



SandHI

notes

SCIENCE AND HERITAGE INITIATIVE

an initiative of the IITs

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Edited by : Dr.Gaurav Raheja, IIT Roorkee (with inputs from Prof.Michel Danino, IIT Gandhinagar)

PREFACE

The genesis of this confluence of science & technology with **culture**, an initiative of the IITs evolved from an urgent need of reconnecting, reopening and redefining Indian knowledge sources to infuse an integrated approach for education under the holistic framework of *Indian Culture*. Interpretation of Indian Culture today needs to advance from a performing arts status to an integrated knowledge systems approach where Science and Technology become inclusive agents of progress and no longer remain delinked. Our national pedagogic processes must find ways to align with the traditional and contemporary knowledge systems and percolate into Indian society as a meaningful resource. This long term vision got initiated by a series of two workshops jointly organised by Ministry of Human Resource Development (**MHRD**) and Ministry of Culture (**MoC**) on **3rd January & 13th September, 2013** respectively at Indian International Centre, New Delhi. Constructive discussions with science and technology experts on diverse cultural (archaeological) perspectives emerged from this workshop and a new humble beginning towards a holistic future emanates, we title it as **Science and Heritage Initiative –SandHI**.

PERSPECTIVES, PROJECTS & POSSIBILITIES

Rigorous brainstorming and discussions by expert representations from IITs, IIMs & SPAs during these the two workshops on the above mentioned dates have led the way forward towards a generation of multiple perspectives, conceptualisation of new projects and immense possibilities of working on culture as a holistic concept. Following possibilities emerged through the views shared by the various experts during the workshop.

WORKSHOP – I [3rd JANUARY . 2013]

Study the science of art and the art of science.

-Leonardo da Vinci

Knowledge is holistic. Science and art naturally overlap enquiries into ideas engaging with the material and social world synthesising multiple cognitive faculties and transforming the understanding of the world beyond what its appearances. In ancient Greece, the word for art was *techne*, from which *technique* and *technology* derive signifying both scientific and artistic practices. There are initiatives towards evolving multidisciplinary knowledge processes where science and engineering techniques help in analyzing and reconstructing the epistemic and material forms of culture and heritage as well provide innovative ways of enriching technical education. Recognising the multi-disciplinary nature of knowledge, it is proposed to focus, foreground and foster educational initiatives that engage with cultural forms as learning processes for a variety of learning



objectives, nurturing the capacity for a more holistic view of life. Cultural forms such as heritage architecture, buildings, arts, crafts, traditional knowledge systems and archaeological sites, to cite a few examples, traditionally located in the domain of cultural studies, are equally expressions of engineering and scientific knowledge. An interdisciplinary study of science and technology and cultural resources has the following benefits:

- i. It connects technology with society and helps in building up the nation's cultural heritage and so contributes to social capital.
- ii. It transforms the pedagogy and curriculum of technical education by using cultural forms as learning objects, and so contributes to educational and technological innovation.
- iii. It opens up new / broadens employment avenues for humanities graduates such as management of cultural resources, museum management, heritage tourism management, conservation and documentation specialization, and so contributes to economic capital.

Everything comes from everything, and everything is made from everything, and everything can be turned into everything else; because that which exists in the elements is composed of those elements. [Plato, Timaeus, 55]

The following speakers shared their thoughts on the topics (*in italics*) as listed below.

Sh. Michel Danino - *Integrating Technology and Culture in India's Higher Education*

Prof. PremKalra, Director IIT, Rajasthan - *Setting up the Centre for Arts, Culture and Heritage.*

Prof. P. Anandam - *The Digital Restoration of Hampi*

Prof. Arum Menon & Prof. C.V.R. Murthy, IIT Madras - *Earthquake Safety of Heritage Structures in India*

Prof. Veeravalli, IIT Delhi - *Engineering Analysis of some Traditional Water- Harvesting/ Irrigation systems*

Dr. R.K. Dube - *Ancient Indian Tests and Metallurgical Technology*

(Solid state refining of gold, Flaky Metal Powder for Paint Application)

Prof. Rajeev Sangal, Director, IIIT, Hyderabad – *Technology and Language*

Dr. KapilaVatsyayan

Prof. Indranil Manna– *IIT Kanpur, Perspective in Inter-disciplinary Studies (Culture and Technology.*

Prof. S.P. Mehrotra, Director, IIT Gandhinagar- *Plan for Archeological Sciences at IIT Gandhinagar*

Prof. Ajay Khare, Director, SPA Bhopal –*Heritage Education*

Prof. Sreekumar, IIM Kozhikode- *Setting up the Indian Business Museum*

Ms Kaumadi Patil, IIT Kanpur – *Crafts and Technology*

Dr. BrajBhusan, Dr. Vimal Kumar and Ms. Satrupa Roy, IIT Kanpur – *Culture, Society and Technology*

Dr. K. Peddayya, Emeritus Professor – *Technical Education and Heritage Monuments*



Michel Danino's Thoughts on **Technology-Culture Interface**

The Symptoms

Ignorance of Indian Traditional Knowledge Systems (ITKS) at a school student level

Academic field:	Students have little or no knowledge of:
Mathematics, astronomy, chemistry, botany, zoology...	<i>Advances in those fields</i>
Civil engineer	<i>Construction techniques, water conservation...</i>
Agricultural engineer	<i>Traditional theory and practice of agriculture</i>
Medical doctor	<i>Ayurveda and other traditional systems of medicine</i>
Philosophy graduate	<i>Indian systems and schools of philosophy</i>
Psychology graduate	<i>Indian psychology based on yogic knowledge of the inner man; meditation techniques</i>
Political science graduate	<i>Governance and society in ancient India</i>
Education graduate	<i>Educational systems in ancient India</i>
Business & Management graduate	<i>Business and trade in ancient India</i>

Suggested Remedies

a) **Classical knowledge can still be useful**

b) **Creation of inter-disciplinary centres of excellence**

Some of the examples (*as known to the author*) are listed below:

- *The case of IIT Gandhinagar: a Centre for Archaeological Sciences*
- *IIT Gandhinagar: an attempt to create a full-fledged course on history of science & technology.*
- *IIM Ranchi: Courses on Indian culture, philosophy, ethics*
- *IIM Calcutta: Management Centre for Human Values*
- *Amrita VishwaVidyapeetham (T.N., Karnataka, Kerala): a comprehensive course on cultural education.*
- *Jain University (Bangalore): a recently created Centre for Ancient History & Culture.*

c) **Towards a deeper integration**

- *Promoting short courses /special papers on ITKS*
- *Introduce historical modules in all major scientific / technological disciplines.*
- *Have introductory chapters in textbooks*



CONCLUDING OBSERVATIONS

1. *Institutions to consider supporting such innovative proposals from both the regular plan grants from MHRD as well as the MHRD scheme of establishment of 50 centres for Training and Research in Frontier areas of Science and Technology. IITM and IITK have already supported such centres for heritage buildings and frugal technologies respectively.*
2. *Dialogue with the Ministry of Culture and its various organisations such as ASI, National Museum should be further strengthened.*
3. *Skill development courses and Heritage/Museum Art management programmes should be started to develop trained manpower for using ICT resources to professionalize the management of cultural resources while also opening avenues of employment.*
4. *UNESCO should also be contacted to aim at international exposure and expansion plans.*

WORKSHOP – II [13th SEPTEMBER . 2013]

Thought processes and possibilities as emerged during the second workshop held on the above date are given below.

Dr. Amita Sharma, Additional Secretary, Ministry of Human Resource Development

- *Fusion of Culture through Science and Technology*
- *Redefining curricula, Pedagogy of infusing knowledge through science and technology*
- *Reopening our cultural resources through embedded knowledge systems*
- *Culture beyond performing arts –Focus on Knowledge systems*
- *Developing fascinating narratives on Historical cities, crafts, languages, etc.*
- *Students connect to society – a consistent engagement required*

Shri Ravindra Singh, Secretary, Ministry of Culture

- *Concerns of keeping up with the Knowledge Systems*
- *Bridging monuments to museums for knowing Indian culture*
- *Documenting Contemporary along with ancient (Eg. Emergence of IT in Indian cities, Impact of NREGA on migration patterns)*
- *Revisiting MoUs and their structure for implementation*
- *New domains in the business of Culture like Art Management (a programme with IIM Bangalore)*
- *National Mission on Intangible Culture*

IIT Kanpur [Onkar Dikshit, Javed Malik]

- *Center for Archaeological Sciences and Technologies (CAST) established at IIT Kanpur, 2008*
- *Activities at IIT Kanpur Training of ASI archaeologists into techniques of Geo informatics (remote sensing, image processing, GPS, laser scanning, etc.)*



- *Structural engineering (seismic analysis and structural retrofitting, analysis and examination of structural elements and materials, natural polymers, composition of mortars for future repairs)*
- *Engineering Geology (Geoarchaeology, geomorphology, dating, GPR studies, isotope studies)*
- *Study of structures, impact of pollution (e.g. Taj Mahal)*
- *Creation of a national database of cultural heritage, monuments and artifacts*
- *Digital archiving using integrated geospatial technology and Cultural Resources management (CRM)*
- *Capacity building through short- and long-term courses on surveying, GIS and archaeometry*
- *Setting up of dating facilities which are dedicated to archaeological applications such as carbon dating, thermo luminescence and OSL.*
- *Archaeometallurgy , Archaeoseismology: imaging of subsurface (such as at Ahichhatra through GPR, Humayun tomb)*
- *Study of ancient Indian metallurgy and its further application for small scale manufacturing*
- *All of the above in 2005-09 or so, as a result of which an MoU was signed with ASI*
- *Projects in Gujarat: Dholavira and Rann of Kachchh*

IIT Kharagpur [William Mohanty, Sanghamitra Basu, Saikat Paul]

- *Seismic studies in Orissa (tilting of buildings in Puri region)*
- *Correlation with the “Nilachal” legend*
- *Study of Bhubaneswar’s architecture and town-planning, Evolution of cities and community involvement, Development of Bye laws and zoning regulations learnings from historical towns*
- *Simulation and interpretation of Heritage structures and ancient settlements*
- *Study of coastal erosion in West-Bengal and Orissa*
- *The case of Vishnupur: monuments but also arts and crafts, intangible heritage (music, textiles), Study and analysis of ancient culture customs*
- *Studies of 3D visualization. Pools and step-wells of Gujarat, palaeochannels.*
- *Social Networks and Human Interpretation Analysis of Chandra Ketugarh*
- *Use of GPR and other non-invasive techniques to identify sites*
- *Simulation and interpretation of design, space syntax analysis, shape grammar studies of traditional knowledge systems in architecture and settlement planning (applications in climate sensitive design and creation of design interface)*
- *Concerns about sharing of existing knowledge repositories on archaeology, culture within India*

IIT Madras [Arun Menon]

- *National Centre for Safety of Heritage Structures, funded by MHRD, July 2013-09-13*
- *Experimental and Numerical Research facility*
- *To carry out fundamental research and technology development on*
- *Structural forms, Structural Material Characterisation, Structural Behavior, Structural Assessment, Retrofit*



- *Study traditional materials and techniques of construction*
- *PhD programmes in safety of heritage structures, after 3 yrs, M Tech in safety of heritage structures*
- *Short Term Courses scheduled to begin this year for ASI, State Archaeology and Conservation Industry*
- *Structural safety and conservation engineering*
- *Work on pilot projects with the help of ASI*
- *MoU with ASI, fundamental research and technology development in the field of conservation.*

IIT Roorkee [Gaurav Raheja]

- *A holistic focus on Culture & Heritage and spearhead the role of Science & Technology through projects with Regional focus (Eg. Uttarakhand Hill Development Issues)*
- *Strong footing of Civil Engineering (for Structural Assessments, Soil & Foundation studies, Environmental Impact assessment studies), Earthquake Engineering (for Seismic Assessments), Earth Sciences (Dating techniques, geomorphological studies, soil profiles, river course studies, etc.)*
- *Visual documentation techniques of contemporary and heritage structures to generate visual narratives and archival material*
- *Communication design and Remote Sensing techniques to create layered cultural maps*
- *Structural assessment and Heritage conservation of sites in the region (Eg. Kedarnath Shrine)*
- *Space making craft narratives through Interior architecture [Eg. Uttarakhand Craft Clusters]*
- *Study of Vernacular built forms and Traditional knowledge systems in India*
- *Study of Identity of Traditional towns and Urban Forms and Space behaviour research*
- *Documentation studies of Historical, Heritage structures through Measured Drawing Camps by Students of Architecture (Eg. Jaisalmer, Darjeeling, Braj, Leh)*
- *e- interpretation centres, a technology driven cultural reach out framework*
- *Antique industry –Strategies to revive a dying culture*
- *Documentation of heritage structures and their architectural features*
- *Study of Passive Technologies in Heritage structures and their relevance in*
- *Research on Himalayan Geology and Ecology – Environment as a Cultural perspective*
- *Universal Design India Principles - Culture an integral part of the five principles*
- *Universal access to heritage sites*
- *Studies on Contemporary culture through Built forms and space behaviour*

IIT Delhi [S V Veeravalli]

- *Research on traditional systems – a journey beyond heritage preservation.*
- *Revival of this lost science and engineering*
- *Sustainable development through traditional knowledge systems and inclusion in course curricula*
- *Examples cited: Anangpur Dam and the tank & anicut systems of South India*



IIT Gandhinagar [Sudhir Jain, S.P. Mehrotra, Michel Danino]

- *Sanskrit learning by IIT Gandhinagar students an encouraging approach towards culture*
- *Project of an Archaeological Sciences Centre where archaeological samples can be tested through joint collaborative research projects. The project is intended to boost the potential of archaeological data in view of the paucity of good laboratory facilities available to archaeologists. (Proposal submitted to Ministry of Culture)*
- *Two workshops with archaeologists (one of which with IIT faculty in material sciences and chemistry).*
- *Recruitment of faculty and post-doctoral researchers under way.*
- *Future projects can extend to field work: survey, 3D-scanning, GPR, etc. (Possible study of Dholavira.)*

Archaeological Survey of India (ASI), Ministry of Culture

Shri Pravin Srivastava, DG ASI

- *Overarching MoUs with all IITs through IIT council or specific MoUs with IITs*
- *Condition Assessment of Monuments, Heritage structures (Structural assessment, Seismic assessment and remedial measures)*

Dr. B R Mani, ADG ASI

- *Key Areas of support for ASI*
a) Explorations b) Excavations c) Conservation d) Documentation e) Capacity Building

Shri S. Dayalan, Director Monuments, ASI

- *Analysis of Materials and Development of regional database*
- *Pigment analysis, Radar studies, Paleochannel analysis*
- *Impact of illumination and sound on monuments*
- *Ancient water management systems*

Shri Jhanjwaj Sharma, Director Conservation

- *National Policy on Conservation on the verge of finalisation*
- *Technology sharing – on creating material laboratories in each region*
- *Development and publishing of Technical manuals, monographs*
- *Restructuring of Heritage Committee in National Disaster Management Agency (NDMA)*
- *Design aspects of engineering solutions*
- *Interpretation Centres and role of technology in enhancing the experience*

Shri V N Prabhakar, Suprintending Archaeologist In Excavations

- *Need for Archaeological Research*
- *Stable Isotope studies*
- *Researches on ancient dietary practices, ancient DNA*



Shri Deepak Kaul, Director, Ministry Of Culture

- *Training of ASI personnel*
- *Heritage Bye Laws*
- *National Research Labs*

Projects Proposed by ASI for various IITs

- 1. Red Fort, Delhi**
Survey of ground water and resistivity besides Ground Penetrating Radar (GPR) Survey.
- 2. Rajgir, Bihar**
LiDAR Survey for understanding the mounds of ancient city.
- 3. Nalanda**
Ground Penetrating Radar (GPR) Survey in the protected area to locate earliest structures and towards north of the protected area to understand the extent of the site.
- 4. Dholavira and area around Rann of Kach, Gujarat**
Mathematical modelling of the Harappan city, Ground Penetrating Radar Survey and total station survey.
- 5. Sankisa, Uttar Pradesh**
Ground Penetrating Radar Survey of the entire protected area to understand the anomalies for future excavation projects.
- 6. Vigukot, Rann of Kach, Gujarat**
Study of earthquake evidence and water channel of old river system - Ground Penetrating Radar Survey.
- 7. Bagh Caves, Madhya Pradesh**
Study through remote sensing radar, with facility to lower the camera in cavities and gaps for taking pictures of the collapsed rock-cut caves.
- 8. Anangpur Dam, Faridabad, Haryana & Satpula, New Delhi**
A comparative study of the development of bridge engineering design during the last one thousand years.
- 9. Cheraideo Maidens, District Sibsagar, Assam**
To understand the distribution pattern of burial mounds and their extent through Ground Penetrating Radar Survey.

CONCLUDING OBSERVATIONS [Sudhir Jain, Amita Sharma, Ravindra Singh]

1. Education – Research – Application continuum instead of piecemeal approach.
2. Archaeology/ Culture needs to be looked into a holistic sense and MoC shall provide this platform for connecting to the same.
3. Seed money(funding) to be provided for Culture/ Archaeology based research through ASI.
4. Core group be formed by Ministry of Culture to continue dialogues and engagement with IITs.



In your life,

you must find time to spend with beautiful things.

- Mihoko Koyama

(Patron of Miho Museum on Human Civilization, Japan)

SANDHI

a confluence of culture, science and technology

initiated by the IITs

