Technology

- **Meanings of Technology**
- The word "technology" encompasses essentially five meanings:
  - The specific configuration of techniques and thus machinery and equipment designed for the production processes or for the provision of services, which can be summarized under the term "technical hardware". In other words, they include *tools and instruments* that enhance human ability to shape nature and solve problems;

- The scientific and technical knowledge, formal qualifications and experience-based knowledge, which can be entitled "know-how"; that is the *Knowledge of how to create things or how to solve problems (such as to formulate drugs, brew coffee or to make an atomic bomb)*;

- The **management methods** used to link technical hardware and know-how, known as "organization";

- The physical good or service emerging from the production process – the "product".

- *Culture (our understanding of the world, our value systems).*

- Historically, the emergence of human civilization has been closely connected to the development of tools for hunting, agriculture, irrigation and water management, and navigation.

- In the second meaning which equates technology with knowledge, technology becomes the understanding of how to make and use tools and instruments and suggests that the knowledge is transmissible as technological knowledge and know-how.

- Related to this second meaning of technology is the development of modern scientific knowledge, based on empirical observations, hypotheses, and generalizations on the natural laws concerning the behaviour of materials and the living environment.

- Technology is understood within the context of culture. Technology has permeated society to such an extent that separation between technology and culture is no longer meaningful.

- All human activities, like housing, nutrition, transportation, work, leisure, even art and imagination, become heavily enmeshed with technology.
- We "own" products of technology by a process of "cultural appropriation", in which the use of technologies is learned, interpreted, and given meaning in everyday life. (Hard and Jamison, 2005).
- We are living in a "culture technique" in the sense that our deepest and most private knowledge and emotions are permeated by technology.

- The transition from technology as tool-use to knowledge began around the emergence of the first industrial revolution, more than two centuries ago.

- The transition to technology as culture accelerated after the Second World War, and is closely related to the rise of information and communication technologies, biotechnology, computers, and the Internet.

- the term technology reflects four different dimensions as summarized by Hillebrand (1994b: p. 4): 1. 2. 3. and 4.

- **Science and Technology Contrasted**
- In contrast to technology, science is seen as an organized search for "truth" and "objective knowledge" about reality and the laws of nature.
- Science can be characterized by a rigorous methodology exemplified by Popper's claim that science is an unending process of conjecture and falsification.
- In practice, the boundaries between modern science and technology have become blurred; moreover, modern philosophy of science treats scientific knowledge to a certain extent as "socially constructed".

- **Technological Innovation**
- Technological innovation is generally understood as bringing a new product, process, or service successfully to the market, meaning that it can be sold for a profit (Freeman, 1997).
- Technological innovation thus goes beyond invention, which depicts the elaboration and prototyping of a new technological principle; it is related to diffusion, which refers to the spread of new technology into the wider society.
- Of course, innovation is by no means identical with creating the physical conditions for a "good life".
- Because of companies' profit motives, as well as unintended and unforeseen consequences, technological innovation can be both positive and negative.

- ***The Paradoxes Of Technological Development***
- The effects of technology underlie early twenty-first century global challenges.
- On the one hand, since the Enlightenment, technology, especially science-based technology, has offered the promise of a better world through the elimination of disease and material improvements to standards of living.
- On the other hand, resource extraction, emissions of dangerous materials, and pollution of air, water, and soil have created conditions for unprecedented environmental catastrophe and have already caused irreversible damage to the biosphere.
- While the future might promise a vast acceleration of technological innovation, the scale and impact of environmental degradation may reflect this vast acceleration as well.

- A related painful paradox is that, despite the ongoing technological revolution, the majority of the world population still lives in abject poverty with inadequate food, housing, and energy, plagued by illnesses that could be easily cured if clean water and simple drugs were made available.

- Fortunately a significant number of former "developing" countries are now on the threshold of development, helped by technology transfer and technological innovations that have benefited large parts of their populations.

- Some countries, such as China, India, Korea, Taiwan, Singapore, and, to a certain extent, Brazil, have followed their own technological trajectories.

- However, for large populations in Africa, Asia, and Latin America the benefits of technology remain a dream, even if new technologies like photovoltaic cells (**type of photoelectric cell:** a photoelectric cell that detects and measures light intensity using the potential difference that arises between unlike materials when they are exposed to electromagnetic radiation), cellular phones, and the Internet could help them "leap-frog" towards the twenty-first century.

- The persisting contradictions between a better life created and supported by technology for the wealthy few, and increasing environmental degradation and persistent poverty for the vast majority calls for a deeper exploration and understanding of the nature of technology and its relationship to society, especially to a sustainable society.

- In the context of the effort to catalyze a *Great Transition* to a sustainable global society, in which deep changes in culture, values, consumption patterns, governance, business, and institutions are envisaged (Raskin et al., 2002), questions about the role of technology become even more pressing.

- For example, would a *Great Transition* society require an intensive use of technology to abate the environmental degradation of the ecosphere, or might technology play a much more modest role in such a society?

- Would that society essentially return to the time before the first industrial revolution when technology offered a limited, incremental extension of human capacity to transform nature?

- In either of these visions we must ask how to imagine the development of technologically and economically underdeveloped countries.

- **Drivers of technological change**
- The main actors that drive technological change are:
- ➢ **Governments**
- Governments at all levels rank high among the most important drivers of technological change.
- Governments will play important roles by regulating adverse technological consequences, investing in research and development (R&D) and in new technological innovative forms, purchasing sustainable products and services in order to pave the way for broad market introduction, setting criteria that foster sustainable and appropriate technologies, curbing excessive private interests-driven research, setting long-term goals, and communicating about science and technology issues with the public at large.

➢ **Citizens-consumers**

- The second most important drivers of technological change are the citizens-consumers.

- A strong Global Citizens Movement (GCM) and a progressive change in dominant societal values (Kates et al., 2006) has raised awareness among consumers that their lifestyles were not only unsustainable, but also unhealthy and stressful, which prevents them from feeling happy and fulfilled. Shorter working weeks, more walking, biking, and playing, that is to say, less stress and more exercise, have become broadly accepted as desirable consumer products.

- **Citizens' Self-organizing Groups (SOGs) and NGOs**
- Citizens-consumers organize themselves in ways that foster the public good.
- These organizations and institutions, formerly known as non-governmental organizations (NGOs), have been aptly renamed citizens' self-organizing groups (SOGs), or in some places in the world, like India, as self-help groups (SHGs).
- SOGs are organized around each and every issue for which a demand exists, from transportation and housing, to sustainable food and shopping, to health and medical care, to environmental issues.
- The Internet and ICTs are again very instrumental in forming and developing these groups.
- Early forerunners could be seen in early twenty-first century as eBay and a host of chat groups and email lists.

- **Business**
- Business can be divided into big multinational corporations (MNCs), small and medium-seized enterprises (SMEs), and emerging new firms (mainly science-based or service-oriented).
- Large MNCs were curbed because a world government emerged that enforces the rule of law.
- The World Trade Organization, in combination with the World Court and some parts of the UNO, have jointly developed into a much more socially oriented world government system that is committed to sustainable development, equity, and justice.

- **Education**
- Deep changes are needed in high school and college education on science, technology, and sustainability.
- The history of technology, the differences among technologies in various cultures, the social shaping of technological artifacts, the societal processes and decision structures that shape technological innovations, and the consequences of technology for society should be taught in ways that engage students in a deeper understanding of technological change processes.
- Similarly, sustainability needs to be taught in a holistic way, connecting technology with institutions and values, ecology with economy and society, consumers with producers and governments, short term with long-term, well-being with equity, and differences between cultures with global values.

- **Communication**
- Communication media are dominated by commercial advertisements promoting the fruits of technological innovation in the form of desirable consumer products that are absolutely necessary for a good life and for "well-being".
- The media could become another driver for a transition to sustainability, if it could address issues of sustainability in an integrated and holistic way, understanding the mass culture, but trying to strengthen its sustainability.
- Communication about really sustainable forms of need fulfillments would be the way to do it.

❖ Factors that drive technological development

- Technology development has been the result of interplay of many factors:
- Scientific discoveries,
- Changing business self-image and interests,
- Changing consumer demand,
- Government regulation,
- The global citizens movement, emerging institutions and paradigms, and
- Ultimately changing dominant values.