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Institutional Museums and Archives for Disseminating India's Technological History: An Example from CSIR-Central Glass & Ceramic Research Institute

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ABSTRACT

Museums constitute an important tool in modern science communication. Archives on the other hand provide the key content on which institutional museums are usually built. Taken together, archive and museums play a seminal role in preserving heritage and disseminating an institution's niche to the wider audience. The Atma Ram Memorial Museum & Archives at the CSIR-Central Glass & Ceramic Research Institute, Kolkata not only traces the evolution of CSIR-CGCRI but also intertwines it with that of CSIR; and contextualizes it against the technological history of India. Aimed for the students, public and researchers a like, the initiative is one of its kind within the CSIR.

1 Introduction

Gurukul culture envisioned learning science by observing nature and questioning thoughts. Experiments conducted to frame such thoughts resulted in meticulous inferences. From this, all scientific developments emanated over the ages. Post-modern times, science education is also rooted to the same base; think, experiment and learn. Amidst such a cycle, learning the history of science is as important as learning the science itself. Understandably therefore, science archives and museums are critical to bolster our science learning exercise. Archives are the repositories of historical references having an enduring value for both the present and future.

Information in a variety of forms like documents, photographs, audio-visuals etc. are managed in these storehouses serving especially the purpose of administrators and scholars. (Schwartz & Cook, 2002) Museums on the other hand can provide the fundamental human right of people to engage with scientific and cultural activities. They are places for students intending dialogue and constructive debates. (Winchell, 1891) Archives and museums are often considered as institutions of evidentiary heritage and therefore play a prominent part in collection and preservation of both tangible and intangible relics. They often act as a centre piece in protecting and institutionalising the human civilization. Organisations responsible for promoting & formulating policies for these two socio-cultural institutions give them a distinctive identity.*"Archives are the documentary by-product of human activity retained for their long-term value. The records created in the course of the everyday lives and actions of individuals and organisations offer direct insights into past events. Like people, archives are diverse. They come in a variety of formats including text, photographs, video, sound, analogue and digital. Archives are held by individuals and institutions (both public and private) around the world, with the buildings housing them often sharing the name of archives."* (International Council on Archives, Paris)*"A museum is a not-for-profit, permanent institution in the service of society that researches, collects, conserves, interprets and exhibits tangible and intangible heritage. Open to the public, accessible and inclusive, museums foster diversity and sustainability. They operate and communicate ethically, professionally and with the participation of communities, offering varied experiences for education, enjoyment, reflection and knowledge sharing."* (International Council of Museums, Paris)

Science museums play a vital role in bridging science and society. They have long enjoyed a relationship for 'trustworthiness and objectivity.' (Cain & Rader, 2017). Its role in scientific research and public service is more manifested than the archives. The latter, in particular, is typified by a reduction in communication between the exhibits and the audience. Research scholars suit more as the audience here rather than students because of its complexity. Scientific archives which safeguard historical objects scan act as the cornerstone for science

museums. This connection can be simplified by the relation of a kitchen and dining room in a restaurant. Science museums differ from science centres in its 'archival' component where the latter did not accumulate or study collections. Historical backgrounds to science museums collections have a double blinded effect in visitor learning process. (Lourenço & Gessner, 2014). During more recent times, museums and collections evolved as powerful players within their parent institutions for public engagement, inclusive practices and citizen participation, business and advertisement, spreading and disseminating knowledge. (Plaza, 2022)Traditional management models have been unable to meet the advancing needs of modern innovative archives and science museums. (Barrio, 2009) have analysed museums as a fruitful arena for case studies in socio-cultural context for the regional museum networks in Spain. They hypothesize that these regional bodies represent one organization of productive resources that aim to provide services and products related to its basic functions. In this approach the authors endeavour to measure the efficiency of heritage institutions. Active citizenship, social responsibility, engagement with complex science and technology issues, and a proactive civic agency become the new profiles of fourth generation science museums. (Pedretti & Iannini, 2020). Amalgamation of socio-cultural institutions could give birth to new knowledge enterprises. When the National Library of Canada merged with the National Archives, the approach fructified in the formation of a more diverse organization which can respond enormously towards public expectations. (Wilson, 2022). Cooperation and collaboration between libraries, archives and museums can easily accomplish the demand of outreach and engagement. The 'host-guest' nature of these institutions has evolved over the years. Active participation becomes their motto for achieving goals to best serve the society. (Yarrow, Clubb, & Draper, 2008). Therefore, intertwining between scientific archive and museum becomes a pursuit of excellence in education. (Given & McTavish, 2010). The conjoined theatre can easily harmonise with academics, create storming thoughts in its visitors, especially children and youth and will help them to develop an interest and appreciation in learning science. Important innovations are slowly reshaping the identity and

purpose of these mixed entities.(Kirchhof, Schweibenz, & Sieglerschmidt, 2008).

The Council of Scientific and Industrial Research (CSIR) is among the largest and most diverse public funded R&D organization of India that is typified by a distributed network of 37 institutions spread across the country. Having a long and eventful journey of almost a century, the organization represents an effective platform for driving the national museum & archives movement. With this realization, CSIR-Central Glass and Ceramic Research Institute, Kolkata undertook the exercise of setting up an institutional archive & museum during 2021. Backed up by the overarching support of CSIR, the Atma Ram Memorial Museum & Archives (ARMMA) emerged as a flagship outcome that fostered critical thinking, creativity, collaboration, curiosity and communication for advanced learning opportunities. Uniquely positioned against context of the technological advancements of ancient India in the areas of ceramics and glass, it takes the visitor across a journey that covers more than 10,000 years of civilization.

This paper intends to take a look at this unique project highlighting its genesis, facilities created for disseminating a broad spectrum of scientific information and the insights and avenues that emerged from these experiences. It represents a case study of the practices of a National Laboratory's distinctive approach in science communication. Placed in context of the technological history of India, this initiative underpins the intricate intertwining of the ancient past and the more recent times in shaping the country's scientific landscape.

2 Genesis of the Initiative

As a part of a special impetus from the Government of India to set up museums and galleries in select CSIR laboratories, the initiative began with a Memorandum of Understanding between the Council of Scientific & Industrial Research (CSIR) under the Ministry of Science & Technology and the National Council of Science Museums (NCSM) under the Ministry of Culture.

It was inaugurated on 8th June 2022 by Dr Shekhar C. Mande, former Director General of CSIR. The layout of galleries was

implemented through a separate MoU between CSIR-CGCRI and NCSM; as well as extensive in-house research at CSIR-CGCRI. Exhibits and galleries were eventually opened to the public by Dr N. Kalaiselvi, Secretary, Department of Scientific & Industrial Research & Director General, CSIR on 26thAugust 2023. ARMMA, made up in a 2000 square feet space, is open for intending Visitor during Institute hours. The initiative provides room for exchange of ideas, engagement of stakeholders to the STI ecosystem and the large and diverse student population intending to understand the country's scientific pursuits.

3 Objectives of the Archives & Museum

The archives and museum at CSIR-CGCRI has the following laid down objectives:

- Recording the historical evolution of CSIR & CSIR-CGCRI through a systematic and curated information resource.
- Underline the seminal role played by ceramics and glass technology in the advancement of Indian Civilisation.
- Chronicle the institutional technologies and knowledgebase over the decades, underscoring the transformative role played by them.
- Restore inventories, artefacts, documents etc. for posterity.
- Showcase the contribution of CSIR as a whole to the national scientific ecosystem.
- Foster scientific temperament through student outreach and public programming.
- Cooperation, communication & information exchange with diverse institutions for dissemination of new knowledge in the field.

4 Methodology and Gallery Planning

This section outlines the methodology, the standards and best practices followed to create and manage the archives & museum. The site selected was in the ground floor of the main building of the Institute, in a publicly accessible space, near the eastern entrance and spread over a built-up area of 2000 sq. ft. The hall

has been adequately retrofitted to serve the purpose; and appropriately refurbished. The wall and floor colours have been chosen to express an elegant way of moulding science and culture. Illumination was done both to meet the requirements of exhibition-accent lighting and maintenance-ambient lighting. Appropriate measures were taken to provide circulation area; crowd dispersal systems; accessible to persons with disabilities and so on. Finally, the retrofitted premise has been evolved as an immersive cognitive space designed in such a way that it can be used flexibly for different functions, such as research activities, workshops, seminars and events. One fourth of the total area is apportioned for the archives considering the digital restoration and curation of materials. The remaining space was asymmetrically distributed for the three unique galleries of the museum. The proportional coverage in space given to these galleries is: Ancient India (25%); CSIR (25%); CSIR-CGCRI (50%).

Reconditioning work for antique items available in the institute was carried out to restore its original appearance. Adequate emphasis was given to annotation i.e. the temporal and information connect of various items. Revisiting the Institute's reports and bulletins in the fifties enabled the re-designation of some of the unidentified artefacts. These reinvented collections expounded as "threads" became this part of ARMMA's archives.

5 Reinventing a Past Creation

Study of historical references in the Institute Library confirms that the ARMMA is originally associated to the Museum of Raw Materials & Finished Products (1950s) that exiisted during the Institute's formative years, thanks to the visionary zeal of the founder Atma Ram and his mentor Shanti Swarup Bhatnagar. Rare historical specimens of ceramics dating back to the Indus-Sarasvati Civilization and glass artefacts from Mohenjo-Daro, Harappa, Mughal, Napoleonic, pre-Victorian and Victorian periods were retained (approximately 71+)in this old museum; that have now been salvaged and restored. A series of exhibits such as double ended discharge tube belonging to de la Rive; a Wolfe's bottle used by Davy and Faraday; an original heavy glass prism made by Faraday; porcelain prism and glass semi-cylinders of Sir J. C. Bose; a desiccator, stone ware bottle and a measuring cylinder used by Sir

P. C. Ray, a specimen of glass from the first atomic explosion in New Mexico etc were also identified among these collections. All these artefacts along with the 'cabinet of curiosities'(Macintosh, 2013)speckled at different locations of the Laboratory were then transferred to the new museum.

6 Museum Galleries

The museum comprises of three different galleries. The seminal role played by ceramics and glass technology in the expansion of Indian civilization is chronicled in the ancient Indian gallery. Gallery for CSIR depicts the tale of its genesis, the beginning of a stream of National Laboratories and Research Institutes and, achievements over the last eight decades, which helped the nation to achieve self-sufficiency. The CSIR-CGCRI gallery highlights the eventful journey of the Institute from the 1950s providing a snapshot of its contributions in technological self-reliance, industrial rejuvenation and socio-economic development. The initiative is built on the idea to enhance learning capabilities in science to different stakeholder groups, especially students and academic researchers. It aims to show the reflective characteristics between science museum and a background archives.

6.1 Ancient India

The gallery of Ancient India offers insights of culture and associated technological advancements beginning from the Palaeolithic phase. As humans adapted from the nomadic phase of stone-age to more settled phases of Neolithic and Chalcolithic periods, there was a progressive growth of urbanization, technological adoption and creativity. Ceramics, glass and metals have played a key role in driving such transformation that not only enriched India culturally but also laid the foundation for scientific and technological advancements over the centuries that followed.

6.2 CSIR

Established in 1942, with an aim of bolstering self-reliance in Indian industry, CSIR has been the key innovation engine for independent India. The decades of pre-independence marked a major surge in growth of academics and scientific institutions of

Fig. 1 – The gallery of Ancient India that portrays the evolution of ceramics and glass technology in India from the palaeolithic period to the first century post Christ

the country that were fuelled very significantly by Indian visionaries. As it became more and more apparent that independence cannot be very far away, these personalities envisioned a strong and self-reliant India with vibrant institutions. The Council of Scientific and Industrial Research (CSIR) was one such outcome that laid the foundation of India's science and technology institutional framework that would deliver not only on high quality science but also imminent technological and industrial needs. The CSIR gallery traces the evolution of this great institution from its conceptualization to the present. Tributes are being paid to the vision of the great national leaders and exuberance of scientific men who had stewarded this organization to achieve phenomenal progress in the last eight decades.

6.3 CSIR-CGCRI

Among the first group of Laboratories formed under the CSIR during 1950, the CSIR-Central Glass and Ceramic Research Institute stands as an apostle in R&D and technology development for the nation in materials science & engineering.

Fig. 2 – The journey of the CSIR beginning 1914 till the new millennium is displayed in the CSIR gallery.

Over the period of seventy-four years, the Institute positioned and repositioned itself with the changing expectations of the country. It has nevertheless shown extraordinary resilience in this journey. It served the needs of the country in terms of providing alternative raw materials for manufacturing industry to technologies for strategic sector that were denied by foreign sources. It also provided state of art industrial and societal technologies that would bolster economic advancement and social well-being.

Fig. 3 – (above) and Fig. 4 – (below): The technologies and activities of CSIR-CGCRI

It was implicit that the museum should showcase and resonate the archives in the best way possible where most of the resources are digitally preserved. The role played by archives is background only and in its pillars the museum is spectated. ARMMA explored all opportunities to dissolute the boundaries between its archive and museum part. Major questions rose in this scenario were: how to identify, collect, preserve and utilize these archival collections. Identification, collection, keeping and demonstration of records and artefacts from 1930s to 2010s (CSIR, established on 1942) & 1940s to 2000s (CSIR-CGCRI, established on 1950) was contemplated as one of the most important tasks. About 154+ research objects, 300+ photographs, 122+ records & 35+ documentaries of profound value were acquired (as on 31-03-2024). Research objects, collected from eight major research divisions of the Laboratory, were annotated, classified and placed inside the display cabinets of the Museum. Conservation and preservation methods were followed while depositing and displaying the optical glass chunks, tank periscope prisms, railway signal glasses, radiation shielding window glasses, ceramic super conductors, strain discs, mica sheets, optical fibre performs etc. All photographs prior to 2010 of institutional importance were transferred to the archives from the Publication section. Records comprises mainly of important correspondences, patent certificates, scientific & technical reports, booklets and

brochures. Research documentaries shared from sister Laboratories and the Film Archives of Ministry of Information & Broadcasting became part of audio-visual contents in the repository. Regional and national level collaborations were structured and engagements focussing primarily for sharing of documented heritage. (Table 1)Scientific information gathered and deposited in the archives was then selectively integrated to the exhibition panels. (Table 2) The possibility to interact with the displayed objects was met with the help of multimedia kiosks where exhibition is executed automatically. (Table 3). The progress achieved in Laboratory's inventions based on new scientific theories and know-how is constantly updated in this flexible system. Research highlights from the disciplines of advanced ceramics and speciality glasses were incorporated along with the artefacts in cabinet exhibition. A close cooperation and dialogue among the scientists and the museum on a collaborative platform, as well as the focus on science communication was essential to achieve the objectives of this interdisciplinary research project which took over the course of 1.9 years to complete. The museum extensively embraces a first-person perspective and deciphers the context in a storyline format.

Table 1 Major collaborators for ARMMA in shared heritage

Institutes/Organizations	**Shared/Acquired Information**
National Archives of India, New Delhi	Historical documents of CSIR & CSIR-CGCRI, Personal Archives of Shanti Swarup Bhatnagar& Atma Ram
Prasanta Chandra Mahalanobis Memorial Museum & Archives at Indian Statistical Institute (ISI), Kolkata	Correspondence between Atma Ram (CSIR-CGCRI) & Prasanta Chandra Mahalanobis
National Film Archives of India, Pune	Documentaries pertaining the establishment of National Laboratories
Nature Archives, UNESCO, ACS Archives	Articles, Editorials, Newsletters, Couriers etc.
CSIR Headquarters	Reports, Certificates, Patent Files, Books, Brochures
CSIR Laboratories	Research videos, Photographs, Research information

Table 2 Panel exhibitions

Sl. No.	Title of the Panel	Information Presented
1	Ancient India	Introduction to the gallery
2	Timeline of Ancient India	Milestones in advancement of ceramics, glass & metals (2,000,000 BCE-0 CE)
3	Palaeolithic Cultures in India	Development of tool technology, prehistoric rock art, excavated sites (50,000-10,000 BCE)
4	The Mesolithic Phase	Micro-lithic industry, rock paintings, pottery & terracotta, copper & iron technology, important sites (10,000-2000 BCE)
5	Early Farming Communities in South Asia	Cultural developments from Mehrgarh Phase I to Phase VII (7500-1300 BCE)
6	Regional Chalcolithic Cultures-I	Ochre Coloured Pottery, Copper Hoard, Black & Red Ware, Kayatha, Ahar & Malwa cultures (4500-700 BCE)
7	Regional Chalcolithic Cultures-II	Savalda, Jorwe, Southern, Eastern & North Eastern cultures (4500-700 BCE)
8	Harappan Cultures (Indus Sarasvati Culture)	Excavated sites, raw materials & trade networks, growth of technologies in different phases (3300-1300 BCE)
9	Early Iron Age	Painted Grey Ware, Northern Black Polished Ware, Megalithic cultures, beginning of glass technology, pottery firing techniques, iron technology sites (1300-200 BCE)
10	Early Historic Period	Terracotta art culture, glass working sites, maritime trade, agriculture communities, bronze metallurgy (400 BCE-700 CE)
11	The Threads of Continuity	The moving story of technology evolution, comparative research on Harappan techniques with Chola & modern Dokra arts
12	CSIR	Introduction to the gallery
13	The Pre-Independence Period	The Indian Industrial Commission, Industrial Intelligence & Research Bureau, The Board of Scientific & Industrial Research (1916-1942)
14	Establishment of CSIR	Foundation (1942) & projects vital to the national economy
15	Father of Indian National Laboratories: Shanti Swarup Bhatnagar	Patronage of S. S. Bhatnagar and his contributions

16	The Story of the Bhatnagar Eleven	Proposals to establish the first eleven National Laboratories of CSIR
17	Regional Research Laboratories, Cooperative Associations & Museums	Objectives of CSIR's past initiatives which were repositioned with the changing times
18	The Journey of CSIR	Milestone achievements of CSIR from 1950s to 2010s
19	Some Technology & Innovations of CSIR-I	Aerospace, electronics & instrumentation, strategic sector, earth and ocean science, ecology, environment & water, health care
20	Some Technology & Innovations of CSIR-II	Civil infrastructure & engineering, mining minerals, metals & materials, chemicals, leather & petrochemicals, energy & energy devices, agriculture, nutrition & biotechnology, New Millennium Indian Technology Leadership Initiative
21	CSIR Foot Prints	Science dissemination, Traditional Knowledge Digital Library, Academy of Scientific & Innovative Research, International Partnerships, Intellectual Property, Human Resource Development
22	Old Press Clippings	Glimpse of media collections
23	Historic Literature Assorted	Snapshot of reference materials
24	CSIR-CGCRI	Introduction to the gallery
25	The Genesis of CSIR-CGCRI	World War & recommendations of the Indian Tariff Board (1931)
26	Museum of Raw Materials & Finished Products	Memory of the old Museum (1948) & retraced historical artefacts
27	The Earliest Laboratories	Clay laboratory, optical glass pilot plant, refractories lab, mica bricks production unit
28	Our Founder: Atma Ram	Biographical Sketch of Atma Ram
29	Products & Technologies Over the Decades	CSIR-CGCRI innovations & inventories (1950s-2010s)
30	The Landmark Assignment to Make Optical Glass	Knowledgebase & stories behind the invention of optical glass
31	Leveraging Industries	Industry competitiveness and significant contributions

32	Innovations for Technology Denial & Addressing Critical Challenges	Role in combating technology denial for strategic sectors on defence, atomic energy and space
33	Driving Innovations for Social Good	Technologies for Affordable health care, rural industrialization & generating sustainable livelihood
34	Visitors & Comments	Snaps of eminent personalities visited & comments
35	CGCRI Bulletin, Newsletter & Press Clippings	Publications & media coverage
36	Acknowledgements	Acknowledgements for guidance & support for ARMMA

Table 3 Interactive multimedia kiosks

Sl. No.	Title of Content	Curated Information
1	Technological Heritage of Ancient India	Scientific aspects and socio-cultural perspectives of flourishing Indus Sarasvati Civilization
2	CSIR-The Innovation Engine of India	Technological success-stories achieved across 38 National Laboratories of CSIR
3	CSIR-CGCRI Products & Technologies	Elaborates the scientific principles behind the Institute‘s discoveries and inventions.

Discussion

ARMMA became the first and most significant outcome that emanated from the association of CSIR with NCSM. Identified as a fourth-generation science museum, it provides an access to materials that capture the spirit of the past. It also explains the ‘reasons’ for transitions happening at various levels in the co-evolution of both CSIR & CSIR-CGCRI. The well-achieved continuity of information captured in the exhibits, underscores appreciation of our scientific and cultural achievements by our predecessors. The selection, cataloguing and deposition of materials themselves represented a great challenge involved with the project. The unprecedented requirement of digital curation was addressed by the integration of acquired data into multimedia platforms. This

helped the students to perceive the distinctiveness of diverse scientific phenomena associated with former inventions. This digital interface is blended in a practical way, so that the content may be easily used and understood. Between June 2022 and March 2024, approximately 50 events of varying lengths took place in the museum with a total of nearly 1,000 active participants. The comments received from these audiences from different fields of expertise and mostly students provided new knowledge to shape science education agenda for a new curriculum based on archives and museums. ARMMA can emerge as a 'centre for research' in two areas. The first is study on the scientific and technological heritage of ancient India in ceramics and glass and the second about new ways of science communication pertaining to heritage of research laboratories to public at large. The approach to rehabilitate the 1950s museum is not intended to serve as a model for other implementing organizations as it was shaped by local circumstances. This old museum where many of its exhibits were received from foreign nations, stands as a testimony to cross-cultural exchange and international cooperation for such initiatives. ARMMA in totality evokes collective memories of various personnel who worked in the Laboratory at different times. The initiative essentially evolved as a tribute for their dedication and hard work.

7 Conclusion

The importance of and the need to record decisions, actions and memories was the key factor in establishing ARMMA. The initiative transformed as a 'cultural wealth' and has created innovative new approaches to engaging the students. It serves as an exemplary model to build new hybrid museum practices in research laboratories and educational institutes. ARMMA, designed for science learners and enthusiasts, is planned to be a mission in continuous evolution; unfinished, as it were, in an endeavour to remain always open to new avenues of intellectual pursuit.

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