Impact of Science Museums and Centres

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Abstract

Science Centres render a valuable service to their communities. As a result of visitor oriented activities, Science Centres have a profound impact on learning, motivation and attitude of a person, on local economies, on social processes and on policy making at official level. Personal impact means enhancing the knowledge or skills of an individual or group; economic impact is a measurable contribution to the economy of the surrounding community; societal impact means any identifiable impact on social processes at the individual or social level; political impact encompasses any influence at the decision making level or in gaining mileage. Science Centers are institutions that offer hands on science learning environment. Science Centres strengthen the motivation of students, and influence learning strategies, attitudes towards science and the career choices of young people. Though many Science Centres run on subsidy, they pay back many folds of the subsidies as personal, social and economic impacts on the local communities as well as enriching public understanding and appreciation of science and technology. Science Centres are among the major tourist attractions all over the world. They are also prime elements in cultural tourism. Millions of people visit Science Centres globally. Science Centres also work tirelessly for physically challenged and underprivileged people and are in constant endeavor to take science learning to distant rural areas. Leaders of the state consider Science Centres as agents for development and social change. Qualitatively, it is easy to understand the impacts of science centres. What we need is the evidence of a long term quantitative impact.

Introduction

A Science Museum or Centre is a public institution. With mission, goal and strategic plan, these institutions rely on funding (government, public or self-generated revenue), and staff for their daily functioning. They produce a large numbers of tangible outputs for clients or visitors such as exhibitions and educational activities and intangible outputs like learning, motivation to do science and socio-cultural influence. In addition, they have strong economic and political implications. These outputs significantly impact the science center's community of interest.

By the turn of the last millennium, there were about 1200 science centres all over the world attracting some 184 million visitors and with a total turnover of US$1.4 billion [1,2,3]. According to the Global Science Center Statistics[4], in 2005 the total number of science centres around the world was 1492 serving to 275.3 million visitors with an operating budget of US$3.6 billion. *Beetlestone et al*[1] have also noted that the average increase in the number of science centres round the globe is about 30 percent per decade. Though there are differences in the survey statistics on science centres, it is clear beyond all doubts that science centres have come in a big way in recent times. In India, the number of science centres in 2001 was 35 and that has grown to more than 50 in 2009; over 25 new centers are in the pipeline or in the process of development. The demand has steadily grown over the years with their existence is being linked to social and community development. However, the pace would be even faster if the growth and development were not restricted by lack of infrastructure creation, inadequate professionals and slow capacity building.

Science Centres provide a significant range of educational, social, cultural and economic benefits to their communities[5]. We now see a new dimension to their relevance i.e., political as politicians take keen interest in their development to project, the activity as significant infrastructure development in their constituencies to take mileage. Science Museums and Centres serve as educational forums and centres of expertise, providing opportunities for community involvement in their activities through friends' groups, volunteers, project work and in other useful ways. Science Centres give support to educational organizations, and offer a facility for educational events and activities in an environment which otherwise is not available in educational institutions[6]. In every sense, science centres and museums enhance the quality of lives of people and can play a key role in developing a sense of identity for the area in which they are located.

In short, the Science Centers provide a medium

* for building up a trust between the public and the scientific knowledge through dialogue, participation, engagement and experience
* to translate a particular scientific information into a fairly comprehensible and relevant mode to the population
* to motivate the public by educating them on intricate scientific topics
* for engaging the general public with scientific issues and play imperative roles in sustaining values in local communities
* to provide a hands-on and minds-on learning environment and support science education programme of educational institutions

* to encourage young audiences to make career choices in science by demonstrating excitement of science and engaging them in true process of scientific enterprise

Various studies on the impact of science centres and the assessment of the extent of the influence of the science/scientific knowledge and understanding implicated by the masses have indicated definite outcomes in terms of personal, social and economic impacts. The political impact predominantly appears to be an Indian phenomenon.

Garnet[7] developed a model based on the description of the impact of science centres described by *Persson*[8]. The impact of science centres could be divided into four main types; personal, societal, economic and political.

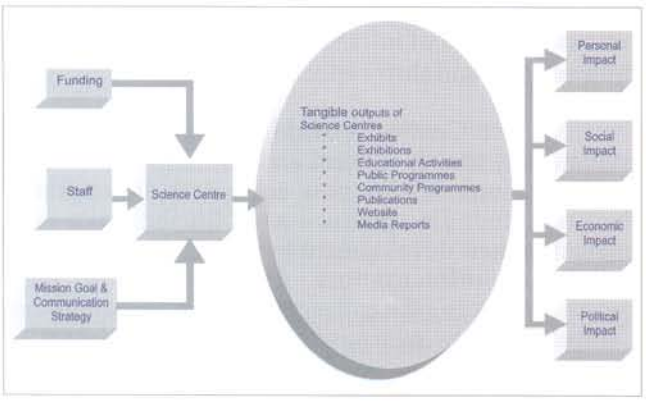

Fig. 1. A Model of Impact of Science Museums/Centres

The **Personal impact** of a science centre is defined as the change that occurs in an individual as a result of his/her contact with a science centre. It includes factors such as:

* Science learning (Cognitive development) through non formal means
* Scope for free choice and lifelong learning
* Development of skills
* Scope for nurturing Creativity
* Changed attitudes towards science or its appreciation
* Social experience, family learning
* Motivation, interest and outlook change
* Career choice formation
* Increased professional expertise through training programmes
* Personal enjoyment
* Adoption of method of science in day to day activities

The **Societal impact** is defined as the effect that a science centre has on groups of people, organizations, and on the community as a whole and natural and social environment. Examples of societal impact are:

* Community leisure activities
* Creating a Science Awareness and development of Scientific Temper in the society
* Community partnerships; involvement of local clubs and societies
* Science Centres as hub of scientific discussion on important issues
* Environmental restoration
* Promote scientific solutions of their local problems
* Enhance employability through skill and knowledge development
* Clarify the scientific issues confronting the community
* Eradication of superstitions or unscientific belief
* Create awareness on health issues relevant to the society
* Promote use of improved scientific practices and technological tools to improve productivity and profitability of the individuals and community.
* Infrastructure development
* Develop into a centre of community activity and symbol of pride for the community.

The **Economic impact** of a science centre is the direct and indirect effect it has on employment and the local economy. It includes factors such as:

* Local/regional/international tourism
* Income brought into the science centre from visitors
* Income brought into community by visitors
* Science centre expenditure
* Job creation for staff (particularly for the youth) and outside service providers
* Urban redevelopment
* Appreciation of real estate
* Business activity develops for variety of vendors serving the visitors
* Demand creation for science education resource material

The **Political impact** of a science center is its influence on government policies and priorities (laws, local regulations, urban planning decisions by municipality etc.). It is its impact on all levels of Government and political leadership who consider and promote development of science centre as an essential parameter of social and regional development.

Personal Impact

The personal impact is mostly in the cognitive, psychomotor and affective domains. In addition, they include fostering creativity, motivation and developing a positive attitude towards science as an outcome of learning, interaction and experience in science centres.

Science Learning

A science centre is a forum which provides facilities for activity based learning process for cognitive development and to inculcate a spirit of enquiry, to develop a positive attitude towards the subject matter, to foster creative talent and to generate scientific temper and build up a self-reliant culture of science in the community as a whole. It is characterized by its two channels of communication-exhibits and activities. The exhibits are interactive and participatory and intended to kindle fire of imagination in a young mind. They encompass a wide variety of subjects such as physical, applied, natural sciences, energy, environment, crafts, industries and such other areas as broadly linked with science to fulfill the

Fig. 2. Learning in Science Centres is activity and participation oriented

requirements of a wide spectrum of population. Activities include year round science demonstrations, shows and training programmes, hands-on workshops, temporary and mobile exhibitions, audio-visual communication, people science movement and similar sort of exposure oriented programmes. The activities are oriented towards the students as well as the community. Science centre experiences are enjoyable, leading to measurable increase in motivation and interest among students for science. The learning is a bonus. Many studies have revealed increase in the range and depth of visitors' conceptual understanding. Commenting on Science Centre learning *Rennie & McClafferty*[9] concluded that "visits to interactive science and technology centers, museums, aquariums and zoos provide valuable motivational opportunities for students to learn science and they affect students' learning." Their studies also indicated that students usually find visits enjoyable but both the extent and nature of their cognitive and affective learning vary.

Free Choice Learning

Free-choice learning is a dominant form of learning in the world; about 60 percent of a person's total learning comes as free choice learning. The culture of school learning is characterized by strict curriculum and evaluation. Science Centres, in contrast, typically impose no such curriculum, and the learning pathways to be followed are normally determined by the learners themselves. Mapping learners' achievements thus depends on recognizing the destinations that are reached along this pathway. It also depends on an understanding that the journey and the destinations are equally significant. Every learner starts and finishes the science center experience at a different point on the pathway. According to *Falk & Dierking*[10] and *Falk*[11,12] science centers may be described as *"free-choice learning environments."* Personal, sociocultural, and physical contexts contribute to and influence visitors' interactions and experiences.

Hands-on Learning

Students in hands-on science programs have been known to exhibit increase in learning and creativity, positive attitudes toward science, perception, logic development, communication skills, and reading readiness. Understandably, *Oppenheimer*[13], while planning for The Exploratorium, was greatly influenced by the philosophy of great American educational philosopher John Dewey. Dewey contented that education should be practical and it needs to be useful in life. It is today the guiding philosophy of most of the Science Centres including NCSM units. *David*[14,15] remarked, "Exhibits and education programs are contemporary, participatory, informal education instruments rather than historic, 'hands-off' repositories of artifacts and they offer the public opportunities to learn in a semi-random web of experiences, facts, lessons and impressions that result in an unstructured and usually undirected accumulation of knowledge." *Bradburne*[16] says, "Science Centers vulgarize knowledge to make it palatable to the masses, or sugar-coat science with gratuitous hands-on interactions to arouse visitor curiosity."

Fig. 3. Hands-on experience with science is a major characteristic of Science Centre learning

To have practical knowledge, one must practise and participate as science cannot be learnt without props. Most educational programmes in a science centre are active and hands-on. The science camps, model making workshops, computer training programmes, creative science workshops, science fairs and teachers' training programmes are aimed at, *inter-alia*, developing practical skills. *Bloom*[17] has categorized the learning into cognitive, affective and psychomotor domains of which psychomotor skill development plays an important role in science centres.

Motivation

Skinner[18] has concluded that a person gains 80-85 percent knowledge mostly by self learning. Learning in science centres is thus voluntary and self-directed. Motivation plays a very important part in science centre learning. Here people learn because they love to learn and not because they are coerced to learn. As the science centres do not follow any set pattern of syllabus, and as the exhibits in the science centres are not sequentially placed, learning is self directed. Thus visitors are encouraged to explore the science centre as if they are in charge, deciding where to go and what to see. Science centres thus create spaces where people can learn independently, safely and creatively. *Csiskzentmihalyi & Hermanson*[19] have called this an intrinsic motivation, but the situational interest developed from the visit to a science centre can act as an external motivation for science learning which comes through three steps: attraction, engagement and ownership. Along with the findings and observations focusing on the attitude toward science learning and career choice there are case studies emphasizing solely on the motivation of school students visiting Science Centers. *Salmi*[20], suggested that the situational motivation of students could be changed to intrinsic motivation by well organized events or programs linking schools to the informal, open learning environments of science centres.

Nurturing Creativity

Creativity is a mental process involving the generation of new ideas or concepts, or new associations between existing ideas or concepts. From a scientific point of view, the products of creative thought (sometimes referred to as divergent thought) are usually considered to have both originality and appropriateness. Fostering creativity is one the most important goals of the science centres. Most exhibits and activities are aimed at that goal. The exhibits, activities like *creative ability camp, hobby camp, science seminar, science drama, quiz, poster design and software development* etc are important examples. Learning in science centres has five dimensions, of which divergent thinking is with the prescription of *Torrance*[21] (5 steps to encourage creativity), science centres always encourage free, independent and divergent thinking in activities such as creative ability camps or science seminars.

Socio Cultural Learning

According to *Vygotsky*[22], a major portion of the learning takes place in the perspective of meaningful activity and social communication. Many people visit science centres in family groups. In such a group, a child does not learn alone; rather he learns by asking questions to his elders and friends and enjoying the

Fig. 4. In a Science Centre, people learn together. Here, socially mediated learning is important

exhibits. Through interaction, families have been observed to move from identifying and emphasizing to interpreting and applying their science centre experiences.

Supplementing School Curriculum

Science Centres work directly with schools through in-house and outreach school programs, reaching an estimated 3.5 million school children (25-30 percent of science centre visitors) every year in India alone. Science Centres have an important role in providing education services to users, whether these are children or adults. Some education services will provide a range of formal teaching opportunities in the science centres; others will work closely with teachers to allow teachers to make better use of the educational resources available through displays and exhibitions, databases, handling collections and science centres staff. The

look of wonder on a child's face can be the reward for a lifetime's work in science centres. It is the aim of science centre education to foster contact between people – whether children or adults - and science: not to teach facts, but to sow a seed of interest, a spark of inspiration. The liveliest science centres are not content to wait for people to come and visit them: they take their service out into the community. Similarly, science centres education services are not limited to helping visiting school-children- they include many different ways of taking the science centres out into the schools and into other parts of the community.

Choice of Careers in Science and Technology

A number of studies in several countries have identified an informal exposure to science, comprising visits to science centres, as a major factor in career choice. In India several successful scientists attribute their career choice to their visit to science museums and centres in formative stage of their educational path. A glimpse at the visitors' book of any science centre will reveal that generations of scientists attributed their lifelong interest in science to the childhood visit to Science Museums. *Woolnough*[23] found that extracurricular science activities encouraged students to study science at school and to pursue science careers. While surveying university students in Australia, *Coventry*[24] found that 80 percent of students studying for science-based careers had visited science centres at least once.

Visits to Science Centers Leave Long-term Memories

Learning is "constructed over the years as the individual moves through his socio-cultural and physical world; over time, meaning is built up, layer upon layer," and science centre visits aids as an element of our long-term memory store house. *Stevenson*[25] examined for the influence of a major interactive science exhibition immediately after the visit, a few weeks later, and then after six months. It was observed that even after six months, visitors were able to recall spontaneously the details of their experience. *Beiers & McRobbie*[26] found proof of children integrating the science centre experience into pre and post visit mental models over the course of a few weeks. According to *Reisberg & Heuer*[27], the experiences of the visitors generate powerful emotions which enable the experiences to be more memorable and easier to recall.

Societal impact

Science has become a part and parcel of almost all activities of modern society. It has entered into the fabric of our community life. Knowledge of science having relevance to daily practices must, therefore, must be brought within the reach of every citizen. They must be guided to explain their daily happenings in terms of science and not by superstition and prejudices. They should be made to realize that so called taboos have no value in their life and it is the applications of science that can help solve many problems they face

Fig. 5. Technology access for sr. citizens

very often. What is, therefore, needed is the organization of sustained science programmes for the community people so as to make them understand the values of science and overcome the barriers of social prohibitions and restriction those result from convention and tradition. Many social and voluntary organizations are active in the field. Science Centres too have to be oriented to provide well-planned and well-organized programmes for catering to the needs of community people. The change of mindset, learning of skills and very approach to day to day activities are the evidences of social impact. *Travers & Glaister*[28] put forward that science centres promote "bridging social capital", precisely developing a connection between several communities and groups.

Community Leisure Activities

In the early 1970s Duncan Cameron, motivated by the impact of early science centers, focused the discussion on the institutional change, needed to move from the museum as a "temple" to a "forum"[29]. More recently, *Casey*[30] described the museum "as a forum for debate by offering reflective space in which people can consider issues in context." Traditionally, museums were showcases of curios, which people did not touch but admired and appreciated from a distance. Science centers promoted a different role for the museum with their emphasis on learning through fun and enjoyment. As a major attraction for leisure activities, today's science centers are tough competitors of amusement parks or zoos. This is reflected in number of visitors who come to science centers. Average visitor figures of some major science centers are given in Table 1:

Science Centres	Average annual visitors (millions)
Science Museum, London	1.7
Cite de Sciences, Paris	3.5
Air & Space Museum, Washington DC	7.0
Science City, Kolkata	1.5
Global total	350.0 (approx)

Table 1: Major Science Museums/Centres and their average annual visitor figure.

Scientific Awareness & Scientific Temper

Having understood the vital role of science centres in public education, we can well guess that they can play a very important role in creating a scientific awareness in the society, developing a scientific temper among the people, elicit public opinion on controversial scientific issues, dispel social taboos and superstitions and thus indirectly play the role of social reformers of the modern society. In India, science centres rendered a yeomen service in dispelling widespread superstition about celestial events or diseases. The science centres also provide a platform for social interactions on scientific issues that, and encourages and facilitates better learning of science. *Cameron*[29] argues, cultural institutions can act as the trusted incubators for change by providing a variety of information sources, offering challenging and participatory experiences but significantly for science centres to facilitate visitors to engage topics on their own terms in their own capacity as expert informants as opposed to the older pedagogic paradigm as authority. In addition to the evidence of the gain of knowledge and understanding, considerable evidence has also been collected of visitors to science centres practicing and developing skills of exploration, observation, interpreting data, sharing ideas, and other skills directly related to scientific belief (e.g. *Allen*[31]; *Borun, Chambers, & Cleghorn*[32]; *Tunnicliffe, Lucas, & Osborne*[33] ; *Schauble et al.*[34]; *Crowley et al.*[35]; *Crowley & Jacobs*[36]).

Community Partnerships

Scholars and users argued that a deeper relationship between the science centre and its public is necessary in order to sustain the institutional renewal process. A science centre is not defined merely by its display but rather by how its resources are used to achieve the goals framed by its mission and by the interactions developed with its public[37]. It is, therefore, necessary to develop partnership with the surrounding community including schools, colleges, universities, research labs, various societies and NGOs and encourage them to collaborate with the science centres. This enhances the effectiveness of as well as public support for the science centres. The activities of policies of science centres directed to community have positive impact in establishing such partnership as evidenced by the participation and utilization of science centre resources.

Science Centers as Resource Centres

The science centres develop a joint venture with other organizations, including schools, to bring the science center hands-on curriculum with variety of props into the classroom or to organize several innovative educational programs, thus act a facilitator of science and technology transfer; for example, for the production of educational kits. The centers also endeavor as a catalyst for the conveyance of innovation from research to new business activities. The institution develops into a resource for science education, vocational guidance and providing training; for example, experiences of student both at the science centre and in the classroom, teacher development programs and materials resources, distance learning opportunities, interactive events and virtual exhibits on the internet. Several science museums use their collections in combination with hands-on exhibitions and innovative programs to support inquiry-based learning (such as the Science Museum and the Natural History Museum in London, and the Deutsches Museum in Munich). *Kelly*[38] examined the roles of (science) museums as credible information resource for an increasingly complex contemporary information society and in the contentious subjects' context. In India, developing learning resources including exhibits as per the need of the educational institutions and by organizing in a way that supplement school curriculum have made science centres as important institutions to fall back for education system. *Bradburne*[39] recommends that Science Centres should become collection (including hands on exhibits) and user oriented rather than collection and visitor oriented.

A Source of Pride for the Local Community

The science centres focus for generating pride in their region for local residents, resulting from the success and reputation of the science centre. Accordingto *Rosentraub*[40] the visitors see The Children's Museum as the core factor in the cultural identity of Indianapolis and Central Indiana and the residents include it among reasons for pride towards living in the area. He also suggested that "The reputation ... and the pride produced for an area's residents by a civic asset can be as important or in some instances more robust that the economic benefits." The fame of the local community is also improved by the display, in several other parts of the country, of the museum's name on its travelling exhibits. Local community takes pride in facilitating or recommending visit to science centres for their guests and relatives or accompanies them which enhance social interaction

and values. In India Science City, Kolkata has become an iconic place of pride both for local community and government.

Environmental Restoration

Science Centres are often built on plots which would have no other utility. However, once the science centres are built and lush greenery of science parks develop, an environmental restoration and upgradation takes place. Two glaring examples from India are Nehru Science Centre, Mumbai and Science City, Kolkata which were built on garbage dumping grounds.

Economic Impact

A study by *Groves*[41] has dealt the economic impact in detail. Economic impact is made up of primary and secondary impacts: primary or direct economic impact is referred as the expenditure by the science centre itself, in addition to the expenditure by those visitors to the science centre who come from outside the local region in order to visit the centre helping to increase economic activity. Secondary economic impact is a combination of indirect and induced impacts. Indirect economic impact refers to the fact that expenditure by the science centre and its visitors contribute new money into the economy by inducing the purchasing of goods and services in order to satisfy the requirements of the science centre and its visitors. Hence are named as the 'supplier' effects. Induced economic impact is the flow-on created by the collective effect of direct and indirect economic impacts. Larger total wages and increased organizational revenues are, partially, returned to the local economy through further 'consumption' expenditure.

Indirect and induced impacts can only be quantified on the basis of a good understanding of the overall economy and inter-industry relationships in the region concerned. Fiscal impact on the local (or wider) economy also results from an institution's activities. This is related to but separate from the economic impact. An institution's direct economic impact occurs as a result of its own spending and spending by some of its out-of-region visitors. It also includes the jobs provided directly by the institution. The direct impact resulting from the institution's own spending, on both employee wages and payments to suppliers of goods and services, is readily determined from the institution's salary and expenditure records. *Brand et al.*[42] and *Witschey*[43] recommended a broader foundation for considering 'economic impact', although the secondary impacts are hard to be quantified.

Local/regional/international Tourism

The science centres provide a source of attraction especially for tourists, both local/regional and international in its own right. It also develops a partnership with local hotels in packaging tourism offers. The centres often develop a partnership with tour operators, to link up with other attractions in the region. *Persson*[2,44] has indicated that 30 percent of US population pays at least one visit to science centres annually. The figure is 16 percent for Great Britain, 10 percent for Scandinavian countries and about 1 percent for India. Globally science centres draw about 350 million visitors every year. This is about 6 percent of the global population. *Jasper* [45] reported that "the business survey calculated the positive and negative influences on local tourism-related businesses, increments as well as reductions in the customer number and income; along with the improvements and a positive effect on the image of a worsening of traffic in some areas and some increased difficulties of recruitment. However, the positive effects were, overall, stronger than the negative ones, and arguably the most significant effect was a lengthening of the tourist season."

Income Brought into the Science Center from Visitors

Ninety percent of the science centres in the world charge entry fee to their visitors. By the year 2000, the total turnover of science centres around the world was US$1.4 billion. One can assume an increase of 30 percent over last ten years making it to about US$2.0 billion. *Beetlestone et al*[1], *Persson*[2,4] *Groves*[41] reported that Science Centres in the USA generate 80-90 percent of their operating expenditure from various sources of income. The figure is 60-70 percent for children's museums in the USA, 15-20 percent for science centres in the UK, 30-70 percent for other ECSITE members and 46 percent of the operating cost for NCSM (except Science City, Kolkata which is self reliant). Globally, the figure is about 45 percent[41]. Thus, we see that visitors contribute a huge sum of income to the science centres. *Wright* [46] concluded from his studies that while the science centres "will never become self-sustaining, a larger facility would allow for more earned income, near or at 60 percent of annual cost of services (compared with the current 50 percent), in addition to an added annual economic impact of over $500,000".

Income Brought into Community by Visitors

The science centres act as a cause of income for a group of community associated with providing travel, food, accommodation, retail purchases and visits to other attractions for visitors. The institutions provide flow-on effects to other businesses and industries in the region—the extra turnover generated for suppliers and the resulting growth in employment and local spending power, and successive waves of such impacts among

downstream suppliers and service providers. These flow-on effects are sometimes called multiplier effects. *Greene* [47] observed, "For every pound sterling spent by visitors at the museum (The Museum of Science and Industry in Manchester), twelve pounds are spent elsewhere in the local economy."

Science Center Expenditure

Globally science centres have an operating budget of more than US$4 billion annually. Surveys showed that about 55 percent of this goes for Non Plan expenditure including staff salary. Remaining 45 percent is developmental expenditure which primarily contributes to national and local economy, which in turn generates employment. Science Centres also pay various taxes and revenues to government and local bodies.

Contributing to Urban Development

The science centres promote site rehabilitation by encouraging governmental or municipal funding to the region, for the redevelopment of the areas near the science centers site. New roads are built, new transport links are established. Small scale urbanization takes place around every science centre. As considerable land is required to set up a science centre and land is scarce in cities, in most cases it happens that unwanted land gets allotted for the development of science centre. The science centre in such land enhances the value and contributes to development of the area. In three such examples, the Nehru Science Centre, Mumbai, Raman Science Centre, Nagpur and Science City, Kolkata were set up on erstwhile garbage dumping grounds of respective cities. Now these localities have been transformed into prime and valuable localities.

Appreciation of Real Estate

The development of the areas close to the science centres gets an economic upward thrust owing to the overall upgradation in property of the local areas and thus the economic development of the local property owners. Housing investment activities of community development corporations can be associated with a positive impact on the residential real estate market within their respective service. A striking example is the Science City, Kolkata where the land cost appreciated over four hundred times in 15 years after its development in hitherto garbage dumping ground.

Direct and Indirect Job Creation

The science centres act as a source of opportunities for local businesses in order to promote their products and services through association with the same. They provide employment opportunities, particularly for students and the youth group of the society, including internships, vocational training, job guidance and start-up projects. They sometimes endow with travelling exhibitions and outreach programs to other venues or to other communities,

Fig. 6. Science Centre's social responsibility: Vocational training for rural women.

generating income for those as well. Science Centres under NCSM, particularly the small centres situated in remote and backward areas, have a long tradition of providing vocational training to the local unemployed people, which could help them start small enterprises and earn a decent living. In many such cases in India, the Science Centres acted as catalysts of technology transfer from laboratories and industries to the local community.

Political Impact

The political impact refers to the system in which the policy-makers and policies are affected by the learning , knowledge or value of social development attached. The influence is administered by the interests and attitudes of the politicians, administrations and citizens while having a query about the public interest involving science and technology, public action like law-jurisprudence-ethics, politics, including several events on regulating norms, standard rules and the participation of the citizens in making scientific and technological decisions. *Lafrance*[48] noted, "The Laurentian University faculty behind the new Graduate Diploma in Science Communication believe that citizens need to get a handle on the quickly-evolving information to be in a position to weigh risks, make choices and question the decisions of policy makers and politicians.Only then can they fully participate in the affairs of their communities and countries." The science centres, as described by *Ferguson*[49] as "powerful symbols and signifiers of political identity…act as a moral technology for many", have played a vital role in stimulating the knowledge of the citizens to come across the contentious subjects making an auspicious embankment towards the political knowledge of the citizens. *Cameron*[29] also suggested, "the institutions might consider re-politicizing practice", that is, to leave the monotonous prevailing

methods of pedagogy and to allow the public to look into the scenario in a more open-minded, precise manner in order to generate expertise group of general public who can deliver their knowledge, potentials and skills to the ordinary in a much more easily understandable way to capture the ordinaries' minds rapidly and deeply.

Fig. 7. For leaders of the country, science centres are important for overall development

In India, the connotation of political impact is different. Since the independence of India in 1947, the government has been considering the science museums and centres as an integral part of the overall development (educational as well as socio cultural) of the country. In 1978, NCSM was formed as the apex body of all science museums and science centres with a goal of setting up of science centres at every nook and corner of the country. After thirty two years of existence NCSM has 27 units under its control. The Council has developed eleven more centers for various state governments and other institutions and nine more are under development. Twenty five new projects specially from states are under consideration. In addition, NCSM has provided catalytic support to many Science Centres in India and abroad. Very often proposals are received for new science centres from leaders who consider science centres as tool of constituency development. This shows that the policymakers at governmental level consider science centres as an important tool for societal development.

Conclusion

Qualitatively it is easy to understand the impact of science centres on different aspects of our lives. However, most studies conducted are focused on short term impact. The real challenge is how to measure and demonstrate the long-term impacts on individuals and communities. Also, most of the studies concentrated on Personal Impact. There are very few studies on societal or economic impact and practically no study on political impact. A systematic study of long term impacts, personal, social, economic and political would reveal, quantitatively, the real benefits of science centres.

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