BOOK OF PROCEEDING

7th CONFERENCE OF INTERDISCIPLINARY RESEARCH ON REAL ESTATE

Ankara, Turkey

October 14-15, 2022

Institute for Real Estate Studies

ANKARA ÜNİVERSİTESİ 1946

SCIENTIFIC COMMITTEE:

Prof. Dr. Bojan Grum, Avrupa Hukuk Fakültesi, Slovenya
Prof. Dr. Harun Tanrıvermis, MRICS, Ankara Üniversitesi, Uygulamalı Bilimler Fakültesi
Prof. Dr. Alenka Temeljotov Salaj, Norveç Bilim ve Teknoloji Üniversitesi, Norveç
Prof. Dr. Darja Kobal Grum, Ljubljana Üniversitesi, Sanat Fakültesi, Slovenya
Prof. Dr. Anita Cerić, Zagreb Üniversitesi, İnşaat Mühendisliği Fakültesi, Hırvatistan
Prof. Dr. Champika Lasanthi Liyanage, Central Lancashire Üniversitesi, Birleşik Krallık
Prof. Dr. Metin Arslan, Ankara Üniversitesi Uygulamalı Bilimler Fakültesi
Prof. Dr. Nihan Özdemir Sönmez, MRICS, Ankara Üniversitesi Uygulamalı Bilimler Fakültesi
Prof. Dr. Mustafa TOMBUL, Ankara Üniversitesi Uygulamalı Bilimler Fakültesi
Prof. Dr. Oğuz GÜNGÖR, Ankara Üniversitesi Uygulamalı Bilimler Fakültesi
Doç. Dr. Yeşim ALİEFENDİOĞLU (TANRIVERMİŞ), MRICS, Ankara Üniversitesi Uygulamalı Bilimler Fakültesi
Doç. Dr. Erol DEMİR, Ankara Üniversitesi Uygulamalı Bilimler Fakültesi
Dr. Öğr. Üyesi Orhan Ercan, Ankara Üniversitesi Uygulamalı Bilimler Fakültesi
Dr. Öğr. Üyesi Md Moynul Ahsan, Ankara Üniversitesi Uygulamalı Bilimler Fakültesi
Dr. Öğr. Üyesi Monsurat Ayojimi Salami, Ankara Üniversitesi, Uygulamalı Bilimler Fakültesi
Dr. Öğr. Üyesi Dr. Erdem Ercan, Ankara Üniversitesi Uygulamalı Bilimler Fakültesi
Doç. Dr. Knut Boge, Norveç Bilim ve Teknoloji Üniversitesi, Norveç
Prof. Dr. Valentina Zileska Pancovska, Ss. Cyril ve Methodius Üniversitesi, Makedonya
Prof. Svein Bjørberg, Norveç Bilim ve Teknoloji Üniversitesi, Norveç
Dr. Öğr. Üyesi Božena Lipej, Avrupa Hukuk Fakültesi, Slovenya
Dr. Öğr. Üyesi Boštjan Kerbler, Slovenya Cumhuriyeti Şehir Planlama Enstitüsü, Slovenya
Dr. Öğr. Üyesi Boštjan Aver, Avrupa Hukuk Fakültesi, Slovenya
Prof. Dr. Athena Roumboutsos, Ege Üniversitesi, Yunanistan
Prof. Dr. Marija Bogataj, Zavod INRISK, Slovenya
Doç. Dr. Visar Hoxha, Rektör, College ESLG, Priştine, Kosova
Dr. Öğr. Üyesi David Bogataj, Zavod INRISK, Slovenya
Dr. Jardar Lohne, Norveç Bilim ve Teknoloji Üniversitesi, Norveç
Prof. Dr. Tore Haugen, Norveç Bilim ve Teknoloji Üniversitesi, Norveç
Dr. Öğr. Üyesi Aljoša Dežman, Avrupa Hukuk Fakültesi, Slovenya
Dr. Öğr. Üyesi Marjana Šijanec Zavrl, Yapı ve İnşaat Mühendisliği Enstitüsü ZRMK, Slovenya
Doç. Dr. Francisco Campuzano Bolarin, Universidad Politécnica de Cartagena, İspanya
Prof. Dr. Susanne Balslev Nielsen, Oslo Metropolitan Üniversitesi, Norveç
Goran Milanov, Bulgaristan Tesis Yönetim Derneği Başkanı, Bulgaristan
Doç. Dr. Eva Martínez-Caro, Universidad Politécnica de Cartagena, İspanya
Prof. Dr. Edward Finch, Birleşik Krallık
Doç. Dr. Marit Støre Valen, Norveç Bilim ve Teknoloji Üniversitesi, Norveç
Prof. Olav Torp, Norveç Bilim ve Teknoloji Üniversitesi, İnşaat ve Çevre Mühendisliği Bölümü
Prof. Carmel Lindkvist, Norveç Bilim ve Teknoloji Üniversitesi, Mimarlık ve Tasarım Fakültesi
Dr. Öğr. Üyesi Milena Vukmirović, Belgrad Üniversitesi, Orman Fakültesi, Sırbistan
Ass. Prof. Dr. Mina Jowkar, Edinburgh Napier University, UK

EDITORIAL COMMITTEE:

Published by:

INSTITUTE OF REAL ESTATE STUDIES
INŠTITUT ZA NEPREMIČNINSKE VEDE
Ukmarjeva 6, 1000 Ljubljana, Slovenia
Tel: +386(1)4214210
Fax: +386(1)4214215
e-mail: cirre2016@gmail.com

Edited by
Bojan Grum
constructa@siol.net
tel: +386(1) 4214210

Kataložni zapis o publikaciji (CIP) pripravili v Narodni in univerzitetni knjižnici v Ljubljani
COBISS.SI-ID **142954243**
ISBN 978-961-95781-2-4 (PDF)

Electronic edition
Leto izdaje: 2023
Kraj izdaje: Ljubljana, SLovenija

Content

1 Turning the wheels of the reuse market, an implementation of a guide for reuse mapping in Norway.

Svein Ola Sørseth
Norwegian University of Science and Technology
Svein.ola@byggalliansen.no

Abstract

This article investigates the effects of the implementation of a guide on ordering reuse mapping in Norway. According to EU and the UN, the shift to a circular economy is necessary to reach the climate goals and avoid climate disaster. This applies especially for buildings, which contributes to 36% of the emissions in EU, with a large portion as embodied emissions in new materials and components. In addition, the construction industry stands for a large fraction of the waste production globally. There is in other words no doubt that circular economy and reuse are some of the most important measures for the construction industry to reduce climate change. However, before reusing, an assessment of the potential for reuse in the existing buildings needs to be done, and for the assessment it is necessary to contract a consultant. In 2021 the reuse market in Norway was relatively immature, and due to the lack of competence and several barriers in the market the Norwegian Green Building Council (NGBC) and the Public Building Developer, Statsbygg, decided to develop a guide on how to order a reuse mapping. This article looks at how the guide has affected the market, and more precisely addresses the following question: has the implementation of the guide led to increased competence in ordering reuse mapping and an improved "common language" around reuse in the industry? The objectives in conjunction with the implementation of the guide are specifically set by NGBC and Statsbygg. The method used to answer the research question is semi-structured interviews with both consultants and procurers of reuse mapping, combined with a literature review to get an overview of the barriers and incentives for reuse in the market. The findings show that those who ordered reuse mapping and used the guide have increased their competence in ordering and communicating with the consultants. The consultants confirm that the guide has led to better communication, and a shift towards a common language. However, there are some obstacles that are not met by the guide. This article therefore suggests some improvements to the guide to further increase the competence in the market, as well as some suggestions for the government to reduce the barriers in the market.

Keywords
Reuse, mapping, communication, building, circular economy, components, materials

Introduction

"We are on a fast track to climate disaster. Major cities under water. Unprecedented heatwaves. Terrifying storms. Widespread water shortages. The extinction of a million species of plants and animals. This is not fiction or exaggeration. It is what science tells us will result from our current energy policies."

These words are from the video-speech of UN Secretary-General António Guterres following the launch of the third part of the Sixth Assessment Report, *Climate Change 2022: Mitigation of Climate Change* (UN Press, 2022). Guterres has a strict undertone, but there is hope to be found in the report. The report states that the pathway to reaching the climate goals can be based on tools and measures that already exists (IPPC, 2022).

Among other measures, the report stated that implementation of a circular economy is a necessary mitigation approach that will minimize waste of resources and energy. For the real estate sector, this means reuse, refurbishment, recycling, and material efficiency (IPPC, 2022 p. 102). Circular economy is particularly important for the real estate sector due to the large amounts of raw materials, land use, energy consumption and emissions linked to production and waste management of materials and building components (IPPC, 2022, Asplan Viak, 2019 p. 15, Galleo-Schmid et al., 2020).

Based on the urgent need for implementation of a circular economy the Norwegian government developed a national strategy for making the economy more circular and sustainable. In this strategy they mentioned reuse of building components as an important measure in the real estate sector (Rotevatn et al., 2021). According to EUs "waste hierarchy", preparing for reuse is the best course of action after prevention of waste (European Commission, 2008).

There are several reliable sources claiming that reuse and circular economy are necessary measures to make the building sector sustainable. The challenge for the Norwegian building sector is that going from a linear production line to a circular means a completely new approach for most of the sector. Construction, renovation, and demolition of buildings were previously associated with linear activities. There was a missing link between the national strategies and targets and the actual implementation of reuse. Therefore, the Norwegian Green Building Council (NGBC) and Statsbygg, the government's building commissioner, property manager and developer, worked together to develop a guide on how to order and carry out a reuse-mapping. The goal was to create a guide that would help any commissioner and real estate developer who wanted to carry out a reuse-mapping, by increasing their competence. The guide would tell the commissioner how to order a reuse mapping, what to ask for, and what to expect from the actual mapping. In addition, NGBC and Statsbygg had a hope the guide would lead to a common language in the reuse market. All these goals were steps towards the main goal: to increase the circularity in the economy (Grønn Byggallianse & Statsbygg, 2021).

However, NGBC and Statsbygg could not be sure the guide would be able to cover the needs in the broad market. A study on the effects of the guide was necessary to see how the implementation went and what should be adjusted to reach the goals set by NGBC and Statsbygg. For this study, the research question is:

RQ: Has the guide "Ombrukskartelgging og bestilling" had the intended effect on the Norwegian reuse market?

To answer the main research question, there are five sub research questions:

Sub RQ1: What barriers and lack of incentives affects the reuse market?

Sub RQ2: What challenges are there in the process of ordering a reuse mapping?

Sub RQ3: Does the guide contribute to increasing commissioners' competence in ordering reuse mapping?

Sub RQ4: Does the guide contribute to a common language in the building sector?

Sub RQ5: What changes is necessary in the revision of the guide to fight the barriers in the reuse market?

Theoretical background: Reuse-mapping as a part of the future real estate sector

Circularity

In context of the accelerating climate crisis and resource scarcity, the construction industry and the real estate sector must act. This sector stands for a large fraction of the world's greenhouse gas (GHG) emissions, waste production and resource consumption (Bai & Cabeza, 2021). One of the measures to battle the climate crisis in the real estate sector is to increase the circularity in construction and refurbishment processes. This measure is suggested by both the UN (IPCC, 2022), in the EU taxonomy (European Commission, 2021), and by national strategies for the Norwegian economy (Rotevatn et al. 2021). Harmful processes for the nature and the climate occur all over the production line in a project, and several of those processes are in conjunction with producing, transporting, processing and disposal of the materials (Asplan Viak, 2019, Bai & Cabeza 2021). To avoid as many of these processes as possible, one should seek to reach as high on the waste hierarchy as possible. When avoiding waste is impossible, the next best thing to do is reusing the materials (European Commission, 2008). Reuse will reduce mining and extraction of raw materials, production at the factory, transport, and disposal processes.

The early stage of a project

When considering reuse, decisions should be done early, so that the contracting of a consulting engineer is done in time to conduct the reuse mapping. In the early stages of construction- demolition- and refurbishment projects, the framework, the contract, and the cost of changing framework are all relevant factors with respect to reuse mapping.
The framework for a project is laid in the early stages and is often tied to the desired final *value* of the project for the stakeholders. The different stakeholders can have different opinions on which processes bring value to a project (Bowman & Ambrosini, 2010). The owner will probably appreciate measures leading to less cost of maintenance, the user will probably appreciate actions leading to lower use of energy and increased comfort, such as improved air quality and temperature. In some cases, the image of the user or the owner is important, and thereby having a project leading to a building that reflects their image can increase the value.
The cost of changing framework or details in a project increases as the phases of the project go by. In the initiation phase it is cheap to implement changes to the final product because few or no restrictions are laid. When entering the preconstruction phase, more frames for the project are laid, and implementing changes will cause extra work. In the procurement phase and the construction phase it will be even more expensive to implement changes because that will lead to return of orders and change of contracts. As a rule of thumb, the earlier in a project one implement changes, the cheaper the change will be (Samset, 2015).

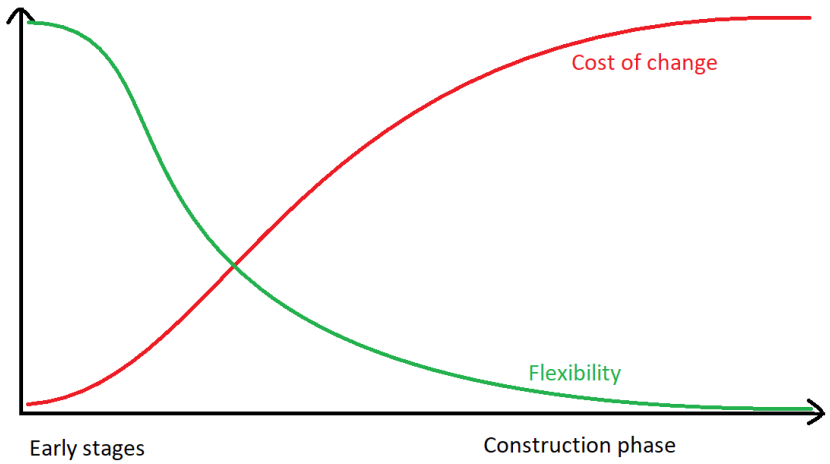


Figure 1: Flexibility in projects (Based on Samset (2015))

Due to the high cost of changes later in a project, the framework should be clear and unambiguous before forming a contract. According to Lædre (2009), disputes are often an outspring of contractual interpretations. Choosing the correct contract strategy and being precise in the contract is especially important in a less traditional project. In projects like a reuse-project, a joint enterprise should be considered because it can promote collaboration between the various actors, and advantage can be taken from combining the different actors' skills and strengths (Hjorteland & Gjein, 2021).

Methodology

A literature review combined with a document study laid the foundations for describing the current situation in the reuse market in Norway. The literature review and the document study constituted the basis for some of the questions in the interviews. The literature review was mainly conducted in Google Scholar and Oria, a search engine for the Norwegian University of Science and Technology. Google Scholar was used because of the size of the database combined with the possibility to choose commands for filtering the search results. Oria was used to find relevant literature describing the conditions in the Norwegian market. In both search engines, all searches on reuse, barriers, incentives, and the market were limited to publications over the past five years to make sure the articles were up to date. From these searches, two reports became central in describing the current market situation. The first report by Sandberg & Kvellheim (2021) maps the market barriers and incentives, while the second one by Sandberg et al. (2022) describes key takings from model projects in Norway, Denmark, and Belgium. Other relevant literature that formed the theoretical background covered value, cost of change, contracts, building physics, and circularity.

The most important document in the document study was the guide itself, "Ombrukskartlegging og bestilling – slik gjør du det". Other relevant documents were the updated regulations for the building sector concerning demolition and reuse (TEK17), the new BREEAM-NOR-manual with more specific requirements for reuse-mapping and circular economy, ANNEX 1 to the EU taxonomy, and information pages about some of the digital and physical platforms for reuse.

In the spring of 2022, 23 semi-structured interviews were conducted. The interviewees were project managers, commissioners, and consulting engineers which had conducted reuse-mappings or ordered reuse-mapping, in accordance with the guide. All the interviews were conducted digitally for four main reasons, (1) digital interviews contributed to a larger geographical reach, (2) less travel logistics and more time to the interviews, (3) the digital platform had an intuitive build up, with recording and transcription as possible options, and (4) the omicron wave of the covid19 pandemic caused uncertainty related to physical meetings. The interviews lasted between 30 and 60 minutes and followed an interview guide. Two interview guides were used, one for the consulting engineers conducting the reuse mapping, and one for those who ordered the mapping. The interviews consisted of eight questions, each with sub-questions, starting with the interviewees background, their experience with reuse-mapping and their reflections on the reuse market. The mid-section of the interview was concentrated around the interviewees experiences with using the guide, and how the guide covered the barriers in the market. Questions on how the guide had changed the language and operations in the company was assigned to the last section of the interview.

The interviewees' statements that would help answering the research questions were selected. When the same statement was found in several interviews, the statement was sorted in tables with overview of the interviewees' reflections for further discussion.

Findings

The findings in the literature review and the document study revealed incentives and barriers for reuse and reuse mapping in the market. The interviews confirmed the findings form the literature review and the document study. They also described how the guide had affected those barriers, and what changes could be done to improve the guide.

The main findings in the literature review and the document study are presented in Table 1 and Table 2. Table 1 is an overview of the incentives for reuse and reuse mapping, and Table 2 is an overview of the barriers.

Table 1: Incentives for reuse mapping found in document study and literature review

Incentive	**Effect on the market**
BREEAM-NOR v6.0	BREEAM-NOR is the most common certificate for sustainable buildings in Norway. In the 2016-version, it is possible to gain points for reuse mapping (Grønn Byggallianse, 2019). The newest version, v6.0, has this as a minimum demand, in addition to gaining points for obtaining reused materials (Grønn Byggallianse, 2022). The v6.0 is therefore a stronger incentive for reuse mapping and reuse than the 2016-version.
New regulations in TEK17	The new requirements in §9-7 of TEK17, the Norwegian Technical Building Works Regulation, state that for any residential building and any commercial building, a reuse mapping must be done, and a report from the mapping must be prepared (Direktoratet for byggkvalitet, 2022, TEK17, 2022). In a report from SINTEF, it is suggested that a change in the regulations similar to the change in §9-7 TEK17 would create an incentive for reuse mapping (Sandberg & Kvellheim, 2021).
Improved platforms and infrastructure	Over the past few years, several platforms for reuse have appeared. Some platforms are physical storages (BrukOm, 2021), while others are digital mapping and selling platforms (Loopfront, 2021). Improvements in platforms and infrastructures that lead to economic savings in projects, can therefore function as an incentive to do reuse mapping (Skanche, 2020).
Sustainability	Increased focus on sustainability and reducing GHG emissions is an important incentive for reuse and reuse mapping. In some cases, the goal for a project is a zero-emission building (ZEB), where reducing emissions from materials is crucial (Fufa et al., 2016). In these cases, reuse mapping becomes a tool to reach that goal. Both politically and in general in the society, the view on sustainability has changed, and to appear sustainable is beneficial for the reputation of the company. Therefore, both the municipality, the owner, the architect, and the entrepreneur can take the initiative to reuse-mapping (Sandberg & Kvellheim, 2021).
The EU Taxonomy	The EU Taxonomy is a classification system for sustainable activities. All big companies and financial institutions must report on how much of their portfolio is compliant with the EU Taxonomy. Because of the need to report on the investments and economic activity, the reporting on taxonomy compliance will go downwards from banks and big companies to contractors and suppliers. Therefore, the taxonomy will be relevant for almost every actor in the building sector (Grønn Byggallianse, 2021). To be compliant with the taxonomy, one must sort at least 70% of the construction waste into fractions prepared for reuse, recycling and material recovery (European Commission, 2021). Due to its wide range the EU taxonomy will therefore be an important incentive for reuse mapping.

Table 2: Barriers to reuse and reuse mapping found in the literature review and document study

Barrier	**Effect on the market**
Cost of new materials and labor	An important barrier for reuse is project economy. In most cases it is cheaper to demolish and build with new materials rather than to reuse. This is because of the relative high costs of labor, and the low costs of new materials. The processes associated with reuse, such as mapping, disassembling, and testing are conducted by competent workers, and are therefore cost drivers (Sandberg & Kvellheim, 2021).
Building physics	The technical requirements in TEK17 can be a barrier. For each revision of TEK 17, the minimum requirements for building physics are increased. An example is the required U-value for windows, which is lowered to 0.8W/(m^2K) in the 2017 version (TEK17, 2022). The intension behind the changes is to improve the building energy performance, but a side effect of that is that any window from before 2017 will probably not reach the necessary standards for new buildings. Extra time and creativity is needed to reuse old building materials while reaching the necessary building physics (Sørnes et al., 2014).
Toxins	In additions to the requirements for building physics, the maximum levels for toxins in the materials can be a barrier to reuse. Some additive substances that previously was used to improve building physics, is today seen as a toxin, and the maximum content of the substance is set in TEK 17. An example of this is asbestos which among other things was used as flame retardant, but is today seen as a highly carcinogenic substance. For this reason, a lot of materials from the 20th century is unfit for reuse. (Sørnes et al., 2914). Although it is difficult to avoid barriers linked to maximum limits for toxins, the government can reevaluate wether the limit is in proportion to the damages caused by the toxin. The maximum limit for chrome 6 in concrete was quadrupled in 2020. As a result, a larger share of the concrete waste could be reused. (Sverdrup Strand, 2020)
Platforms and infrastructure	Deloitte AS (2020) wrote in an inquiry for national strategy on circular economy, that the current infrastructure is unfit for reuse. The few large physical platforms lie in the biggest cities (BrukOm, 2021, Pådriv Oslo, no date), and the digital platforms are still unknown to large parts of the market (Deloitte AS, 2020).
Geographical location	Norway is a country with decentralized settlement, and findings points toward that reuse is easier in the central areas. The large physical platforms lie in the big cities, the model projects are found in the biggest cities (asndberg et al., 2022), and municipalities with more demolition projects are more likely to find donor buildings for reuse projects (Nordby et al., 2021).

Interviews

Out of the 23 conducted interviews, 15 were with procurers of reuse mapping, and 8 were with consulting engineers, who carried out the mappings. 8 of the procurers had used and were familiar with the guide, while all the consultant engineers were familiar with it. The procurers came from both public and private companies, and are based in municipalities ranging from 20.000-700.000 citizens, and in all regions of the country, except "Sørlandet". The following tables show the reflections from the informants. Table 3, Table 4 and Table 5 respectively summarize reflections from the procurers on the barriers and incentives, the processes in the early stages, and the guide. Table 6, Table 7 and Table 8 summarize reflections from the consulting engineers in the same topics. The number in parenthesis shows the number of informants mentioning that specific reflection.

Table 3: Procurers reflections on incentives and barriers for reuse and reuse-mapping

Incentives:	**Barriers:**
I1: Own ambitions for sustainability (10) I2: More accessible and improved platforms make the job easier (6) I3: Upcoming regulations will push the entire industry in the right direction (5) I4: BREEAM was a triggering factor (4) I5: The new BREEAM-manual will lead to more actual reuse (3) I6: External stakeholders' interest in reuse influenced us (2) I7: Increased focus on reuse in the sector influenced us (2) I8: Reuse mapping was a way of mapping the economic value in the building (2) I9: Rising prices of raw materials (2) I10: EU taxonomy (2)	B1: Increased project costs due to more processes (12) B2: Insufficient platforms and infrastructure (8) B3: Risk linked to certifying used materials (6) B4: Lack of competence (4) B5: Building physics (4) B6: Lack of room for the necessary infrastructure in a small construction site (3) B7: BREEAM-NOR 2016 had few incentives for actual reuse (3) B8: The governments taxing system incentivizes demolition and new construction (3) B9: Laws and regulations are limiting (3) B10: There is a believe that new materials are better than used once (3)

Table 4: Procurers reflections of the early-stage processes

Positive effects	**Negative effects**
P1: We were happy with the offer and the price (5) P2: The mapping was done early, and sat the frames for the contracting (4) P3: Having a diversity of consultants for different areas of knowledge contributed to better conclusions (3) P4: Early detections helped reduce work later in the project (2) P5: A joint enterprise was favorable (2)	N1: We should have started the reuse mapping earlier to make more use of it (5) N2: Time was a limiting factor (4) N3: We should have been more precise in how we wanted the data presented (3) N4: Reuse mapping was done before the users had moved out, that lead to less access for the consultant engineer (1)

Table 5: Procurers reflection on the use of the guide

Positive effects	**Still missing in the guide**
PE1: The guide made us learn about reuse in general in addition to reuse mapping (7) PE2: The guide laid the baseline for our processes (7) PE3: We have become remarkably better at ordering reuse mappings after using the guide (5) PE4: The guide is a particularly useful tool for those who haven't ordered previously (3) PE5: Before the guide, we stumbled. Publishing the guide was a necessity (2) PE6: If we had followed the steps in the guide, we would have had a better result (2) PE7: The examples from the guide have affected how we think about preparing for reuse in our new constructions (2)	M1: Would be nice with a summary (3) M2: The guide could with advantage have explored the steps following the mapping (2) M3: The guide could have mentioned advantages with procuring consulting engineers with different competence (2) M4: Certain actors does also oversee disassembly, transport, and sales, the guide could have mentioned that (2) M5: It is important to express that everybody can do reuse mapping, they just need to adjust effort to the level of ambition (2) M6: The guide could have told how to evaluate the offers (2) M7: could have been more dynamic (1)

Table 6: Consultant engineers' reflections on barriers and incentives for reuse and reuse mapping

Incentives	**Barriers**
I1: BREEAM-certificates are an important reason reuse mappings are conducted (6) I2: Some procurers have become aware of the new targets in BREEAM-NOR v6.0 (4) I3: The EU taxonomy increases interest in reuse (2) I4: Some commissioners implement circular economy in their strategies (1) I5: The new regulations in TEK17 will incentivize the reuse market (1) I6: Increased cost of raw materials will drive the market forward (1)	B1: Platforms are not well enough developed (6) B2: Reuse mapping is done to gain points in BREEAM rather than for reusing (5) B3: Time and cost of recertification and documentation (5) B4: A belief that reuse is bad for the design (3) B5: Unclear regulations (2) B6: Disposal is more common than purchase (2) B7: Toxins in the used materials (1) B8: Governments need to set higher requirements for reuse (1) B9: A diverse user group leads to fragmentized inventory (1) B10: No sharing of data between the platforms (1) B11: Building physics (1)

Table 7: Consulting engineers' reflections on the early stage

Positive effects	**Negative effects**
PE1: Certain procurers are months to years ahead of project start, and can implement the results in their planning (5) PE2: Mostly a good understanding for price and timeframe of reuse mapping (5) PE3: Certain procurers creates good conditions for cooperation and joint enterprise. (1)	N1: Procurers were too late in ordering, and didn't use the report well (7) N2: Procurers were uncertain in what they wanted (3) N3: Procurers do not always connect the reuse mapping to the rest of the project (2) N4: The reuse mapping was limited by the procurer or the building owner by what parts of the building was accessible for the consultant engineer (2)

Table 8: Consulting engineers' reflections on the guide

Positive effects	**Still missing in the guide**
P1: The guide clarifies communication (7) P2: The guide helps the procurers to understand what they order (7) P3: We have updated our own templates in accordance with the guide (4) P4: The guide helps clarify the differences between the consultants (4) P5: The development and publishing of the guide itself increased focus on reuse (3)	M1: It should be clearer how the data can be presented (4) M2: The guide should shed light over the rest of the process after the mapping (2) M3: Orders that follows the guide might ask for too many irrelevant details (2) M4: More awareness that there exists a guide is necessary (1) M5: The guide does not seem to have led to earlier orders (1) M6: The guide should encourage to setting specific targets (1)

Discussing and answering the five sub research questions is necessary to answer the main question "Has the guide "Ombrukskartelgging og bestilling" had the intended effect on the Norwegian reuse market?".

Sub RQ1: What barriers and lack of incentives affects the reuse market?

Both the literature review and document study as well as the interviews covered barriers and incentives that overlaps with each other. However, some barriers and incentives found in the interviews were not covered in the literature review and document study. The reason for this might be that the market is changing quickly.

BREEAM-NOR 2016 and *BREEAM-NOR v6.0* are both seen as incentives, but the newest version is believed to lead to more actual reuse because it awards more points for implementing measures for reuse. The *new regulations in TEK17* are believed to be an incentive for ordering and conducting reuse mappings, both according to the interviews and to the document study. However, the formulation of the regulation is resembling the criteria for reuse mapping in BREEAM-NOR 2016, which was criticized for not necessarily leading to any actual reuse. As much as 2/3 of the procurers stated their *own ambitions for sustainability* as an incentive for reuse mapping. The procurers see reuse as a way to create value for themselves, because it is in line with their ambitions. AT the same time 1/5 of the procurers see the users' perception of value as a barrier when the users consider reused materials as less attractive. At the same time, when having a building with several users, some consultants see the individual preferences of the user group as a barrier because it leads to a fragmentized inventory. A measure to dampen the demand for new materials should therefore also aim towards changing the perception of what value is.

An interesting factor not covered in the literature review, but in the interviews, is the incentive from *increased cost of new materials*. During the interview period alone, the costs of materials for an apartment block increased by 6% (Statistisk Sentralbyrå, 2022). The high price increase in the market can potentially strengthen the reuse market. The other incentives and barriers, the EU taxonomy, building physics and toxins were covered both in the interviews and the literature review.

Sub RQ2: What challenges are there in the process of ordering a reuse mapping?

In the theoretical background of this article, the framework and value, the cost of changing framework and disputes in the contract is presented as relevant for reuse mapping in the early stages of a project. The most common reflection from procurers on the early stage was that they should have started the mapping earlier. 7/8 consulting engineers' states that procurers order the reuse mapping too late, and therefore get less use of the report. Some of the informants' state that their early reuse mapping had led to savings later in the project, or more room to implement the findings in the project. This is consistent with the illustration of cost of change and flexibility in a project from Samset (2015). This points towards the high importance of ordering and conducting the reuse mapping early.

Lædre (2009) stated that disputes often are outsprings of contractual interpretations. The interviews show no signs of disputes, and most of the procurers seems to be satisfied with the price and the offer. However, some consultants state that procurers can be unsure of what they order, and some procurers stated that they should have been more precise in how they wanted the data presented. More precise contracts can lead to reports and mappings that fit better to the intentions of the procurers, which will increase the probability of implementing reuse. It will also help preventing disputes in the future.

Sub RQ3: Does the guide contribute to increasing commissioners' competence in ordering reuse mapping?

A large share of both the procurers and the consultants state that the guide has contributed to increasing the commissioner's competence in ordering reuse mapping. However, some reflections suggests that there are potential changes in the guide which an increase the commissioners' competence even more. ½ of the consultants suggests that the guide could be even clearer on describing how procurers should request consultants to present the data. Both consultants and procurers state that the guide should further describe how to do the rest of the processes after the reuse mapping is done. In addition, the guide should mention that one should shape the order accordingly to the level of ambition for the project. The objective of increasing competence is reached, but can be improved even further.

Sub RQ4: Does the guide contribute to a common language in the building sector?

Some procurers said they stumbled before using the guide, and 7/8 procurers who had used the guide stated that the guide was the baseline for their processes on reuse. If the market was fragmentized before,

the guide has most likely contributed to a more common language. Also, the consultants' interviews, indicates that the guide has affected the communication. 7/8 consulting engineers stated that the guide clarifies communication, and helps the procurers understand what they order. Also, ½ of the consultants stated that they had implemented parts of the guide in their own templates. ½ of the consultants stated that following the guide would help clarify the differences between the consultants. All in all, the findings suggests that there has been a positive development in the language linked to reuse in the market due to the guide.

Sub RQ5: What changes is necessary in the revision of the guide to fight the barriers in the reuse market?

The guide "Ombrukskartlegging og bestilling» can be an important document for procurers who order reuse mapping for the first time. The guide answers to a lot of the problems occurring as when commissioners want to order a reuse mapping. However, the guide does not solve problems in conjunction with platforms, geographical location, and certain other barriers. Some of the barriers are too big to be solved by a single guide, and should therefore be worked on by different instances simultaneously. The governments can strengthen the incentives and reduce the barriers tied to the regulations. They can also give support to initiatives for reuse, such as physical platforms and make sure to prepare the industry so adjust to the EU taxonomy.

This study has discovered areas where the guide could have been changed so it would reach a better goal attainment. The guide should therefore be revised with respect to the findings in this study. The guide could result in better communication if it was underlined even further that procurers should communicate how they wanted the data presented.

The development in supply is tied to the development in demand. The access of platforms, consultant services and so on is closely affected by the demand for these services. If the volume goes up, the services will be more standardized, accessible, and cheaper. Different actors can therefore help improving the market, simply by increasing the demand.

Conclusion

This study has covered the following incentives for reuse and reuse mapping: new regulations in TEK17, higher requirements for reuse in the new BREEAM-NOR-manual, the EU taxonomy, increased focus on sustainability, more accessible platforms and infrastructure, and higher material prices. At the same time, the study has found some barriers: toxins in the materials, high required standards for building physics, high costs compared to the costs of new materials, insufficient platforms and infrastructure, and differences in geographical location. Both the government and public actors, procurers and NGBC can contribute to increasing the amount of reuse, improve the reuse processes and reduce the barriers. The government and public actors should:

- Support and encourage an upscale of the platforms in the market
- Implement laws and regulations that incentivizes reuse
- Use the power of being a large consumer to increase the demand for reuse

This study has also found some processes in the early stage of a project to be essential to reuse mapping. The earlier one carries out a reuse mapping, the more likely it is they will use the report. Clear communication is also necessary to get the data presented in such a way that it is suited for its intended use. Commissioners that consider reuse should therefore:

- Assess reuse mapping as one of the first things in a project
- Think through what they want to do with the data before ordering the reuse mapping
- Carry out the reuse process to increase the demand, even dough it is not necessary economically profitable

Based on the interviews one can conclude that the guide has had a positive effect on the market. It has led to better communication and NGBC and Statsbyggs' goal that the guide should help improve procurers' competence in ordering a reuse mapping is to some extend reached. The procurers' competence in ordering reuse mapping could be improved even further with some adjustments to the guide. Statsbygg and NGBC should therefore include the following measures when revising the guide:

- Underline the importance of specifying how the data should be presented
- Further describe the processes after the reuse mapping is done
- Underline the importance of the early-stage processes of a project, for reuse mapping and reuse

Acknowledgements:

I acknowledge Alenka Temeljotov-Salaj for the help with shaping this study, and Anne Solgaard for guidance and support along the way.

Reference list:

Asplan Viak (2019) *Bygg- og anleggssektorens klimagassutslipp – En oversikt over klimagassutslipp som kan tilskrives bygg, anlegg og eiendomssektoren (BAE) i Norge* (No. 621256) Available from: https://www.bnl.no/siteassets/dokumenter/rapporter/klimautslipp_bae_2019.pdf (Accessed 12 April 2022)

Bai, Q., & Cabeza, L. F. (2021) *Chapter 9: Buildings* (AR6). IPCC. Available from: https://report.ipcc.ch/ar6wg3/pdf/IPCC_AR6_WGIII_FinalDraft_Chapter09.pdf (Accessed 12 April 2022)

Bowman, C., & Ambrosini, V. (2010) How value is created, captured and destroyed. *European Business Review*, 22(5) p. 479-495.

BrukOm (2921) *BrukOm Trondheim Renholdsverk*. Available at: https://brukom.trv.no/ (Accessed 21 February 2022)

Deloitte AS. (2020) *Kunnskapsgrunnlag for nasjonal strategi forsirkulær økonomi – Delutredning 2*. Available at: https://www.regjeringen.no/contentassets/7ca1a81f57cc4611a193570e80c4dafd/deloitte_kunnskapsgrunnlag-sirkular-okonomi_barrierer.-delrapport-2.pdf

Direktoratet for byggkvalitet (2022) *Byggteknisk forskrift (TEK17) med veiledning §9-7 (28.06.2022)*. Available from: https://dibk.no/globalassets/endringshistorikk/byggteknisk-forskrift/01.07.22/tek17_-9-7.-kartlegging-av-farlig-avfall-og-bygningsfraksjoner-som-ma-fjernes.-krav-til-miljosaneringsbeskrivelse_01.07.1730.06.22.pdf

European Commission (2008) Council Directive 2008/98/EC of 19 November 2008 on waste and repealing certain Directives. *Official Journal of the European Union* Available from: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32008L0098&from=EN (Accessed 10 August 2022)

European Commission (2021). Annex 1 to the EU Taxonomy Climate Delegated Act. (C(2021) 2800 final Annex 1). Brussels: European Commission. Available from: https://ec.europa.eu/finance/docs/level-2-measures/taxonomy-regulation-delegated-act-2021-2800-annex-1_en.pdf (Accessed 9 January 2022)

Fufa, S. M., Schlanbusch, R. D., Sørnes, K., Inman, M. R., & Andresen, I. (2016) 2. THE ZEB BALANCE, *A Norwegian ZEB definition guideline.* SINTEF Academic Press.

Gallego-Schmid, A., Chen, H.-M., Sharmina, M., &Mendoza, J. M. F. (2020) Links between circular economy and climate change mitigation in the built environment. *Journal of Cleaner Production* 260, p. 1 – 14 doi: 10.1016/j.jclepro.2020.121115

Grønn Byggallianse. (2019). *BREEAM-NOR 2016 for nybygg*. Available from: https://byggalliansen.no/wp-content/uploads/2019/06/SD-5075NOR-BREEAM-NOR-2016-New-Construction-v.1.2.pdf

Grønn Byggallianse. (2021) *EUs taksonomi – Nye rammebetingelser for bærekraft.* Available from: https://byggalliansen.no/kunnskapssenter/nye-rammebetingelser-for-baerekraft-i-bygg-og-eiendom/#1606741285578-be585f95-d079 (Accessed 218 January 2022)

Grønn Byggallianse. (2022). *BREEAM-NOR v6.0 for nybygg*. Available from: https://byggalliansen.no/wp-content/uploads/2022/04/BREEAM-NOR-v6.0_ENG.pdf

Grønn Byggallianse & Statsbygg (2021), *Ombrukskartlegging og bestilling – Slik gjør du det.* Available from: https://byggalliansen.no/kunnskapssenter/publikasjoner/ombrukskartlegging-og-bestilling-slik-gjor-du-det/ (Accessed 9 January 2022)

Hjorteland, K., & Gjein, S. E. (2021) Innlegg: Samspillsentreprise. *Byggeindustrien*. Available at: https://www.bygg.no/innlegg-samspillsentreprise/1473504!/ (Accessed: 12 February 2022).

IPCC (2022) Summary for Policymakers [H.-O. Pörtner, D.C. Roberts, E.S. Poloczanska, K. Mintenbeck, M. Tignor, A. Alegría, M. Craig, S. Langsdorf, S. Löschke, V. Möller, A. Okem (eds.)] *Climate Change 2022: Impacts, Adaptation, and Vulnerability.* Available from: https://report.ipcc.ch/ar6wg3/pdf/IPCC_AR6_WGIII_FinalDraft_FullReport.pdf (Accessed 15. May 2022)

Loopfront (2021) Loopfront er Norges største sirkulære plattform for byggematerialer og inventar. *Loopfront.* Available at: https://www.loopfront.com/no/produkt (Accessed 21 February 2022)

Lædre, O. (2009) 1 Bakgrunn, *Er det noen sak? – Forebygging og håndtering av tvister i bygg- og anleggsprosjekter*. 1th edn. Trondheim: Tapir Akademiske Forlag, pp. 1 - 10

Nordby, A. S., Lunke, R., & Andersen, R. (2021) *Erfaringsrapport ombruk_Kristian Augusts gate 13* [Erfaringsrapport].
Pådriv Oslo. (no date) *Sirkulær resurssentral.* Available at: https://paadriv.no/prosjekt/sras (Accessed 8 December 2021)
Rotevatn, S., Nybø, I., Bollestad, O. V., Ingebrigsten, O. E., Astrup, N., Asheim, H. Ropstad, K. I., Søreide, I. E., & Hareide, K. A. (2021) *Nasjonal strategi for ein grøn, sirkulær økonomi.* Departementene. Available from: https://www.regjeringen.no/no/dokumenter/nasjonal-strategi-for-ein-gron-sirkular-okonomi/id2861253/ (Accessed 9 January 2022)
Samset, K. (2015) 5. Usikkerhet, risiko og muligheter, *Prosjekt i tidligfasen – Valg av konsept.* 2nd edn. Bergen: Fagbokforlaget, pp. 53-70
Sandberg, E., Fufa, S. M.,Knoth, K., & Eberhardt, L. C. M. (2022) Ombruk av bygningsdeler – læringspunkter fra forbildeprosjekter i Norge, Danmark og Belgia. *Praktisk økonomi og finans, 38(1),* P 23-46.
Sandberg, E., & Kvellheim, A. K. (2021). *Ombruk av byggematerialer-marked, drivere og barrierer.* (SINTEF Notat 40) Oslo: SINTEF akademisk forlag. Available from: https://sintef.brage.unit.no/sintef-xmlui/bitstream/handle/11250/2828094/SINTEF%2bNotat%2b%2b40.pdf?sequence=1&isAllowed=y (Accessed: 21 January 2022).
Skanche, M. (2020) Kommune sparer millioner på ombruk. *Blog.loopfront*. Available from: https://blog.loopfront.com/no/blog/asker (Accessed 10 October 2021)
Statistisk sentralbyrå (2022) *Byggekostnadsindeks of bustader*. www.ssb.no Available form: https://www.ssb.no/priser-og-prisindekser/byggekostnadsindekser/statistikk/byggjekostnadsindeks-for-bustader/
Sverderup Strand, S. (2020) Dette er de nye grenseverdiene for krom 6 i betong. *Byggeindustrien.* Available from: https://www.bygg.no/dette-er-de-nye-grenseverdiene-for-krom-6-i-betong/1422590!/ (Accessed 26 January 2022)
Sørnes, K., Nordby, A. S., Fjeldheim, H., Hashem, S. M. B., Mysen, M., & Schlanbusch, R. D. (2014). *Anbefalinger ved ombruk av byggematerialer.* Oslo: SINTEF akademisk forlag
TEK 17 (2022) *Byggteknisk forskrift (TEK17) med veiledning.* Available at: https://dibk.no/regelverk/byggteknisk-forskrift-tek17/9/9-7/#edit-history
UN Press (2022) *Secretary-General Warns of Climate Emergency, Calling Intergovernmental Panel's Report 'a File of Shame', While Saying Leaders 'Are Lying', Fuelling Flames* Available at: https://press.un.org/en/2022/sgsm21228.doc.htm (Accessed 15 May 2022)

2 Vpliv vsebine pogleda skozi okno na odziv anketirancev

prof. dr. Živa Kristl
Nova univerza, Evropska pravna fakulteta, Delpinova ulica 18B, 5000 Nova Gorica
e-mail: ziva.kristl@epf.nova-uni.si

prof. dr. Ajda Fošner
Univerza na primorskem, Fakulteta za management, Izolska vrata 2, 6000 Koper, Slovenija
ajda.fosner@fm-kp.si

prof. dr. Martina Zbašnik-Senegačnik
Fakulteta za arhitekturo Univerze v Ljubljani, Zoisova 12, 1000 Ljubljana, Slovenija
martina.zbasnik@fa.uni-lj.si

POVZETEK

Zaradi pospešene urbanizacije prihaja v naseljih so zgoščevanja pozidav, zato je pomembno poskrbeti za primerne bivalne razmere, kar vključuje tudi primeren pogled v zunanjost. Raziskovalci ugotavljajo, da je mogoče omejeno daljavo pogleda delno nadoknaditi z uvajanjem naravnih elementov (npr. zelenja) v okolje, vendar so glede teh vplivov potrebne nadaljnje študije. V tej študiji smo predvsem ugotavljali kako ozelenitev bližnje fasade spremeni odziv anketirancev. Za zbiranje podatkov je uporabljeno anketiranje, rezultati pa so obdelani z metodami opisne statistike. Doprinos študije je tudi v tem, da poleg ugotavljanja odziva anketirancev neposredno ugotavljamo tudi vzroke za posamezne odzive. Kot kažejo rezultati, so se anketiranci pozitivneje odzivali na poglede, ki so vsebovali zelenje kot pa na poglede brez zelenja. Pri pogledih skozi okno brez zelenja ima zelo izrazit vpliv na odziv vzdrževanost fasad, njihova kompozicijska kvaliteta in obdelava površine.

ABSTRACT

As a result of accelerated urbanization, built environment is becoming denser, so it is important to ensure suitable living conditions, which also includes a suitable window view. The researchers note that limited viewing distance can be partially compensated for by introducing natural elements (eg, greenery) into the environment, but further studies are needed regarding these effects. In this study, main focus was on how the greening of the window view changes the response of the respondents. A survey is used to collect data, and the results are processed using descriptive statistics methods. The contribution of the study is also that, in addition to determining the response of the respondents, the causes of individual responses were also determined. The results show, the respondents assessed more positively the views that contained greenery than the views without greenery. The maintenance of the facades, their compositional quality and surface treatment have a very pronounced influence on the response when window view does not contain greenery.

KLUČNE BESEDE pogled skozi okno, urbano okolje, dnevna svetloba, trajnostnost, življenjsko zadovoljstvo

KEYWORDS window view, urban environment, daylight, sustainability, wellbeing

1. Uvod

Delež urbane populacije po svetu narašča in v razvitem svetu obsega že okoli 80% (UN, 2018). Zaradi pospešene urbanizacije prihaja v mestih do povečane gostote stavb velikih volumnov, kar zmanjšuje dostopnost do dnevne svetlobe, hkrati pa omejuje tudi kakovostne poglede skozi okno (van den Berg *idr*., 2007; Thwaites *idr*., 2005). Trend zgoščevanja urbanega prostora se bo nadaljeval tudi v prihodnosti, saj se tudi zaradi načel trajnostnega razvoja in omejevanja širjenja mest navzven urbani predeli dodatno pozidavajo (UN, 2018). Primeren pogled skozi okno običajno obsega ospredje in obzorje (Littlefair, 1996) in tri "vidne sloje" (tla, srednji sloj narave ali grajenega okolja in nebo) (Bell in Burt, 1995). Glede na ugotovitve študij so ustreznejši motivi, ki vsebujejo različne informacije. Npr. Kent in Schiavon (2020) ugotavljata, da je motiv, ki vsebuje oddaljene elemente bolj zaželen kot ozek ali bližnji pogled, da je raznolik in dinamičen motiv zanimivejši od enoličnega in da je pomen oddaljenosti motiva od okna manjši, če ta vsebuje zelenje. V zadnjem času veliko študij ugotavlja, da je zelenje v pogledu komponenta, ki je zelo pomembna. Ko *idr*. npr. menijo (2020), da pogled na naravo učinkuje podobno kot bi bili dejansko v naravi, Chang *idr*. (2020) ter Kaplan (2001) pa ugotavljajo, da je bližnji pogled na naravo skozi okno pozitivno povezan z življenjskim zadovoljstvom. Pogled na naravo in naravne elemente (drevesa in drugo zelenje, nebo, sončno svetlobo in vodo) omogoča sproščanje in regeneracijo po stresnih situacijah (Van Esch *idr.* 2019). Kaplan (2001) tudi ugotavlja, da kratki in ponavljajoči se odmori s pogledom v naravo izboljšajo počutje in zmanjšajo stres. Nekateri avtorji gredo še dlje in pogled na zelenje povezujejo z regenerativnimi učinki. Hernández in Hidalgo (2005) sta npr. primerjala regenerativne potenciale urbanih motivov brez zelenja in podobna ozelenjena okolja. Ugotovila sta, da omogoča urbano okolje z zelenjem, v nasprotju z urbanim okoljem brez zelenja, veliko višjo stopnjo regeneracije. V študiji so bili vsi motivi z naravnimi elementi ovrednoteni bolje kot katerikoli urbani motiv brez zelenja.

Rezultati nekaterih raziskav sicer kažejo, da je restorativni potencial odvisen od afinitete osebe do določenega okolja. Wilkie in Stavridou (2013) sta npr. ugotovila, da bi bilo mogoče predvideti prevladujočo naklonjenost naravnemu ali mestnemu okolju glede na izhodiščno življenjsko okolje posamezne osebe. Patuano (2020) npr. ugotavlja, da sta za mestno prebivalstvo urbano in hibridno okolje bolj restorativna od naravnega. Podoben vpliv značilnosti lokalnega okolja, pripadnosti določenemu tipu okolja, spola in starosti na dojemanje restorativnega potenciala ugotavljajo tudi drugi (Liu *idr*., 2020; Liu *idr.,* 2021; Twedt *idr*., 2019). Poleg tega so lahko želje posameznikov odvisne od trenutne potrebe po regeneraciji (Twedt *idr*., 2019). Najnovejše raziskave so pokazale, da vsi motivi pogledov skozi okna niso enako privlačni in da je treba pri proučevanju vpliva motivov upoštevati njihove značilnosti oz. sporočilnost (Kristl in Zbašnik-Senegačnik, 2020; Koprivec *idr*., 2021). Specifične značilnosti in informacije v motivu namreč lahko sprožajo pozitivne ali negativne odzive pri uporabniku (Aries *idr.* 2010; Martens *idr.,* 2011). Pri gosti urbani pozidavi je vidnost vseh slojev težko doseči, zato večina uporabnikov v pogledu skozi okno vidi pretežno srednji sloj. Raziskovalci ugotavljajo, da je mogoče omejeno daljavo pogleda delno nadoknaditi z uvajanjem naravnih elementov (npr. zelenja) v okolje (Kent in Schiavon, 2020), vendar so glede teh vplivov potrebne nadaljnje študije (Subiza-Perez *idr*., 2021). Zato je pomembno, da raziščemo vpliv oblikovanja in obdelave fasad na odziv uporabnikov in ugotovimo ali posamezni elementi lahko izboljšajo občutek povezanosti z naravo. V tej raziskavi smo si postavili tri ključna raziskovalna vprašanja:

- kako ozelenitev bližnje fasade spremeni odziv anketirancev,
- ali na odziv anketirancev vpliva kvaliteta zunanjega okolja, dostopnost do zelenih površin, siceršnji pogledi v zunanjost,
- kateri elementi fasade pomembno vplivajo na odziv.

V študiji so uporabljeni pogledi na dejanska urbana okolja. Za zbiranje podatkov je uporabljeno anketiranje, rezultati pa so obdelani z metodami opisne statistike. Pričakujemo rezultate, ki bodo pokazali kaj je dodatno potrebno upoštevati pri oblikovanju fasad v urbanem okolju in oceniti restorativni potencial analiziranih primerov. Doprinos študije je tudi v tem, da poleg ugotavljanja odziva anketirancev neposredno ugotavljamo tudi vzroke za posamezne odzive.

2. Zasnova študije

Izvedba študije obsega dva dela: spletno anketo in analizo odziva na dvajset pogledov skozi okno. Anketni vprašalnik je oblikovan s pomočjo spletnega anketnega orodja 1KA in vsebuje 52 zaprtih vprašanj. Vključuje (1) demografske podatke, (2) podatke o življenjskem okolju in življenjskem slogu ter (3) del, z odzivi na poglede skozi okno. Odzivi na tipične urbane poglede skozi okno so vključeni v tretji del, kjer je poudarek na vplivu različnih oblik zelenja v urbanem pogledu skozi okno. Vsak pogled skozi okno ima dve pripadajoči vprašanji »kakšen odziv v vas zbuja ta okenski pogled« in »kaj je razlog za tak odziv – izberite prevladujoč vzrok iz možnosti". Možni odgovori na prvo vprašanje so (1) nevaren, zastrašujoč, grozljiv; (2) nerazumljiv, neprijeten, moteč; (3) zelo moteč, odbijajoč, depresiven; (4) dolgočasen; (5) pomirjujoč, prijeten; (6) razumljiv, harmoničen, čitljiv; (7) privlačen, fascinanten, poživljajoč; (8) zasanjan, romantičen; (9) skrivnosten; (10) sprejemljiv, nevsiljiv; (11) ne vzbuja posebnega razpoloženja. Odgovori so oblikovani tako, da v desetih stopnjah zajamejo odgovore od negativnih (odgovori 1–4), prek nevtralnih/pomirjujočih (5–6, 10–11) do pozitivnih/poživljajočih/poživljajočih (odgovori 7–9). Odzivi so bili določeni s pomočjo referenčne literature (Elsadek *idr.*, 2020; Van Esch *idr.*,2019; Aries *idr.*, 2010; Martens *idr.*,2011; Kaplan, 2001; Hernández in Hidalgo, 2005). Možni odgovori na drugo vprašanje so: (1) značilnost površine (npr. barve, tekstura); (2) kakovost kompozicije (dobro in slabo, npr. položaj in razmerja elementov); (3) pripovednost (npr. vzbujanje nehotene pozornosti), sugestivnost; (4) kompleksnost (npr. razgibanost, obilica detajlov, bogastvo oblik); (5) dinamičnost (npr. gibanje zelenja, aktivnosti ljudi na/v nasprotni stavbi); (6) urejenost (npr. vzdrževanje, varnost, zdravje, skladnost), enotnost; (7) ne morem opredeliti vzroka. Ta sklop odgovorov je bil oblikovan za anketirance, ki imajo določeno stopnjo arhitekturnega predznanja, razumejo strokovno terminologijo ter obvladajo bistvene principe oblikovanja fasad.

Nabor možnih pogledov skozi okno vsebuje bližnje poglede na srednji sloj dejanskih stavb kot bi bile videti ob pogledu skozi okno v urbanem okolju. Pogledi so tipični, enostavni, nevtralni in ne vsebujejo dodatnih elementov, ki bi lahko vplivali na odziv. Poleg tega so si večinoma podobni, razlikujejo se le v relevantnih značilnostih. Deset izbranih primerov smo uporabili v izvirni obliki kot primere pogledov brez zelenja in modificiranih z dodanim zelenjem. Dodatna vegetacija je bila na obstoječe fasade dodana s programom Adobe Photoshop. Primeri so v anketi predstavljeni v naključnem zaporedju. Anketirani so bili študenti 3. letnika arhitekture na Fakulteti za arhitekturo UL, ki so anketo izpolnili preko povezave v e-učilnici. Dostop do nje ima 136 študentov, anketa pa je bila anonimna. Udeleženci niso predhodno dobili nobene informacije ali literature glede pomena pogleda skozi okno. Zavedamo se določenih omejitev študije, ki je posledica nabora anketirancev. Vendar pa smo zaradi občutljivosti anketirancev za določene okoljske vidike in arhitekturnega predznanja lahko postavili zelo natančna vprašanja v zvezi z oblikovanjem in kompozicijo fasad, ki v splošni populaciji ne bi bila mogoča. Za analizo zbranih podatkov smo uporabili predvsem deskriptivno statistiko z orodjem Excel 2013.

3. Rezultati

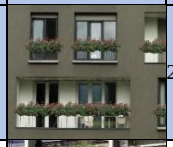
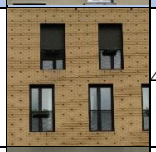
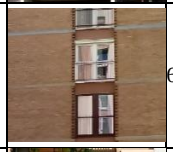
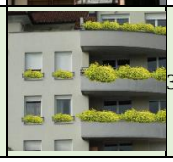
Anketa je bila izvedena maja 2021. V njej je sodelovalo 98 študentov, kar je 72 % kontaktiranih študentov. Vse ankete so bile v celoti izpolnjene. Odgovarjalo je 36 moških in 62 žensk. Starostna struktura ni bila posebej merjena, saj vzorec sestavljajo študenti 3. letnika FA UL, ki so stari v povprečju 21,6 let (podatek je pridobljen iz fakultetne statistike).

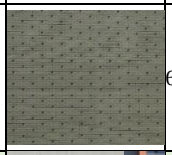
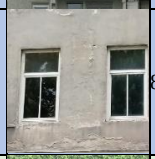
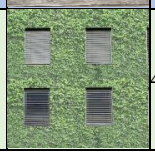
Prvi del raziskave je usmerjen v ugotavljanje tipa naselja, v katerem živijo anketirani, saj je nanj vezano ugotavljanje odzivanja na poglede skozi okno v povezavi z vrsto in velikostjo naselja ter dostopnostjo do zelenih površin. Iz anketnih odgovorov vidimo, da so anketiranci enakomerno razporejeni med manjša naselja z do 2000 prebivalci (44%) in nekoliko večja naselja nad 10.000 prebivalcev (56%). Anketiranci so tudi precej enakomerno razporejeni med okoljem z redko poselitvijo, manjšim ali srednje velikim krajem ali večjim mestom (18 jih živi v okolju z redko poselitvijo, od 27 jih je v 2-strnjena vas, manjši kraj, 21 jih je v 3-srednje velik kraj, 21 jih je v 4-večje mesto). Glede na odgovore je mogoče sklepati, da jih manjši delež živi v izrazito urbanem okolju (11 odgovorov), 36 jih živi v hibridnem okolju (kombinacija urbanega in zelenega okolja), ostali v precej zelenem okolju (51 odgovorov).

Nadalje nas je zanimal tip stavbe in etaža v kateri anketiranci preživijo večji del dneva, ter kako ta vpliva na tip pogleda skozi okno in na dostopnost do zunanjega prostora. Glede na tip stavbe so anketiranci precej enakomerno razporejeni (31 jih prebiva v nizki stavbi, 42 v stavbi z 2-4 etažami, 15 v stavbi z nad 4 etažami). Njihov bivalni prostor se prevladujoče nahaja v nižjih nadstropjih, velika večina jih prebiva v pritličju (56 odgovorov) ali v 2-4 nadstropju (36 odgovorov). Le 6 jih stanuje v 5. ali višjem nadstropju. Prevladujoč delež anketirancev meni, da ima zelene površine zelo blizu (77 odgovorov) in do njih najpogosteje dostopa peš (92 odgovorov).

V drugem delu študije so anketiranci presojali 20 primerov pogledov skozi okno (preglednica 1). Modro so označeni pogledi skoz okno z zelo visokim deležem negativnih odzivov (nad 70%), zeleno pa pogledi skozi okno z pretežnim deležem pozitivnih odzivov (manj kot 50% negativnih odzivov). V nadaljevanju so predstavljeni izbrani značilni urbani pogledi skozi okno in odzivi anketirancev.

Preglednica 1: Pregled pogledov skozi okna s prikazom deleža negativnih odzivov 1-4 ((1) nevaren, zastrašujoč, grozljiv; (2) nerazumljiv, neprijeten, moteč; (3) zelo moteč, odbijajoč, depresiven; (4) dolgočasen) in najpogostejših odzivov (pogledi z deležem negativnih odzivov nad 70% so obarvani modro, pogledi z deležem negativnih odzivov pod 50% pa zeleno)

Št.	Pogled skozi okno	Delež odzivov 1-4	1. najpogostejši odziv	2. najpogostejši odziv	3. najpogostejši odziv	Št.	Pogled skozi okno	Delež odzivov 1-4	1. najpogostejši odziv	2. najpogostejši odziv	3. najpogostejši odziv
1		90.8%	4	3	2	**11**		73.5%	3 in 4	3 in 4	2
2		14.3%	10	5	6	**12**		71.4%	4	3	2
3		88.8%	3	2	1 in 4	**13**		25.5%	10	4	5
4		48.0%	4	2	10	**14**		72.4%	2	3	4
5		69.4%	4	3	2	**15**		65.3%	4	2	3
6		31.6%	4	5	10	**16**		62.2%	2	3	4
7		26.5%	5	10	2	**17**		33.7%	10	4	6

Št.	Pogled skozi okno	Delež odzivov 1-4	1. najpogostejši odziv	2. najpogostejši odziv	3. najpogostejši odziv	Št.	Pogled skozi okno	Delež odzivov 1-4	1. najpogostejši odziv	2. najpogostejši odziv	3. najpogostejši odziv
8		88.8%	3	2	4	**18**		69.4%	3	4	1
9		87.8%	1	3	2 in 4	**19**		43.9%	7	2	3
10		45.9%	10	2	2	**20**		89.8%	4	2	3

Primer 1

Pogled skozi okno št. 1 je značilna nečlenjena fasada s pravilno razporejenimi odprtinami v nevtralni barvi predstavlja generičen primer novejšega stanovanjskega bloka. Vidimo, da se je pri primeru 1 pričakovano velik delež anketirancev opredelil za odzive na negativnem delu lestvice (odzivi 1-4). Od teh je največ odzivov 4-dolgočasen. Nato sledita sorazmerno pomembna deleža odzivov 2-nerazumljiv, neprijeten, moteč in 3-zelo moteč, odbijajoč, moreč. Preseneča izrazita enotnost odzivov. Za veliko večino anketirancev ima ta pogled negativne lastnosti oziroma vzbuja negativne odzive. Kot vzrok za dolgočasnost fasade so anketiranci precej enakovredno navedli vse predlagane vzroke. Najbolj pogosto so izbrali vzrok 2-kompozicijska kvaliteta, sledi vzrok 1-značilnost površine. V najmanjšem deležu so kot vzrok izbirali 4-kompleksnost.

Primer 16

Primer 16 je izrazito razgibana fasada z balkoni in specifično oblikovanimi ograjami, različnimi odprtinami in drugimi fasadnimi elementi, ki je obdelana v nevtralni barvi. Pogled skozi okno omogoča opazovanje dogajanja (dinamičnost) in zato podaja precej informacij. Rezultati kažejo, da so anketiranci kumulativno največkrat izbrali odziv v negativnem delu 1-4 (71%). Predvsem po številu izstopata odgovora 2-nerazumljiv, neprijeten, moteč (23%) in 3-zelo moteč, odbijajoč, depresiven (20%). Omeniti je potrebno tudi relativno velik delež odgovora 1-nevaren, zastrašujoč, grozljiv (12%). V nevtralnem in pozitivnem delu so odzivi razporejeni precej enakomerno in so zastopani le z nekaj odstotki. Izmed teh gre omeniti le nekoliko večji delež odgovorov pri odzivu 10-sprejemljiv, nevsiljiv, ki je 9%. Vidimo, da je večina anketirancev pogled ocenila negativno kot dolgočasen ali še negativneje kot neprijeten, moteč. Značilna je precej izrazita enotnost odzivov. Za veliko večino anketirancev ima ta pogled negativne lastnosti oziroma vzbuja negativne odzive. Kumulativno je najbolj moteča lastnost pogleda 6-neurejenost. Zaradi izrazito dinamične kompozicije fasade bi lahko bil vzrok za vtis neurejenosti tudi veliko število elementov v vidnem polju (kompleksnost) in zato težje čitljiva kompozicija.

Primer 2

Primeru 2 je ozelenjen vzorec pogleda skozi okno, pri katerem je bilo primeru 16 dodano zelenje na balkonskih ograjah, preostali elementi so ostali nespremenjeni. Kumulativno se je z ozelenitvijo balkonskih ograj delež negativnih odzivov v območju 1-4 zmanjšal na 14. Podrobneje, odzivi pri primeru 2 so koncentrirani v 10-sprejemljiv, nevsiljiv. Znatno število je zaznati tudi pri odzivih 5-pomirjujoč, prijeten in 6-razumljiv, harmoničen, čitljiv (15% in 14% odzivov). Lahko sklepamo, da je dodano zelenje vplivalo na odzive. Kot vzroka za izbrane odzive so anketiranci največkrat navedli 5-dinamičnost in 4-kompleksnost.

Primer 10

Primer 10 je ozelenjen vzorec pogleda skozi okno, pri katerem je bilo na 1. primer pogleda skozi okno dodano zelenje, vsi ostali elementi pa so ostali nespremenjeni. Precejšen delež odzivov je tudi pri tem

primeru še vedno v območju negativnih odzivov 1-4. Če primerjamo vse negativne odgovore s primerom 1 (skupaj jih je 89) vidimo, da se je v primeru 10 njihovo število skoraj prepolovilo. Ugotavljamo, da je dodano zelenje izboljšalo odzive na pogled skozi okno. Pri primeru 10 je skoraj polovica anketirancev odgovorila, da je na njihov odziv najbolj vplivala 1-značilnost površine. To je zelo pomembna ugotovitev, saj vidimo, da obdelava površine lahko močno vpliva na odziv. Vendar lastnost površine ni edini pomemben dejavnik, saj je še vedno velik delež anketirancev kljub ozelenitvi izbral odgovor v negativnem območju ponujenih odzivov.

4. Razprava

V anketnih odzivih je bilo zaznati malo odzivov 11-ne zbuja posebnih občutkov, kar nakazuje, da so bili predlagani odgovori primerno izbrani. Iz prikazanih primerjav posameznih primerov vidimo, da odzivi anketirancev precej fluktuirajo. To nakazuje, da so posamezni opazovani elementi pogledov skozi okno pomembni in da vplivajo drug na drugega, zato pri anketirancih zbudijo vedno drugačen odziv. Po drugi strani pa vidimo, da so se anketiranci zelo konsistentno odzivali na podobne poglede skozi okno (recimo pogleda 1 in 16 ter 2 in 10). Izrazito negativno so se odzivali na tipične urbane poglede brez zelenja, pozitivneje pa so se odzivali na poglede z elementi zelenja, kar se sklada s predhodnimi študijami (Twedt *idr*., 2019; Kent in Schiavon, 2020). Ker večina anketirancev živi v manjših in srednje velikih naseljih, se glede na ugotovitve (Liu *idr*., 2020 in Liu *idr*., 2021) težje poistoveti z izrazito urbanimi pogledi brez zelenja, lažje pa sprejme poglede, ki so hibridni (vsebujejo zelenje). Gornjo ugotovitev lahko povežemo tudi z dognanji študije ki ugotavlja, da lahko značilnost površine (recimo sivo obdelana površina) in odsotnost informacij pri neozelenjenih primerih (predvsem odziv dolgočasno) v anketirancih ne zbudita spomina na domače okolje in občutka pripadnosti.

Iz analize primerov različnih pogledov skozi okno je razvidno, da uvedba zelenja na fasado pomembno spremeni odziv anketirancev. To je mogoče potrditi s pomočjo drugega dela ankete, v katerem so anketiranci izbrali najbolj zaželen pogled z okna (trava na tleh in daljni pogled v naravo), še bolj pa v nadaljevanju s primerjavo pogledov skozi okno brez in z zelenjem. V anketi so anketiranci izpostavili tudi najpomembnejši vzrok za izbrani odziv. To je specifičen doprinos te študije, saj smo v nasprotju z drugimi študijami, ki so predvsem ugotavljale odziv, anketiranci navedli tudi najpomembnejši vzrok za posamezen odziv. Pri neozelenjenih fasadah se navedeni vzroki za odziv niso ponavljali in so bili v različnih primerih odvisni od vsakokratne situacije (pri starejših fasadah so anketiranci predvsem izpostavili element (ne)urejenosti, pri izrazito raznoliko oblikovanih fasadah kompozicijo, ki je lahko imela tudi negativno konotacijo, pri obarvanih fasadnih oblogah tudi značilnost površine. Pri ozelenjenih fasadah pa so anketiranci precej pogosto odgovarjali, da je fasada postala bolj dinamična. To se sklada z ugotovitvami drugih avtorjev, ki pravijo, da je ob dodajanju naravnih elementov (npr. zelenja) zadovoljstvo uporabnikov nekoliko večje (Kent in Schiavon, 2020). Nekateri avtorji tudi ugotavljajo, da posebne značilnosti in informacije v motivu lahko sprožajo pozitivne odzive pri uporabniku (Aries *idr*., 2010), s čimer bi tudi lahko obrazložili pozitivnejši odziv anketirancev ob dodajanju zelenja

5. Sklep

Zaradi pospešene urbanizacije prihaja v naseljih so zgoščevanja pozidav, zato je pomembno poskrbeti za primerne bivalne razmere, kar vključuje tudi primeren pogled v zunanjost. Pomembno se je zavedati, da pogled skozi okno za uporabnika lahko pomeni edini stik z naravo. Kot kažejo rezultati te študije so se anketiranci pozitivneje odzivali na poglede, ki so vsebovali zelenje kot pa na poglede brez zelenja. To je v skladu s predhodnimi študijami, ki so obravnavale drugačne populacije. Nekatere študije nakazujejo, da na odziv vpliva tudi predhodna afiniteta do prostora. Pri pogledih brez zelenja ima zelo izrazit vpliv vzdrževanost fasad, njihova kompozicijska kvaliteta in obdelava površine. Na primer, veliko primerov brez zelenja, čeprav kompozicijsko zanimivih in dobro vzdrževanih, je bilo v anketi ocenjenih izrazito negativno. To pomeni, da kljub kvalitetno oblikovani arhitekturi v pogledu še vedno "nekaj manjka". Odzivi anketirancev tudi kažejo, da zelenje v pogledu vedno povzroči ugoden odziv (z drugimi besedami, vpeljava zelenja v pogled skozi okno vedno povzroči pozitivnejši odziv kot v enakem primeru brez zelenja).

Zahvala: Ta študija je bila delno financirana s strani Javne agencije za raziskovalno dejavnost Republike Slovenije skozi projekt: Vrednotenje trajnostnega razvoja urbanega prostora skozi parametre razvoja socialne infrastrukture in življenjskega zadovoljstva; št. projekta **J5-3112** in skozi raziskovalni program:
Trajnostno oblikovanje kvalitetnega bivalnega okolja št. **P5-0068**.

Literatura

Aries, M.B.C., Veitch, J. A., in Newsham, G. R. (2010): Windows, view, and office characteristics predict physical and psychological discomfort. *Journal of Environmental Psychology,* 30(4), str. 533–541. DOI: /10.1016/j.jenvp.2009.12.004

Bell, J., in Burt, W. (1995): *Designing buildings for daylight*. London, Construction Research Communications Ltd.

Chang, C-C., Oh, R.R.Y., Nghiem, L.T. P., Zhang, Y., Tan, C. L.Y., Lin, B. B., idr. (2020): Life satisfaction linked to the diversity of nature experiences and nature views from the window. *Landscape and Urban Planning*, 202, str. 103874. DOI: /10.1016/j.landurbplan.2020.103874

Elsadek, M., Liu, B., Xie, J. (2020): Window view and relaxation: viewing green space from a high-rise estate improves urban dwellers' wellbeing. *Urban Forestry & Urban Greening Available online*, str. 126846.

Hernández, B., Hidalgo, M. C., (2005): Effect of Urban Vegetation on Psychological Restorativeness. *Psychological Reports*, 96(3 Pt 2), str. 1025-1028. https://doi.org/10.2466/pr0.96.3c.1025-1028

Kaplan, R. (2001): The Nature of the View from Home: Psychological Benefits. *Environment and Behavior*, 33(4), str. 507–542. DOI: 10.1177/00139160121973115

Kent, M., Schiavon, S. (2020): Evaluation of the effect of landscape distance seen in window views on visual satisfaction. *Building and Environment*, 183, str. 107160.

Ko, W. H., Brager, G., Schiavon, S., in Selkowitz, S. (2017): *Building envelope impact on human performance and well-being: experimental study on view clarity*. Berkeley: Center for the Built Environment, University of California. Dostopno na: http://www.escholarship.org/uc/item/0gj8h384 (sneto 14. januar 2021).

Koprivec, L., Zbašnik-Senegačnik, M., Kristl, Ž. (2021): Analiza odzivov anketirancev na motiv pogleda skozi okno = Analysis of survey responses to the window views. *Igra ustvarjalnosti : teorija in praksa urejanja prostora*, 9, str. 14-23. https://www.iu-cg.org/paper/2021/IU-CG.2021.09.pdf, DOI: 10.15292/IU-CG.2021.09.014-023.

Kristl, Ž., Zbašnik-Senegačnik, M. (2020): Študija pomena dnevne svetlobe v prostorih vrtca in šole. *Sodobna pedagogika,* 71(3), str. 98-114.

Littlefair, P. J. (1996): *Designing with innovative daylighting*. Watford, Herts, IHS BRE Press.

Liu, Q., Wu, Y., Xiao, Y., idr. (2020): More meaningful, more restorative? Linking social landscape characteristics and place attachment to restorative perceptions of park visitors. *Landscape and urban planning,* 197, str. 103763.

Liu, Q., Zhu, Z., Zhuo, Z., idr. (2021): Relationships between residents' ratings of place attachment and the restorative potential of natural and urban part settings. *Urban foresty and urban greening*, 62, str. 127188.

Martens, D., Gutscher, H., in Bauer, N. (2011): Walking in "wild" and "tended" urban forests: The impact on psychological well-being. *Journal of Environmental Psychology*, 31(1), str. 36-44. DOI: 10.1016/j.jenvp.2010.11.001

Subiza-Perez, M., Korpela, K., Pasanen, T. (2021): Still not that bad for the grey city: A feld study on the restorative effects of built open urban places, *Cities,* 111(5), str. 103081. DOI: 10.1016/j.cities.2020.103081

Patuano, A. (2020): Biophobia and urban restorativeness. *Sustainability* 12, str. 4312.

Thwaites, K., Helleur, E., & Simkins, I. M. (2005): Restorative urban open space: Exploring the spatial confguration of human emotional fulflment in urban open space. *Landscape Research, 30*(4), str. 525–547. DOI: 10.1080/ 01426390500273346.

Twedt, E., Rainey, R.M., Proffitt, D.R. (2019): Beyond nature. The roles of visual appeal and individual differences in perceived resorative potential. *Journal of environmental psychology* 65, str. 101322.

van Esch, E., Minjock, R., Colarelli, S. M. in Hirsch, S. (2019): Office window views: View features trump nature in predicting employee well-being. *Journal of Environmental Psychology*, 64, str. 56-64.

UN (2018): *Revision of World Urbanization Prospects.* https://www.un.org/development/desa/en/news/population/2018-revision-of-world-urbanization-prospects.html, 20.10.2021

van den Berg, A. E., Hartig, T., & Staats, H. (2007): Preference for Nature in Urbanized Societies: Stress, Restoration, and the Pursuit of Sustainability. *Journal of Social Issues, 63*(1), str. 79–96.

Wilkie, S., Stavridou, A. (2013): Influence of environmental preference and environment type congruence on judgments of restoration potential. Urban For. *Urban Green* 12(2), str. 163–170.

3 The Development of the Outsourced Facility Service Market in the EU

Alexander Redlein
IFM/Real Estate and Facility Management
Vienna University of Technology, Austria
alexander.redlein@tuwien.ac.at

Eva Stopajnik
IFM/Real Estate and Facility Management
Vienna University of Technology, Austria
eva.stopajnik@ifm.tuwien.ac.at

Abstract:

There is a lack of scientific reports about the Facility Service (FS) industry because the FS sector is not presented as a whole in NACE, the classification system for industries in the European Union. Most reports are based on NACE. This article reduces that lack by providing an overview of the FS market size in terms of turnover, companies, and employees:
How did turnover, the number of companies, and the number of employees in the outsourced FS sector develop in the EU and the five largest European economies since 2008?
The European norm EN 15221:4 provides a list of all activities that are regarded as FS. Eurostat provides economic measures like turnover, number of companies, employees, and others for most economic activities of NACE on a very detailed level. The list of services that are FS from the EN was matched with the list of economic activities of Eurostat, and the relevant services for FS were selected. There were many plausibility checks performed to assure data quality. The size of the FS sector was estimated in terms of turnover and companies from 2008-2018. This development is compared between countries and is put into relation to the business economy as a whole.
Results show that the FS sector in the EU generated more than 1142 billion turnover in 2017. There are almost 2 million FS companies and more than 15 million employees in FS in the EU. The development in the EU is stable. The financial crises of 2008/2009 didn't hit the FS sector as hard and fast as the rest of the economy in the selected EU countries.

Keywords: Facility Services, Facility Management, Turnover, Market Size, Companies

1 Introduction

Facility Services (FS) are defined as “support provision to the primary activities of an organization, delivered by an internal or external provider” (British Standards 2007) by the European Norm EN 15221-1. “Facilities Management” (FM) is defined as the “integration of processes within an organization to maintain and develop the agreed services which support and improve the effectiveness of its primary activities” (British Standards 2007) FS can be organized by a company itself or they can be outsourced. This study only analyses the outsourced FS sector.
The understanding of what FM and FS actually is, was different from country to country and even from organization to organization. (British Standards 2007) To close this gap, in 2011, another part of the European Norm was added that lists all services and activities that can be considered FS. The standards were created to make benchmarking of FS possible in different countries. (British Standards 2012)

There are only a few reports about the market size, but they are national, not comparing the FS sector in different countries. One reason for the lack of reports is that the FS sector as a whole is not presented in the statistical classification of economic activities in the European Community (NACE Rev.2), which was created in 2008. NACE lists economic activities on a very detailed level, but FS are spread over different aggregated sectors. (European Commission/Eurostat 2008) As most reports and analyses are based on this system, the FS sector is not shown separately. Scientific reports and analyses about the FS sector concentrated on value added and employment of the FS sector (Redlein, Stopajnik 2017 and 2021). Reports about the FS market size in terms of turnover and companies are missing. Therefore, the research question is:

How has the market size of the outsourced FS sector developed in terms of turnover and the number of companies and employees in the largest European economies and the EU since 2008?

The number of employees in FS is estimated again to provide current results for this market analysis. In order to answer the research question, reliable data from Eurostat was selected. Eurostat offers a database that includes structural business statistics with its annual detailed enterprise statistics. The annual detailed enterprise statistics are based on NACE. (European Commission/Eurostat 2021) They include many different ratios like turnover, employees, number of companies, production value, and many more. The data is available on the most detailed level of NACE, which is a hierarchical structure with very detailed industry sectors on the lowest level. All in all, there are several hundred sectors on the lowest level. The data that is shown in the database is collected by the national statistical offices of the EU member countries. They collect it mostly from enterprises and pass the data to Eurostat yearly. Structural business statistics include all sectors of the business economy. Agriculture and personal services are omitted. (European Commission/Eurostat 2019)

2 Literature review

Studies based on the NACE system and data from Eurostat have already been published, but they concentrate on employment and value added:
A study showed that the FS sector in the EU employed slightly more than 14 million people in 2013 (Redlein, Stopajnik 2017). This means that in terms of employees, the FS sector is the third largest sector in the EU. Only wholesale and retail trade with more than 32 million employees and manufacturing with almost 30 million employees are larger. Value added at factor cost came up to more than 455 billion Euros in the EU in 2013. This is almost as much as in the construction sector (487 billion Euros) and the transportation sector (499 billion Euros). In comparison, the most significant sector, manufacturing, reached 1630 billion Euros and wholesale and retail trade reached 1147 billion Euros in 2013. (Redlein, Stopajnik 2017)
An analysis of the development of employment and value added at factor cost showed that the FS sector is very stable during and after the recession (Redlein, Stopajnik 2021). The reason is that services such as janitorial work and maintenance activities, waste and sewage management, etc., have to be kept

running, even if there is a crisis like the economic crisis of 2008/09. The study showed that between 8% and 13% of employees in the business economy work in the FS sector in different European countries. This is much higher for value added at factor cost, where the FS sector is only between 6% to 8% of the business economy. (Redlein, Stopajnik 2021)

A detailed analysis of the FS sector in Germany and Austria between 2008 and 2016 was conducted. The measures of full-time equivalents, wages and salaries, personnel costs and profits, and working hours were analysed. The study showed that the FS sector increased immensely, especially in Germany, in terms of employment. This increase is partly due to decreasing weekly working hours in Germany, but only partly. Certain FS activities such as cleaning, janitoring, and building installations showed huge increases. The study also showed that employment is much more stable than profits. (Stopajnik, Redlein 2020)

On a national level also studies about the market size have been published. Cross-country comparisons are not possible as those studies use a variety of different methods and as it is not always clear which services are included for estimating the market.

Moss stated in 2008 that estimations for the FM market in the UK range from 4.5 to 187 billion pounds. The reason for those enormous differences is that different activities were defined as FS in the different reports. (Moss 2008)

Jensen estimated the size of the Danish FM market by conducting phone interviews with FM providers and customers. Included in the interviews were only companies with more than 50 employees. The size of the Danish market was estimated at 4.9 billion euros.
In the Nordic countries Sweden, Finland, Iceland, Denmark, and Norway, the market size was also estimated in 2004. Therefore, interviews were conducted with the FM department of 29 large companies that demand FS and seven large FS providers. Then building areas were split up into housing and office buildings, and the size of the market was calculated for office buildings. In total, the potential FS market for those five countries was estimated at 53 billion euros. It was assumed that the actual market was only 25% of the potential market. (Jensen 2010)

In Germany, in 2010, the size of the FM market was also estimated. Thomzik et al. used the gross fixed assets of relevant resident and non-resident buildings. This way, they came to the result that the FM industry is 5.03% of the gross domestic product. (Thomzik et al. 2010). It can be seen that the results due to the different methodologies and underlying data sources vary to a high degree.

3 Method

To use a validated and trustful database, this study is based on data from Eurostat and the European Norm EN 15221:
The EN 15221-4:2011 includes a list of all services that are regarded as FS. (British Standards 2012) This list was used to determine the FS sector. It was matched with the detailed activities of NACE, and so the services that can be considered FS were selected. The necessary and reliable data was found in the database from Eurostat. In this way, the relevant services which form the FS sector were identified. They were grouped into two groups: “Typical Facility Services” and "General Facility Services" for business and residential buildings. The first group, "Typical FS" includes very typical FS activities, e.g., cleaning, janitoring, and security services. Examples of "General FS" are sewerage, waste management, and water supply. Those groups together form FS in total.
Then suitable data was selected carefully. The database of Eurostat was examined, and the measures of turnover and number of companies were chosen. Additionally, the measure employees were selected. As a first step, it was used for plausibility checks. Then, it is displayed in the study because current data is necessary and this measure gives valuable insights into the market. The data was checked in detail for its completeness and plausibility. It turned out that the financial sector was incomplete, with many missing values. So, the financial sector was excluded to avoid considerable breaks in the development that would lead to misinterpretations.

Other missing values were handled carefully. The following procedure was used: If values were missing in specific years, the value from the year before or after was taken, and the percentage of total non-financial business economy was calculated. If the percentage of the missing value was estimated at being less than 0,3% of the total business economy, the data is shown. 0,3% as an upper limit was chosen because the breaks in the time series are tiny then.
As plausibility checks, the ratios of turnover per company and employees per company were calculated. Outliers and sudden breaks in the time series were analysed. Only the number of companies in Germany in 2018 in the energy sector D seemed implausible as it increased from 2000 to almost 70000 within one year. So, it is excluded and not shown in the graphic.
For the study, the five largest countries in the European Union measured by GDP and the EU were selected. (Statista 2021) The UK is included as it was a member of the EU until 31st of January, 2020. The sum of the turnover of the five largest countries is more than two-thirds of the turnover in the EU. To make comparisons possible, the total-nonfinancial business economy was determined as a relation. The data is shown in percentage of total non-financial business economy and also in absolute numbers.

4 Results

Figure one shows the turnover in a million €, the number of companies and employees of different industry sectors, including the FS sector in the EU 28 in 2017. The year 2017 was chosen as to this point, it is the most current year with a sufficient reliable database. For 2018 there is still more data missing. The figure shows that although the FS sector is not the sector with the highest revenue, it is still very important, generating more than 1142 billion in turnover in 2017. The number of FS companies is relatively high, with almost 2 million. In terms of employment, the FS sector ranges in place 4. In 2017 there were already more than 15 million employees in FS in the EU. The average turnover per company is around 580 000 Euros. This is not very high but even higher than in the construction sector where turnover per company is around 490 000 Euros.

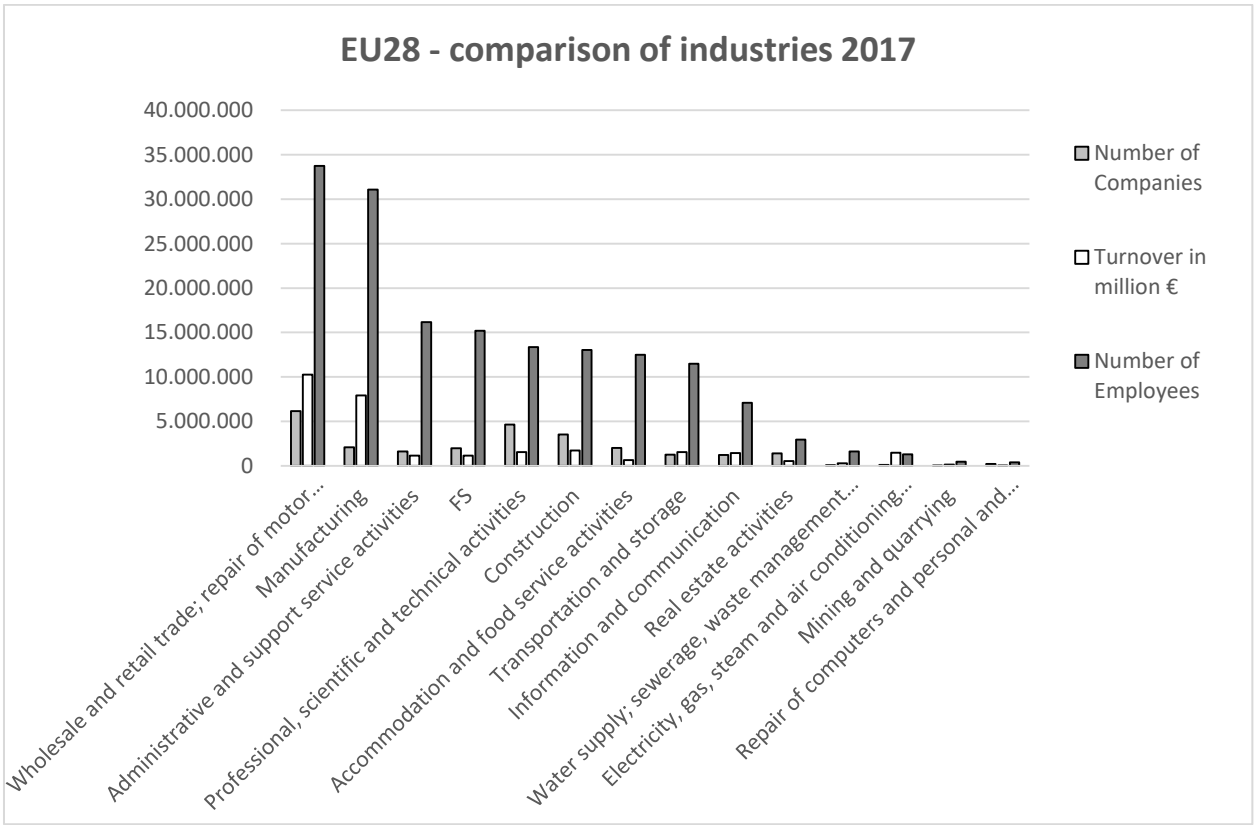


Fig. 1: Turnover expressed in millions of €, number of employees and number of companies in the EU 28 in FS and the other industry sectors

Source: Own calculation on the base of annual detailed enterprise statistics (European Commission/Eurostat 2021/2022)

Figure two shows the turnover of the FS industry as a percentage of the total non-financial business economy. It is between 3,5% and 4,8%. This is a very small range, showing similarities between the countries. Compared to the other published studies about employees and valued added, which were mentioned in the literature review, the percentage is rather low.

It is also visible that there is a slight peak in 2009 and 2016 in Germany, the UK, and Italy. While the FS sector in Italy seems to decrease compared to the business economy around 2014, this is not the case for the UK and Germany. In Spain, the share of the FS sector in the non-financial business economy showed a substantial increase between 2017 and 2018.
The time series of the EU is very stable. Due to missing values, the time series is lower by 0,1% to 0,2% in specific years.

Figure three shows the turnover in Facility Services and non-financial business economy in absolute numbers. It is visible that in 2009 during the economic crisis business economy declined in all countries, and the FS sector also declined in all countries except for Germany. Therefore, the peaks in Figure two were provoked by the fact that the FS sector didn't decrease as much and as quickly as the rest of the economy.

Figure three also shows that turnover in FS and in the business economy was very stable in Italy until 2016. In Italy and Spain, a slight upwards trend is visible after that. France is also rather steady. In Germany and the UK, FS and the business economy have constantly been increasing since 2009. Only in the UK in 2016, the year of the Brexit referendum, the trend is broken.

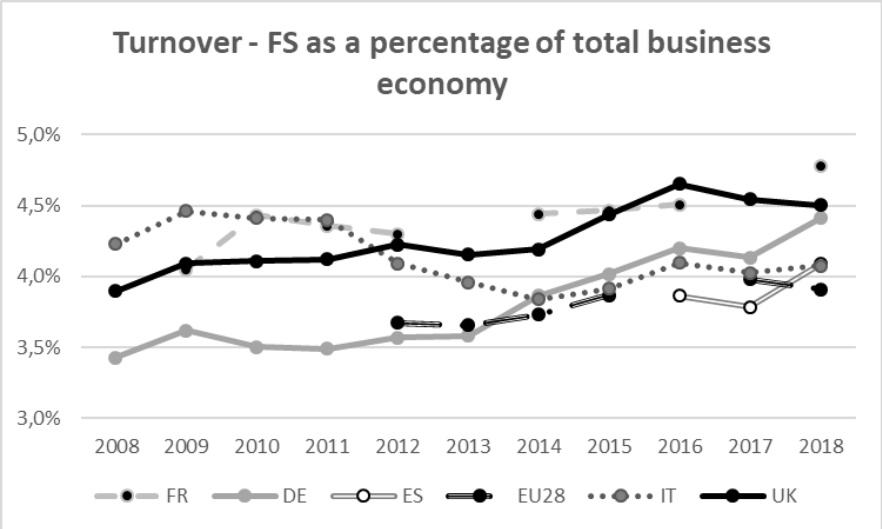
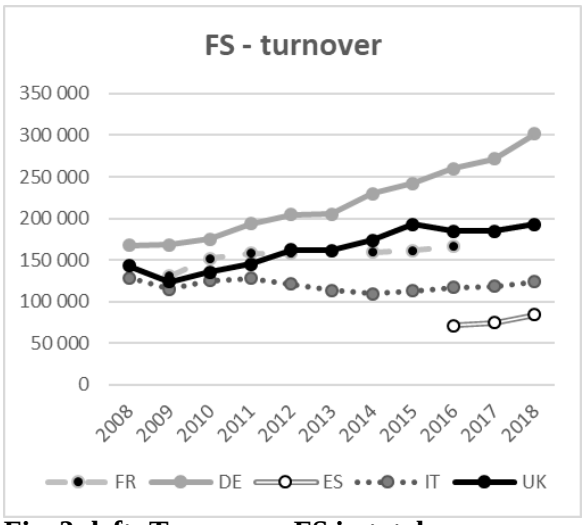


Fig. 2: Turnover as a percentage of non-financial business economy (NACE B-N, S95, excl. K*)* expressed in millions of €
Source: Own calculation on the base of annual detailed enterprise statistics (European Commission/Eurostat 2021)



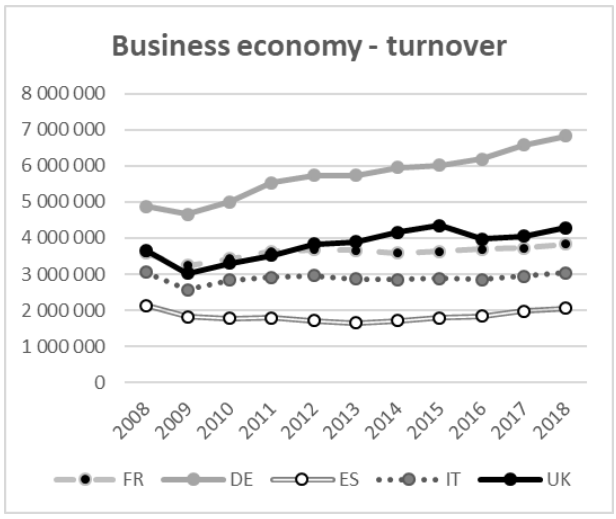


Fig. 3: left: Turnover - FS in total
right: Turnover in the total non-financial business economy (B-N, S95 excl.K)
Source: Own calculation on the base of annual detailed enterprise statistics (European Commission/Eurostat 2021) expressed in millions of €

Figure four shows the number of companies in FS as a percentage of the total non-financial business economy. In all countries, the number of companies is very stable only Germany has shown an enormous increase since 2013. The percentage of companies in the business economy that are FS companies varies between 6% and 12,3%.

Figure five shows that the absolute number of companies is not as stable as assumed from the first graph, at least not in all countries. In France and Germany, there are quite visible breaks in the time series. While many companies in France dissolved in 2015, Germany showed enormous growth from 2014 onwards, especially in the FS sector. This increase goes hand in hand with the increased turnover. In Italy, the time series is very stable.
It is visible that during crises such as the economic crisis of 2008/09 or Brexit in the UK in 2016, the number of companies seemed quite stable; rather, turnover sank.

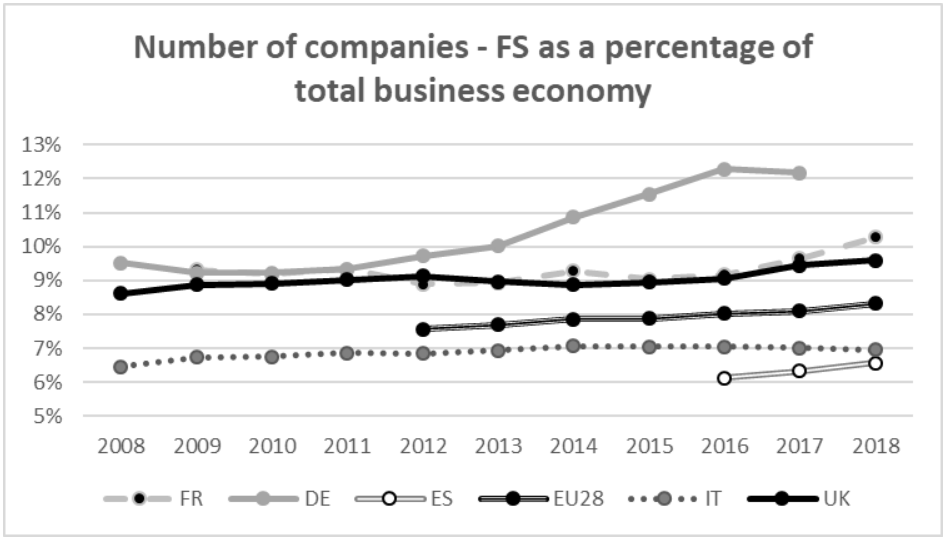


Fig. 4: Number of companies as a percentage of non-financial business economy (NACE B-N, S95, excl. K)
Source: Own calculation on the base of annual detailed enterprise statistics (European Commission/Eurostat 2021)

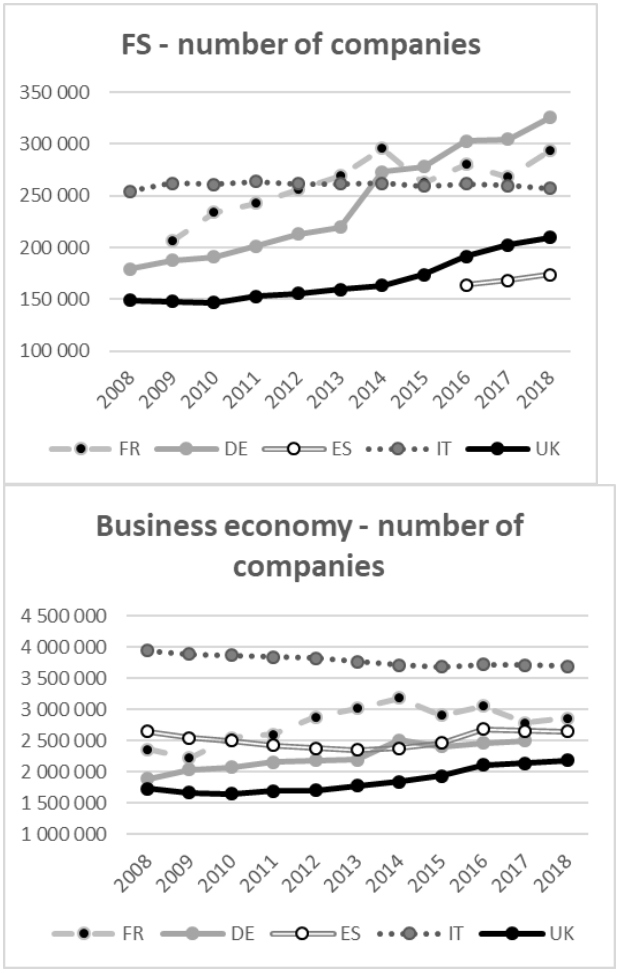


Fig. 5: left: Number of companies - FS in total
right: Number of companies in the total non-financial business economy (B-N, S95 excl. K)
Source: Own calculation on the base of annual detailed enterprise statistics (European Commission/Eurostat 2021)

Figure six shows the number of employees in FS as a share of all employees in the non-financial business economy. As the study mentioned in the literature review, the graphic shows that the share of FS-employees in the business economy was quite high in 2013. In Spain and Germany, more than 12% of employees work in FS. In the EU, the UK, and Italy, there are approximately 10% of employees working in FS.
France is not shown as there are too many missing values for FS.

Figure seven shows the number of employees in FS and in the business economy. Germany constantly shows enormous increases in employees in FS and in the business economy. Employment in the other countries decreased after the financial crises, but employment started to recover around 2015. Similar to the number of companies, employment seems quite stable during crises such as the recession in 2008/09 or after the Brexit referendum.

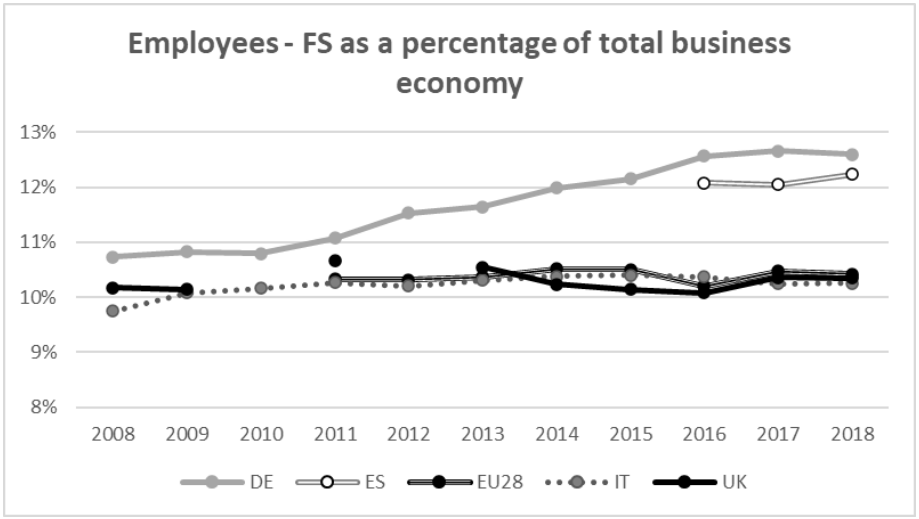
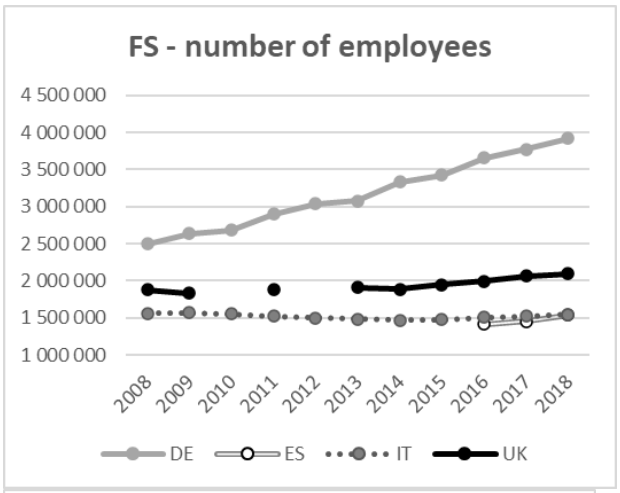


Fig. 6: Number of employees in FS as a percentage of non-financial business economy (NACE B-N, S95, excl. K)
Source: Own calculation on the base of annual detailed enterprise statistics (European Commission/Eurostat 2022)



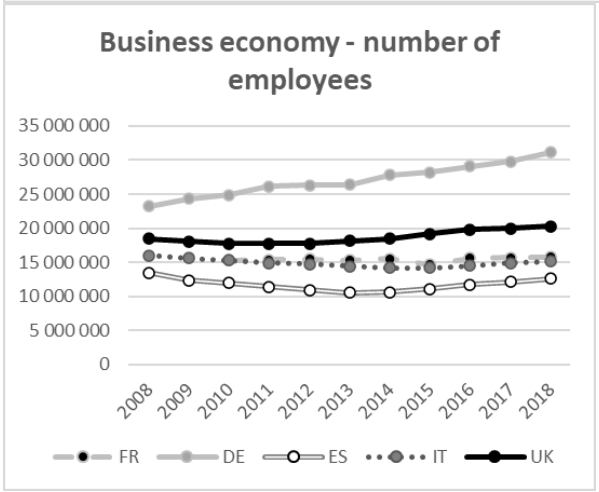


Fig. 7: left: Number of employees - FS in total
right: Number of employees in the total non-financial business economy (B-N, S95 excl. K)
Source: Own calculation on the base of annual detailed enterprise statistics (European Commission/Eurostat 2022)

5 Conclusion

Results show that the FS sector in the EU generated more than 1142 billion turnover in 2017. The number of FS companies is high, with almost 2 million. In 2017 there were already more than 15 million employees in FS. The average turnover per company is around 580 000 Euros. This is not very high but even higher than in the construction sector where turnover per company is around 490 000 Euros.

The FS industry's turnover represents only between 3,5% and 4,8% of the total non-financial business economy in the EU and the selected countries. This is a minimal range, showing similarities between the countries. The time series of the EU is very stable. The financial crises of 2008/2009 did not hit the FS sector as hard and fast as the rest of the economy.
Turnover in FS and the business economy was very stable in Italy until 2016. In Germany and the UK, FS and business economy are constantly increasing. The trend was only broken in the UK in 2016, the Brexit year.

The number of companies in FS as a percentage of the total non-financial business economy is very steady in all countries. Only Germany has shown an enormous increase since 2013. The percentage of companies in the business economy that are FS companies varies between 6% and 12,3%, a pretty wide range. The share of employees working in FS is relatively high, ranging between 9% and 13%.

The development of the number of companies shows that while in some countries, namely Italy, the time series is very stable, in other countries there are some dips or increases: In France and Germany, there are visible breaks in the time series. The enormous growth in Germany in the number of companies and employees, especially in the FS sector, goes hand in hand with the increased turnover.

During a crisis such as the economic crisis of 2008/09 or Brexit in the UK in 2016, the number of companies and employees seemed quite stable. Turnover rather sank.

In the next step, the enlargement of analyses into the 1990ies would be of interest as there were a lot of large European companies like Lufthansa, and Siemens that outsourced their FS provision. It would be of interest how large this impact was in total of the non-financial business economy. Also, the analysis of the impact of COVID19 on this industry is of interest. There the main question is if this industry also was quite stable or if it even grew during this crisis because of the demand for new and more services like disinfection and sanitisation.

Data Availability Statement:

The datasets analysed during the current study are available in the database of Eurostat by the European Commission:
"Annual detailed enterprise statistics – industry and construction (sbs_na_ind)", „Annual detailed enterprise statistics – trade", „Annual detailed enterprise statistics – services" in „structural business statistics (sbs)",
available at: < https://ec.europa.eu/eurostat/web/structural-business-statistics/data/database > (accessed 5. July 2021, 7. February 2022 and 22. August 2022)

6 References

British Standards (2007). *BS EN 15221-1:2006, Facility Management Part 1: Terms and Definitions*, London, UK.

British Standards (2012). BS EN 15221-4:2011, *Facility Management Part 4: Taxonomy, Classification and Structures in Facility Management*, London UK

European Commission/Eurostat, last modified 2021 and 2022. "*Detaillierte jährliche Unternehmensstatistiken für das Baugewerbe* (NACE Rev. 2, F)", „*Detaillierte jährliche Unternehmensstatistik für den Handel* (NACE Rev. 2, G)", „*Detaillierte jährliche Unternehmensstatistik für Dienstleistungen* (NACE Rev. 2, H-N und S95)", *„Detaillierte jährliche Unternehmensstatistiken für die Industrie* (NACE Rev. 2, B-E)", in „structural business statistics (sbs)", available at: <https://ec.europa.eu/eurostat/web/main/data/database?p_p_id=NavTreeportletprod_WAR_NavTreeportletprod_INSTANCE_nPqeVbPXRmWQ&p_p_lifecycle=0&p_p_state=normal&p_p_mode=view> (accessed 5. July 2021, 7. February 2022 and 22. August 2022)

European Commission/ Eurostat (2019): *Structural business statistics (sbs) - Reference Metadata in Euro SDMX Metadata Structure (ESMS)*.
Available at: <https://ec.europa.eu/eurostat/cache/metadata/en/sbs_esms.htm> (Accessed Sept. 10, 2019)
European Commission/ Eurostat (2008): *NACE Rev. 2 – Statistical classification of economic activities in the European Community*, Luxembourg.
Available at: <https://ec.europa.eu/eurostat/documents/3859598/5902521/KS-RA-07-015-EN.PDF> (Accessed: Apr. 4, 2019)

Jensen, P.A. (2010): The facilities management market in Denmark, *Facilities* 28.7/8, S. 383-394

Moss, Q.Z. (2008): FM market research review: do we really have the "intelligence"?, *Facilities*, Vol. 26, Iss 11/12, S. 454-462

Redlein A., Stopajnik E. (2017): "*The Facility Service Industry in Europe*"; 22nd EBES Conference, Rom; 24.05.2017 - 26.05.2017; in: "*22nd EBES Conference -Rome, Program and Abstract Book*", EBES Publications, Conference Book (2017), ISBN: 978-605-84468-9-2; S. 180.

Redlein A., Stopajnik E. (2021): "*Facility Services: An Underestimated Sector?*"; in: *Eurasian Business and Economics Perspectives*, Eurasian Studies in Business and Economics, Vol. 18, Chapter 13, Mehmet, Huseyin, Bilgin et al. (Eds):, ISBN 978-3-030-71868-8

Statista 2021. Gross domestic product at current market prices of selected European countries in 2020 (accessed 27. July 2021)

Stopajnik E., Redlein A.: "*The Upwards Trend of the Outsourced Facility Service Industry in Germany and Austria*"; 13.IFM-Congress 2020, Vienna; 12.11.2020 - 13.11.2020; in: "*Journal für Facility Management*", IFM TU Wien, Vol. 20/2020 (2020), 2415-1858; S. 66 - 76.

Thomzik, M., Striewe, F., Knickmeier, A., 2010, „*FM-Branchenreport 2010, Die volkswirtschaftliche Bedeutung der Facility Management-Branche",* Bochum, Deutschland: Institut für angewandte Innovationsforschung (IAI) e.V. an der Ruhr-Universität Bochum, Deutscher Verband für Facility Management (GEFMA) e.V., Bonn

4 New models of archıtecture ın the real estate market

Mihajlo Zinoski
Professor, ”Ss Cyril and Methodius” University, *Faculty of Architecture,* Skopje, RN Macedonia
Vebi Fazliu
Docent, “Mother Teresa” University, *Faculty of Civil Engineering and Architecture,* Skopje, RN Macedonia
Jana Brsakoska
Assistant, ”Ss Cyril and Methodius” University, *Faculty of Architecture,* Skopje, RN Macedonia
Valmir Dalipi
Assistant, “Mother Teresa” University, *Faculty of Civil Engineering and Architecture,* Skopje, RN Macedonia

ABSTRACT

Problem Statement: The real estate market transforms the built environment radically in the past two decades. Therefore architectural practice as well try to respond by attempting to establish contemporary paradigms of objective reality which used to be determined by specific functional typologies and standards in the past period of socialist modernism in Macedonia. Under the influence of socio-economic, cultural, political, and market proprietary changes today, the emerging architectural mixed-use or hybrid typologies are evidence of transformations and need to be researched as a phenomenology of build space. The problem area of this research is the redefinition of the role of architectural practice in the commercial real estate market where a building is a product that is used specifically for real estate business or income-generating purposes.
Purpose of Study: To respond to the global and regional economical development of the real estate market today and create more community-oriented sustainability of buildings today, it's very important to define the particular program to meet the needs of future users of buildings. Through the research of recently emerging architectural concepts of hybrid/mix-used buildings, the purpose of this paper is to recognize the model of integration through the program and determine the factors that have a decisive influence on real estate buyers and also have the potential to provide rental income as well as a capital appreciation for investors.
Methods: The research is focused on public mix-used buildings with disparate program contents and program integrated hybrid models, as case studies. The research process will investigate and observe the flows in the commercial real estate market to quantify the program. Through statistical methods of particular stakeholders, this research will recognize models for sustainable economy of the built environment.
Findings and Results: The expected results of the research will determine the economic and social factors that trigger transformative processes from existing to new models of architectural typologies.
Conclusions and Recommendations: The assumption that mix-used/hybrid models give the possibilities for a sustainable market economy, this research re-presents architecture as contemporary paradigms of the built environment. The unifying character of mixed-used and hybrid buildings is ready to accommodate planned and unplanned activities in the city. The hybrid scheme proposes environments that mix already known typologies and create allies that improve existent conditions.

Keywords: hybrid models, transformative typologies, public buildings, architectural concepts, commercial real estate, contemporary paradigm.

Introduction

With the changes in the political system after the breakup of Yugoslavia in the 90s, the state lost its role as the main controller over real estate and distributing investments. In the years that followed, additional laws were passed to regulate the right to property, which marked the beginning of the transition from state to private ownership. Once these transitions in political, economic, and social life were put in motion, the architectural practice that used to be determined by socialist standards, tries to respond by attempts to establish contemporary paradigms of the new reality.

Emerging architectural mixed-use or hybrid typologies are evidence of North Macedonia's built environment transformations in the past years, that are happening to respond to global and regional economic development and the commercial real estate market that is used specifically for business or income-generating purposes.

In the following, this paper conducts research on the newly emerging architectural concepts of hybrid/mix-used buildings in two cities in North Macedonia. By recognizing these models of integration through an analytical approach, the research determines the factors that drive these transformations and have a decisive influence on real estate buyers, and contribute toward rental income.

In the first part of the research, an overview is made of the transition process from a socialist system to liberal market in North Macedonia, and the conducted procedures of privatization of real estate. This part demonstrates the methods of privatization that were implemented in direction of the new market policies, economic restructuring, and social and political changes. The newly established property-ownership relations triggered the transformative processes from existing to new models of architectural typologies.

The second part of the research makes an overview of the transformations and the correlation between typology and emerging programs, where architecture is presented as the phenomenon of the problem. This section analyzes three case studies of decisive factors in the real estate market, that directly influence the redefinition of typologies, resulting in new models of buildings with an integrated program.

The first case elaborates on the transformative typologies of existing public buildings inherited from the socialist period in Yugoslavia, connected to the commercial real estate market in Skopje. In these cases, the location has a key role as a decisive factor for real estate stakeholders. They are placed in locations that rate higher on the attractiveness scale in the urban hierarchy, so-called "premium" locations, related to a great variety of services and proximity to strategic points. On the other hand, these facilities have land-property ownership issues, as a consequence of incomplete privatization, where a great part of the land is still owned by the state. Therefore, it is more difficult for them to be placed in the sale-purchased market unless they undergo a specific transformation to be active in retail.

The second case in this section elaborates on informal tourism where various typological transformations in existing residential spaces are evident in the touristic town of Struga. These facilities are transformed through various expansions within the city to meet the needs and requirements of the market, real estate agencies, and tourist accommodation.

The third case considers the typological transformation of residential buildings in Skopje, where a close location to a kindergarten is a significant price-determining factor. The research analyses the price rate of new apartment buildings, designed as hybrid models with integrated new compatible, and complementary programs to be more valued in the real estate market.

The last section concludes that these several decisive factors influence the built environment, triggering transformations as possibilities for a sustainable market economy. The results are new models of architectural typologies, where their hybrid scheme proposes environments that mix already known typologies and create allies that improve existent conditions.

2. The transition period between 1990-2021

The real estate market today in North Macedonia is still developing in the new economic norms since the breakup of Yugoslavia, where in the last 30 years, a very slow adjustment is in the process to regulate the real estate supply and demand.

The transition from a socialist system of the economy into neoliberal economics is still in motion. While in Socialist Yugoslavia the management of capital investments, the property, and the means owned in common was only governed by the state as the main controller, nowadays there is a third party involved, and that's the private investor. With these changes in the real estate market relation scheme, the interest of the society also began to change, which affects the built environment.

The period after the break-up of Yugoslavia included many transitions such as the political, economic, and social transitions, and urbanization as an aspect of social transition is associated with the process of urban changes, where the high level of urbanization is not always equal to high levels of economic development (Tsenkova,2008). Privatization becomes a priority of the newly independent states in the Region. In North Macedonia, as a result of the newly set priorities, the Law on the Transformation of Enterprises with Social Capital was adopted in 1993.

Over the course of a decade, from 1990 when 10% of all homes were under state ownership until 2002 this percentage decreased to 0.69% (Tsenkova, 2008).

Different methods of privatization were implemented in direction of the new market policies, economic restructuring, and social and political change. Tsenkova (2008) categorizes these methods into the following simplified groups: privatization of public housing; deregulation of housing markets and restructuring of subsidies; as well privatization of state construction enterprises[1].

Most of the privatization of public properties went through the process of selling public housing to the existing tenants, as well as the process of restitution as a procedure for providing compensation for property confiscated for the benefit of the state built before 1944, and the transformation of cooperatives into condominiums. Privatization of state construction enterprises included sales to foreign investors or giving vouchers to the citizens who can buy or take shares, or shares were sold or given to the employees (Tsenkova, 2008).

All of this action affected the economic market as well as the distribution of wealth and increased social inequality. The transition contributed toward a greater controlling role of the market and less control of the state, where private actors set prices on the market according to their interests.

In the first ten years of the transition, there are no records of sales data from the real estate market, and no state or private organization provided analyzes until 2013 when the law on real estate cadastre was adopted. In 2015, the Real Estate Cadaster Agency established the Register of Prices and Rents, which enables access to all information related to real estate transactions in the territory of North Macedonia (Real Estate Cadaster Agency, 2017).

As follows, the market value of the real estate is determined according to the Methodology for assessing the market value of the real estate (2012), where its attractiveness is evaluated through statistical methods for site valuation and dynamic methods that are also corrective methods. The formal transformations of the architecture are only according to the interest of private investors.

In the following two decades, the interest in investments in the construction of public and social facilities declining on the liberal market in Nmacedonia. Large percentage of urbanization is noted with a high increase in the construction of housing facilities as the most profitable in the real estate market. Since 2000, the housing price index has been continuously growing, while the highest annual rate of change (%) is 20.2 in 2008, and from 2020 to 2021 is 6.1 (National Bank of the RN Macedonia, 2022). Moreover, most public buildings are an architectural heritage built during the Socialist Yugoslavia, where already established typologies and programs do not contribute to the profit of capital interests. The situation is made even more difficult by the diversity of property rights, where a large part of these buildings are state-owned, and through several methods of lease and sale, spatial units are transferred to private investors.

[1] See more: Tsenkova S. (2008). Housing Policy Reforms in Post Socialist Europe: Lost in Transition. Springer Science and business media. p.65-68.

Therefore, the sense of collectivity is lost, where privacy and ownership of space, land, facilities, enterprises, and even ethnicity are emphasized through architectural phenomenology on a micro level. With the transformation of the existing buildings, architecture is faced with variable primary and open secondary functions.

3. Architecture as a response

While the political transition is affecting the urban changes, the politics of capital interests is what drives the transformation in architecture, thereby transforming its social and physical form. With the increasing powers of the consumerist city, various variations of simulations enter the physical form, affecting administrative, commercial, and even residential functions (Bugarič, 2006). In following are three cases of typological transformations, showing the redefinition of the role of architectural practice in the real estate market, where the building is a product that is used specifically for real estate business or income-generating purposes.

3.1. Transformative typologies in the commercial real estate market

Due to the land-property ownership issues, where the ownership rights of the inherited public buildings are mostly private, but a big percentage is still owned by the state (Real Estate Registry Agency, 2022), is difficult for these facilities to find their place in the commercial real estate market in a manner of purchase and sale. On the other hand, due to the dense urbanization of the central city area, where the financial and commercial areas are, the construction of new business centers is almost impossible (Fortonmka, 2021). As a result of this situation, typological transformations are happening to the existing facilities, where they take on functions that are missing, to adapt to commercial needs and to remain placed in the real estate market.
Considering that the main percentage of the population is still located in the city's central area, the market demands are still centralized and the demand for retail space outside the organized units is increasing significantly. Investment capital in terms of administrative and office space is closely related to the location - so-called "premium" locations – that are placed in areas in the urban hierarchy, with a great variety of services and proximity to strategic points, offering greater price stability and being easier to rent. Moreover, a flexible space that can be adapted to customer needs, with sufficient parking spaces provided, is preferred. In North Macedonia, the biggest interest and demand in the commercial real estate market in 2021 comes from IT companies, where 80% of total transactions are located in the central city area. Due to the constant expansion, these companies lease space, making 36% of the total leased office space, and thus have the largest representation. The most frequent transactions in 2021 refer to the lease of office space from 150 to 400 m2, with an average price of 13 euros per square meter. The price concerns the new buildings evaluated as energy efficient - class A (Fortonmka, 2021).
According to this data, a study case is conducted on three public facilities in Skopje, showing their transformations to adapt to the commercial real estate market needs.

The City Trade Center –"GTC" (Figure 1) built in 1973, is a building designed with a mixed program, where programs through the decades have gone through significant transformations to maintain their function. Although the transformations kept the primary focus on trade, many of the primary functions were dismissed as inadequate to the economic sustainability of the country. The architectural structure is designed as open and transparent. In its typology, it represents a combination of the western capitalist shopping malls and the dense space of the traditional shopping streets of the Old Skopje Bazaar, located in the very heart of the city.
During the socialist period, the shopping center and its goods were managed by the state, but during the period of privatization, the building ownership passed into a joint-stock company, managed by private owners. It was designed as a city multifunctional center, as an ideal model of the city structure in a planned monocentric model. In this monocentric model, the city trade center had the central position with a distribution of smaller trade centers at the proper distance according to the city's needs (Zinoski,

2011). Nowadays that model is fully abandoned, where the new decisive factors don't relate to city demographic and distance, but rather to income-generating purposes.
The City Trade Center from 2015 till 2018 noted several leases, relating to smaller areas, from 15m2 up to 170m2 units (Real Estate Registry Agency, 2022). Therefore, a specific transformation is noted in the department stores[2] that with time as a concept is abandoned. These programs in the initial solution occupied large areas, but with the reduction of spatial capacities, new formal units are formed that are easier to be managed and enable a higher selling price in the real estate market. The biggest number of transactions are noted toward trade functions, but also administrative and office spaces are getting more occupied on the higher floors (Table 1).

Figure 1: City Trade Center –"GTC", Skopje. Source: authors, 2022.

Figure 2: Department store building "NAMA", Skopje. Source: authors, 2022.

[2] Department store: a large shop that sells a wide variety of goods - a single retail business establishment.

The department store building “NAMA” (Figure 2) is part of the silhouette of square "Macedonia", built in 1959, and designed by the architect Slavko Brezovski. This building follows the principles of early modernism and successfully implements them in its typological characteristics. The interior of the department store is designed as an open space, where the ground floor and the first floor are connected by vertical communications. The space allows flexibility, and uninterrupted circulation of visitors, employees, and products. In its 60 years of existence, the facility has undergone countless changes in its property ownership status as well as in its program. The building was governed by the state till 2003, remaining empty and closed until 2005 when it was sold and become private property. Nowadays, a great part of the land is still owned by the state. As the need for shopping centers changes, so do its premises. The concept of a common space or a department store, with the privatization in the 90s, loses its meaning. It's been divided into smaller commercial and business units, and later it accommodates various compatible uses such as education. In 2021, space on the first floor is rented for the office premises of an IT company. However, despite its many exterior and interior changes, the building's location, and its connection to the square and the City Trade Center remain of crucial importance (Table 1).

The third example is the National arena “Toshe Proevski”, formally known as City Stadium in Skopje (Figure 3), which was built in phases, starting in 1978 and it is finalized in 2010. It is an architectural concept that accommodates sport as the main program and other commercial content that is complementary to its function. Its typology is categorized as an elliptical stadium with spectator stands on four sides around the football court and a track around the athletic field. The southern stands were built first and later the northern, eastern, and western ones. The Stadium is a modern structure, located in the greenery of the City Park with a complex construction system, which allows the accommodation of an additional program in the sub-stands area. The building has a complex ownership status, where the main stadium is governed and owned by the state, while most of the sub-stands areas are private property. The additional programs are in constant transformation but following the market needs, where the most repetitive program are commercial units and administrative spaces (Table 1).

Figure 3: City Stadium, Skopje. Source: authors, 2022.

Table 1:

	Building 1: City Trade Center GTC	Building 2: Department store NAMA	Building 3: Sport stadium
Built:	1973	1959	1978-2010
Location:	City center, Skopje	City center, Skopje	City Park, Skopje
Levels:	3	5	3
Program:			
Ground floor	Trade + restaurants	Trade + restaurants	Trade
First floor	Trade	Trade	Offices
Second floor	Trade + offices	Offices	Offices
Third floor	/	Offices	/
Fourth floor	/	Offices	/
Rental price per m^2 :	**3-30 e** *(data year: 2016)	**6-15 e** *(data year: 2018)	**6-17 e** *(data year: 2015)
Area of commercial units:	15-170 m^2	20-550 m^2	100-500 m^2

The information in Table 1 is according to the Real Estate Registry Agency (2022) data, for the period of the biggest number of lease transactions. It shows the current state of the case study buildings and the occupied space for administrative activities and offices by levels. The location has a key role in terms of the suitability of these uses. It is evident that the rental price varies and it is closely related to the maintenance of the building and its premises, where the average rental price for adapted facilities is close to the rental price of 13e for newly built class A office buildings. In terms of the used area, it remains within 550 m^2, which confirms the need for smaller spatial units to make higher profits.

3.2. Informal tourism

The phenomenon of informality is known and widespread in many areas of society, most often in economics, which is closely related to architecture. The word “formal” derives from the Latin word "forma" meaning form, figure, and shape (Online etymology dictionary, 2014), it also refers to “agreed" and often official or traditional way of doing things (Cambridge dictionary, 2022). Informality is the opposite of the two quotes above about formality. Tourism is one of the world’s major economic sectors, it is the third-largest export category and in 2019 accounted for 7% of global trade (UNWTO, 2020). Parallel to traditional formal tourism, another form of so-called informal tourism is developing, particularly in developing countries.

As a post-socialist state, Macedonia has developed significant tourism, especially in the southwest of the country, where the traditional tourist towns of Struga and Ohrid are located on the shores of Lake Ohrid. During the socialist era, tourists were mainly accommodated in state-owned hotels. After the change in the political system and the liberalization of the market, tourism experiences a surge in development when existing hotels can no longer meet the demand for accommodation, and informal accommodation in individual residential units and commercial buildings is offered as an alternative (Figure 4).

Russo (2002) stated that tourist accommodation in residential spaces has a major potential to increase as opposed to hotel accommodation. According to Agyeiwaah (2019), touristic accommodation in houses is one of the terms used to characterize a small lodging owned by a family also known as B&B2, accommodation-house, guests-house, boutique, hotel, among others.

This type of accommodation does not require extensive available plots and buildings, a condition that is very restrictive in consolidated urban contexts as the historic center and urban zones are endowed with touristic services. In addition, there are fewer operational regulations and standards governing the establishment of touristic accommodation in houses which makes it easier for this type of accommodation to be established (Collado Baldoquín et al., 2020).

Figure 4: Some of the numerous facilities used for informal tourism in the town of Struga, Source: authors, 2022.

In the last three decades, a large number of residential buildings in the city of Struga have been typologically transformed through various expansions within the city to meet the needs and requirements of the market, real estate agencies, and tourist accommodation.

All these interventions in residential buildings lead to a phenomenon that causes various typological transformations, not only architectural but also social, cultural, tourist, and economic.

The phenomenon of informal tourism generates various architectural patterns, wherein the existing residential buildings there is a transformation of the function of the building by the owners, who share the same building with tourists during different periods of the year, with particular emphasis on the summer season, when tourism reaches its peak.

Architectural and typological transformations, aimed at a profit, can be divided into two groups; the first group includes mainly buildings built in the period of the former socialist system and adapted to the needs of informal tourism (Figure 5), while the second group includes buildings planned and designed from the beginning mainly for the development of informal accommodation and housing in the post-socialist period until nowadays.

Looking at the prices of accommodation through international accommodation companies such as Airbnb and Booking for the month of September 2022 in the city of Struga and analyzing their offer for a standard room, we conclude that the prices of informal accommodation facilities are almost half of the prices of formal accommodation facilities such as hotels. According to the analysis of about 20 accommodation objects from both facilities, the average price of an overnight stay in the informal accommodation facilities is 32 € per night, while in the hotels it is about 65 €. In connection with the above-mentioned research on competitive prices offered by informal accommodation establishments and their increase after the post-socialist period in Struga, we can generally conclude that this type of service will continue to gradually increase in the future.

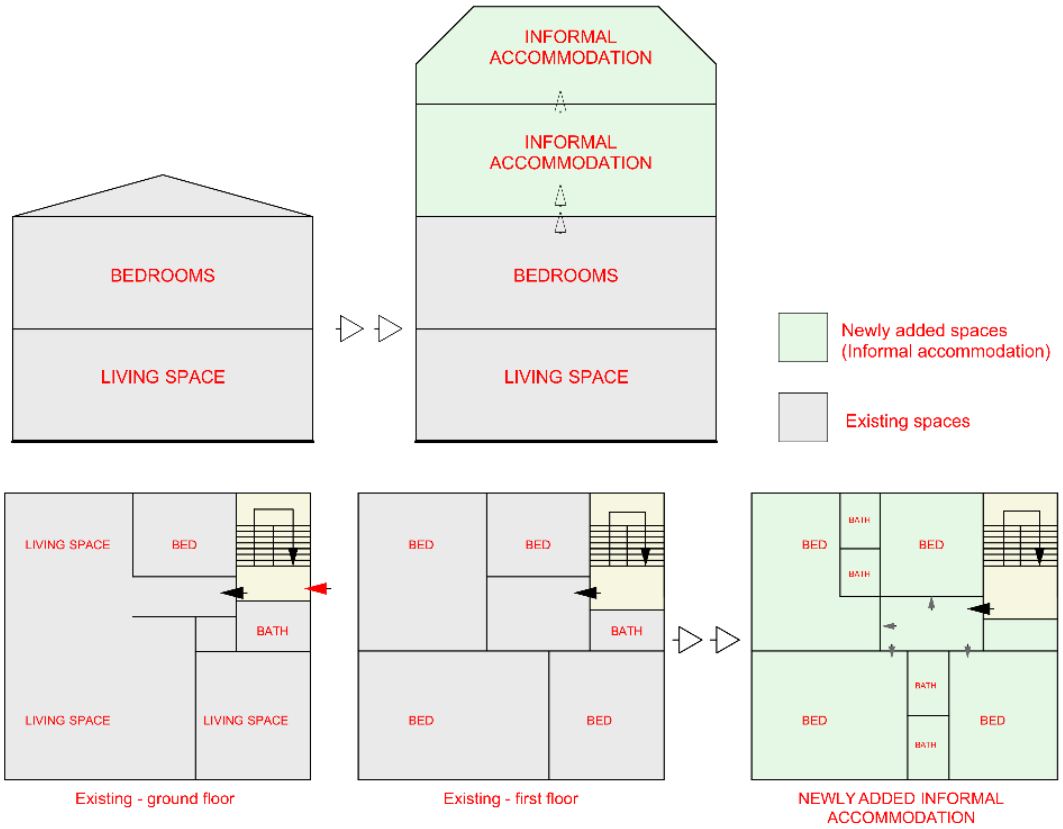


Figure 5: One of the typical floor plan typologies for the transformation of buildings built before the 1990s, with additional floors to create informal tourist accommodation. Source: authors, 2022.

Apart from the "negative" fact of being an informal type of accommodation, such as informal tourism, these types of patterns generated by residential and commercial facilities are pushed to creation by market demands, profit, and real estate agencies, providing hybrid typologies that need to be explored in detail to understand the genesis of their appearance in society in all aspects. On this basis, various anomalies in the functioning of the new architectural patterns can be discovered and from them, new urban planning strategies can be developed for the tourist sites of Macedonia, in the interest of a better adaptation to the needs of the market, the accommodation demands of tourists, the intersection of cultures and profit.

3.3. Integration of kindergartens into housing

Housing is a particular type of asset with a dual meaning as consumption and an investment good (Glindro et al., 2008). According to data from real estate agencies in Skopje, a close location to a kindergarten is a significant price-determining factor in housing prices besides other factors. The value of housing facilities decreases as the distance from kindergarten increases (Bergantino et al., 2022). Till the end of the 20th-century kindergartens in Skopje were built and managed by municipal bodies as a public educational facility. At the beginning of the 21st century, powered by legal procedure changes, the first private non-state kindergartens were presented. Smaller in space and services they started to be integrated into segregated commercial facilities. Time has shown that those kindergartens didn't work not because of their quality but because of their location (Theisen, Emblem, 2018). The newly appeared program was struggling for space. Private kindergartens integrated into apartment buildings by transforming the ground floor into kindergarten have been shown to be much more successful. In recent years there were built many housing facilities in Skopje, and some of them in their designing projects, have integrated kindergartens into their program.

In following is conducted research, examining whether the newly added program has an impact on apartments price and the time of the first sale. The data used for analysis refer to 3 apartment buildings in the same neighborhood in Butel Municipality in Skopje that were built from 2019 to 2022. The Buildings are named Building A, Building B, and Building C. Building A is a multi-level apartment building with a mixed program consisting of a shopping mall, commercial units, a kindergarten, and mainly apartments. Buildings B and C are also multi-level buildings, consisting form commercial units and mainly apartments. Building A is set to complete at the end of 2022, Building B is completed in 2022, and building C is set to complete at the end of 2022. The data are categorized in Table 2.

Table 2:

	Building A:	Building B:	Building C:
Beginning of construction:	2019	2019	2020
Levels:	13	12	12
Program:			
Ground floor	Shopping mall	Commercial units	Commercial units
First floor	Shopping mall	Commercial units	Apartments
Second floor	Commercial units	Apartments	Apartments
	Kindergarten	Apartments	Apartments
Third – last floor	Apartments	Apartments	Apartments
No. Housing units:	108	90	112
Sale price per m^2 of apartments:	**1150 - 1200 e**	**950 -1050 e**	**950- 1050 e**
Time to first sell:	**0 – 8 month**	**3 – 12 month**	**3 – 15 month**
Area of housing units:	60 – 120 m^2	70 – 130 m^2	45 – 90 m^2

From the data in Table 2, we can conclude that apartments in Building A besides the higher selling price also have a better time rate of the first sale. Buyers in the three buildings are mainly young couples with or without kids, mostly from other cities of North Macedonia rather than Skopje. We can point out that with the increasing diversity of housing facilities programs, their value increases also. Kindergartens added and integrated into the housing facilities program have a significant impact on the value of housing units.

4. Conclusion

It is evident from the first two cases above that existing buildings have undergone changes in terms of their functions in their short historical existence, turning into hybrid models. In the third case it is evident that is an increasing practice of building new apartment buildings in a manner of hybrid models with integrated new programs, to be more valued in the real estate market.

Hybrid models, present a mixture of several typologies in one location or building, resulting from the need for space, purpose, program, or in favor of the economics and the real estate market.

In the case of new hybrid models of public facilities, their viability in the real estate market is closely related to their location, and by that, the rental prices have less tendency to volatility. Smaller space areas are most competitive in the commercial real estate market.

In the case of informal tourism, the hybrid model with an adapted program for tourism facilities achieves a greater offer on the market with competitive prices and by that attracts bigger investments. In comparison to formal tourist accommodations, they are easier to develop and manage in the dense urban context.

In the third case, new models enable dwelling in a residential building with integrated compatible and complementary uses, where the presence of kindergartens reaches a higher sale price on the market.

In conclusion, buildings with a hybrid character allow the continuous increase of their real estate values. The three case studies confirm the need for new models, where architecture takes the role of contemporary paradigms of the built environment.

5. References:

Agyeiwaah, E. (2019). Exploring the relevance of sustainability to micro tourism and hospitality accommodation enterprises (MTHAEs): Evidence from home-stay owners. *Journal of Cleaner Production*, *226*, 159-171. Available at: https://doi.org/10.1016/j.jclepro.2019.04.089

Bergantino, A. S., Biscione, A., De Felice, A., Porcelli, F., & Zagaria, R. (2022). Kindergarten proximity and the housing market price in Italy. *Economies*, *10*(9), 222.
Available at: https://doi.org/10.3390/economies10090222

Bugarič, B. (2006). Transformation of public space, from modernism to consumerism. *Urbani izziv*, *17*(1-2), 173-176. Available at: https://doi.org/10.5379/urbani-izziv-en-2006-17-01-02-001

Collado Baldoquin, N., Rueda Guzmán, L. A., González Couret, D., & Lemus Mesa, K. M. (2020). Urban tourism the impact of tourist accommodation in residential buildings at Vedado, Cuba. *Revista interamericana de ambiente y turismo*, *16*(1), 35-48.
Available at: https://doi.org/10.4067/s0718-235x2020000100035

Glindro, E. T., Subhanij, T., Szeto, J., & Zhu, H. (2008). Determinants of house prices in nine Asia-Pacific economies. *SSRN Electronic Journal*. Available at: https://doi.org/10.2139/ssrn.1333646

Methodology for assessing the market value of the real estate. *Official Gazzete RNM no.23/2012*
Russo, A. P. (2002). The "vicious circle" of tourism development in heritage cities. *Annals of Tourism Research*, *29*(1), 165-182. Available at: https://doi.org/10.1016/s0160-7383(01)00029-9

Theisen, T., & Emblem, A. W. (2018). House prices and proximity to kindergarten – costs of distance and external effects? *Journal of Property Research*, *35*(4), 321-343.
Available at: https://doi.org/10.1080/09599916.2018.1513057

Tsenkova, S. (2008). *Housing policy reforms in post-socialist Europe: Lost in transition*. Springer Science & Business Media.

Zinoski M. (2011). *МЕТОДА ЗА РЕКУРЗИВНА АНАЛИЗА НА КОМПЛЕКСНИ ПРОГРАМСКО – ПРОСТОРНИ АРХИТЕКТОНСКИ КОНЦЕПТИ НА ПРИМЕРОТ НА ГОЛЕМИТЕ ТРГОВСКИ ЦЕНТРИ ВО СКОПЈЕ* [Unpublished doctoral dissertation]. Faculty of Architecture, Ss. Cyril and Methodious University.

5.1 Internet sources:

Cambridge Dictionary. (2022). *Formal*. Cambridge Dictionary | English Dictionary, Translations & Thesaurus. Available at: https://dictionary.cambridge.org/pt/dicionario/ingles/formal

Cushman&Wakefield/FORTONMKA. (2022). *Office H1 2021*. https://cwforton.mk.
Available at: https://cwforton.mk/ri_category/office/76155/55554/178

National Bank of the RN Macedonia. (2022, July 4). *Цени на недвижности*. Македонски - Почетна. Available at: https://www.nbrm.mk/ns-newsarticle-osnovni-ekonomski-pokazateli-za-republika-severna-makedonija.nspx

Online Etymology Dictionary. (2014, December 20). *formal*.
Available at:https://www.etymonline.com/word/formal

Real Estate Cadaster Agency (2017, July 3). Wayback Machine.
Available at:
https://web.archive.org/web/20170703042234/katastar.gov.mk/mk/Page.aspx?Id=606&m=1673

Real Estate Registry Agency. (2022). *Register on prices and rents*.
Available at: https://ossp.katastar.gov.mk/OSSP/

Tourism and COVID-19 – unprecedented economic impacts. (2020, August 24). UNWTO | World Tourism Organization a UN Specialized Agency.
Available at:https://www.unwto.org/tourism-and-covid-19-unprecedented-economic-impacts

5 Methodological approaches to research on the “dark side” of the AEC industry

Jardar Lohne
Frode Drevland
Ola Lædre

Abstract:

Purpose: Research on the AEC (Architecture, Engineering and Construction) industry is riddled with delicate fields of investigation. a clear example of themes such a field are those falling under the umbrella of the “dark side” of projects, that is, practices that are either unethical, unlawful or both. This paper reflects on the suitability of research methods for investigating such themes. The ambition is to show the implications of industry structures on the suitability of methodological approaches found in the literature. Key aspects discussed are the types and procedures of literature reviews, document studies, and interviews.
Methods: The main research approach is a review of the literature with the ambition to identify the most used methods within the field. This literature mapping is enriched with experiences from a small research program, where the authors have published in scientific journals and peer-reviewed conferences.
Results: The literature review reveals that little systematic effort has been put into the guidance of practical research on delicate fields of investigation in the AEC industry from an industry structure perspective. Debates are often found at a level of abstraction that renders them inaccessible or uninteresting to the research community. It seems that there are discrepancies between the typical object of research and adequate research methods. Practical experiences from using research approaches within the research program are lain out.
Implications: There is a need for a broad reflection within the different research communities concerning best practices for research methods for construction management in general, and all subjects pertaining to the “dark side” in particular. Without proper insight, research on facilities management will not be able to capture the nature and extent of “dark side” phenomenon.

Keywords: crime, ethics, dark side, research methods, qualitative research

1 Introduction

The particularities of the AEC (Architecture, Engineering and Construction) industry and the projects carried out within it have often been underlined (e.g. Vrijhoef, 2011). The implications of these particularities for the choice of methodological approaches have been little studied. They are, it seems, poorly understood.

For what concerns less honourable aspects of the AEC industry, such as unethical or illicit behaviour – hereafter named the "dark side" of the industry – questions related to the relationship between industry structures and methodological approaches are even less examined. Partly, this stems from a lack of general scientific interest in such themes (see e.g. Bredillet, 2014; Lohne et al., 2020; Locatelli et al., 2022), both within the frame of the AEC industry but also within the broader project management (PM) literature. According to Hogson and Cicmil (2008), for instance, the PM literature frequently neglects political, social and ethical dimensions" of what they study. in addition to this we can add, the methodological implications of such dimensions are to a large degree excluded. Still, as Hogson and Cicmil (2008) maintain, "PM is a highly complex, political and social process", for which scholars need to "expand their appreciation of PM work as being more complex in its social context that merely delivering instrumentalist and mechanistic functional management processes". For what concerns the AEC industry, concealment can be found added to the complexity.

Challenges related to concealment proves particularly true for research into the "dark side", where concealment lies at the core of all endeavours. As Ambraseys and Bilham, (2011) maintain, the "assembly of a building, from the pouring of foundations to the final coat of paint, is a process of concealment, a circumstance ideally suited to the omission or dilution of expensive but essential structural components". Further, such concealment can be found at all stages and levels of management processes. Therefore, efforts to break through complexity and concealment should be reflected in the methodological practices chosen.

Questions pertaining to how to investigate when we investigate phenomena such as the "dark side" of construction projects seem, however, still underexplored in the literature. "If we are to address the "dark side" scientifically", maintain Locatelli et al. (2022), "the community of scholars that studies projects and their management needs to unveil the failing political, intellectual, and moral influences that silence or push practitioners and other project stakeholders to the dark side". Yet, how to carry out such an unveiling of practices in a methodologically sound manner is far from evident. As Locatelli et al. (2022) continue, "[t]his topic is problematic, difficult to study, and should be more central to our research and teaching practices". In order to address this general inquiry, we in this paper address the following research questions:

- What are the main recommendations for research methodologies found in the contemporary research literature?
- What are the main challenges identified with these proposed practices?
- What measures can be envisaged to improve methodological practices?

The research presented in this paper springs from the research program *Mapping opportunities for criminal behaviour in the Norwegian BAE industry* [Kartlegging av mulighetsrom for kriminell adferd i norsk BAE-næring], supported by Project Norway (projektnorge.no/krim). Since 2014-, the program has analysed crime in the Norwegian construction industry from a building process perspective.

2 Theoretical framework

In the following, we follow the definition from Locatelli et al. (2022) on the dark side of projects: "The dark side of projects is any illegal or unethical phenomena associated with projects". When we in the following treat phenomena issuing from the "dark side", the practices described stem from all phases of projects within the AEC industry, at least from the design to the termination phases. This is not to underestimate the particularities of Facility Management (FM) related challenges. Indeed, as Roper and Payant (2014) point out, there are inherent challenges related to, for example, bribery and corruption within FM. They underline how:

"it is extremely important that facility managers conduct themselves with a high sense of ethics and be watchful that others do the same. Our actions, from selecting an architect, to agreeing on what kind of

boilers will be used, to managing the selection of the builder, all impact huge organisational resources, and we must always be concerned about our actions as well as their appearance in the process." (2014:212)

Interestingly, Roper and Payant (2014) underline to what extent such a concern ought to be grounded both in the particularities of AEC industry particularities – here mainly in the form of procurement strategies – and in an understanding of the role(s) of FM professionals within the organisational hierarchy, since:

"the use of political influence by social contacts among upper management to obtain either the design or construction contract noncompetitively on major projects is not to be allowed. Often executives do not realise that they are bypassing the proper design-build processes, so they must be warned that a good business practice, managed by the facility manager, is in place and that bypassing that practice is not good business" (2014:212).

However, Roper and Payant (2014) do not provide actual guidelines for how this should be observed in practice. Neither do they provide any indications for how such a high sense of ethics ought to be arrived at, nor an understanding of what actions should be avoided. In the following, we examine pathways to how such an understanding can be built through practical research approaches within the AEC industry before we – in the discussion – examine its relevance to the field of FM.

2.1 Characteristics of the AEC industry and consequences for research thereof

Several authors (e.g., Ballard and Howell, 1998, Dubois and Gadde, 2002)) have outlined particularities of the AEC industry compared with other manufacturing industries according to a production systems optic, underlining characteristics that distinguish them from other industrial ventures. One good summary of characteristics of the AEC industry and the challenges these typically lead to for the manufacturing process can be found in Vrijhoef (2011), which we cite in extenso:

"The [AEC] industry can be typified as a project-based industry with specific characteristics such as location-bound design, one-off production, changing production coalitions per project, outdoor and environmental circumstances, multiple clients and multiple suppliers involved in a single project. In comparison to many other industries, the production environment in building is relatively complex and unstable. This generally leads to negative effects, such as low levels of effectiveness and efficiency, low rates of innovation and impediments to knowledge sharing and learning. The performance level of the building sector is considered to be lower and lagging behind other industrial sectors."

The above-listed characteristics – size, complexity, skill diversity, fragmentation etc. – all contribute to complex organisational structures, involving multiple actors with the ability to both act and counteract according to their respective points of view.

Not surprisingly, these characteristics have been found reflected in how the industry operates so that "actual operations in the industry can be interpreted as responses to its inherent complexity" (Dubois and Gadde, 2002:3). In the extension of such an argument, we would argue that research on the actual operations in the industry should be responsive to this identified complexity.

In their introduction to the 2010 special issue on research methodologies (*Journal of construction engineering and management 136*(1), 1), the editors underline the practical challenges posed to research methodologies caused by the characteristics of the AEC industry:

"The interdisciplinary project-based nature of the work, industry fragmentation, one-of-a-kind end products, site-based production, and other factors combine in ways that make following established research methodologies [here: of a traditional positivist nature] difficult" (Taylor and Jaselskis, 2010).

Throughout this special issue, the extent and nature of the challenges met by the researcher daring to venture into an understanding of the industry is repeated at several reprises. What is particularly interesting here is that this is not only a question of deciding on practical research methodologies; rather, the very nature of what type of knowledge research on the AEC industry is to produce is set under debate.

2.2 Roots of the problem – epistemological positions and their methodological responses

As outlined by Panas and Pantouvakis (2010), the debate over the theoretical foundations of appropriate methodological approaches for construction research has been a subject of concern over the last decades. Most notably, this can be found expressed in the mid to late 1990's with a series of papers appearing in *Construction Management and Economics (Volumes 13-16),* later followed up by the 2010 special issue mentioned above.

According to Ehwi et al. (2022), the 1990s debate was "initiated by Seymour & Rooke's (1995) critique of the dominance of the rationalistic paradigm in CEM research and Runeson's (1997) defence of quantitative approaches". The debate sparked a controversy between academics favouring positivist perspectives – typically found paired with belief in rationalism, empiricism and objectivity (Hariss, 1998) – and academics in favour of interpretivist approaches – underlining ideas of truth and reality as being characterised by subjectivity (Rooke et al.,1997).

The vehemence in these discussions on seemingly abstract questions can be somewhat surprising. One explanation could be that the antagonism stems from the seemingly paradigmatic shift. A typical characteristic of such shifts is that the conceptual foundations constituting the established paradigm prove incommensurable with the conceptual foundations of the new (Sankey, 1993). Both in the simplified form described here and in more refined manners, these debates have continued up to current times (Sherrat and Leich, 2020). As noted in Locatelli et al. (2022), nowadays, it has been customary to recommend explicitly to declare not only what the theoretical contribution of the work presented consists of but also what theoretical lenses the research presented is carried out with and that this has become essential in leading journals. It seems reasonable to suppose that the perceived need for such declarations stems from the debates on epistemology described.

Whatever the fundamental reason, the change in epistemological approach has for practical consequence been the opening for new interpretative research approaches.

Such debates of a paradigmatic nature seem rarely to be settled through any direct clash of arguments. Instead, a sort of collective judgement can be said to be carried out by the actual research within the research community (Lohne et al., 2022). In the debate over the epistemological foundations of research on the AEC industry, the result has been sort of a draw between the positivist and the interpretivist positions. Within practical research, the last two decades have, in fact, witnessed an increase in methodological pluralism within the field of construction engineering and management (CEM), going from being "overwhelmingly positivist in its orientation, with a resultant reliance on quantitative methods" (Dainty, 2007) into being more dominated by methodological pluralism (Agyekum-Mensah et al., 2020). These latter authors reviewed 4,166 publications in CME, Journal of Construction Engineering and Management (JCEM), Association of Researchers in Construction Management (ARCOM) proceedings, and Engineering Construction and Architectural Management (ECAM) between 2000 and 2017; and found that 41.4% applied qualitative, 33% quantitative and 9.6% mixed methods.

Following such mappings of research practices, in-depth studies have assessed the suitability of non-quantitative methodological practices for the field. Araújo and Lucko (2022), for instance, have examined the use of case study approaches within CEM research. Not surprisingly, their findings indicate that for the study of project-based ventures such as construction projects, "case studies are well suited to the nature of construction itself: each project entails creating a facility by employing physical means and methods with managerial plans and controls that are subject to a unique set of requirements of constraints. In other words, a project is a case" and that, conversely, "experiments under controlled laboratory conditions are almost impossible". This notion falls in line with the general insights presented by Abowitz and Toole (2010), underlining how

"[c]onstruction is essentially a "social" process […] The fact that people play key roles in nearly all aspects of the construction process suggests that in order to understand the human or social factors, effective construction research requires the proper application of social science research methods" (Abowitz and Toole, 2010).

Acknowledging that the nature of the industry calls for interpretivist approaches, implies a challenge, however, a practical nature. This consist of turning away from positivist experiment-like processes and

towards approaches infused with insights from other epistemological positions, such as is typical of contemporary social sciences.
Territorial struggles between positivists and interpretivists have been characteristic throughout science throughout the latter decades of the 20th century (Cusset, 2005). However, they tend not to consider the question of tangible contextual factors shaping the research object – such as industry structure – as a determining factor in research strategy, design and execution. Moreover, there is a need to adapt research design to the characteristics of the potential data stemming from AEC industry research.

2.3 Addressing the problem – adapting research design to the sensitive nature of AEC industry data

We have underlined how methodological challenges stemming from the fact that AEC industry projects and the interactions they lead up to are complex. Phelps and Horman, for instance, underline how "[t]raditional construction research methods […] are often not adequate to enable understanding of the complex interactions that lead to many of the industry's pervasive social and technical problems" (Phelps and Horman, 2010). Still, it can be argued that the challenges involved in studying such projects and their context run deeper than merely a constatation of complexity; these challenges stem from the very nature of the data sought, often sensitive. As Hallowell and Gambatese (2010) comment, the "dynamic and transient nature of construction projects makes construction engineering and management (CEM) research particularly challenging. For example, experimental research on safety, risk management, innovation, and technology forecasting is often unrealistic due to the *sensitivity* and complexity of the topics" (our emphasis). In addition to complexity, the sensitivity of data of different sorts poses problems to the researcher.
In fact, "[m]any topics of CEM research, such as safety and health, risk management, forecasting, and innovation, are complex, involve many confounding factors, or are extremely sensitive precluding the use of traditional research methodologies" (Hallowell and Gambatese, 2010). Here can be added phenomena such as corruption, collusion, unethical behaviour in general and others belonging to the "dark side" of the AEC industry.
In the keel water of such considerations, the literature provides ample advice for the researcher who wants to venture beyond the traditional research methodologies. Phelps and Horman (2010), for instance, recommend ethnographic studies as an alternative method for data collection. This is due to their propensity to "to take in as much of the complexity of an environment as possible", before using the analysis of such observations of complexity to "refine future observations based on research questions that emerge from earlier observations" (Phelps and Horman, 2010). Such procedures provide "great opportunities for the construction research community to understand complex phenomena" (Phelps and Horman, 2010). Along similar veins, (Leicht et al., 2010) propose observational studies as a way in which qualitative categorisation can form the basis for later quantitative data on processes and interactions. Others venture into the use of other avenues of research, in the case of Hallowell and Gambatese (2010), the use of adapted forms of the so-called Delphi process. Finally, on an even more practical level, several researchers propose concrete measures for practical research, such as the use of structured workshops or research "charettes" (Gibson and Whittington, 2010), with specific recommendations for the selection of participants (random or quota-based) and the tactical use of overbooking.

2.4 Knowledge gap – implications for research on the "dark side"

Within the context of "dark side"-subjects, several industry characteristics seem to influence the nature of the phenomena observed. The availability of a diversified methodological toolbox does not, however, suffice for the researcher searching for concrete approaches soundly founded theoretically for her research endeavour. The large degree of sub-contracting, for instance, facilitates arenas where criminals can exploit the lack of control by clients over the people actually carrying out the work (Lohne et al., 2021). Similar conclusions seem to apply to characteristics of the materials value chain, where the lack of traceability of materials renders effective control over what can be found construction materials nearly impossible – thereby opening a room to manoeuvre for actors familiar with "dark side" practices (Mohn

and Lohne, 2022; Lohne and Mohn, 2022a). A third example of such industry characteristics opening up for "dark side" practices is the manner in which project teams are typically totally replaced from one phase of the building process to the next – so that effective control needs to be taken care of through more or less adequate governance systems (see for instance Hjelmbrekke et al., 2015). However, it seems well acknowledged that such governance schemes do not capture "dark side" practices of highly imaginative actors, as observed in Lohne et al. (2017) and Lohne et al. (2020).
These investigations are, however, only starting blocks into understanding how industry structures influence actual practice. Still, this seems largely little understood. Further, the methodological consequences thereof are not drawn.
The AEC industry typically receives attention as an industry of doubtful virtue: where neither the police, the tax authorities, nor the professional organisations fully master the challenges posed by professional practice (Andersen et al., 2014); where the inherent complexity in itself opens the opportunity for suspicious dealings (Gunduz and Önder, 2012); where fraudulent business practices undermine the reputation of the industry (Slettebøe et al., 2003); and that lacks a clear vision based on a fortified ethical foundation (Wolstenholme et al., 2009).

In other words, vices are rife in the industry, and it seems that actors do, in fact, act in an opportunistic manner – an egoism leading to criminal activity. The literature review carried out in preparing this article revealed that crime in the AEC industry typically has been examined according to specific perspectives, notably corruption research (e.g. Locatelli et al., 2017; Chan and Owusu, 2017; Gunduz and Önder, 2012), research on workplace-related crime (e.g. The Chartered Institute of Building (CIOB), 2009; Zitkiene et al., 2016; Golden and Skibniewski, 2010), so-called social dumping (e.g. Fromentin, 2016; Bengtsson, 2014; Bernaciak, 2016), and tax evasion schemes (e.g. Behling and Harvey, 2015). Comparatively, little research seems to have been undertaken on what fundamental structures of the industry function as fundamental drivers for criminal and unethical behaviour. Following this, even less emphasis seems to have been put on research methods and strategies permitting for understanding "dark side"-phenomenon within the industry.

3 Methods

3.1 Research design

The unit of analysis of the different projects within the small research program has been the AEC industry as a whole, in terms of the whole building process from strategic definition to termination; the whole material supply chains, from primary producers to wholesalers, including how illicit materials enter the workplace; the supply chain, from clients to sub-contractors actually carrying out the physical work on the construction site. The unit of analysis equally includes formal and informal rules and regulations concerning both product- and process awareness. 26 research analyses have been carried out to provide a representative picture of the overall situation, all published in peer-reviewed journals or conference proceedings (for a presentation of these, see Lohne et al., *Forthcoming*).
What the paper presents in the following is guided by general insights arising from this series of research, mainly on the Norwegian construction industry. However, the insights are applicable in a wide range of contexts.
The research presented has as its primary goal to increase the understanding of methodologies suitable for investigating subjects of a delicate nature in the AEC industry, particularly belonging to the "dark side" of projects. This paper is based on a meta-analysis of the combination of this overall goal and research results. Meta-analysis should not be understood here very technically but rather in its original sense as an "analysis of analyses" (Glass, 1976).
Apart from the publications stemming from the different projects within the research program, a literature review and a series of workshops formed the basis for the analysis.

3.2 Literature review

There is a relatively small body of literature within the field, and it highly varies regarding quality and scientific rigour. This general body was presented in Lohne et al. (2019) and later expanded through follow-up literature reviews. In order to address the main recommendations for research methodologies from a material of sufficient significance, the main object of analysis of the literature examined consisted of a small series of papers whose impact (number of citations), distribution channel (quality of journal), and scientific quality (personal assessment by the authors of this paper) make them stand out.
The small series of papers examined include Ambraseys, N., & Bilham, R. (2011); Bowen et al. (2012); Sichombo et al. (2009); Locatelli et al. (2017); Locatelli et al. (2022); Chan and Owusu (2017); Vee and Skitmore (2003); Reeves-Latour and Morselli (2017).
For the supplementary review specifically pertaining to questions of ethics within the field of Facilities Management (FM), the main search engine used was Google Scholar, in addition to Norwegian library database Oria. Thematic search words included "facilities management", "ethics", "crime", "dark side", "virtue", "professionalism", "silo-thinking", "information asymmetry", "problem of many hands" and combinations of these using Boolean operators. Search words aiming to capture prevalent methodological approaches included "methods", "methodologies", "industry structure", "literature review", "systematic", "scoping", "mapping", and combinations of these using Boolean operators. A first round of this review was carried out in spring 2021. The procedures of this are reported in Lohne et al. (2021a). A second supplementary review was carried out in the summer of 2022, focussing mainly on updating the results of the first round of review through snowballing techniques as outlined by Wohlin (2014).
In addition to the above, the Special Issue on Research Methodologies in Construction Engineering and Management (Journal of construction engineering and management January 2010) was given particular attention. Representing what we perceive as the state-of-the-art for general issues about CEM research, insights of potential applicability to the particularities involved in studying "dark side"-phenomena were actively searched for.

3.3 Workshops

Workshops were the second primary methodological approach to the paper. These were carried out through assessments of different aspects of the subject matter among the paper's authors. The participants contributed directly to the elaboration of the specific sections falling under their main area of expertise.
The main theme of the workshops was the relationship between the experiences stemming from the work with the different publications constituting the parts of the research program and the insights provided from the research literature. Emphasis was continuously lain on tying together concrete research experiences with theoretical insights.

4 Results

In the following, section 4.1 presents results from the international context based on the literature review carried out. Section 4.2 provides an overview of methodological recommendations identified from the international literature. Finally, section 4.3 presents experiences from the different research projects within the research program *Mapping opportunities for criminal behaviour in the Norwegian BAE industry*.

4.1 Challenges to "dark side research" and their methodological responses

As can be observed, a main trend within the scholarly literature is to base empirical data-gathering on surveys of different sorts. The predominant use of surveys is not surprising, given insights from the criminology and criminal justice field. Kleck et al. (2006) describe how no other method rivals survey methodology for gathering information on crime, criminals, and society's reaction to crime. Their material spanned the seven most recognised journals within the field. They found that some kind of

formal survey was used to generate information in 45 percent of all empirical research articles published. Archival data, mostly drawn from criminal justice records, was used in 32 percent of the articles, and official statistics concerning macro-level units, which were used in 26 percent of articles. Experimental research generated data for only 4 percent of the articles published in the seven journals. Likewise, the principal tools used in qualitative field research, informal interviews and direct observation, were used in only 12 percent of the research. However, even this modest figure overstated the prevalence of research that was primarily qualitative. Articles using these methods were primarily quantitative articles supplemented with a handful of informal interviews, such as statistical analyses of sentencing patterns supplemented by a few interviews with judges.
Copes et al. (2020 later followed up on this analysis. They found that although the number of published qualitative articles has risen, the relative percentage remained relatively stable. During the period examined (2010-2019), 11.3% of all articles in the 17 criminology and criminal justice journals used qualitative methods.
Still, other approaches are present, such as core-periphery social network analysis (Reeves-Latour and Morselli, 2017) and document analysis of secondary sources (Hajikazemi et al., 2020). In addition, recommendations for further and alternative research approaches can be found.

The use of surveys – scope

Most of the sources examined based parts or the entire analysis on the use of surveys. The scope and content of these varied. On the slighter side, Sichombo et al. (2009), for instance, had sixty questionnaires distributed with a response rate of 82%, a number that was "determined to be acceptable" (2009:824). For Vee and Skitmore (2003), a targeted sample of 75 various compagnies and individual practices in a major Australien conurbation area was selected randomly. A total of 31 (42 per cent) valid responses were received.
The survey carried out by Bowen et al. (2012), on the other hand, had a different amplitude, with 11608 distributed questionnaires, 493. Out of these responded 176/36% to the open-ended questions included in the questionnaire. The questionnaire survey was web-based and used to elicit the perceptions of clients and construction industry professionals regarding the nature and extent of corruption.

The use of surveys – ambitions

For Sichombo et al. (2009), the "questionnaire adopted closed-ended questions with a few provisions for open-ended questions to elicit any other relevant information from the respondents" (2009:824). The use of this approach was chosen based on the insight that «[u]nethical practices are generally concealed, and as such respondents could give inadequate information for fear of being quoted. […] To minimise inadequacies in elicited information, a self-administered questionnaire was adopted for data collection. Respondents were assured of anonymity and were urged to be as open as possible in order to enhance the confidence that could be derived from the results of the study (2009:824)». For Bowen et al. (2012), "[b]eyond the quantitative evidence sought through the survey instrument design, it was thought that a more invitational, open-ended approach to data collection might yield additional value by capturing the direct experiences of people involved in the processes and products of the construction industry. The survey participants were invited, through the use of open-ended question options, to provide relevant information. These data are not susceptible to straightforward quantitative analysis, and the content of the verbatim responses is thus dealt with thematically in this paper" (2012:888).

Other methodological approaches

Reeves-Latour and Morselli (2017) based their analysis "on a core-periphery social network analysis" (2017:158), where "the study monitors irregular bidding indicators across a data set compiled from more than 7000 public construction tenders that were processed by the city [of Laval, Quebec] from 1966 to 2013" (2017:158). "This study is based on a strategic case study of the city of Laval's construction industry across five decades. […] [I]ts focus has become a greater issue due to a heightening scandal that publicised systemic collusion and corruption involving construction industry entrepreneurs, civil

servants, and public officials across multiple Quebec municipalities. […] The city of Laval emerged as one of the more important focal points of this scandal" (2017:160).
Hajikazemi et al. (2020), based their analysis on "a processual single case study approach" (2020:1127) with main source of information "secondary data" (2020:1127)."The approach for this study was qualitative ad the empirical data was derived from publicly available information including: (1) Annual report and accounts documents published by Carillion from year 2000 to 2016, (2) Selection of relevant articles published by the House of Commons and the National Audit Office on Carrillion between years 2016 and 2019, (3) Selection of relevant articles published in electronic periodicals and newspapers on the case of Carillion between years 2016 and 2018 (a total of approximatively 120 articles) including the Guardian, BBC and Financial Times, which have monitored the company closely over these years" (2020:1127).

Validity and reliability

Representativity was actively sought for. For Vee and Skitmore (2003), for instance, the survey was deigned to provide "the results of a small, but representative, questionnaire survey of typical project managers architects and building contractors concerning their views and experience son a range of ethical issues surrounding construction industry activities" (2003:117).
For Hajikazemi et al. (2020), "Concerning the validity and reliability of this research, the use of secondary data, archival records and documentation, has both upsides and downsides. […] The use of archival data can […] be considered as particularly suitable for studying longitudinal event chronologies (Langley *et al.* 2013). However, typically archival and documentary data are completed with other types of evidence such as interview for the purposes of triangulation. Hence, our sources of evidence may potentially affect the validity of our findings (Yin 1989)" (2020:1128).

Information brought up by the use of the methods chosen

For Sichombo et al. (2009), the research unraveled that "[e]conomic crimes or unethical practices are usually concealed. Due to the complex nature of construction, diversity of skills and the sheer size of some projects, coupled with long execution periods, it is very difficult for anyone who does not understand construction processes and procedures to uncover illegal activities" (2009:824). Vee and Skitmore (2003) reported that "[n]o respondent was aware of any cases of employers attempting to force their employees to initiate, or participate in, unethical conduct. Despite this, all the respondents had witnessed or experienced some degree of unethical conduct, in the form of unfair conduct, negligence, conflict of interest, collusive tendering, fraud, confidentiality and propriety breach, bribery and violation of environmental ethics" (2003:117). Perhaps even more interestingly, their material shows a change in who is actually carrying out "dark side" activities. "The research indicated and confirmed the types of ethical impropriety that exist. Also confirmed is the continuing role of contractors as champions of unethical behaviours. What is new, however, is the emergence of clients and government bodies as contenders in the unethical stakes. This group of traditionally highly influential leaders in the development of construction industry practices, seem to have moved dramatically in recent years away from setting the highest standards to a form of economic rationalism that is virtually devoid of any ethical consideration at all" (2003:126).

4.2 Recommendations for methodological practices

Locatelli et al. (2020), for one, maintain that phenomena concerning what they denote the "dark side of projects" – all things bad, immoral, and/or unethical – are inherently difficult to examine. Moreover, most illicit exchanges are conducted behind closed doors, making it practically impossible for researchers or authorities to monitor such behaviour (Reeves-Latour and Moselli (2017)). Still, several of the above-cited authors provide recommendations for future methodological practices.

The use of secondary data.

Locatelli et al. (2022) underline the use of secondary data sources – "investigative journalist materials, regulators and governmental agencies' documentation, parliamentary enquiries, and judicial cases" – as a manner by which to overcome challenges of obtaining reliable primary data. "Data are difficult to obtain, and their quality and trustworthiness can be questionable and difficult to verify". This difficulty especially concerns the gathering of empirical data and its trustworthiness.

Positive perspective

Another possibility outlined by Locatelli et al. (2022) is what they call a "positive perspective" on the research approach. For example, "in investigating modern slavery, asking questions such as: "Which policies in your company prevent modern slavery?" or "What would you do if you learned that a subcontractor was employing modern slavery?".

Interdisciplinary collaboration

That the PM scholars have not appropriately taken into account key phenomena within "dark side" challenges does not mean that they are unknown to research. Locatelli et al. (2022) underline, for instance, while studies on money laundering are scarce within project studies, "it is an established field per se; the *Journal of Money Laundering Control* is an established peer-reviewed journal indexed in Scopus". There is, in other words, the potential for associating with a research community outside the strict boundaries of project studies.

4.3 Methodological practices in the research projects of the program

Within the research program, the potential for criminal activity in the Norwegian AEC industry has been observed within a wide range of optics, varying from white-collar criminals to illicit workers at the construction site, potentially using below-grade materials in building projects. The program has also highlighted the role of rules, regulations and ethical awareness amongst the actors.
Consequently, a certain disparity between the different contributions can be observed in the methods employed. Most studies were based on case studies of individual projects or sets of comparable projects – following the prescriptions of Yin (2013) – and combined semi-structured interviews with literature reviews and document studies. The research processes that utilised these methods are described in the individual studies respectively (for an overview, see Lohne et al. *Forthcoming*). Three studies (Lohne et al. 2019b; Drevland et al., 2017; Lohne et al, 2016) were entirely theoretical. These were carried out as desk-top studies based on industry knowledge and relevant literature gathered from the fields of project management, supply chain management, and ethics theory. One study (Lohne et al., 2017a) presented a desk-top study of university curriculums following insights from Krippendorf (2013).

4.3.1 Indirect approaches to the phenomena scrutinised

Following Tourangeau et al. (2000), three psychological dimensions typically impact respondents' willingness to answer a sensitive question accurately and honestly, notably 1) the social (un)desirability of the response, 2) the intrusiveness of the inquiry, and 3) the perception of disclosure to third parties. Investigations into "dark side" phenomena will involve all these three dimensions. Direct questioning concerning these phenomena will then typically trigger non-responsiveness from interviewees. Different approaches are needed.
Another strategy for obtaining valid responses pertaining to sensitive behaviours is indirect questioning techniques. As Krebs et al. (2011) maintain, in indirect questioning, the respondent is asked a series of questions that, while not eliciting individual-level data about an event or behaviour of interest, enable prevalence estimation of the event or behaviour for the sample of respondents. Such approaches are thought to increase the validity in particularly sensitive behaviours, since respondents are not asked to

report directly about their own behaviour, thereby avoiding the psychological dimensions to question sensitivity.
All case studies and other studies involving interviews within the research program used indirect approaches. The primary approach to the questioning was to try to understand the room for manoeuvre – or opportunity space – for actors within the interviewee's position. Such semi-hypothetical questioning served surprisingly well in many circumstances. Actors without real previous awareness that their role could be used to promote "dark side" phenomenon developed potential pathways for dubious actors filling these same or similar roles. A good example of this can be found in Øversveen (2022), illustrating the potential for illicit actions for quality assurer relatively low in the hierarchical structure of the contractor organisation.

4.3.2 Experiences from the conduct of interviews

The literature review found that the literature scrutinised discussed only to a very limited extent – if at all – the practical conduct of interviews concerning "dark side" phenomenon. During the research program, several insights of a practical nature materialised, and these are summarised in what follows.

The personal touch – prior knowledge of interviewees

The field of research has proved, not surprisingly, challenging to explore through the use of interviews. In one of the articles (Lohne et al., 2017), the limits to common approaches to interviewing commonly used, as outlined in Yin (2013), were made obvious. Two master's students of project management carried out the initial academic footwork of the research in Lohne et al. (2017). Unfortunately, this initial research did not yield noteworthy results – the students found the respondents unwilling to comment on the questions concerning ethics. Consequently, a more personal approach was chosen, where two of the authors contacted colleagues with whom they shared professional backgrounds. This approach proved more fruitful. Still, the value-laden questions necessitated a certain period of convincing before the interviewees revealed pertinent information. Therefore, the interviews were carried out over a period of one year.

Learning from police interrogation techniques

One example of an alternative approach can be found in Gunnerud et al. (2019). "Owing to the sensitivity of the subject, the interview guide was adjusted to align with the principals of KREATIV (Bjerknes & Fahsing, 2018), an explorative questioning method of police examination used by the Norwegian police, developed from the PEACE framework of Milne & Bull (1999). The questioning encourages interviewees to elaborate on a subject from different angles and approaches, making it difficult for them to omit important information and eventually forcing them to share information otherwise kept secret. Combining KREATIV and Yin's recommendations gives a more extensive and time-consuming interview". This approach was equally followed by Evjen et al. (2019), proving efficient in identifying and clarifying potentially sensitive themes.

Sensitivity to time

One main experience drawn from the interviewing was that there was a considerable difference between the time needed for interviews in the different research projects forming the program. In Kennedy (2022) (N=10), for instance, interviews lasted around 30 minutes. In terms of the vocabulary of Yin, these might then be called focused interviews rather than in-depth interviews. However, this notion only reflects part of the reality of the interview situation, the interviewees of Gamit (2022) were all in subordinate positions. All interviews were carried out during breaks, such as during lunch hours. It was then simply not more room for lengthy interviews. Themes pertaining to the particular characteristics of interview objects within the AEC industry are rarely mentioned, apart from general underlining of the challenges involved in actually getting people to talk. However, such general complaints surpass the materiality of the challenges involved. Not only do the people of interest to the researcher have little time, but they are also often hard-pressed for space where interviews can be conducted in private. Talking freely under

part or full scrutiny of superiors is rarely easy when it comes to touchy themes. It seems reasonable, therefore, to adapt a "get as much information as you can"-approach to the interviewing within such circumstances.

Informal interviews

Another perspective that seems to have gained little attention in the literature is the role that the interviewer's experience can play. In a series of papers, a dialogic approach was chosen by one of the authors, a senior researcher with almost four decades of experience in the AEC industry (Lohne and Mohn (2022a, *in press*); Mohn and Lohne (2022, *in press*); Lohne and Mohn (2022b, *in press*)). As underlined by Robson and McCartan (2016), informal interviews are non-standardised, open-ended, and in-depth. A key element of this approach is the use of interview guides which are less extensive and detailed than in the semi-structured in-depth interviews outlined by Yin (2014) – the latter being the form chosen in all other interview-based projects within the research program. The key ambition for such interviews is to make interviewees speak freely and use their own terms about the subjects brought to discussion mainly by the interviewer, thus leaving ample space for subjects that are felt to be of particular relevance to the interviewee. In the interviews reported on in the three publications mentioned above (Lohne and Mohn (2022a, *in press*); Mohn and Lohne (2022, *in press*); Lohne and Mohn (2022b, *in press*)), the interviewing time ranged from 1.5-2.5 hours and were conducted on a one-to-one basis. All personal information was entirely anonymised and randomised.
As Robson and McCartan (2016) maintain, informal interviews are not an easy option for the novice. The interviewees subjected to this kind of interviewing generally stand out with their experience and standing within a professional community, and are thus characterised by a deep understanding of the phenomena under discussion. Overseeing the veritable importance of elements discussed or being unaware of personal or professional interests of the interviewee is always a danger that can lead to significant misapprehension.

4.3.3 Literature reviews

The literature scrutinised was found to discuss only to a very limited extent – if at all – the practical use of literature reviews for understanding the specific fields concerning "dark side" phenomenon under examination. All of the research resulting in individual papers within the cadres of the research program contained a combination of literature reviews pertaining to the "dark side" in general, and to the specific subject matter in particular. Gamit (2022), for instance, focused his literature review on "dark side" aspects of Operation and Maintenance (O&M) During the research program, however, several insights of a practical nature materialised, and these are summarised in what follows.

The case for scoping reviews

The main approach chosen for the literature studies has been different variants of scoping literature reviews, as proposed by Arksey and O'Malley (2005), further elaborated by Levac et al. (2010), Daudt et al. (2013), and Colquhoun et al. (2014).
In carrying out the scoping literature reviews, the following insight from Arksey and O'Malley (2005, p. 20) guided the authors' approach:
So what might we consider to be the main differences between a systematic review and a scoping study? First, a systematic review might typically focus on a well-defined question where appropriate study designs can be identified in advance, whilst a scoping study tends to address broader topics where many different study designs might be applicable. Second, the systematic review aims to provide answers to questions from a relatively narrow range of quality assessed studies, whilst a scoping study is less likely to seek to address very specific research questions nor, consequently, to assess the quality of included studies.
In the authors' understanding, a systematic review employs a highly specific delimitation of relevant literature to be examined. In addition, it adds an evaluation of the quality of the research identified, and the recommendations it provides are based on a qualitative synthesis of all the evidence or only the high-quality evidence. In contrast to this, a scoping study includes a tentative integration of all relevant

evidence from the field of research. The theme of crime in the construction industry appears to be little researched. Correspondingly, the literature review carried out has had a broad approach, aiming to identify both sources of relevance within the academic and non-academic (gray) literature. In addition, white papers were scrutinised for information concerning the subject matter. The authors have, in fact, tried to create an inventory of research findings available through common research engines according to the research scope defined.
An early example of this approach can be found in Lohne et al. (2019). This article, with a main purpose of identifying research trends and themes, covered 376 articles, papers and grey literature of high relevance. A key insight from conducting this research was that the investigation of such a high number of written sources is difficult to handle. Following this, later scoping literature reviews conducted under the supervision of the main author of this paper (see for instance Stagrum et al., 2020; Prabowo et al., 2021; Fahlstedt et al., 2022) have limited their number of sources examined to approximatively 80-100. This number has proved sufficient to understand the main trends and loopholes in the literature, whilst being sufficiently restrained to allow the authors to be in control over their subject.

Figurative representations of the research process

A note is here necessary to make concerning the figurative representations of the research process leading to the final sample examined. A main finding from the research literature in general is that understanding both the reliability and the validity of research carried out is challenging due to a widespread phenomenon of flow-diagrams that typically are too general in nature for it to actually be able to follow the research procedure in detail. The importance of graphic illustrations of the research process, it seems, a theme that is little understood in parts of the editorial teams of relevant journals for the subject matter presented here. In the case of Xue et al. (2020), for instance, the original detailed illustration of the research process was removed after a clear recommendation from the reviewers. The research process illustrations found in Fahlstedt et al. (2022) and Engebø et al. (2020) correspond to what the authors of this paper consider best practice.
The note on graphic illustrations is crucial for mapping and understanding sources within fields pertaining to the "dark side" of projects. As grieved over within several publications, there has been a clear lack of research interest within this field – a lack reflected in a very limited number of publications found in respected journals.
Consequently, those interested in gathering practical and theoretical insights within this field are pushed towards closer scrutiny of grey literature than what is common within construction management research. Although, as is commonly known, the grey literature is far more heterogeneous than the research literature, it is highly varying in quality, methods, scope, intended audience, and thematic orientation. Navigating in such a landscape is inherently tricky. Therefore, both describing clearly in the methodological procedures chosen (see for instance Engebø et al. (2020) about supplementing the procedures described by Arksey and O'Malley (2005) with contributions from Levac et al. (2010), Daudt et al. (2013), and Colquhoun et al. (2014)) and good figural representations of research procedures are essential for being able to assess the literature found.

Implications for the use of search engines

As described above, questions pertaining to "dark side" phenomenon have been little researched in the research literature. Therefore, a significant part of the relevant literature is to be found in non-academic publications stemming from official bodies and NGOs. Moreover, the question of the availability of alternative sources of information has been found to be little thematised within the research literature.
On a practical level, this has been found to have consequences for the choice of search engines. Other than competence building (the gathering of a library of publications from diverse bodies) within the research program, the importance of including "grey" literature (here understood as non peer-reviewed literature) has been found to be crucial. Several search engines have been tried out and utilised throughout the process; not surprisingly, Google Scholar has turned out to constitute the richest source of "grey" literature of relevance.

5 Discussion and conclusion

In this paper, we set out to address

- What are the main recommendations for research methodologies found in the contemporary research literature?
- What are the main challenges identified with these proposed practices?
- What measures can be envisaged to improve methodological practices?

As outlined, the literature review reveals that little systematic effort has been put into the guidance of practical research on delicate fields of investigation in the AEC industry from an industry structure perspective. Debates are often found at a level of abstraction that renders them inaccessible or uninteresting to the research community. It seems that there are discrepancies between the typical object of research and adequate research methods. Still, increased openness to new methodological approaches over the last years have opened the field for more appropriate approaches. These approaches seem not, however, to have been exploited to any significant degree within the international research literature. Still, surveys are the most commonly used research method. Very little use has been made of qualitative techniques such as interviews etc.

The limited use of qualitative techniques seems to leave loopholes in the understanding of the phenomena scrutinised. As several authors comment, it is difficult to obtain valid and reliable information concerning touchy subject matters. Still, not exploiting the best available tools for knowledge gathering cannot be considered a good way ahead.

Therefore, there is a need for a broad reflection within the different research communities concerning best practices for research methods for construction management in general, and all subjects pertaining to the "dark side" in particular. Without proper insight, research on facilities management will not be able to capture the nature and extent of "dark side" phenomenon. The methodological approaches outlined from the research program are here to be understood as essays to surpass the challenges observed. Keywords for this effort are understanding the potential role of informal interviews, exploiting prior knowledge of interviewees, learning from from police interrogation techniques and being sufficiently sensitive to temporal aspects of interview situations. In addition, the use of scoping reviews based on search engines that take in grey literature is highly recommended for understanding the state of the art of the subject matter at hand. Furthering the efforts in the directions indicated will serve to shed appropriate light on the "dark side" of the construction industry.

Competing interests

The authors have no competing interests to declare that are relevant to the content of this article.

Bibliography

Abowitz, D. A., & Toole, T. M. (2010). Mixed method research: Fundamental issues of design, validity, and reliability in construction research. Journal of construction engineering and management, 136(1), 108.

Agyekum-Mensah, George; Reid, Andy; and Temitope, Titiloye Ayodeji (2020). Methodological pluralism: Investigation into construction engineering and management research methods. Journal of construction engineering and management, 146(3).

Ambraseys, N., & Bilham, R. (2011). Corruption kills. *Nature*, *469*(7329), 153-155.

Andersen, R.K., L. Eldring and J. Røed Steen, 2014. «Privatmarkedet i byggenæringen – Usynlig arbeidsmarked i de tusen hjem». Fafo-rapport 2014:14. Oslo: Fafo.

Azhar, S., Ahmad, I., & Sein, M. K. (2010). Action research as a proactive research method for construction engineering and management. Journal of construction engineering and management, 136(1), 87-98.

Ballard, G. & Howell, G., (1998) What kind of Production is Construction? Proceedings IGLC '98

Behling, F., and M. Harvey. 2015. "The evolution of false self-employment in the British construction industry: A neo-Polanyian account of labour market formation." Work Employment Soc. 29 (6): 969–988.

Bengtsson, E. 2014. "Social dumping cases in the Swedish Labour Court in the wake of Laval, 2004–2010." Econ. Ind. Democracy 37 (1): 23–42.

Bernaciak, M. 2016. "Polish trade unions and social dumping debates." Transfer: Eur. Rev. Labour Res. 22 (4): 505–519. https://doi.org/10 .1177/1024258916667017

Bjerknes, O.T. & Fahsing, I.A. (2018) Etterforskning – prinsipper, metoder og praksis Fagbokforlaget
Bowen, P. A., Edwards, P. J., & Cattell, K. (2012). Corruption in the South African construction industry: A thematic analysis of verbatim comments from survey participants. Construction Management and Economics, 30(10), 885–901. doi: 10.1080/01446193.2012.711909.
Bredillet, C. (2014). Ethics in project management: some Aristotelian insights. International Journal of Managing Projects in Business.
Chan, A. P., & Owusu, E. K. (2017). Corruption forms in the construction industry: Literature review.Journal of Construction Engineering and Management, 143(8), 04017057.
CIOB (Chartered Institute of Building). 2009. "Crime in the construction industry." Accessed September 2019. www.ciob.org/.
Colquhoun, H. L., Levac, D., O'Brien, K. K., Straus, S., Tricco, A. C., Perrier, L., Kastner, M., & Moher, D. (2014). Scoping reviews: time for clarity in definition, methods, and reporting. Journal of Clinical Epidemiology, 67(12), 1291–1294.
Copes, H., Beaton, B., Ayeni, D. et al. A Content Analysis of Qualitative Research Published in Top Criminology and Criminal Justice Journals from 2010 to 2019. Am J Crim Just 45, 1060–1079 (2020). https://doi.org/10.1007/s12103-020-09540-6
Cusset, Francois (2005) French Theory - Foucault, Derrida, Deleuze et Cie et les mutations de la vie intellectuelle aux États-Unis, La Découverte, ISBN-102707146730
Dainty, A. (2007, July). A review and critique of construction management research methods. In Proceedings of Construction Management and Economics 25th Anniversary Conference, University of Reading, July (pp. 1533-1543).
Daudt, H. M. L., van Mossel, C., & Scott, S. J. (2013). Enhancing the scoping study methodology: A large, inter-professional team's experience with Arksey and O'Malley's framework. BMC Medical Research Methodology, 13(1), 48. https://doi.org/10.1186/1471-2288-13-48
Drevland, F., Lohne, J., & Klakegg, O. J. (2017, July). Ethical dilemmas in value delivery: Theoretical conditions. In 25th Annual Conference of the International Group for Lean Construction (Vol. 1, pp. 145-152).
Dubois, A., & Gadde, L. E. (2002). The construction industry as a loosely coupled system: implications for productivity and innovation. Construction management & economics, 20(7), 621-631
Engebø, A., Lædre, O., Young, B., Larssen, P. F., Lohne, J., & Klakegg, O. J. (2020). Collaborative project delivery methods: A scoping review. *Journal of civil engineering and management*, *26*(3), 278-303.
Evjen, S., Gunnerud, G., Lædre, O., Søfting, R. and Lohne, J. (2019), "Sub-Contractors' Perception of Contracting: The Case of Crime", Lill, I. and Witt, E. (Ed.) 10th Nordic Conference on Construction Economics and Organization (Emerald Reach Proceedings Series, Vol. 2), Emerald Publishing Limited, Bingley, pp. 59-67. https://doi.org/10.1108/S2516-285320190000002059
Fahlstedt, O., Temeljotov-Salaj, A., Lohne, J., & Bohne, R. A. (2022). Holistic assessment of carbon abatement strategies in building refurbishment literature—A scoping review. *Renewable and Sustainable Energy Reviews*, 112636.
Fromentin, V. 2016. "The global economic crisis and migrant workers: The case of the construction sector in Europe." Int. Econ. J. 30 (1): 147–163. https://doi.org/10.1080/10168737.2014.894550.
Gamit, Kennedy A. (2022), Ensuring Ethical FM Services Performance Control, Master's thesis in Project Management, NTNU
Gibson Jr, G. E., & Whittington, D. A. (2010). Charrettes as a method for engaging industry in best practices research. Journal of Construction Engineering and Management, 136(1), 66-75.
Glass, G. V. (1976). Primary, secondary, and meta-analysis of research. *Educational researcher*, *5*(10), 3-8.
Golden, S. K., and M. J. Skibniewski. 2010. "Immigration and construction: Analysis of the impact of immigration on construction project costs." J. Manage. Eng. 26 (4): 189–195. https://doi.org/10.1061/(ASCE)ME .1943-5479.0000021.
Gomes Araújo, L., & Lucko, G. (2022). Best Practices for Case Studies in Construction Engineering and Management Research. Journal of Construction Engineering and Management, 148(8), 04022062.
Gunduz, M. and Önder, O. (2012), "Corruption and internal fraud in the Turkish construction industry", Science and Engineering Ethics, Vol. 19 No. 2, pp. 505-528
Gunnerud, G., Evjen, S., Søfting, R., Lædre, O., Kjesbu, N., & Lohne, J. (2019). Project Managers: Gatekeepers or Inside Men? In 10th Nordic Conference on Construction Economics and Organization. Emerald Publishing Limited.
Hajikazemi, S., Aaltonen, K., Ahola, T., Aarseth, W., & Andersen, B. (2020). Normalising deviance in construction project organizations: a case study on the collapse of Carillion. Construction Management and Economics, 38(12), 1122-1138.
Hallowell, M. R., & Gambatese, J. A. (2010). Qualitative research: Application of the Delphi method to CEM research. Journal of construction engineering and management, 136(1), 99.

Harriss, C. (1998) Why research without theory is not research: A reply to Seymour, Crook and Rooke. Construction Management and Economics, 16(1), 113-116.
Hjelmbrekke, H., Hansen, G. K., & Lohne, J. (2015). A motherless child–Why do construction projects fail. Procedia Economics and Finance, 21, 72-79.
Hodgson, D., & Cicmil, S. (2008). The other side of projects: the case for critical project studies. International Journal of Managing Projects in Business.
Hughes, W. (1994) The PhD in construction management. In: Proceedings of the 10th Annual ARCOM Conference, 14-16 September, Loughborough.
Kleck, G., Tark, J., & Bellows, J. J. (2006). What methods are most frequently used in research in criminology and criminal justice? Journal of Criminal Justice, 34(2), 147-152. https://doi.org/10.1016/j.jcrimjus.2006.01.007
Krebs, C. P., Lindquist, C. H., Warner, T. D., Fisher, B. S., Martin, S. L., & Childers, J. M. (2011). Comparing sexual assault prevalence estimates obtained with direct and indirect questioning techniques. Violence Against Women, 17(2), 219-235.
Leicht, R. M., Hunter, S. T., Saluja, C., & Messner, J. I. (2010). Implementing observational research methods to study team performance in construction management. Journal of Construction Engineering and Management, 136(1), 76-86.
Levac, D., Colquhoun, H., & O'Brien, K. K. (2010). Scoping studies: advancing the methodology. Implementation Science, 5(1), 69. https://doi.org/10.1186/1748-5908-5-69
Locatelli, Giorgio, Mariani, Giacomo, Sainati, Tristano, Greco, Marco (2017). Corruption in public projects and megaprojects: There is an elephant in the room! International Journal of Project Management, Vol 35 (3), pp 252-268.
Locatelli, Girogio; Geraldi, Joana; Konstantinou, Efrosyni; Sainati ,Tristano (2020), «The Dark Side of Projects - Uncovering Slavery, Corruption, Criminal Organizations, and Other Uncomfortable Topics», Special issue call for papers, Project Management Journal
Locatelli, G., Konstantinou, E., Geraldi, J., & Sainati, T. (2022). The dark side of projects: Dimensionality, research methods, and agenda. Project Management Journal, 53(4), 367-381.
Lohne, J., Drevland, F., Åsgård, T., Hoven, T., Lædre, O., & Ryum, T. (2017a). Homines Oeconomici or moral saints? On the purpose of educating civil engineers. In Proceedings of the 9th Nordic Conference on Construction Economics and Organization (pp. 362-374).
Lohne, J., Svalestuen, F., Knotten, V., Drevland, F. O., & Lædre, O. (2017b). Ethical behaviour in the design phase of AEC projects. International Journal of Managing Projects in Business.
Lohne, J., Kjesbu, N. E., Engebø, A., Young, B., & Lædre, O. (2019). Scoping literature review of crime in the AEC industry. *Journal of Construction Engineering and Management*, *145*(6), 03119002.
Lohne, J., Engebø, A., & Lædre, O. (2020). Ethical challenges during construction project handovers. International Journal of Project Organisation and Management, 12(1), 31-53.
Lohne, Jardar; Gamit, Kennedy; and Temeljotov Salaj, Alenka (2021a) Ethics in the use phase of building projects – a scoping review, CIRRE 2021, conference of Interdisciplinary Research on Real Estate (6 ; 2021 ; Enschede), ISBN 978-961-94204-8-5 COBISS.SI-ID 90318339
Lohne, J., Drevland, F., and Lædre, O. (2021b). "Agency problems as a driver for crime in the AEC-industry" Proc. 29 th Annual Conference of the International Group for Lean Construction (IGLC29), Alarcon, L.F. and González, V.A. (eds.), Lima, Peru, pp. 383–392, doi.org/10.24928/2021/0123, online at iglc.net.
Lohne, J., Torp, O., Andersen, B., Aslesen, S., Bygballe, L., Bølviken, T., ... & Lædre, O. (2022). The emergence of lean construction in the Norwegian AEC industry. Construction Management and Economics, 40(7-8), 585-597.
Lohne, J. and Mohn. K (2022a) On transparency in construction industry materials value chains, 12th Nordic conference on construction economics and organization, in press.
Lohne, J. and Mohn, K. (2022b) Silos and transparency in construction industry materials supply chains, 14th European conference on product and process modelling, in press.
Lohne, J., Klakegg, O.J. & Lædre, O. Forthcoming. Understanding the potential for criminal activity in the Norwegian AEC industry – a building process perspective. *Journal of Construction Engineering and Management*, DOI: 10.1061/(ASCE)CO.1943-7862.0002416.
Milne, B., & Bull, R. (1999). Investigative interviewing: Psychology and practice. Wiley.
Mohn, K and Lohne, J. (2022) Chaos and black boxes – barriers to traceability of construction materials, 14th European conference on product and process modelling, in press.
Panas, A., & Pantouvakis, J. P. (2010). Evaluating research methodology in construction productivity studies. *The Built & Human Environment Review*, *3*(1), 63-85.
Phelps, A. F., & Horman, M. J. (2010). Ethnographic theory-building research in construction. *Journal of construction engineering and management*, *136*(1), 58-65.
Prabowo, B. N., Salaj, A. T., & Lohne, J. (2021). Urban Heritage Facility Management: A Scoping Review. *Applied Sciences*, *11*(20), 9443.

Reeves-Latour, M., & Morselli, C. (2017). Bid-rigging networks and state-corporate crime in the construction industry. *Social Networks*, 51, 158-170.
Rooke, J., Seymour D. and Crook, D. (1997) Preserving methodological consistency: a reply to Raftery, McGeorge and Walters. Construction Management and Economics, 15(5), 491-494.
Roper, K., & Payant, R. (2014). The facility management handbook. Amacom.
Runeson, G., 1997. The role of theory in construction management research: comment. Construction management and economics, 15 (3), 299–302.
Sankey, H., 1993. Kuhn's changing concept of incommensurability. The British journal for the philosophy of science, 44 (4), 759–774.
Seymour, D., and Rooke, J., 1995. The culture of the industry and the culture of research. Construction management and economics, 13 (6), 511–523.
Seymour, D., Crook, D. and Rooke, J. (1997) The role of theory in construction management: a call for debate. Construction Management and Economics, 15(1), 117-119.
Sherratt, F., & Leicht, R. (2019). Unpacking ontological perspectives in CEM research: everything is biased. Journal of construction engineering and management, 146(2).
Sichombo, B., Muya, M., Shakantu, W., & Kaliba, C. (2009). The need for technical auditing in the Zambian construction industry. International Journal of Project Management, 27(8), 821-832.
Slettebøe, A., H. Buseth, B. Gangås, E. Wold, N. Mo, S. Melleby and E. Anskau, 2003. «Seriøsitet i byggenæringen». Oslo: Fafo.
Stagrum, A. E., Andenæs, E., Kvande, T., & Lohne, J. (2020). Climate change adaptation measures for buildings—A scoping review. *Sustainability*, *12*(5), 1721.
Taylor, J. E., & Jaselskis, E. J. (2010). Introduction to the special issue on research methodologies in construction engineering and management. Journal of construction engineering and management, 136(1), 1. https://doi.org/10.1061/(ASCE)CO.1943-7862.0000141
Tourangeau, R., Rips, L., & Rasinski, K. (2000). The psychology of survey response. New York: Cambridge University Press.
Vee, C., & Skitmore, C. (2003). Professional ethics in the construction industry. Engineering, Construction and Architectural Management.
Viana, D. D., Formoso, C. T., & Kalsaas, B. T. (2012, July). Waste in construction: a systematic literature review on empirical studies. In ID Tommelein & CL Pasquire, 20th Annual Conference of the International Group for Lean Construction. San Diego, USA (pp. 18-20). sn.
Vrijhoef, Ruben (2011) Supply chain integration in the building industry - The emergence of integrated and repetitive strategies in a fragmented and project-driven industry, Delft University Press, ISBN 978-1-60750-962-2 (print)
Yin, R. (2014) Case study research: design and methods. 5th edition. USA: SAGE Publications.
Xue, Y., Temeljotov-Salaj, A., Engebø, A., & Lohne, J. (2020). Multi-sector partnerships in the urban development context: A scoping review. Journal of cleaner production, 268, 122291.
Zitkiene, R., Z. Karazijiene, and E. Kazlauskiene. 2016. "Problems in assessing the expression of illegal work from the aspects of economic activity and policy in the EU." Eng. Econ. 27 (1): 66–77. https://doi.org /10.5755/j01.ee.27.1.8840.
Wohlin, C. (2014) 'Guidelines for snowballing in systematic literature studies and a replication in software engineering', in Proceedings of the 18th International Conference on Evaluation and Assessment in Software Engineering. Storbritannia: ACM Press, s. 1–10. doi: 10.1145/2601248.2601268.
Wolstenholme, A., S.A. Austin, M. Bairstow, A. Blumenthal, J. Lorimer, S. Mcguckin, S. Rhys Jones, D. Ward, D.Whysall and L.E.Z. Grand, 2009. "Never waste a good crisis: a review of progress since rethinking construction and thoughts for our future". London: Constructing Excellence.
Øversveen, A., Lædre, O., & Lohne, J. (2022). Crime in the AEC-industry: Opportunity space for the quality assurer. Procedia Computer Science, 196, 800-807.

6 Urban resilience in the light of sustainable development of the built environment

Bojan Grum
New university, European Faculty of Law, 1000 Ljubljana, Slovenia
e-mail: bgrum@siol.net
Darja Kobal Grum
Department of Psychology, Faculty of Arts, University of Ljubljana, 1000 Ljubljana, Slovenia

Abstract

The study of urban resilience (UR) in the context of sustainable development (SD) is a relatively new chapter, so we give it our full attention in this article. We seek to link UR and SD by understanding the complexity of current natural and anthropogenic hazards. In our study, we go a step further and create a hypothetical model based on hazards that links the key factors of UR and SD. We set the following two objectives: whether and how research incorporates newly perceived conceptual hazards (pandemic, war) and whether all groups of factors are explored equally and simultaneously. We focused on articles from 2019 – 2022. The study showed that newly perceived conceptual tensions (pandemic, war) related to UR and SD have not been adequately explored. The study confirmed the lack of existing research in the broader context of understanding resilience of the built environment, and thus the lack of studies that provide a foundation and perspective for SD of the built environment. Therefore, we believe that further research should specifically focus on the plurality of approaches to understand the complex interactions, their impacts, and feedbacks in the context of multidimensional urbanization to understand UR as a perspective for SD.

Keywords: urban resilience; sustainable development; build environment; natural hazards; anthropogenic hazards; systematic review

1. Introduction

The resilience of urban environments to ecological, socioeconomic, and political uncertainties has been the subject of sustainable development (SD) research for some time (Meerow et al., 2016; Ribeiro & Pena Jardim Gonçalves, 2019). Today, most of the world's population lives in urban environments, which, as hubs of resource consumption, production centers, and socioeconomic bases, have become laboratories for measuring resilience to various internal and external impacts, both in practice and in theory (Meerow et al., 2016). The term resilience originates from physics and refers to the property of a substance or system to return to its original position after deformation (Cuttles & Burton, 2010). Hollin (1973) used the concept as early as 1973 to define the ability of a natural ecosystem to recover from natural disasters. Since then, the concept has been widely used in the field of urban research, especially in the field of SD of urban settlements, as a promising paradigm to promote disaster risk reduction (Mayer, 2019). Urban settlement resilience, or so-called urban resilience (UR), almost always has a positive connotation that emphasizes the adaptive capacity of the local community (technical, organizational, social, and economic resilience), the flexibility of the socioeconomic paradigm (social, economic, physical, and human capital), and the physical resilience of the built environment (natural capital, physical characteristics of the environment, resource stability, and infrastructure) (Bruneu et al., 2010; Patel et al., 2017). The main objective of UR is to reduce the consequences of disturbances originating from different sources (Riberio & Jardim Gonçalves, 2022).

The concept of resilience encompasses processes related to both natural (e.g., earthquakes, hurricanes, cyclones, drought), and anthropogenic hazards, such as human errors or malicious attacks (Gill & Malamud, 2017; Jha, 2010; Moghim & Garna, 2019). Existing studies in the field of UR focus mainly on the capacity of communities to adapt to natural disasters in the context of climate change (e.g., Asadzadei et al., 2017; Bueno et al., 2021; Coallee, 2008; Cutter et al., 2008; Gaillard, 2010; Jon, 2019; Klein et al., 2003; Leichenko, 2011; Marto et al., 2018; Wang et al., 2014; Zhong, 2020), but there are fewer such studies in public health (Shi et al., 2022) and very few in physical aggression or war (Laakkonen, 2020). The COVID-19 pandemic has encouraged researchers to explore resilience, but mainly from the perspective of human capital resilience, social capital resilience, and system (risk) management (Gu, 2020). Modern societies are often exposed to both exogenous and endogenous threats (Monstadt & Schmidt, 2019). One such example of a completely unexpected risk was the COVID-19 pandemic, which triggered health, social, and economic consequences for cities, higher unemployment rates, changing attitudes toward public spending, accessibility of public services and public facilities, mobility, infrastructure, etc. (Jovanović et al., 2020; Wister & Speechley, 2020). However, other aspects of UR remain unexplored, such as spatial elements, institutional and sociocultural contexts, which also have a strong influence on UR (Shi et al., 2022). Therefore, the aim of our study is to respond to the lack of existing research in the broader context of SD of the built environment and to identify a clear perspective on SD of the built environment considering UR.

SD of the built environment is understood as the synergy of development in three areas: environmental (emission reduction, water conservation, waste reduction, etc.), economic (economic benefits, energy and water savings, property value enhancement, etc.), and social (improved health, better schools, more recreational areas, etc.) (Reddy, 2016). Zhang and Li (2018) thus argue that UR and sustainability are complementary and share several principles. Understanding UR and sustainability of the built environment is therefore essential to address threats in a rapidly changing world (Zeng et al., 2022). Every major crisis, and especially major crises, no matter where they originate in human life, trigger changes in the economic and social fabric, creating new environments, different relationships, and interdependencies (Grum & Kobal Grum, 2020). Because various forces, such as climate change or human encroachment into natural habitats, may increase the frequency of pandemics in the future, there is an urgent need to better understand the patterns and dynamics of pandemic impacts on urban environments and the actions needed to prepare, respond, and adapt (Connolly et al., 2020).

In this context, the recent pandemic provides an unprecedented opportunity to understand how urban cities can be affected by a pandemic and what actions are needed to reduce these impacts and increase

the UR. Leichenko (2011) sorted urban resilience into four categories: urban ecological resilience; urban hazards and disaster risk reduction; resilience of urban and regional economies; and promotion of resilience through urban governance and institutions. Sharifi and Khavarian-Garmsir (2020) summarize the key factors into four main categories: environmental quality (air quality, environmental factors, and water quality), socioeconomic impacts (social and economic impacts), management and governance (governance, smart cities etc.), and transportation and urban design.

Not only COVID-19, but also political instability or even physical aggression on the urban environment (war in Ukraine) affect the resilience of the built environment. Cities have political, economic, and symbolic value, so even an aggressor seeking to undermine an attacked country's political stability, economic vitality, and social stability will find cities attractive targets. On the other hand, cities offer considerable advantages to defenders by serving as sanctuaries, surveillance, and reconnaissance platforms, turning them into fortresses (Amble, 2022). All aggression leads to migration. Although the phenomenon of migration is not a new problem, with its different patterns, it is becoming a force that has significant implications for urbanization due to its complexity and rapid changes in origin, transit, and destinations (Asadzadeh et al., 2022). Inter-racial conflicts, political conflicts, war situations, etc. bring instability and insecurity to urban settlements. They create risks in different dimensions that not only affect the demographic, social, environmental, and economic structure of the city, but also put pressure on the urban macrostructure (Grunewald, 2016). Research on the impact of the 2011 war in Libya found that urban residents developed stronger resilience strategies economically through job creation (Barani & Kahrman, 2019). The study also found that in response to spatial resilience, Benghazi residents have gradually begun to build homes on the outskirts of the city, which in turn puts pressure on the pristine natural environment near the cities (Barani & Kahrman, 2019). A host of studies have examined the vulnerability of the demographic structure of urban settlements by looking at differences in fertility or mortality rates before and after the war (Coale, 1989; Webb, 1963). As Pilav (2012) notes, the 1992 war between Serbia and Bosnia, as a sudden and violent change in the urban situation, led to a new spatial organization, a new understanding of the urban environment, new patterns of movement and traffic, and drastically altered patterns and rhythms within the urban fabric (Pilav, 2012). Several studies have looked at the consequences of migration of people from conflict areas to safer urban areas (e. g. Becker & Ferrara, 2019; Hugo, 2016).

All the hazards of recent years have dictated the need to integrate different skills. Most people are aware that the world is a single entity and that it is no longer enough to control local urban dynamics (Nevejan, 2020). Collaborative scenario building, the development of new tools, disciplines, and solutions is becoming a process that involves all stakeholders in shaping the urban environment (Nevejan, 2020). It points to a transition from a consumer society, where most people expect society to be responsible for their well-being, to a self-determined society, where everyone must take responsibility for what happens (Nevejan, 2020).

The vulnerability of the urban environment because of the war is based on economic hardship (fluctuations in food prices, loss of individual and household income, decline in GDP, etc.) (Collier & Sambanis, 2005). The deterioration of the quality of basic services, the destruction of infrastructure, etc., lead to social discontent and poverty (Khan & Mezran, 2013). Tang Abomo (2019) notes that UR is reflected in the opening of businesses in the postwar period, often run by women from their homes. These are small productive activities that prove to be an important tool for economic recovery (Tang Abomo, 2019). Fahed-Sreih et al. (2010) also noted that the prevalence of these activities reflects the adaptability of the urban environment and indicates the resilience of cities to the harsh economic conditions of war (Fehed-Sreiha et al., 2010).

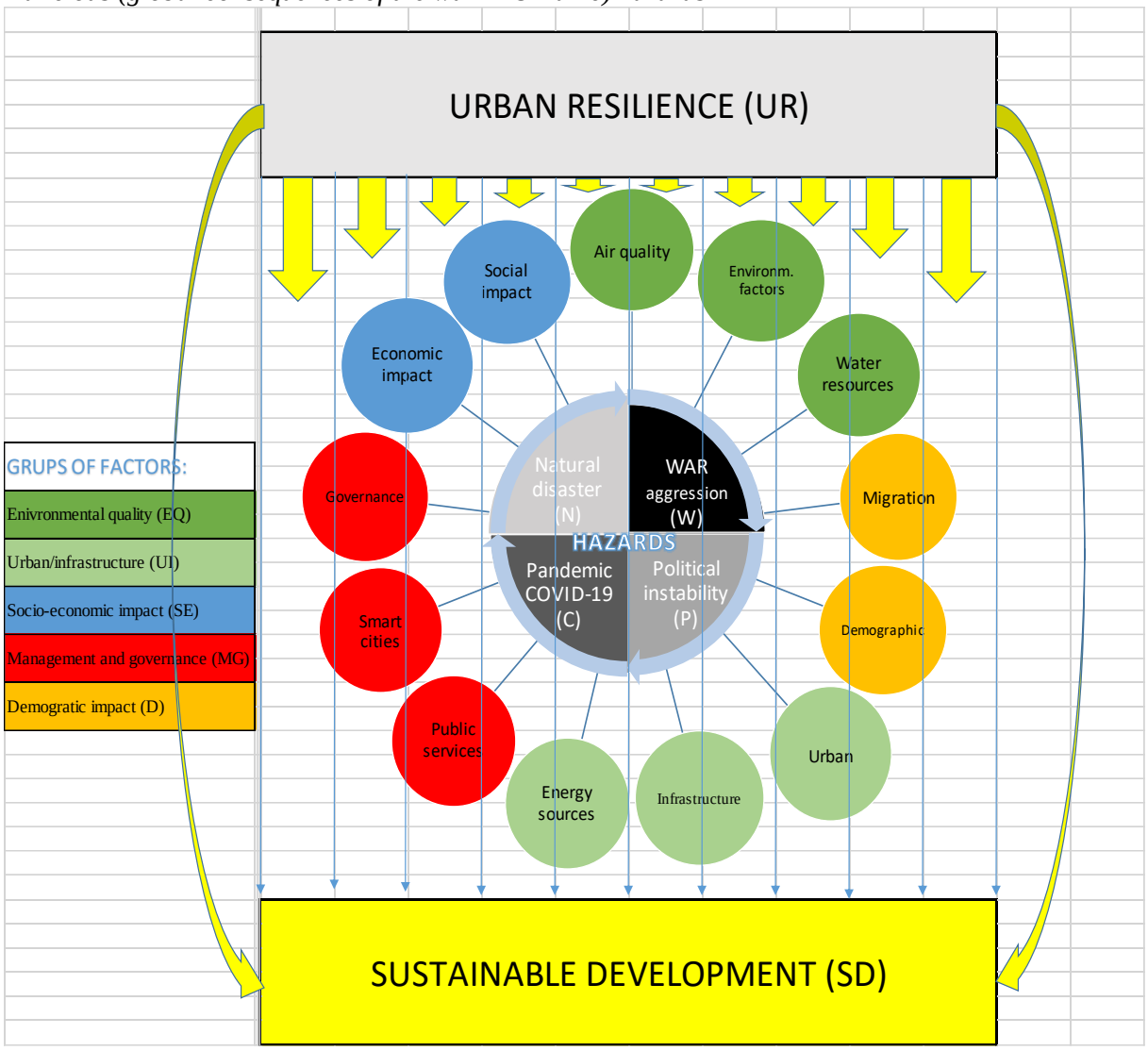
Ostadtaghizadeh et al. (2015) suggest examining the concept of UR in the context of five dimensions: physical (e.g., infrastructure), natural (e.g., ecological, and environmental resilience), economic (e.g., social and economic development), institutional (e.g., political governance and management), and social (e.g., communication among people, coexistence in general). Riberio and Jardim Gonçalves (2022) state that the resilience of cities rests on four basic pillars: resist, recover, adapt, and transform. However, as Büyüközkan et al. (2022) note, all theories generally agree that UR has two main objectives: to adapt to

the hazardous situation and to mitigate the unexpected stresses on the exposed population. And as Büyüközkan et al., 2022 state in the conclusion of their study reviewing the literature on UR, future studies need to incorporate the COVID-19 pandemic and its impact on issues such as health, logistics, supply chains, and other elements related to UR. However, as Büyüközkan et al. (2022) point out, all theories generally agree that the two main goals of UR are to adapt to new and difficult situations and to mitigate unexpected stresses for those affected. They argue that future studies of UR should include the COVID-19 pandemic and its impact on issues such as health, logistics, supply chains, and other elements related to UR. Amirzadeh et al. (2022) note that although the concept of UR has been closely linked to the field of ecology until recently, the concept has expanded to include many different fields, such as psychology, social sciences, education, urban safety, policy and governance, disaster risk management, economics, etc. Interestingly, Amirzadeh et al. (2022) already point out the importance of the link between UR and future urban development through the three basic phases of disaster risk response mentioned above, namely response, recovery, and future development work.

In our study, we go a step further and create a hypothetical model that links the key areas of UR and SD (Figure 1). We place natural and anthropogenic hazards (Gill & Malamud, 2017; Jha, 2010; Moghim & Garna, 2019) at the center of the model, which are further subdivided according to current hazards, namely COVID-19 and the war in Ukraine. All these hazards require accelerated mobilization of various UR factors. We grouped these factors into the following five categories: environmental impact (EI; air quality, water resources, environmental factors, etc.), infrastructure impact (UI; urbanization, infrastructure transformation, energy supply, etc.), socioeconomic development (SE; social and economic impacts due to the changing global context), management and governance (MG; public services and governance of countries), and demographic impact (D; aging population, migration, increasing poverty, etc.). The model assumes that all these factors must be considered equally in order to achieve adequate UR development in today's world. We see UR as a perspective for the SD of the entire built environment.

Figure 1

A hypothetical model of UR and SD factors in times of health (COVID-19) and human-induced malicious (global consequences of the war in Ukraine) hazards



Based on the hypothetical model developed in Figure 1, we conducted a systematic literature review over the past three years (2019-2022). We were interested in whether the research perceives UR and the perspective of SD of the built environment in the puddle of these new, previously unforeseen impacts in the last three years, i.e., in a period of pronounced impacts of the COVID-19 pandemic and war on European soil.

The problem of our study is to identify the most relevant and influential research on the UR-SD nexus, to define its theoretical origins, and to make its contribution to the development of the research field. Based on a hypothetical model of the contemporary relationship between UR and SD, we set the following two objectives: whether and how research incorporates newly perceived conceptual hazards (pandemic, war) and whether all groups of factors are explored equally and simultaneously. Therefore, our study aims to respond to the lack of existing research in the broader context of SD that considers plural UR, and consequently to provide a clear perspective on the SD of the built environment.

Methods

Search protocol

The literature review was conducted according to the PRISMA protocol (Moher et al., 2009; Page et al. 2021). First, we searched the EBSCOhost database for scholarly articles in: Academic Search Complete, Business Source Premier, APA PsycInfo, Scopus, Web of Science (WOS), SocINDEX with Full Text, and GreenFILE. Then, we searched the JSTOR database, and finally other bases, such as Google Scholar.
Since we are interested in the relationship between UR and SD, we searched for terms containing both terms together. We started with a search term with no restrictions on where the terms were located and used the keywords "urban resilience AND sustainable development*", but this did not prove to be stable. We therefore continued to use the keywords "urban resilience" (UR) and "sustainable development" (SD). The searches were conducted in May and June 2022. This search set proved to be stable, as the results obtained with the narrower search datasets were also identified with the final search set, and the hits we relied on for the literature review were also identified with the broader search datasets.

2.2. Inclusion and exclusion criteria

The screening process at EBSCOhost began by evaluating individual articles by title and abstract using the search term "urban resilience AND sustainable development*". Our initial search query in EBSCOhost yielded no results. We therefore used a related search term, "urban resilience" AND "sustainable development" and obtained 127 results. We then evaluated each article using exclusion and inclusion criteria. Figure 2 shows the PRISMA flow diagram corresponding to the search protocol, inclusion and exclusion criteria, screening, eligibility, and final selection process. Articles that met the following inclusion criteria were considered for further review: (1) original empirical study/review article/book chapter, (2) written in English, (3) peer-reviewed, (4) at least abstract accessible, and (5) published between 2019 and 2022. Publications were excluded if they were: (1) commentaries or editorial articles, (2) dissertations, (3) unpublished articles.
The same criteria were used to search for scientific publications in the JSTOR digital library, and the search term "urban resilience AND sustainable development*" yielded only one article. Using the search term "urban resilience" AND "sustainable development", we obtained 188 hits. An identical search in other databases, especially Google Scholar, gave us 165 results. For further analysis, we considered publications that met the same cut-off criteria as those used at EBSCOhost.

2.3. Data extraction

Based on these criteria and a review of duplicate publications, we extracted 66 articles from the EBSCOhost database that could be methodologically classified into review articles and original scientific articles reporting research conducted using quantitative and qualitative methods, and theoretical articles. We then used the EBSCOhost restriction options to choose among the restrictions associated with "subject", namely "subject - thesaurus term", "subject - major heading", and "subject". After an independent content review by both authors, we chose the "subject - thesaurus term" restriction option and included only articles on the following topics: urban planning, SD , urban growth, cities & towns, sustainable urban development, emergency

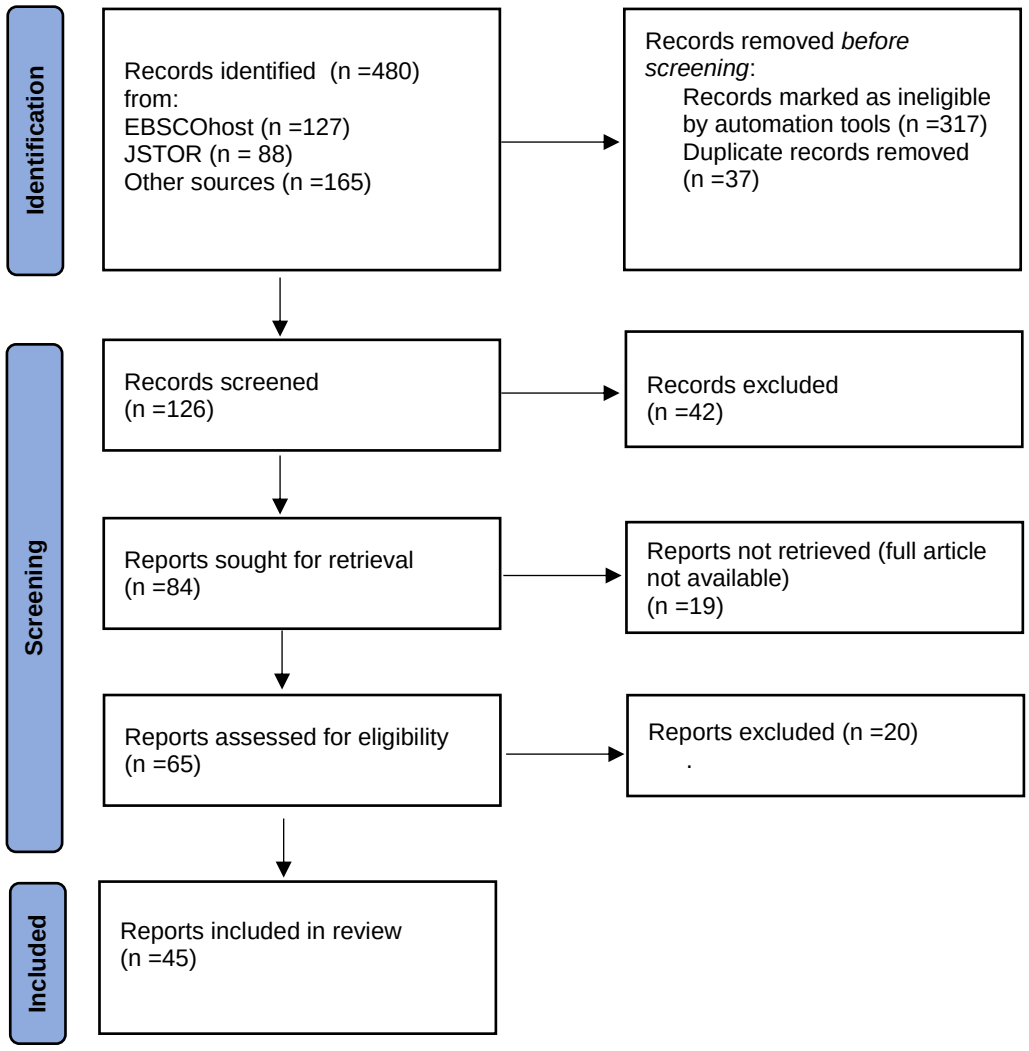
management, social capital, urban renewal, and quality of life. We excluded the other options because they were not relevant to our research problem. There were no choices such as migration, war, etc. that we wanted to cover topics related to war-related aggression. The result was 14 publications.

In the JSTOR digital database, the 17 retrieved publications were further extracted by automatic "subject" bounding boxes and contained only publications on the following topics: environmental science, environmental studies, health science, intergovernmental relations, peace and conflict studies, population studies, public policy and administration, and urban studies, resulting in a total of 7 publications. We extracted 43 publications using Google Scholar, reviewed them, and included 24 publications in the final analysis according to the inclusion and exclusion criteria.

The entire process of the systematic literature search is shown in the PRISMA diagram in Figure 2. This shows that of the 480 articles identified, 45 articles were extracted step by step, which are discussed in more detail in the Results section.

Figure 2

PRISMA diagram of the protocol for searching, inclusion and exclusion of reviewed articles



In the next section, we present the results of the literature review in line with the research questions. The results are followed by a discussion that includes UR and the sustainability perspective of the built environment and incorporates new conceptual tensions (pandemic, war), as presented in Figure 1, and a synthesis of the main findings of the literature review.

3. Results and discussion

Table 1 lists the a priori study and practice focus areas of UR and SD, as well as the study areas (categories) that we identified and named within each focus level based on the underlying themes or constructs.

Table 1 shows that most excluded articles relate UR and sustainability to public sector functioning and governance (E3, E6, E7, E8, and E11), followed by environmental quality with the environmental factors presented (E1, E2, and E12), with significantly less coverage of the other groups of factors. Interestingly, most excluded articles identify natural disasters as a source of resilience (E1, E2, E3, E9, E12, and E14), followed by political instability (E4, E6, E7, and E8), while aggression (war) and climate change (E4, E6, E7, and E8) are the most common sources of resilience. A significant number of articles do not address the causes that lead to a situation in which UR is relevant (E10, E11, and E13).

Table 1
Key elements of the scientific articles included in the literature review by EBSCOhost database

Subject/ Found articles (E)/ Extracted articles (En)	**E(n)/ ***	**Authors**	**Type of the article**	**Title / objectives**	**Outcomes**	**
Urban planning / E=14 / En=2	E1/ EQ	Beceiro et al. (2022)	Case study/Porto/Portuga	Assessment of the contribution of Nature-Based Solutions (NBS) to urban Assessment of the contribution of Nature-Based Solutions (NBS) to UR: application to the case study of Porto	"Nature-Based Solutions (NBS) provide a systemic approach to promote the maintenance, enhancement, and restoration of biodiversity and ecosystem services (ES) in urban areas, helping to enhance UR in the water sector"(p. 1). "The RAF application allowed developing an integrated assessment of the main NBS aspects for the improvement of UR, which to date have been evaluated separately by different studies" (p. 17).	N
	E2/ EQ	Fu et al. (2021)	Case study (Mill Creek watershed, Ohio, USA)	Assessment of green infrastructure performance through an urban resilience lens	"Green infrastructure (GI) is widely recognized for reducing risk of flooding, improving water quality, and harvesting stormwater for potential future use" (p. 1). "To implement the open space scenario in our urban demonstration site, suitable vacant lots could be converted to greenspace (e.g., forest, detention basins, and low-impact recreation areas)" (p. 1).	N
SD / E=13 / En=3	E3/M G	Acute et al. (2020)	Qualitative content analysis	Company disclosures concerning the resilience of cities from the SD Goals (SDGs) perspective	"This study provides new insights into the contribution of companies to the resilience of cities, thus advancing the literature on the link between business and UR" (p. 1)	P
	E4/ UI	Jiménez-Medina et al. (2021)	Case study (La Unión, Spain)	Tourism business, place identity, SD, and UR: a focus on the sociocultural dimension	"Along the twentieth century, city with a mining tradition place faced a severe industrial crisis. Building on its history, heritage, and resources, the local economy changed towards the mining heritage tourism business" (p.1) This article describes such a process of development and UR. Results have shown how the tourism sector allows to preserve the mining tradition.	P
	E5/ D	Aquilino et al. (2020)	Case study (Bari, Italy)	Earth observation for the implementation of SD Goal 11 indicators at local scale: monitoring of the migrant population distribution	"The study focused on updating the distribution map of the migrant population" (p.1). The indicators obtained could support urban planners and decision makers not only in the increasing migration pressure management, but also in the local level monitoring of Agenda 30" (p. 19).	W

Urban Growth / E= 7 / En= 1	E6/ MG	Li et al. (2021)	Case study (Beijing, China)	The dynamic development process of UR: From the perspective of interaction and feedback	"The urban system is gradually becoming a multi-level and multipolar network under the rapid development of information and communication technology" (p.1). "Case study shows that each sub-network resilience has its sensitivity factors, which should become policy concerns and can maximize the output under the same input" (p. 1).	P
	E7/ MG	Sharma (2021)	Case study (Dhaka, Bangladesh)	Reactive, individualistic and disciplinary: the ur project in Dhaka	"At the urban level, resilience represents an uncomfortable partnership between goals of enhanced environmental safety and the continued championing of economic growth as the core indicator of SD. Drawing on a critical political economy approach, this paper worked to tease out the intricacies of this difficult union by theoretically developing the traits of resilience as reactive, individualistic, and disciplinary, and empirically examining Dhaka" (p. 11).	P
Cities & towns/ E=6/ En= 2	E8/ SE	Dai et al. (2019)	Case study (Sanya, China)	A hierarchical measurement model of perceived resilience of urban tourism destination	"This study develops a macro–micro hierarchical resilience measurement model for tourism city from a resident perception-based perspective. Destinations should consider the five aspects of resilience, (social, economic, resources, governance, knowledge) at both the urban and community levels. For example, social networks and learning abilities have proven to be important components of resilience" (p. 777).	P
	E9/ MG	Diaz-Sarachaga & Jato-Espino, D. (2019)	Empirical research	Do sustainable community rating systems address resilience?	"After selecting the most relevant community rating systems, this research determined their adequacy to handle urban challenges by benchmarking them against the major international efforts and some relevant resilience assessment tools extracted from the study of eight global frameworks" (p. 62).	P
Green infrastructure/ E=3/ En=0						
Emergency management/ E=2/ En=2	E10/ UI	Huck et al. (2020a)	Case study (ChristchurchNew Zeland)	Building urban and infrastructure resilience through connectivity: an institutional perspective on disaster risk management in Christchurch, New Zealand	"Study shows that debates on UR can benefit from the concept of institutional connectivity – defined as institutionalized forms of vertical, horizontal or cross-territorial interaction – to systematically address these complexities"(p. 1). "Study argue that scholars of risk management should not see institutional connectivity as a goal in itself but rather as contested processes that can either support or impede specific resilience capacities" (p.8).	/

	E11/ MG	Huck et al. (2020b)	Case study (Rotterdam)	Towards resilient Rotterdam? Key conditions for a networked approach to managing urban infrastructure risks	"Critical infrastructures are increasingly recognized to be playing important roles in UR theory and practice. Conclusions call for national and supranational legal reforms to establish uniform procedural rules for urban risk management and contingency planning to provide guidance for municipalities on how to enhance the resilience of their cities and infrastructures" (p. 12).	/
Housing/ E=2/ En=0						
Disasters/ E=2/En= 0						
Metropolitan areas/E=2/En=0						
Sustainability/ E=2/En=0						
Social capital/ E=1/ En=1	E12/ EQ	Anguelovski et al. (2019)	Case study (Municipality of Medellín)	Grabbed urban landscapes: Socio-spatial tensions in green infrastructure planning in Medellín	"Through the analysis of a greenbelt project, an emblematic case of green infrastructure planning in Medellín, article argue that, as the Municipality of Medellín is containing and beautifying low-income neighborhoods through grabbing part of their territories and turning them into green landscapes of privilege and pleasure, communities are becoming dispossessed of their greatest assets—location, land and social capital" (p.133).	N
S12- Urban renewal/ E=1/ En=1	E13/ SE	Zhou et al. (2021)	Empirical study	Achieving resilience through smart cities? Evidence from China	"Four aspects of UR are analyzed: economic resilience, social resilience, ecological resilience, and infrastructure resilience" (p. 1). " The results show that the construction of smart cities significantly generally improves UR, but different types of UR are affected differently: with urban economic and social resilience being significantly positively affected, and urban ecology and infrastructure resilience being significantly negatively affected" (p. 13).	/
Quality of life/ E=1/ En=1	E14/ SE	Okumura et al. (2021)	Case city (Rio de Janeiro)	Integrated water resource management as a development driver –prospecting a sanitation improvement cycle for the greater Rio de Janeiro using the city blueprint approach	"The purpose of this work is to pose the key role of Integrated Water Resource Management for a city's SD, aiming to improve social, economic, and environmental conditions. It is important to highlight that sanitation strategy accomplishment also relies on a supportive Governance that enables sustainable urban growth by integrating urban plan, urban design, sanitation, mobility, economic expansion, with strong social participation" (p. 1).	N
Urban research/ E=1/En= 0						

Disaster resilience/ E=1/En= 0
Ecological resilience/ E=1/En= 0
Equality – social aspects/ E=1/En= 0
Humanity/ E=1/En= 0
Immigrants/ E=1/En=0
Psychological resilience/ E=1/ En=0
Sustainable buildings/ E=1/En= 0

(*): (EQ)(UI)(SE)(MG)(D): See Figure 1

(**): (N)(W)(P)(C): See Figure 1

Table 1 shows that most articles mention natural disasters (E1, E2, E12, E14) and political instability (E3, E4, E6, E7, E8, E9) as the main hazard. Only one article mentions war aggression (E5) and no pandemic (COVID-19) as threats. We note that a substantial number of articles do not mention a specific hazard that has led to a situation in which UR is relevant (E10, E11, E1¸13). In most of the articles where natural disasters are mentioned as the main hazard, they are about water (water resources, floods). We attribute this mainly to the fact that the water problem has become very relevant in recent years with increasing urbanization (He et al., 2021). He et al. (2021) note that today more than two-thirds of water-scarce cities can alleviate water scarcity by investing in infrastructure, but they must be willing to make significant environmental trade-offs (He et al., 2021). McDonald et al. (2014) have shown that strategic management of water resources in these cities is therefore important for the future of the global economy. On the other hand, there are the political problems arising from the growth of cities (Gottmann, 1990). Therefore, most studies refer to the problem of urban management, economic stability, risk management, government stability, people's sense of security, and trust. The lack of the latter is identified as a threat, so most studies identify the accelerated development of risk management as a solution. It is therefore not surprising that most studies identify MG as the main factor linking UR and SD (E3, E6, E7, E9, E11), followed by SE (E8, E13, E14) and EQ (E1, E2, E12).

According to the objective of whether and how research incorporates newly perceived conceptual hazards (pandemic, war), the results presented in Table 1 primarily show the lack of existing research that recognizes the threat of a pandemic COVID-19. Regarding the objective of whether all groups of factors are equally and simultaneously studied, the results presented in Table 1 show the lack of research that considers the plurality UR in the broader context of SD.

Table 2

Key elements of the scientific articles included in the literature review by JSTOR database

Subject/Found articles (J)/ Extracted articles (Jn)	J(n)/ *	Authors	Type of the article	Title / objectives	Outcomes	**
Environmental sciences / J= 11 / Jn= 3	J1/ UI	Cilk (2020)	Qualitative empirical study; case study	National culture and UR: a case study of resilient cities	“UR efforts are not strongly influenced by national culture, but instead share a common thread of being inclusive, future-oriented, and prioritizing quality of life over profits” (p. 18).	/
-	J2/ EQ	Mantheaw (2020)	Theoretical article (Sub-Saharan	Mindscapes and landscapes: learning to adapt in transnational climate adaptation collaborative in Africa	"Through experiences of self-observation and insightful awareness of local ecologies and realities, people living in their communities are able to self-organize as “Self-Critical Epistemological Awareness”. The capacity to build new knowledge and the ability to utilize the different knowledge forms emerge out of the changing manifestations of climate change impacts" (p. 101).	N
	J3/ D	Siddiqui et al. (2022)	Book chapter (Bangladesh)	Climate Change and Mitigation in Bangladesh: vulnerability in urban locations	"The aim of this chapter is to develop an understanding of those who have moved to urban locations in the context of climate change and assess their gains and vulnerabilities in urban settings" (p. 114).	N
Peace and Conflict Studies/ J=2/ Jn= 1	J4/ MG	Wade et al. (2021)	Empirical study	Sustainable governance networks and urban internet of things systems in big data-driven smart cities	“Smart sustainable cities develop heterogeneous big data-driven tools throughout numerous scales that are linked through various wireless interconnected sensor networks, which supply and systematize incessant input in relation to different features of urbanity” (p. 68).	/
Health sciences/ J=1/ Jn=1	J5/ SE	Thorén (2021)	Book chapter (theoretical)	Resilience	“Resilience is an important concept in sustainability science, but it is crucially secondary to other concepts, such as sustainability itself. Two important forces act on sustainability science: one is the coalescence around some disciplinary core; the other is the expansion and inclusion of further disciplines" (p. 87).	/
Urban studies / J=1/ Jn=1	J6/ EQ	Roggema et al. (2020)	Book chapter; case study (Netherland)	The ‘Beltscape’: new horizons for the city in its natural region	"The concept of the Green Belt is taken as the starting point of reference for Dutch regional and national planning approaches. The core question in this chapter is whether these areas, the former Green Belts, should be allowed to evolve as dynamic new urban centers or whether the notion of open green landscapes should be permanently retained" (p. 119).	N

*: (EQ)(UI)(SE)(MG)(D): See Figure 1

**: (N)(W)(P)(C): See Figure 1

Table 2 shows that most articles identify natural disasters (J2, J3, J6) as the main hazard. We note that a significant number of articles do not identify a specific hazard that leads to a situation where UR is relevant (J1, J4, J5). Most of the articles that mention natural disasters as a major hazard discuss climate change. Climate change is one of many types of shocks and stresses that cities face (Leichenko, 2011). The cited articles in Table 2 associate UR with reducing the risks and consequential damages of natural disasters from climate change. Thus, they note that it is climate change that increases pressures and uncertainties for the economy, the environment, and society in general.

According to the objective of whether and how research incorporates newly perceived conceptual hazards (pandemic, war), the results presented in Table 2 primarily show the lack of existing research that recognizes the threat of pandemic COVID-19. Regarding the objective of whether all groups of factors are equally and simultaneously studied, the results presented in Table 2 show that in the broader context of SD, there is no research that considers the plurality of UR.

Table 3
Key elements of the scientific articles included in the literature review by other databases

Subject/ Found articles (G)/ Extracted articles (Gn)	G(n)/*	Authors	Type of the article	Title / objectives	Outcomes	**
Urban sustainability-UR G= 43/ Gn=24	G1/ MG G1/ EQ	Caldarice et al. (2021)	Case study, Italy	The relevance of science-policy-practice dialogue. Exploring the urban climate resilience governance in Italy	"The paper analyses the urban climate resilient strategies of the Italian metropolitan cities. The paper suggests an iterative process to unlock the science-policy-practice dialogue for contributing to operationalize urban climate resilience fostering thanks to a multiscalar governance approach" (p. 1).	P
	G2/ MG G2/ UI	Carta et al. (2021)	Case study, Copenhagen	Resilient communities: a novel workflow	"Presented model analyses successful sustainable communities extracting information about daily routines (commuting, working, use of buildings etc.). The aim of the proposed model is to suggest to designers and city-level policy makers improvements to help them to achieve different levels of sustainable goals" (p. 1).	N
	G3/ MG G3/UI	Caughman (2020)	Systematic review	Collaboration and evaluation in US and resilience transformations: the keys to a just transition?	"Article explores the role of partnerships and collaborations as well as monitoring and evaluation in facilitating and accelerating equitable urban sustainability and resilience transformation and concludes with the establishment of just transformative capacity" (p. 1).	N
	G4/ SE G4/ UI	Chen (2022)	Systematic review	Integrated social-ecological-infrastructural management for UR	"Enhancing UR requires integrated approaches towards the management of social, ecological, and infrastructural systems. This Article aims to offer a better scientific basis for the planning and design of resilient urban social-ecological-infrastructural systems" (p. i).	N
	G5/MG G5/ UI G5/ EQ	Clavin et al. (2020)	Literature review	Resilience, adaptation, and sustainability plan assessment methodology: an annotated bibliography	"The review findings addresses a set of plan quality principles that can be used for future plan and associated material assessment. The discussion highlights concepts observed related to resilience, adaptation, and sustainability terminology, and findings from the review related to the state of practice and research on resilience, adaptation, and sustainability planning" (p . i).	/
	G6/ UI			UR in climate change hotspot		N

	G6/ EQ	Cobbinah (2021)	Case study, Ghana		"This paper analyzes the unexplored potentials of urban planning in addressing issues of climate change in the continent, and makes recommendations for the engagement of urban planning in developing resilient African cities" (p. 1).	
	G7/ UI	Elmqvist et al. (2019)	Framework development	Sustainability and resilience for transformation in the urban century	"Article propose a new framework that resolves current contradictions and tensions; a framework that will significantly help urban policy and implementation processes in addressing new challenges and contributing to global sustainability" (p. 267).	P
	G8/ MG G8/ SE	Fastiggi et al. (2021)	Quantitative study	Governing UR: organizational structures and coordination strategies in 20 North American city governments	"This paper describes how UR governance is structured and coordinated in 20 North American cities (19 US and one Canadian) based on interviews with city officials" (p.1262). Article pointed the need for a clear definition of resilience, strong leadership, and stakeholder engagement.	N
	G9/ MG G9/ SE	Frantzeskaki et al. (2021)	Literature review	Urban sustainability science: prospects for innovations through a system's perspective, relational and transformations' approaches	Proposal for the future of urban sustainability science centers on emphasizing the relevance and policy applicability of systems' thinking, value and place thinking and transitions/transformations thinking as fundamental to how knowledge is co-produced by search science, policy and society and becomes actionable" (p. 1).	P
	G10/ MG G10/ UI G10/ SE	Yaman Galantini (2019)	Literature review, quantitative analysis	Catching on "UR" and examining "UR planning"	"Paper aimed to clarify how resilience can be positioned in urban planning paradigms" (p. 882) "Paper aimed that assuredly necessitates to understand the interdependencies between various urban aspects" (p. 901).	/
	G11/ UI G11/EQ	Hong (2022)	Standardizati -on of Data	The coupling relationship between UR level and urbanization level in Hefei	Article explains whether the UR level is coupled with the urbanization level and the degree of coupling, providing advice and wisdom for the future high-quality urban development of Hefei" (p.1). "What should be paid more attention to is infrastructure and ecology and to enhance their resilience" (p. 7).	/
	G12/ SE G12/ MG	Kapucu et al. (2021)	Literature review	UR for building a sustainable and safe environment	"Article offers perspectives and conception of UR, and how it can help urban areas to prepare and adapt to absorb and recover from ernal and internal disturbances and reduce urban vulnerabilities with policies and governance" (p. 10).	P
	G13/ D G13 / SE	Khan et al. (2021)	Quantitative study	Factors affecting UR and sustainability: case of slum dwellers in Islamabad, Pakistan	"Study aims to determine and analyze the factors that are associated with UR and sustainability for the slum inhabitants of Islamabad, Pakistan. Study considered a limited number of factors that affect UR and urban sustainability" (p. 1).	/

	G14/ MG G14/ SE	Lopez et al. (2020)	Literature review	Sustainability and resilience in smart city planning: a review	"Urban planning is recognized as an interaction between the state and society, which aims to articulate public policies in the territory, facilitating their administration in favor of greater development and well-being of society. The main result is to consider cities with a complex systems approach" (p. 1).	P
	G15/ UI G15/ SE G15/ MG	Narieswari et al. (2019)	Data source review	Multi-dimensions UR index for sustainable city	"Paper describes quantitative study in Semarang City that aims to build an index using secondary data by considering 5 dimensions: social, economic, infrastructure, institutional" (p. 1). "The results of resilience measurements show the infrastructure dimensions is a very influencing factor" (p. 7).	N
	G16/ EQ G16/SE	Creamer et al. (2021)	Data source review	Long-term resilient and sustainable cities a scoping paper	"The research paper looks at actions needed to make cities resilient and livable places, by prioritizing the inter-relationship between people and place, especially the natural environment" (p. 101).	N
	G17/MG	Ni'mah et al. (2021)	Literature review	Urban sustainability and resilience governance: review from the perspective of climate change adaptation and disaster risk reduction	"This study aimed to identify the general framework of adaptive urban governance by review, elaboration, and analysis of documents" (p. 83). "Anticipatory governance requires application of the principle of proactivity and future foresight in policy formulation" (p. 95).	P
	G17/MG G18/UI G18/EQ	Nodeh et al. (2019)	Descriptive-analytical method	Identifying resilience dimensions and its impact on urban sustainability of Rasht city	"The purpose of this study is to identify the dimensions of UR and their relationship with urban sustainability in Rasht" (p. 63). "Findings show that social resilience, economic resilience, resilience environmental-physical and institutional resiliency affect urban sustainability" (p. 63).	/
	G19/ MG G19/SE	Philibert Petit (2022)	Descriptive-analytical method	Smart city technologies plus nature-based solutions: viable and valuable resources for UR	"Article is about the possible and desirable networking of Smart City Technologies (SCT) with the emerging resource of Nature-Based Solutions (NBS), for cities to efficiently and effectively achieve resilience from threats, hazards, and disturbances occasioned by an SD model" (p. 377).	N
	G20/ UI G20/SE G20/MG	Creamer et al. (2021)	Descriptive-analytical method	Long-term resilient and sustainable cities a scoping paper	Article pointed 5 pillars of UR: urban governance, urban planning and environment, resilient infrastructure and basic services, urban economy and society, urban disaster risk management.	/

	G20/EQ G21/MG G21/EQ G21/UI	Sethi (2021)	Case study, India	How to tackle complexity in urban climate resilience? Negotiating climate science, adaptation and multi-level governance in India	"Article draw on suitable adaptation measures for five key urban sectors- water, infrastructure, building, urban planning, health and conclude a sleuth of climate resilience building measures for policy application through national/state policies, local urban plans and preparation of city resilience strategy" (p. 1).	N
	G22/ EQ G22/UI G22/MG	Zeng et al. (2022)	Literature review	UR for urban sustainability: concepts, dimensions, and perspectives	"Study has identified key indicators of UR under three major components like adaptive capacity, absorptive capacity and transformative capacity" (p. 1). "This study argues that system resilience is critical for attaining sustainability in a rapidly urbanized condition" (p. 18).	/
	G23/UI G23/MG	Tootoonchi et al. (2021)	Literature review	Introducing a new paradigm in urban planning through integration of resilience and critical theory to increase feasibility of UR	"The concept of resilience cannot respond to emerging problems by itself" (p.527). "This article shows that integrating critical theory and resilience can compensate the existing weaknesses in resilience and increase its feasibility" (p. 528).	/
	G24/UI	Urquiza et al. (2021)	Literature review	An integrated framework to streamline resilience in the context of urban climate risk assessment	"Article offers an integrated analytical framework and methodological pipeline to streamline resilience analysis in the context of urban climate risk assessment" (p. 1).	P

*: (EQ)(UI)(SE)(MG)(D) See Figure 1

**: (N)(W)(P)(C) See Figure 1

Table 3 shows that most excluded articles UR and SD refer to management and governance factors (G1, G2, G3, G5, G8, G9, G10, G12, G14, G15, G17, G19, G20, G21, G23), followed by environmental quality factors (G1, G6, G11, G16, G18, G20, G21, G22), while the effects of other groups of factors are addressed much less. Interestingly, most excluded articles mention natural disasters as the main risk (G2, G3, G4, G6, G8, G15, G16, G19, G21), followed by political instability (G1, G4, G7, G9, G12, G14, G17, G24), while aggression (war) and pandemics (COVID-19) are not mentioned as sources of hazard in any of the excluded articles. A considerable number of articles do not discuss sources of danger at all (G5, G10, G11, G13, G18, G20, G22, G23). However, among all articles, there are 7 articles that address the topic more comprehensively, covering at least three or four groups of factors simultaneously (G5, G10, G15, G17, G20, G21, G22). However, we did not find any article covering all 5 groups (EQ, UI, SE, MG, and D) simultaneously.
Following on from the question of whether and how research incorporates newly perceived conceptual hazards (pandemic, war), the results presented in Table 3 show in particular the lack of existing research that considers hazards such as pandemics COVID-19 and political instability. Regarding whether all groups of factors are equally and simultaneously researched, the results presented in Table 3 show the lack of research in the broader context of SD, which considers the plural UR and considers all 5 groups (EQ, UI, SE, MG, and D) simultaneously. The importance of taking a broader view of urban resilience in light of sustainable urban development is also emphasized by Roberts et al. (2020), who argues that global urban resilience design must respond in a way that understands all types of risks while addressing them in the context of resulting vulnerability.

Figure 3 shows the overall results of the study, summarizing the results of Tables 1-3.

Figure 3
Factor groups - survey frequency and intercorrelations

SUM	**23**		**12**		**15**		**3**		**18**
Google	17		7		11		1		15
JSTOR	1		2		1		1		1
EBSCOhost	5		3		3		1		2
	MG		EQ		SE		MD		UI
MG	**23**		3		9		0		**10**
EQ	3		12		2		0		6
SE	9		2		15		1		5
MD	0		0		1		3		0
UI	10		6		5		0		18

The results presented in Figure 3 show that most articles associate UR with urban governance, smart city development, and public services (n=23), followed by UR with infrastructure development (n=18), socioeconomic development (n=15), environmental factors (n=12), and least with demographic impacts and

migration (n=3). Consequently, most of the excluded articles simultaneously address the importance of management and governance and urban infrastructure (n=10). However, we found no article that simultaneously links management and governance to demographic impacts (n=0), and no article that links demographic impacts to urban infrastructure (n=0).

The results show that climate change is one of many types of shocks and stresses that cities face, and that climate change-related shocks usually occur in combination with other environmental, economic, and political stresses. This was also confirmed by Leichenko (2011), who draws on numerous authors (Coaffee, 2008; De Sherbinin et al., 2007; Leichenko & O'Brien, 2008; Pelling, 2003; Wilbanks & Kates, 2010).

Interestingly, the results show that researchers have focused primarily on the relationship between UR and the management and governance of urban built space over the past three years. It is believed that the influence of management and governance plays a key role in UR and consequently in the development of sustainability. On the other hand, our findings show that there is virtually no research linking demographic issues to UR and SD. The importance of the lack of a more comprehensive approach is also highlighted by other researchers who argue that UR as a perspective for SD the built environment requires a better understanding of the complex interactions, their impacts and feedbacks in the context of multidimensional urbanization and the complex governance structures involved, land use change, climate change, changing ecological foundations, socioeconomic factors, emerging risks such as pandemics, multiple uses of urban space and resources, and new opportunities to engage in governance (Andersson 2021; Folke et al. 2021).

In this study we wanted to find out how the research perceived UR and the perspective of SD the built environment in the last three years, that is, at a time when the effects of the pandemic COVID-19 and the war were pronounced on European soil. In this way, we aimed to develop a final model of UR considering the perspective of SD the built environment, including new conceptual tensions (pandemic, war), using the set module (see Figure 1). However, we found that researchers still associate UR mainly with resilience to phenomena resulting from political instability, also understood as lack of risk management, poor governance and management of cities, poor communication between government structures, etc.

Only in second place are causes such as natural and environmental disasters, which surprised us. What surprised us even more was the virtual absence of studies dealing with pandemics (COVID-19) and war (migration) in the context of UR and US. Many of the studies we excluded from our review do not address the causes that UR requires. They understand UR as a general component of SD, to which they attach great importance, but they do not explain the causes, consequences, and interplay of complex interactions that can lead to different scenarios (e.g., Cilk, 2020; Clavin et al., 2020; Creamer et al., 2021; Diaz-Sarachaga & Jato-Espino, 2019; Yaman Galantini, 2019; Hong, 2022; Huck et al., 2020b; Khan et al., 2020; Nodeh et al., 2019; Thorén, 2021; Tootoonchi et al., 2021; Wade et al., 2021; Zhou et al., 2021). As Nathanial and Van der Heyden (2020, p.2) note, "We have memory, we look for patterns, we prepare scenarios." The emergence of COVID-19, of aggression (war), and of many natural disasters, on the other hand, are memories from which we can search for patterns and prepare scenarios. And these scenarios, we believe, should include all the factors that we combine in our study in the hypothetical model (Figure 1) as environmental quality (EQ), urban infrastructure (UI), socioeconomic impacts (SE), management and governance (MG), and demographic impacts (D).

Conclusions

UR almost always has a positive connotation, emphasizing the adaptability of the local community (technical, organizational, social, and economic resilience), the flexibility of the socioeconomic paradigm (social, economic, physical, and human capital), and the physical resilience of the built environment (natural capital, physical features of the environment, stability of resources and infrastructure). In our research, we combined the above factors into a hypothetical model of the determinants of UR and SD observed in the context of threats to the health (COVID-19) and livelihood (global consequences of the war in Ukraine) of the population. Using the method of a systematic literature review over the last three years, the study had two objectives: whether and how research incorporates newly perceived conceptual hazards (pandemic, war) and whether all groups of factors are equally and simultaneously explored.

The literature review was conducted according to the PRISMA protocol (Moher et al., 2009; Page et al. 2021). EBSCOhost, including Academic Search Complete, Business Source Premier, APA PsycInfo, Scopus,

SocINDEX with full text, WOS and GreenFILE, JSTOR, and other databases (Google Schoolar) were searched for scholarly articles. The overall literature review revealed that of the 480 articles identified, 45 articles were progressively extracted and analyzed in more detail. However, the results showed that the newly perceived conceptual tensions (pandemic and war) related to resilience of the built environment have not been adequately explored. The study confirmed the lack of existing research in the broader context of understanding built environment resilience, and thus the lack of studies that would provide support and perspective for SD the built environment. We found that researchers UR still associate resilience mainly with phenomena resulting from political instability, which is also understood as lack of risk management, poor governance and management of cities, poor communication between government structures, political irresponsibility, and so on. Only in second place are causes such as natural and environmental disasters. The importance of the study certainly lies in the number of scientific publications covered. We are aware of this and therefore propose to repeat similar studies, perhaps in other databases (e.g., in other languages). The advantage of this study is that in the future, by having a clear hypothetical model of the determinants of UR and SD, we can observe the intensity of research in this field, especially plural research that promotes complex interactions, their effects and feedbacks in the context of multidimensional urbanization, to better understand UR as a perspective for the SD of the built environment.

In conclusion, the study showed that newly perceived conceptual tensions (pandemic, war) related to UR have not been adequately explored. The study confirmed the lack of existing research in the broader context of understanding built environment resilience, and thus the lack of studies that provide a foundation and perspective for SD the built environment. Therefore, we believe that further research should specifically focus on the multiplicity of approaches to understand the complex interactions, their impacts, and feedbacks in the context of multidimensional urbanization to understand UR as a perspective for SD of the built environment.

In this way, we would encourage researchers to continue their research in this important area, which will ultimately lead to the overall satisfaction and well-being of users of the built environment. It is impossible to predict the response and behavior of citizens in the event of a disaster. However, something can certainly be done to make the built environment more resilient, which may help the disaster itself respond positively to the disruption. Such a response can reduce material damage, migration, and all the negative impacts of a disaster. Therefore, we believe that the above study, which highlights the lack of mainly pluralistic research, can encourage researchers to further investigate this topic.

Funding

Research was supported by the Slovenian research agency [grant numbers J5-3112 and P5-0110].

5. References

Acuti, D., Bellucci, M., & Manetti, G. (2020). Company disclosures concerning the resilience of cities from the Sustainable Development Goals (SDGs) perspective. Cities, 99, 102608. https://www.sciencedirect.com/science/article/abs/pii/S0264275119313654

Adger, W. N., Safra de Campos, R., Siddiqui, T., & Szaboova, L. (2020). Commentary: Inequality, precarity and sustainable ecosystems as elements of urban resilience. Urban Studies (Sage Publications, Ltd.), 57(7), 1588–1595. http://nukweb.nuk.uni-lj.si/login?url=https://search.ebscohost.com/login.aspx?direct=true&db=buh&AN=143325094&site=ehost-live

Albuja, S., & Ceballos, M. (2010). Urban displacement and migration in Colombia. Forced Migration Review(34), 10. https://www.proquest.com/openview/26cfe2fa399bfb5e75aa3d887e545082/1?pq-origsite=gscholar&cbl=55113
Amble, J. (2022). The Two Debates in Military Circles the War in Ukraine Could Help Settle. Modern war institut at West Point, https://mwi.usma.edu/the-two-debates-in-military-circles-the-war-in-ukraine-could-help-settle/
Amirzadeh, M., Sobhaninia, S., & Sharifi, A. (2022). Urban resilience: A vague or an evolutionary concept? Sustainability Cities and Society, 81, 103853.
https://www.sciencedirect.com/science/article/abs/pii/S2210670722001809

Andersson, E. (2021). "Reconnecting cities to the biosphere: Stewardship of green infrastructure and urban ecosystem services"-where did it come from and what happened next?. Ambio, 50(9), 1636-1638. https://link.springer.com/article/10.1007/s13280-021-01515-z

Angheloiu, C., & Tennant, M. (2020). Urban futures: Systemic or system changing interventions? A literature review using Meadows' leverage points as analytical framework. Cities, 104, N.PAG-N.PAG. http://nukweb.nuk.uni-lj.si/login?url=https://search.ebscohost.com/login.aspx?direct=true&db=buh&AN=143766896&site=ehost-live

Anguelovski, I., Irazábal-Zurita, C., & Connolly, J. J. (2019). Grabbed Urban Landscapes: Socio-spatial Tensions in Green Infrastructure Planning in Medellín. International Journal of Urban and Regional Research, 43, 133-156. https://onlinelibrary.wiley.com/doi/abs/10.1111/1468-2427.12725

Asadzadeh, A., Kötter, T., Fekete, A., Moghadas, M., Alizadeh, M., Zebardast, E., Weiss, D., Basirat, M., & Hutter, G. (2022). Urbanization, migration, and the challenges of resilience thinking in urban planning: Insights from two contrasting planning systems in Germany and Iran. Cities, 125, 103642. https://doi.org/10.1016/j.cities.2022.103642

Asadzadeh, A., Kötter, T., Salehi, P., & Birkmann, J. (2017). Operationalizing a concept: The systematic review of composite indicator building for measuring community disaster resilience. International Journal of Disaster Risk Reduction, 25, 147-162. https://www.sciencedirect.com/science/article/pii/S2212420917302364

Aquilino, M., Tarantino, C., Adamo, M., Barbanente, A., & Blonda, P. (2020). Earth observation for the implementation of sustainable development goal 11 indicators at local scale: monitoring of the migrant population distribution. Remote Sensing, 12(6), 950. https://www.mdpi.com/2072-4292/12/6/950

Beceiro, P., Brito, R. S., & Galvão, A. (2022). Assessment of the contribution of Nature-Based Solutions (NBS) to urban resilience: application to the case study of Porto. Ecological Engineering, 175, 106489. https://www.sciencedirect.com/science/article/pii/S0743731522001472

Barani, A., & Kahraman, Z.E. (2018). Uncovering Vulnerabilities and Resilience of Benghazi after the War. Resilience Journal, 3(2), 165-171, DOI: 10.32569/resilience.586657 https://dergipark.org.tr/en/pub/resilience/article/586657

Baravikova, A., Coppola, A., & Terenzi, A. (2021). Operationalizing urban resilience: Insights from the science-policy interface in the European Union. European Planning Studies, 29(2), 241–258.

http://nukweb.nuk.uni-lj.si/login?url=https://search.ebscohost.com/login.aspx?direct=true&db=buh&AN=148382748&site=ehost-live

Bayulken, B., Huisingh, D., & Fisher, P. M. J. (2021). How are nature based solutions helping in the greening of cities in the context of crises such as climate change and pandemics? A comprehensive review. Journal of Cleaner Production, 288, N.PAG-N.PAG. http://nukweb.nuk.uni-lj.si/login?url=https://search.ebscohost.com/login.aspx?direct=true&db=buh&AN=148167000&site=ehost-live

Beceiro, P., Brito, R. S., & Galvão, A. (2022). Assessment of the contribution of Nature-Based Solutions (NBS) to urban resilience: Application to the case study of Porto. Ecological Engineering, 175, N.PAG-N.PAG. http://nukweb.nuk.uni-lj.si/login?url=https://search.ebscohost.com/login.aspx?direct=true&db=a9h&AN=154241577&site=ehost-live

Becker, S. O., & Ferrara, A. (2019). Consequences of forced migration: A survey of recent findings. Special Issue on "European Association of Labour Economists, 30th Annual Conference, Lyon, France, 13-15 September 2018, 59, 1–16. https://doi.org/10.1016/j.labeco.2019.02.007

Benito del Pozo, P., & López-González, A. (2020). Urban Resilience and The Alternative Economy: A Methodological Approach Applied to Northern Spain. Geographical Review, 110(3), 322–340. http://nukweb.nuk.uni-lj.si/login?url=https://search.ebscohost.com/login.aspx?direct=true&db=sih&AN=153560257&site=ehost-live

Borie, M., Pelling, M., Ziervogel, G., & Hyams, K. (2019). Mapping narratives of urban resilience in the global south. Global Environmental Change Part A: Human & Policy Dimensions, 54, 203–213. http://nukweb.nuk.uni-lj.si/login?url=https://search.ebscohost.com/login.aspx?direct=true&db=8gh&AN=134299558&site=ehost-live

Borie, M., Ziervogel, G., Taylor, F. E., Millington, J. D. A., Sitas, R., & Pelling, M. (2019). Mapping (for) resilience across city scales: An opportunity to open-up conversations for more inclusive resilience policy? Environmental Science & Policy, 99, 1–9. http://nukweb.nuk.uni-lj.si/login?url=https://search.ebscohost.com/login.aspx?direct=true&db=8gh&AN=137163783&site=ehost-live

Bristow, D. N., & Mohareb, E. A. (2020). From the urban metabolism to the urban immune system. Journal of Industrial Ecology, 24(2), 300–312. http://nukweb.nuk.uni-lj.si/login?url=https://search.ebscohost.com/login.aspx?direct=true&db=buh&AN=142768806&site=ehost-live

Bruneau, M., Chang, S. E., Eguchi, R. T., Lee, G. C., O'Rourke, T. D., Reinhorn, A. M., ... & von Winterfeldt, D. (2003). A framework to quantitatively assess and enhance the seismic resilience of communities. Earthquake Spectra, 19(4), 733-752. https://journals.sagepub.com/doi/abs/10.1193/1.1623497

Bueno, S., Banuls, A.V., Gallego, M.D. (2021). Is urban resilience a phenomenon on the rise? A systematic literature review for the years 2019 and 2020 using textometry, International Journal of Disaster Risk Reduction, 66, https://doi.org/10.1016/j.ijdrr.2021.102588

Bush, J., & Doyon, A. (2019). Building urban resilience with nature-based solutions: How can urban planning contribute? Cities, 95. http://nukweb.nuk.uni-lj.si/login?url=https://search.ebscohost.com/login.aspx?direct=true&db=buh&AN=139562233&site=ehost-live

Büyüközkan, G., Ilıcak, Ö., & Feyzioğlu, O. (2022). A review of urban resilience literature. Sustainable Cities and Society, 77, 103579. https://doi.org/10.1016/j.scs.2021.103579

Caldarice, O., Tollin, N., & Pizzorni, M. (2021). The relevance of science-policy-practice dialogue. Exploring the urban climate resilience governance in Italy. City, Territory and Architecture, 8(1), 1-11. https://cityterritoryarchitecture.springeropen.com/articles/10.1186/s40410-021-00137-y

Carta, S., Pintacuda, L., Owen, I., & Turchi, T. (2021). Resilient communities: a novel workflow. Frontiers in Built Environment, section Urban Science. https://uhra.herts.ac.uk/handle/2299/25197

Caughman, L. E. (2020). Collaboration and Evaluation in Urban Sustainability and Resilience Transformations: The Keys to a Just Transition? (Doctoral dissertation, Portland State University). https://www.proquest.com/openview/bd9a59b627b0f0198dbf31b45d633e93/1?pq-origsite=gscholar&cbl=18750&diss=y

Chen, B., Sharifi, A., & Schlör, H. (2022). Integrated social-ecological-infrastructural management for urban resilience. Resources, Conservation and Recycling, 181, 106268. https://www.journals.elsevier.com/resources-conservation-and-recycling/call-for-papers/integrated-social-ecological-infrastructural-management-for-urban-resilience

Cilk, M. (2020). National culture and urban resilience. Consilience, (22), 18-30. https://www.jstor.org/stable/26924958?seq=1

Clavin, C. T., Dabreau, A. M., & Walpole, E. H. (2020). Resilience, Adaptation, and Sustainability Plan Assessment Methodology: An Annotated Bibliography. https://www.nist.gov/publications/resilience-adaptation-and-sustainability-plan-assessment-methodology-annotated

Coaffee, J. (2008). Risk, resilience, and environmentally sustainable cities. Energy Policy, 36(12), 4633-4638. https://doi.org/10.1016/j.enpol.2008.09.048

Coale, A. J. (1989). Demographic Transition. In J. Eatwell, M. Milgate, & P. Newman (Eds.), Social Economics (pp. 16–23). Palgrave Macmillan UK. https://doi.org/10.1007/978-1-349-19806-1_4

Cobbinah, P. B. (2021). Urban resilience in climate change hotspot. Land Use Policy, 100, 104948. https://doi.org/10.1016/j.landusepol.2020.104948

Collier, P., & Hoeffler, A. (2005). Resource Rents, Governance, and Conflict. Journal of Conflict Resolution, 625-633. https://doi.org/10.1177/0022002705277551

Connolly, C., Ali, S. H., & Keil, R. (2020). On the relationships between COVID-19 and extended urbanization. Dialogues in Human Geography, 10(2), 213–216. https://doi.org/10.1177/2043820620934209
Cui, X., Wang, X., & Feng, Y. (2019). Examining urban metabolism: A material flow perspective on cities and their sustainability. Journal of Cleaner Production, 214, 767–781. http://nukweb.nuk.uni-lj.si/login?url=https://search.ebscohost.com/login.aspx?direct=true&db=buh&AN=134323384&site=ehost-live

Cutter, S. L., Barnes, L., Berry, M., Burton, C., Evans, E., Tate, E., & Webb, J. (2008). A place-based model for understanding community resilience to natural disasters. Global Environmental Change, 4(18), 598-606. https://doi.org/10.1016/j.gloenvcha.2008.07.013

Dai, S., Xu, H., & Chen, F. (2019). A hierarchical measurement model of perceived resilience of urban tourism destination. Social Indicators Research, 145(2), 777-804. https://link.springer.com/article/10.1007/s11205-019-02117-9

De Sherbinin, A., Schiller, A., & Pulsipher, A. (2007). The vulnerability of global cities to climate hazards. Environment and Urbanization, 19(1), 39–64. https://doi.org/10.1177/0956247807076725

Diaz-Sarachaga, J. M., & Jato-Espino, D. (2019). Do sustainable community rating systems address resilience?. Cities, 93, 62-71. https://www.sciencedirect.com/science/article/abs/pii/S0264275118315245

Dodman, D., Diep, L., & Colenbrander, S. (2017). Resilience and Resource Efficiency in Cities.https://www.researchgate.net/publication/316842059

Elmqvist, T., Andersson, E., Frantzeskaki, N., McPhearson, T., Olsson, P., Gaffney, O., ... & Folke, C. (2019). Sustainability and resilience for transformation in the urban century. Nature Sustainability, 2(4), 267-273. https://www.nature.com/articles/s41893-019-0250-1

Eskandari Nodeh, M., Gholipoor, Y., Fallah Heydari, F., & Ahmadpour, A. (2019). Identifying resilience dimensions and its impact on urban sustainability of Rasht city. Geography and Environmental Sustainability, 9(3), 63-77. https://ges.razi.ac.ir/m/article_1257.html?lang=en

Fastiggi, M., Meerow, S., & Miller, T. R. (2021). Governing urban resilience: Organisational structures and coordination strategies in 20 North American city governments. Urban Studies (Sage Publications, Ltd.), 58(6), 1262–1285. http://nukweb.nuk.uni-lj.si/login?url=https://search.ebscohost.com/login.aspx?direct=true&db=buh&AN=149787004&site=ehost-live

Fahed-Sreih, J., Pistrui, D., Huang, W., & Welsch, H. (2010). Family and cultural factors impacting entrepreneurship in war time Lebanon. International Journal of Entrepreneurship and Innovation Management, 12. https://doi.org/10.1504/IJEIM.2010.033166

Fitzgibbons, J., & Mitchell, C. L. (2019). Just urban futures? Exploring equity in “100 Resilient Cities”. World Development, 122, 648–659. http://nukweb.nuk.uni-lj.si/login?url=https://search.ebscohost.com/login.aspx?direct=true&db=buh&AN=137777505&site=ehost-live

Folke, C., Polasky, S., Rockström, J., Galaz, V., Westley, F., Lamont, M., ... & Walker, B. H. (2021). Our future in the Anthropocene biosphere. Ambio, 50(4), 834-869. https://link.springer.com/article/10.1007/s13280-021-01544-8

Frantzeskaki, N., McPhearson, T., & Kabisch, N. (2021). Urban sustainability science: Prospects for innovations through a system's perspective, relational and transformations' approaches. Ambio, 50(9), 1650-1658. https://link.springer.com/article/10.1007/s13280-021-01521-1

Fu, X., Hopton, M. E., & Wang, X. (2021). Assessment of green infrastructure performance through an urban resilience lens. Journal of Cleaner Production, 289. http://nukweb.nuk.uni-lj.si/login?url=https://search.ebscohost.com/login.aspx?direct=true&db=buh&AN=148596479&site=ehost-live

Gaillard, J. C. (2010). Vulnerability, capacity and resilience: perspectives for climate and development policy. Journal of International Development: The Journal of the Development Studies Association, 22(2), 218-232. https://doi.org/10.1002/jid.1675

Ghouchani, M., Taji, M., Yaghoubi Roshan, A., & Seifi Chehr, M. (2021). Identification and assessment of hidden capacities of urban resilience. Environment, Development & Sustainability, 23(3), 3966–3993. http://nukweb.nuk.uni-lj.si/login?url=https://search.ebscohost.com/login.aspx?direct=true&db=8gh&AN=148754514&site=ehost-live

Glaeser, E. L. (2022). Urban resilience. Urban Studies (Sage Publications, Ltd.), 59(1), 3–35. http://nukweb.nuk.uni-lj.si/login?url=https://search.ebscohost.com/login.aspx?direct=true&db=sih&AN=154040247&site=ehost-live

Godschalk, D. R. (2003). Urban Hazard Mitigation: Creating Resilient Cities. Natural Hazards Review, 4(3), 136-143. https://doi.org/10.1061/(ASCE)1527-6988(2003)4:3(136)

Gottmann, J. (1990). Political problems of urban growth: The guest-editor's introductory statement. Ekistics, 57(340/341), 4–10. http://www.jstor.org/stable/43623056

Grum, B., Kobal Grum, D. (2020). The impact of real estate maintenance costs on the potential resettlement of elderly people: the case of Slovenia, Drustvena Istrazivanja, 29(3), 373-393. https://hrcak.srce.hr/clanak/353290

Grünewald, F. (2013). War in cities: lessons learnt for the new century of urban disasters. In N. R. White (Ed.), War: Global Assessment, Public Attitudes and Psychosocial Effects (pp. 123-156). Nova Science Publishers.

Gu, E., & Li, L. (2020). Crippled community governance and suppressed scientific/professional communities: a critical assessment of failed early warning for the COVID-19 outbreak in China. Journal of Chinese governance, 5(2), 160-177. https://www.tandfonline.com/doi/full/10.1080/23812346.2020.1740468

He, C., Liu, Z., Wu, J., Pan, X., Fang, Z., Li, J., & Bryan, B. A. (2021). Future global urban water scarcity and potential solutions. Nature Communications, 12(1), 4667. https://doi.org/10.1038/s41467-021-25026-3

Hewitt, J. J. (2017). The peace and conflict instability ledger: Ranking states on future risks. In Peace and conflict 2012 (pp. 5-24). Routledge. https://www.taylorfrancis.com/chapters/edit/10.4324/9781315089997-2/peace-conflict-instability-ledger-ranking-states-future-risks-joseph-hewitt

Hestad, D., Tàbara, J. D., & Thornton, T. F. (2021). The role of sustainability-oriented hybrid organisations in the development of transformative capacities: The case of Barcelona. Cities, 119. http://nukweb.nuk.uni-lj.si/login?url=https://search.ebscohost.com/login.aspx?direct=true&db=buh&AN=153372485&site=ehost-live

Holling, C. S. (1973). Resilience and stability of ecological systems. Annual Review of Ecology Evolution and Systematics, 4, 1-23. https://www.jstor.org/stable/2096802

Hong, T., Wang, B., Li, L., & Gou, X. (2022). The coupling relationship between urban resilience level and urbanization level in Hefei. Mathematical Problems in Engineering, 2022, 1-8. https://www.hindawi.com/journals/mpe/2022/7339005/

Hugo, G. J. (2016). Internal and International Migration in East and Southeast Asia: Exploring the Linkages. Population, Space and Place, 22(7), 651–668. https://doi.org/10.1002/psp.1930

Huck, A., Monstadt, J., & Driessen, P. (2020). Building urban and infrastructure resilience through connectivity: An institutional perspective on disaster risk management in Christchurch, New Zealand. Cities, 98, 102573. https://www.sciencedirect.com/science/article/abs/pii/S0264275119309187

Huck, A., Monstadt, J., Driessen, P. P. J., & Rudolph-Cleff, A. (2021). Towards resilient Rotterdam? Key conditions for a networked approach to managing urban infrastructure risks. Journal of Contingencies and Crisis Management, 29(1), 12-22. https://onlinelibrary.wiley.com/doi/full/10.1111/1468-5973.12295

Jiménez-Medina, P., Artal-Tur, A., & Sánchez-Casado, N. (2021). Tourism Business, Place Identity, Sustainable Development, and Urban Resilience: A Focus on the Sociocultural Dimension. International Regional Science Review, 44(1), 170–199. http://nukweb.nuk.uni-lj.si/login?url=https://search.ebscohost.com/login.aspx?direct=true&db=buh&AN=147625046&site=ehost-live

Jon, I. (2019). Resilience and 'technicity': Challenges and opportunities for new knowledge practices in disaster planning. Resilience, 7(2), 107–125. https://doi.org/10.1080/21693293.2018.1461481

Jovanović, A., Klimek, P., Renn, O., Schneider, R., Øien, K., Brown, J., ... & Chhantyal, P. (2020). Assessing resilience of healthcare infrastructure exposed to COVID-19: emerging risks, resilience indicators, interdependencies and international standards. Environment Systems and Decisions, 40(2), 252-286. https://link.springer.com/article/10.1007/s10669-020-09779-8

Kapucu, N., Martín, Y., & Williamson, Z. (2021). Urban resilience for building a sustainable and safe environment. Urban Governance, 1(1), 10-16. https://www.sciencedirect.com/science/article/pii/S2664328621000012

Khan, M., & Mezran, K. (2013). The Libyan economy after the revolution: still no clearvision. Atlantic Council, Rafik Hariri Center for the Middle East.

Khan, M., Wu, Q., Yan, S., & Peng, J. (2021). Factors Affecting Urban Resilience and Sustainability: Case of Slum Dwellers in Islamabad, Pakistan. Journal of Urban Planning and Development, 147(4), 04021053. https://ascelibrary.org/doi/abs/10.1061/%28ASCE%29UP.1943-5444.0000749

Klein, R. J., Nicholls, R. J., & Thomalla, F. (2003). Resilience to natural hazards: How useful is this concept?. Environmental Hazards, 5(1-2), 35-45. https://doi.org/10.1016/j.hazards.2004.02.001
Laakkonen, S. (2020). Urban resilience and warfare: How did the Second World War affect the urban environment? City and Environment Interactions, 5, 100035. https://doi.org/10.1016/j.cacint.2020.100035

Lak, A., Hasankhan, F., & Garakani, S. A. (2020). Principles in practice: Toward a conceptual framework for resilient urban design. Journal of Environmental Planning & Management, 63(12), 2194–2226. http://nukweb.nuk.uni-lj.si/login?url=https://search.ebscohost.com/login.aspx?direct=true&db=8gh&AN=144918535&site=ehost-live

Leichenko, R., (2011). Climate change and urban resilience. Current Opinion in Environment Sustainability, 3(3), 164-168, https://doi.org/10.1016/j.cosust.2010.12.014

Leichenko, R. M. & O'Brien, K. L. (2008). Environmental change and globalization: double exposures. Oxford University Press.

Lei, Y., Wang, J. A., Yue, Y., Zhou, H., & Yin, W. (2014). Rethinking the relationships of vulnerability, resilience, and adaptation from a disaster risk perspective. Natural Hazards: Journal of the International Society for the Prevention and Mitigation of Natural Hazards, 70(1), 609-627. https://doi.org/10.1007/s11069-013-0831-7
Leichenko, R. (2011). Climate change and urban resilience. Current Opinion in Environmental Sustainability, 3(3), 164–168. https://doi.org/10.1016/j.cosust.2010.12.014

Li, G., Kou, C., & Wen, F. (2021). The dynamic development process of urban resilience: From the perspective of interaction and feedback. Cities, 114, 103206. https://www.sciencedirect.com/science/article/abs/pii/S0264275121001049

Manteaw, B. O. (2020). Mindscapes and Landscapes. Consilience, (22), 93-103. https://www.jstor.org/stable/26924966?seq=1

Marto, R., Papageorgiou, C., & Klyuev, V. (2018). Building resilience to natural disasters: an application to small developing states. Journal of Development Economics, 135, 574-586. https://doi.org/10.1016/j.jdeveco.2018.08.008

Mayer, B. (2019). A review of the literature on community resilience and disaster recovery. Current Environmental Health Reports, 3(6), 167-173.

McDonald, R. I., Weber, K., Padowski, J., Flörke, M., Schneider, C., Green, P. A., Gleeson, T., Eckman, S., Lehner, B., Balk, D., Boucher, T., Grill, G., & Montgomery, M. (2014). Water on an urban planet: Urbanization and the reach of urban water infrastructure. Global Environmental Change, 27, 96–105. https://doi.org/10.1016/j.gloenvcha.2014.04.022

Meerow, S., Newell, J. P., & Stults, M. (2016). Defining urban resilience: A review. Landscape and Urban Planning, 147, 38-49. https://www.sciencedirect.com/science/article/abs/pii/S0169204615002418

Moher, D., Liberati, A., Tetzlaff, J., & Altman, D. G. (2009). preferred reporting items for systematic reviews and meta-analyses: The PRISMA statement. Journal of Clinical Epidemiology, 62(10), 1006-1012.

Moloney, S., & Doyon, A. (2021). The Resilient Melbourne experiment: analyzing the conditions for transformative urban resilience implementation. Cities, 110, N.PAG-N.PAG. Business Source Premier. http://nukweb.nuk.uni-lj.si/login?url=https://search.ebscohost.com/login.aspx?direct=true&db=buh&AN=148449795&site=ehost-live

Monstadt, J., & Coutard, O. (2019). Cities in an era of interfacing infrastructures: Politics and spatialities of the urban nexus. Urban Studies, 56(11), 2191-2206. https://doi.org/10.1177/0042098019833907

Monstadt, J., Schmidt, M., & Coutard, O. (2019). Urban resilience in the making? The governance of critical infrastructures in German cities. Urban Studies 56(11), 2353–2371.http://nukweb.nuk.uni-lj.si/login?url=https://search.ebscohost.com/login.aspx?direct=true&db=sih&AN=137592689&site=ehost-live

Narieswari, L., Sitorus, S. R. P., Hardjomidjojo, H., & Putri, E. I. K. (2019). Multi-dimensions urban resilience index for sustainable city. In IOP Conference Series. Earth and Environmental Science (Vol. 399, No. 1). https://iopscience.iop.org/article/10.1088/1755-1315/399/1/012020/meta

Nathanial, P., & Van der Heyden, L. (2020). Crisis management: framework and principlec with applications to COVID-19. Working paper. INSEAD, The Busines School for the World, 1–9. http://ssrn.com/abstract=3560259.
Nevejan, C. (2020). City science for urban challenges, Pilot assessment and future potential of the City Science Initiative 2019–2020. European Commission. https://ec.europa.eu/jrc/communities/en/community/city-science-initiative/document/city-science-urban-challenges-pilot-assessment-and-future

Okumura, C. K., Locke, M., Fraga, J. P. R., de Oliveira, A. K. B., Veról, A. P., de Magalhães, P. C., & Miguez, M. G. (2021). Integrated water resource management as a development driver–Prospecting a sanitation improvement cycle for the greater Rio de Janeiro using the city blueprint approach. Journal of Cleaner Production, 315, 128054. https://www.sciencedirect.com/science/article/abs/pii/S0959652621022721

Ostadtaghizadeh, A., Ardalan, A., Paton, D., Jabbari, H., & Khankeh, H. R. (2015). Community disaster resilience: a systematic review on assessment models and tools. PLoS Currents, 7. https://doi.org/10.1371/currents.dis.f224ef8efbdfcf1d508dd0de4d8210ed.

Page, M. J., Moher, D., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., ... & Mckenzie, J. E. (2021). PRISMA 2020 explanation and elaboration: Updated guidance and exemplars for reporting systematic reviews. The BMJ, 372(160). https://www.bmj.com/content/372/bmj.n160

Patel, S. S., Rogers, M. B., Amlôt, R., & Rubin, G. J. (2017). What do we mean by 'community resilience'? A systematic literature review of how it is defined in the literature. PLoS currents, 9. https://doi.org/10.1371/currents.dis.db775aff25efc5ac4f0660ad9c9f7db2

Pelling, M. (2003). The vulnerability of cities: natural disasters and social resilience (1st ed.). Routledge. https://doi.org/10.4324/9781849773379

Philibert Petit, E. (2022). Chapter 27—Smart City Technologies plus Nature-Based Solutions: Viable and valuable resources for urban resilience. In J. R.Vacca (Ed.), Smart Cities Policies and Financing (pp. 377–398). Elsevier. https://doi.org/10.1016/B978-0-12-819130-9.00001-2

Pilav, A. (2012). Before the war, war, after the war: Urban imageries for urban resilience. Internationl Journal of Disaster Risk Science, 3, 23-37. https://doi.org/10.1007/s13753-012-0004-4

Pokharel, S., & McDonald, K. (2020). Child-centred urban resilience framework: a tool for inclusive city planning. Australian Journal of Emergency Management, 35(2), 7–8. http://nukweb.nuk.uni-lj.si/login?url=https://search.ebscohost.com/login.aspx?direct=true&db=buh&AN=144758754&site=ehost-live

Ramirez Lopez, L. J., & Grijalba Castro, A. I. (2020). Sustainability and resilience in smart city planning: A review. Sustainability, 13(1), 181. https://www.mdpi.com/2071-1050/13/1/181

Reddy, V. S. (2016). Sustainable construction: analysis of its costs and financial benefits. International Journal of Innovative Research in Engineering and Management, 3(6), 522-525. https://www.researchgate.net/publication/312249507_Sustainable_Construction_Analysis_of_Its_Costs_and_Financial_Benefits

Ribeiro, P. J. G., & Pena Jardim Gonçalves, L. A. (2019). Urban resilience: a conceptual framework. Sustainable Cities and Society, 50, 101625. https://doi.org/10.1016/j.scs.2019.101625

Roberts, D., Douwes, J., Sutherland, C., & Sim, V. (2020). Durban's 100 Resilient Cities journey: governing resilience from within. Environment and Urbanization, 32(2), 547–568. https://doi.org/10.1177/0956247820946555

Roggema, R. (2020). The 'Beltscape': New horizons for the city in its natural region. In P. Bishop, A. Martinez Perez, R. Roggema & L. Williams (Eds). Repurposing the Green Belt in the 21st Century (pp. 119–155). UCLPRESS.

Rose, A. (2007). Economic resilience to natural and man-made disasters: multidisciplinary origins and contextual dimensions. Environmental Hazards, 7(4), 383-398. https://doi.org/10.1016/j.envhaz.2007.10.001

Sardeshpande, M., Rupprecht, C., & Russo, A. (2021). Edible urban commons for resilient neighborhoods in light of the pandemic. Cities, 109, http://nukweb.nuk.uni-lj.si/login?url=https://search.ebscohost.com/login.aspx?direct=true&db=buh&AN=147909974&site=ehost-live

Serre, D., & Barroca, B. (2013). Natural hazard resilient cities. Natural Hazards and Earth System Sciences, 13(10), 2675-2678. https://go.gale.com/ps/i.do?id=GALE%7CA481471084&sid=googleScholar&v=2.1&it=r&linkaccess=abs&issn=15618633&p=AONE&sw=w&userGroupName=anon%7E800e5f48

Sethi, M., Sharma, R., Mohapatra, S., & Mittal, S. (2021). How to tackle complexity in urban climate resilience? Negotiating climate science, adaptation and multi-level governance in India. PloS One, 16(7), e0253904. https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0253904

Sharifi, A., & Khavarian-Garmsir, A. R. (2020). The COVID-19 pandemic: Impacts on cities and major lessons for urban planning, design, and management. Science of the Total Environment, 749, 142391. https://www.sciencedirect.com/science/article/pii/S0048969720359209

Sharma, S. E. (2021). Reactive, Individualistic and disciplinary: the urban resilience project in Dhaka. New Political Economy, 26(6), 1078–1091. http://nukweb.nuk.uni-lj.si/login?url=https://search.ebscohost.com/login.aspx?direct=true&db=buh&AN=153705400&site=ehost-live

Shi, C., Liao, L., Li, H., & Su, Z. (2022). Which urban communities are susceptible to COVID-19? An empirical study through the lens of community resilience. BMC Public Health, 22(1), 70. https://doi.org/10.1186/s12889-021-12419-8

Siddiqui, T., Sikder, M. J. U., & Bhuiyan, M. R. A. (2022). Climate change and mitigation in Bangladesh. Cooling Down: Local Responses to Global Climate Change, 113. https://www.jstor.org/stable/j.ctv29sfz9v.12?seq=1

Tang Abomo, P. (2019). R2P Norm of "Rebuilding" in US Foreign Policy Toward the Libyan Civil War. In P. Tang Abomo (Ed.), R2P and the US Intervention in Libya (pp. 215-237). Springer International Publishing.

Therrien, M.-C., Jutras, M., & Usher, S. (2019). Including quality in social network analysis to foster dialogue in urban resilience and adaptation policies. Environmental Science & Policy, 93, 1–10. http://nukweb.nuk.uni-lj.si/login?url=https://search.ebscohost.com/login.aspx?direct=true&db=8gh&AN=134151389&site=ehost-live

Thoren, H. (2021). Resilience in ecology and sustainability science. In C. P. Krieg, & R. Toivonen (Eds.), Situating sustainability : A handbook of contexts and concepts (pp. 79-90). Helsinki University Press. https://doi.org/10.33134/HUP-14-6

Tootoonchi, S., Bahrainy, H., & Tabibian, M. (2021). Introducing a new paradigm in urban planning through integration of resilience and critical theory to increase feasibility of urban resilience. Laplage em Revista, 7(Extra-B), 521-535. https://laplageemrevista.editorialaar.com/index.php/lpg1/article/view/965

UNISDR, U. (2015, March). Sendai framework for disaster risk reduction 2015–2030. In Proceedings of the 3rd United Nations World Conference on DRR, Sendai, Japan (Vol. 1) https://www.undrr.org/publication/sendai-framework-disaster-risk-reduction-2015-2030

UNISDR, U. (2005, January). Hyogo framework for action 2005–2015: Building the resilience of nations and communities to disasters. In Extract from the final report of the World Conference on Disaster Reduction (A/CONF. 206/6) (Vol. 380). Geneva: The United Nations International Strategy for Disaster Reduction. https://www.undrr.org/publication/hyogo-framework-action-2005-2015-building-resilience-nations-and-communities-disasters

Urquiza, A., Amigo, C., Billi, M., Calvo, R., Gallardo, L., Neira, C. I., & Rojas, M. (2021). An integrated framework to streamline resilience in the context of urban climate risk assessment. Earth's Future, 9(9), e2020EF001508. https://agupubs.onlinelibrary.wiley.com/doi/full/10.1029/2020EF001508

Wade, K., Vrbka, J., Zhuravleva, N. A., & Machova, V. (2021). Sustainable governance networks and urban Internet of Things systems in big data-driven smart cities. Geopolitics, History, and International Relations, 13(1), 64-74. https://www.ceeol.com/search/article-detail?id=962925

Wang, J., & Foley, K. (2021). Assessing the performance of urban open space for achieving sustainable and resilient cities: A pilot study of two urban parks in Dublin, Ireland. Urban Forestry & Urban Greening, 62, http://nukweb.nuk.uni-lj.si/login?url=https://search.ebscohost.com/login.aspx?direct=true&db=8gh&AN=150692118&site=ehost-live

Webb, J. W. (1963). The natural and migrational components of population changes in England and Wales, 1921–1931. Economic Geography, 39(2), 130-148. https://www.tandfonline.com/doi/abs/10.2307/142506?journalCode=recg20

Wilbanks, T. J., & Kates, R. W. (2010). Beyond adapting to climate change: embedding adaptation in responses to multiple threats and stresses. Annals of the Association of American Geographers, 100(4), 719–728. https://doi.org/10.1080/00045608.2010.500200

Wister, A., & Speechley, M. (2020). COVID-19: Pandemic Risk, Resilience and Possibilities for Aging Research. Canadian Journal on Aging= La Revue Canadienne du Vieillissement, 39(3), 344-347. https://doi.org/10.1017/S0714980820000215

Wubneh, M. (2021). Urban resilience and sustainability of the city of Gondar (Ethiopia) in the face of adverse historical changes. Planning Perspectives, 36(2), 363–391. http://nukweb.nuk.uni-lj.si/login?url=https://search.ebscohost.com/login.aspx?direct=true&db=buh&AN=149476724&site=ehost-live

Yaman Galantini, Z. (2019). Catching on "Urban Resilience" and Examining " Urban Resilience Planning" "Kentsel Dayanıklılığı" Anlamak ve "Kentsel Dayanıklılık Planlanmasını". İrdelemek İDEALKENT , 10 (28) , 882-906. https://doi.org/10.31198/idealkent.621492

Yang, Y., Fang, Y., Xu, Y., & Zhang, Y. (2021). Assessment of urban resilience based on the transformation of resource-based cities: A case study of Panzhihua, China. Ecology and Society, 26(2). https://doi.org/10.5751/ES-12280-260220

Zeng, X., Yu, Y., Yang, S., Lv, Y., & Sarker, M. N. I. (2022). Urban resilience for urban sustainability: Concepts, dimensions, and perspectives. Sustainability, 14(5), 2481. https://www.mdpi.com/2071-1050/14/5/2481

Zhang, X., & Li, H. (2018). Urban resilience and urban sustainability: What we know and what do not know?. Cities, 72, 141-148. https://doi.org/10.1016/j.cities.2017.08.009

Zhong, M., Lin, K., Tang, G., Zhang, Q., Hong, Y., & Chen, X. (2020). A framework to evaluate community resilience to urban floods: A case study in three communities. Sustainability, 12(4), 1521. https://doi.org/10.3390/su12041521

Zhou, Q., Zhu, M., Qiao, Y., Zhang, X., & Chen, J. (2021). Achieving resilience through smart cities? Evidence from China. Habitat International, 111, 102348. https://www.sciencedirect.com/science/article/abs/pii/S0197397521000370

7 Which measures can contribute to a sustainable project? Case Stavanger rådhus

Mahgol Afshari[1], Daniel Aurstad[1], Aleksander Bergersen[1], Fride Engesland Fuglestad[1], Tonje Brobak Gresseth[1], Mathias Kvæl Nyheim[1], Petter Halseide Sumstad[1]

1. Department of Civil and Environmental Engineering, Faculty of Engineering, Norwegian University of Science and Technology (NTNU), 7491 Trondheim, Norway

Abstract

The background for the rehabilitation project is that the Stavanger rådhus building dates from 1962, and therefore needs to be upgraded to reach current standards. The goal of this research is to look into the major causes for the rehabilitation of Stavanger rådhus, as well as how proposed actions can lead to a more long-term project. The research was done using a mix of literature and case studies. In addition, there were interviews. The major reason for the renovation is that the structure does not meet modern criteria and demands. This includes, for example, the need for universal design and technological conditions, as well as the need for more sustainable solutions. Preparing a full LCC analysis, developing maintenance plans in partnership with facility management, and supporting all three components of sustainable development will be recommended methods to produce a more sustainable project. The inference is that the Stavanger rådhus is a key building in an urban environment and that the city may profit from a successful rehabilitation effort. The advantages might include serving as a signal building for other current and future development projects. As a suggestion for future investigation, consider how the final building performs in relation to the project's objectives. This is due to the fact that the recovery process is still in its early stages.

KEYWORDS: Rehabilitation, Renovation, Sustainability, Maintenance, Facility Management

Introduction

In recent years, both consumers and developers have expressed an interest in sustainable development in the real estate and construction industries. Human impact on nature and climate change has raised much-needed awareness as the globe moves toward a greener future. According to the Norwegian government, over 80% of today's structures will still exist in 2050. (Kommunal- og Regionaldepartementet, 2009). As a result, the sector has been obliged to shift its attention to bringing existing structures up to modern requirements. The world is running out of building materials supplies, and CO2 emissions should be kept to a minimum. Furthermore, development and demolition accounted for 25% of all garbage generated in Norway in 2017. (Kommunal- og moderniseringsdepartementet, 2020). Therefore, modest alterations and adjustments in the sector can have a significant influence on its environmental footprint, and sustainable repair and maintenance are critical to achieving this aim.

Stavanger rådhus

Jan Jæger designed the Stavanger rådhus, which was finished in 1962. The structure was once a library, including facilities for the mayor, president, and municipal administration. Post-war modernist architecture is defined by asymmetrical broken-up building design separated into numerous volumes, horizontal lines, wide windows, button details, and diverse colors (Stavanger kommune, 2019).

The functionality and technical condition of the building have been evaluated several times since 2010 in various ways. The present city hall has to be replaced right away since it doesn't meet the regulatory standards for fire safety and universal design, and the building's components are beyond their useful lives. Stavanger rådhus will be renovated and improved to become a useful, accessible, and on-time city hall. The new structure will give workers pleasant, forward-looking working circumstances, contact with city and municipality citizens, and identity for the area where the majority of the city's municipal authorities are assembled.

Since 2010, several assessments have been made of the building's functions and technical condition. As the current city hall does not satisfy legal requirements for fire safety and universal design, and the building's components have achieved life expectancy, the building has an immediate need for replacement. Stavanger rådhus will be rehabilitated and further developed into a timely, functional, and accessible city hall. The new building will offer good, future-oriented working conditions for employees, contact with the city and the municipality’s residents, and provide identity for the quarter where most of the city’s municipal authorities are gathered. Through an environmental strategy that promotes knowledge of sustainable design, engineering, and construction throughout the restoration process, the building will assist in making Stavanger a green, climate-friendly, and climate-robust city (Stavanger kommune, 2019). Based on this, the main research question of this paper is defined as

“*What are the main reasons for starting the rehabilitation of Stavanger rådhus and which measures can contribute to a sustainable project?*”

Methodology

This research was carried out primarily through a literature review, a case study, and an interview with the project manager of this case study, Stavanger rådhus. Because of the Covid-19 constraints, this study is more of a literature review. Various publications and term papers on facility management, workplace management, technical conditions, social, environmental, and economic sustainability, and life cycle costs were evaluated. The reviewed studies were obtained through an advanced literature search in Google Scholar and Oria, project documents available in the Stavanger municipality's archive and project website, and documents obtained from experts involved in the Stavanger rådhus project, such as the project manager or experienced professors.

Prior to doing the literature review, keywords relating to the issue were created in order to minimize bias in the research. Further, to delimit the study and strengthen the report's accuracy and credibility, a lower limit was set for the year of publication, in addition to the level of publication channel from which the articles were obtained. To eliminate bias, articles published for firms by industry professionals were also omitted from the research. A three-part process was used to find selected sources. The articles were evaluated in the first round based on whether the title corresponded to the research topic. Summaries were evaluated in the second round to see whether the article was still related to the study. The final phase involved a thorough reading of all pertinent materials. The sources were disregarded if it turned out that they were not pertinent in any case.

In addition to the literature research, several semi-structured virtual interviews were done with Zakarias Chibssa, the project manager of Stavanger rådhus. The project manager of Stavanger rådhus was asked some informal questions through email early in the research, and the information he provided was also used as a source of information for this study. A site visit was not possible because of the Covid-19 scenario. As a result, site analysis was ruled out of this inquiry.

Theoretical Background

Facility Management

Promoting the relationship of design to facilities management is one of the most significant aspects for project maintainability and achieving sustainable goals (Whyte et al., 2016; Fedoruk et al., 2015 and Forcada et al., 2015). In other words, competent facilities management boosts production, ensures safety standards, and keeps all assets in excellent working condition. Facility Management may lead to more cost-effective project implementation while also reducing stress and strain. It can also increase productivity and extend the life of project assets. According to the literature research, different articles and standards define Facility Management differently, and in most cases, they are dependent on the organization and grow more full-fledged with time.

Workspace Management

Workspace management is one of several important support tasks in Facilities Management, the primary purpose of which is to assist the core business. According to Atkin and Brooks (2015), efficient and cost-effective space use are two of the most significant criteria in workplace management. They underline the need of including design features that may support various activities at different times, such as fixtures, furniture, lighting, and ventilation. According to Lindkvist and Elmualim (2009), workplace management is defined as the creation of a physical environment that instinctively fits the psychological and physical demands of the respective users. Workspace management is also linked to the Working Environment Act, which aims to "ensure a working environment that provides a foundation for a health-promoting and meaningful work situation, that provides security against physical and psychological damage, and that has a welfare standard that is always in accordance with the technological and social development in society" (Arbeidsmiljøloven, 2005).

Working practices have evolved dramatically in recent decades as a result of office digitalization and more flexible company models. In many circumstances, the staff is not reliant on the workplace to do their job, and modern office designs should reflect this. The many office concepts of today may be defined using three main dimensions: office location, office layout, and office use (de Croon et al. 2010). An office is planned and developed on diverse concepts depending on the requirement for focus and communication, and office landscapes may be separated into cell offices, open landscapes, and activity-based workspaces within workspace design. There is no ideal solution in workplace design where a one-size-fits-all approach may be used. As a result, the final design should represent the working techniques, goals, beliefs, strategies, and procedures of the user firm (Blakstad, 2019). A planned, well-thought-out workplace design will therefore help end users of a facility do their job activities as efficiently as possible, while also contributing to the development of value inside the business.

Condition Survey

A proper condition survey is essential to establish the necessary actions in a restoration project. It may shed insight on potential opportunities and challenges in the relevant endeavor. A condition survey is used to categorize the technical state of a structure or a building portion (Holtmon, 2017). The survey can be conducted on three levels to establish the condition class. The first level is a comprehensive examination that consists mostly of observations and, in some situations, measurements (Anderssen, 2020). Level 2 surveys are more extensive and in-depth than level 1. Level 2 condition surveys are frequently employed in conjunction with modifications or to investigate the amount of damage. The last and most comprehensive level of condition inspection comprises exact measurements as well as deconstructive treatments. In replacement or renovation projects, Level 3 is frequently employed on certain building elements. The studied object is categorized based on its technical state for all levels of condition survey. The condition classes are detailed in the table below using definitions from the Norwegian standard (NS 3424:2012).

Condition class	**Condition in relation to reference level**	**Description of condition class**
CC0	No nonconformity	The investigated object's condition is at reference level or better, and it shows no symptoms of nonconformity.
CC1	Minor nonconformity	The investigated object exhibits normal wear and has been maintained. Age of the object is less than 50% of normal lifetime.
CC2	Essential nonconformity	The investigated object is markedly worn or damaged or has a reduced performance. The building part is older than 50% of normal lifetime. CC2 can also be the result of incorrect design or maintenance, or lack of documentation.
CC3	Major nonconformity	The investigated object has or will in a short time suffer total performance failure. It is in need of immediate measures. The component has exceeded its normal lifetime.
CCNI	Not investigated	The investigated object is not accessible for inspection and potential damages or nonconformity may result in extensive consequences.

Table 1: Condition classes based on NS3424

Social Sustainability

Creating cities and communities that are socially, economically, and ecologically sustainable in the long run is one of the century's major problems (Woodcraft, 2012). The Brundtland Commission defined sustainable development in 1987 as "development that fulfills the requirements of the present without jeopardizing future generations' ability to satisfy their own needs" (UNESCO, 2021). In the first decade following the definition of sustainable development, the idea of social sustainability was overlooked in favor of environmental and economic components of sustainability. In the late 1990s, social sustainability was recognized as a critical component of the sustainability agenda (Rasouli and Kumarasuriyar, 2016).

Social sustainability entails providing individuals with a reasonable base for a good existence (FN, 2019). Sustainable refurbishment and restoration are expected to improve comfort and quality of life while reducing negative environmental consequences and boosting the economic sustainability of the structure (Kylili et. al, 2016). The social component is concerned with how buildings might be constructed to improve people's well-being, health, and quality of life. From how the architecture of the building appeals to us to how the internal environment influences our health and well-being (Byggitegl, 2015). Physical structures form the basis for how people live and work (Meld. St. 28 (2011-2012)). Thus, social sustainability is concerned with how individuals and society coexist. It blends physical building design with social world design, including infrastructure to support social and cultural life, social facilities, and space for people and places to grow (Woodcraft, 2012).

Social Sustainability and Universal Design

As social sustainability is concerned with how the environment affects human quality of life, a socially sustainable built environment should be developed via careful planning and design (Kadir and Jamaludin, 2013). Universal design is an important feature of social sustainability and has emerged as an important component for a healthy lifestyle and social development. The goal of universal design is to organize and build places so that they may be used by as many individuals as feasible (Lid, 2009). Universal design is a crucial component of social sustainability, and social factors should be highlighted more in discussions of sustainability since they impact human behavior and quality of life in a variety of ways (Kadir & Jamaludin, 2013).

The UN Convention on the Rights of Persons with Disabilities (CRPD) states that they should be given equal chances to exercise their human rights. Inclusion of all members of society is a critical objective for both universal design and social sustainability (Vavik & Keitsch, 2010). The fact that everyone has access to a building does not imply that everyone can use it. People with disabilities may have the right but not the opportunity to access a building if it is not adequately built. Universal design should help to create a more inclusive society by increasing accessibility for persons with disabilities and increasing the potential of people with varied needs meeting as equals in accessible settings (Lid, 2009). Universal design must contribute to the creation of good structures and outdoor spaces for as many people as feasible, and a building is universally built when it can be used in an equal manner by all people (Universell design AS, 2021).

Environmental Sustainability

Morelli (2011) defines environmental sustainability as meeting current resource and service requirements without jeopardizing future generations' ability to do the same. To ensure environmental sustainability, the ecosystems that offer access to resources and services must be preserved. The UN has stated a wish for cities to include environmental sustainability into their policies and strategies. The emphasis should be on improved resource usage as well as climate change mitigation and adaptation (FN, 2021). In Norway, we already have a lot of this in the shape of climate and environmental plans. These plans come in a variety of sizes, and it is typical for communities to create their own. These designs are once again utilized for projects that will be carried out inside the municipality.

Stavanger Municipality's environmental plan

The Stavanger municipality's environmental plan, which covers the years 2018 to 2030, was approved by the city council on November 26th, 2018. It is a sub-plan of a broader municipal plan approved in June 2015. The environmental plan is the municipality's own strategy for long-term development, and it covers several issues. This is true for everything from transportation to agriculture. The plan's goal is to provide guidelines for the municipality's future growth based on the municipality's social duty both locally, nationally, and worldwide. It also outlines the foundation for the strategy to be implemented, which is mostly dependent on money, personnel, and dealing with any snags. To emphasize the relevance of the plan, it has been produced in

accordance with the UN's 17 sustainability objectives as well as numerous criteria such as the Greenhouse Gas Protocol (Stavanger kommune, 2018).

Economic Sustainability

The economic dimension of sustainability, like the social dimension, is less well-known and discussed than the environmental dimension. One dimension cannot be fully comprehended until the other two dimensions are included and understood. Economic sustainability is about guaranteeing financial stability for people and society (FN, 2019). Economic sustainability should be considered in connection to buildings and construction projects in terms of how structures and the way they are constructed may help to funding the welfare society in the future. To accomplish so, the building sector must be aware of cost-effective solutions that will benefit not just themselves but society as a whole.

The building business is the one in Norway that generates the most garbage (Miljdirektoratet, 2019). To decrease waste on building sites, the industry must alter its attitude from a linear economy to a more circular economy by reusing resources and focusing on recycling in a much bigger capacity than it already does. Opposing parties in a circular economy, such as material producers that risk losing revenue, might jeopardize the building industry's long-term development. The building sector must develop new business models that enable additional value, economic development, and new workplaces in order to establish a circular economy and more sustainable and ecologically good behavior (Moum, Skaar and Midthun, 2017).

Industries must support a sufficient number of sustainable workplaces in order to fund the welfare society in the future (NHO, 2020). Workplaces are considered sustainable when they are manufactured in an industry that emits low pollution and greenhouse gas emissions (Olerud, Tjernshaugen og Andersen, 2021). A crucial feature of economic sustainability is that what today's society has available in terms of resources, commodities, and employment must be accessible in the same capacity for future generations. As a result, it is critical to focus on sustainability early in the planning process for new structures or the restoration of an existing building, and to apply measures on the construction site to ensure a sustainable construction process.

Life cycle cost (LCC) analysis method

The expenses involved with management, operation, maintenance (MOM), and replacement of a structure during its lifetime are referred to as life cycle costs or lifetime costs (NS 3454: 2013). Life Cycle Expenses can be simplified by defining them as total costs incurred from investment through demolition. The method's goal is to compute the whole cost of the project, including funding, planning, engineering, and construction. The size, design, materials used, quality, and solutions chosen for the building will all have an impact on the expenses associated with wear, cleaning, energy usage, and internal climate, as depicted in figure 1. It is so critical to consider the whole cost of various alternatives rather than simply the investment cost. The functionality and flexibility of the building will have an impact on user productivity and profitability. This should be done early on, when the potential for effect is highest. It will also be beneficial to strike a positive balance between capital and operational expenditures (Hansen, 2019).

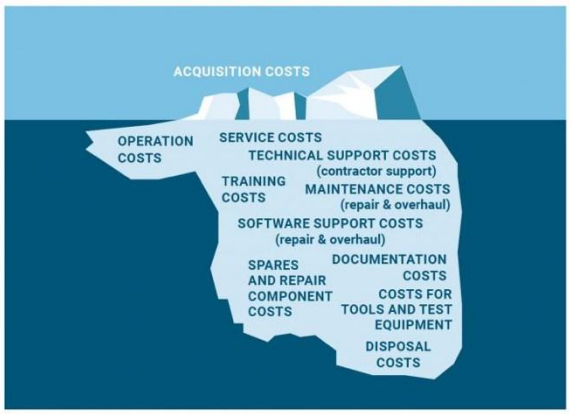


Figure 1: Condition classes based on NS3424

NS 3454 Life cycle costs for buildings

The Norwegian standard for life cycle costs, NS 3454:2013 Life cycle costs for buildings, provides major components for yearly expenses and lifetime costs (Standard Norge, 2021). Norwegian standards are aligned with other international standards, and they provide key and critical information regarding components of a product, service, or work process (Hofstad, 2018). A single standard is essential in a growing construction sector because knowledge vaults are built up from completed projects. In addition, NS 3454 offers calculation methodology and a cost statement for calculating life cycle costs for buildings and building components. NS 3454:2013 is composed of major items (1-digit level) and minor items (2-digit level). The table below summarizes the important points.

Cost item	**Comment:**
1. Acquisition and residual costs	Costs for acquisitions for the building / building part € and residual costs at the end of the analysis period / service life.
2. Management costs	Costs for property management, financial management and administration.
3. Operating costs	Costs for activities that are necessary to maintain the functionality of the building part over an expected lifetime.
4. Replacement and development costs	Replacement of building parts to maintain the value of the building as well as costs for development measures to meet demands from users, the market and the authorities and which increase the value of the building.
5. Supply cost	Costs associated with energy, water, sewage and waste disposal.
6. Available	Can be used for interruption contracts
7. Cleaning costs	Costs for carrying out cleaning activities.
8. Service-/support costs	Costs for activities that support the core business of the building that are not directly related.

Table 2: Self-produced (Inspired by NS:3454 and Hansen, 2019)

The standard displays the major items and their corresponding sub-items in separate tables. The cost items are specified as activities and do not take into account whether the activity is performed by an external or internal provider. In Norway, we frequently compute with a lifetime of 60 years, even though this is frequently exceeded. The base year (t0) denotes the year to which the calculation expenses are discounted and is thus set at 60. (NS 4354:2013).

Annual costs

The annual cost is important for analyzing the repercussions of the chosen investments. The yearly cost shows observable expenses such as investment, future management costs, and operation and maintenance costs as an annuity throughout the life of the building T with a discounted interest rate r.

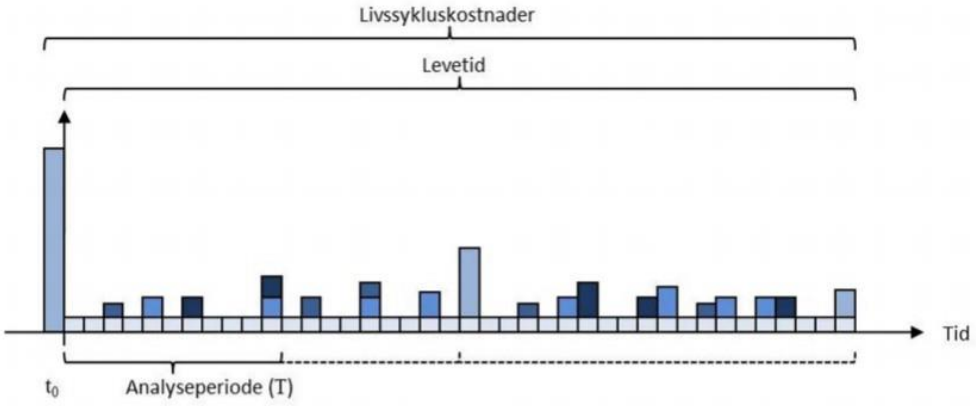


Figure 2: Analysis period (NS3454)

The discount rate is set to the predicted inflation rate, resulting in the LCC being computed as the net present value of future expenses, which are dispersed as an annuity. That is, the amount that must be set aside to meet interest and capital installments during the time (Hansen, 2019, p. 163). This is depicted in the diagram below, where predicted expenses such as investment, replacement, and maintenance are computed and dispersed throughout the life of a structure (NS 3454).

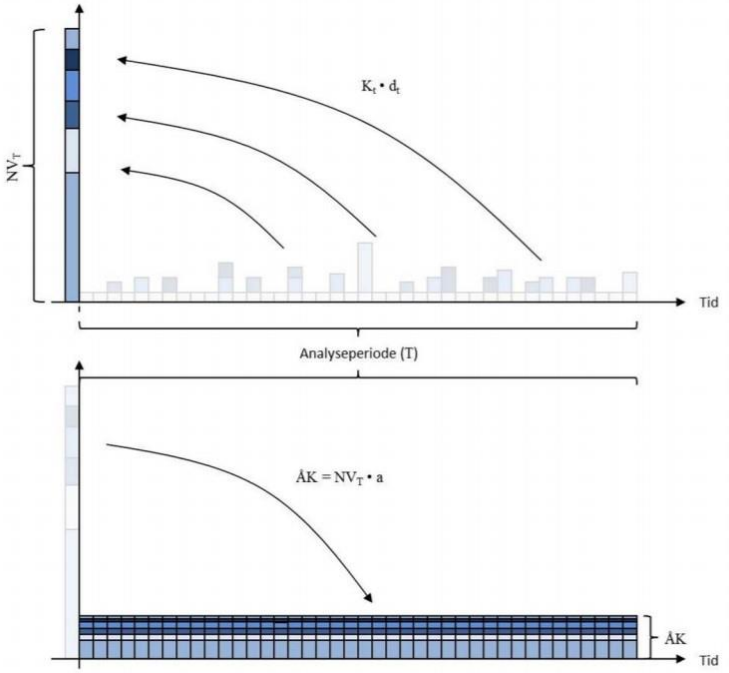


Figure 3: Calculation methodology (NS3454)

Annual cost offers a picture of the project's overall expenses over the life of the building and is a valuable tool for making better material selection decisions for new construction and restoration. Cleaning, together with investment expenses and energy use, accounts for around 25-30% of overall MOM costs. To determine the right yearly cost, it is necessary to consider all solutions, such as substrates. Material selection and other minor construction choices can have a significant influence on cleaning expenses. There should be few loose components, such as trash cans, so that maintenance staff do not have to relocate objects to clean. This is lost time, which makes cleaning less efficient and increases the building's operating costs. What appears to be the cheapest at first glance is not always the cheapest for the building during its lifetime. It is not a stated aim in LCC calculations to have the lowest feasible yearly costs, but the expenses must be made clear (Haugen, Saebe, Foss, 2020).

Results

Seven factors have been identified as crucial in order to have a sustainable project as a result of the literature review, the case study, and the interview with the project manager of this case study, Stavanger rådhus, which are discussed one by one in this part.

Facility Management

Adequate and active facilities management is critical to the success of any firm, regardless of size or scale. This will result in more efficient and smooth operations that are less likely to be disturbed by a variety of technological challenges. Good facility management and upkeep may also improve the organization's agility, flexibility, and sustainability. Outsourcing facility maintenance is a suggested choice for businesses that lack internal facility maintenance knowledge since it may be more effective and cost-efficient (Karssing, 2019).

Time management is one of the outstanding issues that project managers face. Most of the time, there are several tasks that must be completed in a short amount of time, and multiple unforeseen events may occur throughout the project's implementation phase. This increases the burden on project managers, who must find out how to manage and complete tasks by deadlines. The value of having facility management becomes clear in these scenarios. A qualified facility manager may assist the project manager in making more accurate and timely choices, and the project manager can use the facility manager's expertise and experience to discover solutions to forthcoming difficulties and obstacles in less time. In this way, The project's scheduling will be more manageable.

The facility manager's obligations do not end with the project's implementation phase. The building must function well throughout its life cycle, and different persons in various roles will work in Stavanger rådhus at different times. As a result, there is a significant likelihood of some technical difficulties happening in various building systems or facilities such as the lighting system, temperature system, employed materials, and so on. The facility managers of the building are the most knowledgeable persons who know the building better than anyone else since they were involved in the project from the beginning and are intimately familiar with all of the facilities that are utilized in various areas of the building. As a consequence, the necessity of facility management for the project will become clearer in relation to the building's maintenance functions.

Workspace Management

The goal of this section is to shed light on which aspects must be made aware of and taken into consideration in new workstation designs, which are likely to be transferrable to the city hall even if Stavanger rådhus is bound by a local standard.

Forskerforbundet (2020) has compiled a list of important research publications, dissertations, studies, and news items about workplace design, particularly open office landscapes. There appears to be agreement in the studies that open landscapes do not serve their objective in many circumstances. Many studies associate open office landscapes with less productivity and efficiency, fewer interactions, greater sick leave, and lower user happiness. According to the literature review, employees who work from their home office during the pandemic are more likely to continue working dispersed, either in full or in part, following its removal.

The cell offices in Stavanger rådhus, in particular, are susceptible to regular user replacement. The political parties that house these may be changed every four years following the election. In comparison to the seven-year typical lease tenure for office rentals, it presents extra hurdles in terms of the flexibility of more regular modifications or redesigns (DNB Næringsmegling, 2018). One of the project's primary objectives is to boost productivity. As a result, it might be claimed that the proportion of cell offices should be increased above the present 15%, on the grounds that cell offices improve productivity to a larger extent, particularly during concentration-demanding tasks. However, Stavanger rådhus is also known as "folkets hus," which translates as

"people's home," making the transparent features of an open office landscape perfect for inviting the residents of Stavanger and the surrounding region.

Stavanger rådhus may experience further issues in the future due to shorter leases and growing expectations for flexibility for building users. These elements also have an impact on the predictability of the owner, who must plan the extent to which a robust and flexible space program will be supported and which technology will be employed as a foundation. Furthermore, the municipality of Stavanger must take care that future-oriented workspace design does not negatively impact early usage and implementation. However, there will always be ambiguity about the building's future usage and which technology will be installed.

It is not unlikely that the project's choice not to change the workplace design as a result of the pandemic would cause problems with future work patterns and flexibility needs. On the contrary, it is realistic to expect that an open workplace environment and its adaptability will be advantageous in future problems. Covid-19 proves beyond a shadow of a doubt that the digitization process in workplaces has increased, contributing to organizations spending more time on restructuring activities that they would otherwise have spent less time on. It emphasizes the significance of having structures that can adapt to new events and scenarios more quickly, cheaply, and efficiently than ever before.

Recommended measures

It is proposed that end users be more involved in order to achieve the municipality's aim of higher productivity. The ultimate workstation design should be based on human needs rather than area norms. This strategy guarantees that end users have a stronger sense of ownership over both the process and the end result, making it simpler for them to accept changes in both the physical and digital work environments. One of the most difficult issues is balancing competing factors such as user requirements, technology, financial frameworks, universal design, ventilation requirements, and so on. To develop an ideal workplace design, it is advised that a framework with clear success criteria be established and followed, relevant KPIs be measured, and effective change management be anchored inside the firm. Workspace design should be viewed as a tool with a strong link to the organization's fundamental operations and support services, as well as to technology. Covid-19 has demonstrated that the open office design, which is intended to bring individuals closer together, paradoxically works against that goal by fulfilling the demand for social separation. Stavanger rådhus should thus evaluate the pandemic's rippling impacts to a greater degree. As part of a sustainable and circular economy, the literature analysis shows that future office solutions should focus on user-oriented demands, with a flexible workplace design.

Condition Survey

Rdgivende Ingenirers Forening, RIF, published the "State of the Nation" study last year. The report's goal was to look at a sample of public amenities, buildings, and infrastructure. Buildings owned by the municipality are considered and compared to Stavanger rådhus for this assignment. The survey included roughly 7,5 million square meters of public space. According to the results of the condition surveys, around 70% of all public buildings are more than 40 years old, with a significant percentage trailing in maintenance work (RIF, 2021). Furthermore, the majority of them are poorly constructed for their intended use and have low area efficiency. Both of these observations hold true for Stavanger rådhus. The structure has had several changes of use since it was constructed in the 1960s (Stavanger kommune, 2019). The majority of the building components were original and had so outlived their projected lifespan.

Two master's theses from recent years conducted interviews with various building sector experts concerning refurbishing projects. While questioned about unanticipated obstacles when upgrading older structures, the significance of a comprehensive condition evaluation was often mentioned (Lund, 2016). Despite this, some respondents stated that condition surveys were not prioritized because they were viewed as a waste of time and money. Despite a thorough examination, the respondents encountered unforeseen challenges in all renovation projects. A multiconsult official stated that no condition survey was conducted prior to the destruction of

Stavanger rådhus (Kyllingstad, 2021). The selection is based on the building type, age, and accessible papers, which provides engineers with a clear understanding of the structure and any difficulties. A few possible issues are identified, such as moisture infiltration from the ground, a poorly segregated floor towards the ground, and maybe a lack of radon barrier.

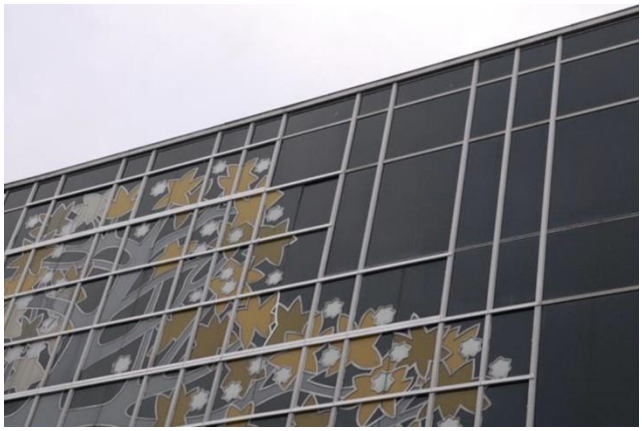


Figure 4: "Kunnskapens tre" on glass cladding with additional horizontal profiles (Stavanger kommune, 2019)

The respondents also stated that the architectural structure will always be unpredictable (Holtmon, 2017). Nonetheless, a destructive investigation of the building structure will minimize project uncertainty. According to the findings of the study, extensive investigations might identify a greater number of building defects (Lund, 2016). Building damage detected late in the process might make staying within the schedule and budget challenging. A thorough condition study may have uncovered information about the building and thereby enhanced the planning process, preventing such nasty shocks. Because of Covid-19, a large number of municipal employees were obliged to work from home this year. The municipality might have taken advantage of the fact that the Stavanger rådhus was practically empty for a period of time and conducted a destructive condition survey.

The most recent condition surveys were conducted in 2009 and 2010, when the glass facade and technological equipment were investigated (Chibssa, 2021). The glass facade was examined on level 2 in 2009, with observatory inspections and sample testing. According to the study, the facade was extensively damaged and was rated as CC3. Concerned that the glass would fall out, prompt action was taken, and horizontal profiles were inserted (see Figure 2). According to the article, the measures were just a temporary remedy owing to aesthetic concerns. The glass façade has not been updated since 2009.

Recommended measures

Though it is too late to do a condition analysis on the existing building, the results of the literature review demonstrate that condition surveys are an effective approach of predictive maintenance (Lund, 2016). As a result, it is advised that the municipality develop a maintenance plan that includes condition surveys every three to four years. Buildings held by the municipality are known to be neglected, thus they should adopt a long-term maintenance strategy (RIF, 2021).

Social Sustainability and Universal Design

The municipality of Stavanger aspires to be generally designed by 2029. (Stavanger kommune, 2014). The municipality has set lofty ambitions for the project, one of which is that the new city hall would place a special emphasis on universal design. One of the key reasons for initiating the renovation project is that the present municipal hall does not fulfill today's criteria for universal design. Furthermore, one of the project's objectives is to win the innovation prize for universal design. The project is evaluated from a comprehensive quality standpoint, including factors such as material selection, functionality, aesthetics, sustainability, and user experience. The need of universal design that goes beyond broad regulatory requirements and minimal standards is underlined (DOGA, 2021).

Knowledge of the barriers that people face when using existing spaces is required for universal design (SINTEF Byggforsk, 2012). It is necessary to identify the barriers and their severity. SINTEF Byggforsk has developed

a guide for the universal design of public and work buildings. The guide is intended to be used as a tool in the design of buildings where everyone should have equal access, and it addresses fundamental principles for how such buildings can be adapted for people with disabilities (SINTEF Byggforsk, 2012). Access, parking, and outdoor living areas in conjunction with buildings, as well as outdoor living space for the general public, are examples of developed outdoor areas (DIBK, 2017). Universell Utforming AS has created a handbook that includes various instances of individual element design in outdoor settings. The guide's goal is to provide advice for developing outdoor areas, and the recommendations go beyond what is provided in TEK 17 (Universell Utforming AS, 2019).

Recommended measures

Several procedures are required to guarantee that Stavanger rådhus may be utilized equally. Tactile signage should be installed to help the vision impaired find their way about the structure. It is also advised to help people who have difficulty with direction and understanding. Using symbols on signs might be one measure. For example, rather than simply saying "wardrobe" on a signpost, it should additionally include symbols indicating what the sign truly implies. It is advised that those with limited mobility install a lift with enough room for a wheelchair. The project investigated whether a turning radius of 1.6 meters is sufficient or whether it should be expanded. In any event, this measure exceeds TEK17, which demands a turning circle of at least 1.5 meters. It is also suggested that the new municipal hall include both natural and artificial illumination. The user's need to orient oneself is thereby met, and their well-being can be increased.

In addition to the inside rooms, the new city hall should support good outdoor areas by building paths and supplying obstacle-free zones. The outdoor areas in the city hall quarter are one of several key projects that will contribute to the regional strengthening of Stavanger (Stavanger kommune, 2021a). It is suggested that recreation zones be established around Stavanger rådhus. One approach may be to set up different benches for everyone to use. These should not be placed in such a way that they restrict access. Outdoor furniture and benches encourage more people to visit the city hall district, contributing to better public health and the well-being of the building's users. Easy access to bathrooms and garbage bins encourages more use of the outside spaces and contributes to the new city hall's social pleasure. Establishing signage with clear and intelligible information is one way to make this obvious to building users. This will make it simpler for walkers, sitters, and cyclists to navigate the outdoor spaces of Stavanger rådhus.

These steps will assist the municipality in meeting its objective of being universally designed by 2029 and in winning the universal design innovation award. At the very least, it will help to optimize social sustainability and guarantee that all Stavanger Municipality people may use the new city hall equitably.

Environmental Sustainability

Key elements of Stavanger Municipality's environmental strategy for the years 2018 to 2030 are outlined here.

Energy and material use in construction

The overall target of the municipality of Stavanger regarding energy and materials used in building and construction is to reduce climate emissions by 80% by 2030. Climate emissions should be completely eliminated by 2040. According to the proposal, CO2 emissions from building and civil engineering account for 18% of total emissions in Oslo and 13% of total emissions in Trondheim. Furthermore, Stavanger is estimated to be of the same order of magnitude as Trondheim, and an SSB study reveals that these values are rising (Stavanger kommune, 2018).

Figure 5: Greenhouse gas emissions from construction 1990-2016 prepared by Statistics Norway. Source: Stavanger kommune, 2018

Large excavators and drying facilities, in particular, emit a significant quantity of CO2. However, the municipality aims to electrify them by 2030, and in the interim, they seek to establish criteria for the use of sustainably recovered hydrogen and biofuels. Stavanger municipality intends to adopt the following step to mitigate climate emissions (Stavanger kommune, 2018):
All fossil-based energy sources must be phased out in municipal buildings by 2020, and on municipal building and construction sites by 2021.

Consumption, reuse, recycling, and waste treatment

According to the environmental plan, a Stavanger resident creates 425 kilograms of garbage each year on average. A considerable portion of this waste consists of non-renewable raw resources that, if not handled properly, would disappear. The most important aim of the municipality of Stavanger in dealing with problems linked to building and construction will be to consume as little material as possible, to prioritize reuse, and to manage hazardous waste in an environmentally sound manner. Furthermore, the study mentions these, as well as how they constitute cyclic economic processes
(Stavanger kommune, 2018).

Figure 6: Circular economy as shown in Stavanger municipality's environmental plan. Source: Stavnger kommune, 2018

Recommended measures

Following the municipality's environmental strategy is advised to guarantee that the renovation of Stavanger rådhus provides a more ecologically friendly building. As a result, the project will guarantee that they are in accordance with the municipality's desires for environmental sustainability. It is significant since it is the municipality of Stavanger's "home." Stavanger municipality, therefore, has the chance to send a signal to others, both existing and future projects in the city, about what is necessary to improve the environment via the restoration.

Even if the construction is still in its early stages and the papers received are mostly pre-analyzes, the project may still be claimed to be in accordance with the environmental plan. This is accomplished, among other things, by requiring a fossil-free building site in accordance with the environmental plan. It is stated here, among other things, that all fossil-based energy must be phased out on municipal projects by 2020. Furthermore, reuse, recycling, and waste management are prioritized. According to internal papers, the project intends to repurpose many pieces from the old city hall, and if the materials cannot be reused, they will attempt to sell them. What is most notable about reuse is that current support systems will be reused. Given that these support systems are mostly made of concrete, employing them will significantly minimize the climatic impact. This is heavily intertwined with the environmental strategy.

As previously said, the project is still in its early stages, so it will be fascinating to see how the end result compares to what is predicted. Large, long-term, and expensive projects frequently undergo adjustments along the road. To gain the impression that goals in the environmental plan have been met, it will be necessary to compare intended goals with completed construction after the project. This manner, it will be able to determine if Stavanger rådhus fits the intended needs

and aspirations for environmental sustainability. This is especially essential given the municipality's desire to design a more ecologically friendly structure.

Economic Sustainability

When it comes to building sites and materials, the construction sector has a lot of room for improvement in terms of economic sustainability. Reducing waste in the construction industry via recycling and reusing materials is critical to making the business sustainable and attaining a circular economy. A paper from SINTEF's literature research on circular economy in tomorrow's building sector identifies four emphasis areas for achieving a circular economy: 1) effective land use, 2) sustainable management of materials and components after use, 3) energy-efficient structures, and 4) efficient resource usage in construction processes (Moum, Skaar and Midthun, 2017).

The first focal area is on how a building's land usage may be optimized by allowing shared use and designing for flexibility. Covid-19 has caused society to adapt to new methods of cooperating from remote regions. As a result, individuals are becoming increasingly accustomed to working from home or on digital platforms in general, which might alter how buildings are constructed in terms of shared workplaces. Moum, Skaar, and Midthun (2017) characterize the second priority area as maximizing resources, eliminating waste, and obtaining new raw materials. Recycling stations on building sites can be an effective way to decrease the requirement for new raw materials in construction projects. Because raw materials and resources are finite on Earth, recycling and reusing items are critical.

Furthermore, energy-efficient buildings can help to minimize greenhouse gas emissions while also supporting the second priority area of maximizing resources. Building digitization can aid in the development of solutions to minimize greenhouse gas emissions and attain zero-emission buildings. Finally, the fourth key area of developing a circular economy will be a greater emphasis on material transformation, refurbishment, and reuse rather than demolition and new building construction (Moum, Skaar, and Midthun, 2017). Planning for maintenance and "end-of-life" materials in the early stages of construction projects will decrease waste and the manufacture of new materials, benefiting the environment.

The Stavanger municipality's climate and environmental strategy 2018-2030 includes aims for reducing greenhouse gas emissions from building sites, as well as achieving a circular economy through improved management of the use and disposal of construction materials (Stavanger kommune, 2018). Multiconsult, the contractor for the Stavanger rådhus restoration project, intends to repurpose materials from the destruction of the current city hall in the rehabilitation project (Byggfakta, 2020). They also seek to recycle materials that cannot be used in the project for use in future municipal initiatives, so contributing to a circular economy under the climate and environmental strategy.

Sustainable workspaces

Buildings must be designed with flexibility and elasticity in mind, as well as universal design, to guarantee that they can adapt to future changes in demands while remaining accessible to all. Buildings may become more sustainable by being simpler to alter, resulting in a longer lifespan (Fufa and Mellegrd, 2020). According to the designs for the Stavanger rådhus rehabilitation project, the goal is to create workspaces that are acceptable and safe, as well as to enable flexibility, universal design, and shared usage (Stavanger kommune, 2019). They are also increasing the overall number of workplaces in the municipal hall as part of the project. The

rehabilitation project aims to be Rogaland County's first fossil-free building site. As a consequence, the new city hall's additional workstations may be considered sustainable.

Life Cycle Cost

As previously stated, the legislation requires that life cycle costs be included in public procurement, which the project has done so far. In 2018, an early phase LCC analysis was conducted in connection with the deployment of a feasibility study for modernizing Stavanger City Hall. The project is now in the pre-project phase, and certain adjustments have been made that will be highlighted in a new LCC analysis that is now underway.

The study results reveal that the project meets the BREEAM NOR criteria for calculating yearly expenses over 30 and 60 years. Because of the substantial expenditure, the yearly cost will rise as a result of the restoration. The operating and maintenance expenses are predicted to be greatly reduced following the rehabilitation, as indicated in Figure 4. The substantial energy efficiency, which is noted in the next paragraph, will practically half supply costs. Because the facility will be larger, cleaning is predicted to be a substantial MOM (Management, operation, and maintenance) item following the restoration. As a result, it is critical to adopt appropriate solutions to offset this expense. The discount rate is set at 4% for 30 years and 3% for 60 years, in accordance with Ministry of Finance guidelines. Furthermore, because the energy price does not follow the same trend, no change has been computed.

The annual cost differs significantly in a 30- or 60-year perspective, as seen in the figure below. This is due to a more even distribution of investment expenses over a 60-year period, as well as lower running costs.

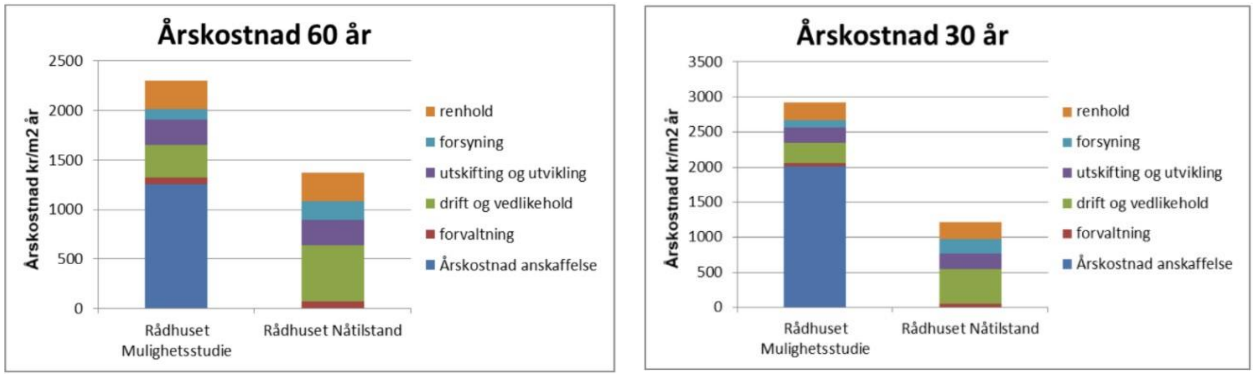


Figure 7: Calculation of annual costs for resp. 60 years and 30 years for feasibility study for conversion and present condition (zero alternative)

The energy requirements of the building are projected to be greatly reduced following repair. The present energy requirements of the building are projected to be 590,000 kWh of electrical energy and 380,000 kWh of heat. The energy required is based on the average energy use from 2013 to 2016. The projected energy need after restoration is 400,000 kWh of electrical energy and 20,000 kwh from biofuels. The shift is due to variables such as improved insulation, facade replacement (windows, etc.), solar panels, and other installations (Stavanger kommune, 2021b).

As previously stated, the project has lofty goals in terms of environmental effect and climate change. In addition to the minimal requirements for the grade; Excellent, the pre-analysis from October 2020 requires that the building must be BREEAM-certified with an aspiration level of at least 70 out of 100 points. The project will obtain 4 out of 4 points under the course MAN02 - life cycle costs and lifetime planning, demonstrating that LCC is an approach they focus on. Several subjects are covered by the life cycle viewpoint, but to mention a few, they will also

gather points in choosing materials from a life cycle perspective, as well as the environmental effect of the building's life cycle (Stavanger kommune, 2021b).
The project is still in the pre-project phase, as previously indicated, therefore several decisions, such the selection of materials, need to be made. In an interview, the project manager stated that while they favor materials that have minimal replacement costs, no other decisions have been made. In addition, between 25 and 30 new employees will be hired following the renovation, which might affect the cost per employee annually.

Discussion

The project is Rogaland County's first structure with fossil-free building and construction site regulations, and it serves as a signal building. Innovative solutions are costly and have an impact on the annual cost. On the other hand, many of the investments will help to reduce operating expenses. If the project proceeds as planned, Stavanger rådhus will be regarded as a model project for future builders in terms of sustainability and life cycle cost analysis. The municipality has begun life cycle planning early, when the potential for impact are highest, which creates favorable conditions for generating an accurate picture of the project's expenses, including risk and opportunity. When compared to similar new structures, the building is anticipated to have somewhat higher yearly expenses per m2. This might be owing to technological enhancements performed in order to get the highest possible BREEAM NOR certification.

The project manager had no idea which materials they were going to utilize or what cost-cutting measures they should take regarding life cycle expenses because they were in the pre-project phase. Nonetheless, NIRAS advised that they be made aware of cost-cutting cleaning procedures. A larger space will be developed as a consequence of the remodeling, and with 25-30 additional jobs, there is a chance that cleaning expenses will rise as a result of the rehabilitation. They must select the correct surfaces that are easy to keep, as well as a solid cleaning approach. Slipped concrete is a suitable choice that has low maintenance and repair expenses. There is no reason for cleaning expenses to be lower than they are now if the project does not select a substrate that is readily maintained.

The project has considerable investment expenses associated with fulfilling its lofty aims in sustainability and the environment. The installations will contribute to operational savings, although the savings appear to be less than the cost of the expenditure. The project management has taken decisions that may not be financially lucrative, but result in environmental savings. With the BREEAM NOR certification Excellent as an objective, it may be expected that the environment is as essential as the financial component for the project. The project is a signal building for the city and municipality, and it is expected that it will set a positive example. The municipality's unique strategy also allows them to gain knowledge and skill, which can have a knock-on impact for more sustainable structures in the city and throughout Norway.

With a halving of supply costs (electricity, water, sewage, etc.), this is an intriguing topic that deserves additional consideration. According to the preliminary LCC study, roughly 19.5 million of the investment cost is for HVAC (heating, ventilation, and sanitation technology) (Havellen, 2020) and around 12.5 million for electric power. A large percentage of the investment is for new installations, which include, among other things, solar panels to be put on roofs and facades (Haaland, 2021). This is a high-cost technology with low supply costs. This argument is validated by evaluating yearly expenses, which show that high investment expenditures result in reduced annual supply costs.

An increase in employment will have an impact on both cleaning and operational costs, including salary costs. If the restoration is completed as planned, the building's quality and sustainability will significantly increase. Furthermore, the structure will be larger and will serve as the foundation for more jobs. It would be logical for yearly costs to rise under such conditions. When the project is further developed, it will be possible to perform calculations on multiple metrics and so determine which alternative provides the highest return, as measured by the life cycle. Solar panels, for example, which do not perform effectively in a nation like Norway, might be replaced with alternatives that have the lowest yearly cost. The mission of BREEAM NOR Excellent certification will almost certainly lead to higher yearly expenditures, since this level of certification is designated for "innovators" when it comes to ecologically beneficial and inventive solutions.

Early phase LCC analyses, like other early stage project assessments, are fraught with uncertainty and risk. Among other factors, the project lacks sufficient input, which creates uncertainty owing to a lack of knowledge. There is also significant ambiguity surrounding expenses for service agreements, wage level, position proportion, and other factors that are not included or analyzed early in the process. Nonetheless, the LCC analysis offers an excellent summary of what to expect and which areas must be addressed. The project will update life cycle costs when new discoveries and improvements are discovered. The project is in its early stages, including an examination of life cycle costs, which can be critical for a successful outcome. Despite the high expenses, they have an excellent cost picture of the project that they can expand on.

Conclusion

Because of the pandemic scenario and the fact that the group has not been allowed to visit the facility, we have been limited in how extensive and in-depth our recommendations can be. As a result, our suggested steps for a sustainable project will be fairly broad.

Stavanger rådhus is a 1962 building with no recent improvements, and as a result, it does not meet contemporary criteria for universal design, room height and ventilation requirements, as well as technical circumstances. These are some of the primary reasons for starting the rehabilitation process. Furthermore, sustainable development is very vital in the building business, and it is heavily stressed in rehabilitation. Because Stavanger rådhus is a public building, the municipality has great chances to set a good example in terms of both fossil-free construction sites and sustainable solutions. This is also consistent with the municipality of Stavanger's own environmental strategy.

One of the recommended strategies to meet the project's aim of creating a sustainable building is to prepare a maintenance plan. This is evident in relation to the importance of incorporating FM in the project's early stages. It guarantees that individuals in charge of the building have a better understanding of how to maintain it in a sustainable manner. The space program is determined by Stavanger municipality policy, which includes large quantities of open landscape regions, which is controversial given the study's conclusions. Given that this is a public facility, it is also proposed that end users be more involved in the planning of new workstations. In terms of universal design, a public building must be sufficiently accessible for both employees and residents of Stavanger municipality.

Universal design contributes to societal sustainability. Meanwhile, the Stavanger municipality's environmental strategy for the years 2018 to 2030 reveals economic and environmental sustainability. The circular economy and fossil-free construction sites are recognized as critical components in attaining greater sustainable development. Looking at the environmental plan has

also provided the organization with a foundation for claiming that it has essentially established rules for the restoration project's development.

Finally, it should be noted that the initiative is still in its early stages. So far, the measures are simply proposed, and there is a great likelihood that they will alter. To avoid this, the project organization must define realistic goals for what is sought in the Stavanger rådhus renovation and to make the building more sustainable. Further study suggests looking at the building after the conclusion of the project to see if the expected services have been achieved.

References

Anderssen, H. B. (2020) Tilstandsrapport (bygning). Store norske leksikon. Available at: https://snl.no/tilstandsrapport_-_bygning (Accessed: 23. March 2021)

Arbeidsmiljøloven. (2005). Lov om arbeidsmiljø, arbeidstid og stillingsvern m.v. (LOV-2005-06-17-62).
Available at: https://lovdata.no/lov/2005-06-17-62 (Accessed: 21. March 2021)

Atkin, B. & Brooks, A. (2015). Total Facility Management (4th Edition). United Kingdom: WileyBlackwell.

Blakstad, H., S. (2019). Strategisk arealforvaltning. Available at: https://www.ntnu.no/documents/1001499401/0/Faghefte-AAR6028-Strategisk-ArealforvH19.pdf/19ecf421-0eb6-62e7-f798-e494ec06c564?t=1573202390650 (Accessed: 12. March 2021)

Byggfakta (2020). *Multiconsult og LINK rehabiliterer Stavanger Rådhus*. Available at: https://nyheter.byggfakta.no/multiconsult-og-link-rehabiliterer-stavanger-radhus-183580/nyhet.html (Accessed: 21. May 2021)

Byggitegl (2015). Tema: Bærekraftig bygging - den sosiale dimensjonen. Available at: https://byggitegl.no/pdf/NORSK_sosiale_dimensjonen_WEB.pdf (Accessed: 13. March 2021)

Chibssa, Z. (2021) Personal communication.

de Croon, E.M., Sluiter, K,J., Kuijer, P,F,M and Frings-Dresen, M. (2005) The effect of office concepts on worker health and performance: a systematic review of the literature. Ergonomics, Vol. 48, No. 2, 10 February 2005, 119-134

DIBK (2017). *Byggteknisk forskrift (TEK17) med veiledning.* Available at: https://dibk.no/regelverk/byggteknisk-forskrift-tek17/8/8-1/ (Accessed: 15. March 2021)

DNB Næringsmegling (2018). *Kortere leieavtaler og mer effektiv arealbruk...eller?* Available at:https://www.dnbnaringsmegling.no/no/kortere-leieavtaler-mer-effektiv-arealbruk-eller/ (Accessed 9.
March 2021)

DOGA (2021). *Kategorier og kriterier.* Available at: https://doga.no/aktiviteter/dogaspriser/innovasjonsprisen-for-universell-utforming/kategorier-og-kriterier/ (Accessed: 27. March 2021)

Fedoruk, L. E., Cole, R. J., Robinson, J. B., & Cayuela, A. (2015). Learning from failure: understanding the anticipated–achieved building energy performance gap. *Http://Dx.Doi.Org/10.1080/09613218.2015.1036227*, *43*(6), 750–763. https://doi.org/10.1080/09613218.2015.1036227

FN (2019) Bærekraftig utvikling. Available at: https://www.fn.no/tema/fattigdom/baerekraftigutvikling (Accessed: 13. March 2021)

FN (2021) Bærekraftige byer og samfunn. Available at: https://www.fn.no/om-fn/fnsbaerekraftsmaal/baerekraftige-byer-og-lokalsamfunn (Accessed: 16. March 2021)

Forcada, N., Macarulla, M., Gangolells, M., & Casals, M. (2015). Handover defects: comparison of construction and post-handover housing defects. *Https://Doi.Org/10.1080/09613218.2015.1039284*, *44*(3), 279–288. https://doi.org/10.1080/09613218.2015.1039284

Forskerforbundet (2020). *Utforming av arbeidsplasser.* Available at: https://www.forskerforbundet.no/var-politikk/aktuelle-saker/utforming-av-arbeidsplasser/ (Accessed: 16.

March 2021)
Fufa, S. M. and Mellegård, S. (2020). Delingsøkonomi i byggeprosessen. (Notat 34) SINTEF. Available at: https://sintef.brage.unit.no/sintef-xmlui/handle/11250/2670358 (Accessed: 20. May 2021)
Haaland T.N/Dagsavisen (2021) *Nå starter renoveringen av rådhuset.* Available at: https://www.dagsavisen.no/rogalandsavis/nyheter/2021/01/28/na-starter-renoveringen-av-radhuset/ (Accessed: 1. February 2021)
Hansen, G. K. (2019) Samspillet i byggeprosessen. Bergen: Fagbokforlaget
Haugen, T.B., Sæbøe, O.E., Foss, M. (2020). Eiendomsforvaltning, Facility Management. Bergen:
Fagbokforlaget
Havellen, V. (2020) VVS. *Store norske leksikon* Available at: https://snl.no/VVS (Accessed: 23. April 2021)
Hofstad, K. (2018) Norsk standard. Store norske leksikon. Available at: https://snl.no/Norsk_Standard (Accessed: 10. February .2021)
Holtmon, K. (2017) Myndighetenes krav til arbeid på eksisterende bygninger - fra praksis til teori.
Available at: https://ntnuopen.ntnu.no/ntnu-xmlui/bitstream/handle/11250/2464030/2017_ORD_Masteroppgave_Kristin%20Holtmon.pdf?sequence= 1&isAllowed=y / (Accessed: 12. March 2021)
Kadir, S.A. & Jamaludin, M. (2013). Universal Design as a Significant Component for Sustainable Life and Social Development. Vol. 85, pp. 179-190. Doi: 10.1016/j.sbspro.2013.08.349
Karssing, S. (2019). Available at: https://limblecmms.com/blog/facilities-manager-roles-and-responsibilities/#:~:text=In%20general%2C%20facilities%20managers%20are,a%20strategic%20and%20operational%20level. (Accessed: 8. April 2021)
Kommunal- og Moderniseringsdepartementet (2020) *Hva kan byggebransjen gjøre for å redusere klimagassutslipp?* Available at: https://www.regjeringen.no/no/aktuelt/hva-kan-byggebransjen-gjore-fora-redusere-klimautslippene/id2692924/ (Accessed: 30. April 2021
Kommunal- og Regionaldepartementet (2009) *Bygg for framtida. Miljøhandlingsplan for bolig- og byggsektoren 2009–2012* Available at: https://www.regjeringen.no/globalassets/upload/krd/vedlegg/boby/handlingsplaner/h-2237_web.pdf (Accessed: 30. April 2021)
Kylili, A., Fokaides, P. A., & Jimenez, P. A. L. (2016). Key Performance Indicators (KPIs) approach in buildings renovation for the sustainability of the built environment: A review. Renewable and Sustainable Energy Reviews. Vol. 56, pp.906-915. Doi: 10.1016/j.rser.2015.11.096
Kyllingstad, S. (2021) Personal communication.
Lid, I. M. (2009) Hva kan man oppnå gjennom universell utforming? En undersøkelse av ulike sider ved begrepet, 2(1), pp. 17-27. Doi: 10.7577/formakademisk.57
Lindkvist, C. and Elmualim, A. (2009). Pervasive technologies for workspace management. Journal of Facilities Management, Vol. 7 No. 2, pp. 98-110.
Lund, O.B. (2016) Tidligfase i rehabiliteringsprosjekter. Available at: https://ntnuopen.ntnu.no/ntnuxmlui/bitstream/handle/11250/2397546/14906_FULLTEXT.pdf?sequence=1&isAllowed=y (Accessed:
12. March 2021)
Meld. St. 28 (2011-2012) (2012). Gode bygg for eit betre samfunn. Oslo: Kommunal- og moderniseringsdepartementet. Available at: https://www.regjeringen.no/no/dokumenter/meld-st-2820112012/id685179/ (Accessed: 16. March 2021)
Miljødirektoratet (2019). Avfallsplan 2020-2025. (M-1582) Miljødirektoratet. Available at: https://www.miljodirektoratet.no/globalassets/publikasjoner/m1582/m1582.pdf (Accessed: 20. May 2021)
Morelli J. (2011) Environmental Sustainability: A Defininiton for Environmental Professionals, Journal of Environmental Sustainability, 1(1), s. 1-9. doi: 10.14448/jes.01.0002

Moum, A., Skaar, C. and Midthun, K. (2017). *Sirkulær økonomi i morgendagens byggenæring*. Available at: https://sintef.brage.unit.no/sintef-xmlui/handle/11250/2491795 (102015054) SINTEF. (Accessed: 9. May 2021)
NHO (2020). Bærekraftig utvikling blir viktigere for eiere, investorer og långivere. Available at: https://www.nho.no/tema/energi-miljo-og-klima/artikler/bedriftene-ma-ogsa-vare-barekraftige/#:~:text=%C3%98konomisk%20b%C3%A6rekraft%20handler%20om%20%C3%A5,bekostning%20av%20fremtidig%20%C3%B8konomisk%20utvikling.&text=%C3%98konomisk%20b%C3%A6rekraft%20kan%20ogs%C3%A5%20ses,sammenheng%2C%20eksempelvis%20knyttet%20til%20statsb udsjettet (Accessed: 8. May 2021)
Olerud, K., Tjernshaugen, A. og Andersen, G. (2021). Bærekraftig utvikling, Store norske leksikon. Available at: https://snl.no/b%C3%A6rekraftig_utvikling (Accessed: 7. May 2021)
Rasouli, A.H. & Kumarasuriyar, A. (2016) The Social Dimention of Sustainability: Towards Some Definitions and Analysis, 4(2), pp. 23-34. Doi: 10.15640/jsspi.v4n2a3
RIF (2021) *State of the Nation - 2021*. Rådgivende Ingeniørers Forening. Available at: https://rif.no/wpcontent/uploads/2021/05/210518_State-of-the-Nation-2021.pdf (Accessed: 5. May 2021)
SINTEF Byggforsk (2012) 220.320 *Universell utforming av arbeids-og publikumsbygninger*. Available at: https://www.byggforsk.no/dokument/2767/universell_utforming_av_arbeids_og_publikumsbygninger (Accessed: 15. March 2021)
Standard Norge (2013) NS 3454:2013 *Livssykluskostnader for byggverk.*
Stavanger kommune (2014). *Stavanger universelt utformet 2029. Kommunedelplan for universell utforming 2014-2029*. Available at: https://www.stavanger.kommune.no/siteassets/samfunnsutvikling/planer/kommunedelplaner/universellutforming/kommunedelplan-universell-utforming.pdf (Accessed: 27. March 2021)
Stavanger kommune (2018) *Klima- og miljøplan 2018-2030*. Available at: https://www.stavanger.kommune.no/siteassets/renovasjon-klima-og-miljo/miljo-og-klima/klima--ogmiljoplan-2018-2030.pdf (Accessed: 6. April 2021).
Stavanger kommune (2019). *19-09-24 Byggeprogram* in 7/19 - Stavanger rådhus, rehabilitering – prosjekt nr. 3844091 Byggeprogram. Available at: http://opengov.cloudapp.net/Meetings/STAVANGER/Meetings/Details/1234827?agendaItemId=221970 (Accessed: 1. May 2021)
Stavanger kommune (2021a). *Handlings- og økonomiplan 2021-2024 - Stavanger kommune*. Available at:https://hop2021.stavanger.kommune.no/11-bymiljo-og-utbygging/#11-5-park-og-vei (Accessed: 12. April 2021)
Stavanger kommune, (2021b). *Nå starter renoveringen av rådhuset.* Available at: https://www.stavanger.kommune.no/nyheter/na-starter-renoveringen-av-radhuset/ (Accessed 10. February 2021)
UNESCO (2021). Sustainable Development. Available at: https://en.unesco.org/themes/educationsustainable-development/what-is-esd/sd (Accessed: 17. April 2021)
Universell utforming AS (2019) *Universell utforming av uteområder.* Available at: https://universellutforming.no/uploads/s6zs3bpT/Uteomrder_krav-og-anbefalinger_WEB.pdf (Accessed: 15. March 2021)
Universell Utforming AS (2021). Bygg og uteområder. Available at: https://universellutforming.no/fagomrader/bygg-og-uteomrader (Accessed: 15. March 2021)
Vavik, T. & Keitsch M. M. (2010) Exploring Relationships Between Universal Design and Social

Sustainable Development: Some Methodological Aspects to the Debate on the Sciences of Sustainability, 18(5) pp. 295-305. DOI: 10.1002/sd.480
Whyte, J., Lindkvist, C. and Jaradat, S. (2016) *Passing the baton? Handing over digital data from the project to operations.* Engineering Project Organization Journal.
Woodcraft, S. (2012). Design for social sustainability. Available at: http://www.sociallife.co/media/files/DESIGN_FOR_SOCIAL_SUSTAINABILITY_3.pdf (Accessed: 13. March 2021)

Internal documents

BREEAM NOR, 2016 - Provided upon request and authorization from the municipality

8 Promoting the creation of smart work environment in the Silver Economy: proof of concept for smart insole technology for older workers

Mara G. Diaconu*

Alenka Temeljotov-Salaj*

**NTNU Norwegian University of Science and Technology, Trondheim, Norway*
(e-mail: mara.diaconu@ntnu.no, alenka.temeljotov-salaj@ntnu.no).

Abstract:

Population ageing is one of the most significant demographic and social trends of the 21st century, affecting nearly all the countries in the world. Increasing life expectancy is indeed a remarkable achievement of development and health care. However, it also poses obvious challenges due to the desire for a longer and healthier working life. The Silver Economy concept seeks to look holistically at ageing and the opportunities it presents, bearing on the future direction of a broad range of policies such as those on the built environment, 50+ employment, life-long learning and preventative healthcare. Moreover, it seeks to embrace new technologies (e.g. health monitoring, smart homes, driverless vehicles, and care robots) and use them to lower the costs of ageing and improve the lives of older citizens whilst simultaneously helping to boost the economy. Every year, age-related government expenditure accounts for 20% of the GDP of Europe, and up to 60% of the blue-collar workers aged 50-59 who are put in early retirement say that they would prefer to stay in the workforce. The article presents the SI-FOOtWORK solution incorporating sensors and digital technologies that offer support for 50+ blue-colour workers that are exposed to back pain due to their daily work activities. The SI-FOOtWORK solution is a proof of concept of a new digitally-enabled adaptive solution, promoting the creation of a smart work environment for older adults, supporting them to remain actively involved in professional life, increasing awareness of their behaviour and improving safety by reducing back-pain incidents. The solution is focusing on improving the living conditions of older adults while strengthening the digital transformation in the workplace and participation in the Silver Economy achievement goals.
The use of the solution brings benefits for various stakeholders in the society: for the employees (primary users) - better work and health conditions, better monitoring of health and prevention of back pain; for employers - less health-related sick leaves, attractive workplace conditions, increased productivity and healthier employees; for the governments – fewer expenses in healthcare, healthier population, lower unemployment rate.

***Keywords*:** Digital Tools, Sensors, Smart Technologies, Smart Work Environment, Health and Wellbeing, blue-collar workers

1. INTRODUCTION

The age distribution of the population in Europe has undergone considerable changes during the past few decades. An increasing proportion of older people brings implications on social security and health care systems, especially if older adults prematurely leave the labour market due to illness. A 2015 study (Ældre Sagen, 2016) shows that almost 60% of the retired workers 50-59 of age, and 33% of 60-69 year old workers, would have preferred to stay longer in the labour market; and 52% of these specified health related problems as the main reason for retiring. Furthermore, it is estimated that physical, musculoskeletal disorders, and psychosocial work environment factors are attributable factors for sick leave in 30% (Bang Christensen K, et al, 2007) of the cases. Physical and mental strains are attributable factors for disability pension in up to 29% (Dorner TE, et al, 2015) of workers. According to studies (HSE report, 2017) physical and psychophysical work-related disorders account for 35% of sick leaves in Europe, leading to expenses between 8.5-34 billion Euros on public healthcare, loss of taxes, retirement, etc. Physical strains at the workplace affect tendons and joints, to an extent that sickness due to physical workloads has been found to be 26% in the general working population and 40% and among blue-collar workers, respectively (Andersen LL, et al, 2016). Annual age-related government expenditure on older people (currently nearly 20% of GDP in the EU) is forecasted to rise by 1.8 percentage points by 2060 (European Parliament, The silver economy report, 2015). The combination of medical treatments, and expenses for early retirement, are the drivers for such economic and societal burden showing the vast impact of work environment factors on the workers' health and work ability, in particular with increasing age. Physical workload is among the primary risk factors for all-cause disability pension, and between 26-40% of long-term sickness absence can be attributable to physical workloads.

One of the major problems for older adults in the workplace is back pain (Vidensraad, 2015; SST DK, 2015). Back pain problems are together with migraine and anxiety attacks the most predominant diseases keeping workers away from retaining their jobs (TV2, Det lider vi af i Danmark, 2015) , and they have even shown to increase the risk of suicide (Ilgen et co., 2013). A major cause of these back pains for blue collar workers and health care professionals in hospitals and care homes stem from heavy lifting, performed too often with high load weights and in awkward postures. Most of the painful attacks due to MSDs last up to a fortnight and 20 to 40% of workers affected will experience new painful spells within the year, rising to 85% over a lifetime. While 90% of workers return to work within two months, less than 50% of those who have not gone back to work after six months will ever do so. Other than the obvious health hazard, such early retirement puts a burden on the social safety net, retirement benefits, etc(European Trade Union Institute, 2018). A previous study from 2013 has shown that one of the major problems among older workers is back pain, much of which stems from heavy lifting (Roos et al., 2013). However, emerging technologies and innovations have the potential to address these issues.

(Ishtiaque et al., 2021)

1.1 SI-FOOtWORK innovation

This paper presents the SI-FOOtWORK concept, digital tool, findings in validation and recommendation for future development of the technology and similar technologies for a sustainable wellbeing, better work environments for adults and support for functional capacities of ageing workers and customers. The project implemented in 2021, aimed to develop a first prototype, proof of concept of a personalized smart insole system to avoid or reduce back pain in the case of older workers.

By using the proposed SI-FOOtWORK insole and the associated AI engine and notification system developed in the project, older workers have kept track of their lifting weight and weight distribution, thus being notified of upcoming overexertion when a lift is incorrect, and pausing the work or correcting the lifting pattern before back pains occur.

Most ergonomic guidelines suggest that lifting should keep the load as close as possible, centred in front, looking up and ahead (University of North Carolina, EHS, 2001). Often, the use of visual instructions is used to guide the person on how to perform this activity, as shown in Figure 1 .

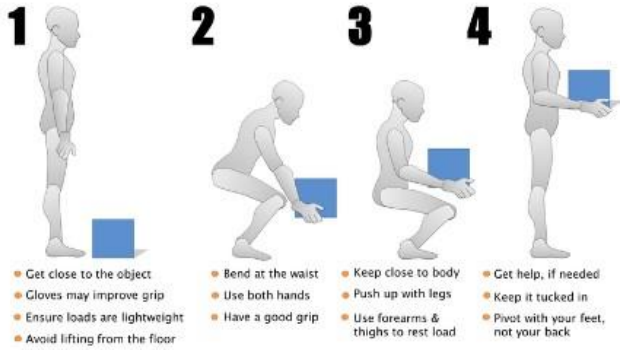


Figure 1. Lifting instructions

While the technology is not at a mature stage yet, this can be considered as a pilot project to show the benefits, challenges, map the expectations of the blue-collar workers, who are the prime beneficiary group, and also show future recommendations for the system. Pressure sensors in the insoles generate heatmaps that allow us to identify incorrect posture using an adaptable Artificial Intelligence (AI) lifting engine. This data is then used to evaluate the lifting actions in real-time and pre-emptively warn the individuals. The target group consists of: older blue-collar workers (>50 years) from the Norwegian construction industry, who are engaged in lifting heavy loads manually, health care personnel (>50 years) from the Romania, and flooring company specializing in selling and installing various types of floor types (≤ 50 years) from Denmark.

1.2 SI-FOOtWORK benefits

Digital support systems for older adults and digital social infrastructure are growing in the usage and it becomes clear that it needs to be incorporated in the workplace environment, development of city neighbourhoods and communities development of smart age friendly environments and empower citizens to take action in relation with monitoring of their health.

With respect to technological innovation SI-FOOtWORK has developed and validated a robust, easy-to-use and costeffective solution targeting older workers assisting them to prevent, mitigate and correct risk behaviours when lifting. The benefits of the solution could be seen in less back pain problems, less sick leaves, leading to keeping workers active and healthy for longer time. The SI-FOOtWORK technology when ready to deploy in an extended market will reduce the recurrence rate of ageing-related events that compromise efficiency and/or ability of older individuals to work – thus contributing to the sustainability of the society.

Finally, a further development to a successful market introduction and exploitation of the SI-FOOtWORK technology could have strong impacts on growth of the European active and assisted living sector, smart digital technologies for active ageing, employment and industrial competitiveness, focus on improving the living conditions of older adults.

2. DIGITAL TOOL

2.1 Hardware technology

The hardware in SI-FOOtWORK is an insole installed in the shoes worn by the workers in they work environments. The uniqueness of the design SI-FOOtWORK insole consist in developing a custom design with a single piece of Velostat covering 16 sensor elements attached to the insole. This gives major advantages in terms of keeping production simple, and scalable. In terms of communication, Long Term Evolution for Machine-Type Communication (LTE-M) was used to forward the measured pressure data to the backend for data analysis. LTE-M was chosen for its benefits on data deliver and it gave the possibility to test this technology in a different field than the ones usually used. By implementing carefully designed data management and compression on the LTE-M unit data forwarder, it was shown possible to deliver a real-time data flow to the backend with a high sample rate of 192 samples per second. Furthermore, custom developed data acquisition module

having necessary components to capture the analogue sensor date and forward it using Bluetooth Low Energy to the gateway and communication models through mobile network infrastructure have been developed based on technologies crating the solution.

Figure 2. Insole Showing Array of Sensor Terminals

2.2 Mobile app

For the users, the access to the information sent by the insole is done through a mobile app. The project and the development of both the mobile app and cloud services followed an iterative process where all stakeholders were involved in order to create a robust proof of concept - the SI-FOOtWORK prototype (Ishtiaque et al., 2021).

With regards to the mobile app and back-end services, the user was enabled to see in real time how sensors in the insoles are activated (colour coded) while also enabling them to train to lift correctly. At the same time, both the mobile and the backend services were built based on iterative testing. Algorithms for detecting a correct, incorrect or no lift situation were created, trained and tested. Through testing it was optimized how data is stored, queried and it was created a first set of modules that would enable scaling of the solution for historical analysis.

The first prototype was released to stakeholders to test and identify potential improvements before doing further pilot tests. The stakeholders provided valuable insights on how the prototype should be improve and the final version as show below has been created.

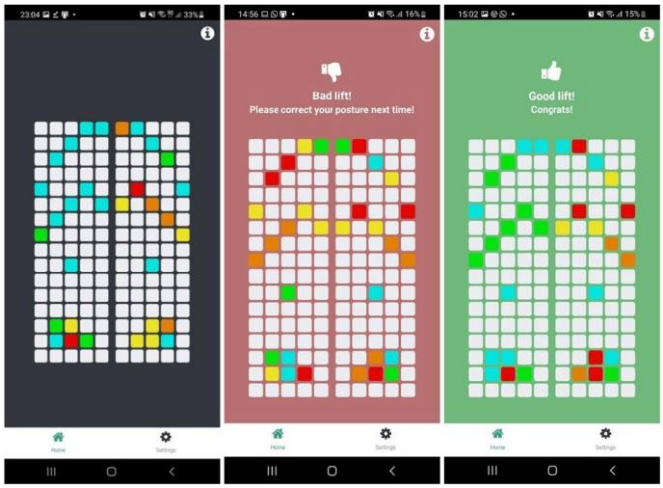


Figure 3. SI-FOOtWORK app screen feedback

As showed in the figure 3 above, the user of the insole can see on the phone the insole sensor data through a (near) real-time pressure colour coded map: first screen -Default state when no lift detected, then the following two are the feedback when a lift is made – “bad lift” or “good lift”. The app has been designed to have the following features:

See in real time how sensors in the insoles are activated

Train for correct lifting using the app

c. View and hear when a good lift or bad lift is achieved

d. Real time analysis of feet movement and detection of lifting

As the primary scope of the prototype was to help user to do more correct lifts and to reduce back-pain, the coaching through iterative process was the approached taken by the development and research team so, the user could train how the best to do lifts in a training section of the app, without interfering or corrupting the data collected during the real-use of the app in real environments.

The digital solution has been developed to promote the creation of smart work environment for older adults, supporting them to remain actively involved in professional life, increasing awareness of their behaviour and improving safety by reducing back-pain incidents.
The development of the classification algorithm when lifting (bad/good) too place in interative stages due to variables that needed to be included in the development. The first step as to start with research of the tools and libraries in Microsoft ML. Then previous datasets with data on lifts and pressure in insole from similar system to train the algorithm. First proof of concept was created on the 3 types of detections in order to visualize if it will be a correct fit or not for the sample data and desired outcome: Time series anomaly detection; Spike detection; Change point detection.
After creating the proof of concept and started doing laboratory testing with the sample data team discovered for each of them some issues: impossible to use 32 <Foot, SensorNumber> points (the total amount of sensors sending data from the insole) for the algorithm to detect an anomaly and same issues trying to use Time Series Anomalies and Change point detection.
Another approach was to normalize the data coming from the sensors (all 32) into single variable. This approach although it seemed feasible at the beginning, become unfeasible due to the lack of consistent and relevant data and results across various data sets. As a last attempt for this initial work, we looked into other machine learning algorithms for Microsoft ML, and tested various scenarios but none of them proved to help us determine any valuable information from the sensor data. Considering all the investigation done in the initial phase, the team realized that this is not only an anomaly detection problem but also a classification problem. We determined that the algorithm should be focusing on determining: Good Lift, Bad Lift, no Lift. In order for the algorithm to determine Good Lift, Bad Lift, No Lift there a set of factors to consider: Size of shoe, Person weight, How fast a person performs a lift, Sensor sensitivity and Error handling. A set of real datasets has to be created in the lab to train the algorithm and detect future anomalies. Various interactions took place in the lab and real environments, until the final prototype has been tested with the users.

2.3 User co-design

The solution has been developed through a co-design process with primary and secondary end-users. The focus of the process was to translate end user's expectations into tangible, technical specifications that can be integrated into the solution. According to Tausif, 2021 (Ishtiaque et al., 2021) the user involvement in the co-creation process was done with three aims in mind: i. To understand the user's needs, requirements, challenges, and expectations in order to know (and adjust the technology response) better how to respond to them. ii. To define specific target users and investigate their needs. iii. This stage is a background for optimizing the selection of end-users for the pilot phase.
The feedback resulted from this process has been integrated in the final solution tested in real-life application.
Co-design (also known as participatory design) is a process of collaborative innovation where the users collaborate with the product designers/researchers to create a solution that is oftentimes more practical and is centred around the user's needs (Asaro, 2000). In the past, co-design has been successfully used within the AEC domain in areas such as cocreating public spaces with citizen participation, facilities management, etc. (Salaj et al., 2020). Co-design has been proven to increase the uptake rate of solutions, turning them from ideas on paper into a long-term sustainable innovation (Steen et al., 2011)
Collecting requirements and suggestions from the involved users through the co-design process gave us not only the users perspective and important information about insole adjustments, notification systems, etc. but also specific information about the work process, such as workloads (e.g., lifting weights), task constraints, and performance-related pressures during daily activities at the workplace. (Ishtiaque et al., 2021)
Due to the fact that the final users, in this case the blue-collar workers will be the most impacted by the technology, the codesign permits the research and development team to make informed decisions about their working lives, needs and desires. The usability feedback came both for the hardware and the software. Some of the feedback and needs could be implemented in the testing prototype, but due to the short time for development and limitation of funding not all the needs could be integrated in

the prototype tested in the project. All the feedback has been collected and is presented in future recommendations for development.

1. PILOTS VALIDATION

3.1 Purpose

Pilot Testing was done to verify the SI-FOOtWORK solution under a real-time operating condition. The purpose is to understand the users experience while interacting with the solution. A selected group of 15 end users have tested the prototype solution. The testing of the prototype was important for checking the product readiness for full-scale implementation. It has given insights of target user's reaction to the solution, and it has been done to measure the success of the system.

3.2 Preparation for the validation

Prior to the pilot trials in Norway, Romania and Denmark, 15 sets of insoles, control boxes and gateways were prepared. The insoles were tailored in size to accommodate the 15 different users and their working shoes and instruction manuals as well as accessories were prepared. An instruction manual, translated in testing sites languages was prepared to instruct non-technical personnel to be able to use the insole system for the duration of the test period. There were instructions about

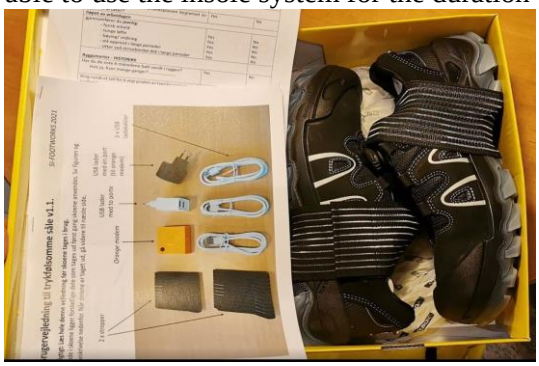


Figure 4. A picture of the entire set of shoes, insoles, gateway, accessories and instructions

how to use the insoles, where care should be taken due to fragile parts as well as charging and how to switch on and off the system.

Before the start of the real environment testing where our focus was on evaluation the functionalities of the system and the application (easy to use, user satisfaction, etc.) the following steps have been defined in the interaction with the users:

Presenting the SI-FOOtWORK project and describing the testing phase

Signing the Informed Consent and privacy

Describing and practical instructions on how to use the system and the application

Asking participants to wear the shoes with installed smart insoles and the system, daily, at their workplace

or when they help someone to do activities of daily living, as caregivers

Participants fill out the questionnaires

Exit strategy

Ethical considerations

3.3 Real environment testing

The real environment testing consisted of four periods: the introduction period, the helping period, the user testing period, and the feedback and evaluation period, as shown on the timeline (Figure 5).

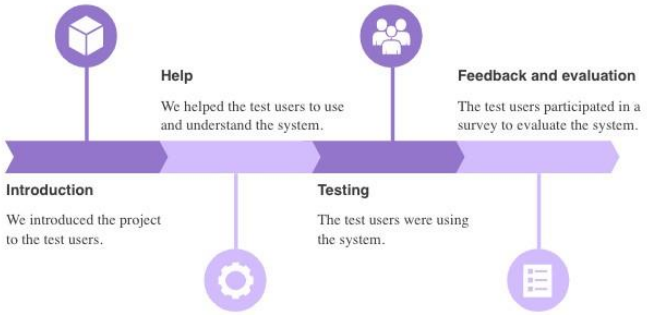


Figure 5. Timeline for SI-FOOtWORK testing

The piloting has been carryout in the same manner, using the same protocol and guidelines, but due to COVID-19 restrictions we needed to have different times for implementation. The selected group of end users tried the system for 1 to 2 weeks and gave us feedback about their experience by using the solution on the daily bases.

3.4 Evaluation

The user experience was evaluated regarding: the use of technology (the smart insole, communication, and the app), usability (the degree of easy-to-use to achieve required goals), satisfaction, behavioural change. Handling it was easy, they followed the instructions, but it could be uncomfortable to wear it for a long period of time or when they have to respect norms for work protection or health protection rules. Users have had different opinions on changing experience (behaviour change), due to the complex and sensitive nature of the concept and their work environment. Even so, the majority agree that changing is possible if workers would foresee the benefits and real support to alleviate their pain.

When evaluation the app user interface the participants have found it was easy to install and to use, and the given information was quite intuitive. All participants value the (real time) alert or notification that is visualized through the app and gave them the possibility they react accordingly.

Usability was measured by questions adapted from "USE Questionnaire: Usefulness, Satisfaction, and Ease of use". Collected data showed that the participants had a positive attitude for all four dimensions (usefulness, easy to use, learnability, satisfaction). In general, participants showed a high degree of satisfaction with the system but more, all of them appreciated the system as a "self-care step" when back pain occurs, and its potential benefits to mitigate risk of back injuries at the workplace.

3.5 Limitations

The study had a short period of testing due to the COVID-19 pandemic. The users and testing sites have had various restrictions and interaction was made hard.

From the evaluation of the solution, we have seen some limitations of the product such as: on the hardware the plastic box for Bluetooth data communication attached to the leg was uncomfortable to wear while working, as it was not very pleasant on the skin. For that purpose we put some soft material on the side of the box that touches the skin. The solution helped and made the system more comfortable to wear while working. Also, some comments about stigmatization were given as the equipment resembled the GPS trackers that probation prisoners are equipped with.

In the Danish testing site the app could not be used due to the early testing and also in Norway the app was used just 5 days out of 14.

Small bugs in the mobile app like closing at usage or slow feedback was also seen, and some of them have been fixed during the testing.

Gender limitations were observed when recruiting and testing, but are related with the target population itself where men are more likely to be in constructions work, however in the healthcare sector we had a mix of men and women.

2. RECOMMENDATIONS

The SI-FOOtWORK solution is a proof of concept prototype with a first real world environment testing and more research, developments, testing and resources must be added for the full development.
From the technology perspective, the current approach which relies on a mobile app to notify end-users in near real-time should be changes from checking the phone screen due to the fact that for a real work environment (in construction, flooring, older adults caring or healthcare) it is not possible to check the phone all the time. A different notification system should be explored namely using force feedback in the insole or audible notifications or integrate in a smart bracelet or smart watch. Considering the ongoing deployment of 5G networks (which include edge computing abilities), data processing and classification could be moved to an independent module on the edge, for example, a later replaced by network services if viable to create an easy communication service between the sensors, algorithms, and the app.
In what concerns hardware design, the ankle bracelet is clearly stigmatizing and should be rethought in a next design iteration. Likewise, the mobile App is presenting pressure based directly on each sensor and not using an anthropomorphic design which might limit the end-user perception of the representation. The app should represent pressure as a real heatmap and tune graphic to look similar to a foot.

3. CONCLUSIONS

Having both the users and the employees' positive feedback that the solution could be considered by them in their daily use, gives confidence that the SI-FOOtWORK solution is rightly dedicated for its target groups. The solution is considered an ambient assisted living solution supporting the older adults to stay healthy and have a longer working life.
Following the first real-world testing, further development of a second prototype is necessary to create a better system of recommendations and usage, the SI-FOOtWORK solution must evolve and be offered at a large scale.

ACKNOWLEDGEMENT
The authors would like to acknowledge Active & Assisted Living programme (AAL) for their support of SI-FOOtWORK project (http://www.aal-europe.eu/projects/si-footwork/). This project is carried out by a consortium of 5 European organizations, namely: Technical University of Denmark (Denmark), Norwegian University of Science and Technology (Norway), Canary Technology Innovations SRL (Romania), Hoka Tæpper og Gulve (Denmark), Ana Aslan International Foundation (Romania). It is funded by the AAL programme, EU, Innovationsfonden Denmark, Research Council of Norway and UEFISCDI Romania.

REFERENCES

Andersen LL, et al, (2016) Physical workload and risk of longterm sickness absence in the general working population and among blue-collar workers: prospective cohort study with register follow-up, *Occup Environ Med*. 2016 Apr;73(4):246-53. doi: 10.1136/oemed-2015-103314. Epub 2016 Jan 6.

Asaro, P. M. (2000). Transforming society by transforming technology: the science and politics of participatory design. *Accounting, Management and Information Technologies*, 10(4), 257-290.

Bang Christensen K, et al (2007) The fraction of long-term sickness absence attributable to work environmental factors: prospective results from the Danish Work Environment Cohort Study Occupational and Environmental Medicine; 64:487-489.

Dorner TE, et al, (2016) Synergistic effect between back pain and common mental disorders and the risk of future disability pension: a nationwide study from Sweden, *Psychol Med.* Jan;46(2):425-36. doi: 10.1017/S003329171500197X. Epub 2015 Oct 15.

European Parliament (2015) The silver economy. Opportunities for againg.
HSE report: Work-related Musculoskeletal Disorders (WRMSDs) *Statistics in Great Britain* 2017
Member States (the United Kingdom, the Netherlands, Germany, Finland and Denmark) have estimated it at between 0.5 and 2% of GDP in Europe.

Ilgen, Mark A.; Kleinberg, Felicia; Ignacio, Rosalinda V.; et al Bohnert, Amy S. B.; Valenstein, Marcia; McCarthy, John F.; Blow, Frederic C.; Katz, Ira R.. (2013) Noncancer Pain Conditions and Risk of Suicide *JAMA Psychiatry*. 2013;70(7):692-697doi:10.1001/jamapsychiatry.2013.908

Ishtiaque, Tausif Ahmed; Salaj,Alenka Temeljotov; Torp, Olav; Diaconu, Mara Gabriela; Ruepp, Sarah Renée; Petersen, Martin Nordal; Velciu, Magdalena; Spiru, Luiza. (2021) Feasibility study of using AI-powered smart insole system to reduce back-pain among older workers in the Norwegian AEC industry, *Conference of Interdisciplinary Research of Real Estate 2021* Ljubljana, Slovenia: Institute of Real Estate Studies 2021 (312-325)

Roos, E. M., Hartvigsen, J., Bliddal, H., Mølgaard, C., Christensen, R. D. K., Søgaard, K., & Zebis, M. K. (2013). Forebyggelse af skader og sygdomme i muskler og led.

Salaj, A. T., Gohari, S., Senior, C., Xue, Y., & Lindkvist, C. (2020). An interactive tool for citizens' involvement in the sustainable regeneration. *Facilities*.

Steen, M., Manschot, M., & De Koning, N. (2011). Benefits of co-design in service design projects. *International Journal of Design*, 5(2).

Internet sources:

University of North Carolina, Lifting and Material Handling. Available at : https://ehs.unc.edu/workplacesafety/ergonomics/lifting/ (Accessed: 18.01.2022)
Analytics India Magazine, Anomaly detection in temperature sensor data using LSTM RNN model, Available at: https://analyticsindiamag.com/anomaly-detection-intemperature-sensor-data-using-lstm-rnn-model/ (Accessed: 18.01.2022)
Arundo Analytics, Available at: https://adtk.readthedocs.io/en/stable/quickstart.html (Accessed: 20.01.2022)
Ældre Sagen (2016) Fremtidsstudiet 2015. Available at: https://www.aeldresagen.dk/presse/viden-omaeldre/fremtidsstudiet/fremtidsstudiet-2015 (Accessed: 20.01.2022)
Vidensraad FOREBYGGELSE AF SKADER OG SYGDOMME I MUSKLER OG LED, 2015 Available at: http://www.vidensraad.dk/sites/default/files/vidensrad_for_forebyggelse_forebyggelse_af_skader_og_sygdomme_i_muskler_og_led_2015.pdf (Accessed: 20.01.2022)
SUNDHEDSSTYRELSEN, Sygdomsbyrden i Danmark,

Available at: https://www.sst.dk/da/nyheder/2015/nyrapport-sygdomsbyrden-i-danmark, (Accessed: 20.01.2022)
TV2, Det lider vi af i Danmark
Available at : http://nyheder.tv2.dk/samfund/2015-09-08fakta-det-lider-vi-af-i-danmark (Accessed: 20.01.2022)

9 Competences for the development of future settlements

Andreja Abina
Jožef Stefan International Postgraduate School, Jamova cesta 39, Ljubljana, Slovenia
Bojan Cestnik
Temida, Ljubljana, Slovenia
Jožef Stefan Institute, Jamova cesta 39, Ljubljana, Slovenia
Jožef Stefan International Postgraduate School, Jamova cesta 39, Ljubljana, Slovenia
Rebeka Kovačič Lukman
Faculty of Logistics, University of Maribor, Mariborska cesta 7, Celje, Slovenia Faculty of Natural Sciences and Mathematics, University of Maribor, Slovenia
Eva Žunec
MIITR, International Institute for the Implementation of Sustainable Development, Gregorčičeva ulica 21b, Maribor, Slovenia
Matevž Ogrinc
Jožef Stefan Institute, Jamova cesta 39, Ljubljana, Slovenia
Jožef Stefan International Postgraduate School, Jamova cesta 39, Ljubljana, Slovenia
Aleksander Zidanšek*
Jožef Stefan International Postgraduate School, Jamova cesta 39, Ljubljana, Slovenia
Jožef Stefan Institute, Jamova cesta 39, Ljubljana, Slovenia
Faculty of Natural Sciences and Mathematics, University of Maribor, Slovenia
Slovenian Association for the Club of Rome, Ljubljana, Slovenia e-mail:
Aleksander.Zidansek@mps.si

ABSTRACT

The combined challenges of war, epidemics, food and energy security, and climate change require new skills and competences for the people shaping future settlements. An expert system, RESPO, has been developed to systematically monitor and improve these competences to support decision-making in the selection of educational programs. The RESPO system collects information on the required competences and available educational programs. Individual learners track their progress using the RESPO application, which recommends the best sequence of dynamic education and training programs to achieve the required target competences. Preliminary results and recommendations for applications in future settlement design are presented.

KEYWORDS
Competences, expert system, future settlements.

INTRODUCTION

Sustainable settlements are very important to the ongoing transition to sustainable development. This transition began with the definition of the concept of sustainable development at the World Conference on Earth and Development (WCED) in 1987 [1] and the development of Agenda 21 at the Rio Conference in 1992 [2]. Currently, global sustainability efforts are guided by the UN 2030 Agenda and its Sustainable Development Goals [3].

In 2018, we started developing the RESPO Expert System based on the European Commission's list of key competencies for lifelong learning [4]. The RESPO Expert System is designed to systematically monitor competences and help individuals select the most effective trainings [5, 6].

For the development of sustainable settlements, a well-trained and qualified workforce, both among municipal employees and other relevant stakeholders, is very important. To this end, the RESPO system provides many opportunities to define the required competences for each of the relevant occupations and to monitor the achievement of these competences. It incorporates the estimation of required level of competences for each workplace, as well as the estimation of obtained competences for each employee. Based on the gap between the required and the achieved competences, it suggests the optimal training for employees that best compensates for their lack of individual competences.

This paper describes the RESPO expert system and discusses its modifications for the needs of sustainable urban development.

RESPO SYSTEM

The purpose of the RESPO expert system was to define the required competences of the employees in the companies of the competence centre KOC-TOP and to help them find the best training strategy for the most effective and cost-efficient improvement of the required key competences. Thus, the RESPO expert system was focused on the manufacturing industry. In the following years, this expert system was extended for applications in school and university environments.

In the following chapter, we briefly describe the evolution of the RESPO system for adaptation to different specific sets of skills and competences, such as, for example, those required for sustainable settlements.

RESPO X

The RESPO X project of the Erasmus+ program focuses on the adaptation of the RESPO expert system for college students and their professional competences in nanotechnology and crosscutting competences in both sustainability and digitalisation, including artificial intelligence. The project started in 2022 and has already defined the key competences and the structure of the application. This structure will be the basis for the development of the RESPO VI application under the Norway Grants program by the Government Office for Development and European Cohesion Policy. This project aims to improve the competences of STEM (Science, Technology, Engineering, and Mathematics) students and teachers and to improve bilateral and cross-sectoral cooperation in the implementation of a decision support system to monitor the development of students' competences.
This work is closely related to the European Commission's list of key competences and the European Multilingual Classification of Skills, Competences and Occupations (ESCO), which acts as a dictionary that describes, identifies and classifies occupations and skills relevant to the EU and the education and training programs required. The ESCO system includes more than 13,000 skills and more than 3,000 occupations, many of which are also relevant to sustainable settlements.
To verify the relative importance of the skills, a short questionnaire was created for relevant industrial companies. The companies participating in the Competence Centre KOC-TOP were first asked to define the experience and skills of the employees who take care of professional development and recruitment in their company. The next question asked which competences, which are important for

performing in positions requiring higher education, they felt were most lacking among their company's employees. The initial responses to these questions are shown in Table 1 for the top 30 competences.

These results are interesting, and the findings are also relevant in the broader context beyond manufacturing, i.e., they are applicable to organisations relevant to sustainable settlements and sustainable communities. In the field of sustainable settlements, we encounter a variety of professions, from planners, architects, real estate developers and surveyors, to staff from local, regional, and national administrations. There are also many relevant professions in manufacturing, trading, and educational institutions, all of which play an important role in creating attractive and safe places in future settlements and communities. To ensure a sustainable future in this field, new approaches need to be developed that will enable modern ways of acquiring new skills and new ways of working for all these actors. The RESPO approach is one of them, which can significantly contribute to forming communities in which people want to live and work, and which are sustainable for future generations.

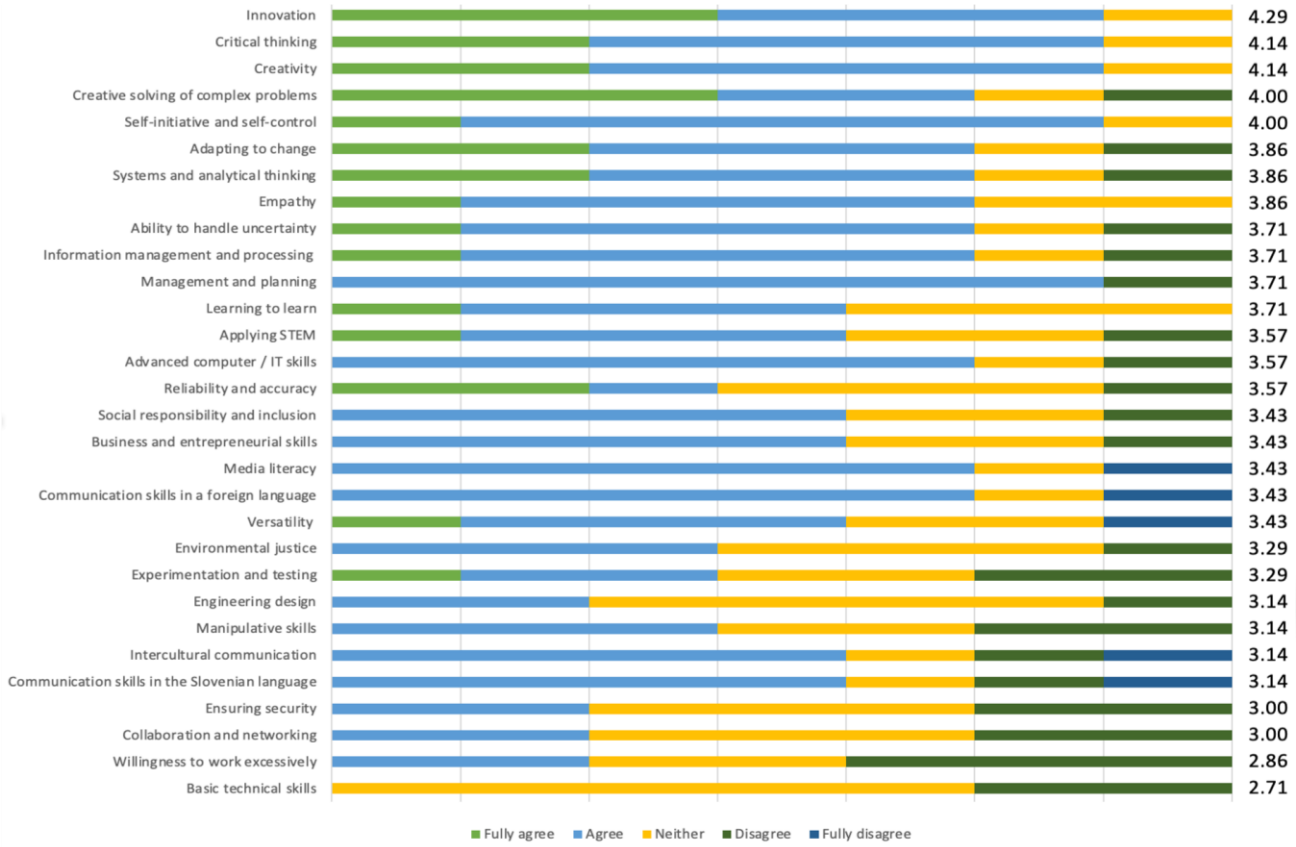


Table 1. Initial results of the questionnaire on the competences required for the industrial companies concerned. The average numerical score is given on the right-hand side as calculated on a scale from 1 (fully disagree) to 5 (fully agree).

As seen from the results of this questionnaire in Table 1, the most important competence is innovation, followed by creativity and critical thinking. Creative solving of complex problems, self-initiative and self-control are slightly behind. Management-related skills are even further behind, while technical skills are rated much lower, with a significant exception of STEM and digital skills, which also rank relatively high.

Delivering sustainable settlements and communities requires not only the professional and technical skills of planning, architecture, and surveying but also a broad range of generic skills, behaviours, and knowledge. There are several interconnections between the skills

included in Table 1 and the generic skills necessary to achieve sustainable communities that were recognised by Egan [7]:
inclusive visioning,
project management,
leadership in sustainable communities,
creative thinking,
team/partnership working within and between teams,
conflicting interests, individual agendas and adversarial behaviour,
process management/change management,
stakeholder management,
financial management and appraisal,
analysis, decision making, learning from mistakes, evaluation, - communication and conflict resolution, - customer awareness.

Based on these results, the relative importance of each skill in the RESPO application will be adjusted. This will guide the RESPO algorithm in selecting the most appropriate training programs for city employees and other relevant stakeholders, which will contribute to the improvement of their skills and competences thus making the transition to sustainable settlements easier.

CONCLUSIONS

The RESPO expert system is a valuable tool for monitoring and more effectively developing competencies, providing good opportunities for better development of competences needed for a more efficient transition to sustainable settlements. We anticipate that the RESPO system will evolve into a valuable tool for better planning the training needs of city employees and other relevant stakeholders in the context of the green transition to more sustainable settlements. To this end, it is necessary to gather more information on the needs of all relevant stakeholders so that the expert system can guide the most effective training programs for key employees on the path to sustainability.

ACKNOWLEDGMENTS

This work includes results from the RESPO 2 project, which was co-financed by the Republic of Slovenia and the European Union under the European Social Fund within the Students Innovative Projects for the Benefit of Society program of the Slovene Public Scholarship, Development, Disability and Maintenance Fund.

This work also includes results from the competence center KOC-TOP project, co-financed by the Republic of Slovenia and the European Union under the European Social Fund within the Competence Centers program of the Slovene Public Scholarship, Development, Disability and Maintenance Fund.

Part of this work was also done within the Norway Grant project RESPO-VI and the RESPO X project of the Erasmus+ program of the European Union.

Co-funded by the
Erasmus+ Programme
of the European Union

REFERENCES

Abina, A.; Batkovič, T.; Cestnik, B.; Kikaj, A.; Kovačič Lukman, R.; Kurbus, M.; Zidanšek, A. Decision Support Concept for Improvement of Sustainability-Related Competences. *Sustainability* **2022**, *14*, 8539. https://doi.org/10.3390/su14148539 [Accessed: September 1, 2022]

Cestnik, B.; Abina, A.; Kovačič Lukman, R.; Zidanšek, A. Expert system for systematic monitoring of sustainability-related competences in higher education. In: BAN, Marko (Ed.). 16th SDEWES Conference on Sustainable Development of Energy, Water and Environment Systems: 10 - 15 October 2021, Dubrovnik, Council Recommendation on Key Competences for Lifelong Learning, see also https://ec.europa.eu/education/education-in-the-eu/council-recommendation-on-keycompetences-for-lifelong-learning_en [Accessed: September 1, 2022]

Croatia. Zagreb: Faculty of Mechanical Engineering and Naval Architecture: SDEWES.org, 2021.

Sitarz D. Agenda 21: the Earth Summit Strategy to Save our Planet. New York: Nova Publishing Company; 1993.

The Egan Review: Skills for sustainable communities, Deputy Prime Minister, 2004, London. https://www.ihbc.org.uk/recent_papers/docs/Egan%20Review%20Skills%20for%20sustainable%20Communities.pdf [Accessed: September 29, 2022]

Transform Our World. The UN Agenda 2030 – Sustainable Development Goals, see also https://sdgs.un.org/2030agenda [Accessed: September 1, 2022]

World Commission on Environment and Development. Our common future. Oxford: Oxford University Press; 1987.

10 Age-friendly environment in Prishtina- a study report based on needs and satisfaction of population aged 65 +

Albana Gjonbalaj
Institute for Sustainable Real Estate Management ISREM
albanagjonbalaj@gmail.com

Vetiola Recica
Institute for Sustainable Real Estate Management ISREM
vetiol@hotmail.com

Besnik Vrella
Institute for Sustainable Real Estate Management ISREM
vrellabesnik@gmail.com

Abstract

Population aged 65+ has doubled in the period of 30 years in Kosovo. A solid number of this population has migrated from rural to urban areas. An increase of building, especially residential buildings has taken place all over the country. This indicates that population aged 65+ ended up living in residential apartments, in completely different lifestyle they used to live in rural areas. Although considered the city with the biggest expansion with building developments, the city of Prishtina has a lot of development to do when it comes to meeting the needs and preferences of elderly people.
This paper will try to measure the satisfaction of third age people with outdoor spaces and buildings in Prishtina, focusing only on spaces that are mostly frequented by this age-group. For this purpose, a questionnaire with local people will be carried out and it will be compiled with questions based on features from the WHO Guide on Age-Friendly cities, focusing only on Outdoor Spaces and Buildings component. Based on the literature review and the results from the questionnaire, it will be possible to have the overview of best practices for this age-group in other countries, while the results from the questionnaire will show us where our city stands in this aspect.

Key words: population, environment, buildings, infrastructure, age-friendly

Introduction

1.1 Background

Data analytics related to the population in any given country/society are essential tools for policy formulation and planning: including education, social security, health, housing and the labour market.
The aim of this research paper is to investigate how age friendly is the physical infrastructure in the capital of Kosova, especially for the most vulnerable age group (65+ years old).
Kosova is known for its young population (rightfully named as "young Europeans") with most of its population below 30 years old. However, this trend is gradually changing, especially during last 20 years, where we are witnessing lot of changes in the social structure in Kosovo society due to the mixture of reasons. In one hand we see drop in natality, on the other hand we are facing massive migration of population aged 25-34 who are migrating due to various reasons, mainly due to the economic ones.

All those reasons contributed to the changes in social structure and increase of percentage of 65+ year old in the entire population.

1.2 Demographic Trends in Kosovo

Last census in Kosovo has been done in 2011, and since then we only had estimations about the social structure of population that lives in Kosovo.

Latest estimations that were done in 2020 estimate that the median age of the population in Kosovo is 30.5.

For additional context, here's a look at how the population in Kosovo breaks down by age group:

Group age	**1991**	**2020**
0-4	13.50%	7.3 %
5-12	18.50%	12.5 %
13-17	12.70%	8. 3%
18-24	12.40%	11.7 %
25-34	15.20%	16.5 %
35-44	10.20%	14.9 %
45-54	7.80%	11.3 %
55-64	5.10%	9.2 %
65+	4.60%	8.4 %

Table 1 How the population in Kosovo breaks down by age group (www.datareportal.com & Instituti I Planifikimit Hapesinor, Raporti i vitit 2004)

As it can be noted from the table above, Kosovo has experienced a lot of changes on its social structure including the ageing of population. In 1991 only 4.6% of its population was over 65 years, whereas within the 30 year span the percentage of 65+ years old people almost doubled as compared to the total number of population, estimated 8.4%.
At the same time life expectancy has increased over time. After WWII it was estimated that average life expectancy was about 46 years, whereas in 1991 it was 74 year (IPH, 2004), almost 30 year increase.

Based on an estimation that has been done by Statistics Agency of Kosova in 2017 this trend of drop of natality and ageing of population will continue to prevail in upcoming decades, contributing to increase of number (and %) of 65+ years old that will live in Prishtina. This will also happen due to the migration of population from rural to urban areas, thus increasing the burden on existing public infrastructure needed by elderly people.

According to a report made by an NGO INDEP about the pension scheme in Kosovo, it was estimated that in 2017 there were 144 718 people living in Kosovo with the age of over 65+ years (see Figure__, INDEP, 2017). However, in this report there was no indication about the number of people over 65+ years old in Prishtina alone, which is our focus of interest for this study.

In 2020 Statistics Agency of Kosova, has made a study on social welfare and in their study we have managed to obtain number of people with 65+ years old in Prishtina alone. At that time it was estimated that 13 761 aged 65+ lived in Prishtina municipality (urban and rural areas combined).

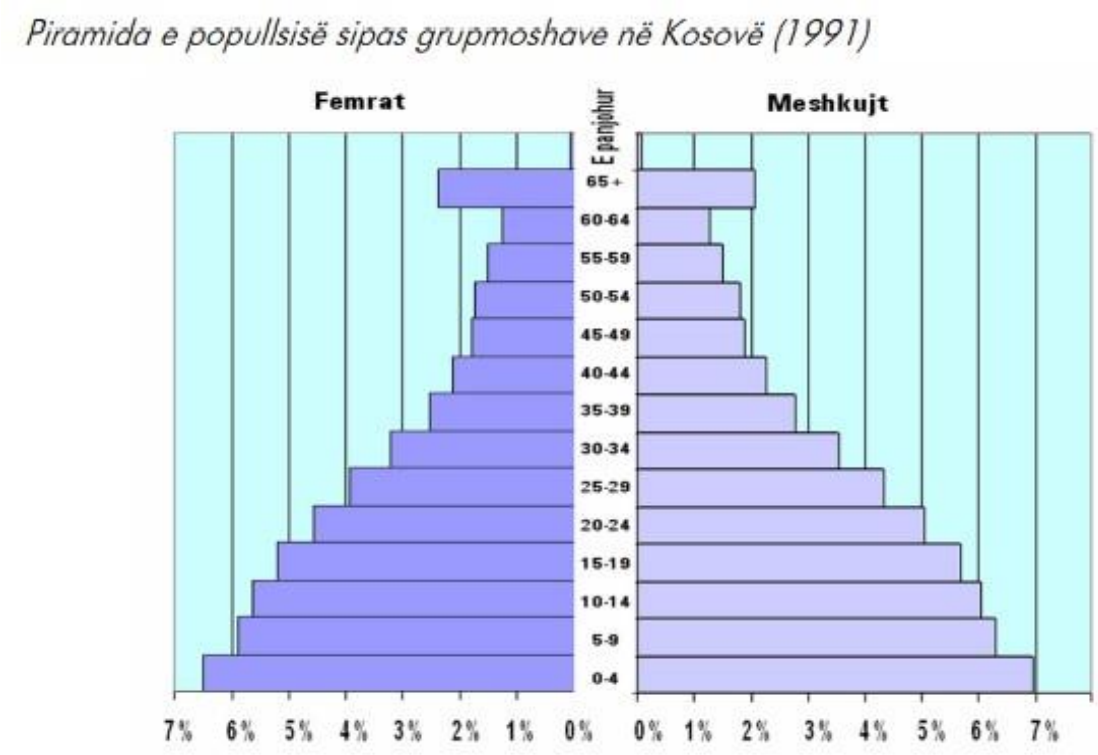


Figure 1Age groups in Kosovo in 1991 (IPH, 2004)

Publikimi i Statistikave të Mirëqenies Sociale, TM1 2020

Tabela 4. Pensionet bazike të moshës sipas komunave

Komuna	TM1		
	Janar	Shkurt	Mars
Deçan	3.343	3.320	3.440
Gjakovë	6.378	6.338	6.499
Gllogovc	2.857	2.911	2.964
Gjilan	8.891	8.903	9.070
Dragash	4.531	4.480	4.590
Istog	4.352	4.374	4.450
Kaçanik	2.022	2.040	2.085
Klinë	3.305	3.344	3.409
Fushë Kosovë	2.230	2.274	2.326
Kamenicë	4.192	4.208	4.279
Mitrovicë	7.064	7.100	7.261
Leposaviq	3417	3538	3584
Lipjan	4.426	4.437	4.573
Novobërdë	569	570	575
Obiliq	1.463	1.467	1.491
Rahovec	3.781	3.793	3.893
Pejë	8.251	8.269	8.471
Podujevë	5.053	5.143	5.228
Prishtinë	13.241	13.401	13.761
Prizren	11.820	11.840	12.095
Skenderaj	3.126	3.125	3.217
Shtime	1.721	1.724	1.768
Shtërpcë	2.240	2.158	2.287
Suharekë	4.391	4.417	4.485
Ferizaj	7.257	7.242	7.458
Viti	3.755	3.719	3.831
Vushtrri	4.222	4.269	4.368
Zubin Potok	1113	1118	1133
Zveçan	1461	1473	1496
Malishevë	3.183	3.178	3.242
Junik	:	:	:
Mamushë	:	:	:
Hani i Elezit	304	308	312
Graçanicë	:	:	:
Ranillug	:	:	:
Partesh	:	:	:
Kllokot	:	:	:
Mitrovicë Veriore	:	:	:
Gj i th s e j	**133.959**	**134.481**	**137.641**

Figure 2 Social Welfare Statistics (ASK,2020)

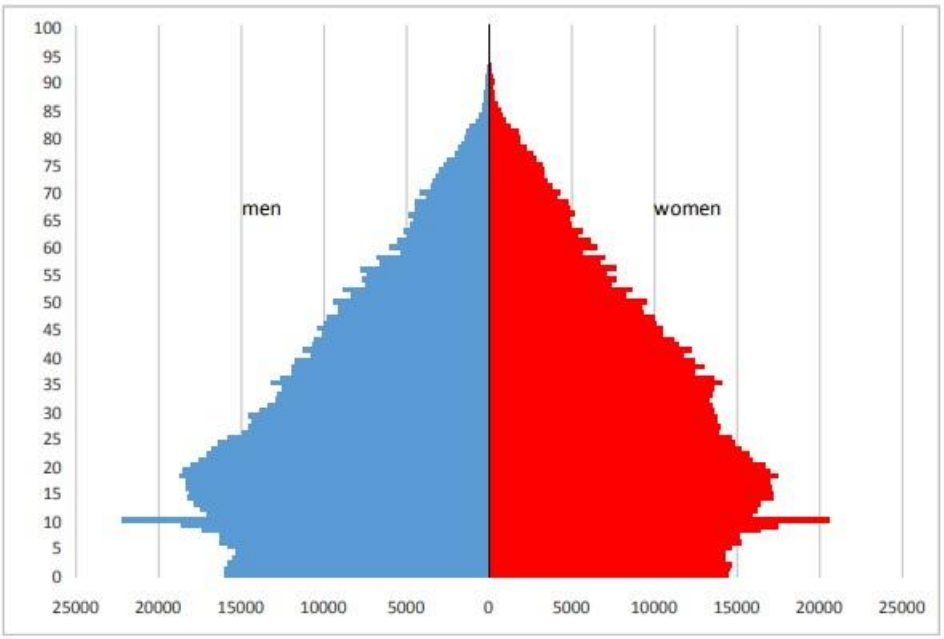


Figure 3 Population pyramid (ASK,2011)

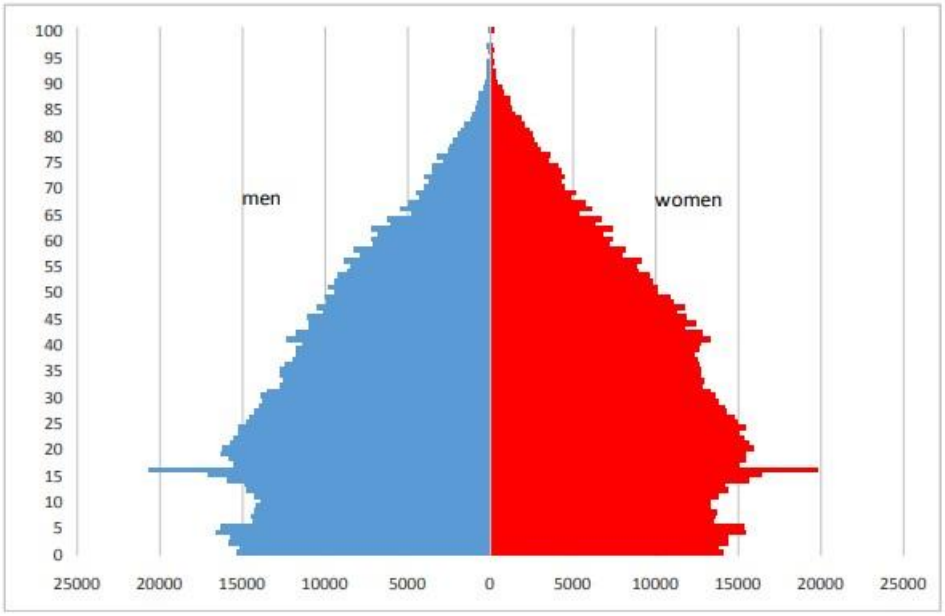


Figure 4 Population pyramid (ASK,2017)

Table 1. Number of births throughout the years and Total Fertility Rate (TFR)						
Year	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**
Births	34,569	34,643	32,528	32,067	29,290	29,428
TFR	2.41	2.40	2.25	2.23	2.07	2.10

Table 2Total Fertility Rate (ASK,2017)

Table 2. Life expectancy in some countries in the region and the gender gap, 2014-2015						
Year	2014			2015		
Country	Male	Female	Gender gap	Male	Female	Gender gap
Bulgaria	71.1	78.0	6.9	71.2	78.2	7.0
Croatia	74.7	81.0	6.3	74.4	80.5	6.1
Romania	71.4	78.7	7.3	71.5	78.7	7.2
Slovakia	73.3	80.5	7.2	73.1	80.2	7.1
Albania	*76.3*	*80.2*	*3.9*	*76.2*	*79.7*	*3.5*
Serbia	72.8	78.0	5.2	72.8	77.9	5.1

Table 3 Life expectancy in the region (ASK,2017)

Life expectancy in Kosovo is 73.4 (male) and 77(female) based in 2011

Figure 7. Life expectancy at birth 2011-2061

Figure 5 Life expectancy (ASK,2017)

Viti	2017
65+, estimation	144,718
Përfitues të Pensionit Bazë	122,716
Përfitues të Pensionit Kontribues	43,300
	- 21,298

Table 4 Number of population 65+(INDEP,2017)

Table 6. Kosovo population according to age group and year (medium variant)

Year	Population by age group				Population by age in %			
	Total	0-14	15-64	65+	Total	0-14	15-64	65+
2017	1,783,531	446,633	1,192,181	144,718	100	25	67	8
2021	1,809,458	431,526	1,211,592	166,341	100	24	67	9
2031	1,818,674	364,294	1,217,592	236,787	100	20	67	13
2041	1,759,492	290,436	1,150,779	318,277	100	17	65	18
2051	1,652,090	247,855	1,034,147	370,088	100	15	63	22
2061	1,492,192	199,518	892,803	399,871	100	13	60	27

Table 7. Kosovo population according to age group and year (low variant)

Year	Population by age group				Population by age in %			
	Total	0-14	15-64	65+	Total	0-14	15-64	65+
2017	1,783,531	446,633	1,192,181	144,718	100	25	67	8
2021	1,750,206	412,028	1,172,614	165,565	100	24	67	9
2031	1,581,731	276,605	1,071,662	233,465	100	17	68	15
2041	1,333,861	176,790	853,614	303,457	100	13	64	23
2051	1,033,647	120,692	596,222	316,734	100	12	58	31
2061	688,847	58,041	349,086	281,721	100	8	51	41

Table 8. Kosovo population according to age group and year (high variant)

Year	Population by age group				Population by age in%			
	Total	0-14	15-64	65+	Total	0-14	15-64	65+
2017	1,783,531	446,633	1,192,181	144,718	100	25	67	8
2021	1,888,375	455,519	1,268,857	163,999	100	24	67	9
2031	2,140,369	477,154	1,431,905	231,309	100	22	67	11
2041	2,348,968	449,273	1,575,949	323,745	100	19	67	14
2051	2,537,973	445,043	1,660,040	432,891	100	18	65	17
2061	2,697,455	447,847	1,675,620	573,988	100	17	62	21

Table 5 Kosovo population according to age group and year (ASK,2017)

1.3 Significance of this Study

This study is significant since it aims to provide information on friendliness of public infrastructure for elderly people in Prishtina., at the same time shed light to the specific aspects that contribute to this friendliness (or not). We will also try to give recommendations on how and where will be required to invest in order to make life easier for this category of people. At the same time we have provided population data and forecast on how things will develop in years/decades to come when it comes to this category of population. Population data is the key component for estimating national accounts, employment, budget allocations, living standard and other socio-economic issues.

2. Theoretical background

2.1 Elderly and environment

By the year 2024 people 65 years and older will represent over a quarter of the global population. This trend in population ageing is inextricably linked with trends towards urbanization, globalization

and migration. These trends are profoundly impacting the way individuals irrespective of age will interact with and experience their environments and age healthy. (IFA)

As Shah Ali et al (2019) supports ageing people need homes that can sustain and enhance their quality of life and well-being. Unsatisfactory home conditions lead to needs of modification, which could effectively decrease difficulty in mobility and performing daily activities.

As it was defined on the research by UNHABITAT (2017) public spaces are all places publicly owned or of public use, accessible and enjoyable by all for free and without profit motive. The toolkit implies that such definition includes both publicly and privately- owned public spaces, as a common good accessible by all with no direct cost, with the primary goal of improving the liveability conditions for the community.
With the aging population a significant part of the population demographics, it is important to understand the characteristics of this population demographic as well as their building functionality requirements and derive appropriate maintenance strategies for buildings they occupy.(Ali et al, 2019)

There is an important connection between urbanization and population.
Urbanization and population ageing are transformative trends that are changing the way we live, work, and experience our urban environments throughout our lives and into older age. (WHO,2018)

2.2 Age-friendly environments

Age-friendly built environments have been promoted by the World Health Organisation (WHO, Geneva, Switzerland) under the Global Age-friendly Cities (AFC) movement in which three domains are related to the built environment. These are: housing, transportation, outdoor spaces and public buildings. (Hing-Wah ,Jamei ,2021)

Menec et al.(2011) and Keating et al. (2013) state that what makes a community age-friendly is having a good fit between the older person and his/her living environment, not conformity with a standard and fixed set of features. As they explain, the fact that there are many diverse groups of older persons with different needs implies that there are correspondingly different “age-friendly” environments with matching resources. Moreover, places evolve over time; a city that is age friendly at one time may become unfriendly at another; thus, becoming or remaining age- friendly is an ongoing process.

An aging friendly community has been defined as “a place where older adults are actively involved, valued and supported with infrastructure and services that effectively accommodate their needs” (Alley et al, 2007)

The demographic change towards a much older population structure has considerable consequences for the built environment, social welfare and community services as explained
by (Hing-Wah ,Jamei ,2021).As they explained there is a framework of eight domains to enhance the age-friendliness of cities which can be classified into three categories: (1) the built environment to cover housing, outdoor spaces, public buildings and transportation; (2) social aspects to cover respect and social inclusion, employment, social and civic participation; and (3) service provisions to cover community support and health services, communication and information.

Dijken et al (2006) explains that traditional housing concepts for the elderly are mainly based on culture, demographic situation, and policy of the country. Unfortunately, little attention is given to the specific needs regarding health and care in terms of building integrated solutions. To meet the desires of the current older population instead, older people turn to receiving home care and the use of additional medical aids to compensate for their decline in health. According to him, the concept of healthy buildings for older adults, however, offers these integrated solutions, giving older people

the feeling of living in an ordinary house instead of in an assisted living facility or a nursing home. Moreover, it will reduce, to some extent, the total care costs.

According to Scharlach and Lehning (2016) , aging-friendly community change will require involvement of governments, community organizations, businesses, and private citizens of all ages. And, older adults must be integrally involved as well- not only as service recipients but also as full community members change partners.

As ageing is a relative experience, age-friendliness requires greater appreciation of how environments promote and inhibit diversity, equity and inclusion across the life course and in the face of dynamic conditions that can disrupt healthy ageing pathways. In this respect, age-friendliness is a temporal construct that must remain open to adaption so as to avoid entrenching a unitary view of what is age-friendly.(Gardiner, C.M., & Webb, E.O.,2022).

3. Age-friendly environment in Prishtina

3.1 Information about survey

The idea behind the questionnaire was to identify if elderly people of Prishtina, are satisfied with the environment the use mostly, according to their age, be this indoor or outdoor environment. There was an assumption that because of migration from other part of Kosovo, villages or other cities, elderly people may end up living in flat apartments, thus having to use outdoor/indoor public spaces rather than their private facilities, as used to do in their old homes. For this purpose, we have compiled a questionnaire, through which we have attempted to measure general satisfaction of elderly people with outdoor/indoor public areas they use for their daily activities.

It has been considered that elderly people have some specific issues regarding the questionnaire, because most of them don’t possess any email account and thus do not have possibility to answer the questionnaire electronically. The patience of elderly people has been taken into consideration during the compilation of the questionnaire, as well. Having these in mind the questionnaire was designed to be very simple, with few necessary and most important questions, and has been printed out to be filled manually. It has been distributed around outdoor spaces where people aged 65+ spend most of their time during the day. In most of cases the team had to assist the respondents filling up the questionnaire. The places where the questionnaires are distributed are Fountain Park in Ulpiana neighborhood, Prishtina City Park, Elderly League of Kosovo premises, Taukbahqe Park and Germia Park. For illustrative purposes, below you will find some photos from these places.

Figure 6 Parku i qytetit (Wikimapia)

Figure 7Parku i Germise (Shqip.com)

Figure 8Elderly League of Kosovo premises (Klan Kosova)

The questionnaire itself was divided in three parts. The first and the second part are consisted of questions regarding demographic and living place information, while in the third part the respondents were requested to answer direct questions regarding the cleanliness, security and the condition of the places the visit mostly during their daily activities.

From the total of 77 questionnaires distributed, we got the response rate of 72.7%. With the gender distribution among respondents 52.8% female and 48.2% male, we have found out that 12.5% of respondents have never held a job position in their life, while 87.5% of them worked in different jobs during their life, such as teacher/professor, economist, lawyer/legalist, engineer and other jobs.

3.2 Results regarding actual living place of elderly people In Prishtina

According to the results 57.1% of the respondents came from other cities/villages to live in Prishtina, while 42. 9% have lived all their life here. This percentage supports the main study question of this research, which is that most of elderly people that live in Prishtina came from other regions and live in completely different lifestyle they used to live in their previous living spaces. It results that from the total number of people that came from other cities/villages, 56.3% live in residential apartments. Exactly 96.8% of respondents have declared to live in their actual living places for a period of 20 years and less, which as well tells us that these people migrated to Prishtina from other regions of Kosovo right after the war in Kosovo, which corresponds with the expansion in the building sector right after the conflict and onwards. From total number of respondents that came from other regions in Kosovo, it results that 71.9% of them don't even know which are most common places that elderly people use during their daily activities.

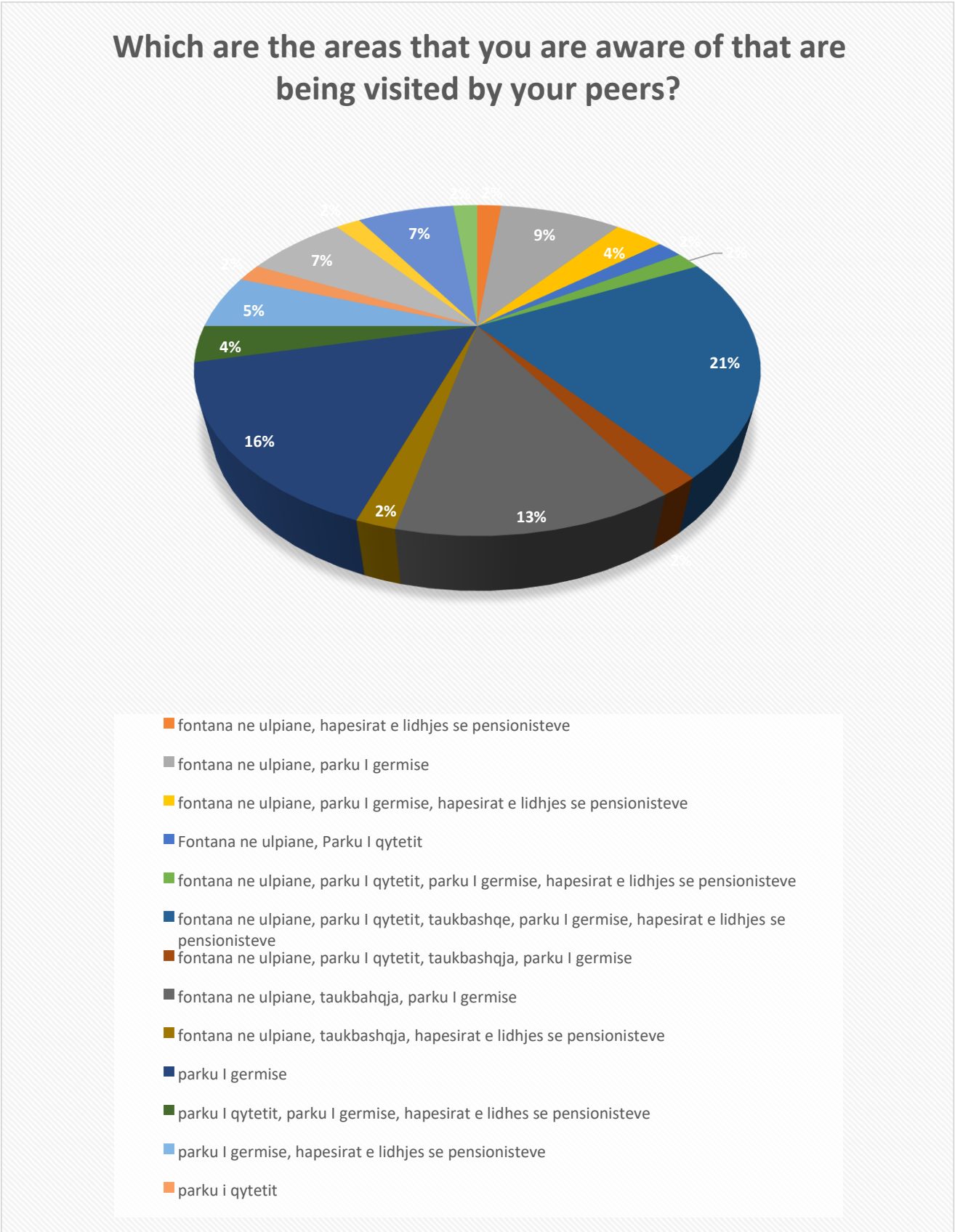


Figure 9 Which are the areas that you are aware of that are being visited by your peers?

On the other hand, it appears that people who have always lived in Prishtina, live in residential apartments as well. The results show us that 54.2% of respondents of this category live in residential

apartments, while 45.8% live in houses. This is because almost half of them appeared to have changed their living spaces, going living from houses to residential apartments.

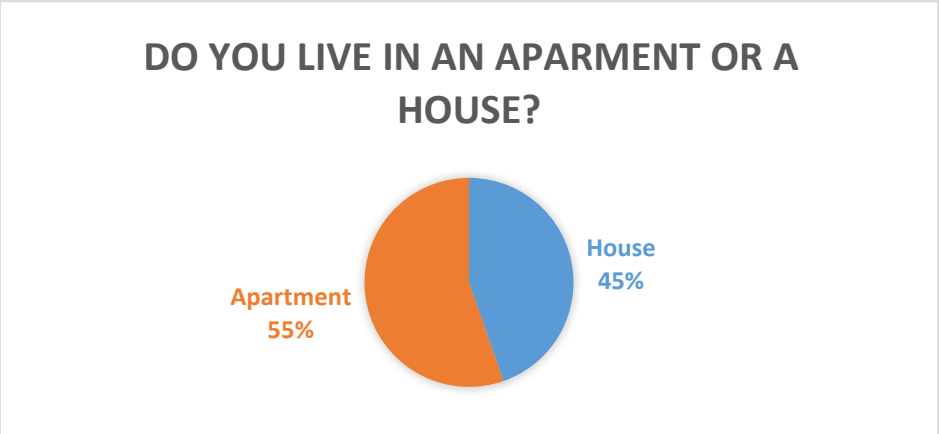


Figure 10 Do you live in an apartment or a house ?

3.3 Results regarding the cleanliness, security and the condition of the places visited by people aged 65+

Besides information regarding living spaces for people aged 65+ in Prishtina, it was considered as a necessity to have some direct insight regarding the cleanliness, security and the condition of the places that are visited by this category of people. To make this questionnaire much more relevant and credible, we have based the questions for this part on the WHO Guide on Age-Friendly cities, focusing only on the component for Outdoor Spaces and Buildings. There are 13 direct questions in this part, answerable with Yes and No, which had help us get elderly people opinion on the places they visit for their daily activities.
Considering the answers given in this part of the questionnaire, we can conclude that the respondents have different opinions only on some of the questions, such as questions about the cleanliness of the spaces they frequent (33.9% declared that outdoor spaces are clean, while 66.1% declared that the spaces are not clean), the fact whether they are cleared of snow or not (41.1% declare that pathways are not cleaned from snow, while 58.9% declare that they are), as well as sufficient lighting in the spaces where they carry out their daily activities (41.1% declare that there is sufficient lighting , while 58.9% declare that there's not sufficient lighting).

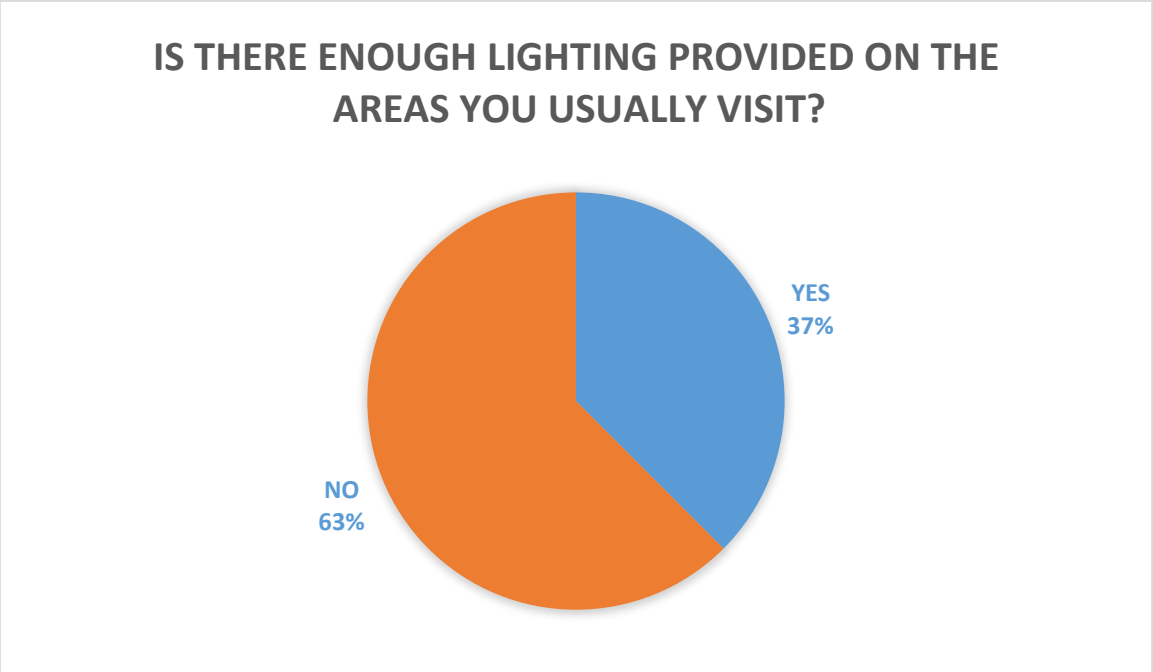


Figure 11 Is there enough lighting provided on the areas you usually visit?

The situation differs when it comes to other questions and it seem that the respondents share almost the exact opinion on the rest of the questions.

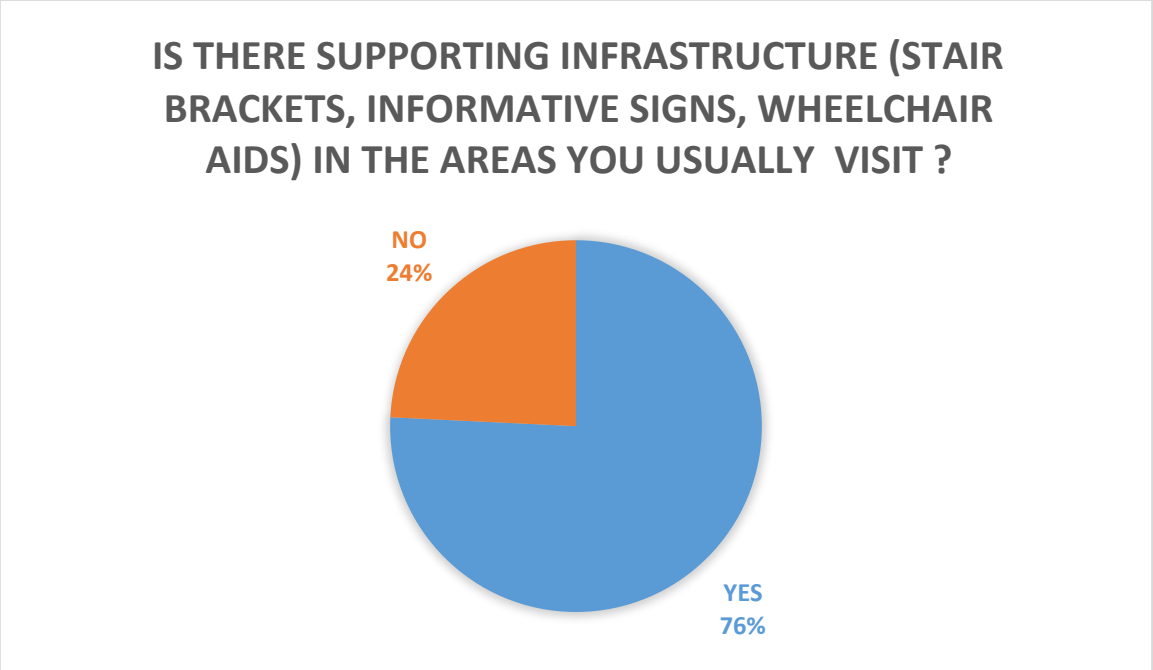


Figure 12 Is there supporting infrastructure (stair brackets, informative signs, wheelchair aids) in the areas you usually visit ?

It results that 78.6% of respondents think that the places they visit are too noisy, 75% of them encounter physical barriers (stairs, grates, stones, tree branches) while moving in the performance of your daily activities, only 3.6% declare that there are public toilets in places they visit, 76.8% declare there are not enough seat in public outdoor space while 89. 3% of respondents admit there are other people whom they consider as an obstacle (scooter riders, bicycle riders) and 92.9% admit that alleys/lanes/sidewalks they walk in are occupied by cars.

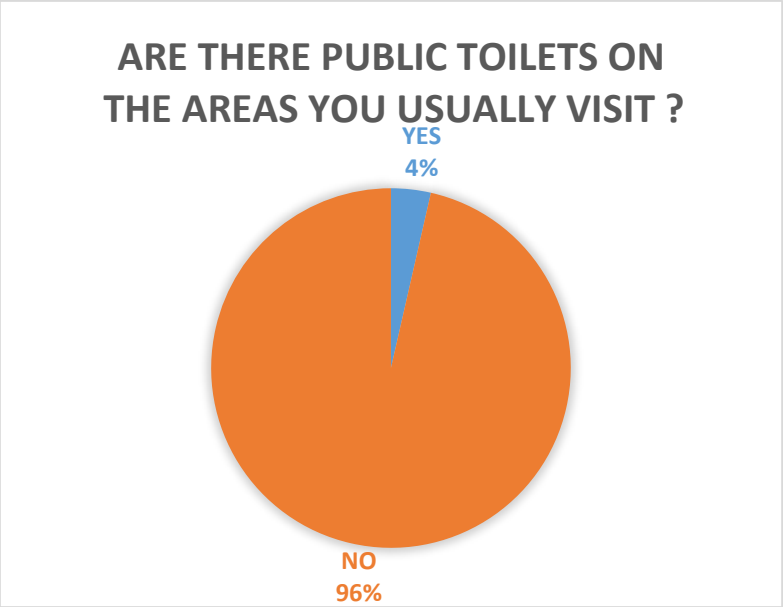


Figure 13Are there public toilets on the areas you usually visit?

4. Conclusions and recommendations

4.1 Conclusions

Age-friendliness of an environment is defined by how easy the buildings and outdoor environments are accessible by the elderly , and supported by infrastructure that accommodates the elderly needs

The absence of staircase holders, wheelchair aids and signage makes it very difficult for the elderly to access the areas where they perform their daily activities

Unfortunately, little attention is given to many public areas when it comes to facilitating the elderly

Public transport plays an important role in the daily life of the elderly and in facilitating their activities

Outdoor environments, especially public parks, are the places where the elderly spend most of their time and the lack of sufficient seats in parks , and the lack of public toilets is an issue that causes them to feel discomfort

4.2 Recommendations

There is an urgent need for supporting infrastructure (stair brackets, informative signs, wheelchair aids) and public toilets in the areas visited by elderly

High importance should be given to the public street lighting

There should be more spaces dedicated to the elderly where they would connect with each other, feel active and contribute to society

In order to improve the age-friendliness of the environment , the elderly should be actively involved together with institutions and organization that work on facilitating their needs

There should be more support for projects related to elderly welfare

References

Agjencia e Statistikave te Kosoves (2020) “Estimation Kosovo Population 2020” [Online] Available from:
https://ask.rks-gov.net/media/6205/estimation-population-2020.pdf
Agjencia e Statistikave te Kosoves (2020) “Kosovo Population Projection 2017-2061” [Online] Available from:
https://ask.rks-gov.net/media/3741/kosovo-population-projection-2017-2061.pdf
Ali, A. & Au-Yong, Ch. & Chua,Sh.. (2019) “A Case Study on the Building Condition of Elderly Homes and its Maintenance Recommendations” [Online] Available from: https://www.researchgate.net/publication/345261012_A_Case_Study_on_the_Building_Condition_of_Elderly_Homes_and_its_Maintenance_Recommendations
Alley, D. & Liebig, P. & Pynoos, J. & Banerjee, T. & Choi, I. (2007).” Creating Elder-Friendly Communities: Preparations for an Aging Society” [Online] Available from: https://www.researchgate.net/publication/6036821_Creating_ElderFriendly_Communities_Preparations_for_an_Aging_Society
Froukje, D. & Hoof, J. & Kort, H. (2006)” Healthy buildings for older adults” [Online] Available from:
https://www.researchgate.net/publication/237730732_Healthy_buildings_for_older_adults
Gardiner, C.M., & Webb, E.O.(2022). “The Age-friendly Lens”
Hing-Wah, Ch.& Jamei E. (2021) “Age-Friendly Built Environment” [Online] Available from:
https://rest.neptune-prod.its.unimelb.edu.au/server/api/core/bitstreams/36a13a86-1079-52b3a2e3-ab0bea59478d/content
IFA “Age Friendly Environments ” [Online] Available from:
https://ifa.ngo/positions/age-friendly-environments/
Keating, N. & Eales, J. & Phillips, J.(2013)” Age-Friendly Rural Communities: Conceptualizing 'Best-
Fit"'.
[Online] Available from:
https://www.researchgate.net/publication/257838293_AgeFriendly_Rural_Communities_Conceptualizing_'Best-Fit'
Lehning, A. & Scharlach, A.& Santo, T. (2010).” A Web-Based Approach for Helping Communities Become More “Aging Friendly”” [Online] Available from:
https://www.researchgate.net/publication/245771003_A_Web-Based_Approach_for_Helping_Communities_Become_More_Aging_Friendly
United Nations Human Settlements Programme (2017) “Public Space Profile Prishtina”
World Health Organization (2018) “The Global Network for Age-friendly Cities and Communities”

Annex
Questionnaire
QUESTIONNAIRE ABOUT YOUR ASSESSMENT OF THE SPACES YOU FREQUENT DURING THE PERFORMANCE OF DAILY ACTIVITIES

Questions for you
Your age
65-70
71-75
76-80
81-85
Gender
Female
Male

Previous profession:
_____
You:
Have always lived in Pristina
Came from another city/ from a village

You live in:
House
Apartment

How long have you been living in the current house/apartment?

About 5 years
About 10 years
Over 20 years
All of my life

Questions about the spaces frequented by the third age
How do you spend your time outside the home environment?

Walking
Daily supplies
Time in the park
Socializing

Are you aware of all the spaces frequented by your peers?

Yes
No

Which are the places that you are aware of, frequented by your peers?
Fontana in Ulpiana
City Park
Tauk Bahqja
Germia Park
League of Pensioners Spaces

How do you get to the destination you frequent for your daily activities?
Walking
By urban transport
By car
Combination of transport and walking

Questions about the cleanliness, safety and condition of the spaces you frequent

Questions regarding cleanliness, safety and the condition of the places you visit for daily activities.	Yes	No
11. In your opinion, are the spaces you frequent beautiful?		
12. According to your assessment, are the spaces you frequent clean?		
13. In your opinion, are the spaces you frequent too noisy?		
14. Do you encounter physical barriers (stairs, grates, stones, tree branches) while moving during of your daily activities?		
15. Are there public toilets in the spaces you frequent during your daily activities?		
16. According to your assessment, are there enough seats in the spaces you frequent during your daily activities?		
17. In the spaces you frequent, are there other people whom you can consider as an obstacle (scooter riders, bicycle riders)?		
18. In your opinion, are the alleys/lanes/sidewalks where you walk broken?		
19. In your opinion, are the alleys/lanes/sidewalks where you walk cleared of snow?		
20. Are the alleys/lanes/sidewalks where you walk occupied by cars?		
21. Are there stray dogs in the spaces you frequent?		
22. According to your assessment, is there enough lighting in the spaces you frequent?		
23. Are there assistive devices (climbing brackets, signs, wheelchair aids) in the spaces you frequent?		

24. Is there anything you would have added that was not included in this questionnaire?

11 The smart silver villages through the lenses of the Slovenian rural inhabitants

Carmen Rajer[1], Marija Bogataj[2], Samo Drobne[3] and David Bogataj[1,2,4]

[1] Alma mater Europaea - ECM, Institute INRISK, carmen.rajer@almamater.si
[2] Institute INRISK, marija.bogataj@guest.arnes.si
[3] University of Ljubljana – FGG, samo.drobne@fgg.uni-lj.si
[4] Alma mater Europaea - ECM, Institute INRISK, New University – EPF, david.bogataj@almamater.si

Abstract: "The Smart Village Initiative« was first put forward in the European Parliament in 2017, to "map out challenges and opportunities in rural areas, provide a definition of 'Smart Villages', and identify good practice examples and case studies on the topic". In this document, it is concluded that "the opportunity for smart villages comes from key drivers of change in the countryside, including the impact of existing and emerging digital technologies, environmental activities related to the conservation of the rural landscape and the circular economy, bio-economy, new short supply chains, new patterns of mobility and better transportation and communication with cities". In the EU policy for rural development, the concept of smart villages emerged to address the need of EU 2020 strategy to be implemented, with the priorities as intelligent, sustainable, and inclusive development. It should be the answer to the search for the sustainable development of rural, especially shrinking villages in peripheral areas. The conceptualization and operationalization are formulated more as an analogy to the smart city and extension of it, containing six basic dimensions: management, economy, mobility, natural and social environment, and quality of life. The goal was the cohesion and strengthening rural development, but the spatial planning and transportation issues were not considered enough. We wish to also add these dimensions to the spatial planning and smart silver village construction, following the hypothesis that "the evaluation of sustainable development of the living environment should base on the consensus of generations and an intergenerational well-being". To reach this goal we considered how the inhabitants in Slovenian rural areas consider the development of smart silver village as a complement of urban facilities for older adults. Through the answers to over 100 questions on these topics we got 577 answers which led us to the list of conclusions given in this paper. The challenges of the development of social infrastructure including social farming and the barriers in the Spatial planning act have been exposed and the model supporting dynamics of investments is presented in order to reach better quality of life also for older adults.

Keywords: smart village, long-term care, social infrastructure, geographical gerontology, ageing

Pametne srebrne vasi z vidika slovenskih prebivalcev podeželja*

Carmen Rajer[1], Marija Bogataj[2], Samo Drobne[3] in David Bogataj[1,2,4]

[1] Alma mater Europaea - ECM, Institute INRISK, carmen.rajer@almamater.si
[2] Institute INRISK, marija.bogataj@guest.arnes.si
[3] Univerza v Ljubljani – FGG, samo.drobne@fgg.uni-lj.si
[4] Alma mater Europaea - ECM, Institute INRISK, Nova univerza – EPF, david.bogataj@almamater.si

Povzetek:

»Pobuda za pametne vasi« je bila prvič predstavljena v Evropskem parlamentu leta 2017, da bi »začrtala izzive in priložnosti na podeželju, uveljavila definicijo 'pametnih vasi' ter opredelila primere dobre prakse in študije primerov na to temo«. V tem dokumentu je ugotovljeno, da »priložnost za pametne vasi izvira iz ključnih dejavnikov sprememb na podeželju, vključno z vplivom obstoječih in nastajajočih digitalnih tehnologij, okoljskih dejavnikov ter aktivnosti, povezanih z ohranjanjem podeželske krajine in krožnega gospodarstva, bio -gospodarstvom, novimi razvoji kratkih dobavnih verige, novimi vzorci mobilnosti ter boljšimi organizacijami prevozov in komunikacij z mesti". V politiki EU za razvoj podeželja se je pojavil koncept pametnih vasi, da bi odgovoril na potrebo po izvajanju strategije EU 2020 s prednostnimi nalogami kot je inteligenten, trajnosten in vključujoč razvoj, ki naj bi bil odgovor na iskanje trajnostnega razvoja podeželja, predvsem vasi, ki se krčijo. Te razsežnosti želimo dodati tudi prostorskemu načrtovanju in gradnji pametne srebrne vasi, pri čemer sledimo hipotezi, da »vrednotenje trajnostnega razvoja bivalnega okolja mora temeljiti na soglasju generacij in medgeneracijskem blagostanju«. Konceptualizacija in operacionalizacija izhajata iz koncepta pametnih mest in sta oblikovani bolj kot analogija pametnemu mestu, ki vsebuje šest osnovnih dimenzij: upravljanje, gospodarstvo, mobilnost, naravno in družbeno okolje ter kakovost življenja. Cilj je bil kohezija in krepitev razvoja podeželja, premalo pa so bila upoštevana vprašanja prostorskega načrtovanja in prometa. Te dimenzije želimo dodati tudi prostorskemu načrtovanju in gradnji pametne srebrne vasi. Za dosego tega cilja smo preučili, kako prebivalci slovenskega podeželja gledajo na razvoj pametne srebrne vasi in kako vidijo zagotavljanje kakovostnega življenja na podeželju in na robi mest. Skozi odgovore na več kot 100 vprašanj o teh temah smo dobili 577 vsaj delno izpolnjenih anket z odgovori, ki so nas pripeljali do seznama zaključkov, podanih v tem prispevku. Izpostavljeni so izzivi razvoja družbene infrastrukture, vključno s socialnim kmetovanjem, in ovire ki jih postavljajo prostorski akti. Predlagan je tudi model v podporo dinamiki investicij v izgradnjo objektov, v katerih se bodo starejši prebivalci bolje počutili.

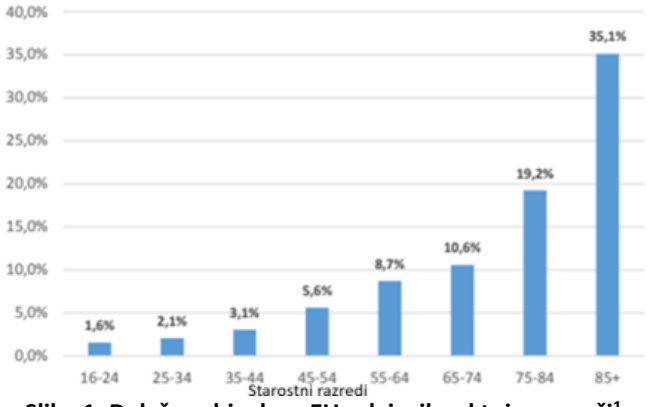
Ključne besede:

pametna vas, dolgotrajna oskrba, socialna infrastruktura, geografska gerontologija, staranje

1. UVOD

1.1 Geografsko - gerontološka problematika

Demografski profili regij EU se zelo razlikujejo, zlasti med mestnimi in podeželskimi območji, ki se močno starajo. Število prebivalcev, ki bodo potencialno potrebovali dolgoročno nego se povečuje od 19,5 milijona leta 2016 na 23,6 milijonov do leta 2030 in na 30,5 milijona do leta 2050 (EU-27, 2021).



Slika 1: Delež prebivalcev EU odvisnih od tuje pomoči[1]

Ta trend pomembno vpliva na vsakdanje življenje ljudi in na naše družbe. Vpliva na gospodarsko rast, fiskalno vzdržnost, zdravje in dolgotrajno oskrbo, dobro počutje in socialno kohezijo. Dostop do storitev zdravstvenega in socialnega varstva je na podeželskih območjih bistveno slabši kot v mestih, kar je še posebej kritično za starejše prebivalstvo, ki je tudi v večjem deležu odvisno od tuje pomoči (slika 1). To namreč močno vpliva na kakovost življenja starejših prebivalcev.

Razvoj skupnostne oskrbe na domu in njene logistike ter njena vključitev v hierarhični sistem integrirane (socialne, zdravstvene in stanovanjske) oskrbe od lokalne prek občinske in regionalne do nacionalne ravni za oskrbo naraščajočega števila starejših odraslih z upadajočimi funkcionalnimi sposobnostmi je prednostna naloga držav članic EU, kjer so za razvoj, vzdrževanje in financiranje mreže skupnostne oskrbe in oskrbe na domu kot dela svoje socialne infrastrukture odgovorne občine, svoje naloge pa usklajujejo z regijami.

Slovenija je v skladu z *"Operativnim programom za izvajanje evropske kohezijske politike v obdobju 2014-2020"*[3] kot ključno področje opredelila spodbujanje razpoložljivosti cenovno dostopnih, trajnostnih in kakovostnih storitev, vključno z zdravstvenimi in socialnimi storitvami splošnega pomena za stare in zelo stare prebivalce. Med te storitve sodi tudi dolgotrajna oskrba, ki še ni ustrezno razvita in za katero smo 9.12.2021 dobili nov zakon, katerega realizacijo pa nova vlada premika daleč v prihodnost. Potrebna je namreč reforma, ki bo omogočila vzpostavitev enotnega sistema skupnostnih storitev, se pravi enako kakovostnih po kategorijah oskrbovancev, kot so oskrbe v domovih starejših občanov po obsegu in kakovosti storitev, za staranje v domačem okolju in za tiste, ki bodo potrebovali institucionalne oblike oskrbe v negovalni domovih. V skladu z novo zakonodajo, katere veljavnost se premika nekam v prihodnost, bo treba razviti model za napovedovanje potreb in upravičenosti do integriranih zdravstvenih in socialnih storitev, dolgotrajne oskrbe, spremljanje prejemnikov storitev in sredstev za dolgotrajno oskrbo ter usklajevanje razvoja integriranih skupnostnih storitev.

18. načelo *Evropskega stebra socialnih pravic* (ES, 2017)[4] poudarja, da ima vsakdo pravico do cenovno dostopne in kakovostne dolgotrajne oskrbe, zlasti oskrbe na domu in storitev v skupnosti.

[3] *REPUBLIKA SLOVENIJA (2014). Operativni program za izvajanje evropske kohezijske politike v obdobju 2014–2020.* https://www.eu-skladi.si

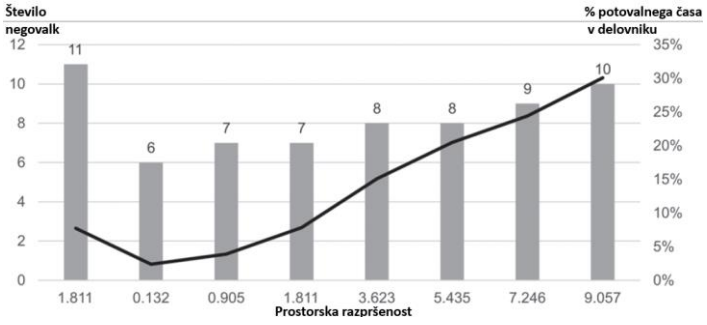
[4] *European Commission (2021). European Pillar of Social Rights - Building a fairer and more inclusive European Union.* https://ec.europa.eu/info/strategy/priorities-2019-2024/economy-works-people/jobs-growth-and-investment/european-pillar-social-rights_en

Ta naj bi bila enako dostopna v mestih kot na podeželju. Zaradi razpršenosti oskrbovancev pa je oskrba na podeželju pogosto mnogo dražja kot v mestih.

Podeželska območja v Evropski uniji (EU), tudi v Sloveniji, se starajo hitreje kot mestna območja, v številnih primerih zaradi odseljevanja mladih. Izdatki za dolgotrajno oskrbno se bodo do leta 2070 povečali za 1-2 % BDP (EC, 2020)[5], s čimer bodo omejena javna sredstva za to oskrbo. Pričakovano

1.2. Problematika razpršenosti prebivalstva na ruralnem področju

Odhodki za izvajanje dolgotrajne oskrbe so veliko višji na podeželju, kjer prostorska razsežnost povzroča dodatne logistične težave in stroške izvajalcem ter zmanjšuje kakovost oskrbe uporabnikov dolgotrajne oskrbe. Študirali smo vpliv razpršenosti (standardna deviacija v minutah) potovanj med dvema oskrbovalnima mestoma) na potrebno število oskrbovalcev (Szander et al., 2017)[6], kar nam prikazuje slika 2. Rezultati so pridobljeni z razvojem programa mTSP (multiple Travelling Salesman Problem), v katerem smo upoštevali nekatere omejitve o času oskrbe.

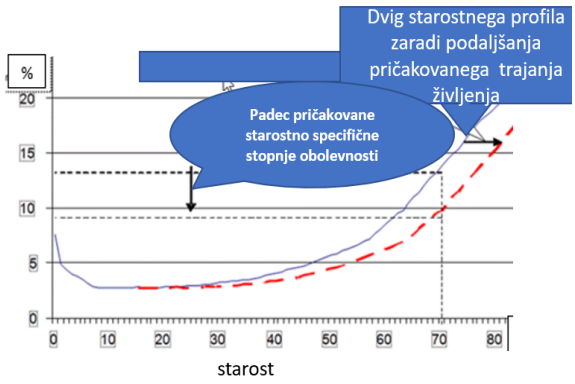


Slika 2: Vpliv razpršenosti domov oskrbovancev na % porabljenega časa za potovanje in število potrebnih negovalk v primeru optimizacije oskrbe z mTSP programom

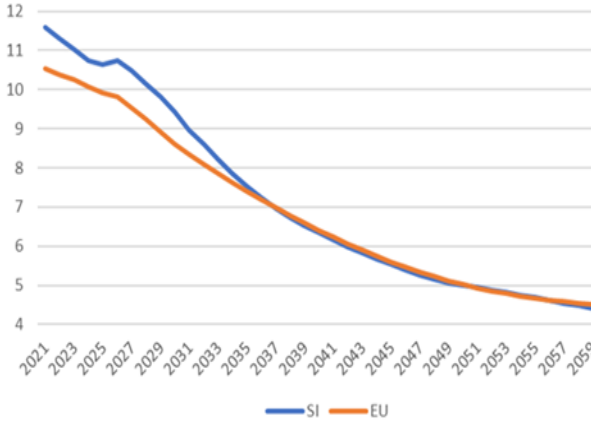
Pomanjkanje delovne sile na področju storitev oskrbe naj bi v naslednjih petih letih doseglo 20 milijonov. Za zagotavljanje novih načinov zdravljenja in učinkovite oskrbe po dostopnih cenah, zlasti na oddaljenih podeželskih območjih, kjer se kažejo potrebe bolnikov, so potrebni bolj trajnostni modeli upravljanja zdravstva in zagotavljanja oskrbe, ki bodo povečali učinkovitost in odpornost sistemov zdravstva in oskrbe.

[5] European Commission (2020). The 2021 Ageing Report: Economic and Budgetary Projections for the EU Member States (2019-2070). https://economy-finance.ec.europa.eu/publications/2021-ageing-report-economic-and-budgetary-projections-eu-member-states-2019-2070_en

[6] Szander, N., Ros McDonnell, L., Bogataj, M., (2017). Prostorska razpršenost stanovanjskih enot kot pomemben dejavnik vpliva na stroške dolgotrajne oskrbe = Spatial dispersion of housing units as an important factor influencing long-term care operational costs. *Urbani izziv 28*(1), str. 67-76, 147-156. http://urbani-izziv.uirs.si/Portals/uizziv/papers/urbani-izziv-2017-28-01-006.pdf , http://urbani-izziv.uirs.si/Portals/uizziv/papers/urbani-izziv-en-2017-28-01-006.pdf



Slika 3: Izdatki za zdravstvo, povezani s staranjem, kot % BDP na prebivalca v EU danes (modra črta) in čez 50 let (rdeča črta), če se zdravstveno varstvo in socialna oskrba izboljšata glede na scenarij EC.

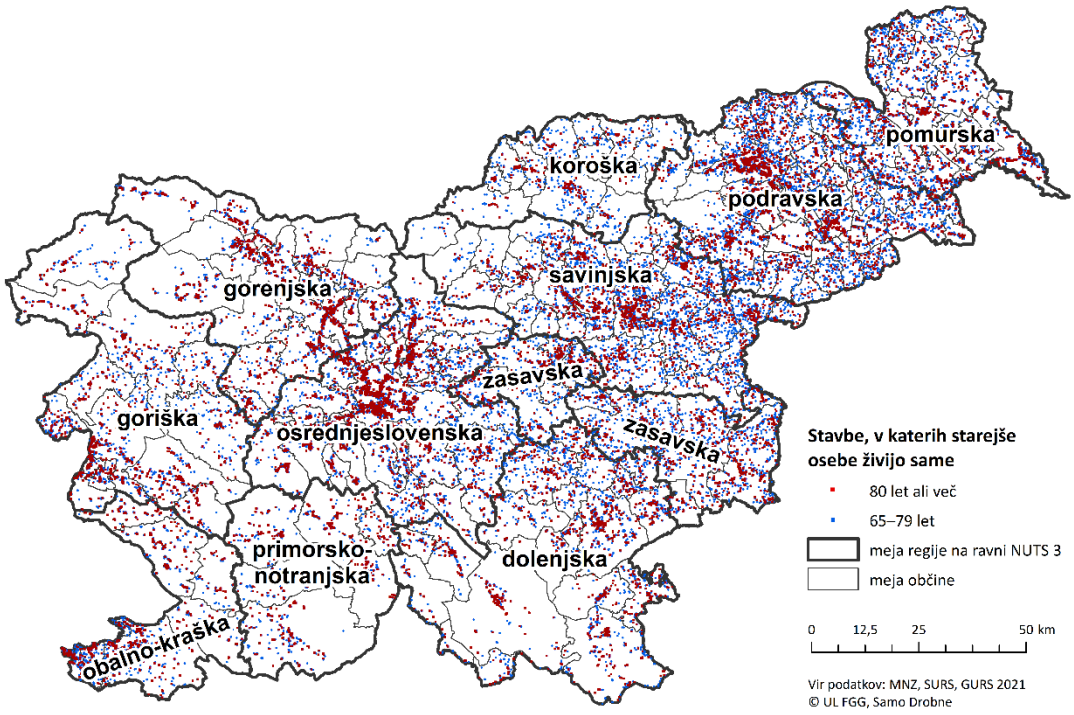


Slika 4: Projekcija razmerja med delovno sposobnim prebivalstvom in prebivalstvom 80 let in več v Evropi in na slovenskem podeželju 2021-2061 (vir EC[7] in Bogataj et al, 2019[8], lastni izračuni)

Povprečni izdatki, povezani s starostjo, so prikazani na sliki 3, vendar bodo stroški zdravstvenega varstva na oddaljenih podeželskih območjih po pričakovanjih veliko višji. Poleg tega je potrebno boljše povezovanje zdravstvenega in socialnega varstva, vključno z upravljanjem ustanov, da bi uresničili trojne cilje: boljšo kakovost oskrbe, trajnostne in učinkovitejše sisteme izvajanja ter ustvarjanje novih delovnih mest v mrežah optimalne hierarhične strukture funkcionalnih območij in regij. Optimalno usklajevanje oskrbe med primarnim zdravstvenim varstvom, oskrbo v skupnosti in drugo ponudbo oskrbe v negovalnih bolnišnicah in domovih za starejše, vse skupaj povezano s socialnim varstvom in podporo družinam, je vse bolj potrebno kot predpogoj za trajnost dolgotrajne oskrbe.

Slika 4 prikazuje, kako se zmanjšuje razmerje med delovno sposobnim prebivalstvom in prebivalstvom nad 80 let v Evropi in na slovenskem podeželju, od skoraj 12 delovno sposobnih na starejšega prebivalca 80+ v letu 2021, do pod 5 že v naslednjih 30 letih. To bo močno vplivalo na vzdržnost sistema oskrbe starejših, tako v smislu pomanjkanja družinskih negovalcev kot v smislu pomanjkanja človeških virov in investicijskih sredstev v objekte za oskrbo v sistemih oskrbe, pa tudi pomanjkanja drugih finančnih sredstev za financiranje te oskrbe. Glede na novi zakon o dolgotrajni oskrbi[9], bodo to oskrbo izvajali ali oskrbovalci družinskega člana na domu ali pa javni zavodi, druge pravne osebe, samostojni podjetniki posamezniki in fizične osebe, ki samostojno opravljajo dejavnost, lahko pa tudi nosilci dopolnilnih dejavnosti na kmetiji. Ker je pričakovati, da bo v primeru oskrbe na domu razpršenost uporabnikov v prostoru velika (glej sliko 5!) je pričakovati, da bo odpiranje manjših, bolj strjenih oskrbovalnih mest v skupnostni oskrbi cenejše. Prav tako pa je pričakovati, da bo tudi v prihodnje veliko starejših prebivalcev na ruralnem področju živelo samih (slika 5), za katere izbira družinskega člana, oskrbovalca, odpade.

[7] EC. (2020). The 2021 Ageing Report: Undelying Assumptions and Projections Methodologies) Brussels, EC
[8] Bogataj, D., Bogataj, M., Kavšek, M., Rogelj, V., Drobež, E., (2019). Socialna Infrastruktura Pametnih srebrnih vasi, MEORL, No.. 26. Trebnje: Zavod INRISK, ISBN 978-961-94333-2-4.
[9] *Zakon o dolgotrajni oskrbi (Uradni list RS, št. 196/21).* *http://www.pisrs.si/Pis.web/pregledPredpisa?id=ZAKO7621*



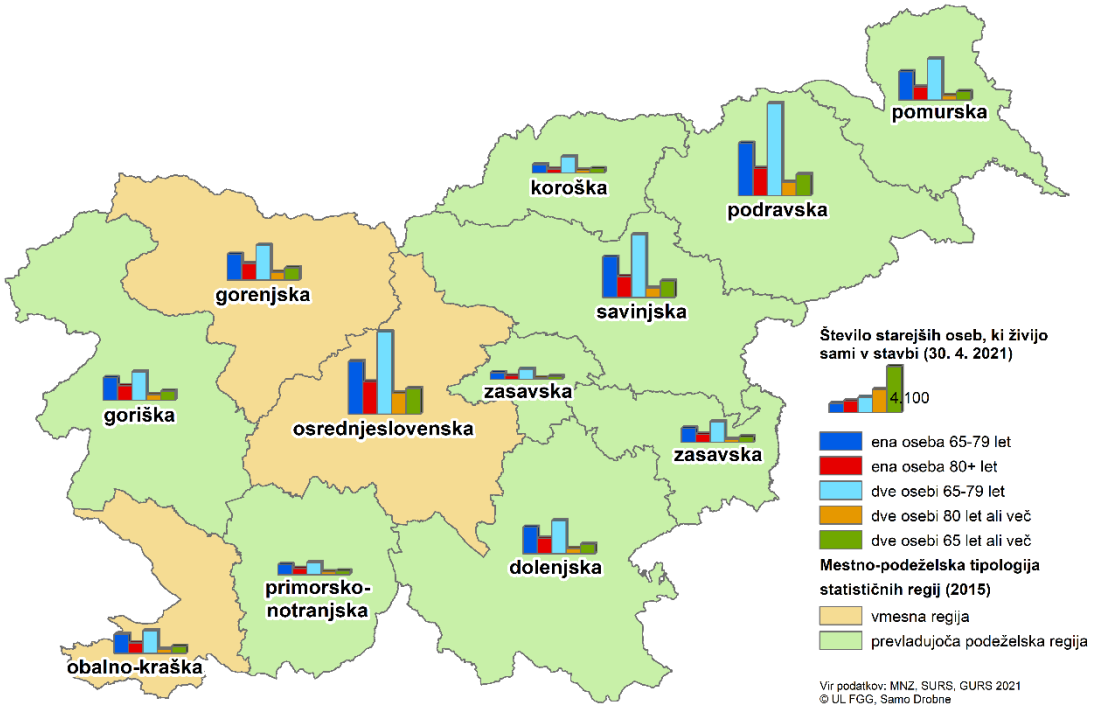
Slika 5: Razpršenost domov starejših prebivalcev, ki živijo sami v stavbi

Razpršenost starejših po regijah, ki jih zajema tabela 1, podaja slika 6.

Tabela 1: Število starejših oseb v Sloveniji, ki živijo razpršeni v prostoru, brez mlajših sostanovalcev

starost	Ena oseba		Dve osebi		Tri osebe ali več	
	Število oseb	Število hiš	Število oseb	Število hiš	Število oseb	Število hiš
65–79	27.136 (7,7 %)	27.136 (4,8 %)	40.324 (11,4 %)	20.162 (3,6 %)	1.497 (0,4 %)	473 (0,084 %)
80 +	15.208 (13,0 %)	15.208 (2,7 %)	7.224 (6,2 %)	3.612 (0,6 %)	177 (0,2 %)	51 (0,009 %)
Skupaj	42.344 (9,0 %)	42.344 (7,5 %)	58.638 (12,5 %)	29.319 (5,2 %)	5.015 (1,1 %)	1.602 (0,3 %)

Kakšno stanovanjsko oskrbo prebivalci slovenije pričakujejo in kakšno si želijo smo želelo preveriti po slovenskih občinah v različnih regijah, še posebej pa smo želeli preveriti, kako oddaljenost od objektov dolgotrajne oskrbe lahko vpliva na izbiro vrste bivališča. Za tiste, ki živijo sami, kot jih prikazujejo slika 5, slika 6 in tabela 1, opcije, da bi jih oskrbovali družinski člani, skoraj ni.

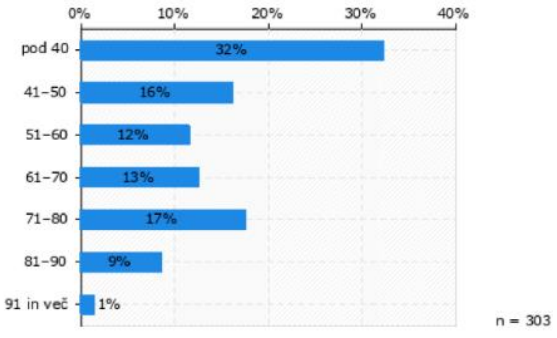


Slika 6: Število starejših oseb, ki živijo razpršeno po statističnih regijah sami (30. 4. 2021)

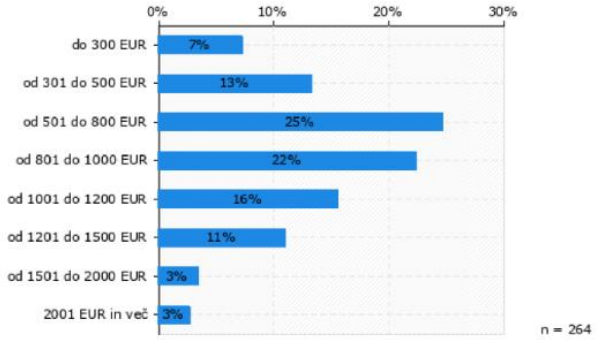
2. METODA DELA IN REZULTATI

2.1 Kaj si želijo in kaj pričakujejo prebivalci Slovenije – rezultati ankete

Za dosego tega cilja smo preučili, kako prebivalci slovenskega podeželja gledajo na razvoj pametne srebrne vasi in nasploh, kako si želijo preživeti pozno starost oziroma kaj menijo, da si sploh lahko privoščijo. Skozi odgovore na več kot 100 vprašanj o teh temah smo dobili 577 vsaj delno izpolnjenih anket z odgovori, ki so nas pripeljali do seznama zaključkov, podanih v tem prispevku. Anketo smo izvedli med 30% moških in 70% žensk. Med odgovori o spoLu je bilo 20% moških in 80% žensk. Od tega jih je že 2% živelo v domu starejših občanov, 16% v kmečkem gospodinjstvu, ostali pa so bili iz mešanih ali sploh nekmečkih gospodinjstev. Slika 7 prikazuje starostno strukturo anketirancev, ki so odgovorili na to vprašanje, slika 8 pa njihove dohodke.

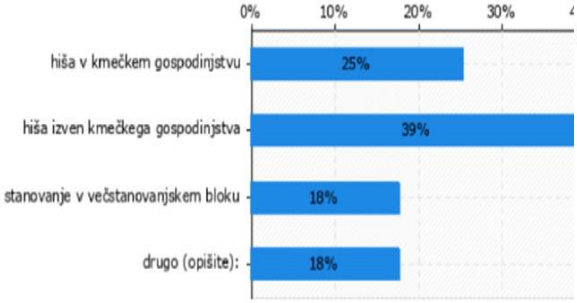


Slika 7: Starost anketirancev

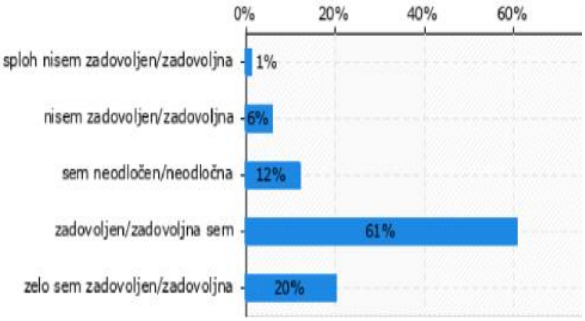


Slika 8: Dohodkovni razredi anketirancev

V času delovne aktivnosti jih je 25% živelo v kmečkem gospodinjstvu, kot kaže slika 9, ostali pa ne. Kar 81% jih je zadovoljnih z bivanjem v svoji občini (glej sliko 10). Prav tako pa v večini anketiranci menijo, da je tudi za mlade življenje na podeželju atraktivno (kar 65%).

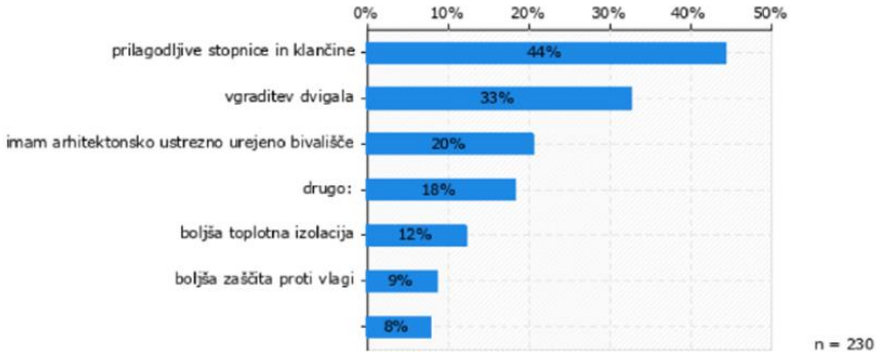


Slika 9: Vrste nastanitve v času zaposlitve

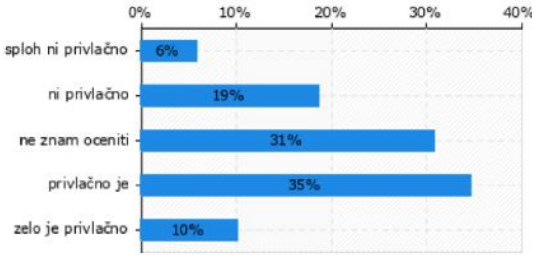


Slika 10: Zadovoljstvo z bivanjem v občini

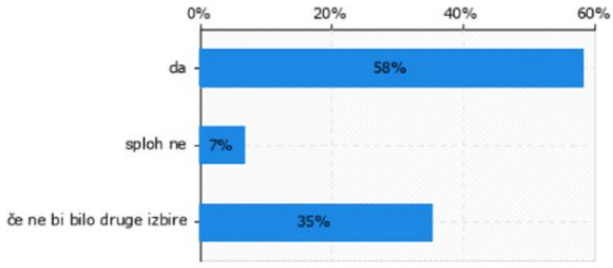
V Sloveniji se tudi objekti, kot so centri za pomoč in dnevni centri, hitro razvijajo v nova središča za zagotavljanje oskrbe in drugih storitev starejšim. Najprej smo jih povprašali, ali menijo, da bi ob boljši organiziranosti oskrbe na domu lahko preživljali pozno starost na domu. Med 239 odgovori jih je kar 96% odgovorilo z da, 4% pa jih je dojelo, da sploh ne. Med izboljšavami, ki jih navajajo, je pogostejša in daljša oskrba s strani medicinskih tehnikov in socialnih oskrbovalcev, pa tudi nujnost prilagoditve doma njihovim zmožnostim. Navedli so nujne arhitektonske prilagoditve, ki so potrebne, da bi ostali doma v obstoječem stanovanju tudi v primeru hujše invalidnosti (n = 230). Odgovori so podani na sliki 11. Kar 18 % vprašanih meni, da bi bila zanje najboljša rešitev ureditev stanovanja v obstoječi garaži doma. Pri tem pa se za skupno gospodinjstvo mladih z ostarelimi starši ali starimi starši kot obliko medgeneracijskega sožitja zavzema le manjši del občanov (slika 12).



Slika 11: Nujne arhitektonske prilagoditve, ki so potrebne, da bi starejši kot invalidi ostali doma

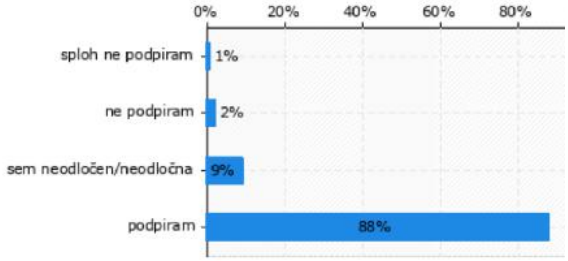


Slika 12: Ocena privlačnosti oziroma sprejemljivosti skupnih gospodinjstev v medgeneracijskih razmerjih

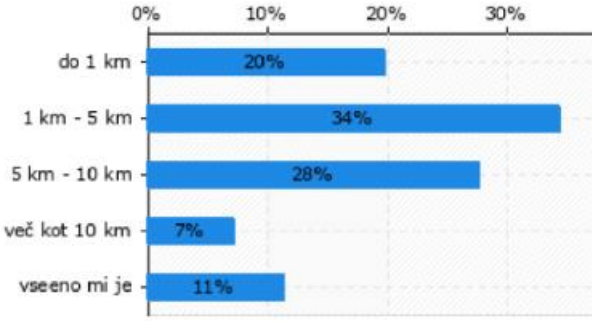


Slika 13: Ali bi se odločili za življenje v gospodinjski skupnosti na kmetiji, ko bi potrebovali tujo pomoč?

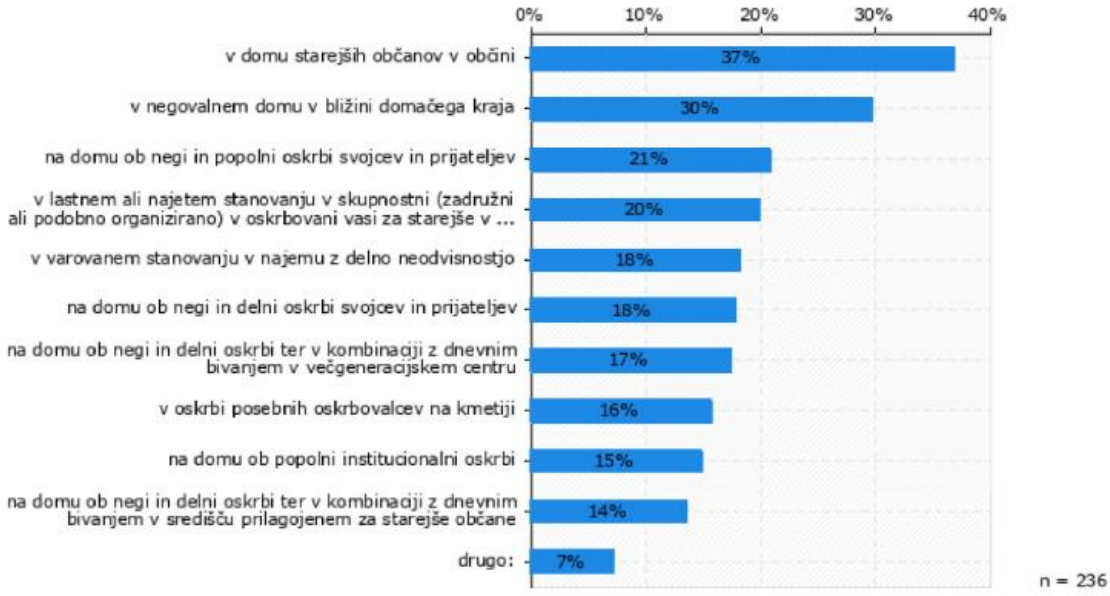
Pri tem pa bi se kar 58 % anketirancev odločilo za bivanje v gospodinjski skupnosti na kmetiji (socialno kmetovanje – social farming), če ne bi bilo druge izbire pa še dodatnih 35 % anketirancev (glej sliko 13!).



Slika 14: Odgovori na vprašanje, kako anketiranci ocenjujejo idejo o izgradnji manjših domov za starejše blizu doma, z oskrbo v enoposteljni sobi, v oskrbni skupnosti in s stalnimi zdravstveno-varstvenimi storitvami (n=239)



Slika 15: Največja sprejemljiva razdalja takšnega objekta od doma (n=239)



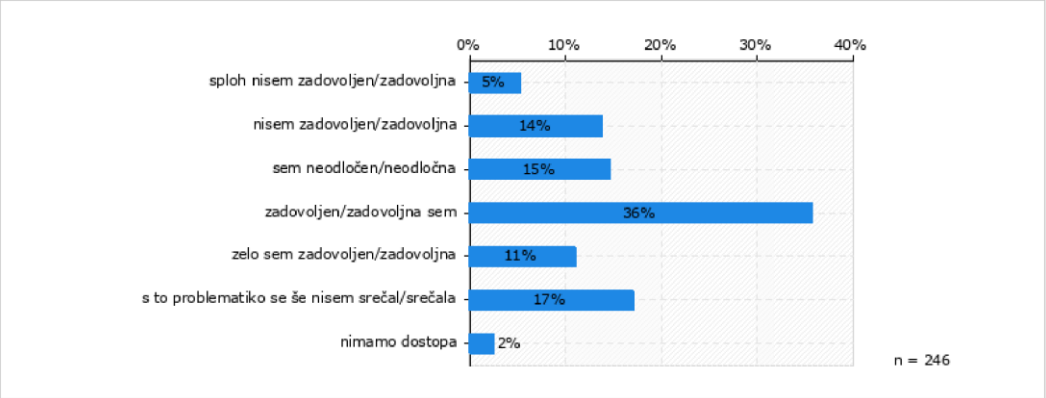
Slika 16: Kje bi želeli preživeti anketiranci starost v primeru popolne odvisnosti od tuje pomoči (možnih več odgovorov)

Kar 88 % anketirancev podpira idejo o izgradnji večjega števila manjših domov oziroma gospodinjskih skupnosti za starejše, saj bi ti tako lahko bili bliže svojih sorodnikov in prijateljev. Ohranjanje socialnih mrež je namreč za starejše izrednega pomena, kar je mogoče razbrati tudi iz slike 16. Kar 7 % anketirancev oziroma kar 28 % anketirancev, ki živijo na kmetijah, pa je potrdilo, da so v njihovem gospodinjstvu zmožni in pripravljeni razviti »oskrbovalno kmetijo za starejše« po vzoru turističnih kmetij.

Glede na rezultate teh anket smo izvedli nekaj simulacij o primernosti sofinanciranja izgradnje manjših enot gospodinjskih skupnosti[10] na podeželju. Ta določa omejitve v velikosti gospodinjske skupnosti na 24 postelj. Po minimalnih tehničnih zahtevah mora imeti soba najmanj 17,5 m^2. Kakšna pa mora biti zgradba, določa Pravilnik o minimalnih tehničnih zahtevah za graditev oskrbovanih stanovanj za starejše ter o načinu zagotavljanja pogojev za njihovo obratovanje[11].

2.2 Kaj naj bi nova organiziranost nudila več, kot oskrba na domu - fizioterapija

Kaj naj bi take skupnosti nudile glede na oskrbo, ki so je deležni na domu? Iz projekta MOST, smo ugotovili, da je med vsemi aktivnostmi, ki so izboljševale stanje oskrbovancev, najpomembnejša reaktivacija, ki vključuje predvsem fizioterapijo. Ko smo povprašali anketirance, kako so bili doslej zadovoljni s fizioterapijo, smo dobili odgovore, kot jih prikazuje slika 17.



Slika 17: Zadovoljstvo oskrbovancev s fizioterapijo

Večje zadovoljstvo so pokazali prav oskrbovanci v mreži MOST. Vendar pa bi vključevanje fizioterapije v integrirano oskrbo na domu po vsej Sloveniji pomenilo velike izdatke za blagajno dolgotrajne oskrbe, ki jo nameravamo vzpostaviti. Zato bi bilo smiselno razmišljati tudi o tem, kako bi razpršenost centrov oskrbe in privlačnost oskrbe v skupnosti pritegnila oskrbovance iz domov v te centre, kar bi jim omogočilo večjo oskrbo s fizioterapijo in drugimi reaktivacijskimi aktivnostmi, z dokazanimi izboljšanimi stanji pacientov pa zmanjšan odliv iz zdravstvene blagajne.

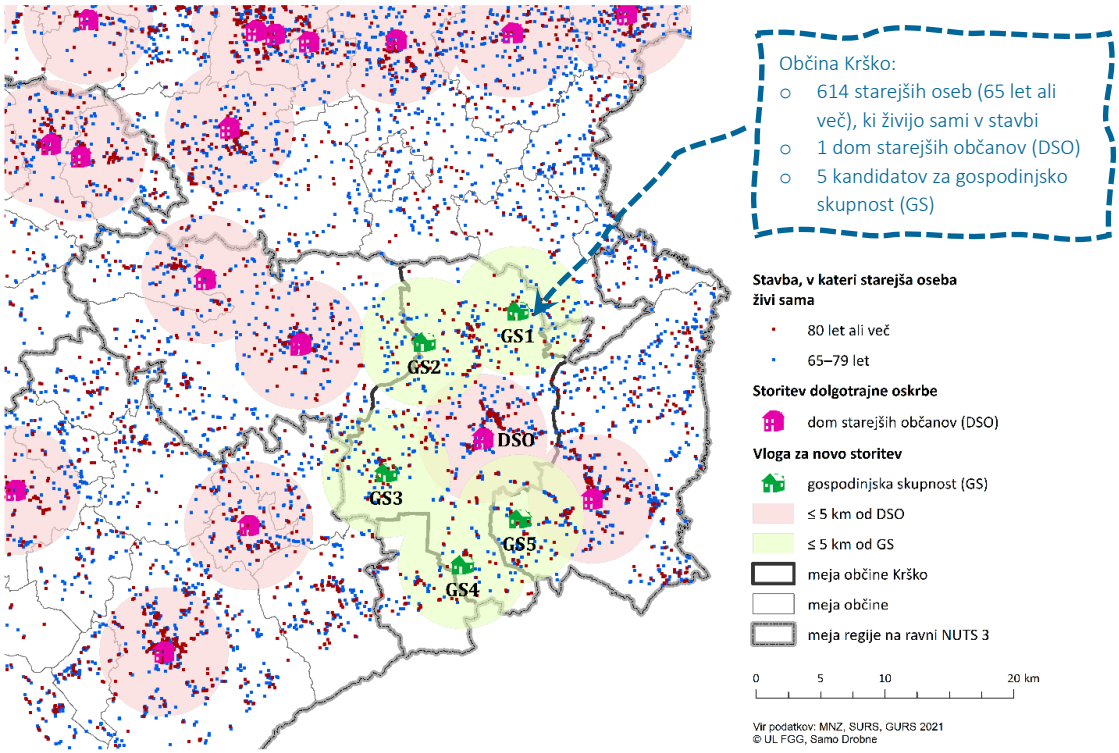
2.3 Primer optimalne alokacije oskrbovancev v objekte dolgotrajne oskrbe

Predpostavimo, da želimo v občini Krško oskrbeti vse starejše, ki živijo samo doma. Za to omamo na razpolago 200 postelj v domovih, za sofinanciranje izgradnje oskrbovalnih enot pa je zaprosilo še 5 potencialnih izvajalcev. Te naj bi sledile merilom izgradnje gospodinjskih skupnosti in bi imele

[10] *Zakon o socialnem varstvu (Uradni list RS, št. 3/07 – uradno prečiščeno besedilo, 23/07 – popr., 41/07 – popr., 61/10 – ZSVarPre, 62/10 – ZUPJS, 57/12, 39/16, 52/16 – ZPPreb-1, 15/17 – DZ, 29/17, 54/17, 21/18 – ZNOrg, 31/18 – ZOA-A, 28/19, 189/20 – ZFRO in 196/21 – ZDOsk).*
http://pisrs.si/Pis.web/pregledPredpisa?id=ZAKO869

[11] *Pravilnik o minimalnih tehničnih zahtevah za graditev oskrbovanih stanovanj za starejše ter o načinu zagotavljanja pogojev za njihovo obratovanje (Uradni list RS, št. 110/04, 81/09 in 17/11)*
http://www.pisrs.si/Pis.web/pregledPredpisa?id=PRAV5888

do 24 postelj v 24 sobah zgrajenih po minimalnih tehničnih merilih. Kakšno je optimalno število sob, ki jih je smiselno subvencionirati ob izbranih pogojih, ki sledijo?



Slika 18: Občina Krško z domom starejših občanov (DSO) in petimi kandidati za subvencije za izgradnjo oskrbovanih domov tipa gospodinjske skupnosti (GS)

Celoštevilčni linearni program z dodatnima dvema parametroma smo sprogramirali v R in dobili naslednje rešitve pri izbranih parametrih a in p in spodaj navedenih formulacijah programa (slika 19):

18.1: $a = 1,\ p = 0.5$

client	SF1	SF2	SF3	SF4	SF5	CH
1	0	0	0	0	0	1
2	0	0	0	0	0	1
3	0	0	0	0	0	1
4	0	0	0	0	0	1
5	0	0	0	0	0	1
		.	.	.		
		.	.	.		
610	0	0	0	0	0	1
611	0	0	0	1	0	0
612	0	0	0	0	1	0
613	0	0	0	0	0	1
614	0	0	0	0	0	1
cap/p	48	48	48	48	48	374
cap	24	24	24	24	24	187

$$min\left\{1/614 \cdot \sum_i \sum_j (l'_{i,j} \cdot x_{i,j})\right\} = 6.29 \text{ km}$$

18.2: $a = 1,\ p = 0.3$

client	SF1	SF2	SF3	SF4	SF5	CH
1	0	0	0	0	0	1
2	0	0	0	0	0	1
3	0	0	0	0	0	1
4	0	0	0	0	0	1
5	0	1	0	0	0	0
		.	.	.		
		.	.	.		
610	0	0	0	0	1	0
611	0	0	0	1	0	0
612	0	0	0	1	0	0
613	1	0	0	0	0	0
614	0	0	0	0	0	1
cap/p	80	80	80	80	72	222
cap	24	24	24	24	21	67

$$min\left\{1/614 \cdot \sum_i \sum_j (l'_{i,j} \cdot x_{i,j})\right\} = 4.59 \text{ km}$$

18.3: $a = 2,\ p = 0.3$

client	SF1	SF2	SF3	SF4	SF5	CH
1	0	0	0	0	0	1
2	0	0	0	0	0	1
3	0	0	0	0	0	1
4	0	0	0	0	0	1
5	0	1	0	0	0	0
		.	.	.		
		.	.	.		
610	0	0	0	0	1	0
611	0	0	0	1	0	0
612	0	0	0	0	1	0
613	0	0	0	0	0	1
614	1	0	0	0	0	0
cap/p	80	80	80	80	74	220
cap	24	24	24	24	22,2	66

$$min\left\{1/614 \cdot \sum_i \sum_j (l'_{i,j} \cdot x_{i,j})\right\} = 7.43 \text{ km}$$

$$= 4.59 + \frac{SV}{c(SV)} \text{ km}$$

Družbena vrednost SV biti blizu socialne mreže (tukaj nad 5 km) je cena trganja mreže pri vsakem kilometru večje oddaljenosti od 5 km, ki jo ovrednotimo iz anket (c(CV)):

$$\mathbf{SV} = \mathbf{c(SV)} \cdot (7.43 - 4.59) = c(SV) \cdot 2.84$$

Slika 19: Rešitve celoštevilčnega programa s spreminjajočimi se parametri a in p.

Pogoji so naslednji:

- Vsota vseh razdalj oskrbovancev do objekta oskrbovanja naj bo minimalna, pri čemer je razdalja in 5 km posebej utežena z a, ki meri družbeno vrednost bližina domu:
- Izračunaj $l'_{i,j} = 5000 + a * l_{i,j}$
- Ciljna funkcija f: $min\{1/614 \cdot \sum_i \sum_j (l'_{i,j} \cdot x_{i,j})\}$; $x_{i,j} \in \{0,1\}$
- Omejitve:
  1. Vsak Potencialni klient ($i = 1,2, \ldots, 614$) gre v natančno eno oskrbo to je gospodinjsko skupnosti (lahko tudi socialno kmetijo SF) ali v DSO (označen na sliki s CH): $\sum_{j=1}^{6} x_{i,\,j} = 1$
  2. Vsaka gospodinjska skupnosti ima lahko kvečjemu 24 postelj/sob 24, za katere se oskrbovanci odločijo z verjetnostjo p, če je p verjetnost, da bo starejše, ki živi sam, brez pomoči mlajših, potreboval dolgotrajno oskrbo: $\sum_{i=1}^{614} x_{i,j} \leq 24/p; \quad j = 1,\ 2,\ 3,\ 4,\ 5$
  3. Dom starejših občanov ($j = 6$) ima kapacitete za 200 oskrbovancev, torej: $\sum_{i=1}^{614} x_{i,6} \leq 200/p$

3. SKLEP

Iz primera 2.2 sledi, da je mogoče s študijem razpršenosti starejših prebivalcev v prostoru, ki ga analiziramo, študirati optimalno alokacijo oskrbovalnih centrov v skupnosti, ki so lahko različnih pravno-organizacijskih oblik, pri čemer lahko verjetnost za izbiro oskrbovalne enote določene organizacijske oblike in tehničnih karakteristik ocenimo iz anket. Prav tako lahko iz anket ocenimo kakšen pomen dajejo potencialni oskrbovanci oddaljenosti od svojih družinskih domov. Tako nam pristop, ki smo ga pokazali v sekciji 2.2, predstavlja dobro ogrodje za nadaljnje investiranje v socialno infrastrukturo za starejše v posameznih slovenskih regijah.

Zahvala: *Zahvaljujemo se ARRS, ki je sofinancirala objavo preko naslednjih projektov: L7-3188: Hierarhična zasnova in financiranje socialne infrastrukture pametnih srebrnih vasi, V6-2041: Medgeneracijsko sožitje na podeželju, razvoj socialne infrastrukture za preprečevanje socialne izključenosti ter blažitev socialnih pritiskov na podeželju in J5-3112: Vrednotenje trajnostnega razvoja urbanega prostora skozi parametre razvoja socialne infrastrukture in življenjskega zadovoljstva.

Literatura in viri

1. Bogataj, D., Bogataj, M., Kavšek, M., Rogelj, V., Drobež, E., (2019). Socialna Infrastruktura Pametnih srebrnih vasi, MEORL, No. 26. Trebnje: Zavod INRISK.
2. European Commission, 2021. Green Paper on Ageing. Fostering solidarity and responsibility between generations. https://op.europa.eu/en/publication-detail/-/publication/ce2ab168-7f23-11ec-8c40-01aa75ed71a1
3. *European Commission (2021). European Pillar of Social Rights - Building a fairer and more inclusive European Union. https://ec.europa.eu/info/strategy/priorities-2019-2024/economy-works-people/jobs-growth-and-investment/european-pillar-social-rights_en*
4. European Commission (2020). The 2021 Ageing Report: Economic and Budgetary Projections for the EU Member States (2019-2070). https://economy-finance.ec.europa.eu/publications/2021-ageing-report-economic-and-budgetary-projections-eu-member-states-2019-2070_en
5. European Commission (2020). The 2021 Ageing Report: Undelying Assumptions and Projections Methodologies. Brussels, EC. https://economy-finance.ec.europa.eu/publications/2021-ageing-report-underlying-assumptions-and-projection-methodologies_en
6. Ministrstvo za okolje in prostor (2004). Pravilnik o minimalnih tehničnih zahtevah za graditev oskrbovanih stanovanj za starejše ter o načinu zagotavljanja pogojev za njihovo obratovanje (Uradni list RS, št. 110/04, 81/09 in 17/11) http://www.pisrs.si/Pis.web/pregledPredpisa?id=PRAV5888
7. REPUBLIKA SLOVENIJA (2014). Operativni program za izvajanje evropske kohezijske politike v obdobju 2014–2020. https://www.eu-skladi.si
8. REPUBLIKA SLOVENIJA (2021). *Zakon o dolgotrajni oskrbi (Uradni list RS, št. 196/21). http://www.pisrs.si/Pis.web/pregledPredpisa?id=ZAKO7621*
9. REPUBLIKA SLOVENIJA (2007). Zakon o socialnem varstvu (Uradni list RS, št. 3/07 – uradno prečiščeno besedilo, 23/07 – popr., 41/07 – popr., 61/10 – ZSVarPre, 62/10 – ZUPJS, 57/12, 39/16, 52/16 – ZPPreb-1, 15/17 – DZ, 29/17, 54/17, 21/18 – ZNOrg, 31/18 – ZOA-A, 28/19, 189/20 – ZFRO in 196/21 – ZDOsk). http://pisrs.si/Pis.web/pregledPredpisa?id=ZAKO869
10. REPUBLIKA SLOVENIJA (2021). *Zakon o dolgotrajni oskrbi (Uradni list RS, št. 196/21). http://www.pisrs.si/Pis.web/pregledPredpisa?id=ZAKO7621*
11. REPUBLIKA SLOVENIJA (2007). Zakon o socialnem varstvu (Uradni list RS, št. 3/07 – uradno prečiščeno besedilo, 23/07 – popr., 41/07 – popr., 61/10 – ZSVarPre, 62/10 – ZUPJS, 57/12, 39/16, 52/16 – ZPPreb-1, 15/17 – DZ, 29/17, 54/17, 21/18 – ZNOrg, 31/18 – ZOA-A, 28/19, 189/20 – ZFRO in 196/21 – ZDOsk). http://pisrs.si/Pis.web/pregledPredpisa?id=ZAKO869
12. Szander, N., Ros McDonnell, L., Bogataj, M., (2017). Prostorska razpršenost stanovanjskih enot kot pomemben dejavnik vpliva na stroške dolgotrajne oskrbe = Spatial dispersion of housing units as an important factor influencing long-term care operational costs. Urbani izziv 28(1), str. 67-76, 147-156. http://urbani-izziv.uirs.si/Portals/uizziv/papers/urbani-izziv-2017-28-01-006.pdf , http://urbani-izziv.uirs.si/Portals/uizziv/papers/urbani-izziv-en-2017-28-01-006.pdf

12 Housing preferences of residents of Roma settlements

Andrej Sluga[1] and David Bogataj[1,2]

[1]Nova Univerza, EPF, Nova Gorica, Slovenia, slugaandrej@gmail.com

[2]Alma Mater Europaea - ECM, Maribor, Slovenia david.bogataj@almamater.si

Abstract

As elsewhere in Europe, the Roma remain one of the largest marginalised groups in Slovenia. The European Commission estimates that they are the largest ethnic minority, with an estimated population of 10-12 million, of whom around 6 million live within EU countries. The EU and each EU Member State have a shared responsibility to improve the living conditions and integration of the Roma. The European Union represents a supranational level where policies are developed in parallel with those of the nation states. The main purpose of these policies is to ensure adequate living conditions. These are ensured through a number of rights guaranteed to individuals by national and international law.

Roma settlements became part of the rural settlement area through permanent settlement and also achieved a remarkable expansion in the second half of the last century, which is still ongoing. They can take the form of a separate settlement, but are mostly parts of settlements where the majority population is not of Roma origin. An example is the Roma settlement of Kerinov grm in the Municipality of Krško, which also has formal settlement status. We have less data on Roma outside the formal settlement, while the formal designation of the settlement allows for the collection of demographic, social and health data, and provides opportunities for research that is based on credible official data and allows for further planning of the development of the settlement.

It is the formation of formal Roma settlements that has allowed us to study the housing needs of the settlement's inhabitants. For the members of the Roma community who actually live within the Roma settlement, we have checked their preferences regarding the type of housing and the architecture of the housing, as well as their financial capacity regarding the type and location of accommodation. The results of this questionnaire were based on closed-type interview with residents of formal Roma settlements. On the basis of the results, we provide projections of needs and proposals for the future construction of housing for Roma. In doing so, we were mainly limited to developments in the Municipality of Krško.

Keywords: Roma, Roma settlements, demographics, housing, social infrastructure, legislation

Stanovanjske preference prebivalcev romskega naselja

Povzetek

Podobno kot drugje v Evropi tudi v Sloveniji Romi ostajajo ena največjih marginaliziranih skupin. Evropska komisija ocenjuje, da gre za največjo etnično manjšino, ki je ocenjena na 10-12 milijonov pripadnikov, od katerih jih približno 6 milijonov živi znotraj držav EU. EU in vsaka država članica EU imajo skupno odgovornost za izboljšanje življenjskih pogojev in integracije Romov. Evropska unija predstavlja nadnacionalno raven, kjer se politike gradijo vzporedno s tistimi iz nacionalnih držav. Osnovni namen teh politik je zagotavljanje primernih življenjskih pogojev. Te se zagotavljajo skozi več pravic, ki so posameznikom zagotovljene z nacionalnimi in mednarodnopravnimi akti.

Romska naselja so s stalno poselitvijo postala del podeželskega poselitvenega prostora in v drugi polovici prejšnjega stoletja dosegla tudi izjemno širitev, ki še kar traja. Lahko imajo obliko samostojnega naselja, večinoma pa gre za dele naselij, kjer večinsko prebivalstvo ni romskega izvora. Kot primer obravnavamo romsko naselje Kerinov grm v Mestni občini Krško, ki ima tudi formalno status naselja. O Romih izven formalnega naselja imamo manj podatkov, medtem ko formalna določitev naselja omogoča zbiranje demografskih podatkov, podatkov s področja sociale in zdravstva ter daje možnosti raziskav, ki imajo podlago v verodostojnih uradnih podatkih in omogočajo nadaljnje planiranje razvoja naselja.

Prav oblikovanja formalnih naselij Romov so nam omogočila študijo potrebne stanovanjske oskrbe prebivalcev naselja. Pri pripadnikih romske skupnosti, ki dejansko živijo znotraj romskega naselja, smo preverili kakšne so njihove preference glede vrste bivališča in arhitekture bivališč, kakšne so njihove finančne zmožnosti glede tipa in lokacij namestitev. Rezultate te problematike smo dobili na temelju intervjujev zaprtega tipa stanovalcev formalnih romskih naselij. Na temelju rezultatov podajamo projekcije potreb in predloge bodoče graditve stanovanj za Rome. Pri tem smo bili pretežno omejeni na dogajanja v Mestni občini Krško.

Ključne besede: Romi, romska naselja, stanovanja, socialna infrastruktura, zakonodaja

1 UVOD

Vzpostavitev Unije enakosti je postala ena glavnih prednostnih nalog Evropske komisije (Evropska komisija 2020), pri čemer imajo EU in vsaka država EU skupno odgovornost za izboljšanje življenjskih pogojev in integracije Romov. Evropska unija predstavlja nadnacionalno raven politike, kjer se politike gradijo vzporedno s tistimi nacionalnih držav, osnovni namen teh politik pa je zagotavljanje primernih življenjskih pogojev, ki se zagotavljajo skozi več pravic, ki so posameznikom zagotovljene z nacionalnimi in mednarodnopravnimi akti.

Evropska komisija (2020) ugotavlja, da je bil splošni napredek pri vključevanju Romov v zadnjih 10 letih omejen, čeprav so med področji politike in državami velike razlike. Največji napredek je bil dosežen na področju izobraževanja, zlasti z zmanjšanjem zgodnjega opuščanja šolanja ter izboljšanjem udeležbe v predšolski vzgoji in obveznem šolanju, hkrati pa se je na področju izobraževanja povečalo število primerov segregacije romskih učencev. Tveganje revščine in samoocena Romov o njihovem zdravju sta se izboljšala, vendar je njihova vključenost v zdravstveno zavarovanje še vedno skromna. Dostop do zaposlitve se ni izboljšal, delež mladih Romov, ki niso zaposleni, se ne izobražujejo ali usposabljajo, pa se je celo povečal. Stanovanjske razmere so še vedno težke, zlasti zaradi neustreznih in segregiranih stanovanj. Obstajajo dokazi, da se je število primerov diskriminacije Romov nekoliko zmanjšalo in da splošno prebivalstvo Rome vse bolj sprejema. Vendar so anticiganizem, kazniva dejanja iz sovraštva, trgovina z Romi, zlasti z ženskami in otroki, še vedno zelo zaskrbljujoči.

Prejšnji strateški okvir (Evropska Komisija 2011) je dajal poudarek predvsem na socialno-ekonomsko integracijo, sedaj veljavni strateški okvir (Evropska Komisija 2020) pa dopolnjuje socialno-ekonomsko vključevanje marginaliziranih Romov s spodbujanjem enakosti in udeležbe. Izpostavlja, da bi vsi Romi morali imeti možnost, da v celoti uresničijo svoje potenciale in se vključijo v politično, družbeno, gospodarsko in kulturno življenje.

Svet EU (2021) je s sprejemom Priporočil o enakosti, vključevanju in udeležbi Romov priporočil državam članicam, da do septembra 2021 v okviru svojih širših politik socialnega vključevanja za izboljšanje položaja Romov sprejmejo nacionalne strateške okvire za Rome in jih pošljejo Evropski komisiji.

Republika Slovenija je priporočila (Svet EU 2021) implementirala s sprejetjem Nacionalnega programa ukrepov Vlade Republike Slovenije za Rome za obdobje 2021–2030 (Vlada RS 2021), ki je programski dokument, katerega namen je določiti glavne cilje in temeljne ukrepe za izboljšanje socialno-ekonomskega položaja romske skupnosti in njenih pripadnikov, ustvarjanje razmer za izboljšanje socialne vključenosti pripadnikov romske skupnosti in njihovo opolnomočenje ter krepitev udeležbe pripadnikov romske skupnosti v procesih za izboljšanje lastnega položaja ter doseganje polne vključenosti in enakosti v slovenski družbi v obdobju 2021–2030.

Za Rome v R Sloveniji je značilno, da poseljujejo tako urbano okolje kot podeželje (Barborič et al., 2013). Zgodovinski viri na ozemlju današnje Slovenije Rome omenjajo že v 14. stoletju (Štrukelj, 2004), od 17. stoletja dalje pa so podatki o njih pogostejši, najdemo jih tudi že v matičnih knjigah. Naselitev Romov v našem prostoru je potekala po treh poteh: Predniki Romov, ki živijo v Prekmurju so prišli k nam preko madžarskega ozemlja, dolenjska skupina Romov preko Hrvaške, na Gorenjskem pa so se naselile manjše skupine Sintov, ki so prišli k nam s severa preko današnje Avstrije. Čeprav gre za prebivalstvo, ki je v začetku živelo predvsem nomadsko in je svoja bivališča pogosto menjalo, lahko danes govorimo o zaokroženih območjih poselitve v Prekmurju, na Dolenjskem, v Posavju in deloma na Gorenjskem. Na teh območjih štejemo Rome med tradicionalno naseljeno prebivalstvo, ki se je v bolj ali manj stalni naselitvi ohranilo do danes. Del »neavtohtonih« pripadnikov pa naseljuje tudi urbane občine kot so Ljubljana, Maribor, Velenje, Murska Sobota,

Novo mesto idr. Del urbane populacije se je v mesta priselil iz ruralnega zaledja, pretežni del Romov pa se je v slovenska industrijska središča (Ljubljana, Velenje, Maribor) preselil v času intenzivne industrializacije, v 70. in 80. letih 20. stoletja iz bivših jugoslovanskih republik (Zupančič, 2018).

V kolikor želimo v osnovi razumeti položaj romske skupnosti v Sloveniji je potrebno najprej zavreči predpostavko, da so Romi enotna narodnost s skupnimi lastnostmi. Zaradi zgodovinske usode in drugih okoliščin so med Romi v Sloveniji razlike, ki temeljijo na tradiciji, specifičnem načinu življenja, pa tudi stopnji socializacije in integriranosti v okolje (Vlada RS 2021). Heterogenost romske skupnosti je neposredno povezana s potmi naselitve, kar ugotavlja tudi Zupančič (2021). Tako lahko v Sloveniji Rome razdelimo vsaj na 4 velike skupine in sicer glede na čas in smer selitev. Te skupine se razen po skupnem izvoru v Indiji razlikujejo po jeziku, ki ga govorijo, veroizpovedi, stopnji prilagoditve večinskemu prebivalstvu predvsem pa po ekonomskem položaju, ustreznosti njihovih bivališč in tudi demografskih značilnostih. Da so Romi heterogena skupnost tudi v tujini, sta za Italijo ugotovila Alietti in Riniolo (2021) za Srbijo pa Grbić et al. (2021), ki je opozarja, da je pri raziskovanju in analiziranju potreb te skupnosti potrebno upoštevati razlike med posameznimi skupinami.

Raziskava Nacionalnega inštituta za javno zdravje (2018) je pokazala na veliko razliko v opazovanih kazalniki med romskim in večinskim prebivalstvom ter občutno krajšo povprečno življenjsko dobo romskega prebivalstva, prav tako pa je pokazala, da se zdravstveno stanje med romskimi skupinami v Sloveniji zelo razlikuje. Glede na statistično značilne razlike kazalnikov med regijami kjer živijo Romi, v prid Romov v Pomurju, je mogoče sklepati, da bolj urejene bivalne razmere, razvita socialna infrastruktura, boljša vključenost v okolje in v širšo družbo, ter sprejetost s strani večinskega prebivalstva ugodno vplivajo na zdravje Romov. Da je celovit in vključujoč pristop ključen za reševanje kompleksnih vprašanj, s katerimi se sooča romska skupnost, opozarja tudi Perić (2012). Dostop do ustreznega stanovanja je osnova za izboljšanje rezultatov tudi na področju izobraževanja, zdravja in zaposlitve.

Perić (2012) je v raziskavi izvedeni med Romi v dvanajstih državah srednje, vzhodne in jugovzhodne Evrope ugotovila, da je dostop do socialnih stanovanj Romom na voljo v manjši meri kot to velja ostale prebivalce. V zvezi s tem Romi trdijo, da so pogosteje diskriminirani na podlagi etnične pripadnosti kot ostali prebivalci. Hkrati je raziskava pokazala, da Romi preferirajo življenje na narodnostno mešanih območjih, kjer so obkroženih z večinskim prebivalstvom.

Ker raziskava ni zajela RS, smo s pomočjo ankete pri prebivalcih romskega naselja Kerinov grm v Mestni občini Krško preverili zadovoljstvo s trenutnimi bivanjskimi razmerami in obstoječo gospodarsko in socialno infrastrukturo, preverili smo ali bi bili pripravljeni zapustiti sedanje bivališče, kakšne so njihove preference glede vrste bivališča in arhitekture bivališč ter kakšne so njihove finančne zmožnosti glede tipa in lokacij namestitev.

Prispevek obravnava del dolenjske Romske populacije, ki je po 2. svetovni vojni tako zaradi spremembe načina življenja kot tudi s strani oblasti zahtevanega opuščanja nomadizma (Komac, 2015) začela trajno vzpostavljati bivališča, ki so se s časom združila v romsko naselje Kerinov grm. Z izrazom »romsko naselje« (Zupančič, 2014) opredeljuje prostorsko združene in funkcijsko povezane agregate bivalnih enot s pretežno romskim prebivalstvom.

Romska naselja so s stalno poselitvijo postala del podeželskega poselitvenega prostora in v drugi polovici prejšnjega stoletja dosegla tudi izjemno širitev. Lahko imajo obliko samostojnega naselja, večinoma pa gre za dele naselij, kjer večinsko prebivalstvo ni romskega izvora. V veliki večini zaradi odsotnosti formalizacije naselja hiše nimajo hišnih številk, oziroma ima hišno številko le ena hiša, na katero so prijavljeni vsi prebivalci posameznega naselja.

Naselje Kerinov grm v Mestni občini Krško je eno izmed treh legaliziranih romskih naselij v Republiki Sloveniji in je največje romsko naselje v Mestni občini Krško. Legalizacijo razumemo kot skupek aktivnosti, postopkov in ukrepov, ki omogočijo, da območja nelegalne stalne naselitve pridobijo status stavbnih zemljišč. S tem je omogočeno, da lastniki v drugi fazi legalizirajo tudi nelegalne stavbe namenjene bivanju.

Kerinov grm leži sredi Krškega polja na vzhodni meji občine Krško, v KS Veliki Podlog. Nahaja se med naselji Gorica, Drnovo, Brege, Mrtvice, Zasap in Hrastje, 9 km od občinskega središča, neposredno ob avtocesti Ljubljana – Zagreb. V naselju je po podatkih SURS na dan 01.01.2022 prebivalo 279 prebivalcev in sicer v 38 objektih (enostanovanjskih hišah s hišno številko), kar pomeni, da v povprečju v eni hiši biva 7 oseb. Širitev naselja onemogoča obvozna cesta, ki obkroža naselje in je obenem ovira pred širjenjem naselja na kmetijske površine.

Po izvedenem odkupu nepremičnin sta se v letu 2005 v naselju zagotovila dostopa do pitne vode in elektrike, v letu 2010 je bilo izvedeno komunalno omrežje, predvsem ceste in poti znotraj naselja, v letu 2017 pa tudi sekundarno vodovodno omrežje in priključki na objekte, zgrajenih pa je tudi 8 malih čistilnih naprav. V letu 2011 je bil postavljen večnamenski objekt in v njem takoj umeščen tudi pripravljalni vrtec.

2. Bivanjska problematika

Komac (2015) romsko skupnost poimenuje kot skupnost splošnega pomanjkanja, ki ji primanjkuje prostora, kapitalov vseh vrst ter tolerance s strani večinskega prebivalstva.

Uvrščamo jo v kategorijo socialno ranljivih skupnosti, ki zaradi ekonomskih, socialnih in drugih razlogov ter omejitev ne morejo zadovoljiti svojih stanovanjskih potreb na trgu in po tržnih cenah (Grbič, 2020). Z vidika socialne razsežnosti je treba poudariti, da je stanovanje nepogrešljiv steber za razvoj človekovega življenja v družbi (Saura, 2017).

Pravica do ustreznega bivališča je kot temeljna človekova pravica priznana v mednarodnem pravu Organizacije združenih narodov (OZN) kot tudi v pravu Evropske unije (EU) in je po svoji naravi tako ekonomska socialna in kulturna pravica.

Različni avtorji različno pojmujejo pravico do stanovanja. Eni smatrajo, da gre za priporočilo vladam, da v okviru možnosti pospešujejo in omogočajo pridobitev primernega stanovanja, spet drugi pa jo opredeljujejo kot subjektivno pravico. (Ordovas, 2013). Ob vse glasnejših zagovornikih pravice do stanovanja kot subjektivne pravice, so pred javne oblasti postavljeni veliki izzivi vezani na družbeno-gospodarsko in politično realnost v danem trenutku (Saura, 2017).

Ne glede na vse dosedanje vložke v komunalno in socialno infrastrukturo v romskih naseljih pa je reševanje stanovanjskega vprašanja še vedno eden izmed najpomembnejših izzivov. Za uspešno stanovanjsko oskrbo romskega prebivalstva moramo poznati njihove preference, dinamiko rasti prebivalstva in povpraševanje po specifičnih stanovanjskih enotah, da se lahko v prostorsko-planskih dokumentih in finančnih načrtih občin načrtujejo razvojne naložbe v gospodarsko in socialno infrastrukturo romskih naselji.

2. Predvidena rast in razvoj naselja

Tako iz rezultatov anket kot tudi iz podatkov SURS izhaja, da so demografske značilnosti prebivalcev romskega naselja značilno različne od značilnosti večinskega prebivalstva.

Na različen demografski razvoj pripadnikov romske skupnosti in večinskega prebivalstva vplivajo različni socioekonomski, kulturni in psihološki pogoji. Brez razumevanja teh pogojev in okoliščin v katerih ta skupnost živi je nemogoče razumeti demografska gibanja.

Kljub heterogenosti romske skupnosti pa lahko za posameznike, ki prebivajo v segregiranih etnično homogenih naseljih, ugotovimo, da je demografski razvoj zelo primerljiv. Značilnost teh skupin romskega prebivalstva, ne le v Sloveniji, temveč tudi v drugih državah srednje in jugovzhodne Evrope, je zelo mlada starostna struktura v povezavi z visoko stopnjo rodnosti in nizko stopnjo umrljivosti (Šlezak, Belic, 2019). Za to skupino Romov so značilne tudi zgodnje poroke, kar pomeni, da Romi prej vstopijo v materinstvo in starševstvo, krajši pa so tudi medporodni intervali (Sedlecky, Rasevic, 2015).

S strani SURS smo pridobili podatke o številu moških in žensk v legalnih romskih naseljih Kerinov grm, Vejar in Pušča po 5 letnih starostnih skupinah za leta od 2014 do leta 2020. Na podlagi pridobljenih podatkov in podatka o številu otrok rojenih v posameznem letu smo izračunali, da je verjetnost, da bo imela ženska v rodni dobi otroka v posameznem letu v Krinovem grmu 0,153671 (TFR 5,37), v Vejarju 0,086976 (TFR 3,04) in v Pušči 0,045902

(TFR 1,61). Upoštevajoč število žensk v rodni dobi ter izračunano verjetnost, smo pripravili projekcijo števila rojenih otrok do leta 2050. Projekcija kaže, da se bo število prebivalcev Kerinovega grma ob upoštevanju celotne stopnje rodnosti (TFR) 5.37 več kot potrojilo.

Pri tem je potrebno opozoriti, da so projekcije prebivalstva v osnovi samo poskus napovedi prihodnjega demografskega razvoja na nekem območju. Sestavljene so iz vrste predpostavk, ki so pogosto zelo negotove, dodatno omejitev pa predstavlja tudi velikost vzorca, zato ugotovitev ni mogoče nekritično aplicirati na celotno romsko skupnost v RS. Nekritično posploševanje podatkov lahko vodi do zavajajočih ali celo nelogičnih zaključkov glede številčnega položaja romske skupnosti v Slovenji v prihodnosti.

Na podlagi projekcije prebivalstva smo pripravili tudi projekcijo rasti romskega naselja in projekcijo potreb po stanovanjskih namestitvah v naselju Kerinov grm. Kot osnovo za določitev potreb po novih stanovanjskih enotah smo določili formiranje novega gospodinjstva. Predpostavili smo, da se novo gospodinjstvo formira z rojstvom prvega otroka. Projekcija je pokazala, da bodo prebivalci naselja Kerinov grm v naslednjih 10 letih letno potrebovali v povprečju 6 novih stanovanjskih enot.

Skladno z lokacijskim načrtom naselja je bilo oblikovanih 58 stavbnih parcel, na katerih je mogoča gradnja, kar pomeni, da je teoretično v naselje mogoče umestiti maksimalno 20 novih stanovanjskih enot. Upoštevajoč projekcijo bo prostora za gradnjo v naselju zmanjkalo v naslednjih 3-4 letih.

3. Rezultati raziskave

Za pridobitev odgovorov na vprašanje kako zagotoviti stanovanjsko oskrbo romske skupnosti, je bila izvedena analiza stanja s pomočjo anketiranja. Anketni vprašalnik je bil razdeljen na tri sklope in sicer sta se prvi in drugi sklop nanašala na trenutne in želene bivanjske razmere, tretji skop pa so zajemala socio-demografska vprašanja, skupno 36 vprašanj. Osebno anketiranih je bilo 91 pripadnikov romske skupnosti starejših od 14 let, ki dejansko živijo znotraj romskega naselja Kerinov grm, pri čemer je bil iz vsakega bivališča v naselju anketiran najmanj 1 prebivalec.

Ne glede na vse vložke v komunalno in socialno infrastrukturo v naselju Kerinov grm je reševanje stanovanjskega vprašanja še vedno eden izmed najpomembnejših izzivov. Kljub izvedeni prvi fazi legalizacije v naselju, kar 55% anketiranih še vedno živi v nelegalnih objektih brez pridobljenega gradbenega in uporabnega dovoljenja, vendar z dostopom do vodovodnega omrežja.

Več kot tretjina anketiranih živi v objektih manjših od 60 m2, za naselje pa je značilna tudi visoka gostota poselitve, saj si več ko tretjina anketiranih nepremično deli z 10 ali več sostanovalci.

Skoraj polovica anketiranih v naselju kljub omejenemu prostoru redi domače živali namenjene prehrani, pri čemer prevladuje perutnina in drobnica, več kot polovica pa ima v oskrbi tudi hišne ljubljenčke, predvsem pse in mačke.

Na vprašanje kako so anketirani zadovoljni z bivanjem v naselju, je 63% vprašanih odgovorilo, da sploh niso zadovoljni, še dodatnih 28% pa je odgovorilo, da niso zadovoljni. Na nezadovoljstvo z bivanjem v romskem naselju kažejo tudi odgovori na vprašanje: «Ali bi bili pripravljeni zapustiti sedanje bivališče?«. Kar 92% anketiranih je na vprašanje odgovorilo z »zagotovo da«.

Z vprašalnikom z ustrezno slikovno podlago posameznih tipov naselij, smo preverjali preference glede kraja bivanja in ugotovili, da je velika večina kot zelo primerno in primerno ocenila samotno kmetijo in razloženo naselje, kot primerno je ocenila obcestno dolgo vas in gručasto vas, z manjšo stopnjo primernosti pa so anketiranci ocenili urbanizirano vas, staro mestno jedro ter mesto.

Glede tipov stavb je kot najprimernejši tip namestitve 97% anketirancev izbralo enostanovanjsko hišo, isti odstotek anketiranih je kot drugo izbiro izbral dvojček, sledi vrstna hiša, lamelni blok in stolpič. Zadnja izbira pri kar 82% anketiranih pa je bila stolpnica.

Na vprašanje: »Ali vam je bilo kdaj v preteklosti, zaradi neustreznih bivanjskih razmer, ponujeno neprofitno (socialno) stanovanje?«, je kar 98% anketiranih odgovorilo z ne. Vezano na dobro počutje v obstoječih neprofitnih (socialnih) stanovanjih je kar 91% vprašanih odgovorilo, da se Romi v njih ne bi dobro počutili.

V sklopu vprašanj o okoliščinah, ki bi bistveno vplivale na odločitev o primernosti bivališča so anketiranci kot okoliščino, ki bi odločilno vplivala, izbrali nepozidanost okolice, temu sledijo neposreden dostop do vrta ali njivskih površin, urejeni sosedski odnosi, varnost soseske, možnost reje domačih živali, kar 60 % anketiranih pa je kot odločilen razlog, ki bi jih odvrnil od bivanja v določen kraju navedlo večje število pripadnikov romske skupnosti v bližini bivališča. Navedeno še dodatno potrjuje izkazano splošno nezadovoljstvo z bivanjem v romskem naselju.

Glede primernosti stavbe v kateri prebivajo pa je kot okoliščino, ki pomembno vpliva na odločitev, kar 95% anketiranih izbralo višino obratovalnih stroškov in stroškov vzdrževanja objekta, dočim fizične lastnosti, izgled in starost stavbe niso ocenili niti kot pomembno niti ne nepomembno.

Kot okoliščino, ki ne vpliva na primernost bivališča so anketiranci najpogosteje izbrali bližino glasbene šole, knjižnice in kulturnih ustanov, kar kaže, da Romi teh oblik socialne infrastrukture ne poznajo oziroma jim ni blizu.

V okviru sklopa socio-demografskih vprašanj smo preverjali tudi višino mesečnih neto prihodkov posameznega gospodinjstva. Več kot polovica anketiranih gospodinjstev prejema več kot 1.000 EUR prihodkov, od tega 5% gospodinjstev z večjim številom otrok prejema več kot 3.000 EUR mesečno. Vsi anketirani, ki svojega stanovanjskega vprašanja še nimajo rešenega, bi se odločili za nakup nepremičnine oziroma za najemno razmerje z možnostjo odkupa nepremičnine. Glede na premoženje in mesečne prihodke je 58% anketiranih pripravljenih za reševanje svojega stanovanjskega vprašanja

nameniti več kot 200 EUR mesečno, kot obliko financiranja pa preferirajo kombinacijo prihrankov in obročnega plačevanja v obliki neposredne obremenitve socialnega transfera kot vira.

4. ZAKLJUČEK

Iz opravljene raziskave je razvidna zelo nizka stopnja zadovoljstva z bivanjem v romskem naselju, ki v povezavi z naraščajočim številom prebivalstva, omejenimi možnosti širitve naselja in specifičnimi stanovanjskimi preferencami, pred državo in lokalne skupnosti postavlja svojevrstni izziv.

Neurejene bivalne razmere predstavljajo izhodišče za marsikatero drugo problematiko oziroma težave, s katerimi se sooča romska skupnost, še posebej pri doseganju ustrezne stopnje izobrazbe, poklicnih kvalifikacij, informiranosti, dostopu do zdravstvenih in socialnih storitev, uspešnosti na trgu dela in sodelovanju v javnem življenju na različnih področjih (Vlada RS 2010).

Skozi razvoj romskih naselij, se je vsaj na primeru Kerinovega grma, pokazalo, da kljub legalizaciji naselja vlaganja v gospodarsko in socialno infrastrukturo niso prinesla bistvenega napredka na nobenem izmed omenjenih področij. Kerinov grm je primer, kako velika etnično homogena naselja vodijo v getoizacijo.

V skladu z Zakonom o lokalni samoupravi (Državni zbor 1993) je izvirna pristojnost lokalnih skupnosti načrtovanje prostorskega razvoja, opravljanje nalog na področju posegov v prostor in graditve objektov ter zagotavljanje javne službe gospodarjenja s stavbnimi zemljišči.

V skladu z navedenim ima lokalna skupnost pristojnosti na področju načrtovanja lokalnega prostorskega razvoja, določanja namenske rabe prostora, določanja pogojev za umeščanje posegov v prostor ter za določanje izhodišč in ciljev prostorskega razvoja občine.

V okviru pristojnosti na stanovanjskem področju pa lokalna skupnost skladno z 154. členom Stanovanjskega zakona (Državni zbor 2003) spodbuja različne oblike zagotavljanja lastnih in najemnih stanovanj ter zagotavlja sredstva za graditev, pridobitev in oddajanje neprofitnih stanovanj ter stanovanjskih stavb, namenjenih začasnemu reševanju stanovanjskih potreb socialno ogroženih oseb med katere sodijo tudi pripadniki romske skupnosti.

Raziskava je dala jasen odgovor zakaj ob zadostnem številu prostih neprofitnih stanovanj in neselektivnih pogojih za pridobitev takega stanovanja, prebivalci romskih naselij te pravice ne izkoristijo. Prvi razlog leži v tem, da jim ta možnost niti ni bila eksplicitno ponujena, drugi razlog pa lahko najdemo v dejstvu, da se obstoječi neprofitni stanovanjski fond, nahaja v večstanovanjskih objektih, ki praviloma ležijo v urbanem okolju. Naselitev v urbanem okolju Romi zavračajo kot neprimerno, zavračajo najemno razmerje kot način reševanja stanovanjskega vprašanja, preferirajo pa življenje na območjih z nizko koncentracijo prebivalstva in možnostjo dostopa do obdelovalnih površin ter možnostjo reje domačih živali.

Lokalna skupnost je postavljena pred izziv, kako na eni strani upoštevati izkazane preference Romov, ki ne želijo več bivati v getoiziranem naselju in politično realnostjo na drugi strani. Politična realnost se kaže v ostrem nasprotovanju prebivalcev ruralnega okolja po kakršnikoli pozitivni diskriminaciji Romov, vključno s poskusi naselitve romskih družin v naseljih z večinskim prebivalstvom.

Za Slovenijo je podobno kot tudi za večino drugih razvitih držav značilna sprememba starostne strukture prebivalstva ter tudi predviden demografski padec. V nasprotju s splošnim trendom pa z nami sobiva tudi skupnost, ki raste. Nakazana rast števila Romov in projekcija potreb po

stanovanjskih enotah postavlja pred javne oblasti velik izziv in odločitev. Kot možnost rešitve se nakazujejo:

-razširitev obstoječega naselja

-umestitev novega naselja

-prostovoljna razselitev

V okviru iskanja najprimernejše rešitve bo potrebno pripraviti analizo rezultatov postopkov legalizacije in vlaganj v gospodarsko in socialno infastrukturo romskega naselja in dobiti jasen odgovor na vprašanje ali je povečane potrebe po stanovanjih smiselno reševati s širitvijo naselja in ponovno začeti pred desetletjem končane postopke legalizacije.

V kolikor bo odgovor negativen, kot rešitev ostane razselitev. Z veliko mero preudarnosti bo potrebno oblikovati model stanovanjske oskrbe, ki bo upošteval želje, preference in finančno sposobnost Romov na eni strani ter pozitivno zakonodajo ter politično realnost, na drugi strani.

Zahvala: *Zahvaljujemo se ARRS, ki je sofinancirala objavo preko naslednjih projektov J5-3112: Vrednotenje trajnostnega razvoja urbanega prostora skozi parametre razvoja socialne infrastrukture in življenjskega zadovoljstva.

5. REFERENCE

Alietti , A., Riniolo. V. (2021) The national strategy for Roma inclusion in Italy: between contradictions and loss of responsibilities, Journal of Contemporary European Studies, 29:1, 9-19, DOI: 10.1080/14782804.2019.1688138

Barborič, B., Žagar, K., Radovan, D., Klanjšček, M., Kete, P., Demšar, J (2013): Tematski atlas romske poselitve v Sloveniji [Kartografsko gradivo] / Ljubljana: Geodetski inštitut Slovenije ;

Državni zbor. (1993). Zakon o lokalni samoupravi. Dostopno na: Zakon o lokalni samoupravi (ZLS) (pisrs.si)

Državni zbor. (2003). Stanovanjski zakon. Dostopno na: http://pisrs.si/Pis.web/pregledPredpisa?id=ZAKO2008

Evropska komisija. (2011) Sporočilo komisije evropskemu parlamentu, svetu, evropskemu ekonomsko-socialnemu odboru in odboru regij. Okvir EU za nacionalne strategije vključevanja Romov do leta 2020. Dostopno na: https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1444910104414&uri=CELEX:52011DC0173

Evropska komisija. (2020). Sporočilo komisije evropskemu parlamentu in svetu. Unija enakosti: strateški okvir EU za enakost, vključevanje in udeležbo Romov. Dostopno na: https://eur-lex.europa.eu/legal content/SL/TXT/HTML/?uri=CELEX:52020DC0620&from=SV#footnote3)

Grbic, M., Dulic, O., Aladzic, V. (2021). Anthropological understanding of culture—The key for designing Romani housing. Open House International, 46(1), 130–142. https://doi.org/10.1108/OHI-07-2020-0078

Komac, M. (2015). Mapping the Roma ethnic minority. Teorija in praksa, letnik 52, številka 1/2, str. 133-149, 305-306.

Nacionalni inštitut za javno zdravje. (2018). Javnozdravstveni pristopi namenjeni romski etnični skupnosti v Sloveniji. Dostopno na: https://www.nijz.si/sl/publikacije/javnozdravstveni-pristopi-namenjeni-romski-etnicni-skupnosti-v-sloveniji

Perić, T. (2012). The Housing Situation of Roma Communities: Regional Roma Survey 2011. Roma Inclusion Working Papers. Bratislava: United Nations Development Programme.

Saura Galiana, A. (2017). Housing as an object of study from the right: housing as a human right and the UNESCO Chair on housing. Hábitat y Sociedad, 10, 129-144. http://dx.doi.org/10.12795/HabitatySociedad.2017.i10.08

Sedlecky, K., Rasevic, M. (2015). Challenges in sexual and reproductive health of Roma people who live in settlements in Serbia. European Journal of Contraception and Reproductive Health Care, 20(2), 101–109. https://doi.org/10.3109/13625187.2014.957825

Svet EU. (2021). Priporočilo sveta z dne 12. marca 2021 o enakosti, vključevanju in udeležbi Romov: Dostopno na: EUR-Lex - 32021H0319(01) - EN - EUR-Lex (europa.eu)

Šlezak, H., Belić, T. (2020). Projekcije kretanja romske populacije u Međimurju – put od manjine ka većini. Geoadria. 24. 141-167. 10.15291/geoadria.2877.

Štrukelj, P. (2004). Tisoč letne podobe nemirnih nomadov, Ljubljana: Družina

Vlada RS. (2021). Osmo poročilo Vlade Republike Slovenije o položaju romske skupnosti v Sloveniji. Dostopno na: http://vrs-3.vlada.si/MANDAT20/vladnagradiva.nsf/71d4985ffda5de89c12572c3003716c4/5450234a113c884ac12586f500301ae0?OpenDocument

Vlada RS. (2010). *Nacionalni program ukrepov za Rome* za obdobje 2010–2015. Dostopno na: https://www.gov.si/assets/vladne-sluzbe/UN/Dokumenti-Romi/35778fa671/Program_ukrepov.pdf

Vlada RS. (2021). *Nacionalni program ukrepov za Rome* za obdobje 2021–2030. Dostopno na: https://www.gov.si/novice/2021-12-28-vlada-je-sprejela-nacionalni-program-ukrepov-za-rome-za-obdobje-20212030/

Zupančič, J. (2014). Romi in romska naselja v Sloveniji. Ljubljana, Znanstvena založba Filozofske fakultete

Zupancic, J. (2018). The Planned Process of Spatial Integration of Roma Settlements in Slovenia-The Way to Deghettoization and Demarginalization? In S. Pelc & M. Koderman (Eds.), Nature, Tourism and Ethnicity as Drivers of (de)marginalization: Insights to Marginality from Perspective of Sustainability and Development (Let. 3, pp. 169-178). Springer International Publishing Ag. https://doi.org/10.1007/978-3-319-59002-8_12
Zupančič, J., (2021). Romi in romska naselja v Sloveniji, Zbirka: Razprave FF. Medmežje:https://e-knjige.ff.uni-lj.si/DOI: 10.4312/9789610

13 Dejanska raba državnıh cest v Republıkı Slovenıjı

Vid Eržen
doc. dr. Božena Lipej,
Evropska pravna fakulteta, Ljubljana, Slovenija

Izvleček

Članek opisuje vzpostavitev dejanske rabe zemljišč na področju državnih cest v Republiki Sloveniji. Prvi zapis o evidentiranju dejanske rabe prometne infrastrukture sega obdobje po letu 2000, ko se je začela posodobitev državnih prostorskih in nepremičninskih evidenc. Ministrstvo za infrastrukturo je v zadnjih letih začelo z evidentiranjem dejanske rabe državne cestne infrastrukture, železniške infrastrukture in občinske cestne infrastrukture. Članek predstavlja zgodovino in pojme dejanske rabe zemljišč prometne infrastrukture in implementacijo projekta evidentiranja državnih cest, skupaj s končnimi rezultati, ki dopolnjujejo podatke zemljiškega katastra, danes poimenovanega kot del poenotenega katastra nepremičnin.

Glavna raziskovalna vprašanja so povezana z ustreznostjo podatkov zemljiškega katastra, ki se uporabljajo za zajem dejanske rabe prometne infrastrukture državnih cest. Raziskuje in odpira vprašanje evidentiranja dejanske rabe državnih cest v zvezi z deležem visoko položajno natančnega zemljiškokatastrskega načrta na parcelah pod državnimi cestami. Distribucija in kakovost katastrskih parcel pod državnimi cestami v zemljiškem katastru se povezuje s kakovostjo evidentiranja dejanske rabe. V zadnjih nekaj letih je državna geodetska uprava izvedla lokacijsko izboljšavo podatkov zemljiškega katastra, kar je povzročilo tudi izboljšanje lokacije parcel pod državnimi cestami. To je prispevalo k prihrankom časa in k višji natančnosti evidentirane dejanske rabe. Splošni rezultat analize je potrdil povečanje natančnosti parcel pod državnimi cestami, ki so posledica lokacijske izboljšave zemljiškega katastra. Drugo raziskovalno vprašanje je povezano s preiskavo neskladja med dejanskim stanjem infrastrukture v naravi in statusom cestne infrastrukture, zabeležene v državnih prostorskih evidencah in zemljiškem katastru. Primerjali smo registrirano rabo zemljišč in območja neskladij med dejanskim stanjem državnih cest in prostorskih evidenc, predvsem z zbirnim katastrom gospodarske javne infrastrukture. Slabih 99 % podatkov prostorskih evidenc se je uspešno ujemalo z realnimi lokacijami infrastrukture na terenu. To je potrdilo, da rezultati zajema dejanske rabe ne predstavljajo višjih tveganj za celovitost evidentirane dejanske rabe državnih cest.

Ključna besede:, dejanska raba zemljišč, državno cestno omrežje, prometna infrastruktura,

Slovenija,, zemljiški kataster

Land use of state roads in the Republic of Slovenia

This article describes land use set-up and its assessment in the area of state roads in the Republic of Slovenia. The first record of the land use of infrastructure date back to around the year 2000, when the modernization of national spatial and real property registers started. The Ministry of Infrastructure has in recent years initiated land use data capture under the state road, railway and municipal road infrastructure. Presented here are the history and notions of the land use of transport infrastructure and the implementation of the land use setup of state roads, and also, the final results, with an assessment complementing the data of the real estate, nowadays part of the unified real estate cadastre.

The main research questions are related to the adequacy of the real estate data used for capturing the land use of the transport infrastructure of state roads. It explores the issue of recording the land use of state roads in relation to the share of high accuracy real estate on state roads. The distribution and quality of cadastral parcels under the state roads in the real estate relates to the land use recording quality. In the last few years, the national Surveying and Mapping Authority has implemented a nationwide campaign on real estate location improvement, which has also resulted in improved locations of cadastral parcels under the state roads. This has contributed to time savings, and to a higher accuracy of recorded land use. The overall result of the analysis confirmed a sufficiently updated accuracy of cadastral parcels under the state roads, due to the executed location improvements. Another research question is related to the investigation of the mismatch between the actual state of the infrastructure in the field, and the status of the public infrastructure recorded in the state spatial records and real estate. The registered land use and areas of mismatch between the actual state of roads and spatial records were compared, primarily with the consolidated cadastre of public infrastructure. Almost 99 % of spatial records matched successfully with the real locations of the infrastructure in the field. This has confirmed that the results of land use data capture do not represent higher risks to the integrity of the recorded land use of the state roads.

Keywords: land use, real estate cadastre, Slovenia, state road network, traffic infrastructure **1**

1 Uvod

Prostorske evidence v sodobni družbi predstavljajo enega izmed temeljev vzdržnega sistema rabe prostora, saj nadzorujejo stanje prostora in se prek njih vzpostavlja pravičen sistem financiranja razvoja in porazdelitve negrajenih in grajenih območij. Prometna infrastruktura zavzema obsežen del grajenega prostora, zato je ključno, da je v prostorskih evidencah dobro definirana. Ena od ključnih evidenc za upravljanje s prostorom je kataster nepremičnin. Gre za novo poimenovanje in nadgradnjo zemljiškega katastra, katastra stavb in registra nepremičnin, ki med drugim vsebuje območja prometne infrastrukture, in se zakonsko opira na novi Zakon o katastru nepremičnin. Kataster nepremičnin vzpostavi, vodi in vzdržuje pravilne in popolne podatke o nepremičninah, ki izkazujejo dejansko stanje v prostoru.[12] Poleg tega pa vsebuje tudi podrobne podatke o dejanskih lastnostih nepremičnin, med drugim njihovo dejansko rabo.

Ločimo različne skupine dejanske rabe, v odvisnosti ali gre za vodna območja, kmetijske površine, gozd, grajeno okolje in znotraj slednjega dejanska raba območij prometne infrastrukture, ki se deli na državne in občinske ceste ter železniško infrastrukturo.

Zajem dejanske rabe na območju državnih cest v Sloveniji se izvaja prvič. Na podlagi raziskav in zakonodaje množičnega vrednotenja nepremičnin, je država s posodabljanjem nepremičninskega evidentiranja naredila vrsto korakov v smeri digitalizacije prostorskih podatkov. Lipej opisuje slovenski interdisciplinarni nepremičninski projekt, izvajan v letih 2000 - 2005, z vsebinami kot so priprava podatkov rabe kmetijskih in gozdnih zemljišč, predlog zakona o množičnem vrednotenju nepremičnin in informacijsko tehnološke rešitve vodenja nepremičninskih evidenc.[13] Država je z zakonodajo o množičnem vrednotenju nepremičnin vzpostavila nov sistem ocenjevanja tržne vrednosti nepremičnin. Država je po posodobitvah zemljiškega katastra začela s zajemom podrobnih podatkov, vključno z dejansko rabo. Prvi podatki so se nanašali na dejansko rabo kmetijskih in gozdnih zemljišč leta 2000. Mivšek navaja, da je bila evidenca dejanske rabe kmetijskih in gozdnih zemljišč vzpostavljena leta 2000.[14] Sledila je nova zakonodaja o vodnih zemljiščih v zemljiškem katastru. Lisec in Navratil sta opisala informatizacijo zemljiškega katastra, ki mora temeljiti na poznavanju zgodovine katastrskega sistema in iz nje črpati najustreznejše postopke.[15] Konec februarja leta 2018 je bil sprejet Zakon o evidentiranju dejanske rabe zemljišč javne cestne in javne železniške infrastrukture. Zakon določa način vodenja evidence dejanske rabe zemljišč javne cestne in javne železniške infrastrukture kot podrobnejših podatkov zemljiškega katastra[16]. Konjar ugotavlja pomen razvoja in načrtovanja dejavnosti v prostoru, da v celoti ne podleže vse večjemu pritisku kapitala, kar se v največji meri izraža na območjih pozidanih zemljišč.[17] Z evidentiranjem dejanske rabe se doseže nadzorovan in upravljan sistem prostorskih informacij o rabi, da se zagotovi pregleden vpogled v podatke matične evidence zemljišč. Upravljavci državne infrastrukture so dolžni opredeliti dejansko rabo glede na vzpostavljeni model in jo v predpisanem formatu posredovati Geodetski upravi Republike Slovenije (v nadaljevanju Geodetska uprava), ki po Zakonu o katastru nepremičnin vodi kataster nepremičnin. S podzakonskim aktom poimenovanim Uredba o dejanskih rabah zemljišč je Vlada Republike Slovenije določila vrste, pogoje, vire in način evidentiranja dejanske rabe zemljišč.[18] Direkcija za infrastrukturo Republike Slovenije (v nadaljevanju Direkcija za infrastrukturo) je v letu 2019 začela z vzpostavljanjem dejanske rabe na območjih državne cestne infrastrukture. Gre za prvo evidentiranje tovrstne infrastrukture. Za celovito izvedbo vzpostavitve evidenc je bilo potrebno

[12] ZKN, 2. člen.
[13] Lipej, 2005, str. 272.
[14] Mivšek et al., 2012, str. 665.
[15] Lisec, Navratil, 2014, str. 500.
[16] ZEDRZ, 1. člen.
[17] Konjar, 2019, str. 165.
[18] Uredba o dejanskih rabah zemljišč, 1. člen.

poleg zakona zagotoviti celoten sklop od priprave, pravilnika, metodologije, tehničnih specifikacij in ostalih dokumentov, ki so bili podlaga za zajem, kontrolo in vpis dejanske rabe v zemljiški kataster s pomočjo sodobnih informacijskih poti. Dejanska raba sodi v sklop podrobnih informacij o nepremičninah v današnjem katastru nepremičnin. V Sloveniji je kataster nepremičnin uradna evidenca zemljišč, sestavljena iz nabora parcel s pripadajočimi podatki. Povezuje stvarne pravice na nepremičninah, ki jih vodi zemljiška knjiga, z njihovo lokacijo v prostoru. Osnovna enota za vodenje podatkov v zemljiškem katastru je katastrska občina, znotraj nje pa parcela, ki je evidentirana z mejo parcele in označena s parcelno številko ali identifikatorjem. Meja parcele je določena z daljicami, ki grafično zaključujejo poligon ene parcele v odnosu do sosednjih parcel.[19] Evidentira se z naborom katastrskih točk s koordinatami v državnem koordinatnem sistemu. Prikaz mej parcel s parcelnimi številkami se grafično prikaže v katastrskem načrtu.[9] Pretekli Zakon o evidentiranju nepremičnin je za grafični prikaz parcel uporabljal zemljiškokatastrski načrt[20], v odsotnosti slednjega pa zemljiškokatastrski prikaz[11]. Uradno stanje je predstavljal zgolj zemljiškokatastrski načrt, ki ga določajo zemljiškokatastrske točke, odmerjene z meritvami na terenu, in urejene s tehnikami izboljšave položaja. Zemljiškokatastrski prikaz podaja obliko in medsebojno lego parcel v zvezni obliki in predstavlja informativni uvid, saj celotno območje Slovenije še ni bilo urejeno v zemljiškokatastrskem načrtu. Pravilnik o evidentiranju dejanske rabe zemljišč javne cestne in železniške infrastrukture določa podrobnejšo vsebino evidence dejanske rabe, ki vključuje mejo območja poligona dejanske rabe, vrsto rabe, upravljalca, datumu vira in ostale povezane podatke.[21] Metodologija za evidentiranje dejanske rabe javne cestne infrastrukture določa, da mora biti dejanska raba pod javno cestno infrastrukturo zajeta na podlagi:

- parcel v zemljiškem katastru
- parcel upravljavca
- podatkv zbirnega katastra gospodarske javne infrastrukture
- podatkov o poseljenih zemljiščih in
- podatkov površja. [22]

Na območjih, kjer je za javno prometno infrastrukturo voden sloj zbirnega katastra gospodarske javne infrastrukture (v nadaljevanju zbirnega katastra GJI) in so parcele odmerjene v zemljiškokatastrskem načrtu, je zajem dejanske rabe sorazmerno enostaven. Zajem se izvede glede na parcelo pod prometno infrastrukturo. Dobršen del območja prometne infrastrukture v Republiki Sloveniji še ni urejen in prikazan v zemljiškokatastrskem načrtu, kar se odraža s slabšo lokacijsko natančnostjo zvezno povezanih mej parcel prikazanih v zemljiškokatastrskem prikazu, poleg tega pa so na nekaterih mestih lokacijski podatki tudi neažurni. Slednje se je dogajalo, ko spremembe v naravi niso bile pravočasno in ustrezno evidentirane v katastrskih in lastniških evidencah. Vse našteto otežuje in upočasnjuje zajem dejanske rabe na območju javne prometne infrastrukture.

Zakon o evidentiranju dejanske rabe zemljišč javne cestne in javne železniške infrastrukture določa, da se dejanska raba zajame glede na uradno evidenco javne infrastrukture, kar

---

[19] ZKN, 16. člen, 2. odstavek. [9] Prav tam, 8. odstavek.

[20] ZEN, 19. člen, 7. odstavek. [11] ZEN, 19. člen, 8. odstavek.

[21] Pravilnik o evidentiranju dejanske rabe zemljišč javne cestne in javne železniške infrastrukture, 1. člen.

[22] Metodologija za evidentiranje dejanske rabe javne cestne infrastrukture, 2019, str. 5.

pomeni, da je vpisana v zbirni kataster GJI.[23] Časovni zamik dokončanja izgradnje nove javne prometne površine ali sprememba lege le-te in njen posledični zapozneli vpis v zbirni kataster GJI je dodatna težava, ki lahko vpliva na aktualnost podatkov dejanske rabe in realnega stanja na terenu. Posamezna sprememba na javnih cestnih in javnih železniških površinah zahteva, kot pogoj za izvajanje prometa, uradno odobritev državnih organov z vsaj začasnim upravnim dovoljenjem infrastrukture.[24] Pravo uporabno dovoljenje pa zahteva dobršen del časa skozi postopke pregledov in uradnega potrjevanja z objavo v Uradnem listu Republike Slovenije.

Šele navedeno uporabno dovoljenje je pogoj za vpis v zbirni kataster GJI. Pogosto se predvsem na cestni infrastrukturi dogaja, da je zaradi potreb javnosti in prometnih tokov promet na novo zgrajeni ali spremenjeni cesti že sproščen, medtem ko prostorske evidence še ne vsebujejo novega stanja. V primeru zajema dejanske rabe je treba v takih primerih dogovoriti kompromisno rešitev zajema dejanske rabe po dejanskem stanju ali po stanju uradnih evidenc. Raziskava vsebuje dve temeljni hipotezi:

- Hipoteza 1: Kakovost zajema dejanske rabe državnih cest je odvisna od razpoložljivosti zemljiškokatastrskih načrtov evidence zemljiškega katastra.
- Hipoteza 2: Neusklajenost dejanskega stanja državnih cest v naravi z evidentiranimi državnimi cestami v zbirnem katastru gospodarske javne infrastrukture je večja od 10 %.

Hipoteza 1, ki izpostavlja vprašanje pri evidentiranju dejanske rabe javnih cest v povezavi z deležem zemljiškokatastrskega načrta na parcelah pod državnimi cestami, bo preverjena s pomočjo analitičnih orodij, ki predstavljajo lastno raziskavo. Analiza bo obsegala statistični pregled razporejenost kakovosti podatkov zemljiškega katastra nad državno cestno infrastrukturo na izbranih območjih, s poudarkom na evidenci zemljiškega katastra pod državnimi cestami. Za izhodišča analize bodo uporabljeni opisni podatki podatkovnega modela in izmenjevalnega formata dejanske rabe javne cestne in javne železniške infrastrukture ter vrednosti evidentirane dejanske rabe državnih cest. Rezultat analize bo definiral stanje katastra nepremičnin pod parcelami državnih cest na izbranih območjih in prikazal razlike med natančnostjo določitve dejanske rabe.

Hipoteza 2 se nanaša na raziskavo neusklajenosti dejanskega stanja državne cestne infrastrukture v naravi in stanja evidentirane gospodarske javne infrastrukture v državni evidenci zbirnega katastra GJI za področje državnih cest. Z lastno raziskavo bodo preverjeni rezultati zajema in območja neusklajenosti dejanskega stanja ter zbirnega katastra GJI za državne ceste. V pričakovanju razhajanj med stanjem v naravi in evidentiranim stanjem dejanske rabe državnih cest bodo kot rezultat lastne raziskave pripravljeni predlogi za zmanjševanje razkoraka in boljšo usklajenost podatkov. S statistično metodo se bo preverilo območja poligonov zajete dejanske rabe državnih cest v odnosu do zadnjega vpisanega stanja državnih cest v katastru GJI. Statistični rezultat bo odstotkovna razlika med zajeto dejansko rabo in dejanskim stanjem v naravi, za območja državnih cest, kjer se podatki zaradi zamika potrditve novo zgrajene infrastrukture ali iz drugih razlogov, ki bodo v raziskavi opredeljeni, ne ujemajo.

1.1 Metode dela

Za raziskavo se je uporabilo več metod, med drugim analitična, induktivna, deskriptivno, empirična, sintezna in statistična metoda.

[23] ZEDRZ, 3. člen.

[24] ZJC-UPB1, 29. člen.

Članek predstavlja vsebinsko in projektno predstavitev tematike zajema dejanske rabe z analitično metodo, ki bo vsebovala analizo obstoječega stanja nepremičninskih evidenc pod državnimi cestami in potrebne izboljšave za ustrezno evidentiranje dejanske rabe. Na temelju posamičnih dejstev bo predstavljeno obstoječe stanje državnih nepremičninskih evidenc.

Deskriptivna metoda bo uporabljena za predstavitev pojma dejanske rabe prometne infrastrukture in delitve na dejansko rabo državnih cest, ki služi kot uvodnik v tematiko raziskave.

Z empirično metodo se bo subjektivno tolmačilo izvedbo evidentiranja dejanske rabe na področju državnih cest in glede na strokovno presojo podalo predloge za izboljšanje postopkov vzpostavitve ažurnejših podatkov dejanske rabe državnih cest.

Statistična metoda bo uporabljena za statistično obdelavo rezultatov zajema, ki bo predstavila dejanske rezultate evidentiranja površine kreiranih poligonov dejanske rabe in pripadajočih mejnih zemljiškokatastrskih točk, odstotkovne primerjave vrste in načina določitve, razlikovanja dejanskega stanja v naravi in poteka gospodarske javne infrastrukture ter podobnega.

V okviru raziskave bo uporabljena tudi sintezna metoda, ki bo spoznanja združila v celosten pregled vsebine in podala zaključke.

2 Projekt inicialnega zajema dejanske rabe državnih cest

Projekt inicialnega zajema dejanske rabe državnih cest je vseboval je več aktivnosti, ki so bile ločene v skupine analiz državnega cestnega omrežja, prostorskih evidenc, lokacijske izboljšave zemljiškega katastra na območju državnih cest in inicialnega evidentiranja dejanske rabe ločeno za avtoceste in hitre ceste, ki jih upravlja Družba za avtoceste, in glavne, regionalne ter turistične ceste, ki jih upravlja Direkcija za infrastrukturo.

2.1 Analiza državne cestne infrastrukture

Analiza, ki jo je izdelal izvajalec projekta, je vsebovala pregled delitev slovenskega državnega cestnega omrežja.

Državne ceste, ki jih upravljata Družba za avtoceste in Direkcija za infrastrukturo, delimo na avtoceste, hitre ceste, glavne ceste, regionalne ceste in turistične ceste:

- Avtoceste (A) in hitre ceste (HC) so državne ceste namenjene notranjemu in zunanjemu prometnemu povezovanju države s tujino;
- Glavne ceste I. reda (G1) so državne ceste namenjene prometnemu povezovanju med središči regionalnega pomena. Navezujejo se na ceste enake ali višje kategorije v državi in na cestni sistem sosednjih držav;
- Glavne ceste II. reda (G2) so ceste namenjene prometnemu povezovanju med večjimi središči lokalnih skupnosti in navezovanju prometa na državne ceste enake ali višje kategorije ter vzporednim povezavam avtocestam in hitrim cestam ter na cestni sistem sosednjih držav;
- Regionalne ceste I. reda (R1) so državne ceste, namenjene prometnemu povezovanju pomembnejših središč lokalnih skupnosti in navezovanju prometa na državne ceste enake ali višje kategorije;
- Regionalne ceste II. reda (R2) so državne ceste, namenjene prometnemu povezovanju središč lokalnih skupnosti in navezovanju prometa na državne ceste enake ali višje kategorije;

- Regionalne ceste III. reda (R3) so državne ceste, namenjene prometnemu povezovanju središč lokalnih skupnosti, za državo pomembnih turističnih in obmejnih območij ter mejnih prehodov z državnimi cestami enake ali višje kategorije, kadar po predpisanih merilih za kategorizacijo ne doseže višje kategorije.[25]

Med regionalne ceste III. reda spadajo tudi turistične ceste, ki povezujejo turistična središča, vendar so ločene iz običajnega nabora šifer in se pri upravljanju s cestami pogosto vodijo kot samostojna skupina.

Z analizo je izvajalec definiral nabor cest, kjer bo treba izvesti lokacijsko izboljšavo podatkov zemljiškega katastra in kasnejše evidentiranju dejanske rabe državnih cest, ločeno za avtoceste in hitre ceste ter ločeno za glavne, regionalne in turistične ceste.

2.2 Analize prostorskih podatkov za dejansko rabo državnih cest

Izvajalec projekta je izvedel več analiz vsebine geoprostorskih podatkov, ki so potrebne za evidentiranje dejanske rabe na območjih državnih cest. Analizirani so bili naslednji prostorski podatki:

- parcele pod državnimi cestami
- državne ceste iz podatkov zbirnega katastra GJI
- digitalni ortofoto Slovenije
- zemljiškokatastrske točke
- parcele v zemljiškokatastrskem načrtu
- parcele v zemljiškokatastrskem prikazu
- parcelne meje
- sferični posnetki državnih cest • dejanska raba vodnih zemljišč in
- digitalni model višin.

Ugotovitve analiz, ki jih je izvedel izvajalec inicialnega zajema dejanske rabe državnih cest, so pokazale, da stanje prostorskih evidenc ob začetku projekta leta 2019 ni bilo pričakovano in ustrezno za začetek inicialnega zajema dejanske rabe državnih cest. Glavna pomanjkljivost je bila neusklajenost podatkov zemljiškega katastra s potekom osi državnih cest, evidentiranih v zbirnem katastru GJI, na več območjih po državi. V sklopu izvedbe projekta inicialnega zajema dejanske rabe se je predhodno izvedla izboljšava lokacijskih podatkov zemljiškega katastra. Izboljšava je obsegala izboljšanje lokacije geoprostorskih podatkov zemljiškega katastra, ki je povečala položajno natančnost katastrskih načrtov v državi, pri čemer se je za potrebe evidentiranja dejanske rabe državnih cest in tudi masovni zajem pozidanih zemljišč izboljšava izvedla na območjih stavbnih zemljišč. Geodetska uprava je skupaj s Fakulteto za gradbeništvo in geodezijo Univerze v Ljubljani in Geodetskim inštitutom Slovenije izdelala sistemsko rešitev za izboljšanje položajne natančnosti večjih območij, ki temelji na uporabi obstoječih podatkov že izvedenih geodetskih meritev v preteklosti, dodatni določitvi in izmeri točk na terenu ter določitvi veznih točk na podlagi podatkov podob analitičnega snemanja (podatki LIDAR) in digitalnega ortofota. Omenjena metoda ne posega v lastninske pravice lastnikov in je izvedbeno relativno hitra. S to metodo se ne odmerjajo objekti, ki še niso evidentirani v zemljiškem katastru (na primer stavbe in nove ali rekonstruirane ceste). Evidentiranje takih sprememb, kot tudi dokončne določitve meje parcel, ki se uredijo v postopkih ureditve meje, je možno le na osnovi

[25] Uredba o kategorizaciji državnih cest, 2. člen.

zahteve in s sodelovanjem lastnikov zemljišč, ki so predmet postopkov.[26] Cilj celotnega projekta Lokacijske izboljšave zemljiškokatastrskega prikaza, ki ga je vodila Geodetska uprava, je bil izboljšati položajno natančnost prikaza parcel na območju države, lokacijska izboljšava parcel pod državnimi cestami, pa je bila del celotnega projekta inicialnega zajema dejanske rabe na območju državnih cest. Izboljšani podatki položaja lomnih točk zemljiških parcel in zemljišč pod državnimi cestami so bili evidentirani kot koordinate v državnem koordinatnem sistemu D96 (E, N) zemljiškokatastrskih točk v bazi zemljiškega katastra – skupaj z obstoječimi zemljiškokatastrskimi točkami z opredeljenimi koordinatami E, N in katerih obodi (poligoni) so bili grafično prikazani v posebnem topološko pravilnem geoprostorskem sloju, zemljiškokatastrskem načrtu. Ker je geoprostorski podatkovni sloj zemljiškokatastrskega načrta po končanem celotnem projektu postal zvezen, je lahko v postopkih učinkovitega upravljanja prostora zamenjal tedanji zemljiškokatastrski prikaz ter tako zagotavljal kakovostnejšo podporo odločitvam in upravljanju prostora.«[27] Z lokacijsko izboljšavo parcel pod državnimi cestami se sloj zemljiškokatastrskega prikaza ni spremenil, zemljiškokatastrski načrt pa je bil dopolnjen z izboljšanimi podatki. Z lokacijsko izboljšavo so se lahko spremenili podatki o vrsti in deležu dejanske rabe na parceli, vrednost bonitetnih točk zemljišč, vrednost nepremičnine in preračun katastrskega dohodka na parceli.[28] Lokacijska izboljšava podatkov zemljiškega katastra pod državnimi cestami je izvzela dve območji od enajstih, ki sta že imeli ustrezne lokacijske podatke iz izvornih terenskih meritev, to sta bili območje Prekmurja, ki je predstavljalo tudi prvo območje evidentiranja dejanske rabe, in območje dela Dolenjske. Lokacijska izboljšava zemljiškega katastra pod državnimi cestami je izvedbeno v večji meri sledila izboljšavi celotnega območja stavbnih zemljišč v državi, vendar je na določenih območjih zaradi potreb evidentiranja dejanske rabe prišlo do sprememb. Kljub zaključku projekta lokacijske izboljšave na območju državnih cest v letu 2019 nekatere naloge na področju urejanja in izboljšave kakovosti lokacijskih podatkov zemljiškega katastra pod državnimi cestami ostajajo. Na posameznih območjih, kjer je bil na razpolago le omejen nabor vhodnih podatkov, je uporabljena metoda dela omogočala, da se je ob naknadni pridobitvi novih podatkov, na primer ob izvedenih novih meritvah na takem območju, lahko izvedla ponovna lokacijska izboljšava, s katero se je izboljšala točnost geoprostorskih podatkov.[20]

2.3 Izvedba inicialnega zajema dejanske rabe na državnih cestah

Dejanska izvedba inicialnega evidentiranja dejanske rabe državnih cest se je tako kot lokacijska izboljšava podatkov zemljiškega katastra začela v začetku leta 2019 in je pokrivala sočasno izvedbo dela lokacijske izboljšave podatkov zemljiškega katastra na parcelah pod državnimi cestami, kot tudi izvedbo evidentiranja dejanske rabe državnih cest. Inicialno evidentiranje dejanske rabe državnih cest se je zaključilo v sredini leta 2020. Direkcija za infrastrukturo in Družba za avtoceste sta končne podatke evidentirane dejanske rabe državnih cest, ki jih je pripravil izvajalec, posredovala tudi Geodetski upravi.

3 Rezultati zajema dejanske rabe prometne infrastrukture

Rezultati zajema dejanske rabe državnih cest so predstavljeni za podatke vseh državnih cest, podrobneje pa so členjeni rezultati inicialnega zajema dejanske rabe glavnih, regionalnih, turističnih cest. Rezultati zajema za državne ceste predstavljajo stanje zajetih podatkov v avgustu

[26] Izboljšava lokacijskih podatkov zemljiškega katastra - GURS, 2018, e-vir.
[27] Rotar, Murovec, 2019, str. 555.
[28] Izboljšave zemljiškega katastra in seznam parcel za območje posega, SL-King d.o.o., 2019, e-vir. [20] GURS zaključil lokacijsko izboljšavo zemljiškega katastra, IUS-INFO, 2020, e-vir.

2022, ko so bili podatki zajeti na celotnem območju države in so že bili opravljeni tudi popravki, ter je stanje zajema dokončno usklajeno za vnos v matično evidenco na Direkciji za

infrastrukturo in Geodetski upravi. Rezultati inicialnega zajema dejanske rabe javne železniške infrastrukture in občinskih cest v avgustu 2022 so delni, ker se projekti še izvajajo.

3.1 Rezultati zajema dejanske rabe državnih cest za glavne, regionalne in turistične ceste

Prikazana je predstavitev rezultatov zajema evidentirane dejanske rabo na vseh državnih cestah, ki vključujejo glavne, regionalne in turistične ceste in ne vsebujejo avtocest in hitrih cest. Omrežje državnih cest je enakomerno porazdeljeno po celotnem območju Slovenije. V spodnji tabeli 1 je prikazana statistična obdelava celotnega geoprostorskega sloja državnih cest brez avtocest in hitrih cest. V okviru lastne raziskave smo izvedli štetje enot in merjenje dolžine cestnega omrežja:

Tabela 1: Statistični podatki dejanske rabe državnih cest brez avtocest in hitrih cest za celotno državo v avgustu 2022

PODATEK	**VREDNOST**
Št. poligonov	19.414
Št. zemljiškokatastrskih točk	652.068
Dolžina državnih cest (glavne, regionalne, turistične) [km]	6153

Vir: Lastno delo na podlagi geoprostorskih podatkov Direkcije za infrastrukturo in Geodetske uprave.

3.1.1 Statistične primerjave podatkov dejanske rabe na državnih glavnih, regionalnih in turističnih cestah

Podane so statistične primerjave rezultatov dejanske rabe državnih cest za glavne, regionalne in turistične ceste z razmerji med posameznimi atributnimi vrednostmi in pojasnjena razmerja delitve podatkov glede na določila podatkovnega modela za evidentiranje dejanske rabe prometne infrastrukture. Predstavljeni so številski in odstotkovni rezultati posameznih atributov, pri čemer so deleži atributov vezani glede na skupno število poligonov, tj. 21.479 poligonov.

1. Tabela 2 predstavlja delitev dejanske rabe glede na vrsto - določa razvrstitev med splošno območje državne ceste in območje objektov.

Tabela 2: Rezultati dejanske rabe državnih cest po vrsti dejanske rabe

VRSTA_DR	**ŠTEVILO POLIGONOV PO VRSTI DEJ.RABE**	**ODSTOTEK**
Državna cestna infrastruktura	19.052	89
Območje objekta na državni cestni infr.	2.427	11
Skupaj	21.479	100

Vir: Lastno delo na podlagi geoprostorskih podatkov Direkcije za infrastrukturo.

Primerjava po vrsti dejanske rabe v splošnem pove, da je na območju državnih cest brez avtocest in hitrih cest več kot 10 % območij, ki predstavljajo objekte. Gre za posledico razgibanega terena v Sloveniji, ki zahteva gradnjo objektov za premoščanje rek, dolin in hribov, to pomeni mostov,

predorov in viaduktov. Skoraj 90 % pa predstavlja običajna cestna infrastruktura na državnih cestah, torej ceste, cestne brežine, hodniki za pešce in podobno.

Primerjava vrste površin dejanske rabe glede na členitev, ki jo določa podatkovni model.

Tabela 3: Rezultati dejanske rabe državnih cest po vrsti površine

VRSTA_POV	**ŠTEVILO POLIGONOV PO VRSTI POVRŠINE**	**ODSTOTEK**
Cestni svet	18.507	86.2
Cestni svet nivojskega križanja z železnicami	97	0,5
Razširitev cestnega sveta	29	0,1
Druge površine potrebne za odvijanje cestnega prometa	507	2,3
Cestni svet objekta	2.339	10,9
Skupaj	21479	100

Vir: Lastno delo na podlagi geoprostorskih podatkov Direkcije za infrastrukturo.

Primerjava po vrsti površine dejanske rabe glede na podatkovni model pričakovano prikazuje največji delež cestnega sveta, ki vsebuje večino območja cest in predstavlja več kot 86 %. Več kot 10 % predstavljajo objekti. Dobra 2 % zajemajo druge površine za odvijanje prometa, to so bencinske črpalke in počivališča ob cestah, zadrževalniki vode in podobno. Odstotkovno malo je razširitev cestnega sveta, to so avtobusne postaje, trgi in podobno, kjer je cestni svet vsaj dvakratno razširjen, in križanj z železnico, ki jih je 0,5 %.

Primerjava načina določitve evidentiranja dejanske rabe glede na vhodne podatke.

Tabela 4: Rezultati dejanske rabe državnih cest po načinu določitve dejanske rabe

NAC_DOL	**ŠTEVILO POLIGONOV GLEDE NA NAČIN DOLOČITVE**	**ODSTOTEK**
geodetska izmera na terenu	0	/
posnetek stanja po končani gradnji	0	/
Interpretacija na podlagi podatkov zemljiškega katastra in tehničnih elementov infrastrukture, ki se določijo na podlagi geolociranega videoposnetka, LIDAR in ortofoto	7085	33
Interpretacija na podlagi podatkov zemljiškega katastra in tehničnih elementov infrastrukture, ki se določijo na podlagi LIDAR in ortofoto	14394	67

Interpretacija na podlagi podatkov zemljiškega katastra in tehničnih elementov infrastrukture, ki se določijo na podlagi ortofoto	0	/
Drugo	0	/
Skupaj	21479	100

Vir: Lastno delo na podlagi geoprostorskih podatkov Direkcije za infrastrukturo.

Način določitve dejanske rabe je izvajalec dvotretjinsko izvedel na podlagi podatkov katastra nepremičnin, digitalnega ortofota in digitalnega modela višin (LIDAR podatki), pri tretjini pa se je dodatno uporabilo tudi sferične posnetke snemanj ceste.

Primerjava natančnosti določitve meje območja dejanske rabe glede na vhodne podatke.

Tabela 5: Rezultati natančnosti določitve dejanske rabe državnih cest

NAT_DOL	**ŠTEVILO POLIGONOV GELDE NA NATANČNOST DOLOČITVE MEJE**	**ODSTOTEK**
Natančnost določitve položajnih koordinat do 4 cm	1825	8,4
Natančnost določitve položajnih koordinat od 4 cm do 12 cm	0	/
Natančnost določitve položajnih koordinat od 12 cm do 30 cm	4284	19,9
Natančnost določitve položajnih koordinat od 30 cm do 50 cm	1	0,1
Natančnost določitve položajnih koordinat od 50 cm do 1 m	2893	13,5
Natančnost določitve položajnih koordinat od 1 m do 2 m	12476	58,1
Skupaj	21479	100

Vir: Lastno delo na podlagi geoprostorskih podatkov Direkcije za infrastrukturo.

Natančnost določitve meje poligona dejanske rabe predstavlja kakovost podatkov katastra nepremičnin za evidentiranje dejanske rabe prometne infrastrukture. Vrednosti so bile določene na podlagi informacije o rangu parcelnih mej, ki se je navezoval na položajno natančnost zemljiškokatastrskih točk na terenu. Zaradi razmeroma velikega deleža območja, kjer je položaj meje parcele katastra nepremičnin slabše odmerjen, so podatki ranga parcelnih mej višji in ima največji delež natančnost nad 1 meter (58,1 %). Dobrih 13 % poligonov ima položajno natančnost med 50 centimetri in 1 metrom, Skoraj 20 % ima natančnost določitve med 12 in 30centimetri, med tem ko ima samo en poligon natančnost med 30 in 50 centimetri. V najvišji rang natančnosti določitve meje je bilo uvrščenih 8,4 % poligonov. Natančnost slednjih predstavlja v celoti terensko umerjene zemljiškokatastrske točke na katere so pripeti poligoni dejanske rabe.

Primerjava usklajenosti dejanske rabe državnih cest s katastrom nepremičnin.

Tabela 6: Rezultati usklajenosti dejanske rabe državnih cest s katastrom nepremičnin

USK_ZK	**ŠTEVILO POLIGONOV GLEDE NA USKALJENOST S KATASTROM**	**ODSTOTEK**
Dejanska raba je v celoti pripeta na zemljiškokatastrske točke (kataster nepremičnin predstavlja dejansko stanje v naravi)	18535	86,3
Dejanska raba je deloma pripeta na zemljiškokatastrske točke (kataster nepremičnin deloma predstavlja dejansko stanje v naravi)	2785	13,0
Dejanska raba ni pripeta na zemljiškokatastrske točke (kataster nepremičnin ne predstavlja dejanskega stanja v naravi)	159	0,7
Skupaj	21479	100

Vir: Lastno delo na podlagi geoprostorskih podatkov Direkcije za infrastrukturo.

Rezultati usklajenosti poligonov dejanske rabe državnih cest glede na podatke katastra nepremičnin obravnavajo, v koliki meri je poligon dejanske rabe »pripet« na zemljiškokatastrske točke. To pomeni, da je so poligoni najbolj usklajeni s podatki katastra nepremičnin. Rezultati so relativno dobri, saj je več kot 86 odstotkov poligonov dejanske rabe državnih cest brez avtocest in hitrih cest v celoti pripeto na položaje zemljiškokatastrskih točk. Preostala dejanska raba državnih cest je bila zajeta s kombinacijo ostalih podatkovnih virov, pri čemer je večina preostanka (13 %) tudi delno pripeta na podatke katastra nepremičnin. Najnižja usklajenost, ki jo ponazarja dejanska raba zajeta po topografskih značilnostih, se pojavlja v zelo malem obsegu, pod 1 odstotkom, kar je v teh okoliščinah sprejemljivo.

Rezultati zajema dejanske rabe avtocest in hitrih cest

Zajem dejanske rabe državnih cest na območju avtocest in hitrih cest se je izvajal sočasno z zajemom dejanske rabe državnih cest, glavnih, regionalnih in turističnih. Zajem je potekal ločeno zaradi različnega upravljavca. V Sloveniji je upravljavec avtocest in hitrih cest Družba za avtoceste. Lastna statistična raziskava nad podatki dejanske rabe avtocest in hitrih cest za celotno državo je zbrana v spodnji tabeli 7. Izvedli smo štetje poligonov dejanske rabe in zemljiškokatastrskih točk. Izmerili smo dolžino avtocest in hitrih cest po digitalni osi, glede na območja kjer je bila dejanska raba zajeta.

Tabela 7: Statistični podatki dejanske rabe na avtocestah in hitrih cestah

PODATEK	**VREDNOST**
Št. poligonov dejanske rabe	2.065
Št. zemljiškokatastrskih točk	72.533
Dolžina avtocest in hitrih cest, kjer je zajeta dej. raba [km]	616

Vir: Lastno delo na podlagi podatkov Direkcije za infrastrukturo in Geodetske uprave.

Zajem dejanske rabe avtocest in hitrih cest je bil v primerjavi z zajemom dejanske rabe ostalih državnih cest, ker so oboje izvajali isti izvajalci projektov, enostavnejši. Razlog je višja urejenost katastrskih podatkov pod avtocestami in hitrimi cestami, saj gre v večini za novejšo infrastrukturo, ki je bila tudi bolj sistematično urejana v smislu prostorskih aktov. Neusklajenost se je pojavila zgolj na območju avtoceste A5 na kraku do Gruškovja, kjer so prostorske evidence vsebovale staro stanje, avtocesta pa je že bila v uporabi.

Direkcija za infrastrukturo je kot upravljavec matične evidence dejanske rabe po izvedbi inicialnega zajema državnih cest (glavnih, regionalnih, turističnih) začela s projektom vzdrževanja dejanske rabe državnih cest. Enkrat letno se izvede posodobitev dejanske rabe celotnega omrežja, v primeru večjih sprememb pa se lahko evidentiranje sprememb izvaja tudi v več korakih znotraj leta. Spremembe dejanske rabe državnih cest, ki jih evidentira izvajalec, se skladno z izmenjevalnim formatom posredujejo Direkciji za infrastrukturo na podoben način kot so se posredovali inicialni podatki. Elaborati sprememb vsebujejo novo stanje, posredujejo se skupaj z opisnimi podatki, ki sledijo podatkovnemu modelu evidentiranja. Po pregledu na Direkciji za infrastrukturi, morebitnih popravkih izvajalca in prevzemu končnega elaborata in poročila, se podatki dejanske rabe na direkciji osvežijo, posredujejo tudi na Geodetsko upravo.

Analiza razhajanj med uradnimi prostorskimi evidencami in dejanskim stanjem državnih cest s predlogi sprememb

V postopku evidentiranja dejanske rabe državnih cest, glavnih, regionalnih in turističnih cest, kot tudi avtocest in hitrih cest so izvajalci zaznali območja, kjer digitalna os zbirnega katastra GJI, ki je predstavljala osnovni potek ceste v naravi, ni bila usklajena z dejanskim stanjem v naravi, ki so ga izkazovali podatki digitalnega ortofota, podatki katastra nepremičnin, sferičnih snemanj cest ali digitalnega modela višin. Zaznana so bila tudi območja novogradenj in sprememb poteka cest, ki še niso bila zavedena v prostorskih evidencah, vendar je promet že potekal po novi ali spremenjeni poti. Našteto je oteževalo evidentiranje dejanske rabe, saj so bili vhodni podatki neujemajoči. Da bi jasneje predstavili problematiko položajnega neujemanja pri evidentiranju dejanske rabe smo v okviru lastne raziskave pripravili analizo razhajanj med uradnimi prostorskimi evidencami in dejanskim stanjem v naravi. Analiza je vsebovala položajno primerjavo osi državnih cest iz zbirnega katastra GJI s preostalimi vhodnimi podatki kot sta kataster nepremičnin in digitalni ortofoto. Slednja predstavljata primarni vir vhodnih podatkov in sta bila vselej v uporabi pri zajemu dejanske rabe. Dodatno smo za lastno primerjavo uporabili digitalno os državnih cest, ki se vodi v projektu Družbe za avtoceste z imenom Vzdrževanje digitalne osi. Digitalna os vsebuje ažurnejše stanje državnega cestnega omrežja, saj se posodablja večkrat letno za namen spremljanja prometnih tokov, nesreč, zapor in podobnega. Služi Nacionalnemu centru za upravljanje prometa, ki skrbi za nadzor dogodkov na državnem cestnem omrežju. Geoprostorska sloja smo delili glede na atribut šifre odseka ceste. Na tak način smo pridobili 850 enovitih vrednosti, odsekov državnih cest, ki bodo osnova za analitično primerjavo. S položajno analizo v geoinformacijskem programu smo ugotovili odstopanje 11 odsekov državnih cest od skupno 850 odsekov, ki v inicialnega obdobju evidentiranja dejanske rabe državnih cest niso bili položajno ujemajoči. To predstavlja 1,3 odstotka vseh državnih cest, torej avtocest, hitrih cest, glavnih, regionalnih in turističnih cest. Položajna analiza je preverila prekrivanje digitalne osi obeh geoprostorskih slojev na določeno maksimalno razliko 3 metrov med osema. na mestu večjega razmaka se je zabeležila oznaka.

Preverili smo tudi lokacije večjih izvedbenih del na državnih cestah v obdobju izvajanja inicialnega zajema dejanske rabe državnih cest. Lokacije smo preverili glede na potek digitalne osi državnih cest iz geoprostorskega sloja GJI in ugotovili, da os iz zbirnega katastra GJI na teh mestih ne sledi dejanskemu stanju, ki je vzpostavljeno po zaključku gradbenih del oziroma ga

predstavlja tehnična dokumentacija izvedbe. V sklopu analize smo tako pri preverjanju ujemanj osi državnih cest iz zbirnega katastra GJI z osjo geoprostorskega sloja Nacionalnega centra za upravljanje prometa, kot tudi preverjanja osi ceste z dejanskim stanjem iz projektne dokumentacije, vedno preverjali stanje podatkov katastra nepremičnin in digitalnega ortofota. Analiza je pokazala dve glavni vrsti razhajanj, novi odseki državnih cest in nova krožišča na državnih cestah. Navodila za evidentiranje dejanske rabe javnih cest v metodologiji določajo, da je treba za evidentiranje uporabiti primarne vire, med katere spadata zbirni kataster GJI in podatki zemljiškega katastra.[29] Izvedba inicialnega zajema je na mestih razhajanj med prostorskimi evidencami in dejanskim stanjem sledila navodilom, pri čemer se je odprlo več vprašanj možnih prilagoditev postopka, da bi hitreje in učinkovitejše zajemali realno in ažurno stanje prometne infrastrukture, tako kot obstaja na terenu. V analizi ugotovljena težava zamika gradbenih del na prometni infrastrukturi in posodobitve prostorskih evidenc na aktualno stanje izvira iz postopka gradbenega zakona v primeru gradbenih del. Ta zahteva utečen postopek načrtovanja sprememb na prometni infrastrukturi oziroma projekta zasnove del, izvedbenega projektiranja, gradbenega dovoljenja, gradbena dela, popis izvedenih del, elaborata posodobitve prostorskih podatkov in končno potrditvijo novih podatkov infrastrukture v Uradnem Listu Republike Slovenije s pridobitvijo uporabnega dovoljenja na lokaciji sprememb ali novogradenj prometne infrastrukture.Izmed naštetih postopkov ocenjujemo, da je za evidentiranje dejanske rabe najbolj kritična faza po zaključku gradbenih del. Postopki vpisa novih podatkov tečejo predolgo, posledica pa so neusklajena stanja, ki so prikazana zgoraj.

V okviru raziskave delu smo izdelali možne predloge, ki bi posledično skrajšali celotni postopek evidentiranja dejanske rabe prometne infrastrukture. Kot prvo rešitev predlagamo, da se na mestih novogradenj in sprememb položaja ceste, ki spremeni tudi potek digitalne osi ceste, sledi novemu poteku osi ceste, pri čemer se dejanska raba evidentira glede na geoorientirane načrte projektne dokumentacije. V primeru, da dejansko stanje vseeno na mestih odstopa od projektiranega stanja, to se zgodi v izjemnih primerih, se naknadno še enkrat evidentira dejansko rabo v sklopu rednega vzdrževanja. Za spremembo v postopku vzdrževanja pa morajo takrat že biti posodobljeni primarni viri, torej kataster nepremičnin glede na terensko izmero. Kot drugo rešitev predlagamo, da se na mestih novogradenj in sprememb položaja ceste, ki spremeni tudi potek digitalne osi ceste, izvede dodatni začasni zajem dejanske rabe. Za začasno stanje evidentirane dejanske rabe se v podatkovnem modelu doda opisne podatke. Ko bi bili vhodni podatki za evidentiranje dejanske rabe posodobljeni na aktualno stanje bi se v sklopu rednega vzdrževanja evidentiralo novo stanje. Tak postopek bi omogočal ažurnejše evidence dejanske rabe. Kot tretjo rešitev predlagamo, da se na mestih novogradenj in sprememb položaja ceste, ki spremeni tudi potek digitalne osi ceste, izvede direktni hitri postopek sprememb vhodnih podatkov za evidentiranje dejanske rabe. Izvede se elaborate sprememb katastra nepremičnin in zbirnega katastra GJI. Ob potrjeni spremembi vhodnih podatkov na dejansko stanje, se izvede novo evidentiranje dejanske rabe.

Vsi predlogi so pripravljeni na način, da kar najmanj posega v obstoječe postopke in stanje prostorskih evidenc, pri čemer prva dva zagotavljata hibridno možnost uporabe podatkov ti. uradnega stanja in aktualno stanje. V ta namen bi bilo potrebno dopolniti pravne in tehnične podlage kot so Zakon o katastru nepremičnin, Zakon o cestah, Gradbeni zakon, Zakon o evidentiranju dejanske rabe javne cestne in javne železniške infrastrukture, Metodologijo za evidentiranje dejanske rabe javne cestne infrastrukture, Izmenjevalni format in podatkovni model za evidentiranje dejanske rabe in drugo. Ključni cilj, ki smo ga zasledovali pri analizi neujemanj je, da bi imeli evidentirano stanje dejanske rabe kar se da aktualno. Že podatkovni model javne

[29] Metodologija za evidentiranje dejanske rabe javne cestne infrastrukture ME009-R1.0, MzI RS, 2019, str. 5.

cestne in javne železniške infrastrukture v načinu določitve predvideva možnost vpisa atributnih vrednosti za določanje z geodetsko izmero na terenu ali s posnetkom stanja po končani gradnji.[30] Poleg tega menimo, da že uporaba pojma »dejanska raba« namreč opisuje, da gre za podatke dejanskega stanja v naravi. Ključen napredek, ki bi moral biti

kratkoročno izveden, predstavlja pospešitev postopkov pridobitve uporabnih dovoljenj, ki omogočajo vpis novih podatkov državnih cest v Uradni list RS. Predlog obsega kreiranje posebne delovne skupine v okviru Ministrstva za infrastrukturo in Ministrstva za okolje in prostor, ki bi namensko preučila možnosti in predlagala načrt izboljšanja hitrosti posodabljanja prostorskih evidenc na območju cestne infrastrukture in hitrejšo, a enako temeljito, pot do uporabnega dovoljenja. Uporabno dovoljenje predstavlja zadnji pravno-formalni korak k potrditvi celovitosti gradnje tako v stavbnem graditeljstvu kot tudi infrastrukturi.

4 Zaključek

Državna cestna infrastrukture potrebuje urejen prostorski sistem, ki opredeljuje njen namen in vlogo zagotavljanja transportnih poti za človeka in potrebne dobrine. Z začetkom evidentiranja dejanske rabe državnih cest je država storila nov korak k celovitosti prostorskih evidenc in razširila nabor dejanske rabe k že obstoječim evidencam kmetijskih in gozdnih ter vodnih območij.

V članku se s prvo hipotezo postavlja vprašanje evidentiranja dejanske rabe javnih cest v povezavi z deležem zemljiškokatastrskega načrta parcel pod državnimi cestami. Geoprostorski prikazi zemljiškega katastra, danes katastra nepremičnin, so se pred sprejetjem novega Zakona o katastru nepremičnin delili na zemljiškokatastrski prikaz in zemljiškokatastrski načrt. Določal ju je Zakon o evidentiranju nepremičnin. Zemljiškokatastrski načrt predstavlja natančno definicijo položaja parcel, medtem ko je zemljiškokatastrski prikaz zgolj osnovna informacija o lokaciji in poteku mej parcele. Pred izvedbo inicialnega evidentiranja dejanske rabe državnih cest je bilo potrebno urediti zemljiški kataster na območju državnih cest. To je izvedla Geodetska uprava s tehniko lokacijske izboljšave podatkov zemljiškega katastra, ki je parcelam z nižjo lokacijsko natančnostjo, z definiranim postopkom, dvignil natančnost, ki je bila primerljiva zemljiškokatastrskemu načrtu. Pri tem se niso spremenile lastniške in stvarnopravne pravice, poleg tega pa je ostala enaka tudi površina parcel. Z lokacijsko izboljšavo se navezuje tudi nova katastrska zakonodaja, ki po Zakonu o katastru nepremičnin ukinja delitev na zemljiškokatastrski načrt in prikaz. Zemljiškokatastrski prikaz je v novem zakonu omenjen še zgolj kot začasno stanje informativnega izkaza do končne vzpostavitve evidence stavbnih zemljišč.[31] Ker so bile parcele pod državnimi cestami natančno izmerjene na terenu (Prekmurje) oziroma lokacijsko izboljšane, je analiza pokazala, da lokacijsko natančnejše parcele poleg višje kakovosti podatkov zemljiškega katastra omogočajo tudi znatno učinkovitejše in hitrejše določanje dejanske rabe. Pred evidentiranjem dejanske rabe državnih cest je bila ugotovljena znatna razlika med območji, glede na položajno kakovost parcel zemljiškega katastra. V primeru, da lokacijska izboljšava ne bi bila narejena, bi bili rezultati natančnosti inicialnega zajema dejanske rabe bistveno nižji.

Hipoteza 1 raziskuje kakovost zajema dejanske rabe državnih cest, ki naj bi bila odvisna od razpoložljivosti zemljiškokatastrskih načrtov evidence zemljiškega katastra. Glavni vir za dejansko rabo državnih cest je predstavljal kataster nepremičnin oziroma zemljiški kataster, ki je

[30] Izmenjevalni format in podatkovni model za posredovanje podatkov v evidenco dejanske rabe zemljišč javne ceste in javne železniške infrastrukture ME0011-R.1.1, 2019, str. 14.

[31] ZKN, 148. člen.

tudi definiran kot primarni in osnovni vir. Ugotavljamo, da je za evidentiranje dejanske rabe državnih cest in tudi druge prometne infrastrukture ključen predvsem obstoj lokacijsko točnih podatkov zemljiškega katastra, ki ni toliko odvisen od tega, ali gre za zemljiškokatastrski načrt ali zgolj zemljiškokatastrski prikaz. Potrdimo lahko, da je v primeru, da so bile parcele pod državnimi cestami v zemljiškokatastrskem načrtu, evidentiranje dejanske rabe državnih cest potekalo hitreje. V večini se je lahko poligone dejanske rabe zajemalo po parcelnih mejah in beležilo visoko natančnost določitve dejanske rabe. Z lokacijsko izboljšavo podatkov zemljiškega katastra se je podatke zemljiškokatastrskega prikaza izboljšalo do te mere, da je evidentiranje dejanske rabe na parcelah v zemljiškokatastrskem načrtu potekalo podobno hitro kot pri parcelah v zemljiškokatastrskem načrtu, razlika je bila le v določitvi opisnih vrednosti dejanske rabe, saj je bilo treba zabeležiti nižjo stopnjo položajne natančnosti. Podatki lokacij parcel pod državnimi cestami so bili na dovolj visoki ravni in se je dejansko rabo v večini lahko vezalo na podatke primarnih virov, kot so podatki zemljiškega katastra. Hipotezo 1 lahko potrdimo, saj je z lokacijsko izboljšavo zemljiškega katastra Geodetska uprava dosegla dvig položajne kakovosti vseh podatkov katastra nepremičnin pod državnimi cestami, na katerih se je tudi evidentiralo dejansko rabo državnih cest. To se potrjuje v statističnih rezultatih opisnih podatkov dejanske rabe, ki se v večini ujemajo s stanjem položajnih podatkov katastra nepremičnin.

Med izvedbo evidentiranja dejanske rabe na območju državnih cest za glavne, regionalne in turistične ceste je izvajalec ugotovil težave evidentiranja na cestah, ki so bile predane v uporabo in izvajanje prometa, vendar uradno še niso zabeležene v prostorski podatkovni infrastrukturi, natančneje v evidencah zbirnega katastra GJI in katastru nepremičnin. Izvajalec je dejansko rabo na teh območjih zajel po določilih Metodologije za evidentiranje javne cestne infrastrukture, ki določa, da mora biti dejanska raba evidentirana na podlagi najnovejših podatkovnih virov kot sta kataster nepremičnin in zbirni kataster GJI. V okviru raziskave smo pripravili analizo, da bi ugotovili mesta lokacijskega neujemanja dejanske rabe državnih cest v primerjavi z dejanskim stanjem v naravi. Ugotovljen razlog razhajanj predstavljajo zahteve gradbenega zakona o vložitvi zahtev za posodobitev prostorskih evidenc in vpisu sprememb na državni infrastrukturi v Uradni list Republike Slovenije, po pridobitvi uporabnega dovoljenja. Postopki v povprečju zahtevajo daljše obdobje za končanje celotnega postopka vpisa sprememb cest v evidenci katastra nepremičnin in zbirni kataster GJI, posledica pa je vidna tudi v postopku evidentiranja dejanske rabe državnih cest, kjer rezultat zajete dejanske rabe ne izkazuje dejanskega stanja na terenu. Dejanska raba cestne infrastrukture je bila na teh območjih evidentirana na podlagi uradnih prostorskih podatkov in ne na območju realnega stanja na terenu.

Hipoteza 2 raziskuje neusklajenosti dejanskega stanja državne cestne infrastrukture v naravi in stanja evidentirane gospodarske javne infrastrukture v državni evidenci zbirnega katastra GJI za področje državnih cest. Za namen primerjave neujemanja smo uporabili geoprostorski sloj Nacionalnega centra za upravljanje prometa, ki se uporablja za spremljanje prometa na državnih cestah, za namen obveščanja o nesrečah, zastojih in gradbenih delih. Geoprostorski sloj vsebuje digitalno os državnih cest in se posodablja večkrat letno, kar smo smatrali kot aktualno evidenco za primerjavo podatkov z digitalno osjo državnih cest v zbirnem katastru GJI. V informacijskem okolju smo izvedli lokacijsko analizo ujemanja položaja digitalne osi glede na definirano maksimalno razliko med njima. Ugotovljeno število lokacijskih neujemanj smo povezali z opisnimi podatki geoprostorskega sloja, pri čemer smo uporabili atribut s podatkom šifre odseka državne ceste, ki je predstavljal enovito lokacijo neujemanja. Poleg tega smo za obdobje evidentiranja dejanske rabe državnih cest v letih 2019 in 2020 preverili nabor večjih gradbenih del na državnem cestnem omrežju in pridobili projektno dokumentacijo. Projektna dokumentacija je s posnetki digitalnega ortofota in digitalnega modela višin predstavljala dodaten vir potrjevanja lokacijskega neujemanja v analizi, saj je služila predvsem za verifikacijo. Število lokacijskih neujemanj dejanskega stanja državnih cest, ki ga je predstavljala digitalna os geoprostorskega sloja Nacionalnega centra za upravljanje prometa, in digitalne osi državnih cest v zbirnem

katastru GJI je, gledano na celotno evidenco odsekov državnih cest, zelo malo. Med 850 odseki na državnih cestah je bilo zgolj 11 odsekov takih, kjer dejansko stanje ni bilo ustrezno zabeleženo v evidenci zbirnega katastra GJI, posledično pa tudi v katastru nepremičnin. Izračunano odstopanje kaže, da je odstotkovno le 1,3 odstotka osi državnih cest v zbirnem katastru GJI neusklajenih z dejanskim stanjem v naravi. V praksi je odstotek lahko nekoliko višji, saj popolnoma realno in ažurno stanje prostorskih evidenc, ki bi se osveževala dnevno, ne obstaja in tudi v prihodnosti ni načrtovano, niti upravičeno. V postopku posodobitve podatkov prostorskih evidenc je veliko zakonskih in tudi tehničnih omejitev, ki bi omogočale vsakodnevno posodabljanje.

Hipoteza 2, ki predvideva, da obstaja 10 odstotkov položajnih razhajanj med prostorskimi evidencami, natančneje zbirnim katastrom GJI, in dejanskim stanjem v naravi je ovržena.

Ugotovljenih je bilo zgolj 1,3 odstotka lokacijskega neujemanja.

5 Literatura

1. Izboljšava lokacijskih podatkov zemljiškega katastra. GURS, 2018. URL: https://www.projekt.e-prostor.gov.si/projekti/zajem-in-izboljsava-podatkov/lokacijskaizboljsava-graficnega-dela-zemljiskega-katastra/, 23.6.2022.
2. Izboljšava lokacijskih podatkov zemljiškega katastra. LGB d.o.o., 2022. URL: https://www.lgb.si/storitve/zemljiski-kataster/izboljsava-lokacijskih-podatkovzemljiskega-katastra/, 23.6.2022.
3. Izboljšave zemljiškega katastra in seznam parcel za območje posega. SL-King d.o.o., 21.9.2019. URL: https://www.kingprostor.si/blog/izboljsave-zemljiskega-katastra-inseznam-parcel/, 23.6.2022.
4. Izmenjevalni format in podatkovni model za posredovanje podatkov v evidenco dejanske rabe zemljišč javne ceste in javne železniške infrastrukture ME0011-R.1.1. (2019). Ljubljana: Direkcija za infrastrukturo RS.
5. Konjar, M. (2019). Stanje in težnje razvoja rabe prostora v Sloveniji in primerjava z evropskimi državami (doktorsko delo). Ljubljana: Univerza v Ljubljani, Fakulteta za gradbeništvo in geodezijo.
6. Lipej, B. (2005). Projekt posodobitve evidentiranja nepremičnin. Geodetski vestnik, let. 2005, št. 49/2005-2, str. 272.
7. Lisec, A., Navratil, G. (2014). Avstrijski zemljiški kataster: od prvih začetkov do sodobnega zemljiškega informacijskega sistema. Geodetski vestnik, let. 58, št. 3, str. 500.
8. Metodologija za evidentiranje dejanske rabe javne cestne infrastrukture ME009-R1.0. (2019). Ljubljana: Ministrstvo za infrastrukturo RS.
9. Mivšek, E. et al. (2012). Dejanska raba vodnih zemljišč in zemljiški kataster. Geodetski vestnik, let. 56, št. 4, str. 665.
10. Pravilnik o evidentiranju dejanske rabe zemljišč javne cestne in javne železniške infrastrukture. Uradni list RS, št. 3/19.
11. Rotar, M., Murovec, K. Lokacijska izboljšava zemljiškokatastrskega prikaza. Geodetski vestnik, let. 63, št. 4, str. 554-567.
12. Uredba o dejanskih rabah zemljišč. Uradni list RS, št. 43/18 in 35/19.
13. Uredba o kategorizaciji državnih cest. Uradni list RS, št. 102/12, 35/15, 38/15, 78/15, 21/16, 52/16, 64/16, 41/17, 63/17, 78/19, 89/20, 163/21 in 20/22).
14. Zakon o evidentiranju dejanske rabe zemljišč javne cestne in javne železniške infrastrukture (ZEDRZ). Uradni list RS, št. 13/18.
15. Zakon o evidentiranju nepremičnin (ZEN). Uradni list RS, št. 47/2006, 65/2007 - Odl. US, 79/2012 - Odl. US, 61/2017 - ZAID in 7/2018.
16. Zakon o javnih cestah (ZJC-UPB1). Uradni list RS, št. 33/2006.
17. Zakon o katastru nepremičnin (ZKN). Uradni list RS, št. 54/2021.

14 Quality of life in housing estates in Slovenia: A preliminary analysis of survey results

Boštjan Kerbler

Richard Sendi

Urban planning institute of RS

Abstract

Under socialism, large housing estates were built in Slovenia. They were characterized by mass prefabricated construction with a low standard. After the transition to a new sociopolitical and economic system, new typologies of collective housing construction began to emerge, mainly characterized by lower apartment buildings with fewer housing units. This article proceeds from the hypothesis that the changed social circumstances and values after this transition brought the residents new expectations or demands regarding quality of life, with the result that housing estates from the socialist period have become less attractive to live in. This hypothesis is based on treating housing as a good with physical and substantive characteristics, which are important indicators of its useful value or key indicators for measuring any changes in residents' social values, which are reflected in their comprehension, perception, and needs regarding quality of life. The data on residents' perceptions and considerations regarding the quality of life in socialist and post-socialist housing estates built in Slovenia were obtained from a survey conducted in June 2022. This is therefore the first publication of the survey results and their analysis and interpretation.

Keywords: quality of life, housing estates, socialist era, post-socialist era, perceptions

1 Introduction

Housing estates, which are mostly built of prefabricated building materials and intended as high-density urban settlements, are found in almost every major city in the world. In Europe, the construction of large housing estates particularly intensified in first two decades after the Second World War. According to Richard Turkington et al. (2004) and Rob Rowlands et al. (2009), the main reasons for this were the following: a) the need to resolve and alleviate demand for housing resulting from war damage, b) poor housing conditions and population growth, c) a greater role for the state in providing housing, especially in financing its construction, d) a modernist view of what was considered good residential architecture and a good residential environment, and e) political support for mass housing complexes, largely provided by the state.

The industrial production of standard building units offered a relatively quick, inexpensive, and fairly efficient means of providing the large quantities of housing required to meet the needs of the rapidly growing urban population (Knorr-Siedow, 1996). Whereas large housing estates account for only 3 to 7% of the total housing stock in western Europe, this type of housing generally represents 20 to 40% of total housing stock in central and eastern Europe, which mostly had socialist political regimes after the Second World War (Dimitrovska Andrews & Sendi, 2001; Temelová et al., 2010). In western Europe, the construction of such mass housing complexes stopped much earlier than in eastern and central Europe, where the construction of these housing estates continued until the late 1980s. This was also the case in Slovenia, which was part of Yugoslavia at that time. This construction ended only after the collapse of Yugoslavia and the introduction of a new sociopolitical and economic system.

However, the transition from the former socialist system to a market economy brought about a number of new issues, including changes in housing policy. Among the many changes to housing policy, one that should be highlighted is the abolition of the state's previous role in providing mass housing. This measure actually meant that the construction of large housing estates ended. Instead, new typologies of collective housing construction began to emerge, mainly characterized by lower apartment buildings with fewer housing units. The key difference is that collective housing estates built after the transition to a market economy are comparatively smaller, in terms of both space and population. There are also many examples of new developments in which smaller multifamily apartment buildings are being built as individual detached buildings and are not part of a large housing estate. All this means that, after the transition from a socialist to a market economy, the term *housing estate* describes a completely different form of housing compared to that of the period before the change in the sociopolitical or economic system; that is, the socialist period (Sendi & Kerbler, 2021). For this reason, two distinctive forms of collective living are identified in this article. Mass housing complexes that were built from the aftermath of the Second World War up to the late 1980s (1945–1990) are called *socialist housing estates*. Multifamily apartment complexes that were built after the transition to a market economy (1991 and after) are referred to as *post-socialist housing estates* by analogy.

This article proceeds from the hypothesis that the changed social circumstances that characterize the post-socialist period have brought the residents new expectations regarding quality of life, which (may) consequently mean that housing estates from the socialist period have become less attractive

to live in because the residents have higher expectations or demands for a better housing standard and better quality of the residential environment due to changed values with regard to quality of life in housing estates. This hypothesis is based on Tone Klemenčič's (1985) treatment of housing as a good with physical and substantive characteristics, which are important indicators of its useful value or key indicators for measuring any changes in residents' social values, which are reflected in their comprehension, perception, and needs regarding quality of life. The hypothesis was tested with a case study of Slovenia.

2 Theoretical backgrounds

Large housing estates built after the Second World War across Europe (also in Yugoslavia) were modeled on ideas developed within the International Congress of Modern Architecture (CIAM; French: *Congrès internationaux d'architecture moderne*). CIAM, already an influential organization before the war, saw architecture as an economic and political tool that could be used to improve the world through building design and urban planning. The basic principle of the movement was that cities' social problems could be solved with a strictly functional segregation of residential areas and resettling residents in high-rise housing blocks with large green spaces in between. They were self-sufficient because they included all the necessary services and infrastructure (Hess et al., 2018). Large housing estates built on these principles were thus seen as a symbol of modernity and were intended to improve the residents' housing conditions (Monclús & Diaz Medina, 2016). Due to their functionality, they were named "functional cities" for different social classes (De Dekker et al., 2005).

According to Anne Power (1999), one of the main drivers of large housing estates and their postwar popularity was the economic advantage that this types of residential construction was expected to offer. In addition to easy access to low-cost greenfield land on the outskirts of large cities, there was also the belief that prefabricated residential high-rises were economical, especially if they were replicated multiple times in a single location. In addition, construction costs were expected to be further reduced by the use of standardized structural elements, which were delivered in large numbers to the construction site and were identically installed in a large number of buildings. This, of course, meant that all the mistakes that occurred during the design and construction of these housing estates were repeated many times over.

In addition to these shortcomings, the typical negative aspects of large housing estates include physical and ecological problems as well as economic, housing, social, and other similar problems, which experts already began to point out in western Europe in the 1970s (Turkington et al., 2004; Murie et al., 2003; De Decker & Newton, 2009; Bolt, 2018). The physical and environmental problems relate to the monotonous appearance of residential buildings and high building density in large housing estates; intrusion into green zones; poorly designed, messy, or unfinished public and green areas; the use of pollutants (e.g., asbestos); and low-cost, unsustainable building materials (Musterd et al., 2017; Bolt, 2018; Hess et. al., 2018). Economic and housing (financial) problems are associated with high maintenance and energy costs resulting from the use of less sustainable building materials and the premature deterioration of building parts (e.g., facades and roof structures) after only a short time, higher infrastructure costs, and higher commuting costs (Priemus & Metselaar 1992; Hegedüs et al., 1996; De Dekker & Van Kempen, 2004). Social problems arise mainly due to

the high concentration of certain minority groups and economically disadvantaged households (Van Kempen et al., 2005).

In the early 1990s, central and eastern European countries abandoned the political system of a socialist, planned economy and replaced it with a market economy system. This also affected housing policy and housing construction. There were changes that had already taken place in western Europe in the 1970s. However, the CIAM models of housing construction were replaced by new spatial planning, the priority of which was better exploitation and improved use of vacant and unsuitably exploited plots of land within settlements such as abandoned or inappropriately used sites, industrial complexes, and so on. In contrast to the socialist period, during which mass housing construction was the sole responsibility of the state (implemented through publicly owned construction companies), private developers as new actors have appeared on the mass housing construction market (Sendi & Kerbler, 2021). Therefore, in all countries of central and eastern Europe (including Slovenia), public space has come under increasing pressure from potential developers, who are constantly looking for vacant spaces that could be used for new housing construction in so-called "in spots" (Sendi et al., 2009).

The design of multifamily apartment neighborhoods and the architecture of buildings have considerably changed. However, the task of the private developer is to build an apartment block in space that is available for new construction, whereas open green spaces and social services are no longer a mandatory constitutive part of neighborhood design. The previous high-rise and high-density large housing estates built on greenfield land were soon replaced by new housing types characterized by lower multifamily apartment buildings with fewer housing units and thus lower residential density. New forms of buildings have become more pleasant to live in. Because they are built within the city or existing urban structure, they allow the residents to connect with the existing urban infrastructure, which gives the residents a sense of greater urbanness. Based on statistical data (see Statistical Office of the Republic of Slovenia, 2012) post-socialist dwellings, which have an average size of 75 m², have become larger than those of the socialist housing estates, whose average size is 55 m². In addition to the comparatively larger size of dwellings, the housing constructed by private developers is also generally of higher quality in terms of the building materials used and the modern design and arrangement of rooms (e.g., a large living room connected to a dining room and kitchen). This has led to some improvement in housing standards and diversification of housing choices (Sendi & Kerbler, 2021).

3 Methods

3.1 Questionnaire and survey

A questionnaire was formulated based on findings on the quality of life in housing estates and current knowledge about the satisfaction, wishes, and needs of residents living in them. The questionnaire measured the residents' attitudes, perceptions, norms, values, and satisfaction related to the quality of housing and their lives in socialist and post-socialist housing estates. The questionnaire consisted of 94 questions, most of which were designed in the form of a Likert scale. Due to space limitations, this article only presents results for some selected questions or part of them.

The data were obtained based on a telephone survey (CATI method), which was carried out between May and June 2022 in housing estates in the two largest Slovenian cities: Ljubljana and Maribor. The survey was carried out by a professional company that specializes in conducting research surveys. Seventeen professional interviewers participated in the survey. The average time to complete one survey was 22 minutes.

3.2 Sampling

For the purposes of sampling, data on housing estates (building constructions and their residents) were obtained from the Real Estate Register and the Central Population Register. Quota sampling was determined for the construction period of housing estates and for the selected cities (Ljubljana and Maribor; see Table 1). Within both categories of housing estates in the selected cities, the construction year of each multifamily apartment building was examined separately. On this basis, only buildings built during the construction period of the specific housing estate were included in the survey. If the buildings in the housing estate were built during different periods (before 1945, during the socialist period, and/or during the post-socialist period), only those were included in which the majority (75% or more) of buildings were built during a certain period. Housing estates whose construction started during the socialist period and ended during the post-socialist period were also excluded. All buildings that were built in 1991, which is the dividing line between the socialist and post-socialist administrations, were also excluded. Based on this, the quota for conducting the survey consisted of 54,985 apartments in buildings from the socialist period and 5,585 apartments (households) in buildings built during the post-socialist period. The company that conducted the survey was provided with this database, which also included the addresses of each building that had been sampled. These addresses were linked to telephone numbers in the telephone directory of Slovenia.

3.3 Survey sample

Professional interviewers called 27,401 telephone numbers listed in the latest telephone directory for Slovenia. The response to phone calls was 2.5%. Excluding calls that went unanswered or were made to wrong phone numbers, the response rate was 3.7%. The final number of surveys completed was seven hundred, which constitutes the sample of apartments and residents living in socialist and post-socialist housing estates. The sample represents 1.2% of all dwellings designated for sampling. Depending on the construction period of the housing estates, the sample includes 613 respondents (87.6%) that live in buildings from the socialist period and 87 respondents (12.4%) that live in buildings from the post-socialist period. The percentage ratio between socialist and post-socialist housing construction in the entire housing stock in the selected cities is approximately the same (89.2% vs. 10.8%), which was already considered when preparing the sample. By selected city, 524 surveys (74.8%) were completed in Ljubljana and 176 (25.2%) in Maribor. This percentage ratio is also present in the entire housing stock of the two selected cities, which was taken into account while sampling.

Table 1: Survey sample by construction period and selected cities

City	Socialist	Post-socialist	Total (location)
Ljubljana	452	72	524 (74.8%)
Maribor	161	15	176 (25.2%)
Total (period)	613 (87.6%)	87 (12.4%)	700 (100%)

The sample includes respondents from 110 housing estates, which is 88.7% of all housing estates in the sample. Eighty-seven (90.6%) of them were built during the socialist period and 23 (82.1%) during the post-socialist period. The buildings in socialist housing estates that respondents live in were built between 1946 and 1989 (on average in 1973), and in the post-socialist housing estates between 1992 and 2011 (on average in 2002). The largest housing estate from the socialist period that the respondents live in has 1,408 dwellings and 10,870 residents. The largest housing estate from the post-socialist period has 594 dwellings and 1,825 residents. On average, the socialist housing estates studied have 4,237 dwellings and 3,279 residents, and the post-socialist housing estates 258 dwellings and 647 residents (Table 2).

Table 2: Descriptive statistics of housing estates in the sample

Variable	Socialist	Post-socialist
Share according to all housing estates	90.6	82.1
Average year of construction	1973	2002
Earliest year of construction	1946	1992
Latest year of construction	1989	2011
Number of dwellings in housing estate	1,408	10,870
Number of respondents in housing estate	594	1,825
Average number of dwellings in housing estate	4,237	258
Average number of respondents in housing estate	3,279	647

Note: Unanswered questions (missing values) and “I do not know” are not included.

In housing estates from both periods, 66% of respondents were female and 34% male. The age of respondents ranges from twenty-four to ninety-six. The average age of respondents from socialist housing estates was sixty-eight and from post-socialist housing estates sixty-four. It is assumed that there are probably two reasons for such a high average age of the respondents. First, the telephone numbers of people from older age groups of the population are published in the telephone directory of Slovenia; that is, the telephone numbers of landline telephones are published, which are mostly owned by households with elderly people. Secondly, it is likely that only this segment of the population is willing to answer telephone surveys. Despite the high average age, it should be emphasized that there were significantly more younger respondents from post-socialist housing estates. The share of those under sixty old was 41%. In socialist housing estates, this share was 24%. Respondents in socialist housing estates have also lived there for a longer period of time than those in post-socialist ones. They have resided in socialist housing estates for an average of thirty-five years, and in post-socialist ones for 18.5 years. Respondents that live in socialist apartments are more often the owners of these apartments (91%) than those that live in post-socialist apartments (77.9%). The share would be a little higher in both cases because the majority of respondents that did not define themselves as owners or tenants were related to the owner of the apartment they live in. Even if this data were taken into account, there would still be more tenants of post-socialist apartments (Table 3).

Table 3: Descriptive statistics of respondents in the sample

Variable	Socialist	Post-socialist
Housing status (%)		
Owner/co-owner	91.0	77.9
Tenant	7.2	18.6
Other	1.8	3.5
Sex (%)		
Male	34.4	31.4
Female	65.6	68.6
Education (%)		
Primary school	5.1	1.2
Specialized high school	7.3	1.2
High school	41.9	22.1
College or university	45.7	75.6
Average number of household members	1.9	2.2
Average years of residence	35.1	18.5
Average age of respondents (years)	68.2	64.8
Average income (euros)	1,876.59	2,507.49

Note: Unanswered questions (missing values) and "I do not know" answers are not included.

3.4 Measuring instrument and selected variables

When determining the measuring instrument, the hypothesis was considered. To verify it, it was necessary to measure the quality of life in socialist and post-socialist housing estates. This was carried out by measuring satisfaction of life among residents and by determining the significance of housing estates for residents as well as the attitudes that residents have regarding housing estates. In addition, the degree of attachment and potential relocation in case of dissatisfaction were measured. A five-point Likert scale was chosen to measure residents' perceptions (i.e., satisfaction, significance, attitudes, and attachment) and considerations (i.e., potential relocation). Even though the five-point Likert scale described is ordinal, for the statistical analysis in this study it was treated as an interval scale even though there is no consensus in the literature on whether it can be treated as such (Jamieson, 2004; Norman, 2010). However, because the ordinal scale is the most frequently used scale in the social sciences due to the predominance of opinion scales, according to the recommendations of the Social Informatics Centre (2022) and assuming that the differences between categories are the same, the ordinal scale can also be used to calculate averages and variance, making it similar to an interval scale. In addition, "I don't know" answers were also excluded from the analysis as well as those respondents that provided no answer to a specific question. Statistical analysis was conducted using SPSS for Windows 23.0. Alongside the basic statistical calculations (means and shares), independent-samples *t*-tests were calculated to determine whether the average value of each selected variable differed between the two groups (i.e., socialist and post-socialist housing estates). Selected variables referred to the six key aspects of the housing estates: a) apartments, b) multifamily apartment buildings, c) the outdoor built environment, d) services, e) residing, and f) inter-neighborly relations.

4 Results

4.1 Residential satisfaction

The residential satisfaction measurement was based on four key aspects: a) apartments, b) multifamily apartment buildings, c) the outdoor built environment, and d) services. As the results showed, the residents, regardless of the housing estate, are satisfied with all key aspects of the housing estates (average score above 3.50). They are most satisfied with their apartments (average score 4.34), followed by services (average score 4.05). They are somehow less satisfied with their apartment buildings (average score 3.99) and the outdoor environment (average score 3.94). However, a more detailed analysis showed that there are greater differences in the assessment of individual elements within the key aspects of these housing estates. This also includes differences in satisfaction with these elements between residents living in socialist housing estates and those in post-socialist housing estates.

There are no major differences in satisfaction between these two types of housing estates except for apartments. Residents of both types of housing estates rated satisfaction with individual elements of the apartment with an average score of 4.34 (Table 4). Both are most satisfied with the size of their apartments; slightly more satisfied are those that live in post-socialist housing estates (average score 4.44). The average size of apartments in housing estates from the post-socialist period is also larger (74 m^2) compared to the size of apartments in housing estates from the socialist period (63.6 m^2). In addition to size, residents of post-socialist housing estates are also slightly more satisfied with the comfort and maintenance of their apartments. In contrast to this, residents of socialist housing estates are somewhat more satisfied with the layout of the rooms and the number of rooms in the apartment, even though the apartments in these housing estates have fewer rooms on average (2.5) than in the post-socialist apartments (2.8). However, it should be emphasized that these apartments also have a smaller average number of household members (i.e., 1.9 compared to 2.2 in post-socialist dwellings). Despite minor differences, all the aforementioned differences between satisfaction with the individual elements of apartments are not statistically significant. Residents of both types of housing estates are generally equally satisfied with their apartments (average score 4.42).

The hypothesis is confirmed by the residents' satisfaction with multifamily apartment buildings. The average satisfaction rating for all elements is 4.03 in the case of post-socialist housing estates and 3.95 in the case of socialist housing estates. The most important difference in satisfaction, which is also statistically significant, is for the interior arrangement and appearance of multifamily apartment buildings. Residents of post-socialist housing estates rated this element at 4.19 on average, and residents of socialist housing estates at 3.85 on average. The former also rate maintenance, external arrangement, and general satisfaction with the residential building higher. It is interesting, however, that residents of older housing estates are more satisfied with the quality of construction. However, it should be emphasized that this element is among the lower rated in both types of housing estates (3.91 vs. 3.84). This also applies to the energy efficiency of buildings, which the residents rated on average at 3.84 and 3.83, respectively.

Table 4: Satisfaction with multifamily apartment buildings and apartments (mean)*

	Socialist	Post-socialist
Multifamily apartment building		
Construction quality	3.91	3.84
Maintenance	3.99	4.06
Energy performance	3.84	3.83
External appearance	4.07	4.13
Internal appearance (stairways, corridor, elevator, etc.)**	3.85	4.19
General satisfaction with building	4.06	4.15
Apartment		
Comfort	4.38	4.40
Maintenance	4.30	4.35
Size	4.42	4.44
Layout of rooms	4.37	4.31
Number of rooms	4.17	4.12
General satisfaction with apartment	4.42	4.42

Notes: * Scale 1–5 (1 = not satisfied at all, 5 = very satisfied); unanswered questions (missing values) and "I do not know" answers are not included; ** significant independent-samples *t*-test of socialist versus post-socialist housing estate difference ($p \leq 0.05$).

Even in the case of the outdoor built environment, it turned out that residents of housing estates from the post-socialist period are more satisfied with this, which also confirms the hypothesis. The outdoor environment was divided into three groups. Respondents evaluated its general characteristics, traffic arrangement, and paths within it. On average, residents of newer housing estates rated all three groups higher in comparison to their counterparts (4.04 vs. 4.00, 3.76 vs. 3.53, and 4.14 vs. 3.89). Regarding general characteristics, the most important difference in satisfaction is for general orderliness (Table 5). Residents of socialist housing estates rated this with an average score of 3.90, and those in post-socialist housing estates with a score of 4.18. The difference is also statistically significant. In post-socialist housing estates, residents are also more satisfied with appearance, safety, peacefulness, and cleanliness. However, it should be emphasized that these characteristics were rated similarly highly by residents of older housing estates. Safety was rated the highest in both cases (i.e., 4.22 and 4.28). Green areas were rated similarly highly, but residents of socialist housing estates are more satisfied with them. Their assessment of green areas is also the highest among all general characteristics of the outdoor built environment (average score 4.29). Construction density, playgrounds, and other outdoor public spaces were rated the lowest. However, greater satisfaction was detected in socialist housing estates with regard to construction density and playgrounds. There is a particularly significant difference in satisfaction regarding playgrounds. Residents of newer housing estates rated this element with an average score of 3.67, whereas residents of older ones rated this element with a score of 3.91.

Similar to general characteristics, residents of post-socialist housing estates are also more satisfied with traffic arrangements, which is in line with the hypothesis. However, it should be emphasized that there is a statistically significant difference in satisfaction only in the case of parking spaces. Nonetheless, the average rating for both types of housing estates is low. Residents of newer housing estates rated this element with a score of 3.28, and residents of older ones with a score of 2.61 (Table 5). This is also the lowest average satisfaction score given by the residents of socialist housing estates for any of the elements evaluated in the survey. In both types of housing estates, traffic density was also rated low. Nevertheless, residents of post-socialist housing estates are somewhat more satisfied

with this element (3.56 vs. 3.50). The opposite for traffic arrangement refers to transport connections with other parts of the city. Residents of both types of housing estates rated this element very highly. However, residents of socialist housing estates are more satisfied with it (4.49 vs. 4.45).

In the case of path arrangements, residents of post-socialist housing estates expressed greater satisfaction with all elements evaluated. The average score is 4.14, and for socialist housing estates it is 3.89. There are statistically significant differences in satisfaction with sidewalks (Table 5). The average satisfaction score for this element is 4.36 in newer housing estates and 3.96 in older ones. Residents of both types of housing estates are less satisfied with bicycle paths (3.61 vs. 3.79) but more satisfied with walking paths (4.12 vs. 4.26).

Table 5: Satisfaction with the outdoor built environment (mean)*

	Socialist	Post-socialist
General characteristics		
General orderliness**	3.90	4.18
Construction density	3.87	3.77
Appearance	4.00	4.08
Safety	4.22	4.28
Peacefulness	4.04	4.10
Cleanliness	3.98	4.11
Green areas	4.29	4.21
Playgrounds	3.91	3.67
Other outdoor public spaces	3.80	3.94
Traffic arrangement		
Transport connections with other parts of city	4.49	4.45
Traffic density	3.50	3.56
Sufficient parking spaces**	2.61	3.28
Path arrangement		
Walking paths	4.12	4.26
Bicycle paths	3.61	3.79
Sidewalks**	3.94	4.36

Notes: * Scale 1–5 (1 = not satisfied at all, 5 = very satisfied); unanswered questions (missing values) and "I do not know" answers are not included; ** significant independent-samples *t*-test of socialist versus post-socialist housing estate difference ($p \leq 0.05$).

The results of residents' satisfaction with the services available in housing estates do not support the hypothesis. On average, residents of socialist housing estates expressed higher satisfaction with services in socialist housing estates (4.09 vs. 4.01). As many as eleven of the fifteen elements evaluated were rated higher than by residents of post-socialist housing estates. For three, the responses of the residents differ statistically significantly depending on the period of construction of housing estates. These elements are schools, preschools, and grocery stores. Residents of socialist housing estates rated schools and preschools with the highest average satisfaction score among all elements evaluated (i.e., 4.64 for preschools in 4.59 for schools). On the other hand, the most important difference in the satisfaction rating is related to grocery stores. Residents of socialist housing estates rated this service with a score of 4.52, and residents of post-socialist housing estates with a score of 4.01. Eight other services with which residents of older housing estates are more satisfied in comparison to their counterparts in newer housing estates are public transport, post

offices, banks, food services, personal care services, churches / places of worship, libraries, and leisure activities. A significant difference in satisfaction was especially seen in library accessibility; namely, 3.77 versus 4.01. In newer neighborhoods, residents are more satisfied only with access to pharmacies, health centers, dental clinics, and cultural services. However, it should be emphasized that, regardless of the differences in satisfaction between the two types of housing estates, the residents rated most services very highly. As many as nine services were rated with an average score higher than 4. Furthermore, for two elements, the residents of at least one type of housing estate rated services with an average score above 4. However, four services were still rated with lower average scores. Based on the average ratings, these services are the following (rated from highest to lowest): banks, leisure activities, dental clinics, and cultural services. Residents of post-socialist housing estates rated cultural services with the lowest average satisfaction score among all elements evaluated (2.91), whereas residents of socialist housing estates rated this service at 2.90, which is just behind the average score assigned to sufficient parking spaces.

Table 6: Satisfaction with service accessibility in housing estates (mean)*

	Socialist	Post-socialist
Public transport	4.33	4.23
School**	4.59	4.33
Preschool**	4.64	4.29
Pharmacy	4.45	4.54
Post office	4.08	4.01
Bank	3.91	3.89
Grocery store**	4.52	4.01
Health center	3.89	4.01
Dental clinic	3.57	3.66
Food services (e.g., restaurant, café)	4.06	4.01
Personal care services (e.g., hairdresser)	4.32	4.28
Cultural services (e.g., cinema, theater)	2.90	2.91
Library	4.03	3.77
Church / place of worship	4.08	4.02
Leisure activities (e.g., gym, education)	3.90	3.79
Overall satisfaction with housing estate	4.20	4.33

Notes: * Scale 1–5 (1 = not satisfied at all, 5 = very satisfied); unanswered questions (missing values) and "I do not know" answers are not included; ** significant independent-samples *t*-test of socialist versus post-socialist housing estate difference ($p \leq 0.05$).

At the end of the satisfaction evaluation of all elements, the residents also had to evaluate how satisfied they are with the housing estate in general. It turned out that the overall satisfaction with the housing estate is higher among residents of post-socialist housing estates (average score 4.33) than among their counterparts in socialist ones (average score 4.20). The difference is not statistically significant, but the result confirms the hypothesis. However, despite everything, it should be emphasized that the satisfaction rating for this element is high in both cases.

4.2 Significance of housing estates

When determining the significance of housing estates for residents, elements of two aspects of the housing estates were evaluated: the outdoor built environment and services in the housing estate. The results show that, on average, the elements of the first aspect are more significant for residents of post-socialist housing estates (average score 4.07 vs. 3.97), whereas the elements of the second are more significant for residents of socialist housing estates (average score 4.02 vs. 3.78). This is somewhat surprising because the satisfaction analysis showed that residents of newer housing estates are less satisfied with services whereas residents of older ones are less satisfied with the outdoor built environment. It would therefore be expected that lower satisfaction increases the significance level of these key aspects. This shows that satisfaction is directly related to what residents consider significant. However, it should be emphasized that a more detailed analysis of significance nevertheless confirms expectations for some elements.

When analyzing the significance of the outdoor environment, it was revealed that five out of seven elements are more important for residents of post-socialist housing estates (Table 7), which is in line with the hypothesis. These elements are proximity to public transport, proximity to walking paths, arranged bicycle paths, low construction density, and enclosure of the housing estate. Proximity to recreational areas and arranged green areas are more significant for residents of socialist housing. Regardless of this, it should be emphasized that residents of both types of housing estates rated almost all elements very high. There are no statistically significant differences between the groups in these elements either. Arranged green areas are the most important to residents. They were evaluated with the highest rating in both types of housing estates: at 4.62 in socialist housing estates and 4.55 in post-socialist housing estates. These are followed by proximity to walking paths with average scores of 4.53 in older housing estates and 4.54 in newer ones, proximity to public transport (4.48 vs. 4.54), and low construction density. The last is more significant for residents of post-socialist housing estates (average score 4.29), who expressed a lower level of satisfaction with this element. In general, residents of both types of housing estates expressed lower satisfaction with this element but rated it as very significant. Among all the elements assessed, the least important for all residents is that the housing estates had to be gated. However, it should be emphasized that residents of post-socialist housing estates rated this element of the outdoor environment as more significant (average score 2.68) than their counterparts in socialist housing estates (average score 2.05). The difference is also statistically significant.

The results showed that all the services evaluated are more significant for residents of socialist housing estates, which does not support the hypothesis. As many as six average scores of evaluated elements are statistically significantly different between the groups of housing estates (Table 7). These are pharmacies, post offices, banks, grocery stores, dental clinics, and personal care services. However, it should be emphasized that the first four services listed are also important for residents of post-socialist housing estates because they were rated very high. The most important service for residents of both types of housing estates is grocery stores. In older housing estates, this service was rated with an average score of 4.77, and in newer ones 4.62. These are also the highest ratings among all the elements evaluated in the survey. Residents attributed much higher significance to this service than their actual satisfaction with it. Residents of socialist housing estates also expressed great significance for three other services that they are less satisfied with regarding accessibility than their counterparts in post-socialist housing estates. These are pharmacies, health centers, and dental

clinics. The first service was rated with an average score of 4.67, the second at 4.49, and the third at 4.35. Among all services, the greatest difference between the average ratings by residents of older and newer housing estates is for dental clinics. It is interesting that residents of both types of housing estates attributed a much higher satisfaction rating to this element. The same applies to schools and preschools, which were rated with average scores of 4.02 and 4.03 in older housing estates and 3.68 and 3.69 in newer ones. Food services, cultural services, libraries, churches / places of worship, and leisure activities are also less important for all residents. The least significant for these is churches / places of worship, with an average score of 2.89 in socialist housing estates and 2.54 in post-socialist housing estates. However, in both types of housing estates the residents attributed a higher level of significance to cultural services than their actual satisfaction with them.

Table 7: Significance of selected outdoor built environment elements and services (mean)*

	Socialist	Post-socialist
Spatial elements		
Proximity to public transport	4.48	4.54
Proximity to walking paths	4.53	4.54
Proximity to recreational areas	4.08	3.99
Arranged bicycle paths	3.83	3.90
Arranged green areas	4.62	4.55
Low construction density	4.22	4.29
Enclosure of housing estate (gated housing estate for non-residents; e.g., fence, barriers, no trespassing signs)**	2.05	2.68
Services		
School	4.02	3.68
Preschool	4.03	3.69
Pharmacy**	4.67	4.39
Post office**	4.47	4.18
Bank**	4.36	4.07
Grocery store**	4.77	4.62
Health center	4.49	4.25
Dental clinic**	4.35	3.94
Food services (e.g., pub, café)	3.39	3.36
Personal care services (e.g., hairdresser)**	3.97	3.62
Cultural services (e.g., cinema, theater)	3.25	3.20
Library	3.91	3.87
Church / place of worship	2.89	2.54
Leisure activities (e.g., gym, education)	3.72	3.53

Notes: * Scale 1–5 (1 = not significant at all, 5 = very significant); unanswered questions (missing values) and "I do not know" answers are not included; ** significant independent-samples *t*-test of socialist versus post-socialist housing estate difference ($p \leq 0.05$).

4.3 Attitudes regarding housing estates

Regarding attitudes related to housing estates, two aspects of the housing estates were evaluated: residing and inter-neighborly relations. On average, in both cases residents of post-socialist housing estates had more agreeable views, which supports the hypothesis. In general, the average score for agreement with the statements in both housing estates was higher regarding residing: 4.21 in socialist

housing estates and 4.28 in post-socialist housing estates. The average rating of all statements in the case of inter-neighborly relations is also higher in post-socialist housing estates; namely, 3.26 versus 3.21 in socialist housing estates. Despite this, it should be emphasized that some statements were still rated higher by residents of older housing estates.

Table 8: Agreement with statements about residing and inter-neighborly relations (mean)*

	Socialist	Post-socialist
Residing		
Meets all my criteria for pleasant living.	4.10	4.17
There are sufficient green spaces.	4.29	4.28
Suitable for all age groups.	4.24	4.38
Inter-neighborly relations		
Residents are good neighbors (willing to help, friendly, etc.).	3.81	3.95
Residents are connected with each other.	3.21	3.18
Residents share the same values.	3.02	3.11
Residents share a similar socioeconomic status.	2.98	3.08
Social diversity encourages contacts among residents.	3.02	2.97

Notes: *Scale 1–5 (1 = do not agree at all, 5 = strongly agree); unanswered questions (missing values) and "I do not know" answers are not included.

When evaluating statements related to residing, residents of post-socialist housing estates agreed more with two statements, and residents of socialist housing estates agreed strongly with one (Table 8). Residents of post-socialist housing estates most agreed with the statement "The housing estate is suitable for all age groups." The statement was rated with an average score of 4.38. On the other hand, residents of socialist housing estates most agreed with the statement "There are sufficient green spaces in the housing estate." It was rated with an average score of 4.29. However, the residents of post-socialist housing estates rated it almost equally (4.28). It should be emphasized that all statements related to residing were rated very high, including the statement "The housing estate meets all my criteria for pleasant living," which was rated by residents of newer housing estates with an average score of 4.17 and by residents of older ones at 4.10. There were no statistically significant differences between the average ratings of the two types of housing estates.

There were also no statistically significant differences between the average ratings of the two types of housing estates regarding inter-neighborly relations (Table 8). Other than this, no statement referring to this key aspect was evaluated with an average score higher than 4. The statement "Residents of the housing estate are good neighbors (willing to help, friendly, etc.)" was rated the highest. It was evaluated higher by residents of post-socialist housing estates (3.95) than residents of socialist ones (3.81). Residents of newer housing estates also rated the following statements higher: "Residents of the housing estate share the same values" (average score 3.11) and "Residents of the housing estate share a similar socioeconomic status" (average score 3.08). Residents of older housing estates rated two statements higher: "Residents of the housing estate are connected with each other" (average score 3.21) and "Social diversity in the housing estate encourages contacts among residents" (average score 3.02). In post-socialist housing estates, the latter was also the lowest-rated statement (average score 2.97). In the socialist housing estates, the lowest-rated statement was "Residents of the housing estate share a similar socioeconomic status" (average score 2.98).

4.4 Housing attachment and potential relocation

In addition to a high level of satisfaction, residents of both types of housing estates also expressed a high level of housing attachment. Attachment to apartments, multifamily apartment buildings, and housing estates was evaluated (Table 9). In all three cases, residents of older housing estates expressed a higher level of attachment, which does not support the hypothesis. They are most attached to apartments (average score 4.45), followed by housing estates (average score 4.16) and multifamily apartment buildings (average score 4.03). Residents of newer housing estates rated only their attachment to apartments with an average score higher than 4 (average score 4.37), whereas they are less attached to housing estates (average score 3.97) and multifamily apartment buildings (average score 3.86). However, the differences in average ratings between the types of housing estates were not statistically significant.

Table 9: Attachment to apartment, multifamily apartment building, and housing estate (mean)*

Attachment to:	Socialist	Post-socialist
Apartment	4.45	4.37
Multifamily apartment building	4.03	3.86
Housing estate	4.16	3.97

Notes: *Scale 1–5 (1 = not attached at all, 5 = very attached); unanswered questions (missing values) and "I do not know" answers are not included.

Although the residents expressed a high level of satisfaction, they were also asked if they would consider moving due to dissatisfaction with their apartment, multifamily apartment building, or housing estate. It turned out that about 80% of the residents of both types of housing estates had not considered moving (Table 10). However, it also turned out that in some cases they had already thought about it anyway. Due to dissatisfaction with their apartment and housing estate, residents of post-socialist housing estates considered this option more often (11.63% in both cases), which does not support the hypothesis. On the other hand, dissatisfaction with apartment buildings caused residents of older housing estates to consider moving more often (10.75% of cases). However, the residents of this type of housing estate thought about moving due to possible dissatisfaction with their housing estate the least often. The share of these is only 8.31%, which is also the lowest among all cases.

Table 10: Consideration of relocation in recent years due to dissatisfaction with apartment, multifamily apartment building, or housing estate (%)*

Dissatisfaction with:	Socialist	Post-socialist
Apartment	11.24	11.63
Multifamily apartment building	10.75	9.30
Housing estate	8.31	11.63

Notes: *Combined share of ratings 4 and 5 from a scale of 1–5 (1 = not considered at all, 4 = considered, 5 = considered intensively); unanswered questions (missing values) and "I do not know" answers are not included.

Residents were also asked how likely they would be to choose some of the housing options offered if they decided to move. The results showed that four options would be chosen more often by residents of post-socialist housing estates, and one by residents of socialist housing estates (Table 11). The majority of residents of post-socialist housing estates (34.88%) would choose to move to another apartment, but in the same housing estate, followed by moving to housing estates built in the last five years (30.23%) and moving to other post-socialist housing estates (18.60%). Only 10.47% of them would choose to relocate to a socialist housing estate. Residents of socialist housing estates would also most often choose to move to another apartment in the same housing estate (25.24%). Moving to newly built housing estates would be chosen by 19.38% of residents of older housing estates, and 16.78% of them would choose to relocate to other post-socialist housing estates. Residents of both types of residential housing estates would therefore least often choose to relocate to (other) social housing estates, which is consistent with the hypothesis. In addition to relocating to housing estates, the respondents could also decide to move to their own house. This option would be chosen by 24.42% of residents of new housing estates and 21.66% of residents of old housing estates. In the case of residents of post-socialist housing estates, this is the third-highest percentage of certainty of choice, and in the case of residents of socialist housing estates it is the second-highest.

Table 11: Probability of choosing offered housing options in case of relocation (%)*

	Socialist	Post-socialist
Other apartment in same housing estate	25.24	34.88
Other socialist housing estate	15.31	10.47
Other post-socialist housing estate	16.78	18.60
Newly built housing estate (built in last five years)	19.38	30.23
Own house	21.66	24.42

Notes: *Combined share of ratings 4 and 5 from a scale of 1–5 (1 = would not choose at all, 4 = would choose, 5 = would choose definitely); unanswered questions (missing values) and "I do not know" answers are not included.

5 Discussion and conclusions

This article investigated the quality of life in two distinctive forms of housing estates, which were built under two different sociopolitical and economic systems: a) mass housing complexes that were built during the socialist era (1945–1990), and b) multifamily apartment complexes that were built during the post-socialist era (1991 and after), which started with the transition to a market economy. The hypothesis was based on the belief that the social and value changes that occurred during the post-socialist period affected residents' expectations, desires, demands, and needs regarding the quality of life in housing estates. It was expected that the housing estates from the socialist era have become less attractive for living because they were presumed to be of lower quality for living compared to the newer post-socialist housing estates. Residents' perceptions and considerations, which reflect the quality of life, were examined by measuring residential satisfaction, by determining the significance of housing estates for residents and attitudes that residents have regarding housing estates, and by measuring the degree of attachment and potential relocation in the case of dissatisfaction with the housing estate's key aspects. Six key aspects of the housing estates were evaluated: apartments, multifamily apartment buildings, the outdoor built environment, services, residing, and inter-neighborly relations.

The results of the research confirmed the hypothesis, but not completely. Residents of post-socialist housing estates are generally more satisfied with apartments, residential buildings, and the outdoor built environment, to which they also attribute great significance. They also mostly have more agreeable attitudes regarding residing and inter-neighborly relations. In the case of relocation, moving to socialist housing estates would be the least common choice for them. All the elements within these key aspects, which were proven to be significantly different between the two groups of housing estates, were also rated higher by the residents of post-socialist housing estates. These elements are the internal appearance of the multifamily apartment building, general orderliness of the outdoor built environment, sufficient parking spaces, sidewalk arrangement, and enclosure of the housing estate.

On the other hand, the results revealed that residents of socialist housing estates are generally more satisfied with the services in their housing estates and also attach greater significance to services. This is confirmed by the fact that all elements evaluated were rated higher for socialist housing estates in comparison to post-socialist ones. Ratings differ significantly in the case of eight elements (i.e., schools, preschools, grocery stores, post offices, pharmacies, banks, dental clinics, and personal care services). In addition to services, some elements of other key aspects have also been shown to be more accessible or better arranged in socialist housing estates. Especially green areas with associated equipment (playgrounds and recreational areas) stand out the most. For these, residents of socialist housing estates expressed both greater satisfaction as well as greater significance compared to residents of post-socialist housing estates. They also indicated a higher level of agreement for the statement that there are sufficient green areas in their housing estates. In socialist housing estates, residents are more connected with each other, as well as more attached to their living environment. This is also confirmed by the finding that, in the case of relocation, they would prefer to move to another apartment in the same housing estate. Residents of socialist housing estates are also more satisfied with public transport and transport connections with other parts of the city.

The research confirmed predictions that post-socialist housing estates offer better housing standards and better quality of the residential environment; therefore, living in them is more desirable. The multifamily apartment buildings in these housing estates are maintained and have a modern appearance, and the apartments are spacious and comfortable. The outdoor built environment is clean, safe, and peaceful, with low traffic density and sufficient parking spaces, and the walking and bicycle paths and sidewalks are well arranged. All the above thus satisfies the residents' needs, wishes, and demands for high-quality and modern living. However, the research also revealed that post-socialist housing estates have significant shortcomings. Namely, they are insufficiently equipped with services, and they lack green areas (i.e., the elements that distinguish socialist housing estates the most). The finding reflects the orientation of the two different sociopolitical and economic systems in which the two forms of housing estates were built. It is true that the construction of large housing estates during socialism was massive with monotonous simple-looking high-rise buildings and prefabricated with minimum living standard apartments, but it had a strongly emphasized social component. Above all, the importance of meeting the daily needs of residents was highlighted. Socialist housing estates were built on the outskirts of cities, mostly near industrial complexes. Therefore, they had an emphasized residential function for workers and included all the necessary infrastructure and services for them. At the same time, they also included extensive green areas. They were created not only because of demands for healthier environments for workers and to improve the aesthetic quality of the housing estates, but mostly to support social interactions, which was one

of the priorities under socialism. Even though large housing estates functioned self-sufficiently and were located on the city's periphery, they were always well connected with the city center by public transport, which is another advantage of socialist housing estates and a weakness of post-socialist ones. All this shows the distinct functionality of socialist housing estates, which is the result of holistic planning of the cities. With the change in the sociopolitical and economic system, this has changed. The main driving force of housing construction was no longer the state and cities, but private developers, and thus financial capital. It is true that construction has become better quality, apartments are more spacious, multifamily apartment buildings have a lower height, and housing estates have a modern appearance, but because developers wanted to make a profit from the sale of such apartments they began to compensate for this at the expense of outdoor space. Building plots have started being fully built up. Green areas in post-socialist housing estates are therefore often almost nonexistent, and, if they do exist, their use is often limited. With this, however, the possibility of social interaction between residents is also limited. In modern society, which has become highly individualistic, this is particularly problematic. Because housing construction focuses only on filling vacant spaces in cities, post-socialist housing estates are very often only individual multifamily apartment buildings, for which services and social infrastructure are not additionally planned and built. In addition, public transport is not adapted to these individual new developments. Even in the case of larger building plots, different developers build on them with their own dynamics and construction vision. In such cases, on part of a building plot the city should plan common social infrastructure and facilities for the future housing estate, but this mostly does not happen, or only to a limited extent (e.g., grocery stores). All these shortcomings reduce the quality of life in post-socialist housing estates.

To improve the quality of life, cities should start planning new housing estates more holistically in the future. They should give up part of the capital that they received by selling the land to housing construction developers and build social infrastructure on this land for the residents of future housing estates. The construction of this infrastructure should go hand in hand with the construction of housing estates. Cities should also determine the extent of green areas that developers should arrange next to residential buildings, or cities should arrange green areas next to buildings themselves. To raise the quality of life in socialist housing estates, cities should start planning and implementing comprehensive regenerations of large housing estates, which should primarily include the renovation of residential buildings and the outdoor built environment. Cities should also ensure that services in these housing estates remain accessible and that green areas are maintained.

However, a high quality of life for residents can only be ensured through holistic planning of post-socialist housing estates and regeneration of socialist housing estates. Future research should therefore focus on how to achieve and implement this goal.

Boštjan Kerbler
Urban Planning Institute of the Republic of Slovenia, Ljubljana, Slovenia
E-mail: bostjan.kerbler@uirs.si
Richard Sendi
Urban Planning Institute of the Republic of Slovenia, Ljubljana, Slovenia
E-mail: richard.sendi@uirs.si

Acknowledgment

The findings presented in this article are the result of the three-year project started in September 2020 titled *Quality of living in the housing estates of the socialist and post-socialist era: a comparative analysis between Slovenia and Croatia*, which was financially supported by the Slovenian Research Agency (grant number J5-2569). The research was also carried out in Croatia, and so the results will be comparable.

References

Bolt, G. (2018) Who is to blame for the decline of large housing estates? An exploration of socio-demographic and ethnic change. In: Hess, D., Tammaru, T. & Van Ham, M. (eds.) *Housing estates in Europe: Poverty, ethnic segregation and policy challenges*, pp. 57–74. Cham, Springer.

De Decker, P. & Newton, C. (2009) At the fall of utopia. *Urbani izziv*, 20(2), pp. 74–82.

De Dekker, K., Hall, S., Van Kempen, R. & Tosics, I. (2005) Restructuring large housing estates in European cities: An introduction. In: Van Kempen, R., De Dekker, K., Hall, S. & Tosics, I. (eds.) *Restructuring large housing estates in Europe*, pp. 1–17. Bristol, The Policy Press.

Dekker, K. & van Kempen, R. (2004) Large housing estates in Europe: Current situation and development. *Tijdschrift voor Economische en Sociale Geografie*, 95(5), pp. 570–577.

Dimitrovska Andrews, K. & Sendi, R. (2001) Large housing estates in Slovenia: A framework for renewal. *European Journal of Housing Policy*, 1(2), pp. 233–255.

Hess, D. B., Tammaru, T. & van Ham, M. (2018) Lessons learned from a pan-European study of large housing estates: Origin, trajectories of change and future prospects. In: Hess, D. B., Tammaru, T. & van Ham, M. (eds.) *Housing estates in Europe: Poverty, ethnic segregation and policy challenges*, pp. 3–31. Cham, Springer.

Jamieson, S. (2004) Likert scales: How to (ab)use them. *Medical Education*, 38(12), pp. 1217–1218.

Klemenčič, T. (1985) *Stanovanjsko gospodarstvo*. Ljubljana, ČGP Delo.

Knorr-Siedow, T. (1996) Present and future outlook for large housing estates. In: Schwedler, H. U. (ed.) *Environmental improvements in pre-fabricated housing estates*. Berlin, European Academy of the Urban Environment, Institute for Regional Development and Structural Planning.

Monclús, J. & Díez Medina, C. (2016) Modernist housing estates in European cities of Western and Eastern Blocs. *Planning Perspectives*, 31(4), pp. 533–562.

Murie, A., Knorr-Siedow, T. & Van Kempen, R. (eds.) (2003) *Large housing estates in Europe*: *General developments and theoretical backgrounds*. Utrecht, Utrecht University, Faculty of Geosciences.

Musterd, S., Marcińczak, S., Van Ham, M. & Tammaru, T. (2017) Socioeconomic segregation in European capital cities. Increasing separation between poor and rich. *Urban Geography*, 38(7), pp. 1062–1083.

Norman, G. (2010) Likert scales, levels of measurement and the "laws" of statistics. *Advances in Health Science Education*, 15(5), pp. 625–632.

Power, A. (1999) High-rise estates in Europe: Is rescue possible? *Journal of European Social Policy*, 9(2), pp. 139–163.

Priemus, H. & Metselaar, G. (1993) Urban renewal policy in a European perspective. *Netherlands Journal of Housing and the Built Environment*, 8(4), pp. 447–470.

Rowlands R., Musterd, S. & Van Kempen, R. (eds.) (2009) *Mass housing in Europe: Multiple faces of development, change and response*. Basingstoke, Palgrave Macmillan.

Sendi, R., Aalbers, M. & Trigueiro, M. (2009) Public space in large housing estates. In: Rowlands, R., Musterd, S. & van Kampen, R. (eds.) *Mass housing in Europe*, pp. 131–156. London, Palgrave Macmillan.

Sendi, R. & Kerbler, B. (2021) The evolution of multifamily housing: Post–Second World War large housing estates versus post-socialist multifamily housing types in Slovenia. *Sustainability*, 13(18), pp. 1–19.

Social Informatics Centre (2022) *Celovita podpora anketnemu procesu*. Ljubljana, University of Ljubljana, Faculty of Social Sciences. Available at: www.1ka.si (accessed 17 October 2022).

Statistical Office of the Republic of Slovenia (2012) *Ljudje, družine, stanovanja*. *Register Census 2011*. Ljubljana.

Temelová, J., Novák, J., Ouředníček, M. & Puldová, P. (2010) Housing estates in the Czech Republic after socialism: Various trajectories and inner differentiation. *Urban Studies*, 48(9), pp. 1811–1834.

Turkington, R., Van Kempen, R. & Wassenberg, F. (eds.) (2004) *High-rise housing in Europe: Current trends and future prospects*. Delft, Delft University Press.

Van Kempen, R., Dekker, K., Hall, S. & Tosics, I. (eds.) (2005) *Restructuring large housing estates in Europe*. Bristol, The Policy Press.