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THE PATH TOWARDS THE CIRCULAR ECONOMY AND SUSTAINABILITY IN HE CONSTRUCTION INDUSTRY: A CASE STUDY OF SERBIA

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Abstract: The construction industry is one of the greatest contributors to pollution, waste, emission of greenhouse gases, and other forms of negative environmental damage. The construction industry by its nature is not sustainable, taking into account the procurement of materials, continuing with the resources that are consumed, all the way to the overall effects on the environment. The harmful nature of the construction industry has to be retained by introducing more sustainable approaches and developing strategies that can reduce the harmful effects of construction. Taking into account that the building sector is one of the greatest contributors to resource consumption it is clear that is very important to develop ways in which negative impacts could be limited. One of the most acknowledged approaches is a circular economy that has aim to find other paths to reconcile the development of states, constant building activities, and limited natural resources that are jeopardized due to these activities. Each state must put an effort towards achieving this balance. This paper analyses the position of Serbia on the path towards sustainability in the construction industry and practices of circular economy that are acquired. This paper is based on the literature review and analysis of official data about construction activities in Serbia. This approach was chosen as it can help establish the position of Serbia toward arising requests that address activities in the construction industry and the current level of compliance with them. Sources were searched using the keywords „circular economy "; "construction industry"; „sustainability"; etc. Most information was withdrawn from the Republic Institute of Statistics and from governmental documents made to support circular economy practices. Data was gathered with a focus on the most recent statistics and changes in trends so that the current position of Serbia is most accurately presented. In addition, clients of the construction companies from Belgrade were asked about their opinions on the importance of sustainability of the construction projects, with a focus on circular economy solutions. Results show that Serbia has a very low application of circular economy strategies despite the great potential that is acknowledged by several sources. Moreover, the research has shown that clients still don't have developed awareness of the importance of sustainable construction and don't have the sensibility to acknowledge and support measures of the circular economy.

Keywords: sustainability, construction, circular economy, Serbia.
Field: Social sciences and Humanities.

1. INTRODUCTION

The construction industry by its nature is not sustainable, taking into account the procurement of materials, continuing with the resources that are consumed, all the way to the overall effects on the environment (Vasilca et al., 2021; Maqbool & Amaechi, 2022). Population growth and the pursuit of development, such as the built environment, have resulted in ozone depletion, global warming, resource depletion, and ecosystem destruction. Buildings are one of the seven biggest contributors to resource consumption (Sandanayake et al., 2019; Sandanayake, 2022). Also, the construction industry is the world's largest emitter of greenhouse gases (Ryłko-Polak et al., 2022). It can be said that the construction industry has a negative impact on air pollution which has direct and indirect effects on the general environment (Cheriyan & Choi, 2020). This has put the construction industry at the center of attention because its activities have a significant impact on the environment (Norouzi et al., 2021; Yılmaz & Bakış, 2015; Aigbavboa, Ohiomah & Zwane, 2017). Due to the rapid global expansion of sustainable building in recent years brought about by resource conservation, this industry has encountered numerous administrative, strategic, and operational difficulties (Kneifel, 2010).

Because of that the term sustainable construction gain more attention. A building or construction project's overall environmental, economic, and social implications are examined when using sustainable construction, which combines ethical environmental practices. Reduced resource use during construction and operation, less environmental effect, reduced waste during construction, decreased planning

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risk, and increased building viability are all advantages of sustainable construction (Azis et al., 2012). As an ample example, it is suggested that the industry should employ green energy-saving buildings as a breakthrough point and assume responsibility for social development to contribute to socially sustainable development (Zhou, 2010).

Taking into account the impact of the construction industry on the environment, the circular economy is offered as one of the potential solutions. The circular economy is considered to be one of the most effective ways of reducing the negative impact of the construction industry. A circular economy ensures that no new natural resources are needed to produce the material and that waste is minimized. Besides the circularity of resources in closed-loop systems, the circular economy focuses on better resource management by rethinking and reducing unnecessary consumption (Ghufran et al., 2022; Afshari & Górecki 2019). Kirchherr et al. (2017) define the circular economy as an economic system that replaces the concept of "end of life" with reduction, alternative reuse, recycling, and recovery of materials in production/distribution and consumption processes. Effective implementation of circular economy principles can eradicate the above problems through the recirculation of materials, for example, by designing for disassembly with mechanical joints that can potentially extend the life of building components for reuse in other building projects through a new cycle or even in another system (Bujnak, 2011). The potential benefits of adaptive reuse rely on the fact that it is possible to take components from an obsolete building and then recycle, repair, reuse, or remanufacture them (Zvirgzdins et al., 2019). From a perspective of circular economy, the main criteria to consider when choosing building materials for all types of buildings should include local availability, embodied energy, recycling potential, recycled content, renewable potential, construction waste reduction potential, lifetime and durability, and maintenance needs.While in the developed countries the level of application of circular economy is higher, and it is estimated to be around 60% (Bilal et al., 2020) developing countries face more problems related to the circular economy practices. In line with this thinking is the need to analyze more how countries behave in this context and what is there position towards sustainability and circular economy. The country selected for the analysis in this paper is Serbia.

The focus of this paper is to analyze the sustainability of the construction industry in Serbia. The goals that are planned to be achieved in this area are clear and set but the position of each state towards these goals differs a lot. To achieve any progress and reduce the negative impact on the environment it is important to determine the current position of states and thus make suggestions for future progress towards sustainable practices and circular economy. To do so, in this paper, by relying on the existing findings the position of Serbia is discussed taking into account the data published by Republic Institute of Statistics about so far achieved results regarding sustainable construction practices and recycling of the construction waste and collection of attitudes of clients of Serbian construction industries about importance of sustainable construction. The goal of the paper is to determine where Serbia stands on its path toward sustainability in the construction industry.

2. MATERIALS AND METHODS

This paper is based on the literature review and analysis of official data about construction activities in Serbia. This approach was chosen as it can help establish the position of Serbia toward arising requests that address activities in the construction industry and the current level of compliance with them. Sources were searched using the keywords "circular economy", "construction industry", "sustainability" etc. Most information was withdrawn from the Republic Institute of Statistics and from governmental documents made to support circular economy practices. Data was gathered with a focus on the most recent statistics and changes in trends so that the current position of Serbia is most accurately presented. In addition, the attitudes with the clients of the Serbian construction companies were researched and analyzed by conducting the interviews and discussing the issue of sustainable construction. The interviews were conducted or in person or via Skype/Zoom and the focus was on researching if one of their concerns regarding project is to make project sustainable and would they pay more for sustainable solution. The focus was also put on the circular economy solutions and how clients are familiar with them and willing to require or accept them.

Based upon the findings and existing literature that was analyzed the conclusions about current practice in Serbia were made and suggestions for changes that have to be made are included. the synthesis of data provides solid insight into the practices that are currently applied in Serbia and plans for the future. This method has significant limitations due to the possibility that data provided by the state doesn't represent the real situation. To overcome this barrier, the perspectives of organizations that promote sus-

tainability and require solutions that include a circular economy are also taken into account.

3. RESULTS

Reflecting on the previously stated importance of the sustainability in construction industry and a great need to include circular economy solutions that are more emphasized than ever in academic and practical filed, the lack of data about these aspects in Serbia seeks additional attention. The first impression made about the current state of sustainability in the construction industry in Serbia is that the state's publications about construction industry trends don't include sustainability as one of the analyzed aspects. This speaks a lot about the attitude towards sustainability and how long the path towards sustainability is for Serbia. Thus, the lack of data that provide insight into sustainable construction practices, or lack of them, is a great indicator of a general attitude towards the importance of making sustainable decisions and taking into account the impact that the construction industry has on natural resources, contamination, and amount of waste. However, a lot about the current situation can be learned through the data that are published. According to the Republic Institute of Statistics, the construction industry contributes more than 5.7 percent of GDP, and involvement is expected to expand in the next years. The increasing level of building activities leads to change in the amount of waste and as a consequence of that makes the issue of sustainability even more important. To concretize, as a result of the increased number of construction projects, the amount of waste produced is increasing as well, potentially endangering the ecosystem. The problem arises not only due to the amount of waste but is highly linked to the lack of practices that could minimize the negative effects of construction work. Serbia still didn't develop any practice that would lead to the separation of construction and demolition waste in Serbia, nor is there a recycling plan that could be applied.

Chart 1: Prediction of the consruction waste reuse in Serbia 2022-2034.

It can be remarked thus that Serbia still doesn't acknowledge the need to address this issue. Only a little quantity of building and demolition waste, as well as asphalt, is recycled, for example, less than 1,000 tons in 2018. Although there is a general legal requirement for manufacturers to collect waste separately and categorize it according to future treatment, this rule is not in effect because there are no by-laws. As a result, high-value waste, such as metals, is mainly recycled, but other potentially recyclable items are disposed of in landfills or, more frequently, end up in illegal places. So far, it can be said that only financial drivers so far have been effective. Even legislative solutions don't provide any concrete results. In 2020, 729,000 tons of building and demolition waste were generated, according to Republic Institute of Statistics data. However, when compared to the amounts of construction and demolition waste in EU countries, the potential is much higher, ranging from 1.6 million to 3.6 million tons. These figures were computed using assumptions such as total construction turnover, total building construction investments, GDP of the construction sector, construction activity of contractors on Serbian territory, and the area of demolished apartments. By comparing this information, it becomes clear that if the Serbian approach changes, it could be possible to achieve great results in reducing the impact of the construction industry on the environment. It is also important to underline that construction waste account for two-thirds of all

waste created in Serbia. Belgrade has difficulty with waste disposal because only a portion of it is disposed of at the Vinča landfill, and the main issue is generated by illegal landfills. There is no official data on how many illegal dumps exist in the capital, but the Association for Demolition, Decontamination, and Recycling estimates that there are more than 500. This represents one of the major problems that occur in practice and that have a huge impact on the plans for the reduction of construction waste. In situations with illegal landfills, it is hard to even make control the progress of the legislation and current suggestions for sustainable practices made. Taking this into account, it should be stated that it is hard to even rely on the data published regarding recycling practices or an official amount of waste.

Still, when discussing the circular economy of construction waste, official data show also very disappointing results. Only 5% of construction waste is recycled. Focusing only on statistical results, it can be said that Serbia is far from an acceptable level of recycling waste and thus reducing the carbon footprint from construction activities.

According to Environmental Protection Agency reports, recycling of construction and demolition waste has yet to be created in the Republic of Serbia, even though 80% of construction waste may be recovered. Because the procedures between the appropriate ministries are not standardized and harmonized, the quantities submitted to the Environment Protection Agency do not reflect the actual situation on the ground. As a result, the precise volume of this form of waste cannot be specified with accuracy. Another piece of information is that there is no construction waste landfill in the Republic of Serbia and that this waste flow is combined with other debris. Another example that emphasizes the problem of negative impact on the environment that is caused by construction activities is that is estimated that there are more than 200 million T of fly ash from thermal power plants in landfills in Serbia. It shows how severe are the aspects of construction activities. All of these issues contributed to the bad results that Serbia achieves in this field. Not to be compared to other countries or to be judged by set standards that are set as desired for the following period, Serbia currently has very unsatisfactory results in this field.

Brussels took notice of the poor situation with building waste and cautioned Serbia in its instructions that it would need to act quickly and set up the necessary infrastructure for the prompt treatment of construction waste. The situation may improve by 2029, when, with the present 5% recycling rate, up to 40% of building waste might be reused. The ultimate goal is to remediate 70% of building and demolition waste by 2034. Uncontaminated soil and other natural material extracted during construction are not included in these 40 and 70 percent figures [49]. To do this, the private sector needs to build 26 locations with mobile waste treatment facilities at the regional level. At the same time, each local authority must ensure that this trash is stored after it has been treated. Simultaneously, arrangements must be provided so that asbestos from demolition can be disposed of in designated areas of regional sanitary landfills.

Although the profile of Serbia as an actor who should contribute to the reduction of negative impacts of construction activities on the environment showed that Serbia barely is stepping forward toward that goal. Some changes in that direction are made. One of the examples is the “FEPLO” corporation as an example of best practice in this field. In freshly constructed buildings, certain construction companies have implemented green and energy passport norms.”FEPLO” is a national company that manufactures ecological waterproof boards that are used as building materials for roof and mezzanine structures. It is used to make waterproof tetra pak boards from municipal and industrial waste, and instead of glue, 10% soluble polymers are added to the boards. They are commonly used in building for roof constructions, mezzanines, walls, and floors. They are used as a substitute for wood for the same functions. This is one of the examples of how χ^2rent problems with negative aspects of the construction industry can be minimized with the applications of good and effective practices. Similarly, company Lafarge aims to be a leader in sustainable and innovative solutions in the construction industry in Serbia. It can be said, that the first companies that are emerging in Serbia and have put efforts to minimize negative effects on the environment are a good start for progressing towards sustainable practices and circular economy practices. To make improvements in this area and develop healthier construction conditions that would reconcile needs of the modern society and nature, the following suggestions should be taken into account.

When it comes to the responses of the clients, it is quite clear that majority of them didn’t event think about susainability when planning the construction project. Only few of them said that they would love to include sustainable solutions but that it is not their priority. Price and complicated aspects of sustaianble construction and application of circular economy practices are main reasons why clients are not willing to insist on sustainable projects. Also, from their answers it is quite clear that the seriousness of the situation and major consequences that are related to the preservtion of natural resurcees are not their main concern.

The main conclusions made after the analysis of Serbia in this context show that Serbia barely acts following sustainable goals and doesn’t incorporate a satisfactory level of circular economy practices.

Researching and developing ways to improve sustainable practices in the Serbian construction industry should be a topic of future research, taking into account the importance of the topic not only to the political and economic development of the country but also to the impact that these practices have on natural resources, health and environment in general.

4. DISCUSSION

Based upon the importance of sustainable practices in the construction industry that was acknowledged in the previous studies and the current position of Serbia it can be concluded that Serbia has to focus more on becoming more sustainable through changes that can be introduced in the construction industry. All done so far was a result of the pressures to comply on paper with EU standards and to adapt the legislation so that these values seem incorporated. Real change lacked. The results that would have been accomplished if the legislative solutions were applied would make Serbia one of the countries with successful results in this field. Even then, the room for development would be opened. It can be thus stated that currently Serbia barely applies any circular economy practices and that has a long way to pass to achieve the results that could be considered successful. A trend of increasing construction activities and the impact that it has on the environment makes it necessary that all countries, including Serbia, try to improve their construction industries and be more responsive to nature. To do so, some of the suggestions that could be useful for this goal are presented in the following text. Serbia should consider the possibility of developing the industry through circular business models to discover a manner of adequate resource management. In this context, specific attention must be paid to the construction sector in terms of support for the creation and promotion of circular business models. The fundamental suggestion is to focus on the actions that would lead to an increase in awareness about the importance of such measures. This suggestion is not limited to only those involved in the construction activities but also to the public. If a change happens within society to acknowledge the importance of a circular economy, the pressures on companies would be higher under law regulations and international standards in this field. Also, this way individuals would prefer companies that try to reduce the negative impact on the environment. The profit as a main driver would have an impact on behavior and lead to change. The change of mindset is the most effective way to encourage all other changes that would help the fulfillment of that goal. That way the social barriers that are one of the main obstacles to achieving desired sustainable practices would be removed. More specific suggestions go to the following areas. First, it is important to make sustainability a priority for all participants in the construction industry. It means that time and budget are usually put as the most important aspects that are matters of concern in this case has to be after sustainable requests. Change in the financial incentives would encourage the change and would lead to more usage of recycled materials. For example, those who choose environmentally harmful practices are those who have to pay and not reverse as it is today. It means that using sustainable sources shouldn't be more expensive than traditional ways of construction that harm nature.

The focus should be put on the practical aspects more than just the legislative framework that is not in use. The values incorporated in the companies' cultures and societies need to change and the idea of sustainability becomes the core of the decision-making.

Other suggestions are more practical and are acknowledged in the existing literature. The new report commissioned by the European Environment Agency included eight suggestions for how to become more sustainable in the construction industry. The first refers to reducing the amount of steel and concrete used to what is strictly necessary. The second refers to the reuse of dismantled steel and concrete components from existing buildings in new buildings. Increasing the reuse of building components can become easier when components are standardized and designed to be easily disassembled, as described in the next action. The third proposed action has an impressive potential for circularity at the level of a single building: up to 90% of the materials from a building designed for dismantling can be reused. This is why a new generation of buildings that can be easily disassembled, for example by twisting parts instead of gluing, and whose components follow standard designs and are easily reused in other buildings, is needed. Using wood could potentially reduce emissions significantly, as trees absorb CO2 over their lifetime and therefore act as a carbon sink. If well maintained, a timber structure can effectively store CO2 as long as the material is intact, potentially being reused and maintained beyond the life of the original building. Serbian construction companies also could try to use climate-friendly types of cement instead of regular cement. Applying this strategy could significantly reduce emissions. For example, some modern types of cement emit significantly less CO2 during processing due to their chemical composition (Li & Colombier, 2009). Optimizing the use of space in buildings to reduce the need for new construction is also one of the

strategies that could be applied with the aim to improve the level of sustainability. Additional two strategies that were suggested are recycling cement from demolition waste using efficient recycling processes and deep renovation of existing buildings instead of demolition and rebuilding.

These are some of the actions that may be included as a part of Serbian efforts to achieve desired goals in his field.

Responses from the clients, as it was said in the results section show great lack of awaresness about their role in changing construction practices by requiring sustainable solutions for their projects from the constructon companies. The change in the behaviors of clients and their requirements about the impact of materials used in the construction industry could lead to the decrerase of the negative impacts of the construction industy on natural resurcees. Among clinets that were interviewed majority didn't think about the issue of sustainability before. The impact of the construction industry is not the topic that people are engage about and this reflcts on the current situation regarding low number of susitinable actions.

5. CONCLUSION

This paper addressed the sustainability practices in Serbia within the context of the construction industry. The purpose was to determine how sustainable Serbia is in this perspective and to what extent it applies the circular economy strategies and practices to reduce negative impacts on the environment. The paper showed that even though Serbia has legislation that supports sustainable practices and introduced plans that could help achieve EU standards in this field, fails in achieving sustainable results in the construction industry. The first contribution of this paper is that by overviewing the position of one state – in this case, Serbia, many problems that arise in efforts to be more sustainable were determined and analyzed. Understanding the problems that one state faces regarding sustainability practices is a first step towards changes that could be made in the future to improve the current situation. It is of immense importance that data show great capacity for developing circular economy solutions and improving the general impact on the environment. The second important contribution of the paper is a synthesis of the existing literature and data from Serbia that have resulted in the suggestion that could be used as a guideline for further research on this topic. Overall, it can be said that Serbia has made some steps toward more sustainable practices but that still faces many problems and that the negative impact is high with many opportunities that are missed in the context of its reduction. The main conclusion is that the mindset has to change to put Serbia on the path of sustainability. Only then, the other more specific strategies that are so far distinguished as potential solutions for negative construction impact could be implemented.

The main limitation of this paper is the validity of data provided by the state. This barrier was partially overcome by including some perspectives of organizations that are focused on sustainability and analyses of current practices. But even their reach is limited. Also, the paper is limited with many unpublished data which also is the consequence of a lack of interest in this topic in Serbia and a poor understanding of its importance.

Additional research in this field is more than necessary. Future research should focus on ways to determine the effectiveness of some practices and a more narrowed discussion. For example, focusing on one construction material or one strategy application. That way more detailed results would be offered. In addition, future research should compare Serbia with EU countries to get better insight into the position of Serbia regarding sustainability. It is not an irrelevant issue either to discuss the concrete documents of solutions introduced by the government.

But in the practical context, it is most important to research the best ways to make a change to find a way to reduce the negative impact of developing the construction industry and to provide insight into barriers and strategies for lifting these barriers. Researchers should focus on this matter, due to the undeniable impact that these practices have on the environment and our society.

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