pottery:

Pottery was a significant craft that thrived for about 2,000 years but later declined due to competition with Chinese porcelain.

Agriculture: The cultivation of lowland rice and the use of diked fields and terraced farming in the Cordillera region.

Boat-building Technology:

The Filipinos had developed the caracoa, a plank-built warship used for inter-island trade and defense. This was noted as highly sophisticated by Spanish chroniclers.

Trade Relations:

Butuan traded with Champa (Vietnam), and the Ma-i community (likely Mindoro) traded with China. The pre-colonial Filipinos traded beeswax, pearls, tortoise shells, and other local products in exchange for Chinese goods like porcelain and iron.

SPANISH REGIME

Reduccion Policy:

Religious and military strategy used by the Spanish to consolidate barangay communities into towns for easier religious conversion and governance. This led to the formation of the modern local government system (e.g., cabezas de barangay).

EDUCATIONAL SYSTEM

Primary Education:

Mostly religious instruction managed by parish priests and missionaries in towns and villages. Lack of qualified teachers, textbooks, and instructional materials limited the scope of education.

Higher Education:

Established by religious orders, focusing on theology, law, and philosophy.

Key institutions include:

University of Santo Tomas (UST): The highest institution of learning, which started with theology and philosophy and later expanded into medicine (opened in 1871) and pharmacy.

Jesuit Colleges:

Established schools like the Ateneo de Manila (1859), offering liberal arts education.

Colegio de San Juan de Letran (1640):

Another significant institution run by the Dominicans. Access to education was highly restricted, with Filipinos receiving limited opportunities compared to the Spanish and mestizos.

Medical and Scientific Developments:

Limited science education: Few courses in science subjects like physics, chemistry, and natural history, with very limited practical training.

Medicine and Pharmacy: The UST Faculty of Medicine opened in 1871, with the first graduates in 1886. Pharmacy graduates were few (e.g., Leon Ma. Guerrero was among the first Filipino pharmacists and is considered the Father of Philippine Pharmacy).

Research on Diseases: Missionaries and friars carried out basic research on infectious diseases like smallpox, cholera, and leprosy.

Publications: Notable works like Manual de Medicinas Caseras by Father Fernando de Sta. Maria cataloged traditional medicinal practices using local plants. Technological Progress in Construction:

Town Planning: Spaniards introduced urban planning, constructing towns with churches, convents, and public buildings using brick, stone, and tiles.

SCIENCE AND TECHNOLOGY DURING THE FIRST REPUBLIC (1898-1900)

Minimal Development:

There was little progress in science and technology due to the short-lived nature of the First Republic.

Educational System:

- The government issued a decree on October 19, 1898, establishing a secular educational system.
- Creation of the Universidad Literaria de Filipinas as a state-supported institution.
- The university offered courses in law, medicine, surgery, pharmacy, and notary public.
- Despite its brief existence, the university held a graduation ceremony in Tarlac on September 29, 1899, where degrees in medicine and law were awarded.

AMERICAN REGIME

Public Education System:

Act No. 74 (1901):
Created the Department of Public Instruction, which established a system of free primary education using English as the medium of instruction.
Philippine Normal School: Trained Filipino teachers to serve in the public school system.
Secondary Schools: Introduced after 1902, with a focus on practical and scientific education.
University of the Philippines (UP): Created in 1908 by the Philippine Legislature to provide higher education in agriculture, engineering, medicine, and law.
UP College of Agriculture (1909): Became a leading institution for agricultural research. UP College of Engineering and Veterinary Medicine (1910) and College of Law (1911) followed. The university quickly expanded to include forestry, pharmacy, tropical medicine, and public health by the 1920s.
Vocational and Industrial Education: Manila Trade School (1901):

Focused on vocational training, but Filipinos generally preferred professional courses like law and medicine.

Scholarships:

Offered to attract students into less popular fields like agriculture, engineering, and veterinary medicine to meet government demand for technical skills.

Pensionado Program:

1903-1912:

The government sent Filipino students (pensionados) to study in U.S. universities, specializing in areas like medicine, engineering, and agriculture. The goal was to create a technically skilled workforce for public service.

Scientific Research Institutions:

Bureau of Science (1905):

The primary research institution responsible for:

- Medical research on diseases like cholera, tuberculosis, malaria, and leprosy.
- Agricultural research on tropical crops and mineral resources.
- Chemical analysis for industries like sugar refining and road construction.
- Published the Philippine Journal of Science from 1906.

Weather Bureau (1901): Provided meteorological data and typhoon warnings.

Bureau of Mines (1900): Conducted research on Philippine mineral resources.

Bureau of Forestry (1900): Focused on sustainable forest management.

Bureau of Health (1898): Dealt with public health issues and coordinated with the Bureau of Science for disease research.

Public Health Initiatives:

- The Americans prioritized public health, establishing a network of public health facilities.
- Philippine Medical School (1905): Trained doctors and health professionals, absorbed into the UP system later. Scholarships for doctors and nurses to study in the U.S. for specialized training.
- Rockefeller Foundation Fellowships: Supported further medical research and postgraduate training in public health.

Engineering and Infrastructure:

- **Bureau of Public Works (1901):** Americans found a shortage of Filipino engineers, so scholarships were offered for engineering education.
- By 1925, Filipinos had replaced most American engineers in the Bureau of Public Works, contributing to infrastructure projects like roads, bridges, and public buildings.

Economic and Industrial Impact:

- The economy remained agricultural and export-oriented due to free trade agreements with the U.S.
- Industrialization was slow, with agriculture and raw materials continuing to dominate exports.
- Government Research: Focused on improving agricultural productivity, with less emphasis on industrial research.

Science and Technology Agencies:
Several new agencies were created to promote scientific research:

- Bureau of Plant Industry (1929)
- Bureau of Animal Industry (1929).
- Bureau of Coast and Geodetic Survey (1905): Conducted geographic surveys of the archipelago.

Science in Agriculture:

- UP College of Agriculture: Research on rice cultivation, sugarcane, coconut, and hemp. –
- Introduction of modern agricultural techniques through research stations across the country.

DURING COMMONWEALTH PERIOD

Science and Technology during the Commonwealth Period (1935-1946):

Political and Economic Context:

- The Commonwealth was a transitional government aimed at preparing the Philippines for independence from the United States.
- Article XIII, Section 4 of the 1935 Constitution explicitly stated: **"The State shall promote scientific research and invention,"** underscoring the government's commitment to science and technology as part of its broader strategy for economic development.
- The focus was on achieving economic self-reliance, which would be necessary to sustain genuine political independence.

Educational Expansion:

- The government continued to expand the public school system to accommodate more students. Grade VII was abolished to streamline the elementary curriculum, making room for more students in schools.
- The government introduced the **"double-single session"** plan to increase school capacity, although this reduced time for teaching certain subjects.
- **Higher Education:**
    - By 1936, there were 425 private schools in the country, of which 64 were colleges, and 7 were universities.
    - Key institutions included Centro Escolar University, Far Eastern University, Silliman University, Philippine Women's University, University of Manila, National University, and the University of Santo Tomas.
    - University of the Philippines (UP) continued to grow and remained the leading public university, alongside these private institutions.

Scientific Research and Government Agencies:

- The Commonwealth government worked towards the development of economic self-reliance, creating several government corporations and agencies to promote research and industry:
    - **National Economic Council**: Tasked with preparing economic programs and advising the government on economic and financial matters.
    - **National Development Company (NDC):** Created to commercialize the results of scientific research from agencies like the Bureau of Science and the Bureau of Plant and Animal Industry. Its role was to turn research into industrial production.
    - **Bureau of Mines:** Promoted mining exploration and development, focusing on utilizing the country's mineral resources.

Scientific Research and Agriculture:

- The Commonwealth government increased appropriations for the Bureau of Science, Bureau of Plant Industry, and Bureau of Animal Industry to promote more agricultural research.
- These agencies were tasked with conducting scientific research to improve agriculture, develop industries, and support the local economy.
- Focus on improving crop yields, preventing disease in livestock, and enhancing agricultural productivity through scientific methods.

Key Scientific and Technological Developments:

- **Research in Agriculture:** The focus was primarily on agriculture, including rice cultivation, sugar production, and hemp.
- **Industrialization Efforts:** Despite scientific research efforts, industrial development remained limited due to continued dependence on agricultural exports and foreign control of key economic sectors.

Challenges and Limitations:

- **Limited Economic Self-reliance**: Although there was a push for self-reliance, the Philippines was still heavily tied to the U.S. economy due to free trade agreements. This meant that the country remained an exporter of raw materials and agricultural products rather than industrial goods.
- **Japanese Occupation:** The Pacific War (1941-1945) and the Japanese occupation of the Philippines severely disrupted scientific and educational activities. Many institutions were destroyed, and research was halted.
- **Manila's Destruction:** Manila, the center of education and scientific research, was devastated during the liberation battles, destroying much of the infrastructure necessary for science and technology.

SINCE INDEPENDENCE

Post-War Context:

- Independence was achieved in **1946**, but the country faced significant challenges, including rebuilding after **World War II**, and restructuring its educational and scientific institutions, many of which were destroyed during the war.
- Manila was devastated during the war, and much of the infrastructure for science, education, and technology had to be rebuilt.

State of Education and Training:

- The structure of education and training for scientists, engineers, and professionals established during the American regime largely continued after independence.

- State support for education remained focused on elementary education, while private colleges and universities played a significant role in providing higher education.
- **State Universities and Colleges (SUCs):**
    - The number of SUCs increased significantly after independence, but many lacked proper funding and resources. Their growth was often driven by political considerations rather than a strategic plan.
    - **University of the Philippines (UP)** remained the **most developed institution**, with extensive programs in science and engineering.
- **Private Universities:**
    - Private universities also **expanded after 1946,** but standards varied widely.
    - Many focused on low-cost courses like business administration, liberal arts, and education, leading to high enrollments in these areas.

Scientific Research and Development Agencies:

- **Bureau of Science** was **reorganized into the Institute of Science in 1947 and later renamed the Institute of Science and Technology (IST) in 1951**. The IST was tasked with conducting industrial research and improving industrial processes.
- **Commission on Volcanology** was established in **1952**, focusing on **volcanic research.**
- **The U.S. Economic Survey Mission (1950)** highlighted the lack of basic information for industrial development and recommended improving research efforts in natural resources.

National Science Development Board (NSDB):

- **In 1958, the Science Act created the National Science Development Board (NSDB) to:**
    - Formulate policies for scientific research.
    - Coordinate activities of existing science agencies.
- The NSDB was responsible for overseeing research and development in various sectors, including agriculture, industry, and public health.

Key Science Agencies and Institutes:

- **Philippine Atomic Energy Commission (PAEC):** Established under the **Science Act of 1958,** focusing on nuclear research and its applications in energy and medicine.
- **National Institute of Science and Technology (NIST):** Created to expand research on industrial development.
- **Forest Products Research and Industries Development Commission (1969):** Focused on research related to forest products. Professional Organizations: The rise of professional organizations for scientists, engineers, and medical professionals followed closely after the expansion of higher education.

    - These organizations helped in self-regulation, influencing curricula and standards of practice in their respective fields.
    - Examples include the Philippine Medical Association (PMA), which actively worked to improve medical education and training.

Educational and Policy Challenges:

- **Brain Drain:** One of the major challenges faced post-independence was the migration of highly trained professionals (scientists, engineers, physicians) to other countries for better opportunities, resulting in a brain drain.
- **Mismatch in Education and Industry:**
    - While the number of science-based graduates increased, the underdeveloped economy could not provide enough jobs for these professionals, leading to unemployment and underemployment.
    - Most graduates in science, agriculture, and engineering ended up migrating or shifting to non-science-related fields due to lack of local opportunities.

Expansion of Research Institutions:

- In the 1960s and 1970s, several new research institutions were established, including: **Philippine Textile Research Institute (1967).**
- **Philippine Coconut Research Institute (1964):** To focus on the country's coconut industry, one of its most important agricultural products.
- **Metals Industry Research and Development Center (MIRDC):** Focused on developing the metals industry.

Further Developments in the 1980s:

- **National Science and Technology Authority (NSTA):** In **1982**, the **NSDB** was **reorganized into the NSTA,** consisting of four research and development councils:
    1. Philippine Council for Agriculture and Resources Research and Development (PCARRD).
    2. Philippine Council for Industry and Energy Research Development (PCIERD).
    3. Philippine Council for Health Research and Development (PCHRD).
    4. National Research Council of the Philippines (NRCP).
- **Centers of Excellence: In 1983, six new National Institutes of Basic Sciences were established**, including institutes for physics, geology, chemistry, biology, mathematics, and natural sciences research.
- **Scientific Career System:** A scientific career system was introduced in 1983 to encourage young people to pursue careers in science and engineering by improving career opportunities and promoting professional development.

Post-Independence Economic Development:

- Despite the focus on scientific research, the Philippine economy remained largely agricultural and dependent on exports of raw materials.
- Philippine Industrialization was delayed due to continued dependence on foreign markets, particularly U.S. trade relations.

Challenges with Coordination:

- Science policy was not well coordinated with economic policy. While efforts were made to boost scientific research, the economy's reliance on agriculture and raw materials limited the development of physical sciences and industrial research.

Key Points and Keywords:

- Independence in 1946: Post-war rebuilding of education and scientific institutions.
- Institute of Science and Technology (IST): Reorganized from the Bureau of Science to improve industrial processes.
- National Science Development Board (NSDB): Established in 1958 to promote and coordinate scientific research.
- Philippine Atomic Energy Commission (PAEC): Focused on nuclear research.
- Professional Organizations: Helped in the self-regulation of professions like medicine, engineering, and science.
- Brain Drain: Highly trained professionals migrated due to lack of local opportunities.
- National Science and Technology Authority (NSTA): Replaced the NSDB in 1982, with a focus on agriculture, health, industry, and energy research.
- Centers of Excellence: Created in 1983 to promote basic sciences.
- Scientific Career System: Launched in 1983 to promote careers in science and engineering.