

# RE-USE AND REMODELING OF OLD BUILDINGS AT ALLAMA IQBAL OPEN UNIVERSITY PAKISTAN, USING SUSTAINABLE DESIGN PRINCIPLES

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**Abstract:** Environmentally sustainable design and construction of built environment requires resource conservation and re-defining the use of old buildings. The construction of new building and infrastructure exploits the natural resources. The life cycle costs of these new facilities are increasing with time. The demolition of old buildings and construction of new facilities in its places is an easy option for designer and architects, but these new buildings are creating a huge burden on depleting natural resources. Hence the reusing and remodeling of the old buildings appears to be a sustainable option in many cases. In this paper a review of the renovation and remodeling of the old buildings of Allama Iqbal Open University Pakistan has been presented and the direct and indirect benefits of re-using of these buildings have been discussed on the basis of Adoptive Reuse Potential.

**Keywords:** built environment, construction, design, sustainable

## I. INTRODUCTION

Environmental design principles for built environment are based on “Sustainable Development”, which require careful utilization of natural resources. The three main principles of environment friendly design are: i. Resource Conservation ii. Minimizing life cycle cost of buildings and iii. Humane (User friendly) design [10]. These principles are further explained as follows:

### 1. *Resource Conservation:*

- i. Energy Conservation
- ii. Water Conservation
- iii. Material Conservation

### 2. *Minimize Life Cycle Costing in pre-building, building and post building stages.*

- i. Use of Renewable and recycled material in buildings.
- ii. Use of harvested material from old buildings.
- iii. Use material with longer life and low maintenance cost.

### 3. *Humane Design*

- i. Respect Topographical Contours
- ii. Do Not Disturb the Water Table.
- iii. Preserve Existing Flora and Fauna

Construction Industry contributes about 6% t the total Global GDP. The annual construction outlay has crossed \$ 5 Trillion. The construction industry is the major consumer of natural resources in the world. At a global level, buildings consume 32% of world resources, 12% of water consumption, 40%of waste to landfill, 40% of air and greenhouse gas emissions, 40% of total energy Use of the world, 71% of electricity consumption, 30% of Raw materials use, 30% of waste output and 12% of Potable Water Consumption [2-4]. Most of the buildings constructed 50 years back in the developing countries are considered for demolition to create space for new construction of high rise buildings. In many cases the buildings materials from demolished obsolete buildings are used for new constructions in urban centers, which has been described as “Urban Ore” by Chusid [5]. It has been observed that the main structure can be remodeled for new uses, which is called “*Adoptive Reuse*”, which attempts to provide new lives in exiting old buildings. In most of the cases where the new buildings are constructed after demolishing of the existing old structures, economic value is considered without least consideration of the environmental degradation. A large number of buildings are becoming redundant due to changes in the technology, user’s requirements and demand for more comfortable work environment [5].

The building may become obsolete due to the following reason(s) [6]

- i. *Physical obsolescence*: Accelerated deterioration of building material like wood, concrete and fixtures reduce the performance level of the buildings.
- ii. *Economic obsolescence*: it refers to lack of marketability of an asset, which may be mainly due to factors external to the building, Wurtzbach and Miles [11] contended that “locational obsolescence is a suitable alternative term for “economic obsolescence” although this assertion was criticized by Baum [2].
- iii. *Functional obsolescence*: The changes in the functional uses of buildings may render the building obsolete particularly the industrial buildings which are used for a particular process, the stage buildings etc.
- iv. *Technological obsolescence*: When the technological changes, may make the existing old buildings least efficient in terms of performance and operational cost.
- v. *Social obsolescence*: The changes in social behaviors, habits and cultures may render the buildings obsolete. For instance the old cinema houses have become redundant due to changes in the habits and behaviors of people as they now prefer to watch movies through cable TV.
- vi. *Legal obsolescence*: Due to changes safety regulations, building bye-laws or environmental legislation and enforcement, the existing building may become obsolete.

Resource Conservation is one of the basic principles of Environment Friendly design of buildings. The re-use of material in the buildings require that the existing buildings may be remodeled for potential future uses. While assessing Adoptive Reuse Potential (ARP) of an old building many environmental and social considerations are not taken into account. Refurbishment of an old building rather than to demolish and reconstruct it may lead to increased employment [10]. Thus Adoptive Reuse of old buildings may have the following advantages:

- i. It may provide substantial political and social opportunities for Governments as base for sustainable development. In case of preservation of historic buildings, social supports can be more attractive for the process.
- ii. In many cases adoptive reuse of buildings may create enormous business and commercial venues for investors and developers.

- iii. The reuse and remodeling of old buildings for improved operational uses may lead to improved image of the organizations. For example remodeling of old buildings for new technological innovations may attract more customers and clients.
- iv. The timely reuse of buildings after vacation can retain the market and commercial value of the building as continued vacation makes the later reuse of building difficult.
- v. The reuse of old buildings is more important for developing economies the construction cost of new buildings is exponentially increasing due to inflation and high input prices. In such countries, the resources saved can be used for poverty alleviation and social sector development projects.
- vi. The adoptive reuse of old buildings may preserve the historical and cultural heritage buildings and at the same times explore new uses for the buildings as well.

The aim of this research was to explore the reuse of old buildings at Allama Iqbal Open University Pakistan to provide space for various new operations and reducing the burden of new developmental projects on the University resources. At the same time the environmental impact of new constructions in the form of resource exploitation, GHG emissions and air and noise pollution was reduced to make an environment friendly campus.

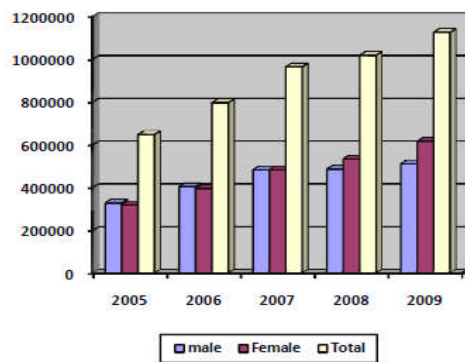
## II. BACKGROUND OF ALLAMA IQBAL OPEN UNIVERSITY AND ITS BUILDING STOCK

Allama Iqbal Open University (AIOU) is the Largest National educational institute of Pakistan, providing learning opportunities to about one million students across the country through formal and Open & Distant Learning (ODL) modes [www.aiou.edu.pk](http://www.aiou.edu.pk). The University was established in 1974 on the model of UK Open University. During last 30 years, AIOU has been recognized as a major national institution providing education in the fields of science, social science & humanities, Information and Communication Technology (ICT) and teacher education. Presently the University offers about 1000 courses and 120 programs from elementary to doctoral levels. Student enrolment growth trends and basic data about the University in 2009 are shown in Table 1 and Fig. 1 [1].

TABLE I:  
STUDENTS ENROLMENT TREND (2005-09)

Year	Students Enrolment			Growth rate (%)
	Male	Female	Total	
2005	327680	319290	646970	
2006	402964	393644	796608	23
2007	481975	481975	963950	21
2008	485204	533181	1018385	5
2009	510210	615118	1125328	10

FIGURE I:  
STUDENTS ENROLMENT TREND (2005-09)



The construction at AIOU can be grouped in two phases. In phase-1, the buildings were constructed in the period (1978-1998), when the Government grants were mainly used for the construction of new infrastructures. The details of buildings constructed in this phase are given in Table 2. The second phase of developmental activities started in 1999 and continues to date, when the returns from the self generated "Endowment fund" were used for buildings and other infrastructures at the main Campus and Regions of AIOU. A number of prestigious buildings have been constructed in this phase.

#### Assessment of Adoptive Reuse Potential of old buildings at AIOU:

C. Langston *et al.* [7] proposed the following equation to determine the "Useful Life" of an old building.

$$L_u = \frac{L_p}{\left(1 + \sum_{i=1}^6 O_i\right)^{L_p}} \quad (1)$$

Where  $L_u$ ; Useful life,  $L_p$ ; Physical life of the building,  $O_i$ ; various types of obsolescence expressed as % p.a,  $L_b$ ; building life in years.

For physical obsolescence, the buildings having normal maintenance, 10% reduction per year is considered. The economic obsolescence is 0% as the Campus is located in the heart of city and very closely connected to the urban centre of metropolitan area. The functional obsolescence of the buildings is taken as 10% on a scale of 0-20%, as the flexibility of the buildings is moderate.

The technological obsolescence is measured in terms of energy demand for the adoptive reuse. Some of the buildings have enough natural ventilation and air and others are highly reliant on active sources for heating and ventilation.

The space requirement of the AIOU is increasing exponentially due to increase in the Students' enrolment. The old buildings of University were constructed about 35 years back in the embryonic stage, when the University had yet to define itself. After 30-35 years of their construction, many of these buildings have become redundant due to operational and technological changes. The Adoptive Reuse Potential (ARP) of these old buildings was initiated on the basis of environmental design principles to improve the Quality of Work Life (QWL) for the employees and at the same time saving financial resources for other important operations of University.

Hence values of 0% are used for energy efficient buildings, whereas 20% values is used for buildings with intense energy demand. For social obsolescence, the buildings owned and occupied were given 0% reduction, whereas buildings partly vacated were given a score of 0%. For legal obsolescence, the buildings with low construction standards are given 20% reduction and for buildings with high quality of construction standards no reduction is affected.

The Adoptive Reuse Potential (ARP) of a building may be increasing or decreasing based on the Effective Useful life ( $L_u$ ) and Effective building Life ( $L_b$ )

$$ARP_{(increasing)} = 100 - \frac{(EL_u^2 / 100)}{EL_u} \times EL_b \quad (2)$$

$$ARP_{(decreasing)} = 100 - \frac{(EL_u^2 / 100)}{100 - EL_u} \times (100 - EL_b) \quad (3)$$

Based on the above the old buildings were ranked for ARP as shown in Table 3.

TABLE II:  
ADOPTIVE REUSE POTENTIAL OF OLD BUILDINGS AT AIOU (BASED ON ASSUMED 100 YEARS OF BUILDING LIFE LP)

Building & Year of Construction	Phy life- $L_p$ (years)	Buildings Life as on 2009 ( $E_b$ )	Obsolescence (%)						Average/year (%)	Useful life of building ( years) $L_u = \frac{L_p}{(1 + \sum_{i=1}^6 O_i)^{V_{op}}}$	Useful life remaining	ARP
			Phy	Eco	Func	Tech	Legal	Total (%)				
Library (1985)	100	24	0	0	10	5	0	40	0.004	67	33	84
Admin (1975)	100	34	10	0	10	15	10	75	0.008	47	53	84
Exams (1975)	100	34	10	0	10	15	10	75	0.008	47	53	84
Mailing (1978)	100	31	15	0	20	20	15	10	0.010	36	64	89
Computer (1978)	100	31	5	0	10	10	10	63	0.006	53	47	84
Admission (1975)	100	34	20	0	20	20	20	10	0.011	34	66	88
Reg. Serv(1980)	100	19	10	0	20	15	10	85	0.009	43	57	92
IET(1985)	100	24	5	0	15	10	5	55	0.006	58	42	86
Education (1985)	100	24	5	0	15	10	10	58	0.006	56	44	87
Secrecy (1975)	100	34	15	0	10	15	15	85	0.009	43	57	85
Auditorium ( 1980)	100	19	5	0	15	10	10	65	0.009	26	33	95

For cases where building life is less than useful life ( $L_b < L_u$ ), eq(2) is used and for cases where building life is more than useful life ( $L_b > L_u$ ), eq(3) is used. The APR of the buildings are determined and the buildings are showing high values of APR>50, which render them highly suitable for adoptive reuse.

### III. PRACTICAL CASES OF REUSE AND REMODELING OLD BUILDINGS AT AIOU

**Central Library building** was constructed in 1985, mostly based on the traditional concepts of library at that stage. However during the last 3 decades and particularly with the advent Information and Communication Technology (ICT), new concepts and practices of online learning and e-library have emerged. The old building was remodeled for renovated for the modern use. Fig.3 shows, various parts of the remodeled old library. About Rs. 30 Million (US\$0.5 Million), have been saved by reusing the old building.

**Old Secrecy building:** The Examination Department has to evaluate about 2 million scripts in each examination twice a year. The evaluation is mostly done through centralized marking system and about 500 examiners are engaged on daily basis for this purpose. Exams department needed to have an independent space

for centralized marking system at AIOU. To solve this problem, a redundant building constructed in 1975, was remodeled and renovated, thereby saving an amount of Rs 20 Million (US\$0.25Million).

**Remodeling of data centre:** Similarly the data center was constructed in Old remodeled building for the

new ICT needs. The remodeled buildings of AIOU have been shown in Figure 2 and 3.

#### 1. Remodeling of Services building Rawalpindi

Part of The old building of Press and Publication has been remodeled for Regional Services building. The functional and environmental improvements in the building have led to effective utilization of the old building.

#### 2. Remodeling and refurbishing of Institute of Educational technology (IET) building

The importance of Radio and TV broadcasting material in the Open and Distance Learning (ODL) has been increased with the advent of Information and Communication Technology (ICT). The old building of IET was also remodeled and refurbished to cater with the growing technological and functional needs.

#### 3. Future Reuse plan of old buildings

The old building stock at AIOU is continuously upgraded and the strong maintenance services of Project Directorate of University are up keeping these buildings. However the following remodeling and reuse plan of old buildings has been developed to effectively utilize the stock of old buildings:

- i. Remodeling and improvement of Admission block ( Block 4)
- ii. Remodeling and Improvement of Administration Blocks,
- iii. Remodeling and improvement of Auditorium building
- iv. Reuse and remodeling of old residential building

FIGURE II:  
REMODELED CENTRAL LIBRARY BUILDING



FIGURE III:  
REMODELED CENTRAL LIBRARY AND DATA CENTRE AT ALLAMA  
IQBAL OPEN UNIVERSITY (AIU)



#### IV. CONCLUSIONS

The human development and population increase in the world and particularly the developing countries would require more infrastructure development. Due to functional, economic, legal, technological or physical changes, old buildings may become redundant, despite of the fact that the structural components of these buildings may be strong enough to remodel these buildings. Adoptive Reuse of old buildings is a philosophy and mindset, which endeavors to remodel and refurbish these old

buildings for present and future potential uses. These efforts at one hand saves the resources of the nations for more important commitments like poverty alleviation, education, water supply and other community uplift programmes. At the same time the environmental impacts of new infrastructure are also reduced. At Allama Iqbal Open University Pakistan, efforts are being made to reuse the old stock of the building for potential future uses.

#### REFERENCES

- [1] Allama Iqbal Open University Pakistan-Statistics about students enrolment. Retrieved from: [www.aiou.edu.pk](http://www.aiou.edu.pk).
- [2] Baum, A. (2005), *Depreciation in UK Commercial Property Markets*, Investment Property Forum, London.
- [3] Chusid, M. (1993). *Once is never enough. Building Renovation*; p. 17–20.
- [4] Harrington, L., Foster, R., Wilkenfeld, G., Treloar, G.J., Lee, T. & Ellis, M. (1999) *Baseline study of greenhouse gas emissions from the Australian residential building sector to 2010*. Canberra: Australian Greenhouse Office; p. 157.
- [5] Johnson A. (1996). Rehabilitation and re-use of existing buildings. In: Mills ED, editor. *Building maintenance and preservation: a guide to design and management*. 2nd ed. Oxford: Architectural Press; pp. 209–30
- [6] Lanston, C., et al. 2008. Strategic assessment of building adaptive reuse opportunities in Hong Kong. *Building and Environment* 43, 1709–1718.
- [7] Langston, C. & Ding, G. *Sustainable practices in the built environment*. 2nd ed. Butterworth-Heinemann; 2001.
- [8] Rees, WE. (1999). The built environment and the ecosphere: a global perspective. *Building Research and Information*, 27 (4/5): 206–20.
- [9] Tully, E. (1993). *Construction employment multipliers to take account of price increases between 1983 and 1992*. Canberra: Department of Industry, Science and Technology.
- [10] U.S. Green Building Council, “LEED for Homes v. 1.23,” 2005. Retrieved from: [www.valuebasedmanagement.net/methods\\_r ogers\\_innovation\\_adoption\\_curve.html](http://www.valuebasedmanagement.net/methods_r ogers_innovation_adoption_curve.html)
- [11] Wurtzbach, C.H. & Miles, M.E. (1984). *Modern Real Estate*, 2nd ed., John Wiley & Sons, New York, NY.