Adaptive Reuse as a Sustainable Solution

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Senior Capstone Fall 2018
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Abstract
The scope of the research if focusing on how adaptive reuse of historic buildings satisfies the three pillars of sustainability. The implementation of adaptive reuse will reduce environmental impact, provide a place for communities to learn and interact with, and bring money into the local economy. The methodology for the study included an online survey, case studies, and literature reviews. This allowed the research to be unbiased and to obtain current research on the topic to figure out if there is a lack of knowledge on the topic. Case studies offer real-world examples of adaptive reuse in and their payoffs. The literature reviews provide information on the concepts and strategies that are involved with adaptive reuse. An online survey was conducted to grasp the general public’s knowledge of the topic. The purpose of researching adaptive reuse in historic buildings is to persuade people to restore a property for a new use rather than constructing a new building. This practice will be able to fulfill social, environmental, and economic sustainability in communities. The findings towards the research topic implied that more research and implementation of adaptive reuse in historic buildings need to be utilized to show the benefits as a sustainable solution.
Introduction

Adaptive reuse is an essential practice for the current environmental issues our planet is facing. With the population continuing to grow there will always be need to build more houses, restaurants, and other commercial facilities. Adaptive reuse can help preserve our greenfield land and allow us to use buildings that are already constructed. Sustainability often focuses on three core ideas or pillars, which include social, environmental, and economic sustainability.

Constructing a new building creates a lot more wasted materials than taking a pre-existing building and remodeling it for a new use. In a book, *Reuse of Materials and byproducts in construction: waste minimization and recycling* states, “…it is estimated that it is as much as 30% of the total weight of building materials delivered to a building site.” (Richardson, 2013, p. 209). With adaptive reuse, you are being environmentally conscientious but also incorporating social and economic factors as well improving the community that the building is located in.

Taking a historical building is key for reducing the amount waste created from new construction and prevents urban sprawl from happening. There is a famous quote by Carl Elefante (2012) which he mentions, “The greenest buildings is… one that is already built” (p.62). This accurately states that we should be using buildings that have already been built rather than constructing new ones. There are more times than not that a building in a neighborhood is left vacant. This decreases the value of the facility when it could be retrofitted to fit the current needs of the community. Gaining a general sense of knowledge on the importance of adaptive reuse has on not just communities but the environment will be crucial for adopting this as a solution in the future. To capture the general sense where the research and literature is at concerning adaptive reuse as a sustainable practice on historic buildings is a quote from *Make Historic Preservation Sustainable*: 
The future of the preservation field and its engagement with sustainability goals hinges on the ability to contribute to all three areas tripartite, but also to demonstrate why social concerns may sometimes trump economic and environmental ones given the fundamentally of social aims of historic preservation. Understanding where tensions lie and why conflict arise is a significant step toward enhancing research about preservation outcomes and their contributions to sustainability and evolving policy to better respond to changing environmental, economic, and societal conditions. (p.105)

Previous research on this topic has explored measurements of how much better reuse of an existing building is rather than building new. Extensive research was done and published in *The Greenest Building: Quantifying the Environmental Value of Building Reuse*, “Reuse of buildings with an average level of energy performance consistently offers immediate climate-change impact reductions compared to more energy-efficient new construction.” (p.VIII). There are many factors that dictate the outcome of a building’s energy efficiency but this strategy has a better payoff than the alternative of building a new facility.

This research should help encourage architects, planners and historic conservationists to work together and fill the knowledge gap when it comes to implementing adaptive reuse of historic buildings. There is a need to push the implementation of adaptive reuse because of its ability to better the community it is located in. It will be important to dive into the current literature and case reviews on this topic to get an idea of what gaps need to be filled to make this an accepted strategy in green design. While there are exceptions as to why new buildings are constructed instead of using adapting preexisting structures, the aim of this research is to provide enough reasoning as to why adaptive reuse should be a part of the planning process when considering developing a new site and whether to construct a new building.
Scope of the Problem

The issue at hand that we are facing is dealing with environmental concerns such as climate change, making it a global concern. To help prevent further harm to the planet would mean focusing on sustainable efforts in regards to the built environment. By seeing a positive relationship between implementing adaptive reuse and the sustainable benefits produced as a result then there will be more utilization of this strategy.

Throughout the paper, literature reviews and case studies will be drawn from to show that adaptive reuse can help fulfil these three pillars. In addition, a survey was constructed to look at the general public’s current knowledge on the topic. There is emphasis on applying the adaptive reuse strategy to historic buildings to restore them in such a way that is going to fulfil the three pillars of sustainability. This practice is not commonly used today due to lack of information about the strategies and benefits that are associated with it. The concept behind adaptive reuse is taking an existing space, in this case a historical building, and repurposing it to be utilized in a way that meets today’s needs. While there are many case studies and literature reviews about the concept, the actual practice is often overlooked and not commonly applied.

Methodology

The main amount of research was done through literature reviews and case studies. The literature review

Includes gathering materials

- Finding articles that focuses on one or all pillars or sustainability in regard to adaptive reuse.
- Using reputable sources such as google scholar and The University of Arizona Library research databases
• Asses if the article was valuable by reading over abstracts and conclusions to get a general idea of the paper.

Case studies will be used as a method for this research to back up the information in real world examples.

Includes gathering qualitative and quantitative research

• Finding articles and other documents that provide examples of research that has been applied
• Illustrate the outcome of implementing adaptive reuse
• Provide enough information to portray that importance of the practice

The methods of obtaining information included finding literature, case studies, and generating an online survey. Each method was used as a way to support the research question. Through these three methods, it was crucial to the study to find information that would allow the reader to gain knowledge on the topic but also inform them as to why adaptive reuse can be and should be used as a sustainable solution.

The literature review section of the research purpose is to find and analyze existing papers on the topic of adaptive reuse. As stated by Helewa and Walker, the work of “A literature review is a type of research article published in a professional peer-reviewed journal. The purpose of a literature review is to objectively report the current knowledge on a topic and base this summary on previously published research.” (cited by Green, Johnson, Adams, 2006, p. 102) The works that are included in this paper provide and support how social, economic, and environmental sustainability can be used in historic buildings. Through this method, the research can be taken a step further to help support the implementation of adaptive reuse in historic or heritage buildings.
Case studies were used as a method to provide real-world examples of how adaptive reuse has been utilized. As stated in Qualitative Case Study Methodology: Study Design and Implementation for Novice Researchers “This ensures that the issue is not explored through one lens, but rather a variety of lenses which allows for multiple facets of the phenomenon to be revealed and understood.” (Baxter & Jack, 2008, p.544). With the use of a few different case studies regarding adaptive reuse will exemplify how sustainability and adaptive reuse go hand in hand.

An online survey using Google Forms was created to capture the public knowledge on adaptive reuse, sustainability as a topic on its own, sustainability regarding social and economic means, historical properties. This was published on a personal (which is private) Facebook page which allowed for a total of 23 responses. This information is valuable for gauging where knowledge lacks for the public about these topics.

**Literature Review**

In *Adaptive Reuse of Heritage Buildings*, the idea that the authors wanted to convey dealt with the three pillars of sustainability. The goal of their work was to develop a decision making-process that helps to decide if the adaptive reuse is the appropriate choice for the building.

Informing the public about the social, environmental, and economic benefits that would come
from this practice. Bullen and Love state, “Adaptive reuse may help communities, governments and developers in the quest to reduce the environmental, social and economic costs of continued urban development and expansion.” (Ball, 1999; Wilkinson and Reed, 2008; Bullen and Love, 2009, as cited in Bullen and Love 2011). The researchers went out and conducted interviews that allowed them to get an idea of what some constraints were in the way of proceeding with adaptive reuse. Figure 1 is an image of showing the respondents answers during the interview. With 60 interviews conducted everyone was asked general questions that had a theme of relating adaptive reuse of historic buildings to the three pillars of sustainability. The findings from this research showed that most people only saw adaptive reuse as being socially and environmentally sustainable and not economically.

The work done in the *Adaptive Reuse of Heritage Buildings* is useful when it comes to the research question at hand. It highlights what the current knowledge of adaptive reuse is for the people involved with the process, such as the architect, planner, and building manager. This gap in information about the economic pay off that can come over a period of time. Research has been done to show that there is economic pay off to adaptive reuse. In *Economics and Historic Preservation: A guide and review of literature* explains “It has been demonstrated time and again that individual historic preservation projects are, under certain conditions, comparable economically to projects involving new construction—in other words, preservation can pay.” (Mason, 2005, p. 5) When adaptive reuse is considered more frequently for historic buildings then the people in the decision-making process will consider it as a viable solution to fulfilling all three pillars of sustainability.

The research in *Adaptive Reuse Strategies for Heritage Buildings: A Holistic Approach* looks at developing a model that will help in the decision-making process of implementing
adaptive reuse in a heritage building, with listed and non-listed sites. This model will help with deciding what course of action should be taken with the building. The first step deals with who is involved in the decision making. Secondly, analysis of the heritage building which considers the building’s physical characteristics and previous uses. Then, deciding what conservation strategy should be taken in action, for instance, does a building just need restoration work or reconstruction work? Fourth, involves assessing the environmental, social, economic, and other potentials that will stem from the project. Lastly, considering the adaptation of the building. Misirlisoy and Gunce state “A successful adaptation is one that respects the existing building and its historic context and adds a contemporary layer to the heritage building rather than destroying its character” (2016).

It is important that city planners, architects, and historic preservationists can work together to discuss the environmental benefits that tie into adaptive reuse. As we continue to deal with growth in our cities there is always a need to create new buildings to fulfil this demand. It has been projected by United Nations Department of Economic and Social Affairs that, “Today, 55% of the world’s population lives in urban areas, a proportion that is expected to increase to 68% by 2050. Projections show that urbanization, the gradual shift in residence of the human population from rural to urban areas, combined with the overall growth of the world’s population could add another 2.5 billion people to urban areas by 2050…” ("2018 Revision of World Urbanization Prospects") It is often a concern with this continuing growth that planning and development of new buildings need to be designed in a way that won’t harm the environment. As stated in the book, Stewardship of the Built Environment, “The primary environmental contributions of preservation and reuse regarding the physical environment are to relieve growth pressures at the suburban periphery and thereby protect open lands, reduce depletion of natural
resources (e.g., nonrenewable energy, raw materials), curtail the flow of building demolition materials into landfills, improve atmospheric quality by reducing reliance on automobiles, and revitalize existing neighborhoods and commercial districts in a manner that directly parallels many of the smart growth principles currently being promoted nationwide.” (Young, 2012, p. 22). There is a connection between using and preserving what is already built to prevent further damage to the issues mentioned above. For future development of buildings whether it be residential or commercial it important that these groups of people can find a way to use a historic building that prevents things such as urban sprawl from happening.
There is also the social sustainability that stems from implementing adaptive reuse. Most of the time people associate a building with feelings and memories. Historic buildings are crucial for maintaining a neighborhood's identity. In Sustainable Building Adaptations: Innovations in Decision-Making, ‘This cultural value is additional to the value of the land and buildings as purely physical entities or structures and embodies the community’s valuation of the asset in terms of its social, historical or cultural dimension.’ (Wilkinson, Sara J., et al, 2014, p.161). The historical building creates a community around it meaning that the value of the building draws people into the area. Preserving the building and converting to a new use still allows those emotions to be captured by people that interact in the space. The role a historical building has on a community creates an everlasting impression through the architecture and history. A great example of the community preventing a building being demolished due to its social significance is the White Lady in Eindhoven, Netherlands, in figure 2.
This paper looks at broadening the idea the sustainability besides just focusing on the environmental, social, and economic factors, and taking into consideration cultural factors. It is important to note that cultural aspects can be considered a subcategory of social sustainability. Integrating Environmental and Cultural Sustainability for Heritage Properties, “Applying this broader definition of sustainability, the reuse and operation of existing buildings not only avoids or minimizes negative impacts on the environment through the conservation and efficient use of resources but also recognizes the role that building construction and the buildings themselves play in fostering regional and local culture…” (Powter & Ross, 2005 p.5) The current sustainable building guideline assessments, such as LEED and Green Globes, need to make criteria more applicable to historic buildings and incorporate it more in the process instead of something that would be considered an extra accreditation. All in all, there needs to be more done to promote and encourage the sustainability of heritage buildings.
The following literature review takes place in Perth, Australia looking at how adaptive reuse has been implemented with the city’s buildings aging and the need for a new use or renovations. A decision-making model was developed as an outcome of this research to guide anyone involved in the adaptive reuse process. As described in the Rhetoric of Adaptive Reuse of Reality of Demolition: Views from the field, “this paper examines owners’ and practitioners’ views and experiences associated with adaptive reuse from a sustainability and social perspective.” (Bullen & Love, 2010, p.216). In Australia preserving historical buildings has been recognized as important because of the cultural and social significance they have on the neighborhood. Often times there are reservations about practicing adaptive reuse due to its unknown payoffs. After conducting 81 interviews on the following topics, “effectiveness of adaptive reuse as a strategy to achieve sustainability, attributes that make a building suitable or unsuitable for adaptive reuse, impact of adaptive reuse on stakeholders, and circumstances in which adaptive reuse of demolition is considered.” (Bullen & Love, 2010) As a result of conducting the interviews, the researchers created the model in figure 3.
In Perth, many of people interviewed agreed that adaptive reuse would be able to provide social and environmental sustainability. It is just a matter of costs, condition of the building, and energy performance of the building that tend to leave practitioners in a bit of uncertainty when it comes to applying adaptive reuse.
Case Studies

In the book *Sustainable Building Adaptation: Innovations in Decision-making* provides a case study over of Dutch offices being converted to houses. The process the researches includes interviewing all the people involved which included the architect, contractor, stakeholders, and others that may have been involved with the decision-making process. The scope of the project involved 15 units that were converted. For the purpose of the study they broke the years of construction into three periods buildings built before 1950, between 1950 and 1965, and built between 1965 and 1980.

Data and Results

The following graphs are from the online survey. The survey sample size was 23 people. The survey was published through a personal Facebook account that way there was no specific demographic or group that was being excluded from answering the questions. Although this does limit to how many people see the link to access the survey. It was important for the purpose of this research that no particular group was selected to answer the questions due to wanting to find out what the public’s knowledge is on the topics pertaining to adaptive reuse, sustainability, and historic buildings. Below are the results from the survey broken into three categories

**General knowledge on topics**

The follow questions in this section of the survey pertain to getting a general idea of the what people know about the topic of adaptive reuse and historic buildings.
Does preserving historical buildings in your town interest you? If other explain your thoughts.

23 responses

![Pie chart showing responses from Online Survey](image)

Figure 1 Responses from Online Survey

Do you know anything about adaptive reuse of buildings?

23 responses

<table>
<thead>
<tr>
<th></th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>no</td>
<td></td>
</tr>
<tr>
<td>Yes. In my career as a city assessor my staff and I often had to consider the impact on value for changing uss of properties.</td>
<td></td>
</tr>
<tr>
<td>Somewhat</td>
<td></td>
</tr>
<tr>
<td>Intelligent individuals take advantage of buildings that can be repurposed into another dimension of use</td>
<td></td>
</tr>
<tr>
<td>Not really</td>
<td></td>
</tr>
<tr>
<td>NO</td>
<td></td>
</tr>
<tr>
<td>a bit.</td>
<td></td>
</tr>
<tr>
<td>Not really, but I'm guessing it's something about using historical or older buildings for something new without having to destroy them.</td>
<td></td>
</tr>
<tr>
<td>Yes.</td>
<td></td>
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</table>

Figure 2 Responses from Online Survey

*the count of 23 responses to this question is inaccurate. The responses of what is provided in the figure is all that were submitted by the respondents.
Historic Buildings Knowledge

The questions below are specifically about buildings recognized as historic by HRHP.
Do you live in a NRHP (National Register of Historic Places) historic district?

13 responses

Figure 5 Responses from Online Survey

If answered yes above, do you think a particular building or buildings could benefit from adaptive reuse?

6 responses

Figure 6 Responses from Online Survey
Are there any buildings in your town that are older than 50 years and have been vacant for 30 months or more?

13 responses

Figure 7 Responses from Online Survey

Sustainability

The final section of the survey asks questions dealing with sustainability.

What is does sustainability mean to you?

20 responses

- Making something into something that will have usefulness for a long time to come
- to be sufficient and find a way to reuse resources
- Social
- The ability to efficiently reuse something
- The ability to be maintained, in this case, a continued or alternative use.
- Being able to preserve and reuse the same things/elements/spaces over time
- Living in a way that helps protect the environment
- Using resources wisely so that can get benefit from consuming least amount of resources possible.
- Not running out, spell check on the following question
- Not relying on finite resources to look to the future.
- maintaining and supporting existing structures
- Living in a way that reduces the amount of resources consumed.

Figure 8 Responses from Online Survey
This is a continuation of responses to the question in figure 11.

Does new construction generate more waste than renovating an existing building?

22 responses

Figure 9 Responses from Online Survey

<table>
<thead>
<tr>
<th>Responses from Online Survey</th>
</tr>
</thead>
<tbody>
<tr>
<td>Using resources wisely so that can get benefit from consuming least amount of resources possible.</td>
</tr>
<tr>
<td>Not running out, spell check on the following question</td>
</tr>
<tr>
<td>Not relying on finite resources to look to the future.</td>
</tr>
<tr>
<td>maintaining and supporting existing structures</td>
</tr>
<tr>
<td>Living in a way that reduces the amount of resources consumed.</td>
</tr>
<tr>
<td>Balance</td>
</tr>
<tr>
<td>maintaining something for use and future reuse</td>
</tr>
<tr>
<td>Creating something that will serve/benefit a community for a long period of time.</td>
</tr>
<tr>
<td>Preservation of land and less waste.</td>
</tr>
<tr>
<td>Prolonging the life of something</td>
</tr>
<tr>
<td>Helping the environment and making the world a sustainable place for us to live.</td>
</tr>
<tr>
<td>Using your resources that are available and being ecologically friendly</td>
</tr>
</tbody>
</table>

Figure 10 Responses from Online Survey
The next set of questions are on a scale of 1 to 10. 1 being very important and 10 being not important.

**Are the following following issues important to you?**

![Bar chart showing responses to different issues](image)

*Figure 11 Responses from Online Survey*

**How important is economic sustainability to you?**

23 responses

![Bar chart showing responses to economic sustainability](image)

*Figure 12 Responses from Online Survey*

**How important is environmental sustainability to you?**

23 responses

![Bar chart showing responses to environmental sustainability](image)

*Figure 13 Responses from Online Survey*
Overall the information gathered from the survey provides an insight as to where knowledge is missing when it comes to adaptive reuse. From these results the intention is to guide the person to look further into the idea of adaptive reuse as a sustainable solution when dealing with a historic building.

**Limitations**

The following research did present limitations when looking for information. While there are many literature reviews and case studies on the topic of adaptive reuse much of them will focus on just one of the sustainability factors, most of them being environmental. While that is crucial for encouraging the implementation of adaptive reuse it would be best if more research was done on social and economic factors too. Future studies on this topic should include researching issues pertaining to reasons why adaptive reuse is not taken into consideration and instead new construction is taken place. With economic incentives in place and respect for conserving our historic buildings adaptive reuse is not typically considered as a first option when looking at properties. Although new construction will continue to be constructed it is crucial to let clients know the option of adaptive reuse. By explaining and quantifying data on how it fulfills the three pillars of sustainability this should persuade how people view building new facilities.
Conclusion

The idea that adaptive reuse is a sustainable solution by fulfilling the three pillars of sustainability provides
Work Cited


Retrieved from https://nsuworks.nova.edu/tqr/vol13/iss4/2


doi:https://doi.org/10.1016/j.cities.2009.12.005


doi:https://doi.org/10.1016/S0899-3467(07)60142-6


Figure 2


