



Adaptive Reuse of Abandoned Industrial Structures for Healthcare Centres

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Abstract

Adaptive reuse as an industry has been marketed as an expensive one. When it comes to the retail, hospitality, or domestic sectors, that is the case; however, the use of abandoned structures has been found to be cost-effective in the healthcare sector. This research paper aims to understand adaptive reuse in the context of the healthcare industry. It is a well-known fact that the worldwide epidemic drove the economy to decline, which led to several industrial set-ups being abandoned. Re-functionalizing these buildings offers a great chance for social and economic advancement. To fulfil the purpose of this research, case studies were reviewed. This review helped identify a number of factors that need to be considered while choosing an industrial abandoned site for adaptive reuse. These abandoned sites can no longer be used for their initial functions and hence can be used to be redesigned for a new purpose, especially for healthcare considering the state of infrastructure or lack thereof. But the research regarding the reuse of abandoned industrial structures for the healthcare division is scattered. Based on the gaps identified through the case studies, a study was conducted which helped answer these concerns. This research paper attempts to study the opportunities and obstacles that arise in an adaptive reuse project, analyse, and compile the data for the same. By doing so, an operational framework can be derived, which will provide useful insights and make the process of adaptive reuse of abandoned industrial sites for healthcare easier.

Keywords: Adaptive reuse; healthcare centres; industrial structures; abandoned structures; factors for site selection

INTRODUCTION

“The “Monster” resembles a man in form as its creator assumed a familiar and pre-existing order; a living structure of bilateral symmetry.” [1] Wong L. talks about the Frankenstein Syndrome in adaptive reuse referring to Mary Shelley’s 1818 novel Frankenstein. Since a new and incompatible order was inserted within an already existing one, this new creature fails. Wong refers to this as the Frankenstein Syndrome.

Adaptive reuse is the process of determining, purchasing, renovating, and reusing a building or comparable structure for a use other than what it was originally intended. This strategy provides

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options to acquire space at prices significantly lower than those associated with new construction, all while reaping various advantages from the restart of operations from previously abandoned facilities. This research paper discusses the issues and topics surrounding abandoned structures and how they can be brought back into a function that is beneficial for society. Abandoned buildings serve as a problem as these structures have been deemed not useful or functional anymore, and a regulatory structure for these kinds of buildings is unavailable, which results in demolition.

This research aims to understand the types of abandoned industrial structures that can be redesigned to be used as healthcare structures. The provision of healthcare services remains predominantly site-based, requiring physical space for doctors, nurses, administrators, and others to carry out all of the tasks involved in the delivery of medical care and attention, despite developments in virtual, mobile, and related technology. The expenditures associated with this space, whether it is owned or leased, are frequently high and divert funds away from patient care. The use of abandoned structures is cost-effective in the healthcare sector as adaptive reuse has a lot of potential for finding a special and advantageous way to meet the healthcare facilities' need for spatial growth. In India, the vast majority of women (88%) said that no one in their family accessed public healthcare. This was due to a lack of close facilities (42.4%), inconvenient facility hours (29.6%), subpar care (52.3%), sometimes absent medical staff (16.8%), and lengthy wait times (39.9%) [2]. Adaptive reuse proposes a solution for problems like these by utilizing obsolete buildings for a function that enhances the community.

The subsequent parts of this paper discuss the challenges that may come up while identifying, purchasing, renovating and reusing an abandoned industrial building. While adaptive reuse proposals are extremely beneficial in terms of sustainability, the community's character as existing buildings contribute to the cultural and historic aspects and many times abandoned structures are located in more busy parts of the city, they also pose many challenges. There can be complications regarding compliance with building codes due to newer designs and construction, older buildings may not be able to match the current accessibility requirements and energy consumption, and the removal of potentially hazardous materials becomes very important as some of these old abandoned structures have such issues. Along with that, there is a lack of cohesion in the available literature which needs to be addressed.

The main objectives of this research paper are:

- Understanding the economic impact of healthcare centres that reuse abandoned structures on the community.
- Understanding the types of Industrial structures and Healthcare Structures.
- Understanding considerations for adaptive reuse (including site selection and viability) of an industrial structure for a healthcare project.

This research report is limited to the use of case studies that are easily accessible online. No such site survey or inspection was conducted in order to fulfil the demands of the proposed goal.

LITERATURE REVIEW

The following literature study highlights the definitions of adaptive reuse and other related terminology as suggested by different authors. It further explores the various processes reported in the research literature. The primary component providing the structure for the analysis is the compilation of different studies focusing on adaptive reuse for the healthcare sector and industrial structures. The focus of the study is on the themes and factors that emerged from these research papers. The structure of the subsequent analysis is thus determined by the results of the literature review.

Adaptive Reuse

Adaptation can be defined as “any adjustment that can respond to anticipated or actual consequences” [3]. According to Wilkinson and colleagues, adaptation does not always indicate a change in the building's usage. Bullen confirms that by stating “adaptation describes rehabilitation, renovation or restoration works that do not necessarily involve changes of use” [4]. According to the Cambridge Advanced Learner's Dictionary & Thesaurus, Reuse is “to use something again”. From these definitions, it can be inferred that the term adaptive reuse is related to a process that alters the use or involves revitalization or rehabilitation while keeping the original structure intact. Langston specifies this process as “if a particular function is no longer relevant or desired, buildings may be converted to a new purpose altogether” [5]. Similarly, Elrod and Fortenberry define adaptive reuse as

the practice of locating, acquiring, refurbishing, and placing back into service a building or comparable structure for a purpose that it was not originally designed for [6].

The use of adaptive reuse instead of demolishing abandoned buildings has various ecological, social, cultural, and economic advantages. Adaptive reuse is more affordable and takes less time to develop since structural building components are usually reused. For newer developments, adaptive reuse is a more sustainable option because it minimises needless waste and lowers the construction's carbon footprint. The economic viability of adaptive reuse can compensate for the frequently higher costs of sustainable design. As the evaluation process must account for both tangible and intangible benefits in terms of cost, i.e., the ratio of the benefits to the predicted cost should be more than or equal to 1, there may be various challenges that arise in an adaptive reuse project [7].

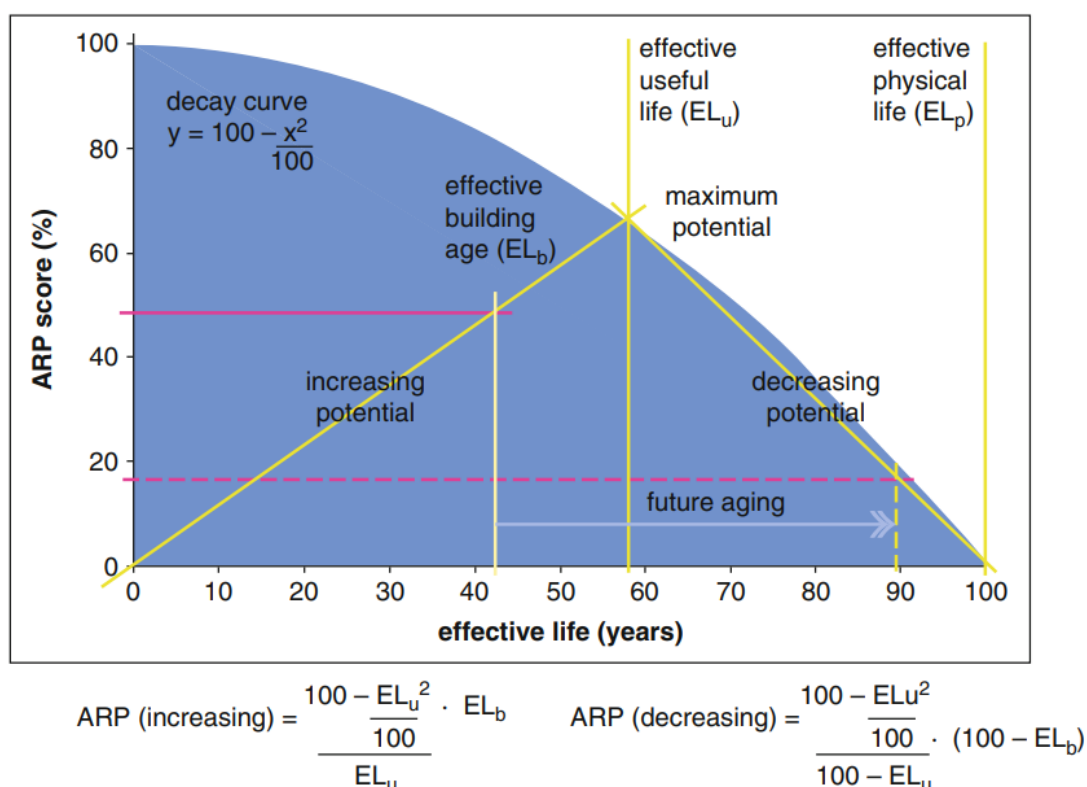


Figure 1. Adaptive Reuse Model. (source: Langston, 2010).

Langston defines a building's obsolescence as having characteristics such as physical, economic, functional, technical, social, legal, or political obsolescence. Any country and building typologies can utilise the adaptive reuse potential model (ARP) (Figure 1), but it needs the building's obsolescence data to determine the building's usable life in an objective manner. This information is fed into an algorithm that examines a building's potential for adaptive reuse, or reusability. Online case studies of repurposed buildings were undertaken using a comparative examination of about 64 areas and their possible building lifespan. This information made it easier to determine the implications that adaptive reuse of buildings has for sustainable development, as well as the benefits to the economy, the environment, society, and the global construction sector [5].

Healthcare and Adaptive Reuse

In India, there is a scarcity of quality medical care, particularly for the most disadvantaged members of society. Toa Bagchi and colleagues explored reasons for the under-utilization of publicly available healthcare facilities in India by using secondary data from NFHS-4 (2015-16) with a sample

size of 351,625 women respondents. According to the study, 88% of respondents' families did not use publicly available healthcare facilities. Major reasons included inadequate level of treatment (52.3%), lack of facilities close by (42.4%), longer time spent waiting (39.9%), unfavourable timings (29.6%), and absence of health professionals (16.8%). Furthermore, people in the lowest wealth quintile (52.7%) complained about a lack of facilities close by more than those in the wealthiest quintile (36.7%). These observations suggest that there is a lack of quality healthcare services in India especially for underprivileged sections of the society. The study also suggests that women of reproductive age are getting much more dissatisfied with the available medical care in India which might be an explanation for booming private healthcare facilities resulting in a 'medical poverty trap' for poor socioeconomic strata [2].

The reuse of abandoned structures has been observed to be a cost-effective measure for healthcare operations. This practice can generate savings for healthcare institutions that can be used to improve the quality of care and infrastructure. The projects completed by Willis-Knighton Health Systems are a good example of the same [6]. The savings generated for these projects were a lot more than the total investments (i.e., acquisition costs plus renovation) (Table 1).

Table 1. Adaptive reuse projects completed by Willis-Knighton Health Systems (compiled by the authors) [5].

Title	Built	Abandoned	Repurposed	Old Purpose	New Purpose	Total cost (Acquisition plus renovation)	Estimated cost for equivalent new construction	Savings
WK Innovation Center (formerly Bossier Medical Center)	1966	2000	2015	Provided healthcare services for many years to the population of Bossier Parish, Louisiana	To house a business office, store medical records, house system-wide education initiatives, showcase its legacy (Medical museum, etc.) provide a conference venue for internal and community use	\$16 million	\$42 million	\$26 million
WK Fleet Service Center (formerly Gulf Oil Service Station)	1950s	1980s	1990	The service station contained vehicle service bays, hydraulic lifts, and additional equipment	To provide routine maintenance for its growing fleet of service vehicles	\$50,000	\$360,000	\$310,000
WK Rehabilitation Institute (formerly Doctors' Hospital)	1907	2010	2017	It served as a leading healthcare facility for downtown Shreveport.	To house its centre of excellence for rehabilitative care	\$26 million	\$44.5 million	\$18.5 million
WK Portico Medical Mall (formerly Portico Shopping Center)	1992	-	1999	A retail shopping centre, anchored by Brookshire's Food and Pharmacy grocery store.	To house the centre of excellence for orthopaedic care, physician offices, and a range of support services	\$13 million	\$41 million	\$28 million

Adaptive Reuse of Industrial Buildings

Businesses frequently look for locations that best fit their demands. These requirements alter as newer markets emerge, which leads to older structures being abandoned or being rendered useless. They are also subject to change depending on the situation of the economy. In addition, the outbreak of a global pandemic radically altered the market and working environment. Millions of people started working remotely from home and altered their shopping, eating, and entertainment habits. Redevelopment is required to accommodate this scenario and it may entail rescuing or refurbishing abandoned commercial premises. Adaptive reuse of industrial buildings offers improved optics and returns, lower costs and savings in physical resources, and the elimination of the need for demolition, as storing and hauling large amounts of waste presents numerous logistical challenges, particularly in an urban setting. Not only that, but adaptive reuse may also qualify for tax advantages [8].

The vast majority of structures are not adaptable. Although architecture is designed with permanence in mind, structures rarely remain the same because the world is constantly changing. Some structures are more adaptable to changing environmental factors than others. Compared to other building categories, industrial buildings offer a better base structure for initiatives like adaptive reuse.[9] This is a result of the open floor plan and generally stronger construction. Big sheds and multistory frames are the type of industrial buildings that are compatible with adaptive reuse [10], [11]. Although they were not specifically made to be adapted, they were still made with flexibility in mind, and adaptive reuse can make use of this flexibility.

RESEARCH METHODOLOGY

An extensive literature review was done to determine the purpose of the study. Based on the following keywords— adaptive reuse, healthcare centres, industrial structures, abandoned structures and factors for site selection—research papers over the last 10–15 years were narrowed down. A formwork was created, which needed to be strictly followed to produce a comprehensive report. The first step was understanding adaptive reuse and abandoned buildings. A detailed study needed to be done to understand the definition of adaptive reuse and the challenges that may come up while proposing adaptive reuse of an abandoned site. Abandoned buildings and the regulations surrounding their purchase, maintenance, renovation, restoration and redesigning were also studied. In order to fulfil the first objective, understanding the economic impact of healthcare centres that reuse abandoned structures on the community, a number of case studies, of healthcare structures that were designed using adaptive reuse, were analysed and a structured table was constructed to better understand the economic impact. The second objective covers the study of healthcare and industrial building typologies. By doing so we understand the different types of healthcare and industrial structures and the designing criteria that need to be known before approaching such projects. The third objective encompasses understanding considerations for adaptive reuse (including site selection and viability) of an industrial structure for a healthcare project. For these objectives, a broad literature review was conducted. A comparative analysis was done for the data that was collected from the case studies and the literature review. This analysis offered insightful information regarding the factors that need to be considered while repurposing an industrial building for healthcare.

RESULTS AND DISCUSSIONS

Hospitals and medical facilities, sometimes necessitate spatial expansion. This requirement is either fulfilled by a completely new construction, demolition of an existing structure or repurposing an existing structure. While the first option is a less daunting approach, the last option is the one that is most suitable as it is far more economically viable along with being more sustainable. The literature review that was conducted, suggests that industrial structures are highly suitable for adaptive reuse as they generally have an open layout along with strong reinforced construction. As industrial structures are very flexible and can adapt to a variety of functions they are suitable to be repurposed for the healthcare sector. Factors that need to be considered while approaching an adaptive reuse project along with the opportunities and obstacles for the same are discussed in the following section.

Table 2. Subjects and Factors that need to be considered while approaching an Adaptive Reuse project [12], [13].

Subjects	factors
Economical	Capital Investment
	Market Value
	Reconstruction cost
	Effects on the Local Economy
Environmental	Emissions
	Embodied Energy
Technical	Age & Physical Conditions
	Former use of the Building
	Structural Layout
	Presence of Hazardous Material
	The ability of Building to Adapt
	Orientation of building
Contextual	Cultural Significance
	Heritage Significance
	Value to the Local Community
Design	Spaces required
	Efficiency of Movement
	Interconnectivity between these spaces
Regulations and Policy	Stakeholder Views
	Governance
	Health, Safety and Accessibility Requirements
	Regulations

Factors

The very first and the most influential subject when it comes to adaptive reuse is the economic aspects of the project. The factors that are a direct effect of this subject are the capital investment and the reconstruction cost. Along with the economic aspect, there are a few other subjects like the environmental factors, the technical factors, the location and contextual factors of the site, the social aspect of the site, the factors considered while designing and the regulations and policies [12], [13] (Table 2) (Figure 2).

From the literature, the seven subjects of economical, environmental, technical, contextual, social, design, regulations and policy aspects emerged. They discuss the various factors that must be taken into account when repurposing an industrial site for healthcare.

Opportunities

The practice of adaptive reuse provides a number of opportunities that range from financial benefits to revitalization of the urban fabric of a place. The economic benefits result from the highly favourable pricing of properties that are effectively out of use. In addition to that benefits are also possible by using existing building materials which reduces labour costs as well as reduces the need for additional materials. In the case of structures with significant heritage value, grants and loans might also be available. Abandoned buildings become safety hazards and act as catalysts for illegal activities. Reclamation of such spaces is beneficial for the local community.

Obstacles

The concept of adaptive reuse offers several benefits. but a number of obstacles may hamper the execution of such projects. The most common problem with this practice is the lack of availability of buildings that possess relevant features like location, market demand, etc. For instance, inconsistencies in the structural stability of the building might increase the renovation costs. In addition to that, maintaining a high standard of healthcare may require extra costs which might affect the economic feasibility of the project. Since adaptive reuse may involve serving a new purpose for a structure that has been in a community for a significant period of time, the stakeholders may view the

new development as a threat. Not just that, compliance with the local bye-laws is also an obstacle as there might be a change in the building use which might have different standards than the prior use.

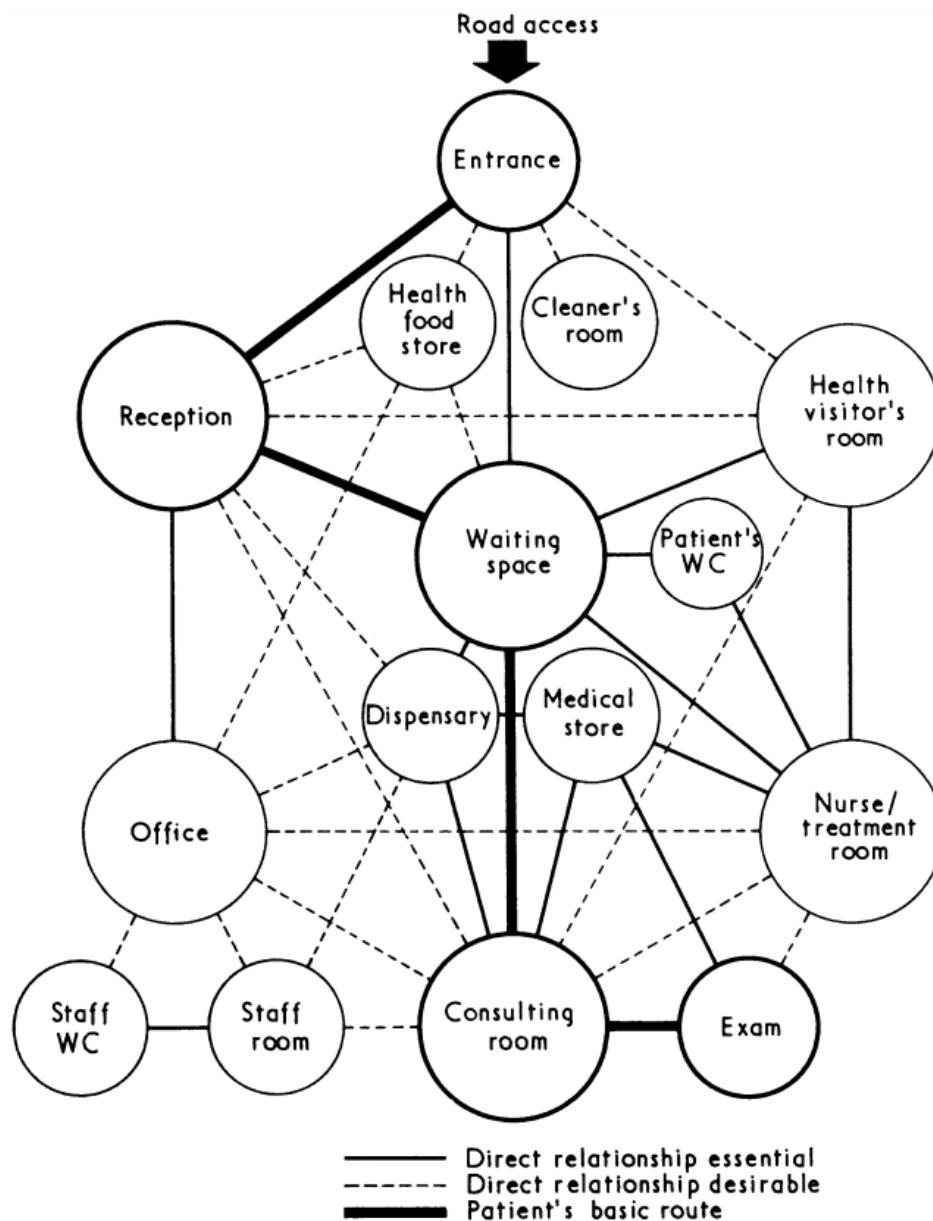


Figure 2. The room relationship diagram for healthcare centres. (source: British Medical Journal, 1971).

CONCLUSION

The study concludes that adaptive reuse as a strategy for spatial expansion is the way forward for the healthcare establishments and industrial structures, by virtue of their inherent structure and planning, are the most compatible for the same. This practice not only benefits medical organisations but also the local communities as a whole. It facilitates better infrastructure, quality of care and access to quality healthcare, especially for the underprivileged sections of society which is very important in the case of developing countries like India considering the lack of such services. Along with being economically profitable and socially impactful, adaptive reuse also acts as an eco-friendly alternative to completely new construction. Despite being a very good alternative, the practice of adaptive reuse has its fair share of drawbacks. The most common is the lack of structures that possess the necessary

characteristics to be reused such as structural stability, compatible location, and reconstruction costs. Additionally, there may be complications in terms of by-law compliance. Non-alignment of the vision of the owners and the local population, higher costs for good healthcare standards, etc. may decrease the chances of such a project being successful. That is why there is a need for a set of guidelines or factors that need to be considered before approaching such a project. This study has compiled a number of such factors and characteristics from different pieces of literature so that the process of deciding strategies for spatial expansion can be chosen in a better, more efficient manner. Furthermore, it is hoped that this study helps in substantiating the notion that adaptive reuse for healthcare facilities, is a practical and beneficial strategy, especially considering the lack of attention the subject has received in academic literature.

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