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THE USE OF WASTE MATERIALS IN CIVIL ENGINEERING IN UZBEKISTAN

Abstract: Given the pressing problem of environmental pollution in Uzbekistan, sustainable development requires innovative solutions.This study explores the concept of waste integration in civil engineering. Analyzing this project in detail is pivotal, as it not only provides environmentally sustainable development, but also provides economic benefits. The use of disposal waste in construction is a concise management of resources, as virgin natural resources will be conserved. Also, management of waste materials is a more economically favorable choice for companies and governments. A combination of descriptive and qualitative data was employed to clarify the idea of waste use in building construction. International case studies and journals were examined and carefully sorted out to make sure only relevant sources are employed. After collecting secondary data, the study recommends focusing on such areas as public education and technological innovations. Integrating the project of waste incorporation in civil engineering in Uzbekistan contributes to the country's overall sustainable development and bright future.

Introduction

As the global population is rapidly growing, so does the waste produced by human activity. In Uzbekistan, 14 million tons of waste was generated in 2024, though only 4.5% is recycled. “The current waste management practices lead to the release of over 7mn tons of greenhouse gases from landfills and the seepage of 43,000 tons of toxic filtrates into the ground” says **Daryo newsletter**[1]. However, with the population also rises the need for housing. Admitting these two problems on a national level, this study explores the application of waste materials for construction purposes. International case studies will be analyzed to better understand the feasibility and potential gaps of utilization of waste materials in the context of Uzbekistan.

Literature review

To have a better idea about waste materials’ possible application in construction, the literature review will focus on international case studies and success applicable in the paradigm of Uzbekistan. Not only environmental benefits will be mentioned, but also benefits to construction will be highlighted. Different categories of waste materials will be analyzed on a subject of applicability in building construction. Also, gaps of existing papers will be mentioned, and the best waste categories for construction will be cited.

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The importance of metal in any building construction is undeniable. Uzbekistan encountered a massive waste production in recent years, with approximately 31% of paper,plastic, glass, and metal being recycled in 2022, according to the Environmental Performance Index[2]. Incorporating disposed of metal of all kinds into building construction on a national scale may yield impressive results both cost-wise and environment-wise. Steel – the world's most recycled metal – can be recycled infinitely many times without a quality decay[3]. Recycling scrap metals for construction purposes, as indicated by **Victorian Metal Traders,** may render buildings durable and long-lasting, while keeping the cost of raw materials reduced[4].

High-Impact Polystyrene (HIPS) – a common waste heavily used in various industries – is a growing source of waste in Uzbekistan. Though companies like Four Season FZE are involved in HIPS recycling, efforts may be not sufficient to reduce environmental impact[5]. Applying HIPS in building construction may not only make a use of waste, but also increase the physical characteristics of construction materials. According to **Science Direct,** addition of HIPS to cement increased their physical and mechanical properties. HIPS improved the compressive strength of cement when added, reaching an optimal characteristic at 19% content. Furthermore, the study underscores the bulk density decrease as high-impact polystyrene is added to solution. The research summarises that the modification to recycled materials may significantly impact building construction, increasing resistance and reducing density[6].

Agro-waste, such as cotton stalk, and industrial-waste are a growing concern in Uzbekistan, given its global cotton production and industrial development. Using waste materials in civil engineering is highly beneficial, as it cuts the cost of construction materials and makes use of potential waste. By-products like cotton stalk and rice husk are environmentally friendly and are important for their renewability. Their structural applications yield better thermal insulation in buildings, highlights **Science Direct.** The study explored enhanced physical and mechanical properties of construction materials, including thermal conductivity, bonding, and strength. It concluded that agricultural and industrial waste integration in building construction presents dual benefits, reducing the cost of construction materials and reducing disposal of waste products[7].

Despite being disposed of and not recycled after the utilization, plastic may be applicable in building materials as well as asphalt mixture. As highlighted in the study by Nidhi Dhull, plastic-modified roads are a way more durable and long-lasting than traditional ones. The study underscores the better performance of plastic-modified roads under the extreme temperatures, which is relevant in Uzbekistan's context. Various types of recycled plastic can be incorporated in road construction, including polyethylene (PE), polypropylene (PP), and polystyrene (PS). Melting and combining plastic with asphalt mixture will yield a homogenous texture, improving water resistance of the road. While reinforcing asphalt without melting waste-plastic is cost-effective as it requires minimum modifications, water stability of a road may be poorer[8]. All in all, application of plastic in asphalt mixture presents higher-quality roads and reduces the rate of plastic disposal.

Aluminium, one more important waste material to be recycled, can be reused as many times as possible. Constructing high-rise skyscrapers from aluminum is not a novelty, though. Many European countries, China, and many others are now making use of aluminium. However, manufacturing it may produce large amounts of CO2, which is a pressing global issue. China, for example, produces 20 kilograms of CO2 per kilogram of aluminum produced. In Europe, manufacturers heavily rely on renewable energy sources that result in reduction of CO2 release by 4 kilograms. There is a way to

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minimize this number, however. A Norwegian company, focusing on low-cost materials, demonstrates the minimum level of carbon footprint, given its use of recycled aluminium. 95% of the 106 meter tall skyscraper was constructed from recycled aluminium. In sum, the company managed to heavily reduce the carbon footprint and cut the building cost due to technological innovations in the field of recycling[9].

Methodology

In this section, the research highlights research methods and sources applied throughout the paper. Secondary data from reliable sources was carefully analyzed for authenticity and applicability in the context of Uzbekistan. Given the nature of the project and financial constraints, secondary data from reliable sources was gathered. Qualitative data were gathered from past research. Specifically, public attitude and waste categories were explored.

This study employs qualitative and descriptive research methods to analyze past research papers on the same topic. Qualitative data explores the types of waste materials that can be used in Uzbekistan, community perception, and benefits. Only materials suitable for application in construction in Uzbekistan are explored, taking into account Uzbekistan's annual waste disposal by category. To report this information, reliable governmental sources were analyzed. Furthermore, a descriptive method was used, focusing on international case studies on waste application in civil engineering.

To take a closer look at feasibility of project adoption, public perception in other countries was viewed. Surveys conducted in Las Vegas and China were analysed, to lower the chances of bias.

Another important area observed throughout the study is environmental benefits that buildings constructed of waste materials present. To explore this aspect of the project, numerous studies were analyzed and descriptive data were reported. International journals and research papers were the main sources.

Although it was carefully designed, methodology introduces some gaps due to limitations. The main limitation of the methodology is absence of primary data. While analyzing international research papers and journals may be valuable, they may be irrelevant in the context of Uzbekistan. Besides, methodology does not present quantitative data. Quantitative information in the study could clearly represent waste material abundance and foster further efforts from stakeholders.

Benefits

The application of waste materials in building construction on a national level introduces various benefits. This section of the study will explore all the merits related to sustainable construction of buildings from waste materials. Both economic merits and environmental benefits will be explained based on data collected from part research papers.

Integration of waste materials in the building construction process could substantially reduce the carbon footprint. Reliance on waste materials during construction can substantially reduce environmental pollution, driven by waste disposed of in landfills. Study has shown that application of waste in raw materials for construction can cut carbon emissions by 30%[10]. Furthermore, natural resource exploitation may be reduced, as less raw materials will be needed for building purposes, given the integration of waste in construction. According to the **World Resources Institute,** environmental degradation caused by excessive mining and resource extraction will be reduced, if the use of waste materials is integrated into building processes on a national level[11].

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Except for environmental benefits, waste materials' integration in civil engineering yields financial advantages. Waste materials present cost effective alternatives to traditional materials, without compromising on quality. By incorporating waste into construction, private companies or governments can reduce construction costs. "Recycled steel may cost less than newly manufactured products. Using waste materials that would otherwise end up in a landfill also provides cost savings on waste disposal fees." writes **Keter journal**[12].Thereby, making use of waste products in civil engineering proposes valuable dual benefits, reducing the overall pollution and benefiting companies and governments.

Public attitude

While exploring a possible application of any new project, public attitude and awareness should be taken into account. Though recycling waste of any kind is supposed to be widely accepted, the community may be concerned about the quality and safety of buildings constructed of waste materials. To clarify it, the study analyzed numerous studies on public perception of constructing buildings from waste. According to Digital Scholarship journal, the population of Las Vegas was largely unaware of the integration of waste materials in building construction. Despite this, the community's attitude toward it was positive: most of the surveyed people did not spot any difference between recycled and standard raw materials used during the construction. Furthermore, the majority of participants thought that quality, cost, and life expectancy of waste materials used during the construction were the same as that of traditional raw materials[13]. Drawing from that, it can be said that overall public perception towards waste material integration in construction is positive. However, a survey conducted in China encountered community resistance to adoption of waste products in building construction. The reason for this was lack of public awareness and limited information[14]. Therefore, further education of the public is paramount in order for waste to be used in civil engineering.

Existing issues

Although the use of waste in building construction seems promising, there are some problems to overcome. This part of the study will cite the possible issues that may appear while applying waste materials in civil engineering on a regional scale. The possible solutions will be proposed and key areas for upcoming researchers to focus will be mentioned.

This study focuses on various waste sources as means of cutting construction costs and addressing environmental troubles. However, before put into practice, clear goals and regulations should be set. With long-term planning, the government could precisely assess the viability of the project. Besides, efforts and resources may be minimized if the project is carefully planned.

Also, before integrating waste material use in construction, focus should be shifted towards technological innovations that allow recycling of by-products. To yield impressive results, executives should concentrate on successful international models of recycling strategies like that of Germany and Austria, recycling 56% and 54% of their waste, respectively. In turn, adoption of recycling technologies may yield a number of merits. "Recycling technology enhances efficiency, reduces operational costs, and minimizes the need for manual labor. It also optimizes the utilization of recycled materials, lowering the demand for expensive virgin resources" writes GME Recycling[15].

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Considering everything listed above, the study misses such important aspects of waste integration in civil engineering as strategic planning and technological innovations for recycling waste. Therefore, the study highly recommends future researchers to focus heavily on these two aspects of the project, exploring its feasibility in Uzbekistan.

Conclusion

This paper has explored the incorporation of waste materials in civil engineering. Benefits and limitations of the project were mentioned, with key areas clearly analyzed. By making use of waste materials in landfills, the government can address the nation's pressing waste management issues.

The study underscores the importance of comprehensive waste management and its integration in building construction. In Uzbekistan, where only 4.5% of waste is recycled, adopting a new vision of waste may play a paramount role in the country's sustainable development[16]. Both financial and environmental benefits were closely examined and recommendations were proposed.

To fully realize the actual potential and benefits of waste integration in civil engineering on a governmental scale, further research should be conducted on technologies for waste recycling. Besides, principles should prioritize public education and policymakers should propose carefully designed regulatory frameworks.

By embracing innovative solutions and environmentally friendly approaches, Uzbekistan can transform its construction sector into a sustainable and economically resilient model.

References:

1. Daryo. (2024, October 21). Uzbekistan generates 14mn tons of waste annually, recycling only 4.5%. Retrieved from https://daryo.uz/en/2024/10/21/

2. Yale Center for Environmental Law & Policy. (2022). Environmental performance index (EPI): Component results for 2022. Retrieved from https://epi.yale.edu/epi-results/2022/component/epi

3. Department of Environmental Affairs, South Africa. (2014). South African waste information system (SAWIS): Annual report. Retrieved from https://sawic.environment.gov.za/documents/5329.pdf

4. VMT Metal Recycling. (n.d.). Top 3 applications of recycled scrap metal. Retrieved from https://vmt.net.au/top-3-applications-of-recycled-scrap-metal/

5. FOUR S. FZE. (n.d.). High impact polystyrene (HIPS) in Uzbekistan. Retrieved from https://www.foursfze.com/high-impact-polystyrenehips-in-uzbekistan.html

6. Du, W., Zhou, Q., Cao, L., Huang, X., & Wang, C. (2016). Performance of sustainable recycled concrete aggregates for structural applications. Procedia Engineering, 145, 1207-1213. https://www.sciencedirect.com/science/article/pii/S1877705816329939

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7. Pacheco-Torgal, F., Tam, V. W. Y., Labrincha, J. A., Ding, Y., & De Brito, J. (2012). Use of recycled materials for sustainable concrete and construction. Cement and Concrete Composites, 34(7), 731-742. https://www.sciencedirect.com/science/article/abs/pii/S0950061812006733

8. AZoBuild. (2013). Benefits of sustainable construction and recycling building materials. Retrieved from https://www.azobuild.com/article.aspx?ArticleID=8690

9. Deutschland.de. (n.d.). Sustainable construction: Recycling building materials. Retrieved from https://www.deutschland.de/en/topic/knowledge/sustainable-construction-recycling-building-materials

10. United Nations Environment Programme (UNEP). (n.d.). Advancing environmental sustainability through global initiatives. Retrieved from https://www.unep.org/

11. World Resources Institute (WRI). (n.d.). Transforming big ideas into action for a sustainable future. Retrieved from https://www.wri.org/

12. Keter. (n.d.). Recyclable building materials: Resources for sustainable construction. Retrieved from https://www.keteres.com/resource/recyclable-building-materials

13. Sturges, A. J. (1987). Construction waste management: Reducing waste generation in construction projects. Retrieved from https://digitalscholarship.unlv.edu/rtds/3303/

14. Finnveden, G., Björklund, A., & Ekvall, T. (2020). Sustainability of waste-to-energy: A critical review of impacts and benefits. Recycling, 5(4), 31. https://doi.org/10.3390/recycling5040031

15. GME Recycling. (n.d.). Global metal recycling: Advancing sustainability in scrap metal processing. Retrieved from https://www.gme-recycling.com/

16. Daryo. (2024, October 21). Uzbekistan generates 14mn tons of waste annually, recycling only 4.5%. Retrieved from https://daryo.uz/en/2024/10/21/