

# Sustainability Aspects of the Construction Industry and Entrepreneurship: Challenges and Opportunities

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## Abstract

The relevance of the research and its significance are being determined by the fact that changes in economic and environmental development could affect the tendencies of the development of the real estate market and construction industry, and entrepreneurship within these sectors, and vice versa. As time passes, the participants of real estate sectors face numerous challenges, and it could be useful to find the possible improvement opportunities for economic analysis and management. The aim of the research is to analyse the factors affecting the real estate market, construction industry and related entrepreneurship in changing environment in the context of sustainable economic and environmental development, paying particular attention to the tendencies within these sectors. The literature, historical, comparative analysis and logical access methods have been used in the research. The conducted analysis could help in the improvement of the entrepreneurial activities for the sustainable development of the real estate market and construction industry.

*Keywords: changing environment, economic sustainability, entrepreneurial aspects, real estate development, real estate entrepreneurship, real estate market, sustainable construction*

## 1. Introduction

Representatives of the business sector are influenced by external and internal factors, and this influence is enhanced also by various factors that affect the overall development of the country and directly and indirectly could affect the development of construction industry and the real estate market. The role of enterprises in the development of the real estate market and construction industry is quite high, as enterprises form the added value and make a contribution also to employment, which could positively influence also economic development. At the same time, managers of the companies together with other stakeholders and interested parties in the process of construction and real estate management make decisions that finally could result in changes in real estate prices, aggregate supply, and aggregate demand within the real estate sector, as well as in the quality of the objects. Several aspects of the development of the construction industry and real estate market are interconnected, as a big number of finished construction objects enter the real estate market through purchase, rent, lease or other aspects. Real estate acquisition and investments in real estate are important for the functioning of the market, and could affect also other industries.

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The real estate market and construction industry are always in development. According to Tempan (2006), changing market conditions is an inevitable and constant process, no matter how gradually and covertly it happens. And the more active the market, the faster the changes will take place, and social, economic, political, natural and other factors also constantly have a positive or negative impact on the value of the real estate (Tepman, 2006). For instance, the real estate pricing concept and its influencing factors, in order to find their influence on real estate prices were investigated by Bindu Nanjundaswamy (2022). Also, for instance, the estimated effect of an increase of local residential real estate prices on investment spending of local companies is nearly high in states with weak zoning regulations, where commercial and residential real estate are close substitutes (Davis, Huang, & Sapci, 2022). At the same time, “by exploiting the information precision channel to assess returns in less transparent markets, foreign investors do not perform worse than domestic investors who use local market information” (Füss, & Ruf, 2022, p. 16).

The aspects of the sustainable development of the real estate market and construction industry also has a social importance, because the availability of qualitative housing, its affordability for purchase or rent, is one of the primary necessities for human, and is important for the sustainable development of the real estate market. At the same time, the land plots are being developed by providing, for instance, a new entrepreneurial or living opportunities. The correct management approach and analysis of risks are necessary to achieve good results in construction from social, economic and environmental points of view.

Constructed new real estate units also could have a crucial role for the sustainable development of cities, as their quality and possible influence on the environment is important. In the definition of sustainable construction product, emphasis is made on the possibilities created in the construction process to use resources more effectively and safely with a minimal possible destructive impact on the environment (Vanags, & Butāne, 2013). Also, construction and built environment could make a big impact on climate change mitigation by improving resource and energy efficiency (Pelli, 2021). In addition, huge potential in climate change mitigation lies in application of circular economy principles (Zvirgzdiņš, Plotka, & Geipele, 2020). People also have a necessity to plan their urban environment in such a way that their needs are met while consciously using the available natural, financial and human resources and reducing their potential negative impact on the environment (Blūms, Zvirgzdiņš, & Geipele, 2022). It is significant that 40% of total consumption of energy in European Union is used by the building sector, and 36% of greenhouse gas emissions in European Union come from building sector (European Commission, 2022).

Legal aspects are important as well. For instance, the discussion of commercial real estate with a short remaining period of land use rights on evaluation thoughts of income approach was recently analyzed by Guo Yukun and Zhou Yan (Yukun, & Yan, 2022). Real estate and land management tend to be highly complex areas and these issues could be important also for local governments (Gross, & Wolny-Kucińska, 2021).

The aim of the current research is to analyse the factors affecting the real estate market, construction industry, and related entrepreneurship in changing environment in the context of sustainable economic and environmental development, paying particular attention to the tendencies within these sectors. The literature, historical, comparative

analysis and logical access methods have been used in the research. Research object is the development of the real estate market and construction industry. Research subject - the factors affecting the entrepreneurship within the real estate market. Attention is being also paid to the timber construction. The practical part of the research includes an analysis of European countries.

Theoretical and methodological aspects of the research are described further.

## 2. Theoretical and methodological aspects of the research

Questions related to “sustainability”, “circular economy” and “circular construction” recently have received increasing attention, but, at the same time, their interpretation could often be unclear, depending how a certain study fits into these research fields (Anastasiades et al., 2020). The current research has mostly environmental and economic focus. Statistical information regarding the economic and environmental aspects is presented in the practical part of the research.

Economic problems or challenges could appear starting with the purchase of land, or later in the operational phase. For instance, one of the periods of high risk in the real estate market for the entrepreneurs could be an overheat period. One of the related terms could be called “real estate bubble”. “The “bubble” as a phenomenon of speculation around financial and other assets has become a true economic concept, very much in force today” (Arrese, 2021, p. 106). After the “bubble” bursts, in some cases, the rapid recession could be observed. Also, if investors wish to reduce the risks of stock portfolios, for instance, within the three chosen European countries, real estate investment trusts do not seem to act as an absolutely safe option for investment, especially during downturns of market development when the association between real estate investment trusts and stocks is heightened (Luchtenberg, & Seiler 2014, as cited in Abuzayed, Al-Fayoumi, & Bouri, 2020). Also, recently “both the long-term diversifying functions of the physical store and the short-term lockdown shock required the investors and retail asset managers to re-evaluate their asset management strategies” (Nanda, Xu, & Zhang, 2021, p. 114). As the consumption of resources and the needs of society are growing, thus being one of the main problems of economic science and sustainable development, the issues of planning of the territorial development also could be important in this context. For instance, as “the pandemic has caused/resulted in space market changes - with the flexibility of work and more digital options for shopping, there is now stronger preference for suburban and rural areas with less congestion, sparse population and easier access to greenspace” (Nanda, Xu, & Zhang, 2021, p. 114).

As different risks could be found in the external environment, a good management of company and real estate projects is very significant. For instance, diverse perceptions and methodologies for the different elements of management system were analysed by Ahmed S. Mohamed, Feipeng Xiao and Chamod Hettiarachchi (2022).

Entrepreneurship within real estate market and construction industry could have a crucial role also in the creation of the sustainable economic and ecological environment of the city. The use of resources in the entrepreneurial process are shown in Figure 1.

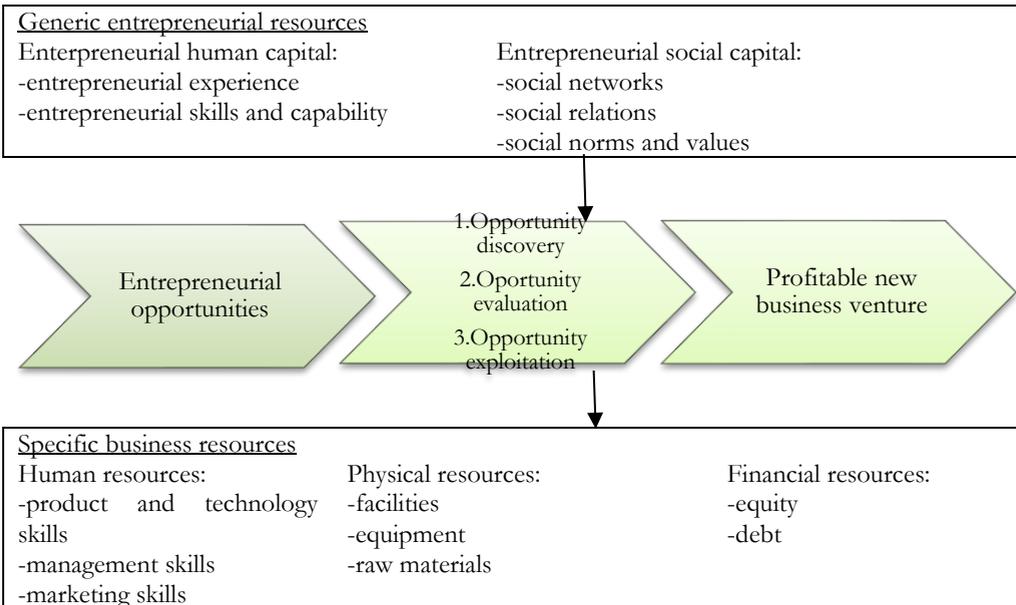


Figure 1. The Use of Resources in the Entrepreneurial Process  
(Source: Ronning, Ljunggren, & Wiklund, 2010, p. 199)

The Figure 1 shows generic and specific resources in the entrepreneurial process. The choice of risk reduction methods depending on the chosen strategy is shown in Figure 2.



Figure 2. Choice of Risk Reduction Methods Depending on the Chosen Strategy  
(Source: Petera, & Voronova, 2003, p. 115)

Quality concerns within building could also influence related costs and necessary time for completion of the project. To achieve the high quality, also the qualitative management of the project should be implemented. For instance, the synergy among traditional, agile and lean management approaches in construction projects were analysed by Abdallah Lalmi, Gabriela Fernandes and Souad Sassi Boudemagh (2022), and, according to authors, “there

may not be a specific methodology that meets the needs of all construction projects, in which case a hybrid between several approaches may be the most beneficial path to take. A hybrid methodology is intended to provide a blend among several project management approaches to allow a project to benefit from the best guiding principles, perspectives, and characteristics aspects of one another” (Lalmi, Fernandes, & Boudemagh, 2022, p. 738). It means that there is the necessity to use the best management and market analysis experiences to achieve a good entrepreneurial results.

As ecological aspects become more topical, managers should take them into account.

Wood is considered to be sustainable and circular material (Zvirgzdiņš, Plotka, & Geipele, 2019). But the sustainability aspect of wooden material is highly dependant on the precondition that wood is extracted from sustainably managed forests. Sets of trees which are the main elements of forest ensure far more ecosystem services than just timber. Trees are providing such environmental service benefits as water cycle management, air filtration, temperature regulation, soil health maintenance, nutrient cycling, erosion control, habitat for wildlife, mitigation of the influence of extreme weather events, disease resistance, carbon sequestration and such social service benefits as aesthetic value, recreational opportunities, inspiration for art, literature, education etc., spiritual value and ecotourism opportunities, and supporting pollinating services (Reed et al., 2017). Sustainable forestry practices envisage harvesting the trees at the peak of their cycle and replacing them with new trees before their ability to absorb CO<sub>2</sub> and emit O<sub>2</sub> declines. Adaptation strategies and approaches for forest carbon management include 1) maintaining or increasing extent of forest ecosystems; 2) sustaining fundamental ecological functions; 3) reducing carbon losses from natural disturbance, including wildfire; 4) enhancing forest recovery following disturbance; 5) prioritizing management of locations that provide high carbon value across the landscape; 6) maintaining or enhancing existing carbon stocks while retaining forest character; and 7) enhancing or maintaining sequestration capacity through significant forest alterations (Ontl et al., 2020). That being said, the importance of sustainable forestry should not be underrated.

Construction time for wooden constructions is short, with a low and sometimes even negative ecological footprint (Švajlenka, & Kozlovská, 2019). For instance, in Brazil, the use of wood in construction was “primarily temporary, and it can represent a great percentage of construction waste” (Kern et al., 2018, p. 446). At the same time, “while environmental benefits of mass timber manufacturing and construction is well documented the end-of-life and the post- end-of-life options for mass timber buildings, their environmental benefits and circular economy potential are discussed much less” (Ahn et al., 2022). Mass Engineered Timber is a building material comprising engineered wooden products with improved structural integrity, for instance, cross laminated timber layers of wood are stacked cross-wise and bonded with structural adhesives and predominantly could be used for walls, floors and roofs (The Building and Construction Authority [BCA], 2020), and Glued Laminated Timber, produced in a similar way but with the grain aligned in the same direction, predominantly could be used for columns, beams and truss elements (The Building and Construction Authority [BCA], 2020). Cross-laminated timber is a recent innovation (Younis, & Doodoo, 2022). Also, the findings revealed significant savings in the greenhouse gas emissions (fourty percent on average) associated with the use of cross-laminated timber. Despite the various applications and the

advantages of being tough light-weight material with good performance in earthquakes, main risks associated with the use of cross-laminated timber are potential moisture damage and the following mold exposure, and fire safety. Even though the cross-laminated timber has proven to burn slowly, it is still at a higher risk of fire damage than more traditional materials. (Younis, & Dodoo, 2022; Brandner et al., 2016; Emberley et al., 2017).

One of the main concerns to reusing structural timber could be related to guaranteeing strength and safety, however, appropriate assessment criteria to guarantee its mechanical properties are needed (Niu et al., 2021). In research of Jozef Švajlenka, Mária Kozlovská “Effect of Accumulation Elements on the Energy Consumption of Wood Constructions” (2019) was found that there is a benefit in using accumulation elements in wood constructions for cost saving, the level of comfort for users, in terms of use of energy and sustainability in general (Švajlenka, Kozlovská, 2019). At the same time, it was recommended to prioritise material recovery rather than energy recovery, and to take into account opportunities of prolonging the storage of biogenic carbon and life cycle of wood (Niu et al., 2021).

Practical part of this research includes the overview of the following indicators:

- annual circular material use rate in European countries, percentage, 2020;
- roundwood production in European Union in 2013-2021, thousand m<sup>3</sup>, annual data;
- gross domestic product at market prices in European Union in 2012-2020, annual chain-linked volumes, index (2010=100);
- house price index (2015 = 100) in European Union in 2013-2020, annual data;
- annual turnover or gross premiums written in construction, million euro, in 2011-2020 (European Union in general, Estonia, Latvia, Lithuania) (\*turnover is “the total of all sales, excluding value added tax, of goods and services carried out by the enterprises of a given sector during the reference period” (European Commission, 2022b);
- construction cost (or producer prices) of new residential buildings in European Union in general, Estonia, Latvia, Lithuania - quarterly data (2021Q1-2021Q4).

Index of production in construction in European countries in 2021 had been investigated as well. Practical part is available further.

### 3. Practical part

Aspects related to the ecological dimension of the construction industry are significant for the sustainable development of the construction sector in general. As the economic, social and environmental aspects in some cases could be considered as “conflicting” (Frini, & BenAmor, 2015), the environmental aspects within the construction industry could influence also the several costs and the overall final economic performance of the real estate project. However, it could be important to understand also the general tendencies within the environmental dimension that could be related to the development of the construction industry. Annual circular material use rate in 2020 in European countries according to Eurostat estimate (Eurostat, 2022a) are shown in Figure 5.

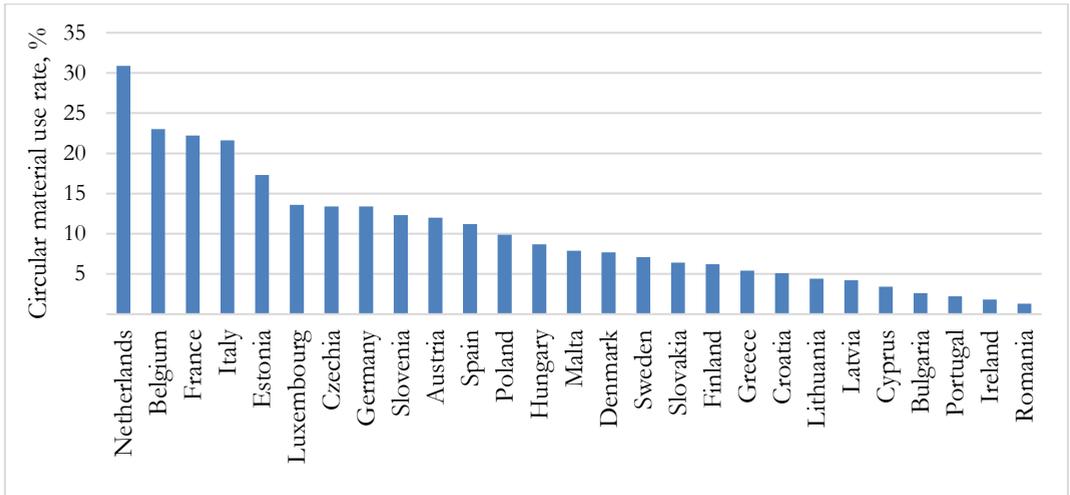


Figure 5. Annual Circular Material Use Rate in European Union Countries in 2020, %. Eurostat Estimate, 03.05.2022. Available Selected Information  
(Source: developed by the authors, based on Eurostat (2022a))

According to Figure 5, the highest circular material use rate in 2020 in Europe according to available information was in the Netherlands, Belgium, France, Italy and Estonia, and the lowest – in Romania, Ireland, Portugal, Bulgaria and Cyprus. Increased ecological challenges and rapid economic growth could be evaluated in interaction with each other (Vanags, & Butāne, 2013). As timber is one of the most frequently used circular materials, it is also considered in this analysis. Roundwood production in European Union from 2013 to 2021 is shown in Figure 6 (Eurostat, 2022a).

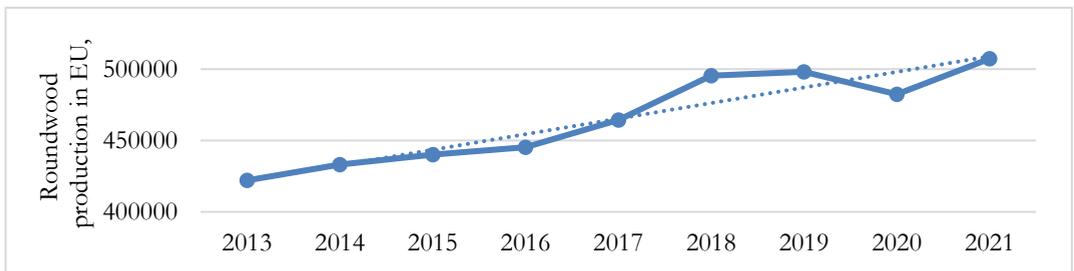


Figure 6. Roundwood production in European Union from 2013 to 2021, thousand m<sup>3</sup>  
(Source: developed by the authors, based on Eurostat (2022a))

According to Figure 6, there is a clear trend in roundwood production increase from 2013 to 2021. Decrease in annual roundwood production in 2020 compared to 2019 could be explained by Covid-19 pandemic and following restrictions in economic activities. Trendline shows that roundwood production is increasing and is expected to do so in the following years, underlining the growing importance of timber as a material. The growth rates of gross domestic product in European Union in 2012-2020 are shown in Figure 7. In Figure 7 and further European Union includes 27 countries (from 2020), from 2013-2020 – 28 countries, in 2011-2013 – 27 countries (Eurostat, 2022a).

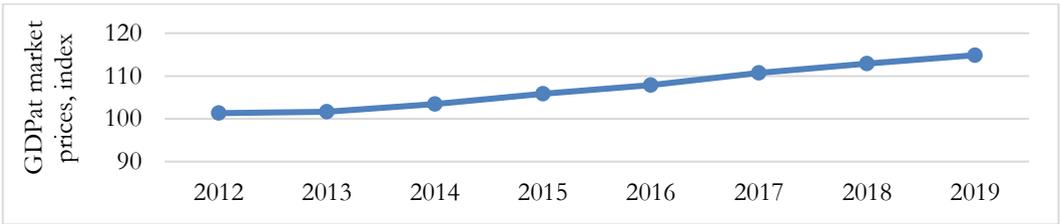


Figure 7. Gross Domestic Product at Market Prices in European Union in 2012-2019, Annual Chain Linked Volumes, index (2010=100)

(Source: developed by the authors, based on Eurostat (2022a))

According to Figure 7, the index of gross domestic product for market prices (2010=100) in the European Union in 2012-2019 has grown by 13.54 points. The development tendencies of house price index in European Union in 2013-2020 are shown in Figure 8. According to Figure 8, the growth of prices of real estate has been observed in the analysed period. According to Figure 8, house price index (2015 = 100) in the European Union in 2013-2020 has grown by 24.99 points, thus achieving 119.75 in 2020. The reason of the growth of prices could be related to the changes and development issues within aggregate supply and aggregate demand for real estate units.

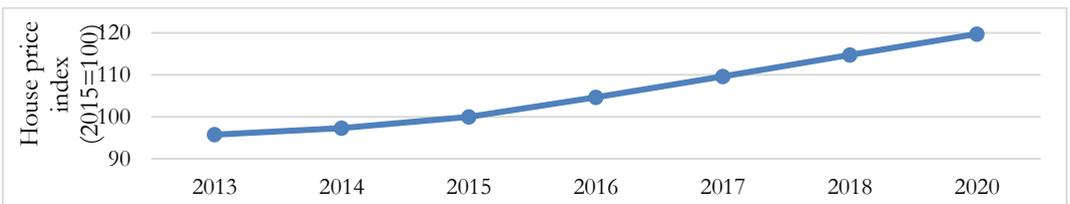


Figure 8. House Price Index (2015 = 100) in European Union in 2013-2020, Annual Data

(Source: developed by the authors, based on Eurostat (2022a))

According to Figures 7 and 8, the economy and real estate market in general had growing development tendencies, which could affect the entrepreneurship within real estate market – for instance, investments and related decisions, construction costs, real estate prices and other indicators that are significant for the real estate market. Annual turnover or gross premiums written in construction in European Union in general, Estonia, Latvia and Lithuania is shown in Figure 9.

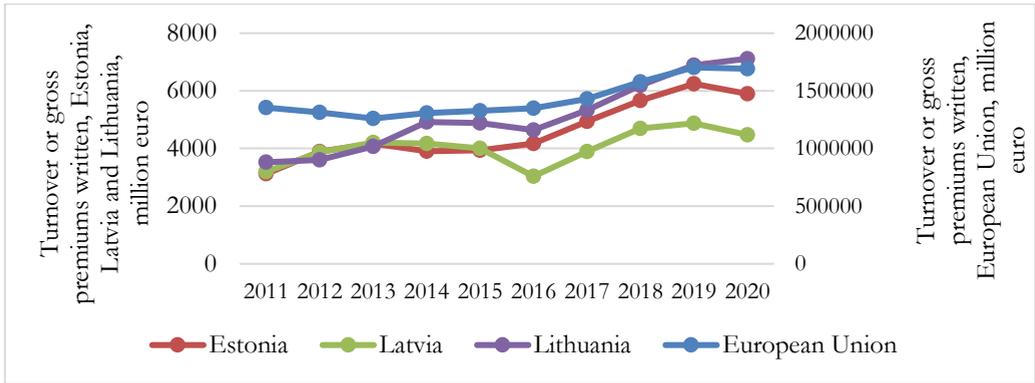


Figure 9. Annual Turnover or Gross Premiums Written in Construction, Million Euro

Note: European Union, 2016 - break in time series; Estonia, Lithuania, 2018 and 2020 – provisional (Source: developed by the authors, based on Eurostat (2022a); information last updated on 18.05.2022)

According to Figure 8, annual turnover or gross premiums written in construction were improving gradually from 2016 to 2019. There has been a small decrease in annual turnover or gross premiums written in construction in European Union in general in 2020. According to available information (Eurostat 2022a), the high index of production in construction in the European countries in 2021 (calendar adjusted data, not seasonally adjusted data, 2015=100) was observed in Montenegro (252.6), Serbia (201.3), Cyprus (195.1), Malta (180.2) and Albania (167.2), and the low - in Greece (67), North Macedonia (67.8), Slovakia (83.8), Spain (84.8) and Bulgaria (89.6).

Quarterly construction cost index could show the tendencies of costs of construction, tendencies within the financial affordability of the resources, thus being important for the planning of construction and investments for developers and investors. The quarterly construction cost index of new residential buildings according to Eurostat estimate in 2021Q4 in European Union in general, Estonia, Latvia and Lithuania is shown in Figure 10. According to the Figure 10, quarterly construction cost index of new residential buildings according to Eurostat estimate in period 2020Q1-2021Q4 was growing. This factor could influence the final price of the construction products in the analysed countries in this period.

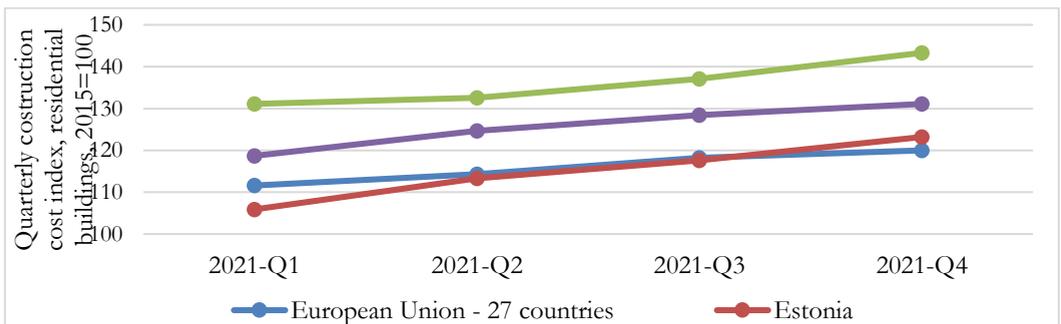


Figure 10. Construction Cost (or Producer Prices) of New Residential Buildings in European Union in General, Estonia, Latvia, Lithuania, Quarterly data, 2021Q1-2021Q4 (2015=100). Eurostat Estimate. (Source: developed by the authors, based on Eurostat (2022a))

All above mentioned indicators are significant for development of the real estate market, construction industry and changes within these indicators could affect the economic results of the entrepreneurs. As economic and environmental aspects in some cases could be considered as “conflicting” (for example, questions related to costs and quality), changes and decisions related to these aspects could result also in the changes of quality, general environmental characteristics of several real estate objects or in the final price of the real estate units, and thus also in the development of the construction industry and real estate market in general. Conclusions are provided further.

## **Conclusions**

Acquisition of real estate and development tendencies in a country in general have a crucial role in the creation of the sustainable environment. As time passes, the participants of real estate sectors face different challenges and changes within the external environment, and it could be useful to find the possible improvement opportunities of management and analysis, by combining latest theoretical and practical information, taking into account the actual tendencies. Implementation of improvements related to environmental development in construction management and real estate projects is also necessary and important, especially in the context of conducted research. Managers should take into account influencing economic, social and environmental factors as they are important in terms of sustainable development. Research study “Ranking of Sustainability Indicators for Assessment of the New Housing Development Projects: Case of the Baltic States” groups and weighs sustainability indicators along main dimensions of sustainable development, prioritising environmental (0,486) sustainability indicators, which are followed by economic (0,268) and social (0,246) sustainability indicators (Tupenaite et al., 2017). Study reveals that there is still a plenty of room for growth in terms of circular material use rate and this indicator will have to increase among all EU member states with European Commission’s Circular Economy Action Plan (European Commission, 2020) in place. In coming years society might see a turning point in terms of use of timber as a sustainable material. It has been indicated by the timber products researched and the increasing trendline of roundwood production in EU (Eurostat, 2022a). The economy and real estate market in general have had growing development tendencies during the research period, which could affect the entrepreneurship within real estate market. As elements of economic and environmental dimensions in some cases could be considered as “conflicting”, changes and decisions related to these aspects could result also in the changes of quality, general environmental characteristics of several real estate objects or in the final price of the real estate units, and thus also in the development of the construction industry and real estate market in general.

The future research directions could be related to the analysis of the management aspects and economic results of construction and real estate companies. Further analysis could be related also to the more detailed analysis of sustainable development of real estate market, construction industry and related entrepreneurship, for instance, by analysing issues of territorial development.

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## References:

- Abuzayed, B., Al-Fayoumi, N., Bouri, E. (2020). Co-movement Across European Stock and Real Estate Markets. *International Review of Economics & Finance*. Vol. 69, p. 189-208. Available at: <https://doi.org/10.1016/j.iref.2020.05.010>
- Ahn, N., Doodoo, A., Riggio, M., Muszynski, L., Schimleck, L., Puettmann, M. (2022). Circular Economy in Mass Timber Construction: State-of-the-art, Gaps and Pressing Research Needs. *Journal of Building Engineering*. Vol. 53, p. 1-16. <https://doi.org/10.1016/j.jobe.2022.104562>.
- Anastasiades, K., Blom, J., Buyle, M., Audenaert, A. (2020). Translating the Circular Economy to Bridge Construction: Lessons Learnt from a Critical Literature Review. *Renewable and Sustainable Energy Reviews*, Vol. 117, p. 1-11. Available at: <https://doi.org/10.1016/j.rser.2019.109522>
- Arrese, Á. (2021). The Use of ‘Bubble’ as an Economic Metaphor in the News: The Case of the ‘Real Estate Bubble’ in Spain. *Language & Communication*, Vol. 78, p. 100-108. Available at: <https://doi.org/10.1016/j.langcom.2021.03.001>
- Blūms, R., Zvirgzdiņš, J., Geipele, I. (2022). Sustainable Development Strategy Options in Urban Environment. In: 21<sup>st</sup> International Scientific Conference “Engineering for Rural Development”: Proceedings, Vol. 21, Latvia, Jelgava, 25-27 May, 2022. Jelgava: Latvia University of Life Sciences and Technologies, p. 560-566. ISSN 1691-5976. Available at: <https://doi.org/10.22616/ERDev.2022.21.TF188>
- Brandner, R., Flatscher, G., Ringhofer, A., Schickhofer, G., Thiel, A. (2016). Cross Laminated Timber (CLT): Overview and Development. *European Journal of Wood and Wood Products*, Vol. 74, p. 331-351. Available at: <https://doi.org/10.1007/s00107-015-0999-5>
- Davis, J.S., Huang, K. X. D., Sapci, A. (2022). Land Price Dynamics and Macroeconomic Fluctuations with Imperfect Substitution in Real Estate Markets. *Journal of Economic Dynamics and Control*, Vol. 134, p. 1-15. Available at: <https://doi.org/10.1016/j.jedc.2021.104274>
- Emberley, R., Putynska, C. G., Bolanos, A., Lucherini, A., Solarte, A., Soriguer, D., Gonzalez, M. G., Humphreys, K., Hidalgo, J. P., Maluk, C., Law, A., Torero, J. L. (2017). Description of small and large-scale cross laminated timber fire tests. *Fire Safety Journal*, Vol. 91, p. 327-335. Available at: <https://doi.org/10.1016/j.firesaf.2017.03.024>
- European Commission. (2020). *Circular Economy Action Plan* [online] [accessed on 25 July 2022]. Available at: [https://ec.europa.eu/environment/circular-economy/pdf/new\\_circular\\_economy\\_action\\_plan.pdf](https://ec.europa.eu/environment/circular-economy/pdf/new_circular_economy_action_plan.pdf)
- European Commission. (2022). *Green Buildings* [online] [accessed on 19 July 2022]. Available at: [https://europa.eu/climate-pact/about/priority-topics/green-buildings\\_en](https://europa.eu/climate-pact/about/priority-topics/green-buildings_en)
- Eurostat. (2022a). *Database* (Statistics Database Eurostat) [online] [accessed on 19 July 2022]. Available at: <https://ec.europa.eu/eurostat/data/database>
- Eurostat. (2022b). Turnover by NACE Rev. 2 [online] [accessed on 21 July 2022]. Available at: <https://ec.europa.eu/eurostat/databrowser/view/tin00149/default/table?lang=en>
- Frini, A., BenAmor, S. (2015). *A TOPSIS Multi-criteria Multi-period Approach for Selecting Projects in Sustainable Development Context*. In: Proceedings of 2015 International Conference on Industrial Engineering and Operations Management, March 3–5, Dubai, United Arab Emirates, 2015, p. 1–9. Available at: <http://dx.doi.org/10.1109/IEOM.2015.7093900>
- Füss, R., Ruf, D. (2022). Information Precision and Return Co-movements in Private Commercial Real Estate Markets. *Journal of Banking & Finance*, Vol. 138, p. 1-17. Available at: <https://doi.org/10.1016/j.jbankfin.2022.106402>

- Gross, M., Wolny-Kucińska, A. (2021). Public Real Estate Resource – A Burden or a Source of Income? A Study of Municipal Land Management in Poland. *Land Use Policy*, Vol. 106, p. 1-16. Available at: <https://doi.org/10.1016/j.landusepol.2021.105447>
- Younis, A., Doodoo, A. (2022). Cross-laminated Timber for Building Construction: A Life-cycle-assessment Overview. *Journal of Building Engineering*, Vol. 52, p. 1-17. Available at: <https://doi.org/10.1016/j.jobbe.2022.104482>
- Yukun, G., Yan, Z. (2022). Discussion of Commercial Real Estate with A Short Remaining period of Land Use Rights on Evaluation Thoughts of Income Approach. *Procedia Computer Science*, Vol. 199, p. 103-109. Available at: <https://doi.org/10.1016/j.procs.2022.01.013>
- Kern, A. P., Amor, L.V., Angulo, S.C., Montelongo, A. (2018). Factors Influencing Temporary Wood Waste Generation in High-rise Building Construction. *Waste Management*, Vol. 78, p. 446-455. Available at: <https://doi.org/10.1016/j.wasman.2018.05.057>
- Lalmi, A., Fernandes, G., Souad, S. B. (2022). Synergy between Traditional, Agile and Lean management approaches in construction projects: bibliometric analysis. *Procedia Computer Science*, Vol. 196, p. 732-739, ISSN 1877-0509. Available at: <https://doi.org/10.1016/j.procs.2021.12.070>
- Luchtenberg, K; Seiler, M. (2014). Did the Recent Financial Crisis Impact Integration between the Real Estate and Stock Markets? *Journal of Real Estate Portfolio Management*, Vol. 20 Iss. 1, p. 1-20, doi: 10.1080/10835547.2014.12089960
- Mohamed, A.S., Xiao, F., Hettiarachchi, C. (2022). Project Level Management Decisions in Construction and Rehabilitation of Flexible Pavements. *Automation in Construction*, Vol. 133, p. 1-25. Available at: <https://doi.org/10.1016/j.autcon.2021.104035>
- Nanda, A., Xu, Y., Zhang, F. (2021). How would the COVID-19 Pandemic Reshape Retail Real Estate and High Streets through Acceleration of E-commerce and Digitalization? *Journal of Urban Management*, Vol. 10 Iss. 2, p. 110-124. Available at: <https://doi.org/10.1016/j.jum.2021.04.001>
- Nanjundaswamy, B. (2022). *Real Estate Pricing Concept*. Master Thesis, Riga Technical University, Latvia, 2022.
- Niu, Y., Rasi, K., Hughes, M., Halme, M., Fink, G. (2021). Prolonging Life Cycles of Construction Materials and Combating Climate Change by Cascading: The Case of Reusing Timber in Finland. *Resources, Conservation and Recycling*, Vol. 170, p. 1-10. Available at: <https://doi.org/10.1016/j.resconrec.2021.105555>
- Ontl, T. A., Janowiak, M. K., Swanston, C. W., Daley, J., Handler, S., Cornett, M., Hagenbuch, S., Handrick, C., McCarthy, L., Patch, N. (2020). Forest Management for Carbon Sequestration and Climate Adaptation. *Journal of Forestry*, Vol. 118(1), p. 86-101. Available at: <https://doi.org/10.1093/jofore/fvz062>
- Pelli, P. (2021). Service Innovation and Sustainable Construction: Analyses of Wood Vis-à-vis other Construction Projects. *Cleaner Engineering and Technology*, Vol. 2, p. 1-12. Available at: <https://doi.org/10.1016/j.clet.2021.100061>
- Petera, G., Voronova, I. (2003). Riski uzņēmējdarbībā un to vadība [Risks in Business and Their Management]. Banku Augstskola [BA School of Business and Finance (BASBF)]. Riga: Rasa ABC. 175 p.
- Reed, J., van Vianen, J., Foli, S., Clendenning, J., Yang, K., MacDonald, M., Petrokofsky, G., Padoch, C., Sunderland, T. (2017). Trees for life: The ecosystem service contribution of trees to food production and livelihoods in the tropics. *Forest Policy and Economics*, Vol. 84, p. 62-71. Available at: <https://doi.org/10.1016/j.forpol.2017.01.012>
- Rønning, L., Ljunggren, E., Wiklund, J. (2010). *The Community Entrepreneur as a Facilitator of Local Economic Development. Entrepreneurship and Regional Development: Local Processes and Global Patterns*. In: C. Karlsson, B. Johansson, R.R. Stough (eds.), p. 195-237. Edward Elgar Publishing Ltd., 368 p. doi: 10.4337/9781781000793.00014
- Švajlenka, J., Kozlovská, M. (2019). Effect of Accumulation Elements on the Energy Consumption of Wood Constructions. *Energy and Buildings*, Vol. 198, p. 160-169, ISSN 0378-7788. Available at: <https://doi.org/10.1016/j.enbuild.2019.06.006>.
- Tepman, L.N. (2008). *Otsenka nedvizhimosti [Real Estate Valuation]*. 2<sup>nd</sup> edition. Moscow: Unity-Dana. 463 p.
- The Building and Construction Authority [BCA]. (2020). *Mass Engineered Timber* [online] [accessed on 3 May 2022]. Available at: <https://www1.bca.gov.sg/buildsg/productivity/design-for-manufacturing-and-assembly-dfma/mass-engineered-timber>

- Tupenaite, L., Lill, I., Geipele, I., Naimaviciene, J. (2017). Ranking of Sustainability Indicators for Assessment of the New Housing Development Projects: Case of the Baltic States. *Resources*, Vol. 6(4), 55. Available at: <https://doi.org/10.3390/resources6040055>
- Vanags, J., Butāne, I. (2013). Major Aspects of Development of Sustainable Investment Environment in Real Estate Industry. *Procedia Engineering*, Vol. 57, p. 1223-1229, ISSN 1877-7058. Available at: <https://doi.org/10.1016/j.proeng.2013.04.154>
- Zvirgzdiņš, J., Plotka, K., Geipele, I. (2020). The Usage of Circular Economy Strategies to Mitigate the Impacts of Climate Change in Northern Europe. In: *Climate Change, Hazards and Adaptation Options: Handling the Impacts of a Changing Climate*. W.Leal Filho, G.Nagy, M.Borga, P.Chávez Muñoz, A.Magnuszewski ed. Cham: Springer, pp.853-873. ISBN 978-3-030-37424-2. e-ISBN 978-3-030-37425-9. ISSN 1610-2002. e-ISSN 1610-2010. Available at: [https://doi.org/10.1007/978-3-030-37425-9\\_43](https://doi.org/10.1007/978-3-030-37425-9_43)
- Zvirgzdiņš, J., Plotka, K., Geipele, S. (2019). Circular Economy in Built Environment and Real Estate Industry. In: *The 13th International Conference “Modern Building Materials, Structures and Techniques MBMST 2019”: Selected Papers, Lithuania, Vilnius, 16-17 May, 2019*. Vilnius: VGTU Press “Technika”, pp.704-713. e-ISBN 978-609-476-197-3. e-ISSN 2029-9915. Available at: <https://doi.org/10.3846/mbmst.2019.046>