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The Sustainable Future: Adaptive Re-use as a Strategy for Sustainable Indian Cities

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Abstract—*The Indian cities are going through difficult times, catering the burgeoning demands of society, economy and the environment. The current practice of linear production - in which something is produced, used and discarded - is no longer feasible for a sustainable future. The new way of thinking emphasizes the recycling, reusing and reducing consumption of what have already been produced. In simple words, adaptive re-use is the process of changing an ineffective or disused item into a useful entity with a different purpose. Adapting existing buildings and sites to realise contemporary requirements is the most practical option than demolition or replacement, thus ameliorating the socio-economic and environmental status of the locality, with giving it a new life. Undeniably, re-using an existing building becomes more responsive to prevailing climatic changes and global warming issues by drastically reducing the energy wastage and consumption involved in building new structures. Consequently, adaptive re-use could be elevated to a new status rather than looking at it as just a strategy for conservation of heritage buildings. Many cities in Australia, Europe and USA are actively encouraging adaptive re-use as a strategy towards sustainable carbon-neutral cities. Keeping all these factors in mind, designing our future buildings with inherent adaptive re-use potential would be a clever approach towards making our cities more sustainable. This paper aims at how efficiently we can determine the adaptive re-use potential of existing buildings by briefly explaining the Adaptive Re-use Potential (ARP) model, along with exploring a strategy to assess the ARP of future buildings.*

Keywords*: sustainable cities, adaptive re-use, adaptive re-use potential, carbon neutral cities*

1. INTRODUCTION

Conservation of our ill-planned cities could be a daunting task to start with, but surely a task that could lead us to a more sustainable tomorrow. As suggested by Dennis Rodwell [1], although their roots are different, both conservation and sustainability share a common ground. According to Rodwell, in the wider, environmental sense, conservation and sustainability have parallel meanings and are frequently used interchangeably to express the need to manage the world's natural resources and the biosphere in order: first, to secure long-term harmony between man and nature; and second, to achieve continuous enhancement in the environment and in the conditions and quality of life for humans and other life forms.

UNEP's Building and Climate change [2] asserts that buildings contribute as much one thirds of the total greenhouse gas emissions, primarily through fossil fuels during their operational phase. According to their statistics, the building sector contributes up to 30% of global annual greenhouse gas emissions and consumes up to 40% of all energy. Thus it is very much clear that the building sector has the most potential for delivering significant and cost-effective greenhouse gas emission reductions [2]. The World Energy Outlook 2009, the global energy usage tracker of the Paris-based International Energy Agency says that the half of world's population in cities is already consuming two third of world's energy. By 2030, cities will be consuming 73 per cent of world energy, accounting for 70 per cent of CO2 emissions [3].

The Indian cities are going through difficult times, catering the burgeoning demands of society, economy and the environment. India is experiencing an unprecedented construction boom. The Building Energy Efficiency in India compiled by US Department of Energy [7] states that, the country doubled its floor space between 2001 and 2005 and is expected to add 35 billion square metres of new buildings by 2050. In short, we won't be left with enough land in our near future to cater the proliferating demand, thus forcing us to grow and expand our cities beyond control into the agricultural and suburban fabric. It is predicted that, if there are no specific sectoral policies to curb building energy use, final energy demand of the Indian building sector will grow over five times by the end of this century, driven by rapid income and population growth [8]. These alarming statistics urges building design professionals to produce more energy efficient buildings and renovate existing stock to meet the sustainability criteria set by their respective authorities [4].

The adaptive re-use of buildings - under the light of all these circumstances - is more than just a practice of conserving the heritage of listed or non-listed structures in a historically significant neighbourhood. In fact, as an alternative to our ever-increasing throw-away society, adaptive reuse offers a sustainable building site with existing infrastructure and materials [5]. This culture of reuse and recycle can be implemented in design strategy for our future buildings,

keeping in mind the benefits of adaptively re-used buildings [6], which can be categorised into the following;

- Environmental
- Social
- Cultural, and
- Economic

The purpose of this paper is to identify the factors and barriers that determines the adaptive re-use potential of buildings in an Indian realm, focussing on developing this as a strategy to design and build our future cities, which could be re-used and recycled as per the demands of the then society. The contemporary researches and literature on adaptive reuse have been reviewed and forms the basis of validity of this paper. The internationally accepted Adaptive Re-use Potential (ARP) model is briefly explained along with the newly introduced rating tool called the adaptSTAR [4]. The paper concludes with a gist of observations from the case study of an adaptively re-used site in Bengaluru – 'The Garden City of India'

2. SUSTAINABILITY & ADAPTIVE RE-USE IN INDIA

According to the article published by the Centre for Science and Environment (CSE) [9] New Delhi, India lacks a holistic regulatory body, unlike the developed countries, for assessment of environmental impact posed by the building construction sectors for its cities. CSE asserts that the only regulatory instrument that is available for composite assessment of impact of the building construction sector is the Environment Impact Assessment (EIA) rules, introduced under the Environment (Protection) Act, 1986 [9]. Though EIA is meant for only large construction projects (built-up area of more than 20,000 square meter), it gives cities a chance to decide if proposed buildings are needed and how must they be designed to mitigate their impacts. To make matters worse, The Union Ministry of Environment and Forests (MoEF) Mumbai, declared on 15 January 2015 [10] that big building projects don't need Environmental Clearances (EC's) from their centre in New Delhi anymore.

Unfortunately, under these circumstances, the exploitation of the cities, environment and the society as a whole is imminent. The rest is upon the building design professionals, contractors and builders whether or not to contemplate the surroundings before conceiving projects of massive scale, which may or may not prove detrimental. But the fact is all evident in our day to day experience, that we need more sustainable developments to curtail the ever growing environmental pollution, global warming, climatic changes and their social impacts. The developed countries have already commissioned strategies to successfully renovate and retrofit existing buildings to the required degree of sustainability standards in order to effectively decrease the environmental impact. This clearly states that adaptive re-use or retrofitting plays such a critical role in reducing emissions from the built environment. According to Christopher Gorse and David Highfield [11], there is no better example of the environmental benefits of effective sustainability in practice than the recycling of buildings. For every building that is recycled through refurbishment, the extraction of raw materials and the manufacturing processes and energy involved in converting these into a completed replacement building are avoided, to the undoubted benefit of the environment.

3. ADAPTIVE RE-USE AND THE ARP MODEL

There are various driving factors responsible for the growth of adaptive re-use as a practical strategy for delivering buildings for new uses. Among them the key driver is rising energy costs, which increases the cost of new construction (e.g. materials, transport, and resources), compelling the clients to re-use existing building stock [13].

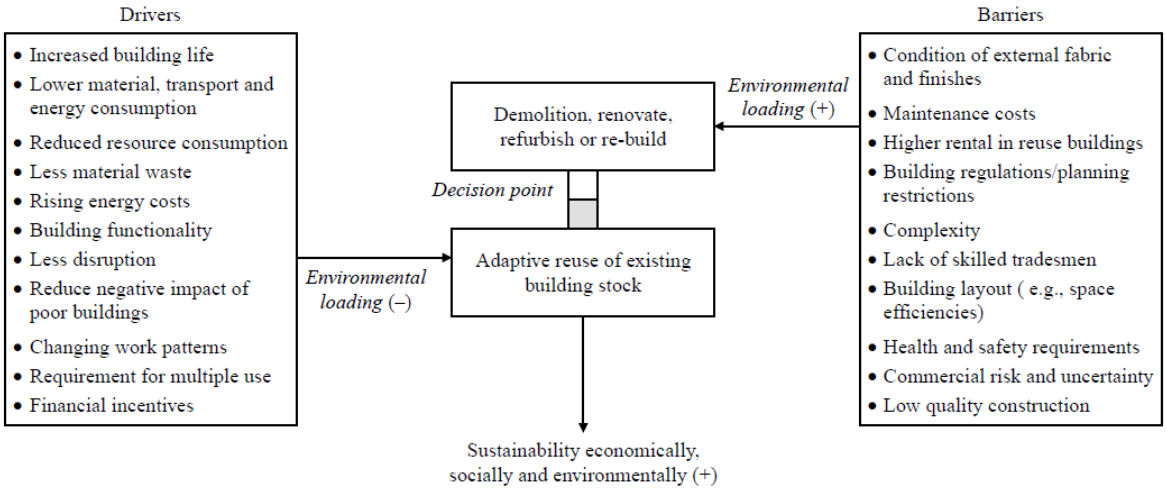

Fig. 1: Drivers and Barriers of Adaptive Re-use [14]

The ever rising energy prices is forcing the realtors and investors to increase the energy efficiency of their projects in order to maintain market demand and rental growths. According to Shah and Kumar [12], significant growth in the construction of new buildings in the recent years has created a wealth of built stock and as a result there are many buildings available for refurbishment and re-use. Although many of these projects don't abide with the prevailing sustainable strategies and environmental performance codes, adaptive re-use of this existing building stock is viewed as an alternative to address this sustainability gap by improving the buildings functionality and reducing its environmental load [14].

The key drivers and barrier influencing adaptive re-use, developed by Peter Bullen and Peter Love [14], are shown in Fig. 1.

Unfortunately there are various barriers that influence adaptive re-use. The old stock buildings may not have taken future considerations while planning, thus making it difficult to house contemporary machinery and services (e.g. HVAC systems, fire safety etc.). Also, it takes considerable time for evaluating the structural stability and quality of construction. However, the benefits of adaptive re-use clearly outruns these barriers, thus making it the most viable strategy towards sustainable growth.

The Adaptive Re-use Potential (ARP) model by Langston [15] identifies and ranks adaptive re-use potential in existing buildings. This model requires an estimate of the expected physical life of the building along with its current age.

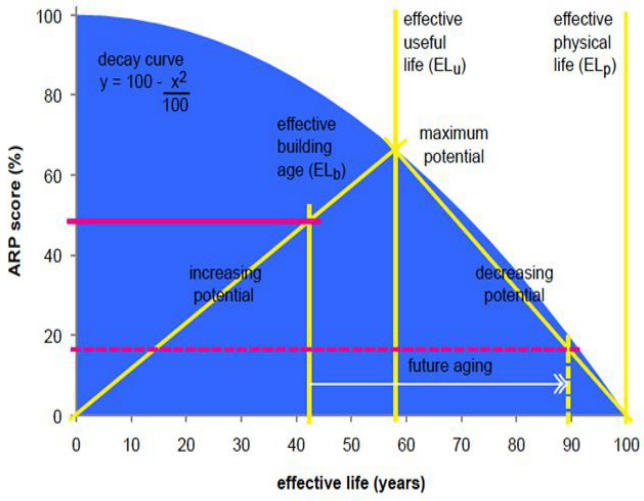

Fig. 2: Adaptive Re-use Potential (ARP) Model [15]

However, due to premature obsolescence, it has been quite difficult to forecast the effective life of buildings [16]. There are mainly seven obsolescence categories in the ARP model, and are listed as physical, economic, functional, technological, social, legal and political, and assessment of all these categories are undertaken using surrogate estimation techniques [15]. The ARP model predicts effective life as a function of (discounted) physical life and obsolescence, and allows the calculation of the adaptive reuse potential of a building's life cycle so that the right timing for intervention can be applied [4].

The ARP model has generic application to all countries and all building typologies. The model has been widely published and is considered robust as it has been tested in hindsight against 64 adaptive reuse projects globally [15] and recently validated by a new multi criteria decision analysis tool called iconCUR [17,18]. The decay curve can be reset by strategic capital investment during a renewal process by the current owner, or a future developer, at key intervals during a building's life cycle. ARP scores in excess of 50% have high adaptive reuse potential, scores between 20% and 50% have moderate potential, and scores below 20% have low value, representing about one-third of the area under the decay curve in each case. Potential means that there is a propensity for projects to realize economic, social and environmental benefits when adaptive reuse is implemented. ARP is conceptualized as rising from zero to its maximum score at the point of its useful life, and then falling back to zero as it approaches physical life. Where the current building age is close to and less than the useful life, the model identifies that planning activities should commence [15,17,18,19].

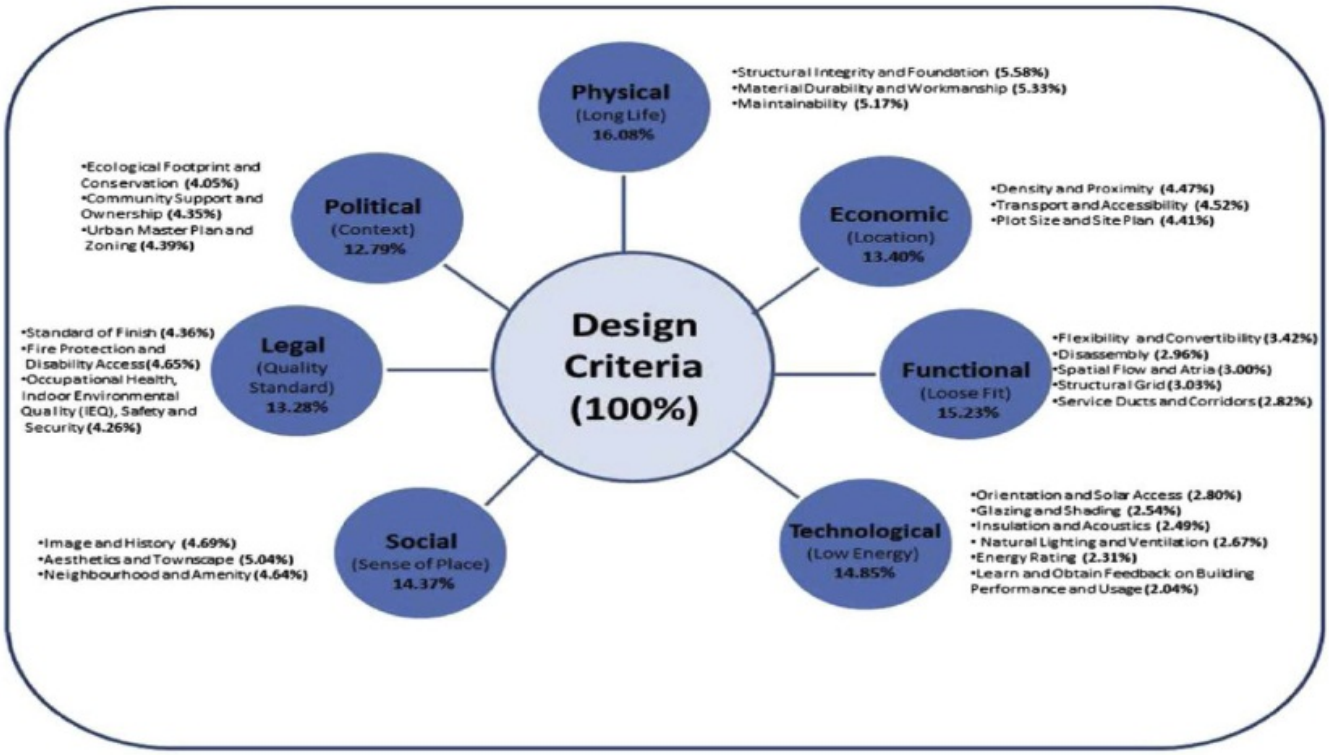

Fig. 3: AdaptSTAR model proposed by Sheila Conejos, Craig Langston and Jim Smith [4]

4. THE ADAPTSTAR RATING TOOL [4]

This rating tool is proposed by Sheila Conejos, Craig Langston and Jim Smith [4], with an aim to make adaptive re-use a key design criterion for future planning of buildings and cities. It is similar in concept to the Green Building Council's Green Star or LEED methodology where performance is assessed using a standard five-star rating scheme. The adaptSTAR design criteria is explained in Fig. 3.

The design criteria will serve as the foundation for the evaluation of new designs using a scale of numerical scores from significant to not significant. The higher this score, the better it is at addressing future adaptive re-use opportunities [4]. The implementation of such a prescient rating tool into our urban planning schemes, along with environmental impact assessments, to rate and analyse future building designs will effectively increase the adaptive re-use potential of the building, catering the demands and aspirations of the then society and thus reducing load on the environment by saving on energy wasted by demolition of existing structures and building new ones.

5. THE FREEDOM PARK, BENGALURU: A CASE STUDY

The results of adaptive re-use are quite dramatic – conversion of unused industrial buildings into schools, old churches into libraries and residential buildings etc.

[20]. The Freedom Park in Bengaluru is one such stupefying projects, where an old Central Jail is adaptively re-used into a public space. The space was out of bounds for the inhabitants, which has now been converted into a space to be used by the people of Bengaluru, so that they enjoy 'the freedom of 20 acres' in the heart of the city!

Freedom Park Entrance [24]

The site of the central jail, located in the heart of Bengaluru city today, lay virtually on a line that once divided the 'old city' and 'cantonment' during colonial rule. A separation

based on the density of the two halves; the congested old city versus the open spaces of the cantonment. The Central Jail complex was built in 1866-67, and today, the activities of this jail have been shifted to a location on the outskirts, thus leaving behind 20 acres of unused space in the busy city, walled off from public presence. The Government of Karnataka then decided to hand over this historical site to the Bangalore Mahanagar Palika (BMP) - with an intention to redevelop this 20 acres into an urban space accommodating various public activities – and floated an open competition for its redevelopment [21]. Mathew and Ghosh Architects won the competition and successfully executed the project. The project was opened to public in November 2008.

The Re-used "Watchtower" [24]

The Freedom Park is now a vital green lung space for Bengaluru. It stages peaceful rallies, protests and dharnas, without affecting the flow of traffic in the surrounding busy roads. According to the Bruhat Bengaluru Mahanagara Palike (BBMP), five acres of the park have been set aside for arranging rallies and protests [23]. The park also houses a joggers track (3'000 sq.m.), children's play area (5'200 sq.m.), jail museum, information corridor gallery, book museum, children's interactive museum in the old cells yard, tree museum, 150 seater amphitheatre, 50 seater enclosed theatre space and an outdoor exhibition park [23].

The Re-used "Barracks" [24]

The proposed design was based on the below mentioned key concepts;

- Making the jail periphery more transparent and inviting to the public.
- Adaptive re-use of the existing buildings - the barracks, the quarantine dormitory, the gallows etc. – by transforming them into 'multi-functional pavilions' in the landscape
- Maximum use of available resources such as solar energy, rain water harvesting, recharging ground water and follow the site gradients.

The Retrofitted "Hospital Block" [24]

The design successfully shifts the focus away from the tower by making it a point of reference for locating oneself within the park. Also the Adaptive Re-use Potential of existing buildings have been carefully perused and the rectangular, walled and rigid barracks are transformed into pavilions, set within the landscape. The whole undulating landscape has plinths as floating platforms, which become surfaces for activity and rest. The existing walls have been transformed from dark, oppressive and dominating stature that of a jail into something that blends well with the landscape, as remnants of the past and as an anchor to activities within the pavilion. The dark roofs of the hospital are appreciated for their structural integrity but are retrofitted to well-lit and structurally-light architectural elements. The natural landform dictates the form of the park and the existing water bodies are retained as sites of silence. The existing high periphery walls of the jail has been partially demolished to ensure proper visual connectivity.

Indian urban spatial history is often considered as fragments in an intricately woven palimpsest. The Urban Park strategy to layer spatial memories (of a formal spatial history such as the "panoptical") and the discovery of the ruin amidst the new apparatus that creates decentralized foci (and thus by position, anchoring and movement dissolves the former built apparatus) is one that is inspired by the evidence of the palimpsest [22].

6. CONCLUSION

Conservation is more than just heritage preservation – it is a strategy to peruse and determine the changing usage of buildings to cater the growing demands of society, while maintaining the heritage value and sustainability. Re-using existing buildings and available resources is more economical and environmental friendly than demolition and reconstruction. The contemporary buildings of our cities are heritage of tomorrow; the designers and building professionals shall keep this in mind while designing buildings and consider adaptive re-use as a potential strategy within the design phase to meet the requirements and desires of the future, while considering the prevailing climatic conditions and sustainable requirements.

REFERENCES

[1] Dennis Rodwell, "Conservation and Sustainability in Historic Cities", Blackwell Publishing 2007

[2] UNEP SBCI, "Buildings and Climate Change; Summary for decision makers", United Nations Environment Programme, 2009

[3] Centre for Science and Environment (CSE), New Delhi, "Energy and Buildings, 2014"

[4] Sheila Conejos, Craig Langston, Jim Smith, "Designing for Future Buildings: Adaptive Re-use as a Strategy for Carbon Neutral Cities", The International Journal of Climate Change: Impacts and Responses, 2012

[5] Sophie Francesca Cantell, "The Adaptive Reuse of Historic Industrial Buildings: Regulation Barriers, Best Practices and Case Studies" Virginia Polytechnic Institute and State University, 2005

[6] Department of Environment and Heritage, Australian Government, "Adaptive Re-use: Preserving our Past, Building our Future" Commonwealth of Australia, 2004

[7] Yu, S., Evans, M., Delgado, A., US Department of Energy, "Building Energy Efficiency in India: Compliance Evaluation of Energy Conservation Building Code", Pacific Northwest National Laboratory, 2014

[8] Chaturvedi, V., Eom, J., Clarke, L.E., and Shukla, P.R., Long term building energy demand for India: Disaggregating end use energy services in an integrated assessment modelling framework. Energy Policy, 2014

[9] Centre for Science and Environment (CSE), New Delhi, "Environment Impact Assessment, 2012"

[10] Clara Lewis, The Times of India, TNN, "Big Building Projects don't need environment clearances from Centre" Jan. 17, 2015

[11] Christopher Gorse and David Highfield, "Refurbishment and Upgrading of Buildings", Second Edition, Spon Press, 2009

[12] Shah, A. and Kumar, A., "Challenges in residual service life assessment for refurbishment projects", Proceedings of the 11th Pacific Rim Real Estate Society Conference, PRRES 2005, Melbourne.

[13] James Douglas, Heriot-Watt University, Edinburgh, UK, "Building Adaptation", Second Edition, Spon Press, 2011

[14] Peter Bullen and Peter Love, Department of Construction Management, Curtin University of Technology, Perth, Australia, "Factors influencing the adaptive re-use of buildings", Journal of Engineering Design and Technology, 2011

[15] Craig Langston, "The Sustainability Implications of Building Adaptive Re-use", (keynote paper), CRIOCM 2008, Beijing, 2008

[16] Seeley, I., "Building Economics: Appraisal and control of building design cost and efficiency", Macmillian Press, 1983

[17] Craig Langston, "Green Adaptive Reuse: Issues and strategies for the built environment", D. WU and M. XU, First International Conference on Sustainable Construction and Risk Management Chong Qing Municipality, China, 2010

[18] Craig Langston and Jim Smith, "making better decisions about built assets", Building a Better World: CIB World Congress, 2010

[19] Craig Langston, "Validation of the Adaptive Re-use Potential (ARP) Model Using iconCUR", 2012

[20] Weburbanist, "7 (more) Amazing Adaptive Re-use Architecture Projects", http://weburbanist.com/2008/07/13/7-more-examples-recycled-urban-architecture/

[21] Kaiwan Mehta, "Negotiating Freedom", Indian Architect and Builder Magazine, Volume 17, June 2004

[22] Mathew and Ghosh Architects, "Freedom Park – The Park of Possibilities", http://www.archello.com/en/project/freedom-park#

[23] Supriya Khandekar, "Move Over Central Jail, Enter Freedom Park", http://bangalore.citizenmatters.in/articles/742-freedom-park-bangalore-central-jail, 2009

[24] Photographs of "Freedom Park" by Dilip Muralidharan