Connecting the Unconnected in Post Disaster Phase through Space Technologies for Sustainable Development Goal #4

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Abstract

A quality education is a force multiplier and can lay a foundation for sustainable development. Accordingly, the United Nations made education as Sustainable Development Goal (SDG) #4. If education is supported before, during and after a disaster, it can save lives, protect children and benefit communities and countries. But education is generally not prioritized in a disaster response, and reconstruction or rehabilitation to ensure continued education. Limited allocation of resources is one of the reasons and thus the gulf between education and student expands in a post-disaster phase. Under such circumstances, space based technologies can help in optimizing the limited resources efficiently and effectively. An exploratory strategy for the realization of SDG#4 is suggested and the same can be scaled-up entire South Asian region as well.

Keywords: *Disruption to learning process; Space based Technologies: South Asia; Sustainability of Education; Education for Sustainability.*

1. Introduction

India, due to its geographical location is vulnerable to numerous natural hazards such as earthquakes, floods, cyclones, droughts, landslides, hailstorms etc. Risk of these hazards becoming disaster looms large on account of India's demographics, socio-economic conditions, unplanned urbanization, development within high-risk zones, environmental degradation, climate change etc. All these factors contribute to India's higher vulnerability and often these disasters seriously threaten India's economy, its population and sustainable development. Over and above, it is projected that by 2030, India will become the most populous nation. To add to the woes, global climate change

projections indicate that both frequency and intensity of these natural disasters will increase and so is its vulnerability with consequent damages shooting up several folds (IPCC AR 6). Such a situation warrants effective disaster management encompassing all stakeholders at every step of Disaster Management process, viz., preparedness, awareness, response, recovery and mitigation.

Every disaster is unique in the way it impacts the community and among the various sections of the society, it is the women, children and the elderly that are the most vulnerable to disasters. In along run, it is the children of vulnerable communities that bear burden the most. A child, sensitive and being in formative years, is not only put to hardships due to disaster impacts and effects, but also, in all probability, miss the process of learning/ education. For instance, cyclones, floods may result in damage to the educational infrastructure or private property and thus disrupt the child education, while, slow onset disasters like drought may disrupt learning process due to processes like out-migration. In post-disaster phase, inter-alia, limited resources, education is generally not prioritized in a response, reconstruction or rehabilitation of damaged schools for continued educationas high demand for resources from other sectors. In this context, this article argues that, Space Based Technologies (SBTs) can help to overcome the disruptions in learning processsignificantly and help in realization of SDG # 4.

2 Education

Quality education is not only the foundation for sustainable development, but also is a force multiplier which enables self-reliance, boosts economic growth by enhancing skills, and improves people's lives by opening up opportunities for better livelihoods. Accordingly, attention to education was stressed in every planning process. Millennium Development Goals (MDG) prioritized education and incorporated it as MDG #2. It aimed to achieve 'Universal Primary Education' to be monitored using three indicators, viz.,

- Target # 2.1 - Net Enrolment Ratio in Primary Education,
- Target # 2.2 - Proportion of Pupils Starting Grade 1 who Reach Last Grade of Primary School, and
- Target # 2.3 - Literacy rate of 15-24-year-olds, women and men, to be realized during the time period 2000 - 2015.

South Asian countries for long have made investments in education sector to achieve Universal Primary Education and in this regard, Sri Lanka and Bangladesh have been

early movers. Sri Lanka has implemented the Free Education Act as early as in year 1945 and Bangladesh has implemented the Primary Education Compulsory Act of 1990. India has adopted the right-to-education legislation in August 2009. Pakistan has passed legislation in 2012 to guarantee the Right to Education (Bajaj et al 2016). A comparison of the progress made on three indicators of MDG #2, indicates that SAC are still away from the realization of the goal of University Primary Education (Table 1).

Table 1: Indicators and progress on MDG # 2

Country	Base year 1990	Status in 2000	Status Vs MDG in 2015
MDG # 2.1:- Progress in MDG Indicator #2.1 - Net enrolment in primary education (%)			
Bangladesh	60.5	85.5	97.7
Bhutan	55	90.7	94.8
Nepal	69.3	98.7	94.8
India	78.2	98.6	94.8
Pakistan	56.2	71.9	94.8
Sri Lanka	99.8	94.3	94.8
MDG # 2.2 - Proportion of pupils starting grade 1 who reach grade 5 (in %)			
Country	Base year 1991	Status in 2000	Status (Year)
Bangladesh	44.7	66.3	79.9 (2012)
Bhutan	31 (1993)	84.2 (2003)	78.9 (2012)
Nepal	35.7	65.3 (2002)	60.4 (2013)
India	57.3 (1995)	61.4	96 (2011)*
Pakistan	-	69.7 (2004)	62.2 (2012)
Sri Lanka	96.9	97.8	98.5 (2012)
MDG Indicator # 2.3 - Literacy Rate of 15–24 Year Olds			
Country	Base year 1990	Status in 2000	Status (year)
Bangladesh	44.7 (1991)	63.6 (2001)	79.9 (2012)
Bhutan	-	74.4 (2005)	-
Nepal	49.61	70.11	82.4 (2011)
India	61.91	76.41	81.1 (2006)1
Pakistan	55.3 (1998)	69.21 (2006)	70.8 (2011)
Sri Lanka	-	96.6 (2001)	98.2 (2010)

Source: Compiled from http://mdgs.un.org/unsd/mdg/Host.aspx?Content=Data/snapshots.htm, *https://unstats.un.org/unsd/mdg/SeriesDetail.aspx?srid=743

As the nation inch towards achieving Universal Primary Education, other associated issues become a concern, for instance, educational infrastructure for later stages of education, i.e., secondary and higher education, both in terms of access and also quality. The United Nations General Assembly (UN) has addressed these concerns in the Sustainable Development Goals (SDGs). In view of its utmost importance, education has been made as a full-fledged goal # 4 and has set for itself the goal, 'by 2030, ensure inclusive and equitable quality education and promote lifelong learning opportunities for all'. It encompasses two key components, viz., a) Access, b) Quality Education. Different Indicators have been selected to monitor the progress. For the purpose of monitoring the progress, NITI Aayog has selected indicators based on the availability pan-India data. Scores pertaining to SDG # 4 of various states in 2020 is given in Fig 1 and a comparison with the score in 2018, most of the states have registered lower score in subsequent years (Table 2). State of Kerala has highest score at 80, followed by the Himachal Pradesh and Goa with a score of 74 and 71 respectively and Bihar occupies the lowest place with a score of 29.

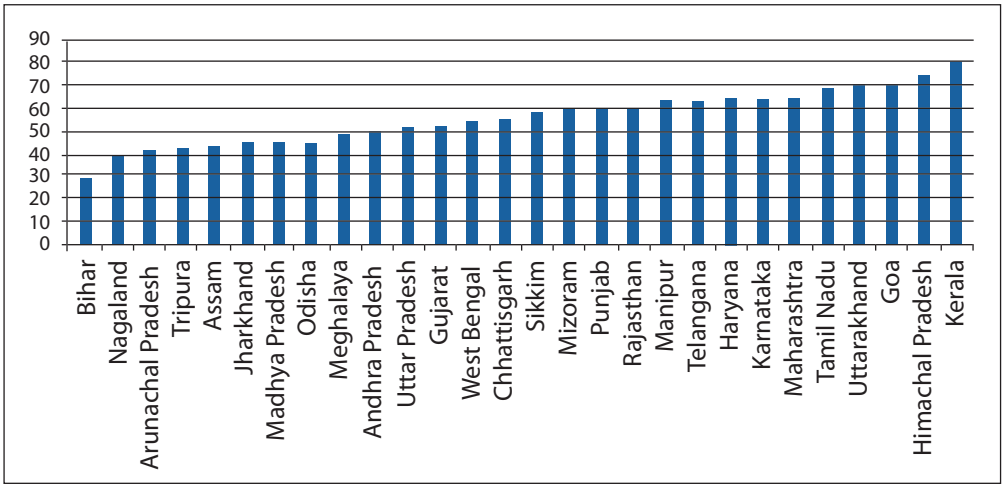

Fig 1: Status of SDG #4 in different states in 2020 (source NITI Aayog reports)

Based on the score, NITI Aayog has made four categories, viz., Achiever (with a score of 100), Front Runners (with score between 65 to 99), Performer (Score between 50 to 64) and Aspirant (Score below 49). Based on the SDG #4 Score, it is surprising to find that there are no states that fall in Achiever Group and majority of Indian States falling into the Performer Group (Table 3). In this backdrop, any disturbances in the form of

natural disasters could have an adverse impact on realization of the Goal. Disasters, by their nature, are divided into two, viz., rapid and slow onset. Rapid disasters such as floods, cyclones, earthquakes may result in loss of life and damage to the infrastructure, with severe impact on the process of schooling. For instance, schools, in general, are preferred as relief centers. Cumulatively, they bound to have impact on both access and quality of education and harnessing the space based technologies could provide additional traction for the realization of the SDG # 4 in general and particularly for quality aspects.

Table 2: Categorization of States

Sl no	Category (score)	States and UTs
1	Achiever (100)	
2	Front Runner (65-99)	Chandigarh, Delhi, Goa, Himachal Pradesh, Kerala, Puducherry, Tamil Nadu, Uttarakhand
3	Performer (50-64)	A& N Islands, Andhra Pradesh, Chhattisgarh, Dadra and Nagar Haveli, Daman and Diu, Gujarat, Haryana, Karnataka, Maharashtra, Manipur, Mizoram, Punjab, Rajasthan, Sikkim, Telangana, Uttar Pradesh, West Bengal
4	Aspirant (0- 49)	Arunachal Pradesh, Assam, Bihar, Jammu and Kashmir, Jharkhand, Ladakh, Madhya Pradesh, Meghalaya, Nagaland, Odisha, Tripura

Source: NITI Aayog 2021

3 Niche for SBT

Due to its geographical location, India is often subject to different types of natural disasters such as floods, drought and effective large population across the country. Consequently, both access and quality of education may get effected and further intensify the un-employability (World Bank 2009, NASSCOM and McKinsey 2005). Different scenarios may emerge in post-disaster and may create disruptions in the process of learning, viz.,

- Student community effected by disaster and thus unable to attend to the education

- Teaching community is either effected by the disaster or engaged in post-disaster related activities and thus unable to attend to the teaching, and
- Education infrastructure itself damaged by disaster or it is being used for post-disaster activities, for instance, as relief centers

Under such circumstances, using satellite mode of communication, linkages can very easily be established between two distant places, if the required infrastructure is in place. This technology can be adopted to establish linkage between two institutions, representing two extremes in terms of infrastructure and resources. The satellite link can be used to disseminate, transfer of knowledge and facilitate interaction between the stakeholders of two or more institutions representing 'Haves' and 'Have Nots' respectively. Such an arrangement can help an educational institution to leapfrog the limitations of inadequate trained resource persons, overcome the physical distance, meet the aspirations and also inspire younger generations.

Financially, implementation of SDG related programs requires significant budgetary allocations. For instance, to close their infrastructure gaps, South Asian Countries require an estimated $2.5 trillion by 2020 and $4-5 trillion by 2030 (NPC Website). By Adopting SBT, entire mountainous region can be assured of both quality and access in education immediately and traditional infrastructure can be developed as and when resources permit. Exploration of avenues such as pooling the resources, leveraging public-private partnerships (PPPs), international development cooperation etc. can ensure earlier adoption of SBT.

3.1 Regional Cooperation in the Field of Education

To promote the welfare of the people of South Asia and to improve their quality of life, South Asian Countries viz., Afghanistan, Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan and Sri Lanka formed an association - The South Asian Association for Regional Cooperation (SAARC) in 1985 and the member countries agreed to promote active collaboration and mutual assistance in the economic, social, cultural, technical and scientific fields at regional level. The SAARC has recognized that literacy is a fundamental human right and the foundation for lifelong learning through education and have explicitly agreed that education may be included as an agreed area of cooperation since all children were the principal means of human resources development (SAARC Website, ISRO Website). These regional agreements of cooperation may be invoked to

achieve regional development, with reference to SDG #4. South Asia Satellite (GSAT 9) put into orbit by India could be one such platform for such regional cooperation.

Table 3: Potential Niche for SBT in SDG#4

Indicator		Extent of Disruptions	Potential for SBT
Participation	4.3.1	Significant	Access to learning nearby, serves as catalyst for higher participation
	4.3.2	Moderate	Higher value addition tend to attract more students to tertiary education
	4.3.3	Significant	Value addition and higher potential for gainful employment encourages enrollment into vocational programmes
Target 4.4			
Skills	4.4.1	Moderate	Virtual classrooms and exposure to SBTs has positive influence
	4.4.2	Moderate	Adoption of SBT increases the per cent of youth with digital literacy
	4.4.3	Significant	Adoption of suitable SBT certainly increase the levels of attainment
Target 4.5			
Policy	4.5.1	Significant	Gender disparities are significant in Mountain communities, and reasons vary from access to affordability. SBT can bring down the opportunity costs significantly.
	4.5.2	Negligible	-
	4.5.3	Significant	Through SBT, access can be ensured to remote population as well
	4.5.4	Moderate	SBT can bring down per student cost of knowledge delivery
	4.5.5	NA	NA

Target 4.6			
Skills	4.6.1	Moderate	SBT can enhance the rate of delivery of service and number of beneficiaries
	4.6.2	Moderate	SBT can help to increase the literacy rate
Participation	4.6.3	Moderate	SBT can make the programs more interesting and thereby better participation

3.2 Earlier Experiments of SBT for Education

- Indian Space Research Organization (ISRO) has helped to evolve and functionalize a satellite-based education program 'Satellite Instructional Television Experiment (SITE)' in 1975. Supported by UNDP, UNESCO, and UNICEF, the SITE initiative was deployed by using the state-of-the-art technological support extended by United States of America (USA). A cluster of 400 villages in 20 districts of six different states were shortlisted for this experiment and two components, viz.,
  a) Educational Television for the school children in the age group of 5-12 years
  b) Instructional Television for adult audience in the areas of agriculture, family planning, health and hygiene, occupation skills constituted the SITE. (Romesh Chander and Kiran Karnik 1978).
    - Success of SITE led to Satellite Telecommunication Experiments Project (STEP), a Joint program with Franco-German Symphonie Satellite during 1977-79. (Kiran Karnik 2015).

World's first education satellite - EDUSAT launched in 2004, exclusively devoted to educational purposes - the virtual classroom concept to provide education to children in remote villages, adult literacy programs and training modules for teachers and quality higher education to students in areas without access to good technical institutes. This program has enabled the dissemination of knowledge/information to thousands of students at once, making classrooms barrierless. The tele-education networking systemoperating in the Ku-band constituted an uplink facility, Satellite Interactive Terminals (SITs) and Receive Only Terminals (ROTs) connecting 56,164 schools and

colleges (4,943 SITs and 51,221 ROTs) covering 26 States and 3 Union Territories of the country as of the year 2013.

4.0 Proposed Model Ecosystem of Convergence

Before presenting the outline of ecosystem of Satellite based program to enhance access and quality of education in the mountain regions, the caveat of argument is that, this is not the debate for either technology or teacher mode. Neither it is the argument of which one is better. Rather it subscribes to argument that teacher is in a position which is irreplaceable and prime importance is accorded to the teacher only. SBT can fill in the gaps if any created by the disasters, to a limited extent only. In addition, SBT can help teachers to play a more effective role in entire process, thus, complimenting each other. An outline of the model is presented here and has been drawn significantly from the Indian context. Similarities with other south Asian countries, make this model suitable for consideration and adoption in other South Asian countries after suitable changes.
Satellites can help overcoming the geographical distance and provide a reliable and continuous communication channel between two institutions. Taking advantage of this aspect, any institution that was not affected by disaster can play the role of 'Mentor' to guide the students of the institution that was affected by the disasters. Teachers from the mentor institution, through uplink facility can interact with students in subject related matters as the case with 'Virtual Class Room'(VCR). Such a mechanism helps to avoid the discontinuity in the process of learning. With very high rates of penetration of mobile, communication has helped to reach out to a larger audience. Use of SBTin post-disaster can also fill this gap between the desired and actual skill sets of youth/ students to some extent (UNESCAP 2017, NSDC web stie). It can be used at both secondary and higher levels and help overcoming issues like continuity and skill gap.

Of the ten targets of SDG #4, Targets 4.1 to 4.6 is prone to disruptions and adoption of SBTs has the potential to overcome those disruptions. For instance, participation under Target 4.3 is directly vulnerable to disruptions caused by disasters and SBT can help to overcome disruptions in participation and also ensure the continuity in terms of quality education. Certainty of continuity helps to increase the enrollment in tertiary education as well as (Indicator 4.3.2). SBT can provide higher levels of exposure to the student and help students of technical and vocational courses, thus helping in the progress of 4.3.3. Similarly, Target 4.4 can be benefitted from adoption of SBTs in as it

can facilitate the quality and access in institutions nearby and thus improve the skill sets of youth and also encourage girl child participation. Similar is the influence of SBTs on Target 4.5 and its indicators. By facilitating effective and easy to understand videos, every indicator under Target 4.6 also can be benefitted by SBTs (Table 4).

Way Forward

Space based Technologies have found wide usage in several sectors, but slow in the education sector, in spite of their potential to help in realization of SDG Indicators from 4.3 to 4.6. In view of several advantages of SBT, such as quality, access and economic benefits, efforts should be made to harness and adopt SBTs to overcome the disruptions caused by the disasters and for faster realization of SDG # 4.

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