



## The Role of Science Museums and Centres in Public Literacy and the Status of ECO Region

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Science Education Policy Forum: Science Literacy, the role of Science Museums and Centers

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## ECO Science Foundation (ECOSF) and the ECO Region?

10 Member States with Good Natural Resources





## ECO Regional Snapshot

Variable	Unit	Quantity	% Share of the World
<b>Population</b>	Million	<b>496</b>	<b>6%</b>
<b>Area</b>	Million Sq. kM	8	2%
<b>GDP Nominal</b>	\$US Trillion	\$ 1.78	2%
<b>GDP Purchasing Power Parity</b>	\$US Trillion	\$ 4.98	4%
<b>Primary Energy Consumption</b>	MTOE	927	10%
<b>Oil Reserves</b>	Billion Barrels	1968	12%
<b>Gas Reserves</b>	Trillion CU M	48	25%
<b>Annual Trade Volume</b>	Billion	\$600	-
<b>Annual Intra-regional Trade</b>	Billion	\$58	-

Source: World Bank, BP Statistical Review of Energy 2015, ECO Secretariat & Ministry of Foreign Affairs Pakistan



## Objectives of ECOSF

- Promote and fund STI research collaboration leading to Economic Development among the member states
- Popularize Science at grass root level (IBSE – Teachers Workshops, Travelling Science Expos, Science Camps, STI Fairs & STEM Policy Forums etc.)
- Harmonize Science, Technology and Innovation policies of ECO countries

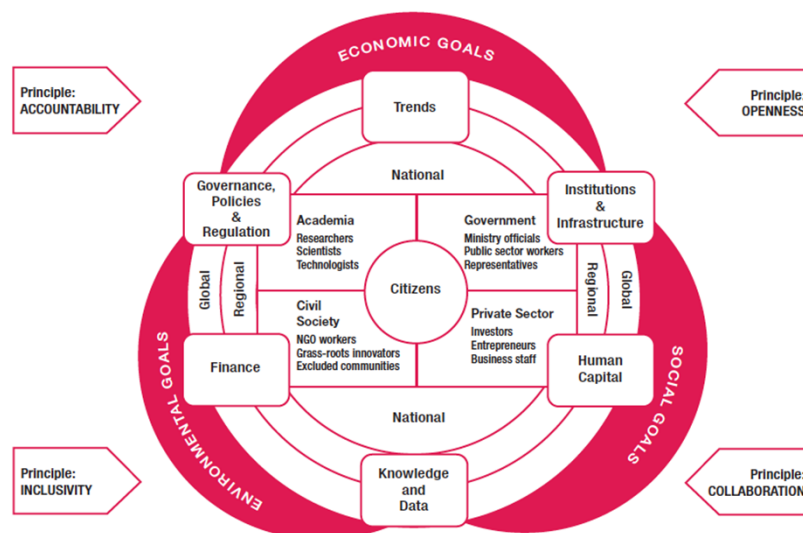
## Promotion of Science and Technology for Sustainable Development of the ECO Region



**ECOSF** pursues the goal of promoting research and technological development for sustainable development and economic growth in the ECO region through the following key objectives:

- ❖ Development of **Human Resource Capacity** for science, technology and innovation as well as science education and engineering in the ECO region.
- ❖ Strengthening **Institutional Capacity** in scientific research and technological development among its members.
- ❖ Scientific, Technological and Research **Collaboration and Cooperation** among its member states and the developed world.
- ❖ Exchange (**Dissemination**) of Information on Scientific and Technological Research and Development through workshops, conferences and meetings etc.

## An STI framework for Sustainable Development



## Emergence of Rational and Scientific Thought: Greek Philosophers

- ❖ The emergence of “Scientific or Rational Thought” changed the way people looked at the world.
- ❖ The Ancient Greeks developed philosophy as a way of understanding the world around them
- ❖ Early Greek philosophers and scientists observed and studied the Earth, Seas and Mountains as well as the Solar system, Planetary motion, and Astral phenomena.
- ❖ Ancient Greek scientists have many inventions and discoveries attributed to them, especially in the areas of Astronomy, Geography, and Mathematics.

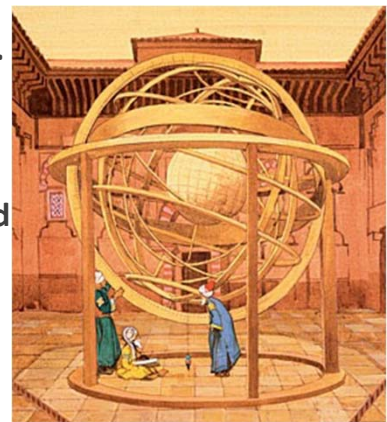
Source: www.thoughtco.com

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## Age of Reason: Golden Age of Islam

- ❖ The Islamic Golden Age (8<sup>th</sup>-15<sup>th</sup> century), was a period of **cultural, economic and scientific flourishing in the history.**
- ❖ Abbasid Caliph Harun al-Rashid established a **House of Wisdom** in Baghdad- a dedicated space for scholarship.
- ❖ He recruited famous scholars to the House of Wisdom; **Muslims, Christians and Jews, all collaborated and worked peacefully there.**
- ❖ A **translation movement** was encouraged, a formal translation of scholarly works from Greek into Arabic took place.
- ❖ **Greek texts, such as Aristotle’s works,** were made available to the Arab/Islamic world.



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## Age of Reason: Golden Age of Islam (Cont....)

- ❖ Scholars living in Baghdad during the Abbasid Caliphate contributed to the **preservation of Greek and other existing knowledge about Philosophy, Astronomy, Medicine, and many other disciplines.**
- ❖ These scholars contributed new insights in their fields and **ultimately passed their discoveries along to Europe.**
- ❖ **Ibn al-Haythm** invented the **first camera** and was able to form an explanation of how the eye sees!
- ❖ Doctor and philosopher **Ibn e Sina** wrote the **Canon of Medicine**, which helped physicians diagnose dangerous diseases such as cancer.
- ❖ And **Al-Khwarizmi**, a Persian mathematician, **invented Algebra**, a word which itself has Arabic roots.

Source: The Khan Academy

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## Enlightenment: Scientific Revolution in Europe

- The Islamic and Arab scientific work was passed on to foster the creation of a new intellectual movement in the late 17<sup>th</sup> and early 18<sup>th</sup> centuries in the Europe, commonly referred as "**Enlightenment**"
- The Enlightenment's core tenet was that natural law could be used to examine and understand all aspects of society
- This critical analysis of everything in society from religion to politics and the optimism that the human mind could find the solution to everything was known as the **Enlightenment**
- Copernicus, Galileo, and Newton developed a new concept of a **universe based on natural laws**
- The new scientific approach promoted **critical thinking**, and **nothing was to be accepted on faith!**

Source: The Scientific Revolution and Enlightenment

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## Scientific Revolution to Industrial Revolution

- Scientific and Industrial Revolution had a profound impact on society and brought **significant social change and the impact on lives**
- Radical transformation led to to **legitimate public communication of science and technology** as a distinct practice
- Inability of scientists to address the public, to be able to share the **'immense powers that knowledge brings'**
- **'Need for Mediators'**, who would serve as intermediary between the scientific community and the general public
- **Science museums and centres served to bridge the knowledge gap between science and society**

Source: The British Museum

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## History: Science Museums



Earlier, many aristocrats collected curiosities for display to their family. Universities and particularly medical schools also maintained study collections of specimens for their students. Scientists and collectors displayed their finds in private cabinets of curiosities. Such collections were the predecessors of modern natural history museums.

- 1683 - Ashmolean museum (now called the Museum of the History of Science) in Oxford
- 1752- Museo de Ciencias Naturales, in Madrid, Spain.
- 1851- The Crystal Palace , London
- 1856- The Academy of Science of Saint Louis , Mississippi
- 1864- New England Museum of Natural History, (now the Museum of Science), Boston

Source: Nishi Goyal, Seema Mehta, Angela Thomas Priyanka Rakesh

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## Science Literacy?

**American Association for the Advancement of Science (AAAS)**

**Project 2061: Science for All Americans:** *“A science-literate person is one who understands key concepts and principles of science, is familiar with the natural world and recognizes both its diversity and unity, and uses scientific knowledge and scientific ways of thinking for individual and social purposes”*

**E. K. Henriksen and M. Frøyland (University of Oslo):** *“Being scientifically literate means not only having an understanding of a range of scientific concepts and processes, but also being able to apply this understanding, together with one’s own experience and values, to a range of science-related matters in private or civic life”*



## Four main arguments for pursuing scientific literacy in the population

1. **Practical argument:** People need an understanding of science and (even more) technology to handle everyday life in a science- and technology-dominated society;
2. **Civic Argument:** People need an understanding of science to relate to the many complex science-related issues that confront citizens of modern democracies- **e.g., Climate Change**
3. **Cultural argument:** Science is part of our cultural heritage and has profoundly influenced our view of the world and of humankind’s place in it; thus, one needs a grasp of what science is in order to understand culture.
4. **Economic argument:** A scientifically literate workforce is necessary for a sound and flourishing economy in most countries.

## How do we improve Science Literacy through Science Museums and Centers?



E. K. Henriksen and M. Frøyland (2000) argue that:

- ❖ Traditional role for museums has been suited mainly to improving the **cultural aspects** of scientific literacy **by displaying exhibits**, illustrating scientific concepts and celebrating scientific advancements and the economic/professional aspect, through **motivating youth for careers within science and technology**.
- ❖ In the present situation, it is no longer enough for museums to contribute to the cultural and professional/economic aspects of scientific literacy.
- ❖ Innovative ways of using the museums' collections and expertise, need to be conceived to realize museums' potential to contribute to the civic & practical aspects of science literacy.

Thus, promotion of scientific literacy could no longer be seen as the **exclusive responsibility of schools** and other agencies of formal education, but **museums and science centers can play an increasing part in promotion science literacy!**

Source: E. K. Henriksen and M. Frøyland (University of Oslo) Economic Cooperation Organization Science Foundation

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## Important Role of Science Museums and Science Centers



*"The holy grail of science museums is not to provide someone all the knowledge they need, but to inspire them, to become a launching point,"* says John Falk, an Ohio State Univ. Professor of Science Education

- Science Museums create an intense impact on science literacy of the general public.
- Enhance public understanding, attitudes and behaviors toward science and technology.



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## We Learn from Many Sources

Falk & Needham (2011):

"An individual's understanding of the physics of flight, for example, might represent the cumulative experiences of completing a classroom assignment on Bernoulli's principle, reading a book on the Wright brothers, visiting a science center exhibit on lift and drag, and watching a television program on birds. All of these experiences are combined, often seamlessly, to construct a personal understanding of flight; no one source is sufficient to create understanding, nor one single institution solely responsible"

Source: Professor Per-Edvin Persson

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## Learning in Science Museums and Centers

The authoritative and extensive review on informal science learning provided by the U.S. National Research Council (2009) concludes that there is compelling evidence of learning in designed settings, such as science museums & centres:

- There is evidence of excitement and positive emotional responses.
- There is clear evidence of learning science content.
- There is evidence of engagement and reflection.
- There is evidence of integrating science learning with values and identity.

Source: Professor Per-Edvin Persson

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## Learning in Science Museums and Centers



The report prepared by Frontier Economics (2009) for the British government concludes that:

- Science museums and centres may improve people's understanding of scientific issues,
- Change people's attitudes, and
- Encourage children to pursue careers in science.



Source: [www.peredvinperssonconsulting.com](http://www.peredvinperssonconsulting.com)

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## Collective Evidence



**The collective evidence strongly indicates that science museums and centres:**

- Strengthen science learning
- Enhance interest in science
- Strengthen motivation to learn science
- Affect attitudes towards science and technology positively
- Increase confidence in science
- Influence career choices by young people

**Science Centre visits however, may result in long-lasting memories, indicating a strong personal impact on visitors**

Source: [www.peredvinperssonconsulting.com](http://www.peredvinperssonconsulting.com)

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## Museums as Key Sites to Accelerate the Climate Change Education



- Museums have a key role in addressing a number of key policies and strategic issues, including the Climate change and Environmental issues
- Museums enjoy a high level of public trust in many cases
- This trust can be put to good use to help people critically interrogate information on Climate change
- Museums can provide arenas for dialogue around Climate change
- The Museum can equip citizens with tactical knowledge that enables participation in actions and debates on Climate change that affects their futures



Source: Henry McGhie, Manchester Museum, University of Manchester UK

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## Emerging Trends in Museum Sector to Accelerate the Climate Change Education



A growing number of networks are strengthening museums' contributions towards climate change education and action, for example:

- **The Coalition of Museums for Climate Justice** has nearly 900 members and participants. It mobilizes and supports Canadian museum workers and their organizations in building public awareness, mitigation and resilience in the face of climate change.
- **'We Are Still In'** is the largest coalition, worldwide, of subnational supporters of the Paris Agreement. The US-based voluntary association has a growing Cultural Institutions sector that engages museums and museum associations in support of UNSDGs.
- The **Museums and Climate Change Network** is an international community of interest, with 50 members.

Source: Henry McGhie, Manchester Museum, University of Manchester UK

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## Museums of Tomorrow (Industry 4.0)

- Technology is evolving at an exponential speed.
- A space is needed where leaders and citizens can come to together to **prepare for technological change** - rather than merely react to it.
- General Public and Policy Makers must be able to anticipate the changes of the Fourth Industrial Revolution and adapt quickly, and cities and communities must be able to do the same.
- **Museum should also be able to showcase technologies of the present and future** and provide opportunities for collaboration to co-design strategies for managing the change, whether it is understanding the impact of virtual reality, artificial intelligence, big data or the Internet of Things



Source: World Economic Forum

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## Scientific and Technological Contributions by the ECO Region



- The scientific culture developed during the Golden Age of Islam, Ottoman and Persian period established the scientific heritage of the present-day Turkey, Iran and Uzbekistan.
- They were at the core of major scientific achievements in the west in the fields of Astronomy, Mathematics, Engineering and Architecture etc.
- Ancient ECO region scientists and scholars showed remarkable success in developing science and were able to produce many works in various branches of science.



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## Science and Technology Museums in Turkey



### Technology Museums

- 1 Bursa Energy Museum, Busra
- 2 Çengelhan Rahmi M. Koç Museum, Ankara
- 3 Mersin Water Museum, Mersin
- 4 Museum of Illumination and Heating Appliances, Istanbul
- 5 Rahmi M. Koç Museum, Istanbul
- 6 SEKA Paper Museum, Kocaeli
- 7 Silahtarağa Power Station, Istanbul
- 8 Tayfun Talipoğlu Typewriter Museum, Eskişehir
- 9 TGC Press Media Museum, Istanbul
- 10 Tülomsaş Museum, Eskişehir

### Natural History Museums

- 1 Ali Demirsoy Natural History Museum, Kemaliye
- 2 Emirlar Archaeological Site and City Forest Museum, Mersin
- 3 Kırklareli Museum, Kırklareli
- 4 Natural History Museum of Ege University, İzmir
- 5 Natural History Museum of İhsan Ketin, Istanbul

### Science and Technology Museums

- 1 Feza Gürsey Science Center, Ankara
- 2 Museum of the History of Science and Technology in Islam, Istanbul
- 3 ITU Science Center, Istanbul
- 4 Kandilli Earthquake Museum, Kandilli
- 5 METU Science and Technology Museum, Ankara

Source: Wikipedia

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## Istanbul Museum for History of Science and Technology in Islam



- This museum opened in 2008, has been established on the basis of firm belief that the history of science and technology represents a common heritage of mankind.
- Islamic Culture Area is highlighted here by means of historical instruments, tools and devices.
- Principle that one should not lose sight of the fact that Muslims did not create these from scratch
- But they adopted at first the inheritance of the preceding cultures, above all, that of the Greeks and the early Byzantines, and then developed this inheritance further



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## Science and Technology Museums in Iran



- 1 Iranian National Museum of S&T
- 2 Natural History and Technology Museum of Shiraz
- 3 Natural History Museum of Isfahan
- 4 Sciences & Astronomy Center of Tehran
- 5 Tehran Biodiversity Museum
- 6 Maragheh Observatory
- 7 Iran Science Park
- 8 Professor Bazima Science Park
- 9 Natural Science Museum, Yazd
- 10 Water Museum



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## Science and Technology Museums in Pakistan



1. Pakistan Museum of Natural History, Islamabad
2. National Museum of Science and Technology, Lahore
3. PIA Planetarium, Karachi
4. PIA Planetarium, Lahore
5. PIA Planetarium, Peshawar
6. MagnifiSci Children Studio, Karachi (by The Dawood Foundation- TDF)
7. **TDF Science Center, Karachi** (under construction)



World's largest specimen of Whale-Shark on display!

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## Science Communication & Popularization in Pakistan



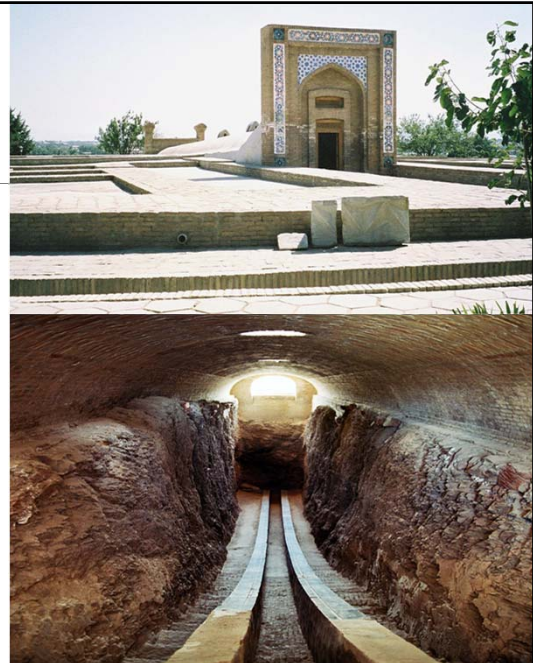
- The avenues for sharing of scientific thoughts and research outcomes amongst scientists, general public & policy makers for decision-making are simply not enough.
- Generally the interest in science is fizzling out among kids and the gap between science and society continues to widen in the country.
- Science communication and science journalism in Pakistan are still in their initial phases; Pakistanis are just getting familiar with the idea of “science for all”
- However, due to interesting, engaging and magnetic nature of science, people are always keen to know more – and this has the potential to brighten the future of science and technology in Pakistan.

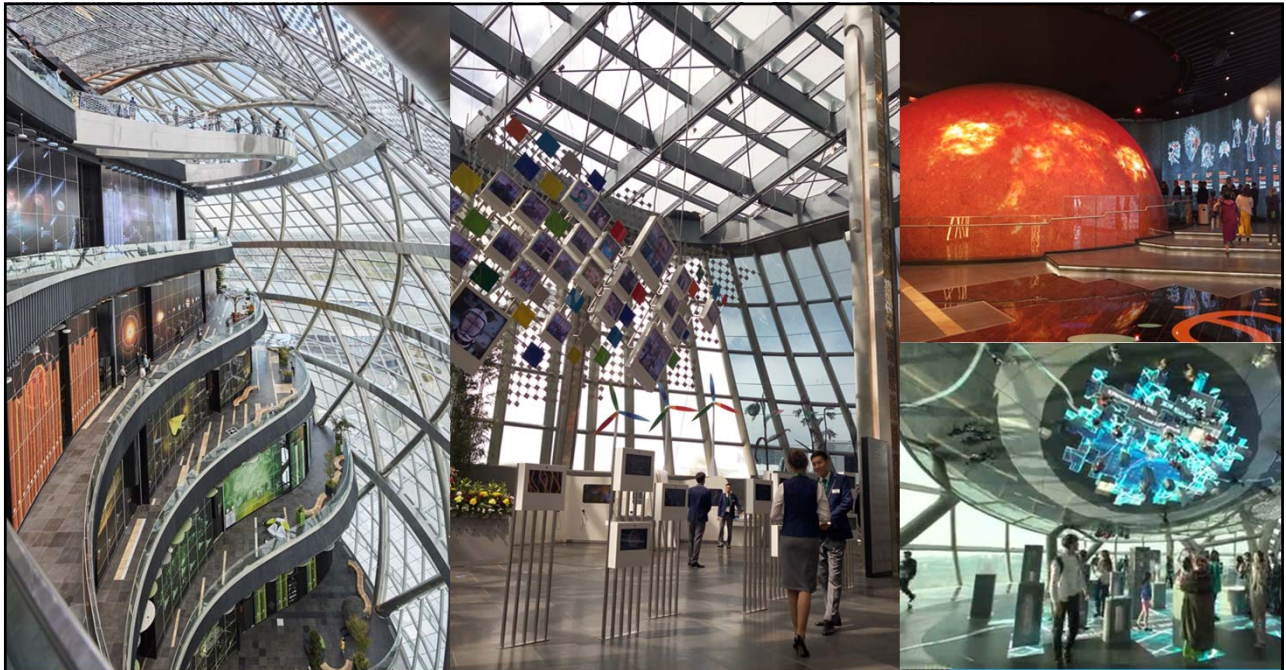
Source: Soomro, M.H., & Raza, K. (forthcoming/unpublished) 'Pakistan – The Initial Phases of “Science for All” '. In T. Gascoigne (ed.), The emergence of Modern Science Communication, ANU Press

## Ulugh Beg Observatory Samarkand, Uzbekistan

The Ulugh Beg Observatory in Samarkand- Uzbekistan:

- Built in the 1420s by the Timurid Astronomer Ulugh Beg, it is considered by scholars to have been one of the finest observatories in the Islamic World.
- Islamic astronomers who worked at the observatory include; Al-Kashi, Ali Qushji, and Ulugh Beg himself.
- The observatory was destroyed in 1449 and rediscovered in 1908; alas, it is now just a historic/archaeological site and a museum!





Kazakhstan Pavilion and Science Museum

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Last Drop of Oil

Kazakhstan Pavilion and Science Museum

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Palace of School Children/Youth, NurSultan (Astana)

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## Inquiry Based Science Education (IBSE) as an important Pedagogical approach



- ❖ Science education community mostly agrees that **pedagogical practices based on inquiry-based methods are more effective**
- ❖ IBSE is effective with all kinds of students from the weakest to the most able and is fully compatible with the ambition of excellence. It is an approach to life long learning skills.

## Launch of Inquiry Based Science Education- IBSE in the ECO Region- Nur Sultan (Astana), Kazakhstan (June 2015)



ECOSF in collaboration with *La main à la pâte* Foundation of France, ISTIC Malaysia, InterAcademy Partnership Science Education Programme- IAP-SEP and the Islamic Development Bank launched its the Capacity Building Programme to promote IBSE pedagogy at schools in the ECO Region.

**Thanks to LAMAP France & IAP-SEP (Dato Lee!)**



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## IBSE in Pakistan and Iran: Capacity Building Workshop for Master Trainers and Teachers (2016--- onwards)



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## Collaboration with China Association of Science and Technology (CAST)



### **BRISECC**

ECOSF, IAP SEP and AETDEW are collaborating with China Association for Science and Technology (CAST) since 2017 and the “Belt and Road International Advisory Committee (BRISECC)” has been established. Dato Lee and I are two of the Vice Presidents for promotion of non-formal science education for school teachers and children.

### **BRISECC Collaboration aims to promote:**



- ❖ Science educators and science researchers to inspire children’s and teenagers’ interests and curiosity in STI.
- ❖ Under the collaboration, two Teenager Makers Camp have been organized in Beijing in 2017 & 2018
- ❖ 3<sup>rd</sup> Teenager Makers Camp due in Sept 2019

# 1<sup>st</sup> Belt and Road Teenagers Makers Camp & Teacher Workshop, Beijing

14-20 December 2017



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# 2nd Belt and Road Teenager Maker Camp & Teacher Workshop, Beijing

15-21 November 2018



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# Need to promote Science Centres and Museums under BRI in Collaboration with CAST

## BRISECC

Perhaps a new dimension of Science Literacy through Science Centres and Museum would add value to BRISECC goals!?

## Strategic Partners of ECOSF



INTERNATIONAL SCIENCE, TECHNOLOGY AND INNOVATION CENTRE FOR SOUTH-SOUTH COOPERATION UNDER THE AUSPICES OF UNESCO

iap the interacademy partner



AETDEW

CAST



Isfahan Regional Center for Technology Incubators & Science Park Development (Under the Auspices of UNESCO)



INTERNATIONAL TURKIC ACADEMY Turkic World Educational and Scientific Cooperation Organization (TWESCO)



ISTC



KISTEP



Sukkur IBA



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# Thank You!

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