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# Kazalo

## Uvodnik



## Članki



## Predstavitev projekta

# Contents

## Editorial



## Articles



## Presentation of project

## Posledice

Prazne ulice, ljudje z maskami, zaprte ustanove in vsakodnevne skrb vzbujajoče novice o številu okuženih in umrlih. Prvi meseci tega leta so bili res povsem drugačni od preteklih. Česa takega nismo predvidevali, čeprav so globalne pandemije s številnimi žrtvami tudi predmet znanstvenega raziskovanja prihodnosti, in ne le katastrofična fikcija. V znanstvenem raziskovanju prihodnosti namreč na podlagi predpostavljenih dogodkov razvijejo več možnih scenarijev, tudi ekstremnih in najslabših možnih, na podlagi katerih se je mogoče pripraviti na podobne situacije in zmanjšati njihove posledice. Takšni dogodki, kakršen je izbruh pandemije, se imenujejo neznanke, to so nepredvidljivi dogodki z zelo velikimi posledicami, za katere je le vprašanje, kdaj se bodo pojavili.

V moje okolje je virus prišel v trenutku, ko se je zdelo, da je vse napeto kot elastika prav pred trenutkom, ko popusti in poči. Ko naloge, obveznosti in roki začnejo uhajati izpod nadzora, občutek nemoči pa začenja vplivati na dobro počutje in zdravje. Potem pa smo z danes na jutri ostali v osami. Nekaj dni smo se privajali, potem smo spoznali, da bo trajalo malo dlje in bo bolj zahtevno, na koncu pa smo se že navadili in bi nekatere prednosti takega življenja tudi obdržali. V presežku časa, ki je bil kar naenkrat na voljo, smo lahko spet malo zadihali. Odmik od službe, šole, družbenih medijev ter znancev, prijateljev in razširjene družine je prinesel več časa zase in za najbližje. In je bilo prav dobro. Odpočile so se ulice in ceste, parki so zadihali svež zrak, narava se je pomladno prebudila, živali so se vrnile v mesta. V dveh mesecih smo osvojili nove spretnosti in navade, več časa smo preživeli v naravi in odkrivali lepe in mirne kotičke čisto blizu doma. Za marsikoga je bil to čas uvida, kaj je res pomembno v življenju, v družbi in v svetu. Vsi smo nekako upali, da bomo to znali ohraniti tudi po tem. Do naslednjič.

Do takrat ne pozabimo, da imamo samo ta prostor, v katerem živimo. Da moramo biti odgovorni in pošteni do sebe in do vsega, na kar vplivamo. Saj je vse, kar se nam zgodi, posledica naših dejanj. Naše zavedanje tega pa ne sme trajati samo v času raznih kriz, ampak tudi takrat, ko se zdi, da je vse v najlepšem redu.

Damjana Gantar,
glavna urednica

## Consequences

Empty streets, people wearing masks, closed institutions, and alarming daily news on the number of new infections and deaths. The first few months of 2020 were truly completely out of the ordinary. No one expected something like this to happen, even though global pandemics with many fatalities are not just a catastrophic fiction, but also the subject of futures studies. Based on assumed events, futures studies develop several possible scenarios, including extreme and worst-case ones, which can be used to prepare for similar situations and reduce their impact. Events such as pandemic outbreaks are called wild cards; that is, unpredictable events with devastating consequences that may happen at any time.

The virus entered my world right at a moment when everything seemed as taut as a rope that was at a breaking point: that point when assignments, obligations, and deadlines start getting out of hand and the feeling of helplessness starts affecting your sense of wellbeing and your health. Then suddenly, we ended up in isolation. It took a couple of days to get used to it, and then we realized that everything would last a bit longer and be more challenging than we initially expected. Once we got used to it, we realized we would even prefer to keep certain advantages of this lifestyle. In all the free time we suddenly had available, we were able to catch our breath again. By distancing ourselves from our jobs, schools, social media, acquaintances, friends, and extended families, we had more time for ourselves and our loved ones. And it was great. The streets and roads got a break, the parks breathed in some fresh air, nature woke up in its spring attire, and animals returned to towns. In two months we acquired new skills and habits and spent more time outdoors, exploring pretty, peaceful little nooks close to our homes. To many, this period provided insight into what really matters in life, society, and the world. We all hoped to somehow be able to preserve all of this even after the pandemic was over. Until the next time.

Until then, let us not forget that the only space we have is the one we live in. That we should be responsible and fair to ourselves and to everything in our control. In the end, everything that happens to us is the consequence of our actions. However, we need to be aware of this not only when a crisis hits, but also when everything seems to be just fine.

Damjana Gantar,
Editor-in-Chief

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# »Hladna, kamnita in razčlovečena« – nepričakovani vplivi prenove na senzorično zaznavanje javnega prostora in vzdušje: primer Tumske ulice v poljskem mestu Plock

V članku avtorja proučujeta, kako spremenjena podoba ulice po prenovi vpliva na dojemanje ulice, njeno senzorično krajino in vzdušje na njej. Na primeru Tumske ulice, glavne ulice v srednje velikem poljskem mestu Plock, dokažeta, da imajo lahko tovrstne spremembe nepričakovane posledice, ki pri prebivalcih vzbujajo negativne občutke. Izsledki raziskave, ki je temeljila na mnenju članov fokusnih skupin, kažejo, da trenutno vzdušje na Tumski ulici povzroča negativne zaznave, ki se nanašajo na štiri vrste senzoričnega zaznavanja oziroma značilnosti krajine: tipne, vidne, slušne in vohalne. Negativna občutja so še močnejša pri posameznikih, ki imajo pozitivne spomine na nekdanjo ulico – na njeno stanje pred prenovo. Zaradi negativnega vzdušja na Tumski ulici in neprijetnih občutij, ki jih vzbuja, so se ulične aktivnosti prebivalcev zmanjšale na najnujnejše opravke. Navedeni izsledki kažejo, da bi morali pri oblikovanju ali preoblikovanju javnih prostorov vedno upoštevati vplive na ulično vzdušje in potrebo po ustvarjanju pozitivnih občutij.

**Ključne besede:** glavna ulica, vzdušje, doživljanje mesta, urbana sociologija, senzorično zaznavanje

## 1 Uvod

Ulica kot vrsta javnega prostora je pogosta tema raziskav s področja urbane sociologije ali urbane etnografije. Možni sta dve glavni metodi proučevanja in analiziranja ulic. Prva daje prednost materialnemu in urbanističnemu vidiku ter se osredotoča na to, kako materialnost ulice določa družbeno vedenje. Pri navedenem raziskovalnem pristopu je ulica del omrežja javnih mestnih prostorov (Degen, 2018; Hubbard in Lyon, 2018). Druga metoda pa proučuje družabno življenje na ulici in poudarja pomembno vlogo ulic pri zagotavljanju občutenja kraja in časa. Lahko jo razumemo kot del širšega koncepta sociologije doživljanja mesta, ki se osredotoča na to, kaj posameznik doživlja v krajih in prostorih ter z njimi (Borer, 2013: 966). Drug pomemben del tega pristopa je analiza senzoričnih zaznav javnih prostorov, tudi ulic, in njihovega ozračja ali vzdušja (Thibaud, 2011). Vzdušje je v tem smislu neločljivo povezano s čustvi, saj je opredeljeno kot zmožnost prostorov, da vplivajo na občutke (Löw, 2008).

Zaradi tovrstnega zaznavanja prostora in vzdušja v njem bi bilo treba razumeti, da je vzdušje pomemben del ulice kot kompleksnega družbenega pojava. Navedeno nakazuje, da bi bilo treba pri oblikovanju ali preoblikovanju mestnega prostora posebno pozornost nameniti možnostim vplivanja na vzdušje (tj. njegovega ustvarjanja ali poustvarjanja). Jean-Paul Thibaud (2015: 42) razlaga novo področje urbane intervencije: *urbanistično oblikovanje se ne osredotoča več samo na predmete, ampak tudi na tisto, kar je med predmeti. Ne gre več samo za vprašanje oblikovanja stavb ali megaobjektov, ampak tudi tega, kar jih obdaja*. Zato je ena izmed nalog arhitektov in odločevalcev, da se ne osredotočajo samo na funkcionalne ali estetske vidike, ampak tudi na občutke, ki jih najverjetneje vzbudijo spremembe javnega prostora. Navedeno se nanaša zlasti na gradnjo in obnovo, pri katerih lahko oblikovanje in preoblikovanje materialnih razmer vplivata na vzdušje na ulici in v povezavi z njim vzbudita negativne ali pozitivne občutke.

V članku avtorja proučujeta, kako spremenjena podoba ulice po prenovi vpliva na dojemanje ulice in vzdušja na njej. Pokažeta, da senzorično zaznavanje ulice pri ljudeh vzbuja negativna občutja in da prebivalci svoja negativna občutja, povezana s sedanjo podobo ulice, običajno primerjajo s pozitivnimi spomini na nekdanjo ulico. Kot primer uporabita Tumsko ulico – glavno ulico v srednje velikem poljskem mestu Plock.

## 2 Glavna ulica in njene spremembe

Nick Dines (2018: 953) za ulico uporablja izraz mikrokozmos mesta in ker ima ulica osrednjo vlogo v vsakdanjem življenju mestnih prebivalcev, bi bila lahko tudi kvazimetafora za mestno življenje. Nekateri raziskovalci trdijo, da ulica ponazarja naravo in dinamiko mesta, kar slikovito opiše tudi Henri Lefebvre (2003: 18): *Ulica je kraj zbiranja (topos), saj brez nje niso mogoča nobena druga dogovorjena srečanja ... Na ulici kot nekakšni obliki spontanega gledališča postanem spektakel in včasih igralec. Ulica je kraj, kjer poteka gibanje – interakcija, brez katere ne bi bilo mestnega življenja ... Ulica je kraj igre in učenja. Ulica je kraj nereda*.

Zanimiv in pomemben predmet raziskav ulic je glavna ulica. Izraz se nanaša na glavno nakupovalno ulico (ali včasih skupek več ulic) v mestnem središču, kjer so zgoščene trgovine in druge storitvene dejavnosti (Carmona, 2015). Glavna ulica ima pomembno vlogo v srednje velikih in majhnih mestih, saj zagotavlja občutek družbene stabilnosti in trajne lokalne identitete. Tradicionalno glavna ulica deluje kot prometno vozlišče in zbirališče, ki zagotavlja priročen dostop do trgovin in raznih storitev (Griffiths idr., 2008). Lahko pa se obravnava tudi kot čaroben prostor, ki ga radi obiskujejo tako prebivalci kot turisti, ki ustvarjajo in spodbujajo medosebne stike, poleg tega oblikuje posebne prostorske in čustvene odnose (Rzegocińska-Tyżuk, 2008).

Glavne ulice so v nekem trenutku izgubile svoj pomen. To je povezano s spremembami v mestnih središčih, ki jih običajno lahko opišemo kot degeneracija in propadanje. Navedena procesa sta se v zahodnih državah začela pojavljati konec tridesetih let 20. stoletja, vrhunec pa sta dosegla po letu 1960 (Robertson, 1995). Zaradi nenačrtnega širjenja mest (Burchell idr., 1998) in decentralizacije (Filion in Bunting, 2006) so mestna središča izgubila svoj pomen na račun predmestij, saj so se ljudje, trgovine in druge storitvene dejavnosti začeli seliti iz mestnih središč (Burayidi, 2001). Posledično so ljudje začeli soseske v središču mesta dojemati ne samo kot nepomembna, ampak tudi manj prijetna območja, na katerih živijo neprivilegirane skupine (starejši, priseljenci in izključeni posamezniki) (Neto idr., 2014). Poleg tega trgovska vloga glavnih ulic upada, pomen drugih mestnih prostorov, ki ponujajo najrazličnejše storitve (finančne, zabavne, zdravstvene itd.), pa narašča (Dawson, 1988). Razmere dodatno slabšajo čedalje večji stroški najema poslovnih prostorov, zaradi česar podjetja zapuščajo glavne ulice (Carmona, 2015). Posledično se te ulice ne dojemajo več kot naravna družbena središča mest.

Na neki točki je upadanje pomena glavnih ulic (tako kot propadanje mestnih središč) postalo družbeno in posledično politično vprašanje. Zato so bili izvedeni številni poskusi revitalizacije navedenih javnih prostorov (Anderson, 1964; Carmon, 1999; Seidman, 2004; Hechesky, 2005; Cerreta idr., 2018). Poleg splošnejših programov revitalizacije so bili uvedeni tudi konkretnejši pristopi k regeneraciji glavnih ulic. Med najbolj zna-

nimi je ameriški program Main Street America (Internet 1), ki problem propadanja glavnih ulic obravnava z večdimenzionalnega vidika, pri čemer se osredotoča na vprašanja, kot so gospodarsko prestrukturiranje, organizacija, promocija in oblikovanje (Robertson, 2004). V mnogih primerih procesi revitalizacije niso dosegli pričakovanih rezultatov, kot so regeneracija skupnosti ali socialna in gospodarska rast mestnih središč (Kaźmierczak idr., 2011). Pogosto so navedeni procesi samo delno učinkoviti. Revitalizacija infrastrukture in podobe ulic je še najlažji del tovrstnih projektov, druge spremembe, kot je boj proti socialni izključenosti, izboljšanje kakovosti življenja prebivalcev ali gospodarska rast, pa je običajno mnogo težje doseči (Nowosielski 2012a, 2012b). Poleg tega so imeli nekateri programi regeneracije nepričakovane posledice: povzročali so gentrifikacijo (Cameron, 1992; Miciukiewicz, 2008), nekateri so vplivali na širjenje gospodarske neenakosti (Stern in Seifert, 2007), zaradi drugih pa je postala infrastruktura mestnih središč in glavnih ulic za prebivalce neudobna in neprijazna (Gehl, 2010).

## 3 Občutenje mesta

Vplivu revitalizacije na vzdušje na javnih prostorih se namenja le malo pozornosti, ob tem se (pozitivni ali negativni) občutki, ki jih vzbuja nova podoba ulice, le redko proučujejo. Analize s področja urbane sociologije se običajno bolj osredotočajo na negativne posledice revitalizacije, kot je gentrifikacija, okrepitev neenakosti ali nezmožnost aktivacije mestnih skupnosti. Vzdušju in občutkom bi bilo treba nameniti več pozornosti. V tem pogledu sta lahko koristna teoretična okvira, ki sta ju predlagala Thibaud oziroma Borer. V skladu s prvim bi se morala posebna pozornost nameniti vzdušju na mestnih prostorih. *Mestni prostor omogoča številne ambiente, ki jih lahko občutimo z vsemi čutili. Ne glede na to, ali gre za živahno odprto tržnico ali pusto parkirišče, privlačno zgodovinsko jedro ali navadno postajo podzemne železnice, to, kako dojemamo te prostore, temelji na tem, kako jih senzorično doživljamo* (Thibaud, 2011: 43). Ulica se tako ne dojema samo kot prostor, napolnjen z materialnimi predmeti ali ljudmi, ampak tudi kot prostor, ki omogoča, da ljudje v njem občutijo vse, kar jih obkroža. Navedeno ima posledice za raziskovalca, ki proučuje vzdušje na ulici. Thibaud (2011: 42) trdi, da pri zaznavanju javnega prostora ljudje ne vidijo stvari take, kot so, temveč občutijo nekakšno *uglašenost z mestnim prostorom, ki jim omogoča, da mestni prostor doživljajo kot občutenje sebe in sveta.*

Drugi teoretični okvir pa temelji na sociologiji doživljanja mesta. Kot navaja Borer (2013: 969), *lahko vsak prostor v mestu ovrednotimo na podlagi čutnih dražljajev, ki jih vzbuja /.../ Ti pomeni so v plasteh naneseni na posamezen prostor, prav zaradi njihove zakoreninjenosti v posamezniku pa se oblikujeta identiteta kraja in navezanost na kraj, ki ju posameznik deli z drugimi*. Navedena izjava ima dve pomembni posledici za nadaljnje raziskave. Prvič, nanaša se na čute, ki urejajo naše doživljanje vzdušja v javnem prostoru in našo uglašenost z njim. Da bi jih lahko analizirali, se moramo osredotočiti na to, kako ljudje zaznavajo prostor s čutili. Borer (2013: 969–978) s tem v zvezi predlaga analizo značilnosti mestnih krajin, ki jih zaznavamo z vidom, sluhom, vohom, okusom in tipom. Navedeno se ujema z razvrščanjem senzorično zaznanih območij, ki ga je predlagal Rodaway (1994) in razlikuje med značilnostmi območja, ki jih zaznavamo s tipom, vohom, sluhom in vidom.

Pri vidno zaznanih krajinah (ang. *seescapes*) je poudarjena vloga vida, s katerim lahko najlažje zaznavamo prostor. Poleg tega *vizualni vidiki grajenega okolja vplivajo na doživljanje mestnih prostorov tako, da ponujajo znake in namige, na podlagi katerih lahko sklepamo, katere vrste interakcij tam potekajo in med kom* (Borer, 2013: 970). Vidne značilnosti krajine zajemajo prvine, kot so oblika, barva, prostornina, velikost, zaporedje, raznolikost, predstavljivost in berljivost (Wankhede in Wahurwagh, 2016: 743). Vizualni vidiki se pogosto upoštevajo pri različnih strategijah revitalizacije javnega prostora (Hubbard, 1996). Pri krajinah, ki jih zaznavamo s sluhom (ang. *soundscapes*), je poudarek na dejstvu, da je mesto polno zvokov, ritmov in hrupov različne intenzivnosti in glasnosti, ki prihajajo iz različnih virov, kot so ulični promet, javni prevoz, industrijske cone in ljudje. Nekatere mešanice različnih zvokov so povezane s posameznimi kraji (Borer, 2013: 971). Krajine, ki jih zaznavamo z vonjem (ang. *smellscapes*), se nanašajo na vohalne zaznave in njihovo interpretacijo, zlasti v smislu sprejemljivih in nesprejemljivih vonjev, ki so običajno povezani s tem, kaj je družbeno zaželeno in nezaželeno. Omeniti je treba, da je za nekatere kulture, tudi evropsko, značilen poseben pojav upravljanja vonjav, katerega cilj je doseči prostore brez vonja (Waskul in Vannini, 2008: 55–56). Opisane krajine lahko na primer opredelimo tudi na podlagi *razlikovanja med aromatičnimi, dišečimi, česnovimi, ambrozijskimi, kozjimi, odbijajočimi, odvratnimi in podobnimi vonji* (Wankhede in Wahurwagh, 2016: 743). Krajine, ki jih zaznavamo z okusom (ang. *tastescapes*), se nanašajo na proces doživljanja mesta prek pripravljanja in uživanja hrane in pijač. Poudarek je na zaznavah *sladkosti, kislosti, slanosti in grenkosti* (Wankhede in Wahurwagh, 2016: 743). Krajine, ki jih zaznavamo s tipom (ang. *touchscapes*), je verjetno najtežje opisati, ker se zdi, da niso omejene samo na *zaznavanje teksture površin s prsti* (Rodaway, 1994: 44), ampak so povezane s kompleksnejšim doživljanjem, ki vključuje premikanje skozi prostore in med predmeti ter njihovo občutenje s celotnim telesom. Med drugim obsegajo občutke *suhosti, hladnosti, hrapavosti in trdote* (Wankhede in Wahurwagh, 2016: 743). To je povezano z ugotovitvijo, da čutno doživljanje krajev ni individualno, ampak prej skupno. Zato bi ga lahko proučevali ne samo indi-

vidualno, ampak tudi v razmerah, v katerih bi lahko analizirali njegovo kolektivno naravo.

## 4 Tumska ulica v Plocku

Tumska ulica leži v starem mestnem jedru Plocka – srednje velikega industrijskega mesta v osrednjem delu Poljske, v katerem živi približno 120.000 ljudi. Ulica je bila na začetku 19. stoletja znana kot Dohm Straße (slo. *Stolna ulica*) in je bila zgrajena v središču mesta kot povezava med trgoma Rynek Kanoniczy (slo. Kanonični trg) in Nowy Rynek (slo. Novi trg) (Rydzewska, 2009). Čeprav je gradnja trajala pol stoletja, je zaradi oblike in središčne lokacije v mestu postala glavna ulica. Sprva je bila pomembna prometna pot, sčasoma pa je začela opravljati tudi druge funkcije (tj., stanovanjsko, storitveno in trgovsko). Trgovska funkcija je postala pomembnejša na prelomu 19. v 20. stoletje, ko si je *Tumska ulica prizadevala postati nakupovalno središče mesta* (Rydzewska, 2009: 24). Postopno je prevzela tudi vlogo kulturnega in družabnega središča Plocka, ki je med prebivalci vzbujalo pozitivne občutke.

Prebivalci Plocka, ki se ulice spominjajo še iz predvojnega obdobja, o njej govorijo kot o živahni ulici, ki je spodbujala preživljanje časa na prostem. Takratni Hotel Angielski, ki ga danes ni več, je bil zbirališče, kjer so ljudje pokušali lokalna vina in plesali. Ulica je bila prostor, kjer se je odvijalo družabno življenje (Luma, 2009). Umetniški klub, kjer so se zbirali boemi, in škofijska katoliška hiša s kinom in gledališčem za 1.500 ljudi, odprta leta 1935, sta zagotavljala zabavo in razvedrilo manj premožnim meščanom (Rydzewska, 2009). Po drugi svetovni vojni se je zaradi prilagoditev, ki jih je zahteval novi socialistični sistem, narava ulice spremenila. Zgrajene so bile nove javne stavbe, večina katerih je bila povezana s trgovino (blagovnica Centrum) in gostinstvom (gostilna Piast oziroma poznejši koktejl bar Hortex) (Rydzewska, 2009). Komunistična oblast je slikoviti Hotel Angielski spremenila v krojaško zadrugo, kulturni center (nekdanja katoliška hiša) na Tumski ulici pa je ostajal zbirališče umetnikov in središče kulturnega življenja, zlasti, ker je bil v njegovih prostorih tudi kino Przedwiośnie. Poleg tega se je postopno spremenila tudi sestava prebivalcev Tumske ulice: premožne meščane in lastnike značilnih večstanovanjskih stavb, zgrajenih iz opeke ali kamna (pol. *kamienice*), so zamenjali pripadniki nižjih družbenih slojev (Luma, 2009). Na začetku sedemdesetih let 20. stoletja je bila ulica prvič prenovljena, in sicer je bila preurejena v pešcono s kotički za sprostitev, ozelenjenimi z rožami in drevesi. Navedene spremembe so med prebivalci vzbujale mešane občutke (Rydzewska, 2009). Po letu 1989 je zaradi prehoda države v tržno gospodarstvo začela cveteti trgovska funkcija ulice, med ljudmi pa se je še okrepila predstava o njej kot o živahnem trgovskem središču mesta. Hkrati so se v mestu gradile nove stavbe, ki so

**Slika 1:** Plock na zemljevidu Poljske (vir: Internet 2)

delno nadomestile stare propadajoče objekte in so se ujemale s prvotnimi meščanskimi stavbami (Rydzewska, 2009). V prvem desetletju 21. stoletja so v Plocku hitro nastajali novi nakupovalni centri, zaradi česar so kupci zapuščali Tumsko ulico, ki je s tem izgubljala vlogo nakupovalnega središča mesta. Hkrati so mestne oblasti dale pobudo za projekt njene posodobitve, ki je bil dokončan leta 2006. Leta 2007 je prejel glavno nagrado na državnem natečaju posodobitve leta, mestne oblasti pa so prenovljeno ulico začele oglaševati pod reklamnim geslom *dnevna soba mesta*. Uveden je bil tudi program subvencioniranja prenove starih večstanovanjskih stavb (Woźniak, 2008). Razen sprememb v tlaku, ulični opremi in zelenih površinah nadaljnji posegi kljub temu niso bili v celoti izvedeni. Poleg tega prenova ni bila samo množično kritizirana, ker je med prebivalci vzbujala močne negativne občutke (Woźniak, 2008; Tybura, 2019), ampak tudi ni zmogla zaustaviti družbenega nazadovanja ulice in upada njenega pomena v očeh prebivalcev. Leta 2012 so Tumsko ulico imenovali celo bančna ulica, saj je bilo na 326 m dolgem območju za pešce kar dvajset bančnih poslovalnic. Primanjkovalo je kavarn, trgovin in predvsem pešcev, kar je dajalo vtis prazne, zapuščene ulice (Woźniak, 2008; Marciniak, 2012).

Do zdaj se položaj ni kaj dosti spremenil. Ulica ostaja predvsem promenada, ki se razteza do Tumskega hriba (pol. *Wzgórze Tumskie*). Zdi se, da je izgubila svoj nekdanji pomen trgovskega, zabavnega in kulturnega središča mesta (Tybura, 2019), kljub temu pa ostaja pomembna čustvena referenčna točka. Ewa Luma (2009: 59) glede tega, kako Tumsko ulico doživljajo starejši prebivalci Plocka, navaja: *Tumska ulica ima pomembno preteklost, pred nami pa je, upamo, veličastna prihodnost. Ali bo postala dnevna soba mesta, bodo pokazala naslednja stoletja. Ljudje, ki se po njej sprehajajo, so njeno življenje. Njena narava je sestavljena iz številnih prvin: stavb (hiš), dvorišč, ulic in oken stanovanj, v katerih živijo ljudje. Prebivalci so srce vsakega mesta. Hiše so samo njena zunanja podoba, medtem ko ulico določajo ljudje in njihovi občutki*.


**Slika 2:** Tumska ulica v Plocku (vir: Internet 3)

## 5 Raziskovalna metoda in podatki

Raziskava, predstavljena v tem članku, temelji na analizi podatkov iz mnenj, pridobljenih leta 2018 v okviru dveh fokusnih skupin, v katerih so sodelovali prebivalci Plocka. V vsaki skupini je bilo po osem posameznikov, ti pa so bili izbrani z namenskim vzorčenjem na podlagi čim večjih razlik med seboj. Za raziskavo so bili tako izbrani posamezniki različne starosti, izobrazbe in poklica. Drugo merilo za vzorčenje je bil kraj bivanja: v fokusnih skupinah so tako sodelovali prebivalci različnih predelov Plocka. Raziskava z obema fokusnima skupinama je potekala v stavbi Mazovijske državne univerze, ki ni v središču mesta, ampak v eni izmed stanovanjskih sosesk v Plocku. Raziskava s prvo fokusno skupino je trajala 1 uro in 26 minut, z drugo pa 1 uro in 40 minut.

V raziskavi s fokusnima skupinama je bilo obdelanih po šest tem, med drugim so si morali člani skupin zamisliti, kako se sprehajajo po sedanji Tumski ulici, in opisati, kaj pri tem občutijo. Prvi sklop vprašanj je bil uporabljen kot ogrevanje in se je večinoma nanašal na podatke o sodelujočih v raziskavi: njihovo socialno-demografsko ozadje, kraj bivanja v Plocku in njihov odnos do Tumske ulice. Drugi sklop vprašanj je temeljil na projekcijskih tehnikah, s katerimi sta želela avtorja raziskave določiti občutke sodelujočih v raziskavi v povezavi s Tumsko ulico in vzdušjem na njej ter njihovo uglašenost z ulico. Pri spraševanju je moderator anketirance pozval, naj zaprejo oči, si zamislijo, kako se sprehajajo po Tumski ulici, in pri tem opišejo svoje občutke. Izkazalo se je, da je bila navedena tehnika med udeleženci zelo dobro sprejeta, njihovi odgovori pa so zagotovili zanimive podatke o tem, kako dojemajo vzdušje na ulici. Tretji tematski sklop raziskave se je nanašal na vsakdanje stike s Tumsko ulico. Sodelujoči v raziskavi so morali povedati, kolikokrat na dan jo obiščejo in zakaj (in če je ne obiskujejo, zakaj ne). Naslednji sklop vprašanj se je osredotočal na dogodke, organizirane na Tumski ulici, in kako jih vprašani dojemajo, peti sklop pa na zaznane prednosti in slabosti ulice. Pri zadnjem sklopu vprašanj pa so morali sodelujoči v raziskavi opisati, kako bi bila videti idealna Tumska ulica.

V članku se avtorja osredotočata na zaznavanje Tumske ulice in vzdušja na njej. Pri njuni analizi je poudarek na štirih kategorijah senzoričnega zaznavanja krajine, kot jih je predlagal Borer (2013), ter na spominih na nekdanjo ulico in posledicah prenove na to, kako jo ljudje zaznavajo. Uporabljena raziskovalna metoda je vključevala delo s fokusnima skupinama kot orodje, ki omogoča večjo angažiranost sodelujočih. Pri taki

**Slika 3:** Kamnita Tumska ulica (foto: Michał Nowosielski)

skupinski raziskavi se lažje odprejo in navežejo stik z drugimi. Poleg tega navedena metoda udeležence spodbuja, da delijo svoje občutke in čustva (Gawlik, 2012) ter se o njih pogovarjajo. Navedeno pa je mogoče doseči samo, če vprašanja, ki se obravnavajo, niso preveč problematična ali intimna.

# 6 Rezultati

Vprašanja o zaznanem vzdušju na Tumski ulici so se izkazala za zelo učinkovita pri pridobivanju informacij o občutkih sodelujočih v raziskavi. Številni odgovori in razprave, ki so sledile, so se nanašali na čutne, skoraj telesne zaznave, ki jih po Borerju (2013) lahko razdelimo v štiri vrste senzoričnega zaznavanja: tipno, vidno, slušno in vohalno. Zaznavanje krajine, ki se nanaša na okus, v raziskavo ni bilo vključeno.

Spodnji primeri izjav vprašanih so šifrirani na naslednji način: če je navedena izjava samo enega sodelujočega v raziskavi, je označena s številko fokusne skupine in številko te osebe (npr. FS1S4), če pa gre za izmenjavo mnenj med več sodelujočimi v raziskavi, je vsaka izjava označena s številko osebe, celoten pogovor pa je označen s številko fokusne skupine. Vprašanje moderatorja je označeno s številko fokusne skupine in črko M (npr. FS2M).

## 6.1 Tipno zaznavanje krajine

Najpogosteje omenjeni občutek je bil hlad, zaradi česar so se sodelujoči v raziskavi počutili zelo neprijetno:

FS1S4: Naj se sliši še tako čudno, čutim hlad in praznino.
FS2S7: Čutim hladno vzdušje.
FS1S7: Zanimivo, tudi jaz sem občutil hlad. Prva beseda, na katero sem pomislil, je bil *hlad*.

Med pogovorom so sodelujoči v raziskavi dodatno pojasnili razloge za opisani občutek. Mnogi so dejali, da so vzrok za hladnost Tumske ulice materiali, iz katerih je zgrajena. Konkretno so omenjali material, s katerim je tlakovana, ter obliko in materiale ulične opreme. Opozorili so predvsem na prevlado kamna.

**Slika 4:** Različna površina in pešci na pločnikih Tumske ulice (foto: Michal Nowosielski)

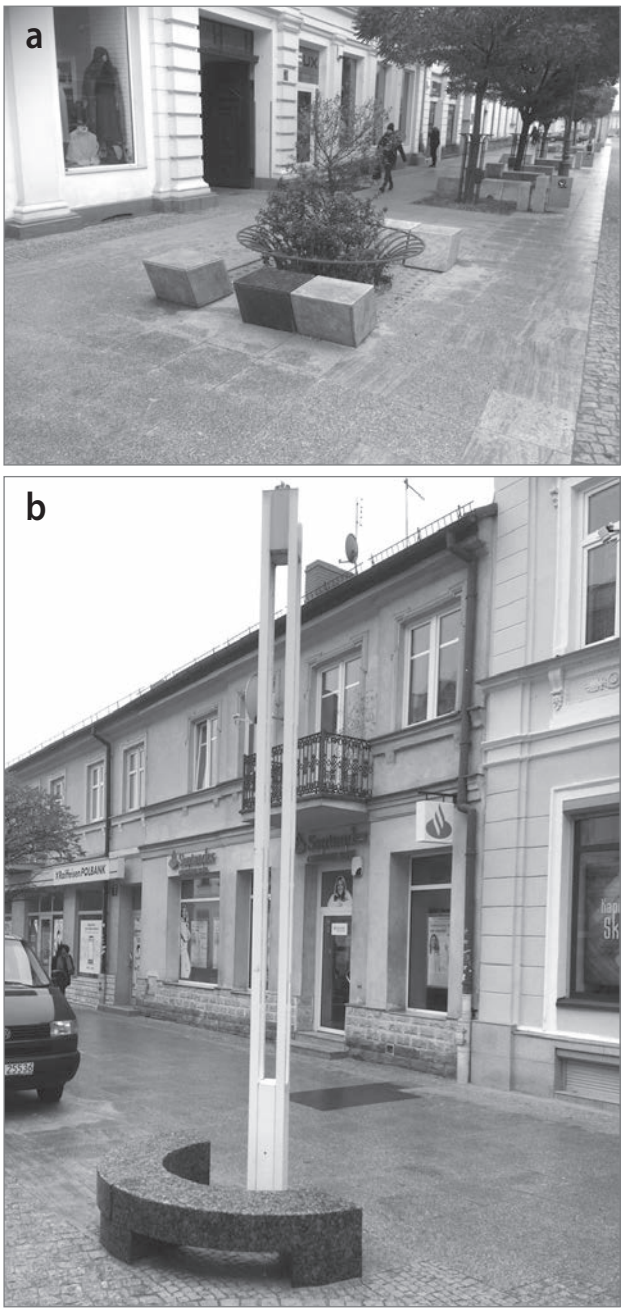
FS2: M: Hlad? Zakaj ga čutite? Od kod prihaja?
S5: Mislim, da iz materialov, iz katerih je ulica zgrajena.
S2: Ja!
S5: Točno tako. Ti tlakovci ...
S1: Te kamnite klopi.
S6: Vse je tako hladno.
S1: Kamniti oglasni stebri. O tem govorite?
S5: Ja. Vse je tako ... Ni nobene spontanosti.

Zdi se, da zlasti ulična oprema in tlakovci pri vprašanih vzbujajo zelo močne občutke. Vidik, ki je pritegnil njihovo posebno pozornost, je različna površina ulice, z gladkimi ploščami ob straneh in neravnimi tlakovci v sredini. Poleg tega, da jo vprašani občutijo kot hladno, jo zaznavajo tudi kot neudobno in nefunkcionalno. Zanimivo je, da so sodelujoči v raziskavi svoje občutke opisovali z izrazi, ki so poudarjali spolzkost ali neenakomernost talne površine.

FS2: S4: Površina ni v redu. Ni ravna. Ko se mi mudi z avtobusa v službo in hodim hitro, je na teh tlakovcih težko. Zlasti ko je spolzko.
M: Sestavljena je iz različnih delov.
S2: Ja. In ko hodim, raje hodim ...
S1: Ob strani, ker je lažje.
S2: Tako je, ker so v sredini tako veliki tlakovci. Priznam pa, da se po sredini vozim s kolesom, ker je tam manj ljudi.
S7: [Robovi] so pozimi spolzki. Pozimi se je bolje držati sredine.

Sodelujoči v raziskavi so opozorili še na kamnito in hladno ulično opremo. Navedene čutne zaznave nakazujejo, da po mnenju ljudi ulična oprema ne opravlja svoje vloge. Vprašani so najpogosteje omenjali klopi, na katerih naj bi sedeli, počivali in se pogovarjali, po njihovem mnenju niso samo neudobne, ampak tudi nefunkcionalne. Opisali so jih kot uporabniku neprijazne in poudarili, da pozimi postanejo še hladnejše, poleti pa še bolj vroče.

FS1: S1: Gole so. Povsod je samo kamen, ki je zelo neprijazen, saj so ta sedišča ...
S7: Popolnoma nefunkcionalna.
S2: Ne spodbujajo te k temu, da nanje sedeš ne poleti ne pozimi, ker so ali prevroča ali premrzla.




**Sliki 5a in 5b:** Klopi na Tumski ulici (foto: Michal Nowosielski)

## 6.2 Vidno zaznavanje krajine

Poleg občutka hladnosti so sodelujoči v raziskavi pogosto omenjali občutek praznosti in opustelosti. Večina je medtem, ko si je zamišljala, da hodi po ulici, navajala, da ni tam nikogar drugega.

FS1S5: Praznost. Na žalost nisem videl nikogar, ki bi šel mimo mene.
FS2S1: Na Tumski ni ljudi.

Nekateri sodelujoči v raziskavi praznosti niso povezovali z družbenimi dejavniki (da ni ljudi), ampak z arhitekturno obliko ulice. Spet se je omenjala kamnitost, poleg pomanjkanja dreves in splošnega občutka praznosti ulice.

FS1S4: Kamnita puščava, to je moja prva asociacija.

## 6.3 Slušno zaznavanje krajine

Sodelujoči v raziskavi so pogosto povezovali občutek hladu in praznosti, pri čemer so nekako poskušali pojasniti enega v povezavi z drugim. Poleg tega so omenjali še en občutek, ki močno vpliva na vzdušje na ulici: tišino. Pri tem so vprašani govorili predvsem o tem, da ni običajnega uličnega hrupa.

FS2S4: Mislim, da hlad ulice ... izvira iz dejstva, da preprosto na njej ni ljudi, da je tako prazna in opustela, ko se po njej sprehodiš.
FS2S7: Verjetno je to najpomembnejše ... Na splošno ni ljudi, ni tega utripa in uličnega hrupa, zaradi katerega bi ulica takoj postala prijetnejša.

## 6.4 Vohalno zaznavanje krajine

Zadnja in najmanjkrat omenjena čutna zaznava je bil vonj. Nekateri vprašani so pri tem, ko so si zamišljali, da hodijo po ulici, poročali o tem, da zaznavajo neprijeten vonj po dimu iz peči, te namreč nekatera gospodinjstva uporabljajo za ogrevanje.

FS2S5: Zadušljiv dim iz dimnikov. Zelo neprijeten občutek.

## 6.5 Vzdušje na Tumski ulici, kot se ga spominjajo ljudje

Nekateri sodelujoči v raziskavi so svoje današnje neprijetne občutke primerjali s spomini na čase, ko so bili ti dosti prijetnejši. Pogosto so primerjali hlad s toploto in praznost s prijetnim občutkom družabnosti. Eden izmed vprašanih je razliko med nekdanjo in sedanjo Tumsko ulico primerjal z razliko med živim in mrtvim.

FS1S4: Še vedno se spominjam nekdanje Tumske. Bila je povsem drugačna. Seveda je bila zanemarjena in ni bila lepa. Bila je malo za časom, kot da bi bila iz nekega drugega obdobja, a je imela neko posebno vzdušje. Vzdušje na njej je bilo povsem drugačno. Na njej so rasla velika, lepa, zelena drevesa z velikimi krošnjami. Vmes so bile niše s klopmi, kamor si se lahko usedel. Ljudje so si kupili tortico ali sladoled in se tam ustavili ali pa so se usedli in se pogovarjali. Različni ljudje – ne samo izobraženci, ampak tudi navadni ljudje, ki so živeli v bližini. Tumska je takrat preprosto živela.

**Slika 6:** Opustela Tumska ulica (foto: Michal Nowosielski)

**Slika 7:** Tumska ulica pred revitalizacijo (foto: Mariusz Kucharczyk)

Ko so bili udeleženci raziskave vprašani, kdaj se je po njihovem mnenju zgodila ta sprememba, so vedno poudarili, da po revitalizaciji. Zaradi prenove naj bi se spremenila narava ulice, ki je postala neprijazna pešcem. Zanimivo je, da se je nova, bolj estetska oblika ulice izkazala za čustveno manj sprejemljivo. Vprašani so pogosto poudarili, da je bila celotna prenova Tumske ulice bolj umetniška vizija arhitekta kot pa odgovor na družbene potrebe in pričakovanja.

FS1S2: Šokiran sem bil, ko sem videl Tumsko po prenovi. Ali si opazil? Nekoč je bila polna dreves, tako da sploh nisi mogel videti nič drugega, če si nanjo ...
S4: Pogledal ...
S2: Točno. Po prenovi pa sem enkrat pogledal tja in videl, da je vse prazno.
FS1S6 Mislim, da je problem pristop, ki ga je arhitekt uporabil ... Kot da bi stanovanje opremil v zelo sodobnem slogu, vendar je to storil samo zase, da bi izpolnil vizijo, ki jo je imel v mislih. To mu je pomagalo pri karieri in za projekt je celo prejel nagrade, vendar s tem ni pomagal nikomur drugemu.

Izjavam, v katerih so sodelujoči v raziskavi opisovali negativne občutke v povezavi s prenovo, so običajno sledile splošnejše

**Slika 8:** Pogled na Tumsko ulico (foto: Michał Nowosielski)

opazke glede tega, komu naj bi bili ulica in njena prenova namenjeni. Pri tem so vprašani znova omenjali močne negativne občutke, ki jih je v njih vzbujala prenova. Prenovljeno Tumsko ulico namreč dojemajo kot razčlovečeno, neprijazno in celo neprimerno za življenje, zaradi česar se na njej zadržujejo samo, če je to res nujno. Tumska ulica se tako uporablja samo kot povezava z drugimi ulicami in mestnimi prostori.

FS1S4: Komu naj bi bila namenjena? Mesto je namenjeno njegovim prebivalcem. Mesto je namenjeno nam in moralo bi biti funkcionalno in prijazno ter spodbujati bi moralo preživljanje časa na prostem. Tumska ulica še zdaleč ni takšna, ljudi celo odbija. Vsi komaj čakajo, da jo prečkajo in zapustijo.
FS1S4: Tumska je preprosto hladna, kamnita, razčlovečena, neprijazna pešcem ... Ni primerna za življenje.
FS1S7: Ulica se uporablja samo kot prehod.

## 7 Razprava

Kot predpostavlja Thibaud (2015: 42), bi se moralo oblikovanje osredotočati na občutke in vzdušje, pri čemer *naš namen ni preoblikovati samo svet grajenih objektov, ampak tudi svet ozračja in zaznavnega vzdušja*. Tovrstna naloga pa zahteva osredotočenost na občutke, ki jih vzbujajo javni prostori in se vzbujajo na javnih prostorih. Zlasti težavna je pri prenovi javnega prostora, kot je na primer glavna ulica, ki ima velik družben in čustven pomen. Arhitekt mora namreč upoštevati tako pričakovanja odločevalcev kot močno uveljavljena mnenja in občutke, ki so jih prebivalci oblikovali na podlagi dolgoletnih osebnih izkušenj.

Analiza raziskave s fokusnima skupinama kaže, da Tumska ulica pri udeležencih zbuja močne občutke v povezavi z vsemi štirimi proučevanimi vidiki: tipnim, vidnim, slušnim in vohalnim zaznavanjem krajine (glej Preglednico 1). Pri tipnem zaznavanju krajine so sodelujoči v raziskavi pri opisovanju splošnega vzdušja na ulici in njenih posameznih prvin govorili o hladu,

**Preglednica 1:** Zaznani občutki na Tumski ulici in vrste senzoričnega zaznavanja

| | Vrsta senzoričnega zaznavanja | | | |
|---|---|---|---|---|
| Opis občutka | Tipno | Vidno | Slušno | Vohalno |
| | Hlad | Praznost | Tišina | Preveč dima |
| | Spolzkost | Opustelost | Brezšumnost | Smrad |
| | Neravnost | | | |
| | Neprijaznost uporabniku | | | |

ob tem pa so omenjali tudi spolzka in neravna tlakovana tla ali uporabniku neprijazno ulično opremo. Pri vidnem zaznavanju krajine so opisovali občutke praznine in ulico primerjali s puščavo, pri slušnem zaznavanju krajine so omenjali pomanjkanje običajnega uličnega hrupa, pri vohalnem zaznavanju krajine pa so poudarjali vonj po dimu.

Vsi štirje vidiki oblikujejo hladno, kamnito in razčlovečeno vzdušje in senzorično zaznavanje današnje Tumske ulice. Tovrstni občutki pa se še okrepijo ob spominih na nekdaj toplo, obljudeno ulico, ki je vzbujala pozitivna čustva. Zdi se, da navedeno potrjuje domnevo Paula Rodawaya (1994), da se zaznavanje ne nanaša samo na sprejemanje informacij, ampak tudi na miselne uvide, sestavljene iz senzoričnih informacij, spominov in pričakovanj. Zaradi nasprotja med pozitivno podobo nekdanje Tumske ulice in precej negativnim doživljanjem njene sedanje podobe je senzorično zaznavanje ulice tako zelo negativno – verjetno še bolj, kot bi pričakovali na podlagi njene objektivne oblike. Primer Tumske ulice v Plocku poleg tega kaže, kako lahko prenova, katere cilj je revitalizirati pomemben javni prostor, povzroči nepričakovane in nezaželene posledice s tem, ko nepopravljivo okrni ulično vzdušje. Prostorske spremembe, ki jih je povzročila prenova, med prebivalci vzbujajo močne negativne občutke, ki jih opisujejo na podlagi intenzivnih čutnih zaznav.

Zaznave uličnega vzdušja in občutki prebivalcev kažejo, da posledice prenove niso omejene samo na psihološke ali čustvene vidike. Kot navajata Kalyani Wankhede in Amit Wahurwagh (2016), pozitivne in negativne čutne zaznave mestnih prostorov močno vplivajo na kakovost javnih krajev. Zaradi njih lahko začnejo ljudje tudi sebe drugače dojemati v tem prostoru (npr. da pripadajo ali ne pripadajo kraju, da so na pravem ali napačnem kraju itd.), poleg tega lahko vplivajo na njihove odločitve glede njegove uporabe. Če je vzdušje na ulici negativno ali če ulica vzbuja neprijetne občutke, se spremenijo tudi aktivnosti, ki jih prebivalci na njej izvajajo, pri čemer jo uporabljajo samo, če je to res nujno. Če uporabimo besede Jana Gehla (2010), se Tumska ulica uporablja samo za nujne, funkcionalne aktivnosti ali aktivnosti, v katere so ljudje prisiljeni (tj. kot povezovalna ulica z drugimi ulicami ali pomembnimi mestnimi prostori). Hkrati so druge, manj nujne aktivnosti (npr. rekreacija in druženje z drugimi) močno omejene.

# 8 Sklep

Pri oblikovanju ali preoblikovanju javnih prostorov je treba vedno upoštevati, da dobro načrtovani in oblikovani prostori ljudi spodbujajo, da se družijo z drugimi zunaj svojega doma, saj pri njih vzbujajo pozitivne občutke, medtem ko slabo oblikovani prostori pri ljudeh vzbujajo negativne občutke in jih odvračajo od druženja zunaj. Izsledki raziskave potrjujejo, da so pri tem ključne čutne zaznave. Pri načrtovanju revitalizacije ali prenove se je zato treba nasloniti na raziskave senzoričnega zaznavanja, ki upoštevajo vse vrste čutnih zaznav ter spomine in pričakovanja prebivalcev. Tovrstne raziskave so lahko v pomoč pri odločanju (Battistini in Mondino, 2017; El-Sayyad, 2019). Hkrati se je pomembno zavedati vrzeli med značilnimi ukrepi strokovnjakov (npr. arhitektov), ki temeljijo na estetskih in funkcionalnih merilih, ter ljudskimi ukrepi prebivalcev, ki se bolj osredotočajo na občutenje prostora in uglašenost z njim. Izsledki raziskave kažejo, da je treba upoštevati oboje. Prejšnje študije razkrivajo, da obstajajo primeri revitalizacije, pri katerih je bila upoštevana pomembna vloga čutnih zaznav (Degen, 2004; Brown, 2012; Henshaw, 2013).

Primer, predstavljen v tem članku, kaže, da so lahko vzdušje, občutki in čutne zaznave uporabni raziskovalni kazalniki na področju sociologije doživljanja mesta in lahko pomagajo razumeti, kako ljudje dobro sprejemajo javni prostor. Treba pa bi bilo opraviti širše raziskave z več primeri in raznimi raziskovalnimi metodami. Čeprav se je raziskava s fokusnima skupinama v tem primeru izkazala za učinkovito orodje, bi jo bilo treba v nadaljnjih raziskavah podpreti z drugimi tehnikami, vključno s posebno metodologijo, ki bi temeljila na senzoričnih sprehodih (vohalnih, slušnih sprehodih itd.), zapisovanju zaznav in interpretacij zaznanih občutij ter izdelavi senzoričnih zemljevidov (El-Sayyad, 2019). Z navedenim postopkom bi pridobili pomembne informacije o čutnem zaznavanju javnega prostora, na podlagi česar bi ga lahko ustrezno oblikovali ali preoblikovali.

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# Uporaba analitičnega hierarhičnega procesa za vrednotenje trajnostnih dejavnikov pri načrtovanju in upravljanju povodij

Čedalje večja rast prebivalstva in gospodarski razvoj povzročata onesnaženje vodnih virov in slabšanje njihovega ekološkega stanja. Eden izmed pristopov k reševanju tega problema zajema trajnostno upravljanje in načrtovanje povodij. V skladu z mednarodnimi sporazumi o varovanju povodij je Turčija začela temeljito spreminjati proces upravljanja in načrtovanja povodij. Trajnostno upravljanje vodnih virov, ki vključuje razne gospodarske, socialne in ekološke vidike, pa ni preprosto. V članku so trajnostni kazalniki razvrščeni po pomembnosti z vidika zagotavljanja dolgoročne vzdržnosti vodnih virov, za vrednotenje trajnostnih dejavnikov pri načrtovanju vodnih virov in povodij pa je uporabljena metoda analitičnega hierarhičnega procesa. Ob upoštevanju, da imajo lahko različni strokovnjaki različna mnenja, sta izbrane dejavnike ovrednotili dve skupini anketirancev (tj. univerzitetni učitelji in drugi strokovnjaki), izsledki raziskave pa so pokazali stopnjo ujemanja med njihovimi pogledi. Skupini sta podobno ovrednotili družbene, upravljavske in gospodarske dejavnike, glede dejavnikov rabe zemljišč in ekoloških dejavnikov pa so se njihova mnenja močno razlikovala. Izsledki raziskave kažejo, da bi bilo treba za oblikovanje ustreznega modela vrednotenja vodnogospodarskih načrtov povodij najprej ugotoviti in uskladiti nasprotujoča si mnenja različnih strokovnjakov.

**Ključne besede:** načrtovanje povodij, trajnostno upravljanje voda, analitični hierarhični proces, Turčija

## 1 Uvod

Porečja ali povodja imajo ključno vlogo pri oskrbi z vodo, prečiščevanju vode ter obvladovanju poplav in erozije. Hitra urbanizacija, rast prebivalstva in vse večje potrebe po družbenogospodarskem razvoju čedalje bolj obremenjujejo sladkovodne vire in povzročajo propadanje mokrišč (Kennedy idr., 2012). Zaradi okoljskih problemov, povezanih s porabo in onesnaženostjo vode ter podnebnimi spremembami, je trajnostno upravljanje voda postalo eden najpomembnejših ciljev trajnostnega razvoja (Združeni narodi, 2014). Cilj vodnogospodarskih načrtov povodij je izboljšati upravljanje in izvedbo programov trajnostnega razvoja vodnih virov (Chandniha idr., 2014), oblikovani in vodeni pa so tako, da vodni viri postanejo bolj prilagodljivi, robustni in odporni proti negotovi in spreminjajoči se prihodnosti (Loucks in Beek, 2017).

Pri zgodnjih metodah trajnostnega upravljanja voda je bil poudarek na raznih indeksih in kazalnikih, ki so se nanašali na večdimenzionalne gospodarske in okoljske vidike (WCED, 1987; Basiago, 1999). Kot to navajajo Brooks idr. (2013), je upravljanje povodij proces urejanja rabe zemljišč in drugih virov v povodju, katerega namen je zagotoviti želene proizvode ali storitve brez negativnega vplivanja na prst in vodne vire. Upravljanje povodij vključuje dodeljevanje vodnih virov različnim uporabnikom in za različne namene, pri čemer se je treba odločati med okoljskimi cilji in človeškimi potrebami (Barrow, 1998; Molle, 2006). Loucks in Gladwell (1999) sta predstavila kriterije, pomembne za zagotavljanje trajnosti vodnih virov, ti so vodna infrastruktura, kakovost okolja, ekonomija in finance, ustanove in družba, človeško zdravje in blagostanje ter načrtovanje in tehnologija. Cilj upravljanja povodij je obvladovati ali odpraviti probleme, kot so suše, poplave in čezmerno onesnaževanje, ki so posledica kmetijske dejavnosti in neustrezne rabe zemljišč v porečjih, ter izboljšati kakovost vode in okrepiti vodne ekosisteme (Loucks in Beek, 2017). Mays (2006) je predstavil sedem zahtev, ki morajo biti izpolnjene za zagotavljanje trajnostnega razvoja vodnih virov, te so osnovna vodna oskrba za zagotavljanje zdravja ljudi, osnovna vodna oskrba za zagotavljanje zdravja ekosistemov, ustrezna kakovost vode, dolgoročna obnovljivost vodnih virov, razpoložljivost informacij o vodnih virih za vse sektorje, institucionalni načrti za reševanje sporov glede vode in participativno odločanje o zadevah, povezanih z vodno oskrbo. Trajnostno načrtovanje in upravljanje povodij pa je kompleksen proces, prepleten z družbenogospodarskimi, ekološkimi, okoljsko-upravljavskimi in tehnološkimi dejavniki (Lal idr., 2001; Crase in Cooper, 2015; Srinivas idr., 2018).

Od konca 19. stoletja se za zagotavljanje trajnostnega razvoja vodnih virov uporablja pristop celovitega upravljanja vodnih virov, ki združuje gospodarske, družbene in okoljske vidike (Internet 1; Kharrazi, 2016). Spodbuja usklajen razvoj in upravljanje voda, zemljišč in drugih virov ter s tem zagotavlja čim bolj enakomerno porazdelitev posledične ekonomske in socialne blaginje brez ogrožanja trajnosti ključnih ekosistemov (Global Water Partnership, 2000). Omenjeni pristop je večdimenzionalen, saj vključuje t. i. trajnostni trikotnik (gospodarstvo, okolje in družba), zakonodajo in zdravstvena vprašanja, tehnologijo, institucionalne in politične zadeve ter zgodovinska in kulturna vprašanja (Thomas in Durham, 2003).

Drug pristop, ki spodbuja trajnostni razvoj vodnih sistemov, je ocena ranljivosti vodnih virov. Na ranljivost vodnih virov vplivajo naravni (fizični in ekološki), gospodarski in družbeni dejavniki ter pristojne ustanove in upravljanje, iz rezultata njenega proučevanja pa je razvidno, koliko lahko človeška dejavnost in naravni dogodki škodujejo vodnemu sistemu. Poleg tega na podlagi rezultata proučevanja ranljivosti določimo stopnjo občutljivosti vodnega vira na podnebne spremembe, poplave, suše, pomanjkanje vode, onesnaženost vode ipd. Bolj ko navedeni pojavi poškodujejo vodne vire, težje je te vodne vire dolgoročno vzdrževati. Dejavnike ranljivosti vodnega vira lahko razdelimo v štiri skupine: fizične, gospodarske, družbene in okoljske (Füssel, 2007, navedeno v Ide idr., 2019). Ta rezultat proučevanja ranljivosti omogoča boljše razumevanje značilnosti vodnih virov in zagotavlja znanstveno podlago za odločitve pri načrtovanju in upravljanju vodnih virov (Ide idr., 2019). Ta ranljivost se lahko proučuje z dvema kvantitativnima metodama: s funkcijsko metodo, ki se osredotoča na značilnosti fizičnega mehanizma ranljivosti vodnih virov, in z indeksno metodo, ki se osredotoča na količino vodnih virov in kakovost vode (Chen idr., 2018). Indeksna metoda vključuje te štiri glavne korake: izbor, določanje uteži, normalizacijo in agregacijo dejavnikov (Ide idr., 2019).

Z vidika načel trajnostnega razvoja oba navedena pristopa k načrtovanju in upravljanju povodij vključujeta pet področij načrtovanja: ekološko načrtovanje, katerega cilj je ohraniti mokrišča, načrtovanje rabe zemljišč in infrastrukture, katerega namen je vzpostaviti ustrezno vrsto rabe zemljišč v povodju (Kirby in White, 1994), družbeno načrtovanje, katerega namen je spodbuditi družbene spremembe in izboljšati življenjske razmere (Keating, 1993; Basiago, 1999), gospodarsko načrtovanje za povečanje gospodarskih koristi, ki jih zagotavlja celotno povodje (Cox, 1987), in upravljavsko ali upravno načrtovanje, katerega cilj je določiti institucionalno zgradbo in metode sodelovanja za uresničevanje zahtev načrta (Kirby in White, 1994; Mencio idr., 2010).

V Turčiji se vodne potrebe prebivalcev, kmetijstva, industrije in energetike od druge polovice 20. stoletja večajo, kar čedalje bolj obremenjuje vodne vire. Do osemdesetih let 20. stoletja se je

pri upravljanju voda upoštevala samo količina vode, načrti so se izdelovali samo za posamezne vrste rabe in težave so se reševale posamično. Nato so odgovorni organi sprejeli številne zakone in predpise za varovanje vodnih virov, na področju njihovega upravljanja pa se je uveljavil celovit pogled na kakovost vode. Poleg tega je Turčija podpisala več mednarodnih sporazumov in deklaracij, povezanih z vodnimi vprašanji ter načrtovanjem in varovanjem povodij v državi. Od leta 2005 država sodeluje v pristopnih pogajanjih z EU in si prizadeva izpolnjevati zahteve iz okvirne direktive o vodah – tj. najpomembnejše okoljske direktive, ki jo je Evropska komisija sprejela leta 2000. Omenjena direktiva poudarja pomen tako količine kot kakovosti vode, vzpostavlja celovit upravljavski pristop, ki temelji na povodjih, in določa okvir za varovanje vseh voda (obalnega morja, površinskih voda, somornic in podzemne vode) razen morij (Bilen, 2008). V skladu z evropsko direktivo o vodah in celovitim upravljanjem vodnih virov je Turčija tako uvedla številne spremembe pri upravljanju in načrtovanju povodij.

Zdi se, da Turčija nujno potrebuje model vrednotenja dejavnikov, ki imajo pomembno vlogo pri načrtovanju povodij ter omogočajo celovit in trajnosten načrtovalski in upravljavski pristop. V Turčiji je 25 povodij z različnimi geografskimi, fizikalnimi in hidrološkimi značilnostmi. Ministrstvo za gozdarstvo in vode, ki je odgovorno za upravljanje povodij, je leta 2013 začelo pripravljati upravljavske načrte za varovanje vodnih teles, ti načrti temeljijo na povodjih ter se osredotočajo na varovanje in ohranjanje površinskih voda in podtalnice, na njihove kemijsko-fizikalne značilnosti in ekološko stanje ter na količino vode. Turčija je poleg tega začela pripravljati vodnogospodarske načrte za vire pitne vode, pri čemer razvija predpise in politiko varovanja virov pitne vode. Čeprav je pri upravljanju povodij dosegla že pomembne rezultate, kot je povečano število čistilnih naprav (Türkiye Cumhuriyeti Kalkınma Bakanlığı, 2014), upravno sodelovanje in primerne raziskave kakovosti, ekosistemskih storitev in krajinskih značilnosti povodij (Tezer idr., 2018), mora na nekaterih drugih področjih, kot so javna participacija, decentralizacija uprave, vodna politika, predpisi in tehnologija, potrebna za ekološko recikliranje ter merjenje in nadzor kakovosti vode, poskrbeti za izboljšave. Cilj članka je zato ovrednotiti glavne trajnostne dejavnike pri načrtovanju upravljanja povodij ter analizirati in primerjati mnenja univerzitetnih učiteljev in drugih strokovnjakov, zaposlenih v vodnogospodarskih ustanovah, o pomembnosti posameznih načrtovalskih dejavnikov pri upravljanju povodij. Na podlagi rezultatov bo lažje razumeti različne poglede teh dveh skupin anketirancev na trajnostne dejavnike in proučiti morebiten vpliv razlik v njihovih vrednotenjih načrtovalskih kriterijev na trajnostni razvoj povodij.

# 2 Metode

## 2.1 Raziskovalni cilji

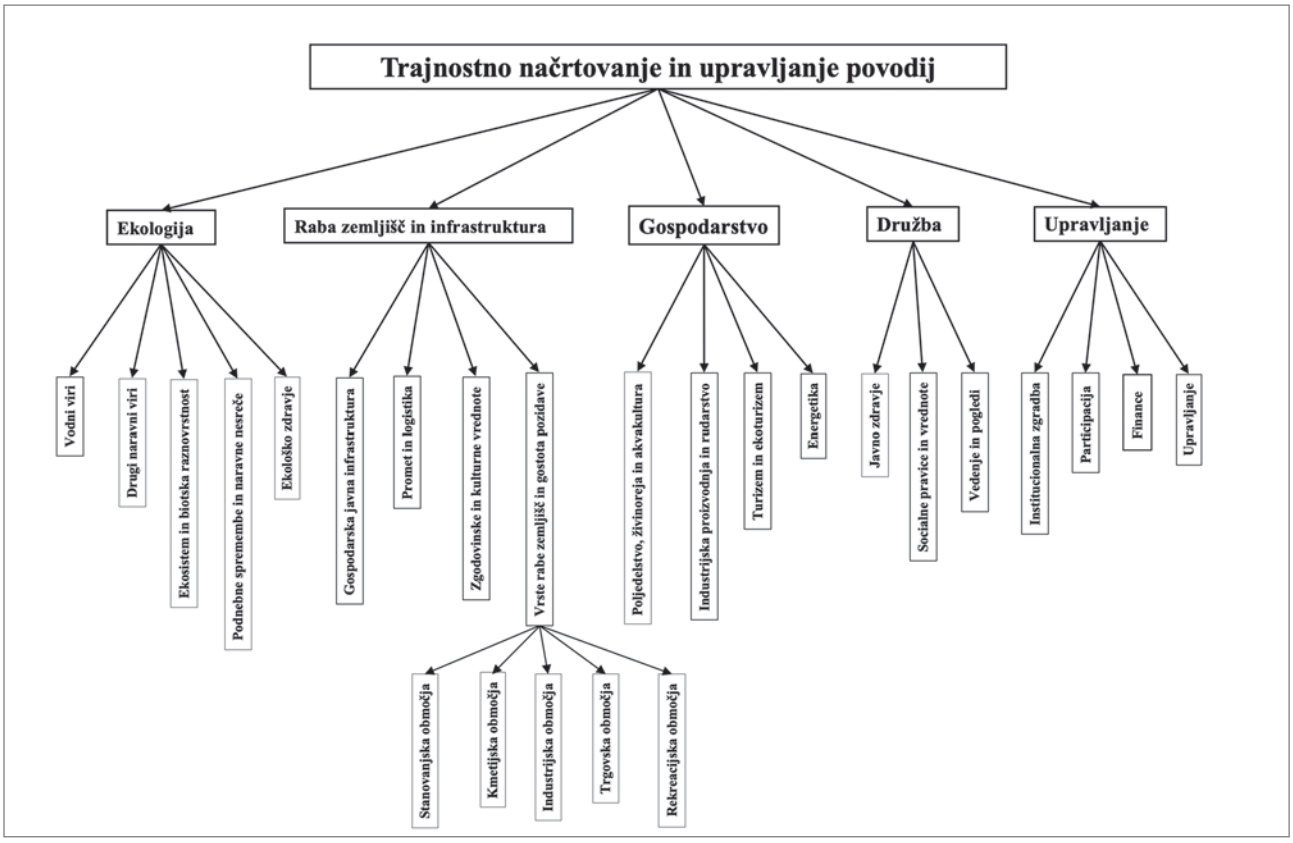
Glavni cilj raziskave je bil oblikovati model vrednotenja trajnostnih kazalnikov pri načrtovanju in upravljanju vodnih virov. Njeni avtorji so poskušali na podlagi strokovnih mnenj določiti povezave med spremenljivkami trajnosti povodij. Predvidevali so, da se lahko odločitve in mnenja univerzitetnih učiteljev (nosilcev znanja) in drugih strokovnjakov (ki imajo praktične izkušnje s področja načrtovanja in upravljanja vodnih virov) razlikujejo. Preden se oblikuje model vrednotenja kriterijev trajnosti povodij, je bilo zato treba razumeti nasprotujoča si mnenja strokovnjakov. V članku so najprej na podlagi pregleda literature določeni glavni kriteriji in kazalniki, nato pa je oblikovana hierarhija kazalnikov z vidika trajnostnega upravljanja in načrtovanja povodij. Sledi kvantitativno vrednotenje izbranih dejavnikov z uporabo kvantitativne metode odločanja, tj. analitičnega hierarhičnega procesa, pri katerem so univerzitetni učitelji in drugi strokovnjaki z znanjem in izkušnjami s področja upravljanja povodij določili uteži dejavnikom in poddejavnikom načrtovanja povodij. Raziskava, predstavljena v tem članku, je temeljila na treh glavnih korakih: na oblikovanju hierarhije, določanju uteži trajnostnim kazalnikom in oblikovanju vprašalnika.

## 2.2 Oblikovanje hierarhije

Za najpomembnejšo enoto upravljanja vodnih območij so bila določena povodja, ki vključujejo vodo v rekah, vodonosnikih in (umetnih) jezerih ter obsegajo najrazličnejšo rabo zemljišč, od gozdov in kmetijskih površin do predmestij in mest. Povodje ni samo hidrološka enota, ampak tudi družbenopolitična entiteta, ki ima pomembno vlogo pri zagotavljanju hrane in gospodarske varnosti ljudem, ki živijo na zadevnem območju (Wani idr., 2008). Voda v povodjih je ključna za oskrbo gospodinjstev, industrije in kmetijstva (New York State Department of State, 2009), upravljanje in načrtovanje povodij pa vpliva na ljudi in domače živali, ki na njih živijo. Da bi oblikovali jasen okvir trajnostnega razvoja povodij, so avtorji v raziskavi določili glavna področja, dejavnike in poddejavnike trajnostnega upravljanja in načrtovanja povodij (glej Sliko 1).

Določenih je bilo teh pet glavnih vidikov ali področij trajnostnega načrtovanja in upravljanja povodij:

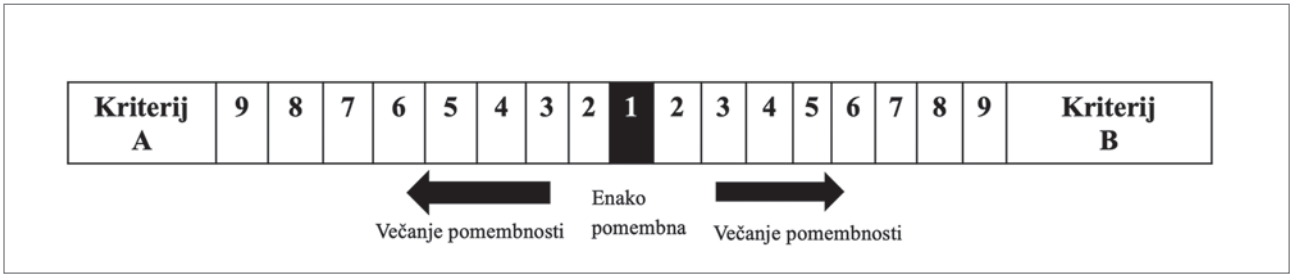
- ekologija: trenutno uporabo posameznega vodnega vira bi bilo treba upravljati tako, da se ohranjajo najpomembnejši ekološki sistemi in se zagotovi, da bodo lahko isti vir uporabljale tudi prihodnje generacije (Jønch-Clausen in Fugl, 2001). Glavni kazalniki okoljske trajnosti, določeni v tej raziskavi, so vodni viri (Ouyang, 2012), drugi




**Slika 1:** Pet glavnih področij trajnostnega upravljanja in načrtovanja vodnih virov z dvajsetimi dejavniki in petimi poddejavniki (ilustracija: avtorji)

naravni viri (zrak, prst in gozdovi), okoljski problemi – npr. podnebne spremembe (Räsänen idr., 2017) in naravne nesreče –, ekosistem in biotska raznovrstnost (Arthington idr., 2009) ter ekološko zdravje;

- raba zemljišč in infrastruktura: to področje se nanaša na zahteve po uporabi ustreznih fizikalnih ved in tehnologije pri načrtovanju povodij, na podlagi česar se uskladijo nasprotujoči si interesi različnih vrst rabe zemljišč. Zagotavljati trajnost grajenega okolja pomeni ohranjati človeške vire in tehnologijo v daljšem obdobju (Yang idr., 2016). V to kategorijo spadajo zanesljivost, zmogljivost in stopnja obnove infrastrukture, promet in logistika, zgodovinske in kulturne vrednote ter raba zemljišč in gostota pozidave;
- družba: zaradi rasti prebivalstva in družbenogospodarskega razvoja potrebe po vodi nenehno naraščajo, s tem pa se veča tudi obremenjenost vodnih virov in nevarnost pomanjkanja vode (Zhou idr., 2018). V načrtovalskem procesu je treba v ospredje postaviti temeljno človekovo pravico dostopa do vode ustrezne količine in kakovosti, da se ohranjanja dobro počutje ljudi (Shen idr., 2011). To področje se nanaša na predpise, ki podpirajo družbene spremembe in boljše življenjske razmere, pri čemer morajo upoštevati, kaj ljudje od povodja potrebujejo. V tem članku so kot glavni družbeni dejavniki trajnostnega upravljanja in načrtovanja povodij določeni socialne pravice in vrednote, javno zdravje in vedenje prebivalcev (preference in mnenja);
- gospodarstvo: namen tega načrtovalskega področja je čim bolj povečati gospodarske koristi, ki jih zagotavlja celotno povodje, in zagotoviti, da so pri njegovem načrtovanju in upravljanju stroški in koristi enakomerno porazdeljeni (Cox, 1987). Razvoj poljedelstva, živinoreje in akvakulture (kot primarnih gospodarskih virov), energetika, turizem, razvoj industrije in rudarstva ter trgovske dejavnosti so bili prepoznani kot pomembni dejavniki izboljšanja gospodarstva celotnega povodja (Jønch-Clausen in Fugl, 2001; Shen idr., 2011);
- upravljanje: cilj tega področja je zagotoviti neprekinjen dolgoročni nadzor nad načrtovanjem povodij. Zahteva vključenost najrazličnejših inženirjev pod neposrednim nadzorom vodstvenega osebja (Kirby in White, 1994) ter zajema predpise, ki se nanašajo na institucionalno zgradbo (institucionalno povezanost in zmogljivost; Dinar idr., 2007; Belay idr., 2010), participacijo javnosti in deležnikov, upravljavske tehnike in orodja ter finance in javna sredstva na področju načrtovanja in upravljanja vodnih virov.




**Slika 2:** Lestvica pomembnosti pri parni primerjavi kriterijev (A in B) (vir: Saaty, 1994)

## 2.3 Določanje uteži trajnostnim kazalnikom

Avtorji so za proučevanje povezav med trajnostnimi dejavniki uporabili metodo analitičnega hierarhičnega procesa (v nadaljevanju: AHP), pri čemer so vsakemu kriteriju trajnostnega upravljanja in načrtovanja povodij dodelili numerično vrednost. AHP, ki ga je v sedemdesetih letih 20. stoletja razvil Thomas L. Saaty, je metoda večkriterijskega odločanja, ki omogoča boljše vrednotenje subjektivnih kriterijev načrtov povodij. Uporablja se na najrazličnejših področjih, na primer za določanje uteži glavnim gonilom urbane rasti (Thapa in Murayama, 2010), razvrščanje dejavnosti, ki podpirajo razvoj podeželja, po pomembnosti (Oddershede idr., 2007), določanje glavnih kazalnikov trajnostnega razvoja mest (Michael idr., 2013) in vrednotenje fizičnih značilnosti pločnikov, ki lahko vplivajo na zadovoljstvo pešcev (Shafabakhsh idr., 2015). Poleg tega je bila navedena metoda v procesu upravljanja povodij uporabljena za izbiro primernega načina čiščenja odplak (Curiel-Esparza idr., 2014), upravnika javnega vodovodnega sistema (Ruiz-Villaverde idr., 2013) in primernih načinov upravljanja vodnih virov (Thungngern idr., 2017) ter analizo mnenj prebivalcev o uspešnem upravljanju voda (Yavuz in Baycan, 2013). S to metodo so avtorji tega članka po pomembnosti razvrstili vse dejavnike načrtovanja vodnih virov z vidika načel trajnostnega razvoja, izdelali parne primerjave vseh kriterijev in jih pretvorili v numerične vrednosti. Uporaba metode AHP v predstavljeni raziskavi je omejena na določanje uteži in vrednotenje načrtovalskih kriterijev, na podlagi česar so razvrščeni glede na pomembnost pri načrtovanju in upravljanju povodij.

## 2.4 Oblikovanje vprašalnika

Za izdelavo parnih primerjav je bil v aplikaciji Google Forms pripravljen spletni vprašalnik, ta je bil nato poslan univerzitetnim učiteljem in drugim strokovnjakom, ki so ovrednotili posamezne načrtovalske kriterije. Vzorec anketirancev je bil tako omejen na posameznike, ki imajo ustrezno znanje ali izkušnje s področja vodnogospodarskega upravljanja in načrtovanja. Na podlagi vprašalnika so bila pridobljena strokovna mnenja o pomembnosti načrtovalskih dejavnikov pri trajnostnem upravljanju in načrtovanju povodij. Strokovnjaki so s parnimi primerjavami določali, kako pomemben je prvi kriterij iz para glede na drugega, pri čemer so izbirali med naslednjimi možnostmi: enaka pomembnost, zmerna pomembnost, močna pomembnost, zelo močna pomembnost in izjemna pomembnost (Preglednica 1). Za določanje vrednosti primerjav je bila uporabljena lestvica od 1 do 9, pri čemer 1 pomeni, da sta kriterija enako pomembna, 9 pa, da je v matriki parnih primerjav en kriterij veliko pomembnejši od drugega (Slika 2).

**Preglednica 1:** Lestvica pomembnosti po metodi AHP

| Vrednost | Pomembnost |
|---|---|
| 1 | Enaka |
| 2 | Enaka do zmerna |
| 3 | Zmerna |
| 4 | Zmerna do močna |
| 5 | Močna |
| 6 | Močna do zelo močna |
| 7 | Zelo močna |
| 8 | Zelo močna do izjemna |
| 9 | Izjemna |

Vir: Saaty (1994)

Spletni vprašalnik je bil poslan 20 univerzitetnim učiteljem in 17 drugim strokovnjakom, zaposlenim na generalnem direktoratu za hidrotehnične objekte (DSI; 4 osebe), v istanbulskem javnem komunalnem podjetju (ISKI; 6 oseb) ali na turškem ministrstvu za gozdarstvo in vode (7 oseb). Univerzitetni učitelji so zastopali različna področja, kot so urbanistično in regionalno načrtovanje (6 oseb), krajinska arhitektura (7 oseb), gozdarstvo (6 oseb) in okoljsko inženirstvo (1 oseba). Drugi strokovnjaki pa so imeli diplomo (65 %) ali magisterij (35 %) iz enega od naslednjih področij: okoljsko inženirstvo (50 %), urbanizem (40 %) in gradbeništvo (10 %).

Parne primerjave spremenljivk na treh ravneh so urejene v kvadratno matriko. Diagonalni elementi matrike so enaki 1, kriterij v vrstici *i* pa je boljši kot kriterij v stolpcu *j*, če je vrednost obeh večja od 1. Drugače velja ravno nasprotno (Bhushan

**Preglednica 2:** Primer kvadratne matrike parnih primerjav treh podkriterijev

| | Podkriterij 1 | Podkriterij 2 | Podkriterij 3 | n-ti koren zmnožka vrednosti | Normalizirani lastni vektor |
|---|---|---|---|---|---|
| Podkriterij 1 | 1 | 2 | 8 | 2,51 | 0,594 |
| Podkriterij 2 | 1/2 | 1 | 6 | 1,44 | 0,341 |
| Podkriterij 3 | 1/8 | 1/6 | 1 | 0,275 | 0,065 |

Vir: Bhushan in Rai (2004)

in Rai, 2004; Preglednica 2). Z izračunom največje lastne vrednosti primerjalne matrike in njeno normalizacijo so avtorji določili relativno pomembnost različnih kriterijev. Lastni vektor so izračunali tako, da so zmnožili vse podatke v vsaki vrstici in nato izračunali *n*-ti koren tega zmnožka (enačba 1). Nato so *n*-te korene sešteli, končno vsoto pa uporabili za normalizacijo elementov lastnega vektorja, tako da je njihova vsota enaka 1,00 (Coyle, 2004). Elementom normaliziranega lastnega vektorja pravimo uteži (posameznega kriterija ali podkriterija).

Enačba 1: n-ti koren zmnožka podatkov =Π= √(n&a1a2a3a4…….)

(vir: Coyle, 2004)

V raziskavi je bilo uporabljeno programsko orodje Super Decision, ki omogoča primerno izvedbo metode AHP (tj. izračun podatkov in oblikovanje matrik). Program je leta 1996 s svojo ekipo razvil Thomas L. Saaty, da bi posameznikom pomagal sklepati racionalnejše odločitve. Avtorji so v program vnesli mnenja anketirancev, na podlagi česar so pridobili rezultate in določili stopnjo njihove občutljivosti, kar je potrdilo ali ovrglo veljavnost podanih odgovorov. Pri tem so v program vnesli povprečne vrednosti odgovorov iz vprašalnika, s čimer so določili končne uteži in normalizirane vrednosti. Tako so pridobili primerjalne matrike in diagrame s sprejemljivo stopnjo konsistentnosti (ki po Sattyju ne sme biti večja od 0,1).

## 3 Rezultati

Povprečne vrednosti odgovorov dveh skupin anketirancev (univerzitetnih učiteljev in drugih strokovnjakov) so bile primerjane in razvrščene po pomembnosti. Normalizirane uteži so povzete v Preglednici 3, ki vsebuje kvantitativne vrednosti za vsak kriterij glede na skupino anketirancev. Avtorji so predvidevali, da bodo pri primerjavah mnenj obeh skupin o glavnih načrtovalskih dejavnikih, ki spodbujajo trajnostno upravljanje povodij, rezultati pokazali jasne razlike in podobnosti. Pri razvrščanju štirih glavnih področij, ki jih je treba upoštevati pri trajnostnem upravljanju in načrtovanju povodij, sta obe skupini na prvo mesto po pomembnosti postavili ekologijo in upravljanje voda. Univerzitetni učitelji so za najpomembnejši dejavnik izbrali ekologijo (42 %), drugi strokovnjaki pa upravljanje voda (36 %). Univerzitetni učitelji so najmanjši pomen pripisali gospodarstvu (8 %), drugi strokovnjaki pa rabi zemljišč in infrastrukturi (5 %). To bi lahko bil tudi razlog za neusklajenost urbanizma in upravljanja povodij. Anketiranci so za tretji najpomembnejši dejavnik trajnosti povodij izbrali družbo.

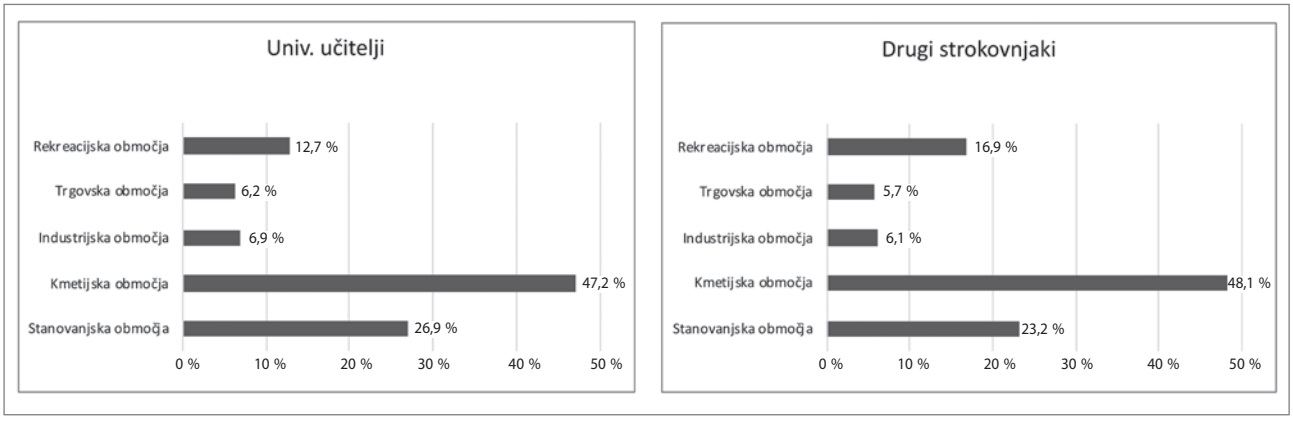
Pri določanju uteži ekološkim dejavnikom je med obema skupinama opazno precejšnje neskladje. Univerzitetni učitelji so največji pomen pripisali ekosistemskim funkcijam in biotski raznovrstnosti (28 %), vodne vire pa so po pomembnosti izenačili z drugimi naravnimi viri. Po mnenju drugih strokovnjakov pa so na področju ekologije najpomembnejši naravni viri (35 %) in ekološko zdravje (26 %). Zdi se, da so vrednotenja drugih strokovnjakov bolj logična glede na trenutne težave, povezane s kakovostjo vode in onesnaženostjo naravnega okolja v državi, hkrati pa kažejo, da so drugi strokovnjaki slabše seznanjeni s pomenom ekoloških funkcij in ekosistemskih ciklov v vodnem sistemu. Analize ekosistemskih storitev in funkcij v povodjih spadajo med najpomembnejše analize pri načrtovanju in upravljanju vodnih območij.

Pri rabi zemljišč in infrastrukturi so univerzitetni učitelji največji pomen pripisali raznim vrstam rabe zemljišč in gostoti njihove pozidave (51 %), drugi strokovnjaki pa so kot najpomembnejše ovrednotili zgodovinske in kulturne vrednote ter gospodarsko javno infrastrukturo (39 %). Po mnenju obeh skupin je promet najmanj pomemben. Glavna razlika med odgovori obeh skupin je bila pri dejavniku vrste rabe zemljišč in gostota pozidave, ki ga je kot pomembnega ovrednotilo samo 14 % drugih strokovnjakov. Z vidika vplivov rabe zemljišč na kakovost vode in okolje povodij sta pomemben del načrtovanja in upravljanja povodij tudi vrednotenje rabe zemljišč in ustrezno coniranje. Če odločevalci med načrtovalskimi dejavniki ne upoštevajo rabe zemljišč, lahko v povodjih ali porečjih nastanejo resne težave.

Pri določanju uteži gospodarskim dejavnikom sta imeli obe skupini podobna mnenja. Na prvo mesto sta postavili poljedelstvo, živinorejo in akvakulturo, sledili so

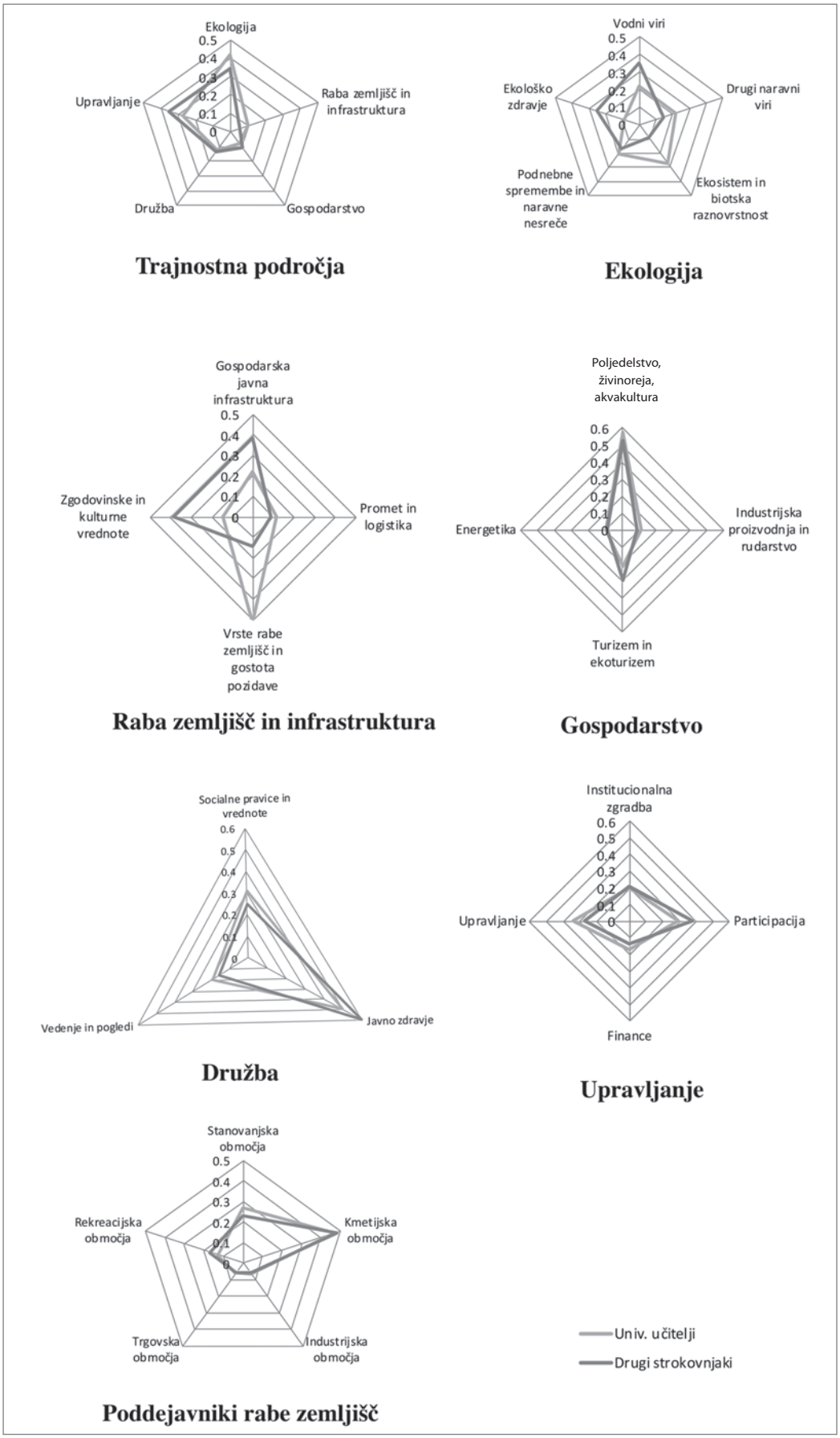
**Preglednica 3:** Normalizirane uteži in vrednosti glede na skupino anketirancev (univerzitetne učitelje in druge strokovnjake), pridobljene z metodo AHP

| Trajnostno področje | Uteži | | Dejavniki | Uteži | |
|---|---|---|---|---|---|
| | Univ. učitelji | Drugi strokovnjaki | | Univ. učitelji | Drugi strokovnjaki |
| Ekologija | 0,418 | 0,347 | Vodni viri | 0,220 | 0,349 |
| | | | Drugi naravni viri | 0,215 | 0,142 |
| | | | Ekosistem in biotska raznovrstnost | 0,275 | 0,086 |
| | | | Podnebne spremembe in naravne nesreče | 0,200 | 0,167 |
| | | | Ekološko zdravje | 0,090 | 0,256 |
| Raba zemljišč in infrastruktura | 0,102 | 0,052 | Gospodarska javna infrastruktura | 0,223 | 0,385 |
| | | | Promet in logistika | 0,114 | 0,087 |
| | | | Vrste rabe zemljišč in gostota pozidave | 0,514 | 0,143 |
| | | | Zgodovinske in kulturne vrednote | 0,149 | 0,385 |
| Gospodarstvo | 0,084 | 0,107 | Poljedelstvo, živinoreja, akvakultura | 0,578 | 0,528 |
| | | | Industrijska proizvodnja in rudarstvo | 0,112 | 0,081 |
| | | | Turizem in ekoturizem | 0,213 | 0,300 |
| | | | Energetika | 0,097 | 0,091 |
| Družba | 0,124 | 0,138 | Socialne pravice in vrednote | 0,311 | 0,249 |
| | | | Javno zdravje | 0,493 | 0,594 |
| | | | Vedenje in pogledi | 0,196 | 0,157 |
| Upravljanje | 0,273 | 0,356 | Institucionalna zgradba | 0,205 | 0,213 |
| | | | Participacija | 0,288 | 0,376 |
| | | | Finance | 0,169 | 0,137 |
| | | | Upravljanje | 0,338 | 0,274 |
| Skupaj | 1 | 1 | | 1 | 1 |




**Slika 3:** Primerjava odgovorov obeh skupin pri vrednotenju poddejavnikov rabe zemljišč pri načrtovanju povodij (ilustracija: avtorji)

turizem, industrijska proizvodnja in rudarstvo ter energetika. Drugi strokovnjaki so turizmu pripisali nekoliko večjo pomembnost (30 %) kot univerzitetni učitelji (21 %), za kar je razlog morda to, da imajo drugi strokovnjaki več izkušenj in informacij glede pozitivnih vplivov turizma na gospodarstvo v turških povodjih. Pri razvrščanju dejavnikov, povezanih z družbo, sta skupini kot najpomembnejše ovrednotili javno zdravje (50–60 %), nato socialne pravice in vrednote (25–31 %) ter nazadnje vedenje in poglede (16–20 %). Vrednotenja se zdijo zanesljiva, saj ima vsakdo pravico do dostopa do varne in čiste vode ter urejene kanalizacije. Čeprav je bil dejavnik javno vedenje ovrednoten kot najmanj pomemben, to še ne pomeni, da ga lahko pri projektih načrtovanja povodij preprosto prezremo. Tudi pri vrednotenju upravljavskih dejavnikov sta imeli skupini podobna mnenja. Za najpomembnejša dejavnika sta določili upravljanje in participacijo (34–38 %), in sicer je bil prvi najpomembnejši za univerzitetne učitelje, drugi pa za druge strokovnjake. Finance so oboji označili za najmanj po-




**Slika 4:** Primerjava odgovorov obeh skupin pri vrednotenju trajnostnih kriterijev načrtovanja in upravljanja povodij (ilustracija: avtorji)

membne pri trajnostnem upravljanju in načrtovanju povodij. Pri vrednotenju poddejavnikov rabe zemljišč na tretji ravni hierarhije trajnosti, opredeljeni v tej raziskavi, so bila mnenja obeh skupin usklajena. Kot je prikazano na sliki 3, sta največji pomen pripisali kmetijskim območjem (47–48 %), nato stanovanjskim (23–27 %) in rekreacijskim območjem (13–17 %) ter nazadnje trgovskim (6 %) in industrijskim območjem (7 %). Navedeno se zdi primerno, saj je kmetijstvo največji porabnik vode, stanovanjska območja pa so sestavni del povodij. Zaradi negativnih vplivov na vodne vire so trgovska in industrijska območja v načrtih povodij običajno zelo omejena, rekreacijske površine pa so na nekaterih območjih delno dovoljene glede na oddaljenost od vodnih teles.

Raziskava je dober primer uporabe AHP za vrednotenje trajnostnih kazalnikov. Metoda AHP je poleg tega uporabljena za ugotavljanje nasprotujočih si mnenj glede upravljanja in načrtovanja povodij, kar je edinstven način njene uporabe. Kot interdisciplinarni proces morata načrtovanje in upravljanje povodij vključevati in upoštevati različne vidike in sektorje, zato morajo odločevalci s področja upravljanja in varovanja povodij in pitne vode dobro poznati ključne dejavnike in vidike, ki jih je treba pri tem upoštevati. Izsledki raziskave so pokazali, da se mnenja strokovnjakov o posameznih področjih trajnosti močno razlikujejo, zlasti pri vrednotenju dejavnikov ekologije in rabe zemljišč. Drugi strokovnjaki so dejavnike, kot so ekosistemske funkcije, načrtovanje infrastrukture, vplivi rabe zemljišč, način upravljanja in drugi naravni viri, ovrednotili za manj pomembne pri trajnostnem upravljanju in načrtovanju povodij. Obe skupini anketirancev sta v glavnem podobno ovrednotili dejavnike gospodarstva, družbe, upravljanja voda in rabe zemljišč (Slika 4). Drugi strokovnjaki, ki nimajo ustreznih informacij o ekosistemskih funkcijah, vplivih različne rabe zemljišč, načinih upravljanja, družbenih in gospodarskih potrebah itd., ne morejo oblikovati načrta trajnostnega upravljanja povodij. Za opredelitev modela vrednotenja načrtov povodij z vidika trajnostnih načel, ki bi ga lahko uporabili za vse projekte načrtovanja in upravljanja povodij, je zato treba ugotoviti in uskladiti mnenja strokovnjakov z raznovrstnih področij.

## 4 Sklep

Upravljanje in načrtovanje vodnih virov sta povezana s številnimi trajnostnimi dejavniki, vključno z ekologijo, gospodarstvom, družbo, rabo zemljišč in upravljanjem. Zaradi tega je tovrstno načrtovanje bolj zapleteno ter zahteva dinamičen, celosten in participativni pristop. Vključenost raznih skupin vodnih uporabnikov in deležnikov v odločanje je ključen dejavnik pri izbiri strategij upravljanja povodij in načrtovalskih pristopov. Sodelovanje med lokalnimi in vladnimi uradi ter javnimi ustanovami je treba zagotoviti že v prvi fazi načrtovalskega procesa. Včasih pa se mnenja med drugimi strokovnjaki in univerzitetnimi učitelji, javnimi uporabniki in deležniki, regionalnimi načrtovalci in lokalnimi upravniki ter celo med strokovnjaki raznih strok (npr. med krajinskimi arhitekti, načrtovalci namenske rabe zemljišč, okoljevarstveniki, ekonomisti in upravniki povodij) lahko močno razlikujejo. Navedene razlike se lahko pojavijo v vseh fazah odločevalskega procesa in lahko zelo negativno vplivajo na odločitve pri oblikovanju načrtov za dodeljevanje vodnih virov, zemljišč in finančnih sredstev.

Raziskava, predstavljena v tem članku, je pokazala, da so si lahko mnenja nosilcev znanja in odločevalcev pri nekaterih vidikih vrednotenja dejavnikov trajnostnega razvoja vodnih virov zelo nasprotujoča, kar lahko preprečuje doseganje trajnostnih ciljev. Pred kakršnim koli resnim razmišljanjem o pripravi vodnogospodarskih načrtov povodij je treba določiti morebitne razlike v pogledih ciljnih skupin. Z ugotavljanjem, na katerih področjih se mnenja razlikujejo, lahko bolje razumemo glavne izzive, ki se bodo pojavili v procesu odločanja ter pri določanju postopkov upravljanja in njihovi izvedbi. Tej težavi se lahko izognemo ali jo omilimo s sestanki, izobraževalnimi delavnicami in predstavitvenimi programi, ki omogočajo razpravo med raznimi skupinami odločevalcev, kot so raziskovalci, univerzitetni učitelji, nosilci znanja in vladni odločevalci. Navedeno se lahko zagotovi v vsaki fazi načrtovanja povodij, na primer pri določanju in razvrščanju ciljev, opredelitvi problemov, določanju upravljavskih strategij, predlaganju rešitev in dodeljevanju virov. Po koncu sestankov in razprav so lahko mnenja in pogledi udeležencev precej bolj usklajeni, na podlagi česar se lahko oblikujejo celovite rešitve.

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# Siva ekonomija v javnem prostoru: zapletene politične in prostorske ureditve na indonezijski ulični tržnici

Zaradi močnega vala urbanizacije in omejenih možnosti formalne zaposlitve v velikih azijskih mestih se čedalje bolj krepi ulična prodaja, ki je zaradi neodobrene uporabe javnega prostora pogosto sporna in nezakonita. Nedeljska tržnica v Kuteku v indonezijski občini Depok se je morala z lokacije zraven univerze, na kateri je bilo običajno polno ljudi, preseliti v razmeroma odmaknjeno stanovanjsko sosesko, kjer pa prodajalci še vedno precej dobro poslujejo. Študija primera, predstavljena v tem članku, temelji na obsežnih terenskih opazovanjih in intervjujih ter pojasnjuje, kako je bila izbrana nova lokacija tržnice in kako je prostorsko urejena, da lahko zadovoljuje potrebe prodajalcev, stanovalcev in kupcev. V članku je predstavljeno, kako so stanovalci in prodajalci razvili inovativen, odprt in samoorganiziran sistem upravljanja tržnice, ki se prilagaja spreminjajočemu se številu in lastnostim prodajalcev in kupcev. Čeprav sistem velja za učinkovito orodje, ki omogoča uspevanje sive ekonomije, zaradi omejenih načrtovalskih zmožnosti zahteva sodelovanje z drugimi deležniki, na podlagi česar se lahko rešujejo nepričakovani izzivi. Sodelovanje med deležniki je povečalo koristi in zmanjšalo slabosti sive ekonomije v javnem prostoru.

**Ključne besede:** ulična tržnica, ulični prodajalci, siva ekonomija, javni prostor, Indonezija

# 1 Uvod

## 1.1 Širjenje ulične prodaje v svetu, ki se čedalje bolj urbanizira

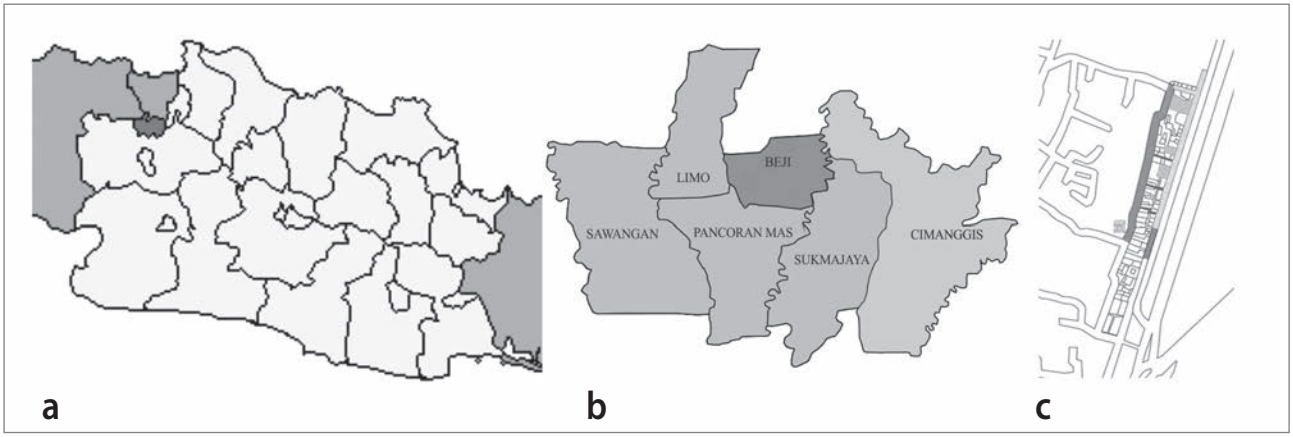
Neskladen regionalni razvoj in slabo upravljanje v številnih državah v razvoju povzročata obsežno nenadzorovano urbanizacijo (Hossain, 2004). Zaradi hitre rasti mestnega prebivalstva mnogi prebivalci težko najdejo formalno zaposlitev (Ligthelm in van Wyk, 2004), ena izmed posledic rasti mest pa je tudi širjenje dejavnosti uličnih prodajalcev (Chirisa, 2009). Njihovo število močno narašča, pri čemer zasedajo javni prostor po večjih mestih držav v razvoju in poskušajo zaslužiti dovolj za preživetje (Faruque in Haque, 2010; Dunn, 2014). Po finančni krizi leta 1998 se je v številnih azijskih državah število uličnih prodajalcev občutno povečalo, saj je mnogo ljudi, ki so bili prej zaposleni v formalnem sektorju, izgubilo službo (Indira, 2015). Prodaja blaga na ulici je postala pomemben vir zaposlitve, storitev in prihodkov za revna mestna gospodinjstva (Fidler in Webster, 1996; Iyenda, 2005; Suriansyah, 2005; Estrada in Hondagneu-Sotelo, 2011). Izraz »ulični prodajalec« se nanaša na prodajalce na urejenih tržnicah, prodajalce, ki postavijo stojnice na pasovih ob robu cestišča, potujoče ulične prodajalce in prodajalce na domu (Cohen idr., 2002). Njihovo poslovanje je pogosto nezakonito, čeprav prodajajo zakonito blago in storitve (ILO, 2002). Njihova dejavnost zato ne poteka v ločenih gospodarskih krogih, ampak se prepleta s formalnim sektorjem (Chen, 2007; Hossain, 2014).

Prisotnost uličnih prodajalcev na javnih prostorih ima pozitivne vplive tako v državah v razvoju kot v razvitih državah; ulični prodajalci so na primer postali nepogrešljiv del mestne krajine Los Angelesa, New Yorka in Čikaga (Munoz, 2012). V New Yorku (Roy, 2005) in Mumbaju (Anjaria, 2006) povečujejo javno varnost in izboljšujejo kakovost življenja v soseskah, kjer delujejo, čeprav jih mestne oblasti še vedno obravnavajo kot javno nadlogo. Veljajo za sestavni del nekaterih sosesk (Deguchi, 2005), stanovalcem pogosto zagotavljajo glavni dostop do hrane (Kabeer, 2004), hkrati pa poživijo javne kraje (Deguchi idr., 2005). Preobrazba javnih prostorov na podlagi uličnе sive ekonomije je novost, ki učinkovito zadovoljuje potrebe mestnih prebivalcevin ljudi spodbuja k druženju (Jimu, 2005; Rojas, 2008), čeprav prisotnost uličnih prodajalcev običajno krši občinske predpise (Danesh, 1999). Kljub raznim pozitivnim vplivom je ulična prodaja v mestni politiki držav v razvoju še vedno zapostavljena (Jimu, 2005). Z vidika sodobnega načrtovanja navedena gospodarska dejavnost spodkopava javni red in državni nadzor (Cross, 2000), zato se v državah Latinske Amerike, kot je Kolumbija (Donovan, 2008), in azijskih državah, kot je Indonezija (Harjoko in Adianto, 2012), močno omejuje.

Želja po oblikovanju privlačnih globalnih mest (Robins in Askoy, 1996) je očarala številne vlade držav v razvoju, ki pri urbanističnem načrtovanju in določanju predpisov zato ne upoštevajo vidikov sive ekonomije, kot je ulična prodaja (Parthasarathy, 2003). Posledično njihovi razvojni načrti niso prilagojeni potrebam neformalnih mestnih dejavnosti (Perera in Amin, 1996) in še poslabšujejo prostorske težave v mestih v razvoju (Yankson, 2000). Lokalnim občinam pogosto primanjkuje politične volje, administrativnega znanja ali inovativnih upravljavskih strategij, potrebnih za učinkovito vključitev uličnе prodaje v mestni gospodarski sistem (Morrell idr., 2011). Če vključitev uličnih prodajalcev ni premišljeno načrtovana, lahko to povzroči prezasedenost javnih prostorov in precejšnje okoljske težave, kot so prenatrpani pločniki in oviran prehod pešcev (Loukaitou-Sideris in Ehrenfeucht, 2011) ter slabe sanitarno-higienske razmere (Rakodi, 2005) zaradi smeti na ulicah, pločnikih in v odprtih odtokih, ki jih mestne oblasti niso več zmožne počistiti (Satterthwaite, 2003; Yankson, 2007). Mnoge empirične raziskave, opravljene v azijskih glavnih mestih, so sivo ekonomijo, vključno z ulično prodajo, preprosto obravnavale kot nekaj, kar je treba upravljati (Ong, 2006; Jiang idr., 2010), ob tem ko se mesto pospešeno razvija v globalno središče (Yeo idr., 2012). Upravljanje uličnih prodajalcev vključuje na primer določitev posebnega območja, kjer lahko opravljajo svojo dejavnost (Chai idr., 2011), ali uvedbo sistema za pridobitev dovoljenj za prodajo (Lincoln, 2008; Chiu, 2013). Tako država prizna obstoj uličnе prodaje kot nečesa, kar ustvarja sistem za preživetje revnih mestnih prebivalcev in s tem zagotavlja red v družbi. Navedeni sistem ima izjemno nenavadno dinamiko samoregulacije, v katerem ni formalnega nadzora nad načrtovanjem (Dovey, 2012), zato je treba dobro razumeti, kako ulični prodajalci na mestnih območjih soustvarjajo prostor za potrebe sive ekonomije.

## 1.2 Prikriti družbeni sistem, na katerem temelji prostorska ureditev uličnih tržnic

Ulična prodaja poteka na javnih prostorih (Satterthwaite, 2003), natančneje na pločnikih (Jimu, 2005), ob poteh (Suharto, 2004), tržnicah (Brown, 2006), na avtobusnih postajališčih (Cohen idr., 2002) in drugih javnih krajih (Yankson, 2000). Oblike zasedanja uličnega prostora so ravno tako raznovrstne kot lokacije, odvisno od vrste območij in dejavnosti v bližini (Suharto, 2004), kot so območja za pešce (Dewar in Watson, 1990) ali prometna vozlišča in vozlišča za dnevne migrante (Bhowmik, 2005). Kot navaja Yankson (2000), je pri izbiri lokacije prodaje glavni dejavnik ta, da je območje privlačno za kupce, sledita razpoložljivost dovoznih cest in pomanjkanje drugih primernih lokacij. Izgon uličnih prodajalcev z nekaterih javnih prostorov lahko učinkovito onemogoči njihovo dejavnost (Idayanti, 2007), saj lokacija vpliva na viši-




**Slika 1:** Lokacija občine Depok (a), okrožje Beji (b) in raziskovalno območje (c) (vir: Internet 1)

no najemnine stojnic in zmožnost ustvarjanja prihodka (Susilo, 2011). Poleg tega so raziskave v Indoneziji pokazale, da sta narava posameznih krajev in njihova privlačnost za potencialne kupce (v glavnem zaradi dejavnosti v okolici) ključna dejavnika pri izbiri lokacije uličnе prodaje (Suparwoko in Sriyana, 2006; Suparwoko, 2008). Brez dobrega razumevanja lokacijskih preferenc uličnih prodajalcev njihova načrtna premestitev na drugo območje zato ne more doseči želenih ciljev.

Raziskava petih tradicionalnih tržnic v Džakarti (Adianto, 2009) in študija tradicionalne tržnice v Bekasiju v Zahodni Javi (Libratono, 2012) sta pokazali, da se lokacija, vrsta prodajnih izdelkov in delovni čas uličnih prodajalcev ujemajo z vzorcem dejavnosti kupcev in proizvajalcev. V vseh tovrstnih raziskavah je bilo ugotovljeno, da ima družbeni sistem, ki določa pravila za upravljanje in uporabo razpoložljivih virov, ključno vlogo pri prostorski ureditvi uličnе prodaje na javnih mestih. Navedeni sistem vzpostavlja samoorganizacijo (Koolhaas, 2005; Mörtenböck in Mooshammer, 2007) pri kateri se oblikujejo prostorske ureditve na podlagi prilastitve ali ponovne prilastitve javnih prostorov (Isin, 1999; Boeri, 2003), ki temelji na posvetovalnem načrtovanju (Koolhaas in Cleijne, 2007) in kreativnih izračunih (Franke, 2006). Zaradi slabega dostopa do formalnih institucij morajo ulični prodajalci razviti nove ali pa izkoristiti obstoječe ureditve in nenapisana pravila za svojo samoorganizacijo, upravljanje in gospodarsko dejavnost (Lindell, 2008). Peters (2013) v raziskavi, opravljeni v indonezijskem mestu Surabaya, opisuje izjemno moč neformalnih dejavnosti in njihov prispevek k sodobnemu mestnemu razvoju na podlagi kolektivnega duha prikrajšanih skupin in delavskega razreda. Podobno opisuje tudi Obeng-Odoom (2011) v raziskavi o prožnosti in sposobnosti za preživetje neformalnih sektorjev v Gani, ki jim stalno grozi deložacija. Kljub stigmatizaciji neformalnost ustvari občutljiv sistem upravljanja, ki deluje v okviru formalnega upravljanja (Dovey, 2012), eden izmed njegovih rezultatov je tudi prostorska ureditev. Omenjena občutljivost spodbuja prožnost in sposobnost preživetja sive ekonomije v moderniziranem mestu pod stalno grožnjo deložacije. Opisane raziskave poudarjajo dejstvo, da je prostor družbena prvina, saj nastaja v vzajemnih odnosih, ki oblikujejo družbene odnose in ti hkrati oblikujejo njih (Lefebvre, 1991; Shields, 1998). Produkcija mestnega prostora se torej ne nanaša samo na preprosto načrtovanje posameznih vrst rabe materialnega prostora, ampak bolj na produkcijo in reprodukcijo vseh vidikov mestnega življenja (McCann, 2002). Po Lefebvru je to, kako ulični prodajalci uredijo svoj prostor, prikrit družbeni red, ki se uporablja za ureditev skupnega območja (Ostrom, 2005). Ulični prodajalci skupaj s kupci in drugimi deležniki, ki imajo korist od njihove prisotnosti, ustvarjajo primerne prodajne prostore.

Avtorji v članku predstavljajo lokacijske preference, ki usmerjajo uličnо prodajo, in kako prodajalci ustvarjajo prostorske ureditve na podlagi samoorganizacije. Konkretno razkrijejo družbeni sistem, na katerem temelji produkcija uličnega prodajnega prostora na nedeljski tržnici v Kuteku v Indoneziji, s čimer želijo obogatiti arhitekturni diskurz o mestni sivi ekonomiji.

## 2 Metoda

Avtorji so v raziskavi proučevali območje Kukusan Teknik v občini Depok v Zahodni Javi, kot je prikazano na Sliki 1. Izbrali so ga zaradi uličnе prodaje, ki ob nedeljah dopoldne poteka v stanovanjski soseski na tem območju. Ulični prodajalci z vseh treh največjih tradicionalnih tržnic v Depoku pridejo v Kukusan prodajat blago vsako nedeljo od 6. do 10. ure. Od 80 do 200 uličnih prodajalcev redno prodaja svoje izdelke vzdolž 300 metrov dolge ulice, ki se spremeni v začasno tržnico na robu stanovanjske soseske.

V raziskavi je bil uporabljen kvalitativni pristop v treh fazah. V prvi fazi, ki je potekala februarja in marca 2015, so avtorji pregledali literaturo in na njeni podlagi zbrali najnovejše iz-

sledke na obravnavanem področju. Sredi marca 2015 je sledil predhodni terenski ogled, na podlagi česar je bila v skladu s teoretičnim okvirom oblikovana zgradba študije primera. Med terenskim ogledom je bilo določenih več pomembnih lokalnih akterjev, kot so vodja združenja stanovalcev soseske (v nadaljevanju: vodja ZSS), vodja združenja lokalnih uličnih prodajalcev (v nadaljevanju: vodja ZUP) in dolgoletni prebivalci soseske. Avtorji so se navedenim posameznikom predstavili in od njih pridobili soglasja za sodelovanje v raziskavi.

Druga faza raziskave, ki je potekala od aprila do junija 2015, je v glavnem vključevala terenska opazovanja in intervjuje. Prednost intervjujev pred drugimi metodami, kot so vprašalniki, je ta, da lahko vprašani s svojimi besedami opišejo svoje izkušnje in pojasnijo, kako živijo (Valentine, 2005: 111). Med terenskimi opazovanji so bili dokumentirani spreminjajoče se število uličnih prodajalcev, izdelki, ki jih prodajajo, in njihova prostorska ureditev. Na podlagi prodajnih izdelkov so bili prodajalci razdeljeni v tri skupine: prodajalci hrane, prodajalci drugih izdelkov in ponudniki storitev (Suharto, 2004).

Intervjuji so bili izvedeni v dveh nizih. Najprej so bili maja 2015 intervjuvani vodja ZSS, vodja ZUP in posamezni stanovalci soseske, ki so predstavili zgodovino ulične prodaje na tem območju in proces samoorganizacije, ki ga izvajajo vsi vpleteni. Drugi niz intervjujev je bil opravljen z naključnim vzorcem uličnih prodajalcev, stanovalcev ulice, ki se začasno spremeni v tržnico, in kupcev. Prodajalci in stanovalci so pojasnili, zakaj prodajajo na navedeni lokaciji ter kako prodajalci v sodelovanju s stanovalci oblikujejo in izvajajo proces samoorganizacije. Kupci so pojasnili, zakaj tam kupujejo in kaj menijo o prostorskih posledicah prisotnosti uličnih prodajalcev v njihovi soseski. Število intervjuvancev v posamezni skupini je bilo različno. V intervjuje je privolilo samo 50 uličnih prodajalcev. Poleg njih je bilo v 12 tednih terenskih opazovanj in intervjujev intervjuvanih še 50 družin, ki živijo v proučevani ulici (kar je precej veliko glede na to, da je v ulici 57 hiš, od katerih jih ima sedem tudi najemna stanovanja), in 300 kupcev. Intervjuvanci so bili različno stari, imeli so različne poklice in mesečne dohodke ter so živeli v različnih vrstah stanovanj.

Tretja faza raziskave, ki je potekala od julija do septembra 2015, je vključevala analizo podatkov, razpravo in zapis izsledkov. Pričevanja intervjuvancev so bila preverjena s triangulacijo (Valentine, 2005). O izsledkih so avtorji razpravljali z akademskimi kolegi na sestankih, na podlagi česar so dopolnili in dodelali rezultate raziskave. Da bi še bolj razjasnili nekatera vprašanja, so avgusta 2015 opravili še nekaj dodatnih terenskih opazovanj in intervjujev.

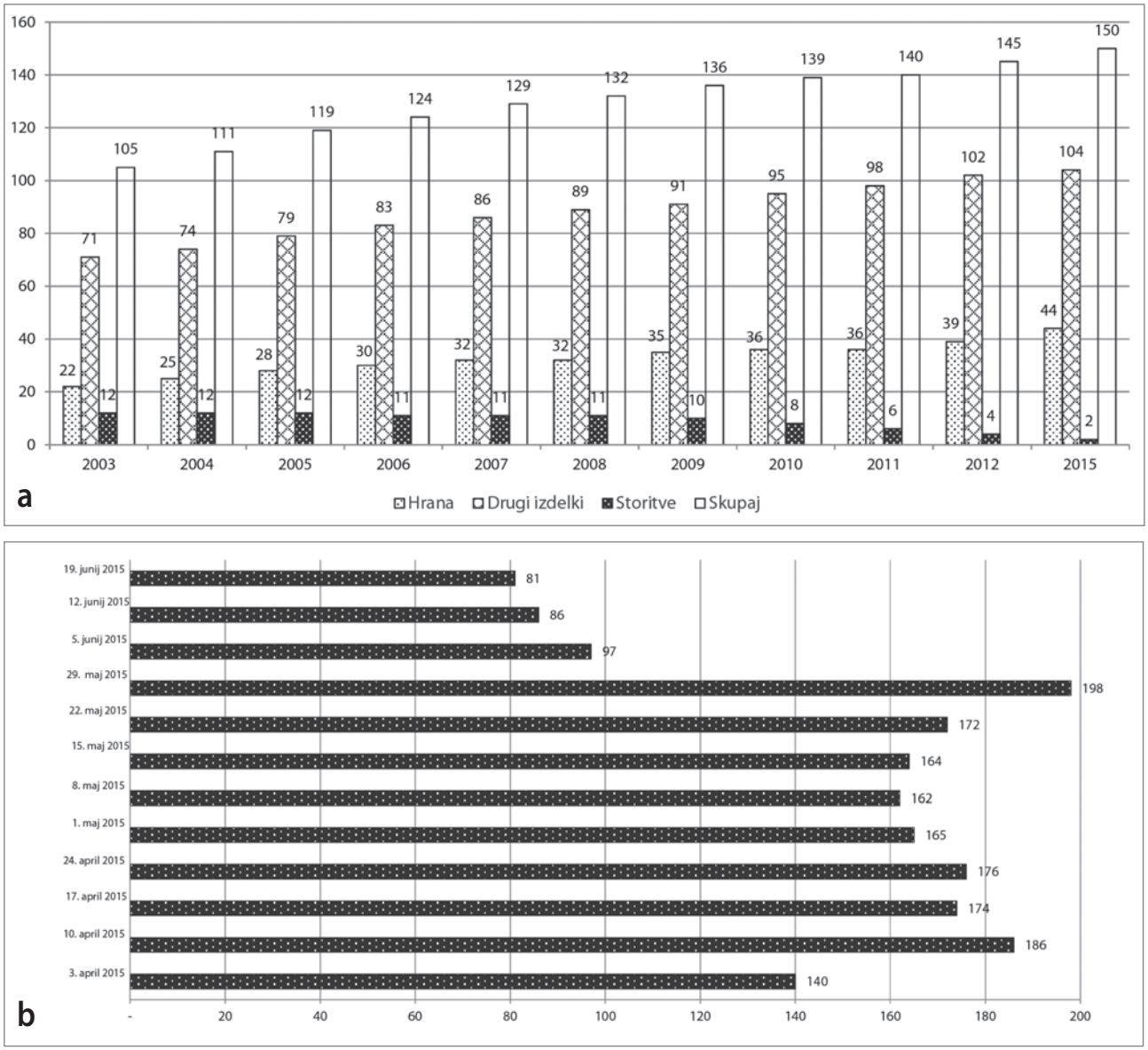
# 3 Rezultati

## 3.1 Zgodovina in sedanje stanje nedeljske tržnice v Kuteku

Od leta 2001 so prostori Univerze v Indoneziji vsako nedeljo odprti za javne rekreativne dejavnosti. Udeleženci večinoma prihajajo iz najbližje občine Depok in iz bližnje metropole Džakarte. Množice ljudi, ki prihajajo na to območje, so tja privabile tudi ulične prodajalce, ki so obiskovalcem ponujali najrazličnejše izdelke, od hrane in pijače do elektronskih naprav in raznih storitev. Po navedbah vodij ZSS in ZUP so lahko ulični prodajalci v okviru univerzitetnega kompleksa prodajali, če so za to plačali zadevni prispevek, pri čemer ni bilo treba, da so bili tudi uradno prijavljeni. Njihova prisotnost torej tehnično ni bila nezakonita, hkrati pa je prinašala korist vsem vpletenim: univerzi, prodajalcem in kupcem.

Opisano dobičkonosno sodelovanje se je končalo leta 2003 zaradi smrtne nesreče, ki so jo povzročili ulični prodajalci. Od takrat univerza ne dovoli več nikakršne ulične prodaje ob nedeljah. Kljub številnim protestom, na katerih so se ulični prodajalci zavzemali za to, da bi bila spet dovoljena prodaja v univerzitetnem kompleksu, je univerza vse njihove prošnje ostro zavrnila. Kot alternativno možnost je vodjema ZSS in ZUP ponudila preselitev uličnih prodajalcev v sosesko v neposredni bližini kompleksa, vzdolž zidu, ki obdaja univerzo. Čeprav je ulica ožja kot območje, kjer so prej prodajali, so se vsi vpleteni strinjali, da bo to nova prodajna lokacija. Izbrana je bila zaradi dveh glavnih razlogov: po eni strani je še vedno blizu univerze, zato bi jo obiskalo veliko ljudi, po drugi strani pa je to slepa ulica, na kateri prodajalci ne bi motili gibanja stanovalcev v soseski. Vodja ZSS je bil imenovan za območnega vodjo, ki naj bi upravljal prodajo in podporne dejavnosti.

Sprva so prebivalci ulice nasprotovali prisotnosti prodajalcev pred svojimi hišami. Posledice preselitve tržnice v to ulico so bile motena zasebnost, hrup, nakopičeni odpadki in ovirano gibanje prebivalcev. Po intenzivnih posvetovanjih so prebivalci privolili v prisotnost ulične prodaje v soseski, če bodo izpolnjeni naslednji pogoji: 1. prodaja lahko poteka samo ob nedeljah od 6. do 11. ure, 2. prodajalci plačujejo prispevke ZSS, ki sredstva porabi za financiranje izboljšav v soseski, 3. prodajajo lahko tudi prebivalci, 4. prodajalci morajo plačati za uporabo elektrike iz hiš na ulici, 5. vsakršno neprimerno ravnanje bo razlog za prekinitev ulične prodaje v soseski. Zaradi varnostnih razlogov se morajo vsi prodajalci prijaviti pri vodji ZSS, za zagotavljanje reda pa mora imeti vsak prodajalec stalno prodajno mesto. Leta 2003 je bilo na območju prijavljenih 105 prodajalcev, njihovo število pa se je vsako leto povečevalo. Leta 2015 jih je bilo tako že 198 (Slika 2).




**Slika 2:** Skupno število uličnih prodajalcev med letoma 2003 in 2015 glede na vrsto prodajnih izdelkov (a) ter skupno število uličnih prodajalcev vsako nedeljo od 3. aprila do 19. junija 2015 (b) (ilustracija: Mitchell Edbert Suryanto)

Med 12-tedenskim opazovanjem je število uličnih prodajalcev nihalo med 81 in 198. Pouk na univerzi je potekal od februarja do junija 2015, pri čemer se je število uličnih prodajalcev s 140 na začetku aprila povečalo na 198 ob koncu maja. Ob koncu izpitnega obdobja na začetku junija je večina študentov zapustila študentsko naselje in odšla domov, zaradi česar se je število ljudi na območju močno zmanjšalo. Posledično je tudi število uličnih prodajalcev strmo padlo: zadnje tri tedne proučevanega obdobja jih je bilo manj kot 100, zadnji teden pa celo 81. Navedeno nihanje razkriva neposreden vpliv prisotnosti študentov na število uličnih prodajalcev na nedeljski tržnici v Kuteku.

### 3.2 Vzajemne koristi za vse vpletene akterje

Prodajalci so navedli, da v glavnem prodajajo na treh tradicionalnih tržnicah v občini Depok: na tržnici PAL (34,15 %), tržnici Kemiri (36,59 %) in tržnici Jaya Depok (29,27 %). Večina jih na nedeljski tržnici v Kuteku prodaja zato, da se izognejo hudi konkurenci na tradicionalnih tržnicah ob koncu tedna. Čeprav tradicionalne tržnice ob koncu tedna pritegnejo ogromno obiskovalcev, se zaradi precej večjega števila konkurenčnih prodajalcev njihov prihodek pomembneje ne poveča. Zato ob nedeljah raje pridejo na tržnico v Kuteku, kjer je manj prodajalcev. Drug ključni razlog so nizki upravni stroški. Štirinajst prodajalcev je v intervjujih razkrilo, da so upravni stroški na večjih tradicionalnih tržnicah tri- do petkrat višji kot na

nedeljski tržnici v Kuteku. Tudi zaradi tega je nedeljska prodaja v Kuteku tako privlačna.

Čeprav tudi lokalni prebivalci prodajajo na nedeljski tržnici, niso vsi navdušeni nad njeno prisotnostjo na njihovi ulici. Družinski člani v devetih hišah (18 %) so navedli, da jih tržnica moti, čeprav omogoča številne prednosti. Motijo jih predvsem smeti. Čeprav po zaprtju tržnice vse smeti pobere za to zadolžen uslužbenec, številne intervjuvance moti, da jih morajo gledati in vonjati. Druga pomembna nevšečnost je ovirano gibanje, saj se prebivalci težko prebijejo skozi množico obiskovalcev. Družine so kot tretjo težavo navedle hrup, več pa jih je omenilo tudi, da množice obiskovalcev v neposredni bližini stanovanjskih hiš motijo zasebnost stanovalcev. Kljub vsem navedenim težavam večina stanovalcev, ki je izrazila nezadovoljstvo, sprejema nedeljsko tržnico na svoji ulici. Prodaja omogoča finančno korist celotni skupnosti in mnogim posameznikom. Prebivalci prodajalcem zagotavljajo najrazličnejše podporne storitve, kot so dostop do elektrike, stojnice in skladiščne prostore, kar jim prinaša dodaten zaslužek. Sredstva, ki jih vsak prodajalec plača za najem prodajnega prostora in odvoz smeti, se porabijo za plačo upravnika tržnice in izboljšave v soseski.

Tržnica skupnosti omogoča številne koristi. Dvajset stanovalcev (40 %) je navedlo, da tako lahko v neposredni bližini dobijo najnujnejše stvari, dvanajst intervjuvancev (24 %) pa je povedalo, da jih prisotnost množice obiskovalcev in različnih prodajnih izdelkov zabava. Devet intervjuvancev (18 %) je navedlo, da tržnica prebivalcem prinaša zaposlitvene priložnosti in dodaten prihodek. Nekateri tudi sami prodajajo na tržnici, mnogi pa izboljšajo svoje prihodke z zagotavljanjem podpornih storitev prodajalcem.

Vsak prodajalec mora prispevati v sklad, namenjen izboljšavam v soseski. Po navedbah vodij ZSS in ZUP ter lokalnih voditeljev skupnost zbrana sredstva porabi za prenovo ulice, popravilo odtočnega kanala vzdolž ulice in vzdrževanje mejnega zidu z univerzo. Pred odprtjem tržnice leta 2003 stanovalci niso imeli skupnega računa, namenjenega izboljšavam v soseski. Od njenega odprtja pa se je zaradi učinkovitega upravljanja sredstev, ki jih prispevajo ulični prodajalci, podoba soseske izboljšala brez kakršne koli vladne pomoči. Čeprav tržnica povzroča več okoljskih težav (npr. smeti, ovirano gibanje, hrup in pomanjkanje zasebnosti), hkrati zagotavlja pomembne družbene in gospodarske koristi. Ne glede na to, da je na zaprtem območju (tj. v ozki slepi ulici, v kateri običajno ni prav veliko ljudi), pritegne kupce iz celotne občine Depok in celo iz Džakarte. Večina intervjuvancev (44,33 %) je navedla, da tržnico redno obišče vsako nedeljo.

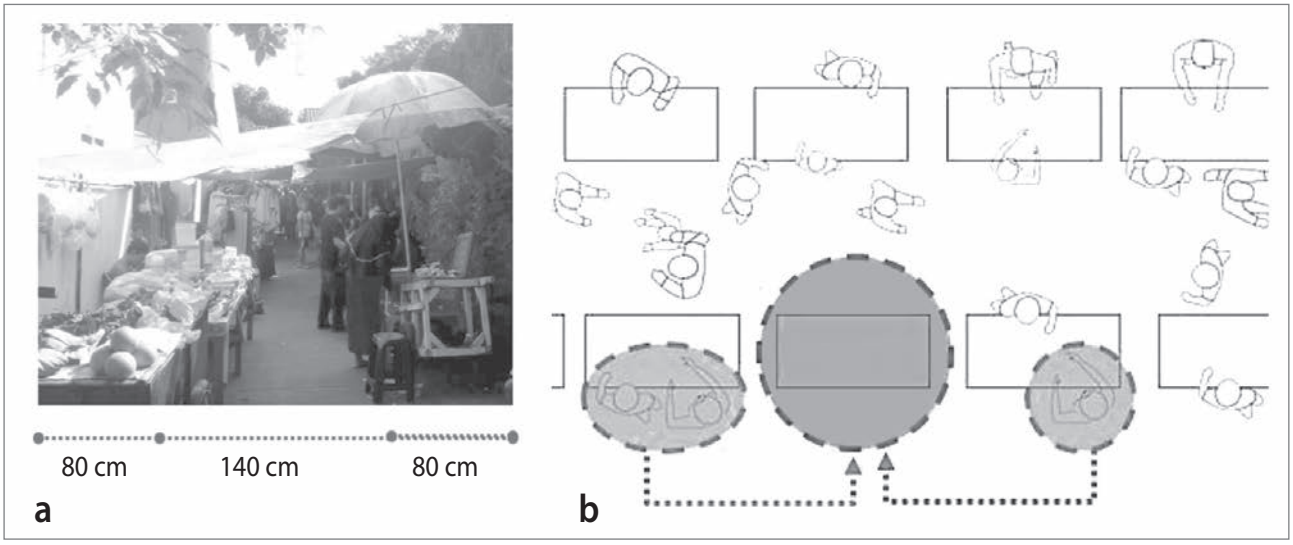
Večina kupcev (44,67 %) živi v občini Depok zunaj območja Kukusan. Iz Kukusana prihaja skoraj enak delež kupcev (41,67 %), 13,67 % pa jih živi v Džakarti. Skoraj polovica obiskovalcev (49,67 %) na tržnico prihaja po najnujnejše stvari in že vnaprej ve, kaj želi tam kupiti. Drugi tja prihajajo zaradi vzdušja (28,67 %) ali na nedeljski izlet s prijatelji (21,67 %). Ti kupci na tržnici uživajo kljub gneči in nekoliko umazanemu okolju. Nedeljska tržnica v Kuteku torej omogoča korist vsem vpletenim: prodajalcem, kupcem in lokalnim prebivalcem. Opisane skupne koristi so mogoče, ker udeleženci upoštevajo družbeno izpogajana in sprejeta pravila, ki urejajo pravice in dolžnosti vseh sodelujočih akterjev, kar omogoča usklajeno prodajno dejavnost.

## 3.3 Prostorska samoorganizacija: od urejene do razdrobljene prostorske členitve

Pri izvajanju sistema prijave uličnih prodajalcev med letoma 2003 in 2012 sta se vodji ZSS in ZUP dogovorila o prostorski ureditvi nedeljske tržnice v Kuteku, ki temelji na umeščanju prodajnih prostorov glede na vrsto izdelkov, ki se prodajajo, ter na določanju parkirnih, skladiščnih in nakladalnih območij. Ureditev je rezultat dogovora med obema vodjema, vsemi uličnimi prodajalci in prebivalci ulice ter omogoča korist vsem, ne da bi kakor koli ogrožala varnost soseske (Slika 3).

Ker se je število prodajalcev nenehno večalo, hkrati pa so na tržnici začeli sodelovati tudi mnogi občasni prodajalci, sta vodji ZSS in ZUP le stežka prijavljala vse nove člane in jim dodeljevala prostor na tržnici. Občasni prodajalci so na nedeljsko tržnico v Kuteku začeli prihajati leta 2010. Gre za potujoče prodajalce, ki se čez dan z vozovi ali kolesi selijo od ene tržnice do druge. Na tržnici v Kuteku ne prodajajo vsako nedeljo, zato nimajo stalnega prodajnega prostora. Kljub temu jim je vodja ZSS dovolil, da prodajajo na tržnici, saj so privolili v plačilo zahtevanega prispevka. Ker se je število prodajalcev nenehno spreminjalo, je leta 2012 vodja ZSS zaustavil prijavo novih prodajalcev. Z občasno prodajo so se začeli ukvarjati tudi mnogi posamezniki, ki živijo na tej ulici, pri čemer kot prodajni prostor uporabljajo svoje sprednje terase, hiše pa so preuredili v proizvodne prostore. Leta 2010 se je s prodajo ukvarjalo šest stanovalcev, do leta 2015 pa se je njihovo število potrojilo. Sprva so prodajali le občasno, zdaj pa na tržnici sodelujejo stalno. Kot je razvidno s Slike 4, prisotnost potujočih prodajalcev in lokalnih prebivalcev med prodajalci na nedeljski tržnici v Kuteku otežuje njeno prostorsko urejanje. Zaradi njihovega spreminjajočega se števila in prostorske fleksibilnosti sta jih vodji ZSS in ZUP prisiljena umestiti na kateri koli prostor, ki je še na razpolago (npr. med stojnice stalnih prodajalcev). Niz tovrstnih in nenehno spreminjajočih se »vdorov« na tržnico krni njeno nadzorovano prostorsko ureditev.

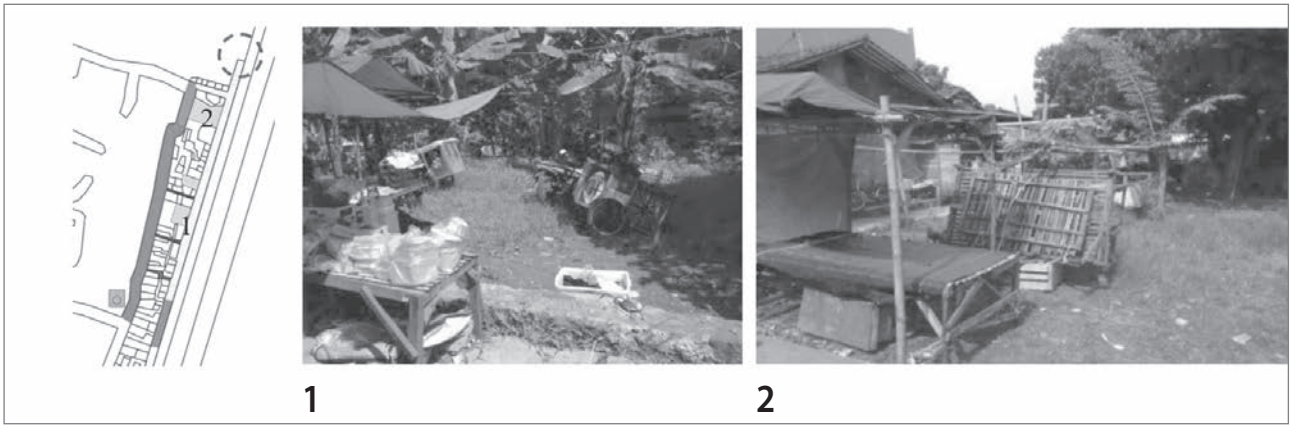
**Slika 3:** Stanovalci prodajajo blago pred svojimi hišami (foto: Mitchell Edbert Suryanto)




**Slika 4:** Velikost stojnic in širina prehoda (a) ter prikaz, kako sosednji prodajalci nadzirajo vmesno prazno stojnico (b) (foto in ilustracija: Mitchell Edbert Suryanto)


**Slika 5:** Ureditev gibanja pešcev (1 in 2) in prodajalcev (3, 4 in 5) (foto in ilustracija: Mitchell Edbert Suryanto)


**Slika 6:** Parkirišča na južnem (1 in 2) in severnem (3) delu tržnice (foto in ilustracija: Mitchell Edbert Suryanto)




**Slika 7:** Prostori za shranjevanje lesenih stojnic vzdolž ulice (foto in ilustracija: Mitchell Edbert Suryanto)

Stalni prodajalci in stanovalci nimajo nič proti dodatnim prodajalcem, čeprav imajo zaradi njihove prisotnosti vsi manj prostora za prodajo. Stalni prodajalci prisotnost drugih dopuščajo v znak spoštovanja lastnega poklica. Zavedajo se, da je njihovo preživetje odvisno od vzajemne podpore in sodelovanja. Poleg tega upajo, da bo prisotnost občasnih prodajalcev vsem povečala dobiček, saj lahko njihovi izdelki pritegnejo dodatne kupce, navedeno tudi spodbuja njihovo sodelovanje. Namesto da bi ovirali občasne prodajalce, stalni prodajalci postanejo odločevalci, ki določajo možne lokacije novih občasnih prodajalcev. Kljub negativnemu vplivu na vizualno urejenost tržnice prodajalci ne nasprotujejo prisotnosti dodatnih občasnih prodajalcev na nedeljski tržnici v Kuteku, dokler ti zagotavljajo dodatne izdelke, ki pritegnejo še več kupcev, in niso neposredna konkurenca že uveljavljenim prodajalcem. Tržnica ima vhod na severu in jugu, kar obiskovalcem omogoča, da vanjo vstopajo iz dveh smeri (Slika 5). Varnost je na območju univerze skrb vzbujajoča, saj so bila tam v preteklosti že zagrešena razna kazniva dejanja. Severni vhod je pravzaprav odprtina v zidu, ki obdaja univerzitetni kompleks in so jo ustvarili lokalni prebivalci, da bi lahko dostopali do univerze, če so bila južna vrata zaprta. Posledično se vsi obiskovalci premikajo z južnega dela tržnice proti severu in se nato vračajo proti jugu, ko jo želijo zapustiti. Navedeno med 8. in 11. uro povzroča velike zastoje in gnečo na tržnici.

Da bi zmanjšali gnečo in omogočili lažje gibanje, so se vodji ZSS in ZUP ter stanovalci dogovorili, da se zahodna ulica ob tržnici uporablja kot dovozna pot za nakladanje in razkladanje izdelkov. Območje prodajalci poleg tega uporabljajo tudi kot parkirišče za svoja vozila. Mnogi obiskovalci pridejo na tržnico z motociklom. Po navedbah vodje ZSS vsako nedeljo tržnico obišče okoli 100 ljudi na motociklih, kar zahteva veliko parkirnih mest, ki se morajo ustrezno varnostno nadzorovati, hkrati pa ne smejo otežiti gibanja pešcev na tržnici (Slika 6).

Prodaja zahteva uporabo stojnice, na kateri lahko prodajalci razstavijo svoje blago. Velikost stojnice je odvisna od števila izdelkov, ki jih prodajalec prodaja, pri čemer je večje stojnice težje premikati. Upravljavci tržnice (tj. vodji ZSS in ZUP ter stanovalci) oddajajo v najem stojnice, ki jih iz rabljenega lesa in bambusa izdelujejo mladi brezposelni prebivalci ulice. Sprva so nameravali najemne stojnice shranjevati na severnem koncu ulice, kjer ni pešcev in motociklistov, ker pa je število stojnic naraslo, so manjše zelene površine spremenili v dodaten prostor za shranjevanje, tako da stojnice ne ovirajo gibanja med tednom ali na tržnici ob nedeljah (Slika 7).

Zemljišče, na katerem stojijo najemne stojnice, je v lasti lokalne skupnosti. Upravniki tržnice, ki so tudi lastniki stojnic, so s sta-

novalci dosegli dogovor o uporabi območja, ki je v korist vsem. Prodajalci imajo prostor, kjer lahko prodajajo svoje izdelke in ustvarjajo prihodek, ob tem tudi stanovalci ustvarjajo dodaten prihodek, saj jim prodajalci plačajo za uporabo elektrike. Tudi soseska, ki jo predstavlja vodja ZSS, nekaj zasluži in s pridobljenimi sredstvi financira svoje izboljšave. Poleg tega tržnica omogoča zaposlitvene priložnosti brezposelnim stanovalcem, ki lahko s tem lažje preživljajo svoje družine, kupcem pa v neposredni bližini njihovih domov zagotavlja različne dobrine in storitve, ki jih potrebujejo. Zaradi vzajemnih koristi, ki jih zagotavlja dosežen dogovor, se lahko javni prostor in nekateri deli zasebnih zemljišč uporabljajo za namene tržnice.

Čeprav se prodajalci običajno strogo držijo pravil, ki veljajo na tržnici, so vseeno nastali konflikti. Kot je priznal vodja ZUP, prodajalci niso ustrezno poskrbeli za ogromne količine odpadkov, ki so jih ustvarili. Za to niso imeli dovolj časa in ljudi, hkrati pa na območju tudi ni bilo dovolj zabojnikov za odpadke. Stanovalci so se na koncu pritožili vodji ZUP in zahtevali takojšno rešitev problema. Vodji ZUP in ZSS ter stanovalci so se o zadevi pogovorili in se odločili, da bodo najeli smetarje, ki jih bodo plačali tako, da bodo od prodajalcev pobirali dodaten prispevek. Storitev opravljajo lokalni prebivalci, ki se s tem rešijo brezposelnosti. Po potrebi vsak prodajalec uporablja elektriko iz najbližje hiše. Ko postavljajo svoje stojnice, do hiš speljejo električne kable in elektriko plačajo neposredno stanovalcem.

## 4 Razprava

Vzajemne koristi vseh vpletenih so glavni dejavnik pri produkciji prodajnega prostora v soseski. Prostor se producira in razvija z družbenimi odnosi, kot pravi Lefebvre (1991), ter z upoštevanjem gospodarskih dejavnikov in dejavnikov, ki vplivajo na kakovost življenja prodajalcev, prebivalcev in nakupovalcev. Da bi dosegli pričakovane koristi, so vsi vpleteni ustvarili sistem prostorske samoorganizacije in uporabili razpoložljivi javni prostor za prodajo. V zameno za ugodno plačilo lokalni prebivalci prodajalcem zagotavljajo prodajni prostor in parkirna območja, urejajo gibanje pešcev, blaga in vozil, skrbijo za odstranjevanje in odvoz odpadkov ter oddajajo v najem stojnice. Nizka cena posameznih storitev prodajalcem omogoča, da prodajajo izdelke dovolj ugodno, da si jih njihove stranke lahko privoščijo. Vzajemne koristi poleg tega odtehtajo negativne vplive tržnice na skupnost, kot so številne smeti, ovirano gibanje, hrup in motena zasebnost. Družbeni odnosi, ki se ustvarjajo v dogovorih, katerih cilj je doseči vzajemno korist, se ob vprašanjih, ki zahtevajo takojšnje rešitve, še dodatno izpopolnjujejo. Zaradi naraščajočega števila potujočih in občasnih prodajalcev na tržnici je bilo treba spremeniti sistem prijave in pravila za prodajna mesta. Zaradi čedalje več prodajalcev je bilo treba zagotoviti tudi več prostora, pri čemer je moralo še več prebivalcev dovoliti prodajo pred svojimi hišami. Sprva so prodajalci na nedeljski tržnici v Kuteku izkoriščali prisotnost množic, ki so v univerzitetni kompleks prihajale zaradi rekreacije, danes pa je tržnica njihova glavna destinacija. Čeprav je od tragične nesreče leta 2003 tržnica na manj privlačni lokaciji, še vedno pritegne veliko prodajalcev in kupcev. Študija primera, predstavljena v tem članku, kaže, da število pešcev, ki prihajajo na neko območje, še ne določa lokacije uličnih prodajalcev ter da sta za uspešno delovanje ulične tržnice poglavitni dostopnost in bližina velikega števila ljudi.

Raziskava je pokazala sposobnost samoorganizacije lokalnih prebivalcev, s katero rešujejo negativne vplive tržnice. Ob selitvi prvotne tržnice je bil nov prostor zagotovljen na podlagi vzpostavljenih družbenih odnosov med vpletenimi stranmi in posledičnega dogovora, ki je bil sprejemljiv za vse. Družbeni odnosi niso nevtralni, ampak temeljijo na natančnih ekonomskih izračunih, ki omogočajo korist vsem vpletenim. Brez možnosti doseganja skupnih koristi ne bi bilo mogoče zagotoviti učinkovite prostorske ureditve. Zaradi potencialnih vzajemnih koristi se vsi vpleteni prizadevajo ustvariti in ohranjati prostorsko ravnovesje med trgovskimi dejavnostmi in vsakdanjim življenjem lokalnih prebivalcev v ozki ulici. Navedena ugotovitev kaže, kako neformalne dejavnosti delujejo v formalnem sistemu (Dovey, 2012). S samoregulacijo se javni prostor in nekateri deli zasebnih zemljišč spremenijo v skupen prostor (Ostrom, 2005) s posebnim in občutljivim novim družbenim redom. Poleg tega samoregulacija spodbuja doseganje skupnih koristi za vse vpletene, hkrati pa zmanjšuje negativne vplive na sosesko. Navedeno se nanaša na prožnost in sposobnost preživetja sive ekonomije v moderniziranem mestu, ki ju omenjata Obeng-Odoom (2011) in Peters (2013).

Kljub temu siva ekonomija ne bi smela biti razumljena kot posledica prožnosti in sposobnosti preživetja (Obeng-Odoom, 2011; Peters, 2013), ampak kot način zadovoljenja različnih interesov vpletenih akterjev. Lokacija tržnice je bila izbrana na podlagi dogovora med vodjem soseske, prebivalci in prodajalci, v skladu s katerim je bila za odmaknjeno ulico oblikovana nova tedenska dejavnost. Ustvarjeni prostorski in družbeni sistem odmaknjeno ulico povezuje s potrošniki, kar koristi prodajalcem in prebivalcem, hkrati pa je bolje poskrbljeno tudi za odvoz odpadkov. Zagotavlja zaposlitev prebivalcem in prodajalcem ter sredstva za izboljšave v soseski. Izmenjuje se s pristopom ničelne vsote, značilnim za formalni sektor, ter tako vzpostavlja sporazumen prostorski in družbeni sistem, ki zadovoljuje interese vseh vpletenih ter ustvarja nov sklenjen prostor, povezan s prostorom formalnih dejavnosti. Siva ekonomija oziroma neformalni sektor tako ni samo alternativen, sporen prostor, ampak prostor, ki je povezan in soodvisen s formalnim sektorjem. Opisano sodelovanje med obema sektor-

jema prinaša skupne koristi, kar zmanjšuje negativne posledice neformalnega sektorja. Sčasoma ta postane sestavni del celotnega družbenega in gospodarskega sistema, pri čemer je ločnica med formalnim in neformalnim močno zabrisana.

## 5 Sklep

Prisotnost neformalnega gospodarskega sektorja, vključno z ulično prodajo, ob pomembnih koristih za preživetje mestnih prebivalcev povzroča tudi okoljske težave na mestnih območjih. Zato je treba poiskati načine za vključitev sive ekonomije v mestno okolje, kar bi povečalo njene koristi in zmanjšalo njene pomanjkljivosti. Ulična prodaja je ključna za preživetje trgovcev ter lokalnih prebivalcev in okoliških nakupovalcev, zato njena popolna prepoved zagotovo ni zaželena. V proučevanem primeru so po prisilni preselitvi tržnice s prejšnjega območja ulični prodajalci za novo prodajno lokacijo, ki je še vedno dostopna njihovim kupcem, izbrali območje Kuteka. Tržnica zaseda prostor na ulici v stanovanjskem predelu Kuteka, kar je zahtevalo obsežno sodelovanje in pogajanja, na podlagi česar so bile dosežene vzajemne koristi za prodajalce in lokalne prebivalce. Prodajalci si lahko tako še vedno služijo kruh, prebivalci pa so dobili nove možnosti zaposlitve in ustvarjanja dodatnega prihodka. Za doseganje želenih ciljev prodajalci in prebivalci uporabljajo sistem samoorganizacije, s katerim upravljajo prodajo in njene podporne dejavnosti. Sistem ureja prostor, gibanje, komunalne storitve in druge zadeve ter se razvija v skladu z lokalnimi razmerami, pri čemer skrbi za to, da se ohranjajo koristi vsake skupine deležnikov. Študija primera kaže, da lahko skupnosti oblikujejo učinkovit sistem samoorganizacije, ki zadovoljuje njihove trenutne potrebe.

Samoorganizirani sistemi imajo običajno omejeno zmogljivost in pogosto zahtevajo sodelovanje z zunanjimi akterji. Navedeno sodelovanje je pomembno, saj sta formalni in neformalni sektor odvisna drug od drugega in tvorita skupen gospodarski sistem, v katerem so ločnice med njima močno zabrisane. Primerni posegi na področju družbenega razvoja ter urbanističnega načrtovanja in oblikovanja lahko sivi ekonomiji na mestnih območjih pomagajo, da postane donosna in ima pozitivne posledice. Tovrstni posegi morajo zadovoljiti interese vseh vpletenih strani, saj se s tem izognemo nasprotovanjem ali novim oviram v prihodnosti. Za potrditev koristi, ki jih neformalni sektorji prinašajo mestnim skupnostim, in proučitev različnih načinov zmanjšanja njihovih morebitnih pomanjkljivosti so potrebne nadaljnje multidisciplinarne raziskave, s katerimi bi proučili, kako lahko povežemo formalne in neformalne gospodarske sektorje na mestnih območjih.

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# Ključni izzivi prilagajanja podnebnim spremembam v gradbenem sektorju

Članek obravnava poglavitne izzive v zvezi z odpornostjo proti podnebnim spremembam z vidika stavbnega sektorja, kot so sheme prilagajanja podnebnim spremembam, energetska učinkovitost in ukrepi za blaženje teh sprememb. Izzivi so ovrednoteni glede na najnovejše stanje razvoja področja, raziskovalni interes in regulativna vprašanja, pri čemer se pri pregledu znanstvene literature presoja napredek in opredeljujejo raziskovalne vrzeli. Pregled literature nakazuje, da se odpornost proti podnebnim spremembam večinoma nanaša na večje sisteme, na ravni stavb pa se to področje šele razvija. Eden od glavnih ugotovljenih izzivov je pomanjkljiv institucionalni odziv. V številnih objavah je mogoče zaznati, da sta nujna prilagoditev politik in razvoj zakonodaje, ki ju včasih zavirajo negotova predvidevanja o podnebnih spremembah. Zakonodaja EU trenutno delno pokriva področji učinkovite rabe virov in podnebnih sprememb v stavbnem sektorju, nacionalna zakonodaja pa pri tem nekoliko zaostaja. Takšne razmere lahko zmanjšajo konkurenčnost nacionalnega stavbnega sektorja, kar lahko povzroči zaostajanje za opredeljenimi trajnostnimi cilji. S finančnega vidika so manjše kratkoročne investicije dražje, saj odlašanje s posegi v temeljito trajnostno prenovo stavb povzroča večja tveganja. Pristojni organi se trenutno odločajo med hitrimi in zapoznelimi ukrepi, uravnoteženjem stroškov zgodnjega ukrepanja in vzajemnimi stroški zamud.

**Ključne besede:** stavbe, podnebne spremembe, odpornost proti podnebnim spremembam, gospodarstvo, prilagajanje podnebnim spremembam

# 1 Uvod

Glede na znanstvene dokaze se podnebne spremembe precej hitreje razvijajo zaradi človeške dejavnosti (ARSO, 2018). Od konca 19. stoletja se je temperatura zraka na Zemlji zvišala za 0,8 °C, v zadnjih 25 letih pa se je zviševala za 0,2 °C na desetletje (UKCP, 2009; Svetovna meteorološka organizacija, 2018). Na sedanji ravni ukrepov se bo glede na predindustrijsko dobo globalna povprečna temperatura do konca stoletja zvišala za več kot 4 °C (OZN, 2018) in podobno se bo zgodilo tudi v Sloveniji (Bertalanič idr., 2018). To bo imelo resne posledice za grajeno okolje. Globalna povprečna temperatura se bo glede na predindustrijsko dobo zvišala za več kot 3 °C (OZN, 2018) tudi, če se uvedejo nekateri blažilni ukrepi, kar bo povzročilo nove zahteve in nove načine rabe stavb. Globalno segrevanje že vpliva na grajeno okolje z izzivi na ravni porabe energije in sistemov oskrbe z energijo (Olonscheck idr., 2011; Wang in Chen, 2014; Pérez-Andreu idr., 2018). Zaradi segrevanja oceanov se viša površinska temperatura, narašča morska gladina, spreminjajo se vzorci morskih tokov (Ministrstvo za okolje in prostor, 2018; Svetovna meteorološka organizacija, 2017) in gosto poseljena priobalna območja so izpostavljena poplavljanju (UNEP, 2018). Od leta 1950 narašča tudi pogostost izrednih vremenskih dogodkov, kar prispeva k precejšnji škodi v grajenem okolju (IPCC, 2012, 2014; Dolinar idr., 2014; ARSO, 2018; Bertalanič idr., 2018). Učinki urbanega toplotnega otoka na lokalni ravni dodatno višajo zunanjo temperaturo in povzročajo pregrevanje stavb (Wandl in van der Hoeven, 2018; Kaplan, 2019). Zato je ključno, da se sprejmejo ostrejši ukrepi za blažitev podnebnih sprememb in prilagajanje grajenega okolja, sicer sprememb v prihodnjih desetletjih ne bo mogoče omejiti na obvladljivo raven.

Zaradi rasti prebivalstva število stanovanjskih stavb v svetu narašča. Te stavbe imajo tudi prednostno vlogo pri blažitvi podnebnih sprememb, predvsem zaradi velikega deleža emisij $CO_2$, velikih možnosti za varčevanje z energijo in naraščajočih zahtev glede ugodja stanovalcev (Andrić idr., 2019; Dino in Akgül, 2019). Rezultati ukrepov, uvedenih v preteklih letih, so delno že vidni. V EU je k absolutnemu zmanjšanju emisij največ prispeval gradbeni sektor. Čeprav se večina držav članic trenutno ne približuje vsem ciljem trajnostnega razvoja iz Agende 2030, vse nameravajo doseči največje zmanjšanje emisij prav v gradbenem sektorju. Razlogi za tak pristop so razpoložljivost primernih tehnologij za zmanjšanje porabe energije in vključevanje obnovljivih virov energije v stavbe (EEA, 2019). To pomeni, da se bodo trajnostni ukrepi v stavbnem sektorju v prihodnje stopnjevali.

Namen članka je proučiti pristope prilagajanja podnebnim spremembam v stavbnem sektorju. Mnogi raziskovalci namreč menijo, da imajo velik potencial za zmanjševanje emisij toplogrednih plinov. Za obravnavanje vplivov podnebnih sprememb in strategij za blažitev teh sprememb so najpomembnejši: upravljavski pristopi za prilagajanje podnebnim spremembam, izboljšanje odpornosti v urbanih območjih in blažitveni pristopi na ravni stavb. Pri tem je ključen pristop, ki temelji na interdisciplinarni in celoviti obravnavi (Kristl idr., 2019). Trenutno se odločitve mnogokrat sprejemajo na podlagi zadevnega vpliva vpletenih deležnikov in zahtev, ki jih je treba izpolniti. V prihodnje pa bodo morali načrtovalci in nosilci odločanja pripraviti in prilagoditi pristope k problemom, metode ukrepanja, razpoložljive vire in morebitne postopke odločanja (Gohari idr., 2020). Članek zajema sistematičen pregled literature, ki obravnava tri glavne teme prilagajanja podnebnim spremembam v stavbnem sektorju: ukrepe upravljanja ter prilagajanje urbanih območij in prilagajanje stavb. Literatura je pregledana na podlagi najnovejšega stanja na področju raziskav, raziskovalnega pomena in regulatornih vprašanj, ki z različnih vidikov omogočajo vrednotenje napredka, opredeljujejo vrzeli v raziskavah in zagotavljajo nadaljnje usmeritve. Pregled in opredelitev glavnih izzivov omogočata dobro izhodišče za nadaljnje raziskave na tem področju.

# 2 Raziskovalni načrt

Sistematični pregled literature (Punch, 2014) poteka kot postopen proces, v katerem se posamezne sestavine postopoma združujejo v celoto. V prvem koraku so proučena ločena področja upravljanja, urbana območja in stavbe, v nadaljevanju pa se navzkrižno kombinirajo s trajnostnimi pristopi in ukrepi za blažitev podnebnih sprememb. Ta metoda omogoča, da se obravnavana literatura analizira z različnih stališč ter da se proučijo problemi, ki na splošni ravni niso upoštevani in bi lahko ostali neobravnavani. Da bi vključili čim več pomembnih informacij, smo pregledali številne vire, ki se nanašajo na tematiko stavb in podnebnih sprememb. Pregled je zajel razne vire literature (monografije, članke, študije, poročila o projektih, smernice, statistične podatke, direktive, standarde, predpise itd.) in raziskovalna področja, na primer strategije prilagajanja podnebnim spremembam (strateške dokumente, predpise), energetsko učinkovitost v spreminjajočih se podnebnih spremembah (metode in izračune) ter odpornost proti podnebnim spremembam in finančno breme (vplive na sisteme in stavbe).

Znanstveni članki so bili izbrani iz več znanstvenih podatkovnih zbirk (npr. Science Direct, World Wide Science, Emerald). Obravnavane so bile recenzirane objave med letoma 2000 in 2020 v angleškem jeziku. Za iskanje so bile uporabljene naslednje osnovne ključne besede: *climate change*, *climate change strategy*, *climate adaptation*, *climate mitigation* in *cli-*

**Preglednica 1:** Število zadetkov in ustreznih študij vsebine na nekaterih kombiniranih temah

| Iskanje besed | Podatkovna zbirka | Zadetki | Naslov + KB | Povzetek | Članek |
|---|---|---|---|---|---|
| Climate change<br>Urban | Science direct | 78.938 | 321 | 16 | 8 |
| | World wide science | 1.430 | 370 | 18 | 9 |
| | Emerald | 5.289 | 26 | 4 | 2 |
| Climate mitigation<br>City | Science direct | 30.034 | 76 | 7 | 3 |
| | World wide science | 897 | 128 | 6 | 3 |
| | Emerald | 2.088 | 52 | 0 | 0 |
| Climate adaptation<br>Building | Science direct | 23.638 | 116 | 8 | 7 |
| | World wide science | 1.394 | 151 | 5 | 5 |
| | Emerald | 1.862 | 2 | 0 | 0 |
| Climate resilience<br>Energy | Science direct | 13.545 | 5 | 5 | 5 |
| | World wide science | 1.013 | 25 | 7 | 6 |
| | Emerald | 1.354 | 0 | 0 | 0 |
| Climate change strategy<br>Policy | Science direct | 78.268 | 117 | 5 | 3 |
| | World wide science | 1.038 | 87 | 4 | 2 |
| | Emerald | 13.922 | 27 | 2 | 2 |

*mate resilience*, te so bile kombinirane s ključnimi besedami *building*, *urban*, *city*, *real estate*, *energy use*, *energy retrofitting*, *energy efficiency*, *heating*, *cooling*, *management* in *financial*. Primeri kombinacij osnovnih ključnih besed, uporabljenih pri iskanju, in njihovi ustrezni rezultati so navedeni v preglednici 1: v stolpcu (1) Iskana beseda je navedeno, katera besedna kombinacija je uporabljena za izvajanje iskanja, v stolpcu (2) Podatkovna zbirka je navedena zbirka podatkov, ki se uporablja za iskanje, v stolpcu (3) Zadetek je navedeno število najdenih rezultatov iskanja, v stolpcu (4) Naslov + KB je navedeno, koliko zadetkov, ki so bili pregledani, sestavljajo naslovi in ključne besede, ki so vsebinsko pomembne, v stolpcu (5) Povzetek je navedeno, koliko vsebin povzetkov se uvršča v kontekst pregleda, v stolpcu (6) Članek pa je navedeno, koliko člankov je ustreznih glede vsebine, pomembne za pregled. Za iskanje pravnih in standardizacijskih virov so bili uporabljeni spletni iskalniki. Enako velja za druge ustrezne spletne vire projektnih informacij in pravnih dokumentov, ki so bili preiskani ročno.

V začetni fazi je bilo na splošno veliko zadetkov (Preglednica 1). Kjer je bilo mogoče, je bilo iskanje v zbirki podatkov nastavljeno na iskanje člankov glede na ustreznost in leto objave. V nadaljevanju iskanja z izbranimi kombinacijami ključnih besed je bilo težje najti ustrezno število člankov z visoko pomembnostjo, zlasti na področju odpornosti proti podnebnim spremembam/energije in prilagajanja podnebnim spremembam/stavbnega sektorja. To je bilo precej presenetljivo, saj je število člankov na področju rabe energije v stavbah in podobnih tem v literaturi zelo veliko. Da bi našli najnovejše publikacije, je bila v tej fazi v nekaterih primerih uporabljena metoda snežne kepe (Wohlin, 2014). Izbrani članki so bili pregledani z vidika ustreznosti ključnih besed ali izrazov. V nadaljevanju je mnogo kombinacij ključnih besed dalo precej zadetkov, vendar je v večini primerov le nekaj začetnih strani dalo ustrezne rezultate. Poleg tega so nekatere zbirke podatkov proizvedle zelo podobne rezultate, kar je zmanjšalo potrebo po nenehni uporabi vseh podatkovnih zbirk. Zmanjšanje števila in filtriranje člankov sta bila izvedena na podlagi naslova članka, ključnih besed, povzetka ali vsebine. Končna izbira je temeljila na raziskovalnih tematikah, navedenih v uvodu. Rezultat preiskave je precej študij in drugih publikacij, izmed katerih jih je bilo več kot 200 izbranih za podrobnejši pregled. Po proučitvi njihove pomembnosti in uporabnosti je bil rezultat nadaljnje izbire več kot 80 virov, ki so bili uporabljeni pri pregledu literature v tem članku. Izbrani *članki* so bili obravnavani z vidika treh pristopov k prilagajanju podnebnim spremembam: ukrepi upravljanja, urbana območja in stavbe.

# 3 Pregled pristopov prilagajanja podnebnim spremembam

## 3.1 Ukrepi upravljanja

V prilagoditvenih procesih imajo ključno vlogo oblasti. Te nato vplivajo na deležnike: od nacionalnih institucij, lokalnih akterjev, nevladnih organizacij, svetovalnih družb, raziskovalcev do zavarovalnic (Torabi idr., 2018). Sistem deluje na podlagi strateških in regulativnih dokumentov, ki se uporabljajo v procesih odločanja. V tem kontekstu je eden od najpomembnejših mednarodnih sporazumov na svetovni ravni Pariški sporazum, COP 21 (2015), ki je izhodišče za pripravo politik. Pregled ranljivosti zaradi podnebnih sprememb in prilagoditvene pripravljenosti v 192 državah članicah OZN, ki sta ga pripravila

Sarkodie in Strezov (2019), kaže, da so razvite države v svoje razvojne agende že integrirale načrte in politike za prilagajanje podnebnim spremembam. Zaradi močnega gospodarskega, upravljavskega in družbenega prilagajanja so tudi manj ranljive za podnebne spremembe kot države v razvoju. Eden od sklepov pregleda je, da morajo razvite države s svojim znanjem pomagati državam v razvoju. Poleg tega je za krepitev odpornosti proti podnebnim spremembam potrebna tudi mednarodna finančna pomoč.

Da se zagotovi polno izvajanje na ekosistemih temelječih pristopov prilagajanja podnebnim spremembam, je na ravni EU strategija prilagajanja (Evropska komisija, 2013a) usmerjena v nadaljnjo pripravo smernic za organe upravljanja, civilno družbo, zasebni sektor in posameznike, ki delajo na področju varovanja okolja. Po konferenci COP 21 je Evropski svet izjavil, da »sporazum ostaja temelj svetovnih prizadevanj za učinkovito obvladovanje podnebnih sprememb in ni več predmet pogajanj« (Evropski svet, 2017: 6). EU je imela pomembno vlogo tudi v procesu, ki je privedel do sprejetja Agende 2030 za trajnostni razvoj (OZN, 2015). Sprejeta je bila skupna izjava o vzpostavitvi enotnega okvira za razvojne politike in izvajanje programa do leta 2030 (Svet EU, 2017). Najnovejši tovrstni dokument je Evropski zeleni dogovor (Evropska komisija, 2019b), katerega cilj je, da bi bila Evropa do leta 2050 prva podnebno nevtralna celina. Čedalje večje zavedanje o vplivu urbanih območij na strategije prilagajanja podnebnim spremembam in njihovo blažitev je spodbudilo, da so bile sprejete številne politične sheme (Pasimeni idr., 2019). Evropski parlament je sprejel zavezo o ogljični nevtralnosti do leta 2050 (Evropska komisija, 2018a) in države članice EU pozval, naj pripravijo nacionalne energetske in podnebne načrte ter podnebne politike. Prvotna različica slovenskega podnebnega načrta (Vlada RS, 2019) je bila grajana zaradi pomanjkanja ambicij (Evropska komisija, 2019a; Zgonik, 2019), vendar je v končni različici vlada okrepila zavezo in cilje zastavila nekoliko pogumneje (Vlada RS, 2020). Slovenska vlada je sprejela tudi Odlok o programu porabe sredstev Sklada za podnebne spremembe v obdobju 2020–2023 (Ur. l. RS, št. 14/20). Na lokalni ravni pa Konvencija županov za podnebne spremembe in energijo (2019) povezuje mesta, ki so se zavezala k doseganju podnebnih in energetskih ciljev EU.

Različne napovedi kažejo, da bo cena vztrajanja pri zdajšnjem vzorcu delovanja veliko višja od pravočasnega in dovolj obsežnega odziva. V Sternovem poročilu (2007) je zapisano, da bi bili skupni stroški in tveganja zaradi podnebnih sprememb enakovredni izgubi vsaj 5 % letnega svetovnega BDP. Trenutne napovedi se niso pomembneje spremenile. V državah srednje in južne Evrope, vključno s Slovenijo, naj bi gospodarske izgube v zadnji tretjini 21. stoletja po sedanji stopnji prilagajanja podnebnim spremembam, presegle 4 % letnega BDP (Evropska komisija, 2018b). Hitro razogljičenje energetskega sistema in zmanjšanje porabe naravnih virov zahtevata 1 % do 2 % svetovnega letnega BDP (Evropska komisija, 2018b; IPCC, 2018). Ob upoštevanju negotovosti dejavnikov vpliva je takšna ocena približna, vendar ni omejena le na podnebne spremembe, pogostost izrednih vremenskih dogodkov in nihanja cen energije. Ne glede na to, ali ima znanost prav ali ne, bodo nekajdesetletne naložbe v zmanjšanje emisij v obsegu 1 % BDP v vsakem primeru imele pozitiven učinek.

Tako imenovane neobžalovalne strategije (UNEP in UNFCCC, 2001: 50) lahko zmanjšajo stroške podnebnih sprememb in delujejo kot pomemben ukrep, tako gospodarsko kot okoljsko. Lahko so priložnost za odpravo nepopolnosti trga in ustvarjanje novih koristi z večjo industrijsko konkurenčnostjo pri doseganju energetske učinkovitosti. Po mnenju več avtorjev je zmanjševanje ogljičnega odtisa najučinkovitejši ukrep za blažitev podnebnih sprememb (Nordhaus, 2017; Freire-González, 2018). V okviru zelene davčne reforme je treba obravnavati davek na ogljik, ki naj bi se po pričakovanjih povečeval. Čeprav se določanje cen emisij ogljika lahko uporabi za številne pomembne namene, globalna zaveza zahteva, da se prizna tudi ključna vloga instrumentov, ki niso vezani na ceno emisij ogljika (Tvinnereim in Mehling, 2018).

Na ravni stavb je najpomembnejše merilo blažitve podnebnih sprememb večja energetska učinkovitost obstoječih stavb. Ekonomske ocene ukrepov za energetsko prenovo tradicionalno temeljijo na obsegu naložb in zmanjšanju stroškov energije. Razen na institucionalni ravni (Evropska komisija, 2012) se pri vrednotenju naložb v energetske prenove prihodnje finančne koristi blažitve podnebnih sprememb na projektni ravni le redko upoštevajo. Nydahl idr. (2019) poudarjajo, da lahko vrednotenje različnih ukrepov energetske prenove postane finančno dobra naložba, če so v analizo vključeni zmanjšani prihodnji stroški blažitve emisij toplogrednih plinov v življenjskem ciklu. Temeljijo lahko na standardih, na primer oSIST prEN 17472 (Slovenski inštitut za standardizacijo, 2020), ali shemah, kot je na primer orodje Level(s) (Dodd idr., 2017). Zato bi morali naložbeni procesi spodbujati ravnovesje med finančnim, poslovnim in družbenim rezultatom ter dobrim počutjem prebivalcev v skupnosti (Boge idr., 2018; Salaj idr., 2018). Poleg tega so potrebni zanesljivejši modeli, ki bi se razvili iz modela vlaganja le v stavbo v model vlaganja v socialno varnost in regionalni razvoj (Temeljotov Salaj idr., 2011).

Zgornje navedbe kažejo, da bo blažitev podnebnih sprememb verjetno povzročila manjšo porabo energije, večje prihranke in spremembo uveljavljenih preferenc potrošnikov (IPCC, 2014). Spremembe bodo vplivale tudi na delež dohodka, ki ga bodo uporabniki ali posamezna gospodinjstva po-

rabili za ogrevanje in hlajenje stavb. Clarke in sodelavci (2018) ugotavljajo, da velik del študij o družbenogospodarskih in energetskih sistemih obravnava statistično gospodarsko razmerje med podnebnimi spremenljivkami in porabo energije. Trdijo, da je tak splošni pristop, ki temelji na podatkih za pretekla obdobja, omejen glede predvidevanja prihodnjih sprememb energetskih sistemov. Posebej zahteven je izračun vpliva porabe energije na delež porabljenega dohodka v gospodinjstvih. Po Olonscheckovi in sodelavcih (2011) se bo neto globalna poraba energetskih virov povečala za 0,1 %, če se bo temperatura zvišala za 2 °C. Če bodo uporabniki poskušali ohraniti enako raven toplotnega ugodja v stanovanjih, bodo morali porabiti dodaten delež dohodkov za energijo (Clarke idr., 2018). Nadzor nad porabo energije s težnjo po energetski neodvisnosti ima lahko zelo velik vpliv na ekonomski položaj gospodinjstev. To zagotavlja manjšo odvisnost energetskih potrošnikov od nestanovitnega trga v smislu pomanjkanja fosilnih virov energije. Poleg tega lahko pomeni pomembno geopolitično prednost v svetu, kjer so dobavitelji naftnih ogljikovodikov močno politično razdeljeni.

## 3.2 Urbana območja

Na splošno se vplivi podnebnih sprememb v urbanih območjih kažejo kot vremenski dogodki, ki vplivajo na temelje urbanih sistemov (prebivalstvo, grajeno okolje in infrastruktura). Posledice so lahko fizične (npr. poškodbe objektov) in/ali družbenoekonomske (npr. izguba dohodka, vplivi na zdravje) (Wandl in van der Hoeven, 2018). Pretekli izredni vremenski dogodki so izpostavili predvsem ranljivost večjih urbanih območij z velikim številom prebivalcev in kompleksno infrastrukturo. Čeprav je odpornost proti podnebnim spremembam lahko povezana z najpomembnejšimi prednostnimi nalogami mestnih oblasti, kot sta gospodarska rast in socialna blaginja, se procesi prilagajanja v večini urbanih območij odvijajo zelo počasi (Carter idr., 2015).

To ni presenetljivo. Odpornost proti podnebnim spremembam je ključni koncept, vendar je v okviru mest to zapleten proces, ki vključuje številne dejavnike (Torabi idr., 2018). Glede na prepletenost urbanih sistemov je težko natančno določiti učinke podnebnih sprememb na nekatere sektorje in sisteme, saj so posledice pogosto obsežnejše, kot je vidno na prvi pogled (Carter idr., 2015). Po Rastandehu (2015) analiza alternativnih podnebnih scenarijev zagotavlja dobro izhodišče za proučevanje verjetnih vplivov blažitvenih strategij na prihodnji razvoj v spreminjajočih se razmerah. Ta pristop je lahko ključni politični instrument za vključevanje podnebnih sprememb v procese odločanja. Vendar je potrebnih več metodologij in tehnik za preoblikovanje teh napovedi v realistične razvojne vzorce. Na primer, Truong in sodelavci (2018) predlagajo nov model za izbiro naložb v prilagajanje podnebnim spremembam, ki upošteva nezanesljivost napovedi. Avtorji ugotavljajo, da navedeni okvir močno poveča vrednost prilagoditvenih naložb v primerjavi s prejšnjimi praksami. Pri tem je pomembno zlasti, da se upošteva ustrezno zaporedje naložb, ki ohranja prožnost naložb v negotovih razmerah na področju podnebnih sprememb. Mata in sodelavci (2019) so v svoji celoviti študiji v okviru petih scenarijev podnebnih sprememb izračunali različne potenciale zmanjšanja porabe energije in stroškov, ki nastanejo pri različnih ukrepih varčevanja z energijo. Pri tem so primerjali negotovost zaradi podnebnih sprememb z drugimi negotovostmi, kot so na primer omejitve popisa emisij in razvoj energetskega sistema. Ugotavljajo, da finančna učinkovitost ukrepov energetske prenove stavb pogosto temelji na relativnem razmerju med letno naložbo in potencialom privarčevane energije. Pri teh izračunih imajo prihodnje podnebne razmere manj odločilno vlogo. Ukrepi, ki vplivajo predvsem na porabo energije za ogrevanje, so bolj robustni kot spremembe rabe električne energije. Menijo, da je treba strategije za energetsko prenovo stavb prednostno osredotočiti na varčevanje z energijo in v mobilizacijo investicij, ki na podlagi sedanjega tehnološko-gospodarskega vidika niso nujno donosne.

Rezultata temeljitega in *čimprejšnjega* razogljičenja gradbenega sektorja bosta zmanjšano povpraševanje po energiji in širša poraba obnovljivih virov energije (Evropski parlament in Svet, 2018). Energetske prenove stavb so torej okoljsko in stroškovno učinkovit pristop. Bunten in Kahn (2017) pa vendarle verjameta, da lahko trajnost nepremičninskega kapitala ovira prilagajanje podnebnim spremembam. V primeru takšnega stanja Dafermos in sodelavci (2018) predlagajo oceno posledic podnebnih sprememb na finančno stabilnost z analizo vrednosti finančnih sredstev ter finančnega položaja podjetij in bank. Ob proučevanju globalnih podatkov za obdobje 2016-2120 ugotavljajo, da lahko podnebne spremembe postopno zmanjšajo likvidnost podjetij zaradi uničenja kapitala in posledičnega zmanjšanja dobičkov. To lahko privede do višje stopnje utaj in tako negativno vpliva na finančni in nefinančni sektor. Škoda zaradi posledic podnebnih sprememb lahko spodbudi selitev kapitala, kar lahko povzroči postopen padec cen delnic prizadetih podjetij. Finančna nestabilnost zaradi podnebnih sprememb lahko negativno vpliva tudi na posojila. Poleg tega lahko nekatere posledice kratkoročnih ukrepov privedejo do naraščanja gospodarskih in socialnih težav v prihodnosti (Champagne in Aktas, 2016).

Matko in sodelavci (2016) ugotavljajo še, da uvedba metod, ki omogočajo oceno tveganj, vpliva na zmanjšanje škode zaradi izrednih vremenskih dogodkov. Dober primer takega pristopa je študija Pasimenijeve in sodelavcev (2019), ki analizirajo sinergijo med ukrepi prilagajanja in blažitve na ravni mest v Italiji in Španiji (prilagoditev mest ter zdravje, promet, infrastruktura in energija). Ukrepi za upravljanje mest so bili

opredeljeni kot mehki (osredotočeni na okoljske informacije), sivi (osredotočeni na stavbe) in zeleni (osredotočeni na rešitve, ki temeljijo na naravi). Skupna primerjalna analiza kaže, da so bili v načrtovanje lokalnih energetskih, okoljskih in podnebnih prilagoditev v velikih in srednjih italijanskih mestih uporabljeni predvsem mehki (52 %) in zeleni (28 %) ukrepi. To je v skladu s sporočilom Evropske komisije (2013b), v katerem beremo, da so zeleni pristopi eno od najbolj uporabljenih, gospodarsko trajnostnih in učinkovitih orodij za boj proti vplivom podnebnih sprememb. Nekatere probleme blažitve in prilagoditve podnebnim spremembam je mogoče reševati tudi z uporabo zelene infrastrukture (npr. z izkoriščanjem prednosti biotske raznovrstnosti in raznih ekosistemov), ki se vse pogosteje izvaja (Ravnikar in Goličnik Marušić, 2019), vendar je treba sočasno uvajati tudi ukrepe na ravni stavb.

Prilagoditve (zelena infrastruktura) vplivajo na zdravje (čistejši zrak, boljša kakovost vode, manj bolezni) in socialne stike (krepitev občutka pripadnosti skupnosti, zmanjšanje občutka izključenosti), ki omogočajo fizične, psihološke, čustvene in družbeno-gospodarske koristi, povezovanje urbanih in podeželskih območij ter ustvarjajo privlačno okolje za življenje in delo ter krepitev regionalnega in urbanega razvoja (Evropska komisija, 2013b). Učinkovitost zasnove in lokalno podnebno odpornost lahko spremljajo kazalniki stopnje prilagajanja. Kot primer takšnega pristopa je mogoče omeniti projekt osmih azijskih mest, v katerem je bil ustanovljen skupni konceptualni okvir, v katerem so posamezna mesta izvedla lokalni prilagoditveni postopek (Tyler idr., 2016). Carter in sodelavci (2015) menijo, da bodo prilagoditveni procesi uspešni, če bodo večdimenzionalni in sinergijski kot so mesta sama, z blažitvenimi strategijami, vgrajenimi v jedro načrtovanja in upravljanja mest.

## 3.3 Stavbe

Pregled literature na temo podnebnih sprememb in stavb kaže, da gradbeni sektor pomeni pomemben potencial za blažitev podnebnih sprememb in doseganje ciljev trajnostnega razvoja (Andrić idr., 2019; Kristl, 2019). Vendar tudi stavba, prilagojena podnebnim spremembam, ni dober izraz (Grynning idr., 2017). Trenutno pregledana literatura ni izčrpna in se večinoma nanaša na splošne zakonodajne ravni in strategije načrtovanja. Ugotovitve so deloma zelo splošne zato niso primerne za uporabo v dejanskih razmerah. Poleg tega je specifične vplive podnebnih sprememb na stavbe precej težko opredeliti, saj so odvisni od lokalnih razmer. Zelo uporabna je študija Antonopoulosove in sodelavcev (2019), ki ugotavlja, da je vpliv urbanih mikroklim na porabo energije odvisen od lokalnih temperaturnih razlik in mikrotermalnih anomalij ter krajevnih in družbenih razlik. To ustreza rezultatom pregleda literature na področju rabe energije, iz katerih je razvidno, da lahko pojav toplotnega otoka za 19 % poveča porabo energije za hlajenje in za 18,7 % zmanjša porabo energije za ogrevanje (Li idr., 2019). Opozoriti je treba, da razpoložljive študije večinoma obravnavajo vplive podnebnih sprememb na porabo energije v stavbah, emisije toplogrednih plinov in toplotno ugodje (Kershaw idr., 2011; Olonscheck idr., 2011; de Wilde in Coley, 2012; Esteves, 2014; Wang in Chen, 2014). V večini primerov dokazujejo, da bo v prihodnje vzorec rabe energije precej spremenjen in da pretekli podnebni podatki niso primerni za natančno oceno energijske učinkovitosti stavb v prihodnosti (Farah idr., 2019). Tudi študija (Dolinar idr., 2010), ki obravnava nizkoenergijsko stavbo v dveh tipičnih podnebjih v Sloveniji, predalpskem in sredozemskem, napoveduje povišanje temperature od +1 °C do +3 °C in povečanje sončnega sevanja od +3 % do +6 %. V predalpski regiji bi se zato poraba energije za ogrevanje zmanjšala za 6 % do 25 %, v obalni regiji pa sprememba ne bi bila tako velika. Te informacije so koristne, saj je iz njih razvidno, da ugodna konfiguracija stavbe omogoča precejšnje zmanjšanje porabe energije za ogrevanje. Vendar bi se v primerjavi z obstoječim stanjem v predalpski regiji poraba energije za hlajenje povečala za približno šestkrat, v obalni regiji pa za približno dvakrat.

Enako številne druge študije napovedujejo, da se lahko delež porabe energije za ogrevanje in hlajenje v primerjavi s sedanjimi razmerami pomembno spremeni. Verjetno se bo spremenila tudi struktura energetskih virov, pričakuje se zlasti precejšnje zmanjšanje porabe tradicionalnih energijskih virov za ogrevanje stavb (Clarke idr., 2018). Ena nedavnih študij napoveduje, da se bo letna poraba energije za ogrevanje zmanjšala za 21 %–22 %, za hlajenje pa povečala za 29 %–31 %. Kombinirana poraba energije za ogrevanje in hlajenje se bo v primerjavi s sedanjo porabo energije zmanjšala za 4 %–5 % (Farah idr., 2019). Poleg tega bodo temperaturne skrajnosti pomembno vplivale na delovanje stavb. Predhodni rezultati, ki temeljijo na energijskih simulacijah, kažejo, da se bo v prihodnosti pojavljalo precejšnje pregrevanje stavb, kar bo močno vplivalo na porabo energije za hlajenje stavb in/ali udobje prebivalcev (Dino in Akgül, 2019). Ocenjuje se, da bo relativna variacija največje obremenitve hlajenja v bližnjih prihodnjih ekstremnih razmerah do 28,5 % večja kot v tipičnih razmerah (Moazami idr., 2019a, 2019b). Energijske robustnosti stavb torej ni mogoče presojati izključno na podlagi tipičnih prihodnjih razmer.

Številne študije kažejo tudi precejšnje razlike med hladnejšim in toplejšim podnebjem. Zmanjšanje števila ogrevalnih ur v hladnejših podnebjih je skoraj zanemarljivo, zmanjšanje tega števila ur v toplejših podnebjih pa je lahko pomembno (za 0,8 % oziroma 43 % ogrevalnih ur v letu 2050 v primerjavi z letom 2010 za srednji podnebni scenarij) (Andrić idr., 2017). To pomeni, da se lahko potreba po energiji za ogrevanje zmanj-

ša, pregrevanje pa se lahko okrepi, zlasti v stavbah, načrtovanih za zdajšnje zmerne podnebne razmere (Košir idr., 2018). To se ujema z izsledki študije (Weng, 2017), ki obravnava toplotno ugodje v stanovanjskih stavbah v Združenem kraljestvu, z uporabo podnebnih scenarijev za leta 2030, 2050 in 2080. Do leta 2050 bo mogoče pregrevanje stavb preprečevati z intenzivnim prezračevanjem, pozneje pa se lahko uporablja tudi nočno prezračevanje. Vendar ima pasivno hlajenje svoje meje, zato bo treba od leta 2080 uporabljati kombinacijo senčenja in umetnega hlajenja. V Severni Evropi se prilagajanje podnebnim spremembam nanaša predvsem na boljšo odpornost proti vlagi zaradi pričakovanega povečanja padavin in rahlega zvišanja temperatur (Lisø idr., 2017). To pomeni, da bo treba obravnavati predvsem tipična gradbeno-fizikalna vprašanja, kot sta hidroizolacija in difuzija vodne pare skozi stavbni ovoj (Grynning idr., 2017). Ob upoštevanju podnebnih sprememb je treba pristop dobro toplotno izoliranih stavb v zmernih podnebjih vnovično proučiti. V toplejših podnebjih se bo v vseh podnebnih scenarijih poraba energije za ogrevanje verjetno zmanjšala, potreba po hlajenju in tveganje pregrevanja pa se bosta močno povečala. Ukrepi, kot so naravno in mehansko prezračevanje, bodo imeli majhen vpliv, toplotna izolacija in zmanjšanje infiltracije pa bosta imela večji vpliv na porabo energije (Pérez-Andreu idr., 2018). Poleg tega Bruno in sodelavci (2017) poudarjajo, da se dobro izolirane stavbe v toplejših podnebjih pogosto pregrevajo vse leto, in predlagajo temeljito obravnavo geometrije stavbe in koncepta stavbnega ovoja. Poleg tega je pomembno, da so na odprtinah nameščena senčila in da se uporablja nočno prezračevanje (Blecich idr., 2016). Obenem se priporoča skrbna študija osončenosti (Košir idr., 2014).

Nekateri deležniki že obravnavajo različne možnosti prilagajanja, kot sta iskanje alternativnih lokacij in izpopolnjeno vzdrževanje obstoječega stavbnega fonda. Vendar ta ukrepa nista dovolj celovita, da bi učinkovito ublažila vse posledice podnebnih sprememb (Bunten in Kahn, 2017), kot sta na primer učinek toplotnega otoka in odpornost prebivalcev. Predvsem pa je treba zagotoviti, da negativni vplivi in bremena, ki so posledica podnebnih sprememb, ne bodo vplivali na nove stavbe in da bo mogoče zlahka popraviti škodo, nastalo zaradi izrednih vremenskih dogodkov (Champagne in Aktas, 2016). V zvezi z obstoječimi stavbami je treba razviti ustrezne in podnebno prilagojene ukrepe za upravljanje in vzdrževanje stavb, vključno z načrti za izboljšanje in nadgradnjo obstoječih sistemov (Grynning idr., 2017). Poleg tega nekateri avtorji menijo, da je treba nemudoma začeti pripravljati multidisciplinarne ukrepe za blažitev posledic podnebnih sprememb z integriranjem inženirskih in družbeno-okoljskih vidikov (Pisello idr., 2017). Podpora odločanju za zmanjšanje tveganj in podnebne ranljivosti v grajenem okolju mora biti univerzalna, sestavljena iz nacionalnih gradbenih aktov, nacionalnih in mednarodnih standardov, certifikacijskih shem in smernic za načrtovanje (Lisø idr., 2017).

## 4 Razprava

Vplivi podnebnih sprememb so številni in se kažejo v naravnem in grajenem okolju. Ker imajo stavbe in infrastruktura dolgo življenjsko dobo, niso podnebju izpostavljeni le v času gradnje, temveč tudi v desetletjih svojega delovanja. Pri prilagajanju podnebnim spremembam je torej smiselno obravnavati nove in obstoječe stavbe. Pregled literature dokazuje, da imajo tri obravnavana področja (regulativni ukrepi, urbano okolje in stavbe) velik potencial za blažitev podnebnih sprememb. Področja se lahko upoštevajo tudi kot tri ravni ukrepov, ki morajo biti medsebojno usklajene, sicer ne bodo imele želenega učinka. Ugotavljamo, da kljub pomembnemu napredku na raziskovanem področju ni veliko celovitih študij, ki bi se ukvarjale z izbranimi vprašanji. Zlasti je mogoče opredeliti tri ključne izzive, na katere se bo treba v prihodnjih letih bolj osredotočiti: pomanjkanje specifičnih strategij prilagajanja podnebnim spremembam, napovedovanje porabe energije v spreminjajočih se podnebnih razmerah in odpornost proti podnebnim spremembam s posebnim poudarkom na finančnem bremenu.

Pomanjkljiv institucionalni odziv je osrednji izziv. Številne študije trdijo, da je priprava politik in zakonodaje ključna, vendar jo včasih ovirajo nezanesljive napovedi glede podnebnih sprememb. To se kaže v neenakomerni pripravljenosti različnih ravni upravljanja. V mnogih razvitih državah so izzivi podnebnih sprememb že vključeni v strateške razvojne dokumente, medtem, ko so infrastruktura in gradbeni predpisi prilagojeni prejšnjim podnebnim vzorcem, metodologije presojanja za daljša prihodnja obdobja pa se šele razvijajo. Nezadostni podatki o posledicah podnebnih sprememb in s tem povezana nezanesljivost napovedi otežujejo tudi izbiro prilagoditvenih ukrepov.

Na ravni urbanih območij je izziv precejšnja kompleksnost, zaradi česar je prilagoditev le eden od izzivov, s katerimi se načrtovalci in odločevalci srečujejo vsakodnevno. Zaradi tega procesi prilagajanja mnogokrat napredujejo zelo počasi, kar zmanjšuje konkurenčnost sektorja in povečuje zaostanke pri doseganju trajnostnih ciljev. Kot primerna strategija za uvajanje prilagoditvenih in blažilnih shem so večkrat predlagane rešitve, ki temeljijo na naravi. Kljub temu so nekateri strateški dokumenti, ki so podlaga za nadaljnji razvoj okoljskih politik, že pripravljeni. Dodatno je treba povečati število raziskav, s katerimi bi pridobili ustrezen obseg informacij za uporabo pri pripravi nadaljnjih prilagoditvenih strategij.

Na ravni stavb še ni jasnih smernic za prilagajanje podnebnim spremembam, čeprav so standardi za trajnostno vrednotenje stavb že v pripravi in je že razvit skupni okvir EU za temeljne kazalnike trajnostnosti. Poleg tega je Evropska komisija vzpostavila pomembno raziskovalno shemo (Horizont 2020), ki podpira razvoj podnebnega modeliranja, metod in standardov, izboljšanja razumevanja ekonomije podnebnih sprememb, razvoj tehnoloških možnosti in strategij za izboljšanje kakovosti zraka in zmanjšanje ogljičnega odtisa evropskih mest ter vzpostavljanje podnebnih mrež. Te dejavnosti imajo velik potencial za smotrnejšo uveljavitev podnebnih smernic v prihodnosti. Na ravni novih stavb so bili na primer za začetek leta 2021 opredeljeni jasni cilji za nZEB (Evropski parlament in Svet, 2010), na področju obstoječih stavb pa so bile podprte naložbe v energetsko prenovo (Evropski parlament in Svet, 2018). Ti ukrepi že kažejo rezultate. Vendar se področje odpornosti proti podnebnim spremembam na ravni stavb še vedno razvija. Podatki nakazujejo, da bo treba v razvitih državah, kjer je bila večina stavb zgrajena pred letom 1980, pozornost še naprej namenjati oblikovanju ustreznih smernic za prenovo obstoječega stavbnega fonda, prilagojenega prihodnjim podnebnim razmeram. Delovanje stavb bo v prihodnosti verjetno odvisno od kombinacije energijskih virov, ki bo drugačna od današnje, saj bodo globalno segrevanje in lokalna temperaturna odstopanja močno vplivali na porabo energije. V državah v razvoju s hitro rastjo mest se je treba osredotočiti na strategije in razvoj okoljskih politik.

Na finančnem področju so takojšnji manjši ukrepi ocenjeni kot dražji, saj odlašanje z večjimi trajnostno naravnanimi naložbami lahko povzroči povečano tveganje in posledično večje dolgoročne stroške. Ocenjuje se, da bodo skupni stroški zaradi podnebnih sprememb precej višji od stroškov ukrepanja za zmanjšanje emisij toplogrednih plinov (Stern, 2007). Vpliv se lahko pokaže tako v rezultatih gospodarstva doma in v tujini kot v mednarodnih trgovskih tokovih (IPCC, 2014; Nacionalni inštitut za javno zdravje, 2016; Svetovna meteorološka organizacija, 2018). To pomeni, da bodo morali uporabniki ali posamezna gospodinjstva čedalje več prihodkov namenjati za stroške energije, kar bi moralo organe spodbuditi, da postopno uvedejo spremembe v načrtovanju in postopkih evalvacije. Prihodnje finančne koristi omejevanja podnebnih sprememb se pri vrednotenju naložb za energijsko prenovo trenutno redko upoštevajo. Izbira med hitrim ali zapoznelim ukrepanjem, s katero se spoprijemajo organi, mora temeljiti na ravnovesju med finančnimi stroški zgodnjega ukrepanja (kot je tveganje predčasnega umika nekaterih še vedno uporabnih kapitalskih zalog) in vzajemnih stroškov zamude. Prelaganje večjih naložb na poznejši čas obsega tudi tveganje prehitrih odločitev o manj kakovostnih naložbah z uporabo trenutnih modelov visoko emisijske naložbene opreme. Če zmanjšanje emisij naglo postane absolutna prednostna naloga, bo predčasno končanje teh naložb zelo drago. Zgodnje ukrepanje ob tem omogoča tudi večjo dolgoročno prožnost naložb za približevanje stabilizaciji koncentracij toplogrednih plinov v ozračju.

## 5 Sklep

Sistemi v svetu se bodo morali prilagajati podnebnim spremembam, krožnim gospodarskim procesom, starajočemu se prebivalstvu, urbanizaciji, priseljevanju in ranljivi infrastrukturi. To pomeni, da bodo morale prihodnje strategije za povečanje konkurenčnosti gradbenega sektorja vključevati nove okoljske, gospodarske in socialne pristope, ki tvorijo tudi tri glavne stebre trajnostnega razvoja. Čeprav strokovnjaki čedalje bolj podpirajo oprijemljive ukrepe za blažitev podnebnih sprememb, je javnost le na splošno naklonjena prilagoditvenim procesom. Podnebne spremembe bodo neizogibno vplivale na trenutni življenjski slog in kakovost življenja. Ob tem postaja vse bolj jasno, da bodo na posameznih področjih potrebne precejšnje finančne naložbe. Zato je treba okrepiti ozaveščanje in informativne kampanje o prilagoditvenih strategijah ter o vplivu podnebnih sprememb na življenje in družbo. Podnebno nevtralnost je mogoče doseči le s preobrazbo zdajšnjih družbeno-tehničnih struktur, vključno z energetskimi in urbanimi sistemi (EEA, 2019). Te informacije so ključne za pripravo konkretnih ukrepov, s katerimi se bodo obravnavali prihajajoči izzivi podnebnih sprememb v stavbnem sektorju.

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# Izračun hitrosti potovanj z mestnim avtobusom: primer Ljubljane

Pri spodbujanju rabe javnega potniškega prometa ima pomembno vlogo razumevanje razmer, ki jih sistem zagotavlja za potnika. Na izbiro potovalnega načina vplivajo številni dejavniki, med katerimi se kot pomembna izkazuje konkurenčnost potovalnega časa ali potovalne hitrosti. Pri njenem izračunu si lahko zaradi razširjenosti elektronskih plačilnih sistemov pomagamo z zbranimi podatki validacij uporabnikov. S tem lahko na podlagi dejanskih potovanj izračunamo njihovo hitrost. V okviru raziskave smo na primeru avtobusnega sistema v Ljubljani analizirali vse vožnje, opravljene na tipičen dan. Na podlagi vstopnih in izstopnih podatkov o avtobusni vožnji smo izračunali opravljeno razdaljo, čas, potreben za pot, in hitrost opravljenih poti. Primerjali smo še, kako hitro bi lahko potniki poti, prevožene z avtobusom, opravili s kolesom ali peš. Ugotovili smo, da je hitrost obravnavanih potovanj z avtobusom odvisna od dolžine potovanja. Pri daljših potovanjih se hitrost povečuje. Kolo je hitrejše na vseh razdaljah, vendar pri večjih razdaljah postane manj sprejemljiva izbira. Hoja je na obravnavanih razdaljah do 2 km glede hitrosti konkurenčna le v manjšem deležu poti. Z opravljenimi analizami nam je uspelo s podatki, ki se zbirajo zaradi elektronskega plačevanja storitve, pridobiti uporaben vpogled v uporabniško učinkovitost sistema javnega prometa, kar je v prihodnje lahko uporabno pri načrtovanju izboljšav sistema.

**Ključne besede:** javni potniški promet, hitrost potovanja, efektivna hitrost potovanja, elektronski plačilni sistem, primerjava hitrosti

# 1 Uvod

Razumevanje potovalnih navad prebivalcev in razlogov zanje je eno od pomembnih področij spodbujanja trajnostne mobilnosti. Cilji ukrepov trajnostne mobilnosti so namreč pogosto usmerjeni v spreminjanje potovalnih navad, predvsem v zmanjševanje rabe osebnega avtomobila in povečevanje rabe javnega potniškega prevoza (v nadaljevanju: JPP), kolesarjenja in hoje kot oblik opravljanja vsakodnevnih poti. Pri odločitvi za rabo JPP je izjemno pomembna njegova kakovost (Vanhanen in Kurri, 2007). Študije, ki se ukvarjajo z obravnavo potovalnih navad, proučujejo dejavnike, ki vplivajo na izbiro potovalnega načina, ali kazalnike, ki opredeljujejo delovanje sistema. Kazalniki kakovosti sistema JPP se delijo v dve pomembni skupini: kakovost ponudbe in kakovost izvedene storitve (KFH Group, 2013). Kakovost izvedene storitve je opredeljena na podlagi uporabnikove zaznave ali dejanskih številčnih meritev (Carreira idr., 2014). V primeru dobre kakovosti storitve so pri odločitvi za uporabo JPP še posebej pomembni pogostost, razpoložljivost, trajanje poti, cena in odnos osebja (Stradling idr., 2007). Ključna kazalnika, ki sta hkrati tudi pomembna dejavnika pri izbiri potovalnega načina, sta hitrost in posledično čas, ki ga uporabnik porabi za neko pot. Slovenskih raziskav na tem področju je malo in ne omogočajo poglobljenega vpogleda v razmere s stališča potnika, pri čemer te razmere vplivajo na njegovo motivacijo za uporabo JPP (Statistični urad RS, 2017; Ljubljanski potniški promet, 2019). Potovalni čas je eden od pomembnejših elementov kakovosti JPP (KFH Group, 2013). Vsi drugi dejavniki izbire potovalnega načina se namreč pomembneje izrazijo šele, ko ima uporabnik na voljo časovno konkurenčno izbiro več potovalnih načinov. S povečevanjem porabljenega časa, na primer za pot na delo, sta neposredno povezana zmanjšanje zadovoljstva uporabnikov (Loong in El-Geneidy, 2016) ter slabšanje počutja in družbene vključenosti (Morris in Guerra, 2015).

Pri izračunu hitrosti JPP so uveljavljene številne metode. Hitrost JPP na nekem segmentu, ki vključuje vse postanke in zastoje, se imenuje komercialna hitrost. Ta kazalnik je pomemben predvsem s stališča operaterja, saj na njegovi podlagi lahko izračuna čas, ki ga prevozno sredstvo potrebuje za izvedbo prevoza po liniji, pripravi vozni red in urnik voznikov ter učinkovito razporeja vozila v sistemu. S stališča potnika pa le podatek o komercialni hitrosti ne zadostuje. Potnik namreč čas potovanja med prevoznimi načini primerja na razdalji od vrat do vrat. Zato sta zanj pomembnejša čas in hitrost, ki vključujeta tudi čas dostopa do postajališča, čakanja, potovanja v vozilu, morebitnega prestopanja in nazadnje še dostopa do cilja (Munizaga idr., 2017; Constantinescu idr., 2018). To hitrost v nadaljevanju imenujemo efektivna skupna hitrost potovanja.

Velik potencial za pridobivanje in analizo teh hitrosti so podatki, ki se zbirajo ob validaciji potnikov z digitalnimi plačilnimi sistemi. Ti podatki omogočajo veliko boljše razumevanje potovalnih navad potnikov, smiselno pa jih je uporabiti tudi pri izboljšavah sistemov JPP (Schmöcker idr., 2016). Podatke t. i. pametnih plačilnih kartic je mogoče uporabiti tudi za izračun ključnih kazalnikov delovanja sistema (Trépanier in Morency, 2016). Na podlagi teh podatkov je mogoče poleg potovalnih hitrosti izdelati še številne druge analize (Jang, 2010).

Namen prispevka je predstaviti metodo za analizo hitrosti potovanj, opravljenih z mestnim JPP v Ljubljani, na podlagi zbranih podatkov dejanskih potovanj. V okviru raziskave smo se ukvarjali s časovnimi parametri potovanj brez analiz občutenih časov. Raziskava je izhajala iz hipoteze, da je na podlagi razpoložljivih podatkov plačilnega sistema in voznih redov mogoče določiti hitrost opravljenih potovanj z JPP, ki bo natančnejša od do zdaj razpoložljivih podatkov. Drugi del raziskave je obravnaval primerjavo hitrosti istih potovanj, če bi jih uporabniki namesto z JPP opravili peš ali s kolesom. Primerjava med posameznimi potovalnimi načini v mestu je sicer pogosto obravnavana tema (Ellison in Greaves, 2011; Andersen, 2014), vendar večinoma nesistematično. Znanstvenih raziskav, ki bi na dovolj velikem vzorcu in primerljivih relacijah omogočale primerjavo med JPP in kolesom, pri pregledu literature nismo našli. Glede na razpoložljive podatke o razmeroma kratki razdalji povprečno opravljene poti smo v tem delu izhajali iz druge hipoteze in sicer, da bi bilo lahko povprečno potovanje, opravljeno z JPP, s kolesom opravljeno hitreje.

## 1.1 Obravnavani primer Ljubljane

V Ljubljani mestni JPP izvaja podjetje Ljubljanski potniški promet (v nadaljevanju: LPP), ki letno prepelje skoraj 40 milijonov potnikov. V zadnjih letih število prepeljanih potnikov upada, in to kljub številnim izboljšavam storitve in udobja potnikov, kot so prenova voznega parka, sistem obveščanja o prihodih avtobusov, izboljšana kakovost postajališč in ločeni pasovi za avtobuse na nekaterih vpadnicah. Poglavitni razlog za upad ni povsem jasen (Ljubljanski potniški promet, 2019). Prostorska dostopnost JPP je na območju mesta dobra (Gabrovec in Bole, 2006; Kozina, 2010; Gabrovec in Razpotnik Visković, 2012, 2018; Tiran idr., 2015).

Področje potovalnih časov je slabo raziskano. Celcerjeva (2009) je analizirala potovalne čase na izbranih linijah in jih primerjala s potovalnim časom na isti razdalji z osebnim avtomobilom, vendar ni izračunala potovalnih hitrosti. Na vseh proučevanih relacijah je ugotovila, da so potovalni časi z osebnim avtomobilom precej krajši. Potovalne čase na nekaterih linijah je proučeval tudi Šabić (2015), vendar je računal le komercialno hitrost, ki ne upošteva tudi časa čakanja in hoje

do avtobusne postaje in do cilja. Podobno tudi LPP meri le komercialno hitrost (Šmajdek, 2011). Iz podatkov sledenja vozilom je bila izračuna hitrost vožnje na liniji 1, ki v vseh delih dneva presega 22 km/h (Čelan in Lep, 2020). Majhna potovalna hitrost je kot ključna težava JPP izpostavljena tudi v strateških dokumentih Mestne občine Ljubljana in ljubljanske urbane regije (Milovanović, 2017; Gojčič, 2018), vendar niso navedene ne sedanje ne ciljne vrednosti, kar je verjetno posledica slabe raziskanosti te tematike.

Potencial za izdelavo analiz je elektronski plačilni sistem, ki je bil v Ljubljani uveden leta 2010. Ob vstopu v vozilo vsak potnik opravi validacijo s kartico ali telefonom. Ob tem se podatek o validaciji skupaj z informacijo o postajališču, ki je pridobljena iz sistema spremljanja lokacij avtobusov (AVL), pošlje na centralni strežnik (Šmajdek, 2011). Razen spremljanja skupnega števila prepeljanih potnikov za letna poročila, ti podatki razen nekaterih izjem (Koren, 2016; Koblar, 2017; Koblar in Žebovec, 2018), niso bili podrobneje analizirani. So se pa izkazali za zelo koristne pri analizi potovalnih vzorcev uporabnikov (Koblar in Žebovec, 2018; Koblar in Mladenovič, 2020) in načrtovanju morebitnih sprememb v omrežju (Koblar, 2017).

## 2 Metode

Za izračun potovalnih časov smo analizirali podatke iz plačilnega sistema. Ker se v plačilnem sistemu zabeleži le vstopna postaja, je bil eden od izzivov izračun izstopnih postajališč in združevanje posameznih voženj v potovanje. Z vožnjo mislimo na opravljeno vožnjo na posamezni liniji, ki je zabeležena kot validacija v plačilnem sistemu. Potovanje je ena ali več voženj, združenih skupaj – upoštevani sta vstopna postaja na prvi vožnji potovanja in izstopna postaja na zadnji vožnji potovanja. Ti podatki so bili nato podlaga za izdelavo nadaljnjih analiz.

### 2.1 Izračun izstopnih postaj in potovalnih časov

Analizo potovalnih časov in hitrosti smo opravili na podlagi opravljenih voženj, ki so zabeležene v plačilnem sistemu LPP. Iz prejetih podatkov validacij za leti 2015 in 2016 smo najprej izbrali tipičen dan, v katerem je bilo opravljeno povprečno število voženj (validacij), ni bilo padavin, šolskih počitnic, cestnih zapor niti drugih posebnih dogodkov. Za tipičen dan je bila izbrana sreda 18. 5. 2016, ko je bilo opravljenih 142.181 voženj.

Ker je večina plačilnih sistemov JPP, podobno kot obravnavani, zasnovanih tako, da se zabeleži le vstop v vozilo, so se s problemom določanja izstopnih postajališč ukvarjali številni avtorji (Cui, 2006; Trépanier idr., 2007; Zhao idr., 2007; Farzin, 2008; Lu, 2008; Wang, 2010; Li idr., 2011; Wang idr., 2011; Alsger idr., 2016; Mosallanejad idr., 2019; Yan idr., 2019; Assemi idr., 2020). V splošnem je bil uporabljen preprost algoritem, ki je za določanje izstopnih postaj za potovanja posamezne osebe primerjal dve dnevni vožnji in upošteval dve merili: izstopna postaja prve vožnje je enaka vstopni postaji naslednje vožnje in izstopna postaja zadnje vožnje v dnevu je enaka vstopni postaji prve vožnje. Poleg določanja izstopnih postaj je treba pri rekonstrukciji potovanj združiti tudi posamične vožnje v sklenjena potovanja. Pri tem je treba pravilno določiti, kdaj gre za prestop na drugo linijo in nadaljevanje potovanja, kdaj pa se potovanje konča. To se določa na podlagi razdalje med izstopnim postajališčem na prejšnji liniji in vstopnim postajališčem na naslednji liniji ter časom, ki preteče med izstopom in naslednjim vstopom (Alsger idr., 2016). Zaradi pomanjkanja ustreznih podatkov večina raziskovalcev ni preverjala pravilnosti rezultatov. Pomemben korak k izboljšanju algoritmov in preverjanju kakovosti rezultatov so naredili Alsger in sodelavci (2016). S podatki validacij iz Queenslanda, kjer se potniki validirajo tudi ob izstopu, so namreč lahko preverili točnost rezultatov. S popravki uveljavljenih algoritmov in vključitvijo podatkov iz voznih redov jim je kakovost algoritmov za določanje izstopnih postaj uspelo dodatno izboljšati. Pozneje so sledile še dodatne izboljšave, ki z zahtevnejšimi metodami (strojno učenje) uspešneje določijo izstopne postaje (Yan idr., 2019; Assemi idr., 2020). Zaradi preprostejše izvedbe in zadovoljivih rezultatov smo se pri svoji raziskavi odločili za uporabo algoritma, ki so ga predlagali Alsger in sodelavci (2016).

Za izračun izstopnih postaj na podlagi uporabljenega algoritma morajo podatki validacij vsebovati informacije o identifikatorju kartice, času vožnje, uporabljeni postaji in liniji. Pridobljeni podatki vsebujejo vse potrebne informacije, poleg tega smo pridobili tudi ustrezno strukturirano bazo voznih redov, ki omogoča povezavo s podatki validacij. Pred začetkom izvajanja analize smo iz baze izločili vožnje, ki niso vsebovale ustreznih podatkov. Nekatere vožnje so bile opravljene na medkrajevnih linijah, zato jih ni bilo v voznem redu mestnega JPP, pri nekaterih pa je bila napačno zabeležena linija ali postajališče. Ker je izstopno postajo mogoče določiti le za potnike, ki so v tistem dnevu opravili več kot eno vožnjo, smo iz baze izločili še podatke za uporabnike z le eno vožnjo v izbranem dnevu (17.614). Osnovne pogoje za vključitev v analizo je izpolnjevalo 113.985 ali 80,2 % vseh opravljenih voženj. V postopku izračuna izstopnih postajališč in določanja prestopov je potrebna matrika razdalj med postajališči. Za postajališča, ki so oddaljena manj kot 800 m, smo razdalje modelirali na podlagi cestnega omrežja, s čimer smo dosegli večjo natančnost izračuna, za razdalje med drugimi postajališči pa smo izračunali evklidsko razdaljo, saj bi bil izračun za matriko 840 × 840 analiziranih postajališč predolgotrajen.

Izračun izstopnih postaj smo naredili s samostojnim programskim orodjem, ki sledi uporabljenemu algoritmu (Alsger idr., 2016). Program najprej analizira zaporedne vožnje iste osebe in jih razvrsti po potovanjih. Eno potovanje je lahko sestavljeno iz več voženj z vmesnimi prestopi. Potencialne izstopne postaje smo določili na podlagi voznega reda, iz katerega se izberejo potencialna izstopna postajališča, in to glede na uporabljeno linijo. Od postajališč, izbranih v prejšnjem koraku, se za izstopno postajališče določi tisto, ki je najbližje naslednji vstopni postaji. Za določitev časa izstopa se vstopnemu času prišteje čas potovanja po voznem redu med obema postajama. Če je naslednja vstopna postaja oddaljena manj kot 800 m in je vmes preteklo manj kot 60 minut, se vožnja označi kot prestop, v nasprotnem primeru pa kot samostojno potovanje. Če je šlo za prestop, program analizo validacij tega uporabnika nadaljuje toliko časa, dokler ne pride do zadnje vožnje potovanja. Če je to zadnja vožnja v dnevu, se kot izstopna postaja izbere tista, ki je najbližje vstopni postaji prve vožnje v dnevu, program pa nadaljuje analizo voženj naslednjega uporabnika.

Izstopno postajo smo določili za 110.069 ali za 96,5 % validacij, ki so izpolnjevale pogoje za vključitev v analizo. Rezultat analize je seznam voženj z dodanim podatkom o izstopni postaji, času izstopa in zaporedni številki potovanja. Pri vožnjah, ki so se nadaljevale s prestopanjem na naslednjo linijo, je zabeležena tudi razdalja do naslednjega vstopnega postajališča. Te podatke smo nato združili po posameznih vožnjah in za te izračunali potovalni čas.

## 2.2 Izračun povprečnega časa čakanja

Eden od dejavnikov, ki vpliva na potovalni čas, je čas čakanja na prihod avtobusa. Ob predpostavki, da potniki na postajališče pridejo naključno, je povprečni čas čakanja odvisen od pogostosti voženj avtobusov, ki peljejo v želeno smer. Zato smo za uporabljeno linijo izračunali razliko v času med uporabljeno, prejšnjo in naslednjo vožnjo. Če je šlo za prvo ali zadnjo vožnjo v dnevu, smo upoštevali le razliko do naslednje oziroma prejšnje vožnje. Po enakem postopku smo čas čakanja izračunali še za preostale linije, ki bi lahko bile uporabljene za vožnjo med izbranima postajališčema. Pri tem smo upoštevali le linije, na katerih najbližji odhod po voznem redu ni več kot 5 minut pred opravljenim časom vožnje ali za njim. Za izračun povprečnega časa čakanja smo čakalne čase na posameznih linijah pretvorili v frekvence, te pa sešteli. Seštevek smo nato pretvorili v čas čakanja in ga delili z 0,5. Za potovanja, pri katerih je bil čas čakanja večji od 4 minut, smo predvideli, da potniki pred vožnjo preverijo vozni red ali napoved voznih redov, zato smo za teh 16.771 voženj določili povprečni čas čakanja 4 minute. Povprečni čas čakanja pri teh vožnjah je po prvotnem izračunu znašal 6,1 minute.

## 2.3 Izračun časa in hitrosti potovanja

Ker se izračuni in opredelitve potovalne hitrosti med seboj zelo razlikujejo, smo zaradi boljše primerljivosti z dosedanjimi raziskavami hitrost potovanja izračunali na štiri načine. Pri tem smo spreminjali upoštevano razdaljo in upoštevani čas potovanja, kot je navedeno v Preglednici 1.

**Preglednica 1:** Metoda izračuna hitrosti potovanja

| | Upoštevana razdalja | Upoštevani čas |
|---|---|---|
| Efektivna skupna hitrost potovanja | Efektivna prepotovana razdalja: $l_{najkrajša} + l_{hoja}$ | Skupni čas potovanja: $t_{vožnje} + t_{čakanja} + t_{hoje}$ |
| Skupna hitrost potovanja | Prepotovana razdalja: $l_{razdalja\ po\ linij\ LPP} + l_{hoja}$ | Skupni čas potovanja: $t_{vožnje} + t_{čakanja} + t_{hoje}$ |
| Efektivna hitrost potovanja | Efektivna prepotovana razdalja: $l_{najkrajša}$ | Čas potovanja: $t_{vožnje}$ |
| Dejanska hitrost potovanja | Dejanska prepotovana razdalja: $l_{razdalja\ po\ linij\ LPP}$ | Čas potovanja: $t_{vožnje}$ |

Pri čemer velja:

$l_{najkrajša}$: najkrajša razdalja med začetnim in končnim postajališčem – izračunana kot peš oddaljenost po omrežju poti,

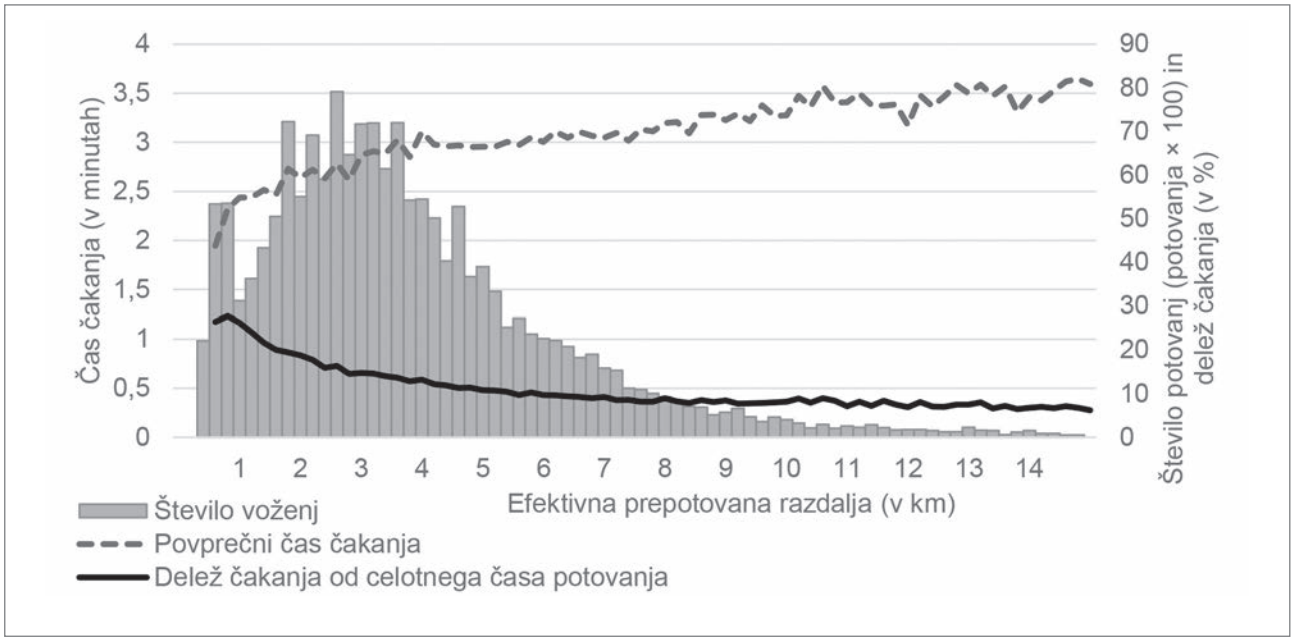
$l_{hoja}$: 400-metrska razdalja – skupna razdalja za hojo do prvega postajališča in od zadnjega postajališča do cilja,

$l_{razdalja\ po\ linij\ LPP}$: prepotovana razdalja z avtobusom, v primeru prestopanja je upoštevana tudi prehojena razdalja med prestopnima postajama,

$t_{vožnje}$: čas med vstopom na prvi vožnji in izstopom na zadnji vožnji potovanja – vključuje tudi čas ob prestopanju na drugo linijo,

$t_{čakanja}$: povprečni čas čakanja na prihod avtobusa na prvi vožnji potovanja,

$t_{hoje}$: 5 minut – čas, potreben za hojo na 400-metrski razdalji, ki je dodana kot $l_{hoja}$. Gre za oceno, podano glede na pripravljenost za hojo do avtobusnih postajališč (Tiran idr., 2019).




**Slika 1:** Povprečni čas čakanja in število voženj, v odvisnosti od dolžine potovanja (izdelal: Simon Koblar)

### 2.4 Hitrost hoje in kolesarjenja

Čas potovanja s kolesom in hojo smo modelirali v programu OpenTripPlanner (Morgan idr., 2019), z uporabo prometnega omrežja, izdelanega iz podatkovne baze OpenStreetMap (OpenStreetMap contributors, 2015). Ti podatki so za Ljubljano dovolj kakovostni, da dobimo dovolj točne rezultate. V programu OpenTripPlanner smo uporabili privzete nastavitve za hitrost in uteži za posamezne kategorije cest. Hitrost kolesarjenja je bila določena na 17,7 km/h. V literaturi se pojavljajo različne ocene o povprečni hitrosti kolesarjev v mestu, in sicer od 15 do 19 km/h (Ellison in Greaves, 2011; Andersen, 2014; Kager idr., 2016). Ker za Ljubljano ni na voljo podatka o povprečni hitrosti kolesarjev, menimo, da je privzeta ocena hitrosti primerna. Za hojo je bila upoštevana hitrost 4,8 km/h. Izračun smo opravili za vse pare izvorov in ciljev potovanj. Za izračun efektivne hitrosti potovanja smo tudi pri hoji in kolesarjenju poleg razdalje med postajališči dodali dodatnih 400 m, kar je pri kolesarjenju pomenilo minuto in pol, pri hoji pa dodatnih pet minut. Za kolesarjenje smo dodali še dodatni dve minuti, ki sta potrebni za odklepanje in zaklepanje kolesa.

### 2.5 Združevanje podatkov in analiza kakovosti

Po izdelavi posameznih analiz smo podatke združili v skupno podatkovno bazo, v kateri so za vsako potovanje zbrani analizirani podatki. Iz baze smo nato izbrisali potovanja, za katera smo predvidevali, da so se v izračunu pojavile napake. Izkazalo se je, da je merilo za združevanje voženj v potovanja, ki upošteva čas prestopanja manj kot 60 minut in razdaljo med postajališči manj kot 800 m, premalo natančno. Zato smo kot kontrolo kakovosti podatkov izračunali koeficient in razliko med $l_{razdalja\ po\ linij\ LPP}$ in $l_{najkrajša}$. Kjer je $l_{razdalja\ po\ linij\ LPP}$ precej večja kot $l_{najkrajša}$, menimo, da gre za napačno oznako prestopa in sta bili v resnici dve potovanji. Iz baze smo zato izločili vsa potovanja, pri katerih je: $l_{razdalja\ po\ linij\ LPP}/l_{najkrajša} < 0{,}8$ ali $> 4$ in $l_{razdalja\ po\ linij\ LPP} - l_{najkrajša} < -100$ m ali $> 100$ m. Dodatno smo izločili še potovanja, pri katerih je dejanska hitrost potovanja < 5 km/h ali > 50 km/h. Tako smo izločili napake, ki so se lahko zgodile zaradi napak v povezavi z voznim redom ali zaradi napačnega združevanja posameznih voženj v potovanje, kadar je bil vmesni čas čakanja predolg. V tem primeru lahko potnik v vmesnem času resnično opravi druge aktivnosti, obišče lokal, trgovino ipd., in nato potovanje nadaljuje. Taka potovanja z vidika proučevanja potovalnih hitrosti namreč niso relevantna. Od 74.085 voženj nam je po izločitvi neustreznih potovanj ostalo 70.768 potovanj, na podlagi katerih so bile izdelane nadaljnje analize.

## 3 Rezultati

Na podlagi analiziranih podatkov je mogoče izdelati številne analize. Ker je glavni namen tega prispevka analiza potovalnih hitrosti, v nadaljevanju predstavljamo glavne rezultate analiz, povezanih s potovalno hitrostjo. Najprej so predstavljeni rezultati analiz za mestni avtobus, v nadaljevanju sledi še primerjava s potovalnimi hitrostmi hoje in kolesarjenja.

**Preglednica 2:** Ključni rezultati analize mestnega JPP

| Kazalnik | Vrednost |
|---|---|
| Efektivna skupna hitrost potovanja | 10,0 km/h |
| Povprečna dejanska prepotovana razdalja | 4,8 km |
| Povprečna efektivna prepotovana razdalja | 4,1 km |
| Povprečni čas čakanja | 2,9 minute |

**Preglednica 3:** Število potovanj glede na število opravljenih prestopov

| Število prestopov | Število potovanj | Delež od vseh potovanj |
|---|---|---|
| 0 | 70.146 | 79,1 % |
| 1 | 16.459 | 18,6 % |
| 2 | 1.682 | 1,9 % |
| 3 | 311 | 0,4 % |
| 4 | 69 | 0,1 % |
| 5 | 14 | 0,0 % |
| Vsa potovanja | 88.681 | 100,0 % |

**Preglednica 4:** Izračunane potovalne hitrosti z avtobusom

| | Povprečna hitrost (v km/h) | Standardni odklon (v km/h) |
|---|---|---|
| Efektivna skupna hitrost potovanja | 10,0 | 3,3 |
| Skupna hitrost potovanja | 11,3 | 3,4 |
| Efektivna hitrost potovanja | 15,7 | 6,2 |
| Dejanska hitrost potovanja | 17,6 | 5,7 |

## 3.1 Mestni avtobus

Ključne ugotovitve rezultatov analize mestnega JPP so navedene v Preglednici 2. Podrobnejši podatki so podani v podpoglavjih.

### 3.1.1 Povprečni čas čakanja

Eden od dejavnikov, ki vpliva na efektivno hitrost potovanja, je povprečni čas čakanja na prihod avtobusa pri prvi vožnji potovanja. Povprečni čas čakanja je 2,9 minute, s standardnim odklonom 1. Na Sliki 1 so prikazani povprečni časi čakanja in delež čakanja od celotnega časa potovanja v odvisnosti od dolžine potovanja. Pri daljših potovanjih so potniki na prihod prvega avtobusa v povprečju čakali dlje kot pri krajših. Eden od razlogov je tudi ta, da so se morala daljša potovanja začeti zunaj mestnega središča, kjer pa so prihodi avtobusov manj pogosti kot v središču mesta. Z dolžino potovanj se zmanjšuje delež časa, porabljenega za čakanje, v primerjavi s celotno dolžino potovanja.

### 3.1.2 Prestopanje

Prestopanje uporabnikom pogosto ni nekaj najljubšega. Omrežje LPP izvira iz obdobja plačevanja vozovnice ob vsakem vstopu, zato je bil eden od ciljev pri oblikovanju omrežja zmanjšati potrebo po prestopanju (Koblar, 2017). V bolj razvitih omrežjih je prestopanje razumljeno kot pomemben del opravljanja poti, saj omogoča kombinacijo številnih ponudnikov in sistemov in s tem večjo pokritost z JPP (Mees, 2010; Dodson idr., 2011). V analizo prestopov smo poleg 70.768 potovanj, za katera smo izvedli tudi druge analize, vključili tudi 17.614 potovanj uporabnikov, ki so na proučevani dan opravili le eno vožnjo in so bile zato njihove vožnje neustrezne za izračun izstopnih postaj. Preglednica 3 prikazuje število potovanj glede na število prestopov, opravljenih med potovanjem.

### 3.1.3 Potovalna hitrost

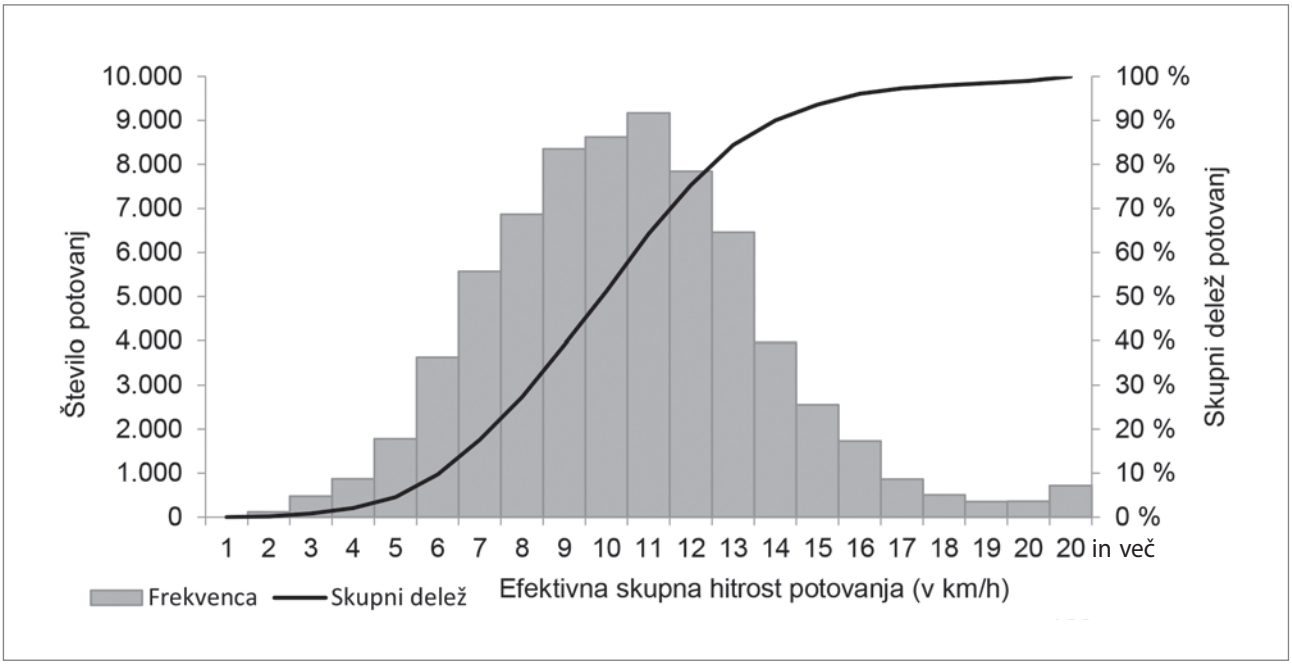
Potovalna hitrost je eden od dejavnikov določanja kakovosti sistema JPP. Preglednica 4 prikazuje potovalne hitrosti glede na različna uporabljena merila iz Preglednice 1.

Poleg povprečne hitrosti je pomembna tudi razporeditev števila potovanj, ki je prikazana na Sliki 2. Histogram ima obliko normalne porazdelitve, z nekoliko večjim številom vrednosti na desni strani grafa.

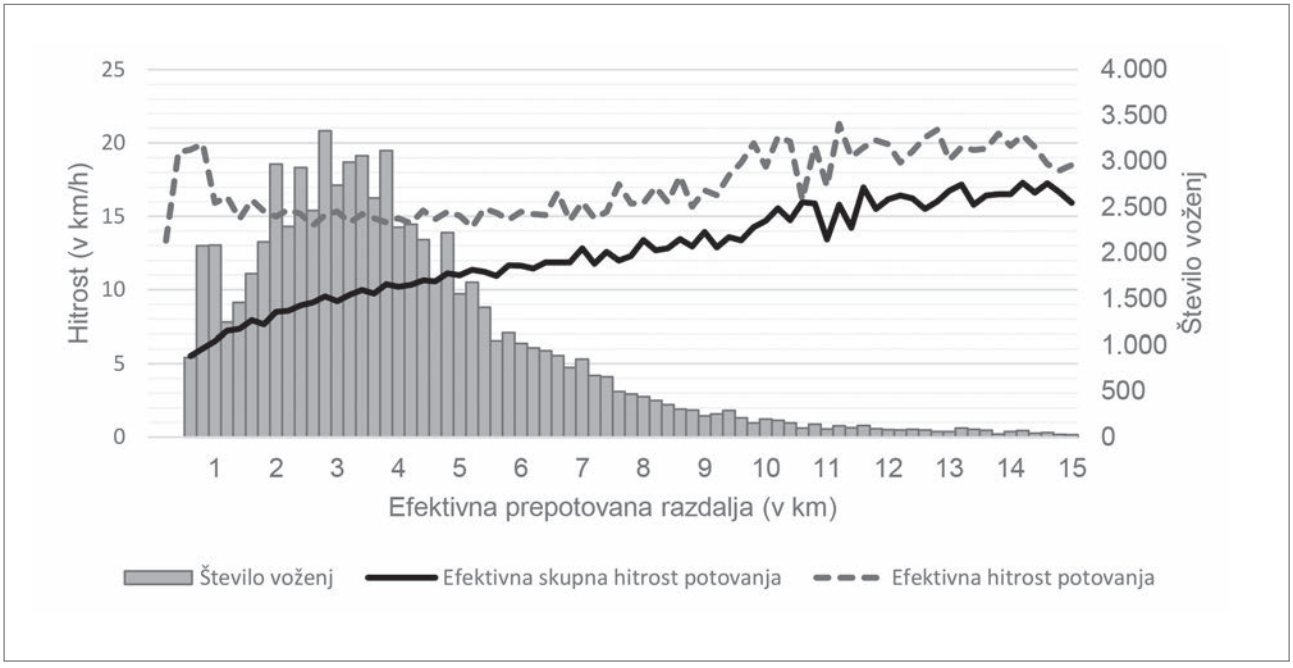
Potovalna hitrost je odvisna tudi od dolžine potovanja. Pri daljših potovanjih čas čakanja in čas, potreben za hojo, zmanjšata vpliv na hitrost potovanja, zato se hitrosti z daljšanjem potovanja povečujejo. Zanimiva je krivulja efektivne hitrosti vožnje, ta hitrost je pri kratkih razdaljah zelo velika, kar je posledica dejstva, da so razlike, kot so ugotovljene med prevoženo razdaljo in najkrajšo razdaljo, pri kratkih vožnjah manjše kot pri daljših. Poleg tega pri teh izračunih nista upoštevana hoja do postajališča in čas čakanja.

## 3.2 Primerjava s kolesarjenjem in hojo

Za boljšo predstavo o hitrosti potovanja z JPP in razumevanje konkurenčnosti JPP v primerjavi z drugimi trajnostnimi oblikami mobilnosti smo naredili še primerjavo s hitrostjo potovanja s kolesom in hojo. Pri primerjavi hitrosti potovanja z avtobusom in kolesom smo upoštevali efektivne skupne potovalne hitrosti, saj te najbolje izražajo uporabniško izkušnjo. Te hitrosti z dolžino potovanja naraščajo, saj se zmanjšuje vpliv časa čakanja in hoje pri potovanju z avtobusom in dodatnega časa, potrebnega za odklepanje in zaklepanje kolesa. Kolo je najhitrejše na vseh razdaljah, razlika v času in potovalni hitrosti pa je največja pri krajših potovanjih. Potovanja bi bila s




**Slika 2:** Število potovanj po razredih efektivne hitrosti potovanja z avtobusom (izdelal: Simon Koblar)

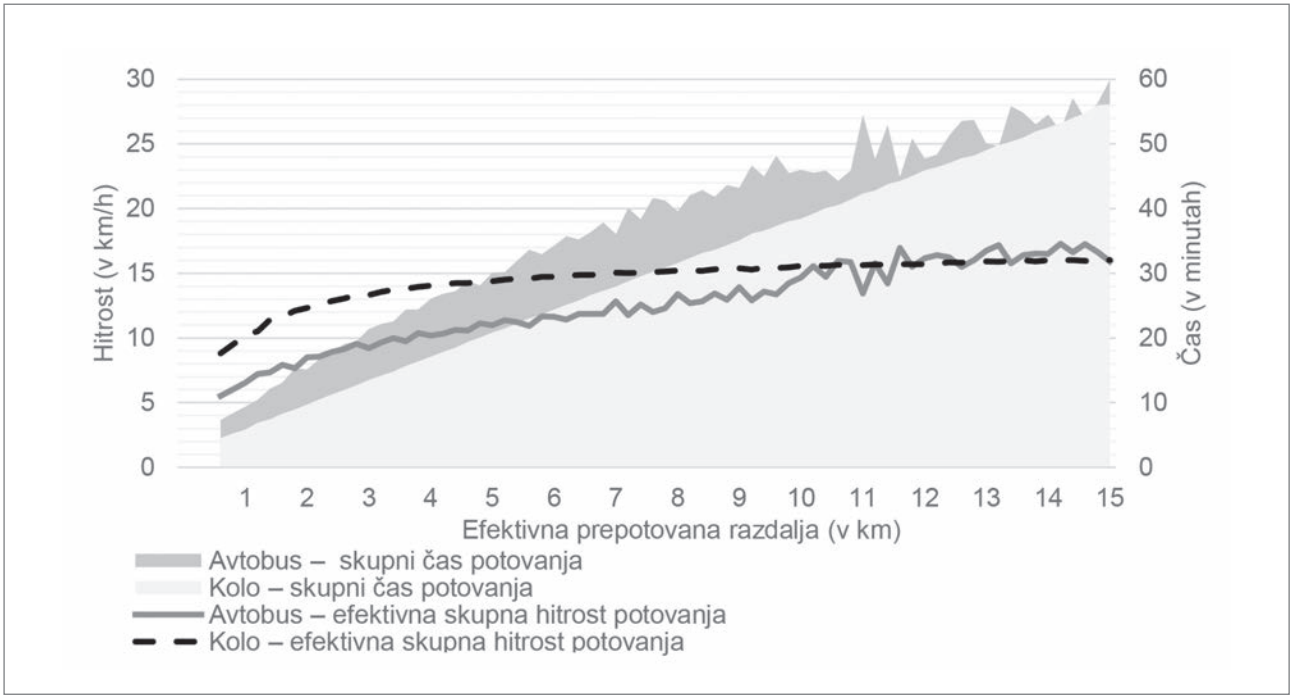



**Slika 3:** Potovalna hitrost v odvisnosti od dolžine potovanja (izdelal: Simon Koblar)

kolesom v povprečju opravljena 7,5 minute hitreje. Z avtobusom bi bilo hitreje kot s kolesom opravljenih le 8 % potovanj. Več kot 5 minut hitreje bi bilo s kolesom opravljenih 46 % potovanj. Zaradi majhne hitrosti hoje smo upoštevali le potovanja, dolga do 2 km. Na razdalji do 2 km bi bilo peš hitreje kot z avtobusom opravljenih 926 ali 7 % vseh teh potovanj. Če upoštevamo še potovanja, ki so z avtobusom le manj kot minuto hitrejša, je takih potovanj 1.783 ali 13 %.

## 4 Razprava

Prispevek prinaša nova spoznanja na področju merjenja kakovosti JPP in razkriva velik potencial podatkov plačilnega sistema za izdelavo nadaljnjih analiz. Ker so analize izdelane na podlagi opravljenih voženj, so rezultati še posebej zanimivi z vidika uporabnikov, saj izražajo uporabniško izkušnjo in dajejo vpogled v obnašanje potnikov. Zaradi odsotnosti podatka o izstopni postaji v plačilnem sistemu je bil eden zahtevnejših




**Slika 4:** Primerjava hitrosti in potovalnih časov med avtobusom in kolesom (izdelal: Simon Koblar)

korakov izračun izstopnih postaj. Pri tem smo z razpoložljivimi podatki uporabili preverjeni algoritem (Alsger idr., 2016), pri čemer smo razdaljo med postajališči modelirali v GIS-okolju po omrežju pešpoti, s čimer smo dosegli večjo natančnost v primerjavi z izračunano zračno razdaljo, ki so jo uporabili Alsger in sodelavci (2016). Za izračun potovalnih hitrosti smo za vsako vožnjo izračunali še čas čakanja na postajališču, čas vožnje in prepotovano razdaljo. Uporabljena metoda za izračun časa čakanja na postajališču, ki upošteva uro in ustrezne linije, zagotavlja z vidika potnikov realnejše rezultate kot v drugih raziskavah kakovosti JPP v Ljubljani pogosto uporabljena metoda štetja prihodov v konični uri (Bole, 2004; Tiran idr., 2015).

Ker je za potnike pomembna predvsem najkrajša razdalja med izvorom in ciljem potovanja, smo poleg razdalje, prepotovane po liniji JPP, modelirali tudi najkrajšo razdaljo po prometnem omrežju. Za izračun potovalne hitrosti se uporabljajo številne metode, zato smo izračun naredili na štiri načine, pri čemer smo spreminjali upoštevano razdaljo in upoštevani čas. Z vidika uporabnika in primerjave z drugimi potovalnimi načini je najbolj relevantna efektivna skupna hitrost potovanja, ki je v povprečju 10,0 km/h, kar je precej manj od dejanske hitrosti potovanja, ki je v povprečju 17,6 km/h. Komercialna hitrost je edini podatek, ki je bil do zdaj na razpolago v primerljivi obliki za celotno omrežje. Po podatkih Ljubljanskega potniškega prometa ta hitrost, ki upošteva le vožnjo, brez vmesnih prestopov na druge linije, znaša 18 km/h (Šmajdek, 2011), kar kaže na pravilnost opravljenih analiz. Velike razlike med rezultati kažejo na pomen izbire metode za izračun potovalne hitrosti.

Z izračunom potovalnih hitrosti smo potrdili prvo postavljeno hipotezo. Na podlagi podatkov plačilnega sistema in voznih redov je mogoče določiti potovalno hitrost opravljenih potovanj z JPP. Primerjava potovalnih hitrosti med JPP ter hojo in kolesarjenjem je pokazala na slabo konkurenčnost JPP v primerjavi s kolesom. V povprečju so poti z JPP trajale 7,5 minute dlje kot enake poti, opravljene s kolesom. S tem smo potrdili tudi drugo hipotezo. Povprečno potovanje, opravljeno z JPP, bi bilo s kolesom opravljeno v krajšem času. Nekatere krajše poti bi bile celo hitreje opravljene peš, kar kaže na pogosto nerazumne odločitve potnikov. Večina teh krajših poti je opravljena v mestnem središču, kjer so avtobusi že tako zelo obremenjeni. Razmerje med potovalnimi hitrostmi z JPP in kolesom je verjetno tudi eden od razlogov za porast kolesarjenja (Klemenčič idr., 2014) in upad števila potnikov na JPP v zadnjih letih (Ljubljanski potniški promet, 2019). Poleg proučevanja potovalnih hitrosti smo dobili tudi vpogled v obnašanje potnikov glede prestopanja. Izkazalo se je, da je kljub spremembi plačilnega sistema, ki omogoča brezplačno prestopanje 90 minut po prvi validaciji, le 20,9 % potovanj opravljenih s prestopanjem. To verjetno delno izhaja iz zasnove omrežja, ki naj bi kar se da zmanjšala potrebno število prestopov, delno pa iz počasnega sprejemanja sprememb in spreminjanja navad (pretežno starejših) uporabnikov tega načina prevoza.

Uporabljena metoda ima tudi nekatere pomanjkljivosti, nekatere bi bilo mogoče odpraviti z dodatnimi raziskavami in uporabo zahtevnejših metod. Zaradi velikega števila podatkov iz plačilnega sistema ne moremo zagotavljati popolnega nadzo-

ra nad kakovostjo podatkov. Napaka se pojavi že pri izračunu izstopnih postaj, poleg tega se v postopku določanja izstopnih postaj izloči del voženj, za katere ni na voljo ustreznih podatkov. Iz vidika kakovosti podatkov je še posebej problematično združevanje več voženj v potovanje, kar bi bilo mogoče izboljšati z uporabo zahtevnejših metod (Assemi idr., 2020). V našem primeru je bilo zato ključno, da smo iz nadaljnjih izračunov izločili izstopajoče vrednosti. Žal ne moremo oceniti točnosti izračuna izstopnih postaj, kar bi lahko po zgledu Wanga idr. (2011) naredili s terensko raziskavo in primerjavo rezultatov. Tudi pri izračunu povprečnega časa čakanja bi uporaba drugačnih predpostavk o naključnem prihodu potnikov na postajališče dala nekoliko drugačne rezultate (Amin-Naseri in Baradaran, 2015). Pri določanju razdalje za hojo smo uporabili enotno vrednost 400 m, saj ni podatka o tem, kolikšno razdaljo uporabniki JPP v Ljubljani dejansko prehodijo. Tudi hitrost kolesarjenja, uporabljena v raziskavi, je bila le ocenjena. Zaradi mnogih elementov, ki vplivajo nanjo (kakovost kolesarske infrastrukture, čakanje na semaforjih, ne nazadnje tudi tip kolesarja in kolesa, ki ga uporablja), bi lahko bili rezultati ob uporabi drugačne predpostavljene hitrosti drugačni. Z izboljševanjem kakovosti kolesarske infrastrukture in povečanjem deleža uporabe električnih koles lahko pričakujemo, da se bodo povprečne hitrosti kolesarjev večale. Napaka se pojavi tudi pri računanju hitrosti vožnje avtobusa, to hitrost smo računali na podlagi voznih redov. Dejanske hitrosti od teh vedno odstopajo, še posebej na postajališčih proti koncu linij. Rešitev bi bila uporaba podatkov iz sistema za sledenje vozilom, na podlagi česar bi bilo mogoče natančneje določiti hitrost vožnje (Wang idr., 2011).

Podatki plačilnih sistemov JPP omogočajo še številne druge analize (Pelletier idr., 2011; Ali idr., 2016; Trépanier in Morency, 2016), ki bi jih bilo v prihodnje smiselno izvesti. Dobro poznavanje sistema JPP in obnašanje potnikov sta lahko v veliko pomoč pri uvajanju izboljšav v sistemu JPP, te izboljšave Ljubljana zaradi slabe konkurenčnosti JPP in neustrezne zasnove omrežja (Koblar idr., 2018) nujno potrebuje. Treba je namreč obrniti trend upadanja števila potnikov, saj bomo le s tem lahko dosegli zastavljene cilje o deležu poti, opravljenih z JPP (Milovanović, 2017), kar bi prispevalo k zmanjšanim okoljskim vplivom. Po drugi strani le izboljšave sistema JPP niso dovolj, potrebna bo tudi boljša integracija prostorskega in prometnega načrtovanja (Plevnik, 1997), kar še posebej velja ob obstoječih koridorjih JPP z dobro ponudbo (Šašek Divjak, 2004).

## 5 Sklep

Predstavljena metoda analize podatkov plačilnega sistema JPP in merjenja hitrosti potovanj, uporabljena na primeru Ljubljane, je eden redkih poskusov merjenja kakovosti omrežja JPP na podlagi dejansko opravljenih voženj. Izračunana efektivna skupna hitrost potovanja veliko bolje izraža uporabniško izkušnjo kot bolj splošno uveljavljene meritve komercialne hitrosti. Primerjava opravljenih voženj v primerjavi s kolesarjenjem in hojo pa te hitrosti postavi v ustrezen kontekst. V postopku izračuna hitrosti smo pridobili še druge pomembne informacije, kot so potovalni čas, prepotovana razdalja, povprečni čas čakanja in število prestopov. V prihodnje bi bilo treba upoštevati dejansko prehojeno razdaljo do postajališča, hitrost vožnje računati iz podatkov sistema sledenja vozilom, večjo pozornost pa je treba nameniti kontroli kakovosti, še posebej pri določanju izstopnih postajališč in združevanju voženj v potovanja. Analizo bi bilo tudi smiselno izvesti za daljše obdobje. Uporabljena metoda je zelo uporabna za spremljanje uporabe sistema JPP in za njegove izboljšave, s čimer bi lahko obrnili trend upadanja števila potnikov. Že trenutni rezultati na primeru Ljubljane so uporabni za prometne načrtovalce in LPP za uvajanje sprememb, ki bi povečale konkurenčnost JPP.

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Daniela Angelina JELINČIĆ

# Projekt KEEP ON: Učinkovite politike za trajne in samozadostne projekte s področja kulturne dediščine

Kako lahko zagotovimo obstojnost in trajnost kulturne dediščine? Čeprav se v večini držav največji del proračuna, namenjenega kulturnemu sektorju, porabi za ohranjanje dediščine in je dediščina vključena v številne programe Evropske unije (EU), ki ji namenjajo precejšnja sredstva, to še ne zagotavlja njene trajnosti. Mnoge kulturne ustanove še vedno težko pokrijejo celo najosnovnejše stroške vzdrževanja. Navedeno je velika težava v celotni EU, pri čemer je kulturna dediščina zaradi nedavnega upada gospodarstva in pandemije covida-19 pomaknjena še nižje na lestvici prednostnih nalog.

Trajnost je kompleksen pojem in ni nujno povezana s finančnimi sredstvi, poleg tega finančna sredstva še ne zagotavljajo trajnosti. Ta je močno odvisna od načina upravljanja dediščine, vključenosti lokalne skupnosti, okoljskih vprašanj, varovanja dediščinskih vrednot ipd. KEEP ON je projekt v okviru programa Interreg Europe in se izvaja od leta 2018, potekal bo do leta 2023, financira pa ga Evropski sklad za regionalni razvoj (ERDF). Njegov cilj je izboljšati javno politiko na področju kulturne dediščine z vidika zagotavljanja kakovostnih projektov, katerih rezultati se bodo lahko z ustreznimi javnimi sredstvi trajno ohranjali. Njegov vpliv na regionalni razvoj naj bi bil dolgotrajen. Politika, ki jo projekt KEEP ON obravnava in izboljšuje, naj bi odpravila sramoten, a običajen pristop k ohranjanju trajnosti dediščine v smislu ko se projekt konča, se vse konča. O trajnosti za zdaj izrecno razmišlja presenetljivo malo kulturnih ustanov. Načrtovati jo je treba že dolgo pred izvedbo projekta, finančni organi pa jo morajo pazljivo vključiti v svoje usmeritvene dokumente. Po drugi strani je zaradi močnega upada javnih in zasebnih naložb v mnogih državah EU in posledic globalizacije pomembno poleg javnih virov financiranja aktivirati tudi zasebne vire. Projekt KEEP ON se osredotoča na naslednja glavna vprašanja: Kako lahko ustanove še naprej podpirajo svoje delovanje, potem ko se javno financiranje preneha? Kako zagotovijo sredstva za kritje prihodnjih operativnih stroškov? Kako trajni dediščinski projekti vplivajo na širše vidike družbe (gospodarstvo, urbanizem, skupnost itd.) in kako lahko javna politika podpira upravičence pri ohranjanju samozadostnosti njihovih projektov? Odgovori se iščejo na medregionalni ravni EU.

V projektu sodelujejo partnerji iz sedmih držav EU (Grčije, Hrvaške, Italije, Nizozemske, Poljske, Portugalske in Španije), ti izvajajo šest instrumentov politike (tri programe ERDF in tri regionalne/lokalne strategije), tako da pripravljajo konkretne akcijske načrte. Sodelujoče države so izjemno bogate s kulturno dediščino, hkrati pa jih ima večina najranljivejša gospodarstva (npr. Španija, Portugalska, Italija in Grčija). Poleg navedenih so v projekt vključene tudi Poljska kot največja prejemnica sredstev na podlagi evropske kohezijske politike, Nizozemska, ki uporablja model kulturne politike z močno vključenostjo lokalnih skupnosti (kar bi lahko imelo velik vpliv na trajnost), in svetovalni partner iz Hrvaške. Dosedanje izkušnje, pridobljene v okviru navedenega partnerstva, kažejo, da države uporabljajo zelo različne pristope k zagotavljanju trajnosti kulturne dediščine. Za večino sta še vedno največja izziva zagotavljanje vzdržnega financiranja kulturne dediščine in nezadostno inovativno znanje njenih upravnikov. Po drugi strani so nekatere države navedena izziva že premagale. Ena izmed njih je Nizozemska, kjer poskušajo vzdržno financiranje dediščine zagotoviti s spremembo namembnosti objektov kulturne dediščine, pri čemer so preobrazbe pogosto namenjene širšemu trgu. Eden izmed izzivov, s katerim se pogosto srečujejo, je povezan

s sakralno dediščino; zaradi manjšanja števila vernikov se cerkve spreminjajo v koncertne dvorane, hotele, restavracije, izobraževalna središča ali študentske domove (Slika 1). Navedeno ne zagotavlja samo stalnih finančnih prilivov, ampak vpliva tudi na večjo obstojnost stavb, saj se redno uporabljajo. Poleg tega izboljša nadzor nad vlago in drugimi naravnimi dejavniki v stavbi, ki lahko vplivajo na njeno življenjsko dobo. Primeri tovrstnih sprememb namembnosti objektov kulturne dediščine so lahko navdih za druge države, čeprav so včasih močno odvisni od značilnosti posamezne dežele. Na primer, v državah, kjer so prebivalci tesno povezani s svojo vero, so tovrstne prakse neprimerne.

**Slika 1:** Nekdanji samostanski kompleks v Mariënburgu v občini 's-Hertogenbosch (vir: Internet 1)

Nizozemski primer je lahko navdih za druge države tudi z vidika načrtovanja politike: dediščinska politika je običajno dolgoročna (pokriva obdobje 20–30 let), kar izraža trajnost, in neodvisna od političnega vpliva tudi, kadar se vladajoče stranke zamenjajo. Po drugi strani je največji izziv, s katerim se spoprijemajo Nizozemci, okoljska in ekološka trajnost. Naraščajoči izpusti ogljikovega dioksida močno vplivajo na gladino rek v mnogih nizozemskih mestih, hkrati pa navedeno neposredno ogroža dediščino in je resen dolgoročni izziv. Zato se javne politike pogosto osredotočajo na zmanjšanje ogljikovih izpustov in energijske porabe, uporabo odpornih materialov in izolacije pri obnovi kulturne dediščine ter uporabo obnovljivih virov energije. Te problematike ne rešuje samo kulturna politika, ampak se obravnava celostno, z vključenostjo raznih področij (npr. urbanizma, izobraževanja, industrije, znanosti itd.). Posebna pozornost se namenja tudi ozaveščanju javnosti, kar pa zahteva dolgoročen pristop.

Tudi primeri iz drugih držav EU kažejo, da se uporabljajo zanimivi pristopi. Grad v Checinyju na Poljskem ponuja lep primer pospeševanja kulturnega turizma, portugalski ekomuzej lanu v Ribeiri de Pena (Slika 2) pa zasluži pohvale za participativni pristop k muzejskemu načrtovanju in upravljanju. Podobno kot na Nizozemskem je preobrazba verskih objektov, zlasti na podeželju, značilna tudi za Španijo. Projekt obnove in preobrazbe starega samostana v pokrajini Ribeira Sacra (Slika 3) je bil odgovor na vprašanje, kako na novo uporabiti ta zgodovinski objekt. Z njegovo obnovo in preureditvijo v hotel je zagotovljeno varstvo grajene kulturne dediščine, samostan tako ohranja svojo arhitekturno vrednost, hkrati pa je postal novo gonilo turističnega razvoja celotnega območja. V projekt je vključenih več deležnikov, med njimi tudi španska državna veriga luksuznih hotelov Paradores de Turismo de Espana, ki ponuja nastanitve v nekdanjih gradovih, palačah, trdnjavah, samostanih in drugih zgodovinskih stavbah. Veriga je skupaj s kulturnim ministrstvom in njegovim generalnim direktoratom za varstvo kulturne dediščine financirala obnovo samostana.

Pristop medregionalnega učenja, ki se uporablja v okviru projektnega partnerstva KEEP ON, lahko pomaga pri pripravi akcijskih načrtov v smislu posegov v instrumente politike, ki odpravljajo zaznane vrzeli pri zagotavljanju trajnosti kulturne dediščine. Ko so uvedeni, morajo poskrbeti za to, da prihodnji projekti, financirani v okviru teh instrumentov, upravičijo naložbe in omogočijo trajne projekte s področja varovanja kulturne dediščine.

Celoten proces deluje po načelu participacije, vanj pa so s strokovnim znanjem vključeni deležniki iz vsake sodelujoče države. Začel se je z izčrpno predstavitvijo vseh obravnavanih instrumentov politike, kar je bilo izhodišče za njihovo primerjavo. Analiza instrumentov politike iz šestih sodelujočih držav je pokazala, da kulturna dediščina ni vedno jasno opredeljena kot prednostno področje, vse države pa se zavedajo njenega razvojnega potenciala, zaradi česar jo vključujejo v svoje razvojne načrte kot del nekaterih širših tem. Kljub temu bi bilo treba politiko izboljšati ter pri tem določiti jasne in konkretne kazalnike, iz katerih bi bilo razvidno, kako financirani projekti vplivajo na lokalno skupnost in regionalni razvoj. Če instrumenti politike ne merijo svojih vplivov na podlagi vnaprej določenih kazalnikov, je zelo težko presoditi uspešnost posegov in ustrezno načrtovati prihodnji razvoj.

Z upravniki kulturne dediščine je bila nato opravljena anketa o dobrih praksah na področju zagotavljanja trajnosti kulturne dediščine, poleg tega so bili analizirani in zbrani tudi primeri dobrih praks, ki so že financirani v okviru instrumentov politike. Najnovejši rezultat projekta je praktični vodnik o trajnosti kulturne dediščine, v katerem so najprej opredeljeni izzivi in nevarnosti v povezavi z zagotavljanjem trajnosti dediščine, nato pa so predstavljene ustrezne rešitve. Največji izzivi so povezani z gospodarskimi, okoljskimi, družbeno-kulturnimi in političnimi pritiski, nanašajo pa se tudi na dediščinske vrednote in standardizacijo dediščine. Posebej so obravnavani izzivi, povezani z upravljanjem dediščine, saj je dobro upravljanje ključni dejavnik pri zagotavljanju trajnih dediščinskih projektov in upravičevanju naložb.

**Slika 2:** Muzej lanu v portugalskem mestu Ribeira de Pena (vir: Internet 2)

**Slika 3:** Samostan sv. Štefana v španski pokrajini Ribeira Sacra (vir: Internet 3)

Dosedanje delo, opravljeno v okviru projekta, daje podlago za pripravo akcijskih načrtov v posamezni državi. Zadnje štiri faze projekta so namenjene izvajanju in spremljanju akcijskih načrtov, s čimer bodo pridobljene pomembne povratne informacije o rezultatih projekta. Pričakuje se, da bo projekt izboljšal razumevanje pomena samozadostnosti kot pametnega orodja za zagotavljanje dolgoročnih koristi naložb. Javne politike lahko olajšajo doseganje boljše obstojnosti in samozadostnosti kulturne dediščine, hkrati pa podpirajo doseganje odličnosti. Širjenje dobrih praks med oblikovalci politik, upravičenci in deležniki bi moralo vplivati na povečanje njihovih zmogljivosti, projekt pa bi lahko na koncu zagotovil boljše razumevanje in aktivacijo zasebnih sredstev v projektih s področja kulturne dediščine.

Namen projekta KEEP ON je zagotoviti dragocene informacije vsem deležnikom v EU, s posebnim poudarkom na prihajajoči kohezijski politiki, ki bo veljala za obdobje po letu 2020. V skladu z novo evropsko kohezijsko politiko za obdobje 2021–2027 bo ključna naloga na področju kulturne dediščine reševanje socialnih in gospodarskih izzivov, velik poudarek pa bo na rezultatih, kar naj bi pospešilo spremljanje in merjenje projektnih rezultatov ter omogočilo uvajanje sprememb. Proračunska sredstva, namenjena kulturi, naj bi se precej povečala (za 17 %), pri čemer bo dediščina med prednostnimi področji. Poleg tega nova kohezijska politika podpira povezovanje kulture in izobraževanja, kar naj bi rešilo problem nezadostnega znanja upravnikov kulturne dediščine. Proračun, namenjen programu Erasmus+, naj bi se tako podvojil. Znova je v ospredju tudi gospodarski vidik, poleg socialnih vprašanj in identitete, ki ponujajo nove priložnosti na področju kulturne dediščine. Med dosedanjimi razlogi za slabo samozadostnost dediščinskih projektov so predvsem njihovo slabo vrednotenje in neustrezni kazalniki uspešnosti. Med prednostnimi nalogami nove kohezijske politike je tudi opredelitev zgoščenih in primernih kazalnikov, na podlagi katerih bi se lahko končno zagotovila trajnost kulturne dediščine. Strateško načrtovanje zato

ne bi smelo biti samo modna muha, ampak orodje za krepitev in ohranjanje dediščinskih vrednosti za sedanje in prihodnje generacije. Po krizi zaradi pandemije covida-19 pa se bodo lahko prednostna področja spremenila in na področju kulturne dediščine se bodo lahko pojavili novi izzivi. Navedeno bo zahtevalo še več ustvarjalnosti in inovativnosti pri zagotavljanju obstojnosti in trajnosti kulturne dediščine, pri čemer bo lahko priprava akcijskih načrtov v okviru projekta KEEP ON še toliko pomembnejša in zahtevnejša.

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## Informacije o projektu in viri

Domača stran projekta: https://www.interregeurope.eu/keepon/

Internet 1: https://commons.wikimedia.org/wiki/File:Voorkant_Mari%C3%ABnburg_%27s-Hertogenbosch.jpg.

Internet 2: http://www.ecomuseu-rpena.pt/museu-do-linho/.

Internet 3: https://commons.wikimedia.org/wiki/File:Parador_de_Santo_Estevo_-_Claustro_de_la_Porter%C3%ADa.jpg.

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# "Cold, stony, dehumanized": Unexpected outcomes of revitalization on the sensory landscape and ambience of public space: The case of Cathedral Street (Ulica Tumska) in Płock

This paper shows how changes to the appearance of a street after the revitalization process influence the perception of the street, its sensory landscape and atmosphere. The example of Cathedral Street (*Ulica Tumska*), the high street in Płock, an average-sized town in Poland, is used to prove that such changes may bring some unexpected results by evoking negative emotions among the residents. The results of the study conducted using focus groups show that the contemporary ambience of Cathedral Street cause negative sensations perceived in four dimensions: touchscape, seescape, soundscape, and smellscape. Those feelings seem to be even stronger taking under consideration positive memories of the street before revitalization. As a result of the negative atmosphere of Cathedral Street and the unpleasant emotions it evokes, the residents' activities conducted on the street are reduced only to fulfilling the most necessary needs. Such conclusion results in a postulate that when designing or redesigning public spaces we should always be aware of the consequences for the ambience of the street and the need to generate positive emotions.

**Keywords:** high street, ambience, urban experiences, urban sociology, sensory landscape

## 1 Introduction

The street, understood as a type of public space, is a research topic eagerly undertaken by urban sociology or urban ethnography. There are two distinct ways in which the street can be studied and analyzed. One type of research prioritizes the material and urbanistic aspects, focusing on how the street's materiality organizes social behaviour. This approach also views the street as constituting an element within the urban public space network (Degen, 2018; Hubbard & Lyon, 2018). The other type of research, however, tends to examine the social life taking place within the street. It also emphasizes the importance of streets in providing individuals and communities with a sense of place and time. This paradigm may be perceived as an element of the broader concept of the sociology of urban experiences, which focuses on "the lived experiences within, and with, places and spaces" (Boer, 2013: 966). Another important part of this approach is analysis of the sensory perception of public spaces – including streets – and their "atmosphere" or "ambiance" (Thibaud, 2011). The atmosphere as understood here is clearly inextricably related to emotions, because it is defined as the potential for spaces to influence feelings (Löw, 2008).

Significantly, this perception of space and its ambience may result in the need to understand that the ambience itself is an important part of the street as a complex social phenomenon. This, in turn, implies that when designing or redesigning the urban space, special attention needs to be paid to the opportunities to influence (i.e., create or renew) the atmosphere. Thibaud (2015: 42) postulates thinking about "a new field of urban intervention" and discusses its meaning: "urban design no longer just focuses on objects but also on what is between the objects. It is no longer just a question of designing buildings or megastructures, but also what surrounds them". Thus, one of the tasks of architects and decision makers is to focus not only on the functional or aesthetic layers, but also on the emotions that are likely to be evoked by changes to a public space. This particularly applies to construction and reconstructions during which the shaping and reshaping of material conditions may, in consequence, exert influence on the atmosphere of the street and evoke negative or positive emotions to its reference.

This paper shows how changes to the appearance of the street after revitalization may influence the perception of the street and its ambience. It demonstrates that the sensory experience of the street evokes negative emotions, and describes how residents tend to juxtapose these negative feelings related the street's current appearance with their positive memories. The case study features Cathedral Street (*Ulica Tumska*), the high street in Płock, an average-sized town in Poland.

## 2 The high street and its changes

Nick Dines (2018: 953) calls the street a "microcosm of the city" and, being situated in the heart of the population's everyday experience, the street may even serve as a quasi-metaphor for city life itself. Some researchers claim that the street exemplifies the character and the dynamics of the city, which is vividly depicted by Henri Lefebvre (2003: 18): "[The street] serves as a meeting place (topos), for without it no other designated encounters are possible. . . . In the street, a form of spontaneous theatre, I become a spectacle, and sometimes an actor. The street is a place where movement takes place, the interaction without which urban life would not exist. . . . The street is a place to play and learn. The street is disorder".

An interesting and significant issue undertaken as part of street research is the "high street". The term is used to describe the main shopping street (or sometimes a conglomerate of several streets), located in the city centre, with its cluster of retail and services (Carmona, 2015). In fact, the high street plays a vital role in medium-sized and small towns because it is connected with the sense of social stability and the permanence of local identity. The traditional high street functions as a communication hub as well as a meeting place, providing convenient access to shopping facilities and service outlets (Griffiths et al., 2008). It can be also treated as a "magical" spot, not only willingly visited by both residents and tourists, creating and facilitating interpersonal contacts, but also generating specific spatial and emotional relationships (Rzegocińska-Tyżuk, 2008).

However, at some point the high street seems to have lost its importance. This phenomenon is connected to changes in city centres that are usually described as degeneration or decline. These processes have been observed in Western countries since the late 1930s but reached their peak after the 1950s (Robertson, 1995). Urban sprawl (Burchell et al., 1998) and decentralization (Filion & Bunting, 2006) caused city centres to lose their significance in favour of the suburbs because of relocation of the population, trade, and services outside of city centres (Burayidi, 2001). As a consequence, some city centres began to be perceived not only as unimportant but also as less pleasant neighbourhoods inhabited by disadvantaged communities (like the elderly, immigrants, and excluded people; Neto et al., 2014).

In addition, the commercial role of high streets has been on the decline, whereas a number of alternative points offering a variety of services (financial, entertainment, health, etc.) have been on the rise (Dawson, 1988). This phenomenon has been further compounded by increasing rental costs for commercial space, leading to the outflow of entrepreneurs from the high

street (Carmona, 2015). As a result, the high street is no longer perceived as the natural social centre of a city.

The decline of the high street – just like the degeneration of the city centres – at some point became both a social and subsequently a political concern. In effect, numerous attempts to revitalize these public spaces were implemented (Anderson, 1964; Carmon, 1999; Seidman, 2004; Hechesky, 2005; Ceretta et. al., 2018). Apart from more general revitalization programs, there were also specific approaches to regenerating the high street. One of the best-known of these is the Main Street America Programme (Internet 1), which addresses the problem in a multidimensional way, focusing on issues such as economic restructuring, organization, promotion, and design (Robertson, 2004). In many cases, however, revitalization processes have not yielded the expected results, such as community regeneration or the social and economic growth of city centres (Kaźmierczak et.al, 2011). Often such processes are only partly effective. The revitalization of the infrastructure and the streets' appearances is the easiest part of the project. Other changes – such as fighting social exclusion, improving the residents' quality of life, or economic growth, are usually much harder to achieve (Nowosielski 2012a, 2012b). Moreover, some of the regeneration programmes turned out to have unexpected effects. Some of them caused gentrification (Cameron, 1992; Miciukiewicz, 2008), some had the effect of spreading economic inequalities (Stern & Seifer, 2007), and still others made the infrastructure of the city centres and high streets uncomfortable and unpleasant for residents (Gehl, 2010).

## 3 Feeling the city

There is little attention being paid to the effect of revitalization on the ambience of public spaces. Neither do the emotions evoked by the new appearance of the street – either positive or negative – undergo frequent scrutiny. Urban sociology analyses have focused more on the negative consequences of revitalization such as gentrification, rising inequalities, or the inability to activate urban communities. There seems to be a need to pay more attention to the issues of ambience and emotion. Two theoretical frames – proposed by Thibaud and Borer – can be helpful in this matter. Thibaud notes that special attention should be paid to the atmosphere of urban spaces. "Urban space provides numerous ambiances to be felt with all the senses. Whether we think of a lively outdoor marketplace or a dull parking lot, an attractive historical centre or a casual subway station, the very way we relate to those places is based on the sensory experience they involve" (2011: 43). Hence, the street is perceived not only as a place filled with material objects, or even with people, but also a place where everything that surrounds the people therein is perceived through the senses. This creates certain consequences for a researcher willing to focus on the ambience of the street. Thibaud (2011: 42) claims that in the process of perceiving public space, people do not simply see things as they are but rather feel a kind of "resonance", which lets them experience urban space as a "feeling of self and of the world".

The second frame is based on the sociology of urban experience. As Borer (2013: 969) notes, "[e]ach place in the city can be assessed through its sensory stimuli . . . . These meanings are layered onto a place, and it is in the very act of embedding these meanings that place identity and place attachment emerge and are shared with others". This remark has two important implications for further research. Firstly, these are the senses that "organize" our experience of ambience and resonance in public space. Therefore, in order to deconstruct them we need to focus on people's sensory experiences within the space. In this context Borer (2013: 969–978) proposes analysis of seescapes, soundscapes, smellscapes, tastescapes, and touchscapes of the city. Those categories somewhat match the classification of "sensual geographies" proposed by Paul Rodaway (1994), who described haptic, olfactory, auditory, and visual geographies.

Seescapes underline the role of sight and vision, which are the most obvious and perceivable ways of experiencing space. Also "[t]he visual aspects of the built environment influence the experience of urban places by giving cues and clues about what types of interactions take place there and between whom" (Borer, 2013: 970). Seescapes focus on elements such as form, colour, volume, size, order, diversity, imageability, and legibility (Wankhede & Wahurwagh, 2016: 743). It is also important that visual aspects are often taken into account in different strategies for revitalizing public space (Hubbard 1996). Soundscapes pay attention to the fact that the city is full of different sounds, rhythms, and noises of different intensity and volume that come from multiple sources, such as street traffic, public transportation, industrial parks, and people themselves. Certain mixtures of sound are often connected with particular places (Borer, 2013: 971). Smellscapes relate to olfactory perception and its interpretation – especially in the context of acceptable or unacceptable scents that are usually associated with what is socially desirable and undesirable. It is worth noting that in certain cultures – including European ones – a specific phenomenon of odour management can be observed, which is targeted at achieving "scent free" spaces (Waskul & Vannini, 2008: 55-56). Smellscapes can be defined through different "classification of smell in term[s] of aromatic, fragrant, alliaceous, ambrosial, hircinous, repulsive, nauseous and so on" (Wankhede & Wahurwagh, 2016: 743) Tastescapes describe the process of experiencing the city through production and consumption of food and drink. They focus on sensual experiences in terms of "sweetness, sourness, saltiness,

bitterness" (Wankhede & Wahurwagh, 2016: 743). Touchscapes are perhaps the most difficult dimension to describe because they are not – as it may seem – limited to "the action of fingers feeling the texture of surfaces" (Rodway, 1994: 44) but are connected to more complex experience of moving through spaces and between objects and feeling them with the whole body. Among others they include feelings of "dryness, coldness, roughness and hardness" (Wankhede & Wahurwagh, 2016: 743). The second consequence is connected with the observation the sensual experiences of the space are not individual but rather shared. As a result, they can be studied not only individually, but also in conditions that offer a perspective on the collective character of these experiences.

**Figure 1:** Płock on the map of Poland (source: Internet 2).

## 4 Cathedral Street in Płock

Cathedral Street is located in the historic town centre of Płock – a medium-sized industrial town in central Poland inhabited by approximately 120 thousand residents. Its history dates to the early nineteenth century, when, earmarked in the heart of the town (then as *Dohm Strasse*) it was planned as a connection between two squares in Płock: Canon Square (*Rynek Kanoniczy*) and New Square (*Nowy Rynek*; Rydzewska 2009). Although its construction took decades, eventually amounting to half a century, both the way it was designed and its central location contributed to its becoming the high street in Płock. It initially performed crucial functions related to being a vital transportation artery. With time, however, it developed other uses: residential, service, and commercial. The commercial function gained importance at the turn of the twentieth century, when "Cathedral Street tried to aspire to the rank of a shopping centre" (Rydzewska, 2009: 24). With time, it also started to play the role of the cultural and social centre of Płock, arousing positive emotions among the town's residents.

Within the memories of Płock residents that remember the street from the pre-war period, there emerges a picture of a joyful agora that favoured spending time in the open air. It was then that the English Hotel (which no longer exists) served as a place for meetings, tasting homemade wines, and dances. The street was a place where one could "go out" (Luma, 2009). The presence of an art club guaranteed by the colourful bohemia, as well as the opening of the Diocesan Catholic House in 1935, with a cinema and a theatre accommodating 1,500 people, provided entertainment for the less wealthy town residents (Rydzewska, 2009). After the Second World War, the character of the street changed through adaptations to the requirements of the new communist system. New public buildings were built – most of which primarily related to trade (the Centrum department store) and gastronomy (the Piast Catering Complex, later the Hortex Cocktail Bar; Rydzewska, 2009). On one hand, the communist authorities transformed the colourful English Hotel into a tailors' cooperative, whereas on the other hand, the Cultural Centre (formerly the Catholic House) on Cathedral Street was still a meeting place for artists and the centre of cultural life with an important place in the form of the Przedwiośnie cinema. Moreover, the profile of the Cathedral Street residents underwent gradual changes, when the wealthy burghers and tenement house owners were replaced by residents of lower socioeconomic status (Luma, 2009). The first street modernization began in the early 1970s. The most important anticipated change was transforming it into a pedestrian precinct with places to relax adorned with flowers and trees; these changes aroused mixed feelings among Płock residents (Rydzewska, 2009). After 1989, the systemic transformation in Poland led to a flourishing of the street's commercial function and strengthening its image as a lively commercial town centre. At the same time, there were new developments appearing that partly replaced the old ruined buildings and corresponded with or matched the original historic buildings (Rydzewska, 2009). The first decade of the twenty-first century coincided with the rapid development of Płock shopping centres. Those openings resulted in the outflow of customers from Cathedral Street, contributing to its decline as a shopping centre in Płock. There followed, however, a simultaneous initiative by the city authorities to modernize the street, with the project completed in 2006. In 2007, the design was granted the main prize in the nationwide competition "Modernization of the Year" and the town authorities embarked on promoting the renovated street under the slogan "City Lounge". A programme to finance tenement revitalization was also launched (Woźniak, 2008). Nevertheless, apart from the changes to the pavement, street furniture, and greenery, further actions were not fully implemented. Moreover, the revitalization activities were not only widely criticized, having evoked strong negative emotions among the town's residents (Woźniak, 2008; Tybura, 2019), but they also failed to


**Figure 2:** Cathedral Street (*Ulica Tumska*) in Płock (source: Internet 3).

halt the street's social degeneration and decreasing significance in Płock residents' eyes. In 2012, Cathedral Street was even called Bank Street – because as many as twenty financial institution offices could be counted within the 326-metre-long pedestrian zone. Attention was drawn to the lack of cafes, the few stores and, above all, the shortage of passers-by, all of which resulted in the impression of an empty, deserted street (Woźniak, 2008; Marciniak 2012).

This situation has not particularly changed since then. The street functionally remains just a promenade leading to Cathedral Hill (Pol. *Wzgórze Tumskie*). It seems to have lost its significance as an important place of trade, entertainment and culture (Tybura, 2019). However, it still remains a crucial emotional point of reference. As Ewa Luma (2009: 59) stated while presenting the elderly residents of Płock's experiential histories of Cathedral Street: "Cathedral Street has an important yesterday, and ahead of us, we hope, is the splendour of tomorrow. Will Cathedral Street be the city lounge? The next centuries will show . . . . The people passing along the street are her life. The street character consists of numerous elements: its buildings; houses, courtyards, alleys, the windows of the flats where people live. Residents are like the bloodstream of every town. The houses themselves are only its external image, whereas the street itself is designated by people and their associated emotions."

## 5 Research method and data

The paper is based on an analysis of the data gathered in 2018 from two focus groups (FGs) comprising the residents of Płock. Each focus group included eight individuals. Purposive sampling based on the maximum differentiation criterion was applied. The people chosen for the study were of various ages, educational backgrounds, and professions. Another criterion of sampling was place of residence: respondents from different parts of Płock took part in the focus groups. Each of the FGIs took place in the building of Mazovian State University, which is not located in the city centre but in one of the housing estates of Płock. The first focus group lasted for one hour and twenty-six minutes, and the second one hour and forty minutes.

The FGI scenario consisted of six topics, including the projection question on the impressions felt while imagining walking on today's Cathedral Street. The first block of questions was treated as a "warm-up" and concerned mostly facts about our

**Figure 3:** Stony Cathedral Street (photo: Michał Nowosielski).

respondents: their socio-demographic background, place of residence in Płock, and relationship with Cathedral Street. The second block of questions was based on projection techniques that were supposed to help to capture the respondents' emotions towards the street and its ambience, and the resonance they experienced. As a verbal stimulus, the moderator asked the respondents to close their eyes and imagine that they were on Cathedral Street. The respondents were asked to visualize themselves walking along the street and then to describe their feelings and impressions. It turned out that the respondents' reactions to this applied projection technique was enthusiastic, and their answers supplied interesting data concerning their perception of Cathedral Street's ambience. The third topic raised by the study dealt with everyday contact with Cathedral Street. The respondents were asked to describe how often they were on Cathedral Street and for what reason, or – if they did not visit it – why not. The next topic concerned events organized on Cathedral Street and their perception. The fifth block of questions dealt with strong and weak sides of the street. The point here was to find the positive and negative elements of Cathedral Street's social perception. The last issue that was raised during the FGI concerned an imagined, perfect Cathedral Street. The respondents were asked to describe what the "ideal Cathedral Street" would look like.

This article concentrates mostly on issues concerning the perception of Cathedral Street and its ambience. Therefore, its analyses focus on sensory experiences of the street divided into four categories as defined by Borer (2013), memories of feelings of the past Cathedral Street, and consequences of the revitalization process for the street's ambience. Focus groups were chosen as a research technique because they are a tool that allows greater respondent involvement. Group processes that take place during a focus group make it easier for respondents to open up to others and make contact. It offers researchers the opportunity to encourage respondents to be more expressive and to share their feelings and emotions (Gawlik, 2012). It may also provide an opportunity to discuss shared experiences and emotions. Obviously, this can only be achieved if the issues raised do not apply to highly problematic or intimate issues.

## 6 Results

The questions about their perception of Cathedral Street's ambience proved highly effective in obtaining data specifying the respondents' feelings. Many of the answers and the discussions stemming from them referred to sensual, almost bodily impressions. Following Borer's concept (2013), they can be or-

**Figure 4:** Diverse surface and pedestrians using sidewalks on Cathedral Street (photo: Michał Nowosielski).

ganized in four dimensions: touchscape, seescape, soundscape, and smellscape. One of the categories – tastescape – was not part of the study.

The respondents' statements below are coded as follows: when a single statement is provided it is coded with the number of the focus group and the number of respondent (e.g., FG1R4); when an exchange of views between more than one respondent is provided, each line is assigned the respondent's number and the whole conversation the interview number. The moderator's questions are coded with the number of the focus group and the letter M (e.g., FGI2M).

## 6.1 Touchscape

The sensation mentioned most often was the feeling of coldness. This association gave the respondents the impression of acute discomfort:

FG1R4: However unspectacular it may sound, [I feel] cold and emptiness.

FG2R7: I feel a cold atmosphere.
FG1R7: And that's interesting, because I felt cold too. The first word I thought was "cold".

During the discussions, the respondents further described the sources of that feeling. Many of them pointed out that Cathedral Street's coldness stemmed from its material makeup, namely from the materials it is paved with, and from the form and materials of the street furniture. In their descriptions the respondents indicated the prevalence of stone materials used throughout Cathedral Street to be to blame.

FG2M: Coldness? Why does it appear? Where does it come from?
R5: I think the materials from which the street was made.
R2: Yes!
R5: . . . made of. It's exactly as I say. This pavement . . . .
R1: These stone benches.
R6: Everything's just so cold.
R1: Glass advertising columns . . . . Is that what you're talking about?
R5: Yes. Everything is so . . . . There is no spontaneity.

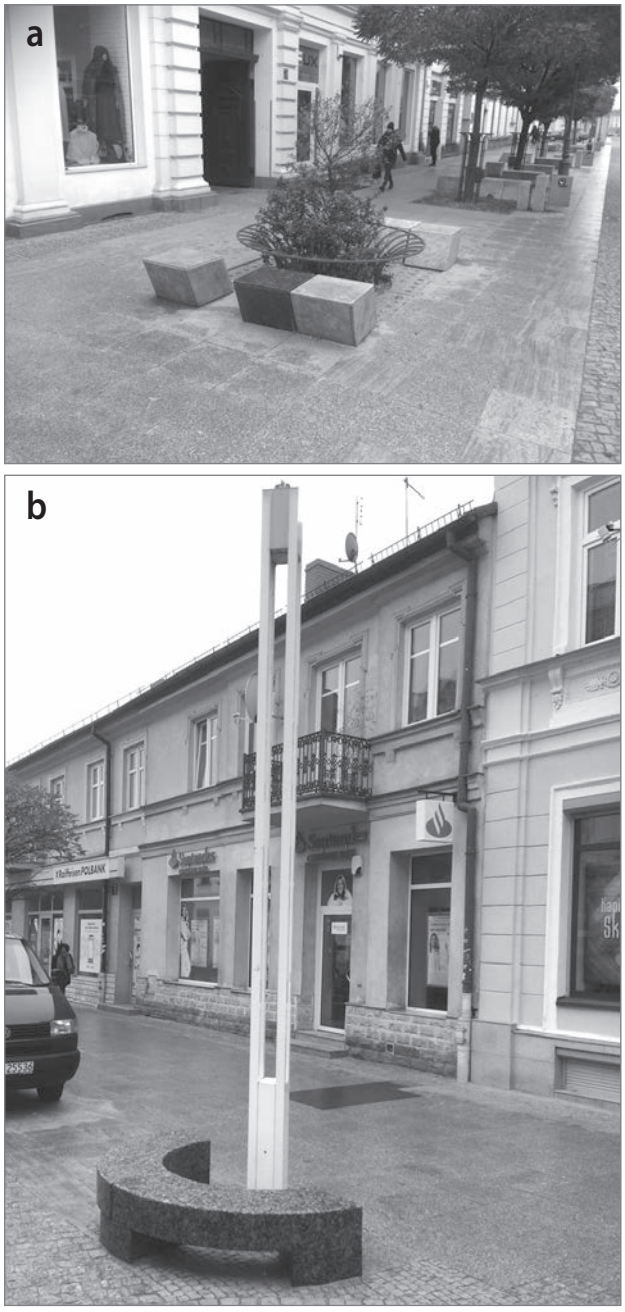


**Figure 5a, 5b:** Benches on Cathedral Street (photo: Michał Nowosielski).

The street furniture and the pavement seemed to evoke especially strong sensations and feelings among the respondents. One of the elements that drew particular attention was the surface of the promenade, which is diverse: with smooth slabs on the sides and uneven paving stones in the centre. Apart from the sense of coldness described above it was also seen as uncomfortable and dysfunctional. What is important the respondents described their experiences using expressions highlighting their sensual feelings of slipperiness or roughness.

FG2R4: The [surface] they put there, it's bad. Simply uneven. When I'm in a hurry, for example, from the bus to work, and I'm going fast, it's hard on those paving stones. Especially when it's slippery.
M: There are different zones.
R2: Yes. And when walking I chose . . . .
R1: The sides. It's more comfortable there.
R2: That's right, because there in the middle . . . there are so many stones. I ride my bike down the middle, I admit, because there are just fewer people.
R7: [The sides are] slippery in winter. In the winter, it's better to stick to the middle of the road.

Another problem the respondents noted was the street furniture, which is also perceived as stony and cold. Those sensual experiences translate into the way the street furniture is perceived as not fulfilling its role. The most frequently discussed examples were the benches, which should be places to sit, rest, and talk, but which the respondents believed were not only not cosy and uncomfortable, but even dysfunctional. They were described as "unfriendly", amplifying the cold in the winter and the heat in the summer.

FG1R1: It's bare. There is just stone, unfriendly anyway, because those seats are . . . .
R7: Completely dysfunctional.
R2: They don't encourage you to sit either in the summer or winter, because it's either too warm or too cold.

## 6.2 Seescape

In addition to cold, another feeling the respondents described was the sensation of hollowness and being deserted. Most of them stated that in their imaginary picture of the street there was no one around them.

FG1R5: Emptiness. I didn't see anyone passing by there, unfortunately.
FG2R1: There are no people on Cathedral Street.

Interestingly enough, some of the respondents did not connect the emptiness with the social factors (lack of people) but rather with the architectural shape of the street. Once again there was a theme of being stony, accompanied by remarks on the lack of trees and the general impression of Cathedral Street being hollow.

FGI1R4: A stone desert, this is my association.

## 6.3 Soundscape

The respondents often associated these two sensations – the feelings of cold and emptiness – somehow trying to explicate one with the other. In addition, they also added another im-

**Figure 6:** Deserted Cathedral Street (photo: Michał Nowosielski).

**Figure 7:** Cathedral Street before revitalization (photo: Mariusz Kucharczyk).

pression strongly affecting the ambience of the street: silence. In fact, the respondents did not refer to quietness but rather to the lack of ordinary street noises.

FG2R4: I think that the coldness of the street . . . I mean, this coldness stems from the fact that there is just a lack of people, that it's so empty, that it's such a deserted street when you go from one end to the other.
FG2R7: Probably it's the most important of all . . . . In general, there's a shortage of people and a lack of life and street noise, which would immediately make it more pleasant, somehow.

## 6.4 Smellscape

The last – and least mentioned – sensual experience was associated with the sense of smell. Some of the respondents claimed that when they imagined walking on Cathedral Street they smelled an unpleasant odour of the smoke from the furnaces used to heat some tenements.

**Figure 8:** View of Cathedral Street (photo: Michał Nowosielski).

FG2R5: Choking smoke from chimneys. Well, this is such a very unpleasant feeling.

## 6.5 Ambience of Cathedral Street in memories

In their statements, the respondents sometimes compared today's unfriendly sensations with their memories of the times when their feelings were much more pleasant. They often juxtaposed coldness with warmth and emptiness with the pleasant feeling of being together with other people. In one of the statements, the respondent compared the difference between today's Cathedral Street and the old one – before revitalization – to the difference between something alive and dead.

FG1R4: I still remember that old Cathedral Street. I remember a street that had a completely different face. That is, it was . . . obviously neglected, it didn't look great. A little bit backward, a bit from a different era, but it had its own atmosphere. It had a completely different atmosphere. There were big, nice, green, spreading trees. There were niches with benches where you could sit down and people would buy either a cake or an ice-cream, and just stop there, or sit down to talk. Well, different people, not only intellectuals after all, but also ordinary people who lived nearby, and that Cathedral Street simply lived.

When asked about the moment of change, the respondents always pointed to the revitalization of Cathedral Street, claiming that the renovation of the promenade changed its character and made it look unfriendly to the passers-by. Interestingly, the new – more aesthetic – form of the street turned out to be less emotionally accepted. In their statements the respondents often highlighted that the whole concept of Cathedral Street renovation was more one of a single designer's artistic vision than an answer to social needs and expectations.

FG1R2: I was shocked when I saw Cathedral Street after the renovation. Did you notice? Once Cathedral Street . . . was full of trees. It wasn't really possible to see . . .

**Table 1:** Experienced sensations on Cathedral Street and types of sensory landscape.

| | Type of sensory landscape | | | |
|---|---|---|---|---|
| Description of sensation | Touchscape | Seescape | Soundscape | Smellscape |
| | Cold | Empty | Silence | Smokiness |
| | Slippery | Hollow | Soundlessness | Smelly/Stinky |
| | Rough | Deserted | | |
| | Unfriendly | | | |

R4: A view of the street . . .
R2: Yes, a view. And at some point after the renovation I looked and saw that there wasn't anything left.
FG1R6 That is, I think, that here is the problem of the approach of the person who planned it . . . it's like furnishing a flat in a very modern style, but he didn't do it for everyone. I think he did it only for himself, to fulfil the vision he had in his mind. Okay, it helped him to pursue his professional life and he actually got the rewards for it, but it hasn't helped anyone else.

Statements describing the negative perception of the renovation were usually the introduction to the more general remarks regarding whom the street and its renovation should serve. In those parts of the discussion, again, respondents made references to their strong negative emotions evoked by the revitalization outcomes. Negative motions evoked by Cathedral Street after revitalization seem to create a specific atmosphere of being dehumanized or unfriendly or even "not for life". It is an important rejection factor, causing people not to use it in any other way than necessary. As a result, the function of Cathedral Street is reduced to a connection between other streets and spaces.

FG1R4 But whom should it serve? The town is to serve its people. The town is for us and it should be functional, it should be friendly, it should encourage spending time in this open space. In the meantime, there is nothing like that, it even repels people, this Cathedral Street pushes you back. As they say, just go, go through it and pass it.
FG1R4 Cathedral Street is simply cold, stony, dehumanized, unfriendly for people, for passers-by . . . not for life.
FG1R7 The street's just a passageway.

## 7 Discussion

Thibaud (2015: 42), postulating about the focus of design on emotions and ambience, writes: "In brief, our purpose is to transform not only the world of the objects built but also the world of the air and the perceptible atmosphere." Such a task, however, requires focusing on the emotions that are evoked in and by public spaces. It may be especially difficult in the case of renovating the public space – especially one of such great social and emotional importance as the high street, where the architect needs to deal not only with the decision makers' expectations but also with the previously-held residents' views and feelings gathered over their years of personal experience.

The FG analysis shows that Cathedral Street evokes strong sensual feelings of respondents in all four analyzed dimensions: touchscape, seescape, soundscape, and smellscape (see Table 1). In case of the touchscape, the respondents reported sensations of coldness, referring to the general atmosphere of the street, as well as to its specific elements. This coldness is accompanied by such feelings as the slipperiness/roughness of the pavement or unfriendliness of the street furniture. As for the seescape, respondents talked about the notion of emptiness, comparing Cathedral Street to a hollow desert. Cathedral Street's soundscape has been described with metaphors of the lack of normal street noise, and the smellscape with the sensation of the odour of smoke.

All four dimensions make the ambience of today's Cathedral Street and its sensory landscape "cold, stony, and dehumanized". Those sensations become even more striking when compared to the memories of Cathedral Street being warm, crowded, and full of positive emotions. It seems that what we witness is a confirmation of Paul Rodaway's (1994) observation that perception may not only mean reception of information but also "mental insight" – a feeling made of sensory information amalgamated with memories and expectations. This clash between positive images of the past Cathedral Street and rather negative experiences with the contemporary appearance of the street makes the perception of the sensory landscape so strikingly distasteful – possibly more distasteful than the objective form of the street would suggest. The case of Cathedral Street in Płock also shows how renovation aimed at the revitalization of an important public space brings unexpected and unwanted results by irreversibly disrupting the street atmosphere. The change of the space brought about by the revitalization process evokes strong emotions in the residents, who describe their feelings with severe sensual impressions. Experiencing Cathedral Street thus induces a negative resonance among Płock residents.

The perception of the street's ambience and the residents' feelings show that consequences are not exclusively reduced to psychological or emotional dimensions. As Kalyani Wankhede and Amit Wahurwagh (2016) note, both positive and negative sensory experiences of urban spaces strongly influence the quality of public places. They may result in changes to how people perceive themselves in this space (e.g., in terms of belonging or not belonging, the feeling of being in the right or wrong place, etc.). They may also have an impact on questioning ways to make use of the space. It seems that when the street atmosphere is negative and the emotions evoked are unpleasant, it changes the residents' activities conducted on the street, reducing its usage only to fulfilling the most necessary needs. Using Jan Gehl's (2010) metaphors, one might say that Cathedral Street is used only for necessary/functional activities – those in which people are forced to use Cathedral Street as a passageway to other destinations: other streets or important spaces. At the same time, other activities (optional or recreational activities, such as walks, and social activities undertaken in the presence of or in cooperation with others, such as group walks and having fun together) of a more voluntary character are seriously limited.

## 8 Conclusion

It can be concluded that, when designing or redesigning public spaces one should always be aware of the rule that well-designed public spaces should induce people to stay among others outside their homes by generating positive emotions, whereas badly designed places can deter and discourage people from spending time together, which in turn evokes highly negative feelings. The study findings prove that sensual perceptions are crucial in this process. It can therefore be postulated that when creating a revitalization or renewal plan, one should use sensory studies that would take into consideration all the senses, combined with residents' memories and expectations. Such sensory landscape studies might be helpful in decision-making (Battistini & Mondino, 2017; El-Sayyad, 2019). At the same time, it is important to mind the gap between the typical measures used by professionals (like architects) – based on aesthetic and functional criteria – and "popular measures" applied by the residents, and focus more on feeling the space and resonating with it. These study findings show that both should be taken into consideration. Previous studies show that there are revitalization processes that have succeeded in considering the important role of senses (Degen, 2004; Brown, 2012; Henshaw, 2013).

The case presented here shows that ambience, emotions, and senses may be useful research measures of the sociology of urban experiences, which help to understand how people "resonate" with the public space. There is, however, a need to conduct broader studies using more examples and more research techniques. Although the FGI proved to be an effective tool, in further research it should be supported by the use of other techniques including specific methodology based on conducting sense-walks (smell-walks, sound-walks, etc.), preparing sense-notes describing perception and interpretation of perceived feelings, and finally creating sense-maps (El-Sayyad, 2019). Such a procedure could be a source of important information on the sensual experience of a public space and provide guidance for how to shape or reshape it.

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# Using the analytic hierarchy process to evaluate sustainability factors in watershed planning and management

With increasing population growth and economic development, water resources have faced environmental pollution and ecological deterioration. Sustainable watershed management and planning has emerged as an approach to address these problems. Following the international agreements on watershed protection, Turkey has initiated fundamental modifications in the watershed management and planning process. However, sustainable management of water resources involves various economic, social, and ecological dimensions, and it is not a straightforward process. This study ranks sustainability indicators in terms of their importance in water resource resilience. The analytic hierarchy process is utilized to weight the sustainability factors in planning water resources and watersheds. Considering the different opinions experts may have, two groups of respondents (i.e., academics and professionals) were chosen to evaluate the factors. The results showed degrees of correspondence and contradictions among the respondents' perspectives. The groups were similar in prioritizing the social, management, and economic factors, whereas they showed considerable differences in evaluating the land use and ecological factors. The article shows that the conflicting views of various groups of experts should be identified and harmonized in order to develop an evaluation model for watershed and water basin plans.

**Keywords:** watershed planning, sustainable water management, analytic hierarchy process, Turkey

## 1 Introduction

Water basins or watersheds are essential sources for water supply, water purification, and flood and erosion control. Rapid urbanization, population growth, and increasing demand for socioeconomic development have increased pressure on freshwater resources and deteriorated wetlands (Kennedy et al., 2012). Furthermore, with facing environmental issues related to water use, water pollution, and climate change, sustainable water management has become one of the most important sustainable development goals (United Nations, 2014). Watershed plans aim to improve the management and implementation of sustainable development programmes for water resources (Chandniha et al., 2014) and they are designed and operated in ways that make the water resources more adaptive, robust, and resilient in the face of an uncertain and changing future (Loucks & Beek, 2017).

Earlier approaches to sustainable water management have emphasized different development indexes and indicators involving multidimensional economic and environmental aspects (WCED, 1987; Basiago, 1999). According to Brooks et al. (2013), basin management is the process of organizing the use of land and other resources within a basin to provide the desired products or services without adversely affecting soil and water resources. Watershed management includes the allocation of water resources between various users and purposes, choosing between environmental objectives and human needs (Barrow, 1998; Molle, 2006). Loucks and Gladwell (1999) provide criteria for water sustainability, which emphasize the importance of water infrastructure, environmental quality, economics and finance, institutions and society, human health and welfare, as well as planning and technology. Watershed management aims to control or eliminate the water basin related issues such as adverse effects of droughts, floods, and excessive pollution resulting from agricultural activities and imprecise land uses in the water basins as well as enhancing water quality and aquatic ecosystems (Loucks & Beek, 2017). Mays (2006) introduced seven requirements to ensure the sustainability of water resource systems: a basic water requirement to maintain human health, a basic water requirement to maintain the health of ecosystems, water quality, long-term renewability of water resources, available information on water sources for all sectors, institutional plans to resolve water conflicts, and participatory water-related decision making. However, sustainable river basin planning and management is a complex phenomenon that is interconnected with socioeconomic, ecological, environmental governance, and technological factors (Lal et al., 2001; Crase & Cooper, 2015; Srinivas et al., 2018).

As a way of integrating various economic, social, and environmental dimensions, the integrated water resource management (IWRM) approach was introduced in the late nineteenth century to ensure the sustainability of water resources (Internet 1; Kharrazi, 2016). It is a process that promotes the coordinated development and management of water, land, and related resources to maximize the resultant economic and social welfare equitably without compromising the sustainability of vital ecosystems (Global Water Partnership, 2000). The IWRM is multidimensional, comprising the sustainability triangle (i.e., the economic, environmental, and social dimensions), legislation and health issues, technique and technology, institutional and political issues, and historical and cultural issues (Thomas & Durham, 2003).

Another approach that encourages the sustainable development of water systems is water resources vulnerability assessment (WRVA). The vulnerability of water resources is influenced by natural factors (physical and ecological), economic and social dimensions, and water institutions and governance, and its assessment shows how much a water system can be jeopardized by both human activity and natural events. Similarly, WRVA determines the ratio of sensitivity of a water resource to climate change, floods, droughts, water shortage, water pollution, and so on. The more the water resources are damaged by these extreme impacts, the less they can be maintained in the long run. Water resource vulnerability factors can be divided into four groups: physical, economic, social, and environmental factors (Füssel, 2007, cited in Idé et al., 2019). WRVA contributes to understanding water resources characteristics and provides a scientific basis for decision-making related to water resource planning and management (Idé et al., 2019). Two quantitative methods can be used for WRVA: the function method focusing on characteristics of the physical mechanism of water resources vulnerability, and the index method dealing with volume and water quality of water resources (Chen et al., 2018). In the index method of assessment four main steps are identified: selecting, weighting, normalizing, and aggregating factors (Idé et al., 2019).

Considering water sustainability principles, the IWRM and WRVA approaches to watershed or water basin planning and management consist of five areas of planning: ecological planning to preserve wetland, land use and infrastructure planning to establish a suitable land use pattern in the basin (Kirby & White, 1994), social planning to support social changes and improve living conditions (Keating, 1993; Basiago, 1999), economic planning to maximize the economic benefits obtained from the whole basin (Cox, 1987), and management/administrative planning to define the institutional structures and the cooperation techniques for the implementation of the plan requirement (Kirby & White, 1994; Mencio et al., 2010).

In Turkey, the water needs for the population, agriculture, industrial development, and energy purposes have been increasing since the second half of the twentieth century, which has resulted in a deterioration in water resources. Until the 1980s, only the amount of water was considered in water management. Plans were made for individual uses, and personalized solutions were developed for the problems. In the following years, many laws and regulations have been adopted by competent public bodies to protect water resources and an integrated view on water quality has been growing in water resource management. In addition, Turkey has signed several international agreements and declarations related to water issues on the planning and protection of the water basins located in the country. Since 2005, Turkey has been in accession negotiations with the EU and committed to implementing the Water Framework Directive (adopted in 2000) as the most critical directive addressed under the environmental chapter. This directive highlights both the quantity and quality of water, adopts an integrated and basin-based management approach, and provides a framework for the protection of all water, including streams, coastal waters, surface waters, transitional waters, and groundwater, excluding seas (Bilen, 2008). Therefore, according to the European Water Framework Directive and using the IWRM approach, Turkey has introduced a series of changes and modifications in its watershed management and planning.

It seems that there is an essential need to provide a valuation model of the watershed planning factors that help with achieving an integrated and sustainable planning and management approach in Turkey. There are twenty-five river basins with different geographical, physical, and hydrological characteristics in Turkey. The Ministry of Forestry and Water Affairs, as the primary authority responsible for river basin management, has started preparing basin-based management plans for water body protection since 2013. In these plans, the protection and conservation of surface and groundwater and their chemical, environmental, and physical qualities, as well as water quantity, have been the priority. Turkey has also started to prepare water management plans for drinking water resources, developing provisions and policies for the protection of drinking water resources. Even though noticeable achievements in watershed management have been attained, such as an increase in treatment plants (Turkey Ministry of Development, 2014), administrative cooperation, and proper studies on watershed quality, ecosystem services, and landscape characterization (Tezer et al., 2018), in some other aspects such as public participation, decentralization of administration, water-related policy and regulations, the technology needed for nutrient recycling, and water quality measuring and monitoring, more work is needed. Therefore, this article aims to weight the primary sustainability factors in watershed planning. Furthermore, it analyses and compares the opinions of academics and professionals working at water management institutions on prioritizing the planning factors in watershed management. The results will help to understand the diverse perspectives of the two groups on sustainability factors and discuss the impact that the different academics' preferences in prioritizing planning criteria might have on watershed sustainability.

# 2 Methods

## 2.1 Research aims

The main aim of this study is to define a valuation model for the sustainability indicators in water resource planning and management. It seeks to understand the interrelationship among watershed sustainability variables according to expert perspectives. Considering different perspectives that might emerge among the experts, it is presumed that academics (knowledge holders) and professionals (those with experience in water resource planning and management) have different selections and evaluations. Therefore, before deciding on an evolutionary model of the watershed sustainability criteria, it is necessary to understand the contradictory views that might exist among the experts. This study first determines the main criteria and the indicators through a literature review, and a hierarchy of sustainability factors is defined in terms of SWMP. Then, the determinant factors are evaluated through a quantitative decision-making method: the analytic hierarchy process (AHP). Using this method, the watershed planning factors are weighted by the academics and professionals with knowledge and experience in watershed management. Therefore, three main steps have been followed in this study: determining a hierarchy, weighting the sustainability indicators, and building a questionnaire.

## 2.2 Determining a hierarchy

Basins were determined to be the most significant watershed management unit. A water basin includes the water in rivers, aquifers, and lakes/reservoirs, and covers a mosaic of diverse land uses, including forest, agriculture, suburban, and urban areas. The water basin is not merely a hydrological unit but also a sociopolitical entity that plays a significant role in providing life support services, food, and economic security to the people living in the area (Wani et al., 2008). Basin water is critical for domestic, industrial, and agricultural water consumption (New York State Department of State, 2009). Watershed management and planning affect people and livestock as an integral part of a watershed. In an effort to provide a clear framework for watershed sustainability, this work identifies the primary areas, factors, and subfactors of sustainable watershed management and planning (SWMP; see Figure 1).

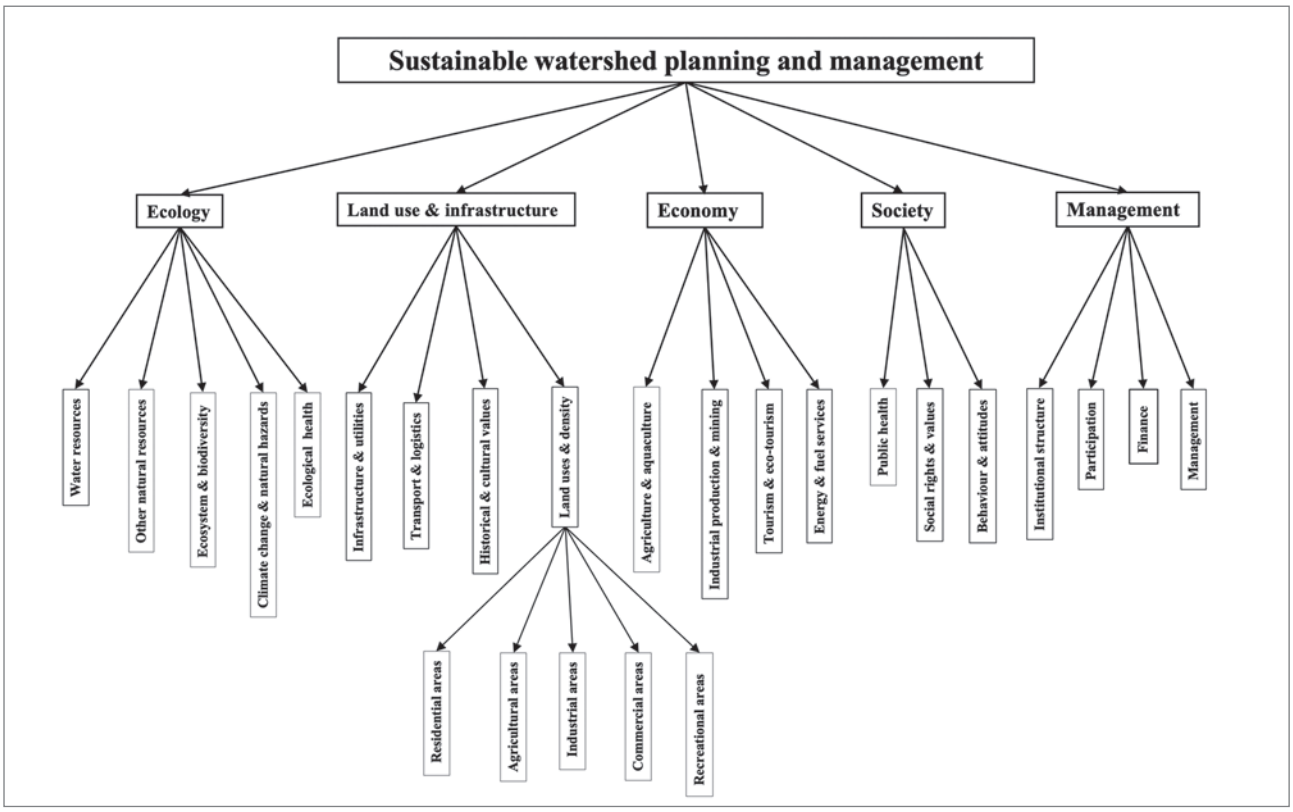


**Figure 1:** Five main areas with twenty factors and five subfactors of sustainable water resource management and planning (illustration: authors).

Five main dimensions or areas of sustainability were recognized in watershed planning and management:

- Ecology: the current use of the water resource should be managed in a way that maintains critical ecological systems, thereby not compromising use of the same source by future generations of (Jønch-Clausen & Fugl, 2001). The leading indicators of environmental sustainability identified in this work are water resources (Ouyang, 2012), other natural sources (air, soil, forest), environmental problems including climate change (Räsänen et al., 2017) and natural disasters, ecosystem and biodiversity (Arthington et al., 2009), and ecological health.
- Land use and infrastructure: this area includes the requirements for using the relevant physical sciences and technology in the water basin plans to harmonize the competing interests of various types of land use. Sustainability of the built environment means maintaining human resources and technology for the long term (Yang et al., 2016). This category involves the factors of the reliability, capacity, and rehabilitation rate of infrastructure, transportation and logistics, historical and cultural values, and land uses and construction density.
- Society: population growth and socioeconomic development continuously increase water demands and, thus, extreme water pressure and water shortage risks (Zhou et al., 2018). The fundamental right for all people to have access to water of adequate quantity and quality for the maintenance of human wellbeing must be prioritized through the planning process (Shen et al., 2011). This area consists of provisions that support social changes and better living conditions, which need to understand what people need from the basin. In this area, social rights and values, public health, and the residents' behaviour (their preferences and perceptions) are defined as the primary social factors in the SWMP.
- Economy: This planning dimension intends to maximize the economic benefits obtained from the entire basin and ensure that these costs and benefits are equitably distributed through the water basin planning and management (Cox, 1987). Agriculture and aquaculture development (as primary economic sources); energy production, tourism; industrial and mining development; and commercial activities were identified as significant factors for economic improvement in the entire water basin (Jønch-Clausen & Fugl, 2001; Shen et al., 2011).
- Management: watershed planning management aims to sustain continuous oversight of water basin planning in the long term. It needs broad engineering responsibilities under the direct supervision of the executive staff (Kirby & White, 1994). It also involves regulations on the institutional structure (institutional integration and ca-

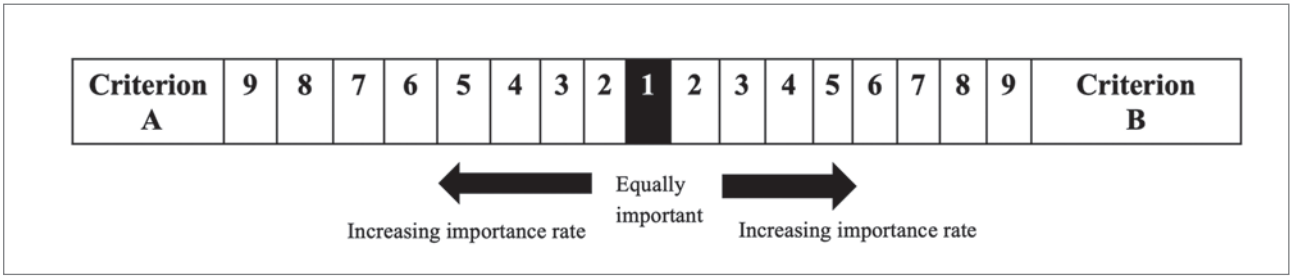


**Figure 2:** The importance scale in pairwise comparison of two criteria (A and B) (source: Saaty, 1994).

pacity; Dinar et al., 2007; Belay et al., 2010), public and stakeholder participation, management techniques/tools, and finance and governmental funding for water resource planning and management.

## 2.3 Weighting the sustainability indicators

In this study, the AHP was used to understand the interrelationships among the sustainability factors by considering a numerical value for each criterion of SWPM. The AHP, developed by Thomas L. Saaty in the 1970s, is a multiple criteria decision-making approach that provides a better evaluation of subjective criteria of watershed plans. The AHP has been used in various areas to weight the main drivers of urban growth (Thapa & Murayama, 2010), to prioritize the activities supporting rural development (Oddershede et al., 2007), to determine crucial urban sustainability indicators (Michael et al., 2013), and to evaluate the potential physical characteristics affecting pedestrians' satisfaction with sidewalks (Shafabakhsh et al., 2015). Furthermore, the AHP has been applied in the watershed management process to select a suitable technique for wastewater treatment (Curiel-Esparza et al., 2014), to decide on the responsible manager of the public water service (Ruiz-Villaverde et al., 2013), to choose the suitable alternatives for water resource management (Thungngern et al., 2017), and to analyse the population's perceptions regarding successful water management (Yavuz & Baycan, 2013). Using AHP, all of the factors of water resources planning in terms of sustainability principles are ranked and pairwise comparisons are made for each criterion that are converted into quantitative numbers. The AHP method in this study is limited to weighting and valuating the planning criteria in order to prioritize them in terms of their importance in the watershed planning and management process.

## 2.4 Building a questionnaire

For pairwise comparison, an online questionnaire was prepared using Google Forms and sent to two groups of professionals and university academics for giving weight and value to the planning dimensions. Therefore, the respondents were limited to individuals that have knowledge or experience in water-related management and planning. In this way, the questionnaire data were obtained from expert judgments on the importance of the planning factors in SWMP. Experts could rate the comparison as equal, moderately strong, strong, very strong, and extremely strong (Table 1). The scale ranges from one to nine, where one implies that the two elements are equally important. On the other hand, nine means that one factor is much more important than the other one in a pairwise matrix (Figure 2).

**Table 1:** The AHP degree of importance scale.

| Scale | Degree of importance |
|---|---|
| 1 | Equally important |
| 2 | Equally to moderately important |
| 3 | Moderately important |
| 4 | Moderately to strongly important |
| 5 | Strongly important |
| 6 | Strongly to very strongly important |
| 7 | Very strongly important |
| 8 | Very strongly to extremely important |
| 9 | Extremely important |

Source: Saaty (1994).

The online form was sent to the selected individuals, including twenty academics (university teachers) and seventeen experts or professionals working either at the General Directorate of State Hydraulic Works (DSI; 4 persons), Istanbul Water and Sewerage Administration (ISKI; 6 persons), or the Turkish Ministry of Forestry and Water Affairs (7 persons). The university teachers had degrees in one of these areas: urban and regional planning (6 persons), landscape architecture (7 persons), forestry engineering (6 persons), or environmental engineering (1 person). The professionals that responded to the questionnaire have either a bachelor's degree (65%) or a master's degree (35%), specializing in environmental engineering (50%), urban planning (40%), or civil engineering (10%).

The pairwise comparisons of variables at three levels are organized into a square matrix. The diagonal elements of the matrix

are 1 and the criterion in the *i*th row is better than criterion in the *j*th column if the value of element (*i*, *j*) is more than 1; otherwise, the criterion in the *j*th column is better than that in the *i*th row (Bhushan & Rai, 2004; Table 2). By calculating the principal eigenvalue of the comparison matrix and normalizing it, the relative importance of the various criteria is obtained. The eigenvector is calculated by multiplying the entries together in each row of the matrix and then taking the *n*th root of that product (Equation 1). The *n*th roots are summed and that sum is used to normalize the eigenvector elements to add to 1.00 (Coyle, 2004). The elements of the normalized eigenvector are termed weights, with regard to the criteria or sub-criteria.

Equation 1: *n*th root of data multiple $=\Pi=\sqrt[n]{a1a2a3a4 \ldots \ldots}$.

(source: Coyle, 2004).

This study used a software program called Super Decision that is appropriately set up for AHP implementation to calculate the data and provide the matrixes. The software was developed by Thomas L. Saaty and his team in 1996 to help individuals make more rational decisions. This program allowed us to enter the judgments, get results, and obtain the sensitivity rate for the results, which shows the validity of the answers. Therefore, the average of the answers obtained on the questionnaire was entered into the program to get the final weights and normalized values. In this way, comparison matrices and diagrams with an acceptable consistency rate were obtained (the consistency rate according to Saaty should not be more than 0.1).

## 3 Results

The average amounts of the answers obtained from the two groups (academics and professionals) were compared and prioritized. The normalized weights are summarized in Table 3, showing the quantitative values considered for each criterion by the two groups of respondents. The results could show brilliant differences and similarities in comparisons of the two groups' perspectives toward the main planning factors of watershed sustainability. In prioritizing four primary dimensions considered for the SWMP, both groups gave the most weight to ecology and water management. The academics chose ecology as the first priority (42%) whereas the professionals considered water management (36%) as their most important factor. The academics gave economy the least weight (8%), but for the professionals, land use and infrastructure was the least important (5%) comparatively. This may be a reason that there is lack of harmonization between urban planning and watershed management. Society was chosen as the third most important area in watershed sustainability.

In weighting the ecology factors, there is considerable disagreement between the two groups' answers. The academics gave the most weight to ecosystem functions and biodiversity (28%), and they considered water resources to have the same value as other natural resources. However, in the view of the professionals, water resources (35%) and then ecological health (26%) are the most important criteria in the ecology dimension of SWMP. It seems that the professionals had more logical valuations considering water quality issues and current environmental pollution in Turkey's water basins. However, this also shows that they may have less knowledge of the importance of ecological functions and ecosystem cycles in the water system. Analysing the ecosystem services and their functions in the water basins has been recognized as one of the most critical assessments in the planning and management of water areas.

With regard to the land use and infrastructure factors, the academics gave the most weight to land uses and density (51%). In contrast, the professionals believed that the highest weight should be assigned to historical and cultural values and infrastructure (39%). Transport was chosen as the least important priority by both groups. The main difference between the two groups' answers is in land uses and density, which was weighted at 14% by the professionals. In considering the various effects of land uses on the water quality and watershed environment, land use assessment and proper zoning planning are significant parts of any watershed planning and management. Therefore, if decision-makers ignore land use as a planning factor, serious problems in the watersheds or water basins will result.

In weighting the economy factors, the two groups had similar priorities. The choices were agriculture and aquaculture as the first priority, followed by tourism, industrial production and mining, and energy production as the least important criteria. The comparisons show that the professionals put a little more weight (30%) on tourism than the academics (21%). It may be because the professionals have more experience and information on the positive effect of tourism activities in the economy of the watershed areas in Turkey. In prioritizing the society factors, the most important values based on the groups' answers were given to public health (50–60%), then to social rights and values (25–31%), and finally to behaviour and attitudes (16%–20%). These preferences seem reliable, considering the right of public access to safe, clean water and sewers. Even though the criterion of public behaviour was given the least weight, it does not mean this dimension can be ignored in watershed planning projects. Valuating the management factors showed that the two groups have similar perceptions regarding their priorities. They gave the highest weight to management and participation (34–38%). The academics chose management as the most valuable one, and the professionals

**Table 2:** An example of a square matrix of pairwise comparisons among three sub-criteria.

| | Sub-criterion 1 | Sub-criterion 2 | Sub-criterion 3 | *n*th root of value product | Normalized eigenvector |
|---|---|---|---|---|---|
| Sub-criterion 1 | 1 | 2 | 8 | 2.51 | 0.594 |
| Sub-criterion 2 | 1/2 | 1 | 6 | 1.44 | 0.341 |
| Sub-criterion 3 | 1/8 | 1/6 | 1 | 0.275 | 0.065 |

Source: Bhushan & Rai (2004).

**Table 3:** Normalized weights and values by category of respondent (i.e., academics and professionals) obtained using the AHP.

| Sustainability dimensions | Weights | | Factors | Weights | |
|---|---|---|---|---|---|
| | Academics | Professionals | | Academics | Professionals |
| Ecology | 0.418 | 0.347 | Water resources | 0.220 | 0.349 |
| | | | Other natural resources | 0.215 | 0.142 |
| | | | Ecosystem & biodiversity | 0.275 | 0.086 |
| | | | Climate change & natural hazards | 0.200 | 0.167 |
| | | | Ecological health | 0.090 | 0.256 |
| Land use & infra-structure | 0.102 | 0.052 | Infrastructure & utilities | 0.223 | 0.385 |
| | | | Transport & logistics | 0.114 | 0.087 |
| | | | Land uses & density | 0.514 | 0.143 |
| | | | Historical & cultural values | 0.149 | 0.385 |
| Economy | 0.084 | 0.107 | Agriculture & aquaculture | 0.578 | 0.528 |
| | | | Industrial production & mining | 0.112 | 0.081 |
| | | | Tourism & eco-tourism | 0.213 | 0.300 |
| | | | Energy & fuel services | 0.097 | 0.091 |
| Society | 0.124 | 0.138 | Social rights & values | 0.311 | 0.249 |
| | | | Public health | 0.493 | 0.594 |
| | | | Behaviour & attitudes | 0.196 | 0.157 |
| Management | 0.273 | 0.356 | Institutional structure | 0.205 | 0.213 |
| | | | Participation | 0.288 | 0.376 |
| | | | Finance | 0.169 | 0.137 |
| | | | Management | 0.338 | 0.274 |
| Total | 1 | 1 | | 1 | 1 |

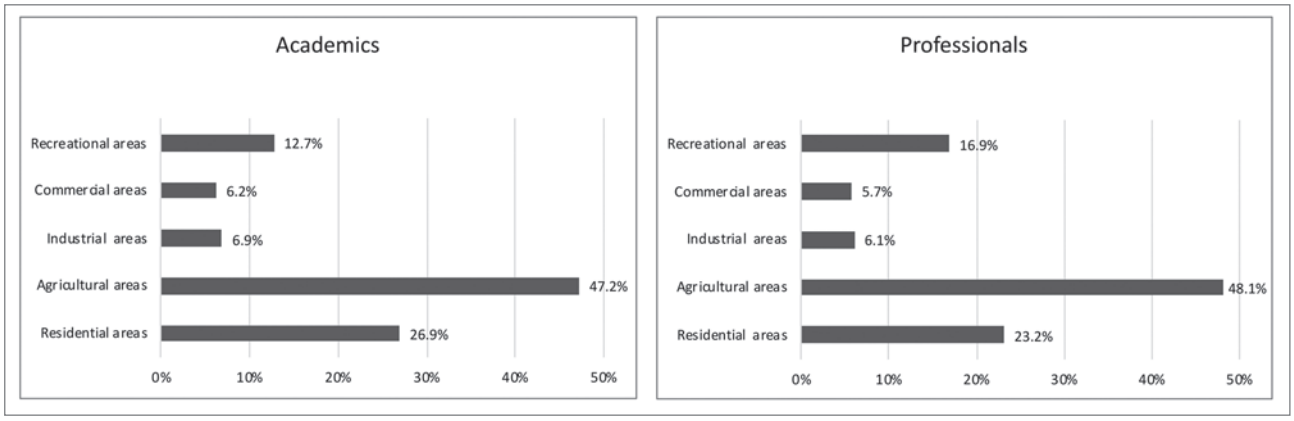


**Figure 3:** Comparison of the two groups' answers in weighting the land use subfactors in the watershed planning process (illustration: authors).

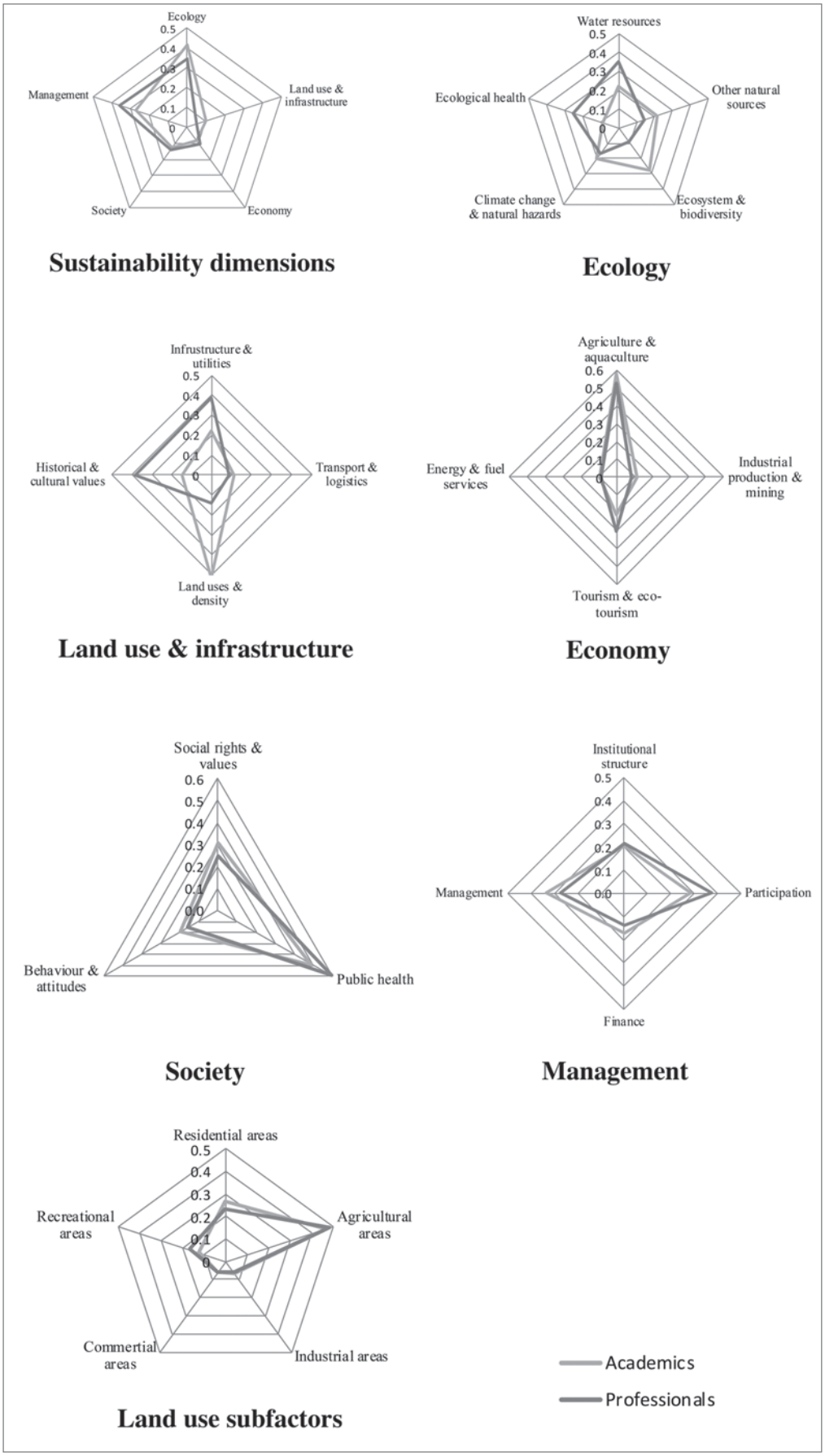


**Figure 4:** Comparison of the two groups' answers in prioritizing the sustainability criteria of watershed planning and management (illustration: authors).

assigned the most value to participation. Finance was selected as the factor with the least weight in the SWMP. In evaluating the land use subfactors at the third level of the sustainability hierarchy defined in this research, the two groups agree on the prioritization. As Figure 3 shows, the most weight was given to agricultural areas (47–48%), followed by residential areas (23–27%), recreational areas (13–17%), and finally commercial (6%) and industrial areas (6–7%). This choice seems to be suitable because agriculture is the main water-using sector and residential areas are an undeniable part of the water basins. The commercial and industrial areas are mostly restricted by watershed planning provisions due to their negative impacts on the water resources. Recreational uses are partially allowed in some areas of the watershed according to their distance from the water bodies.

This study provides a good example of using the AHP for evaluating sustainability indicators. It employs the AHP to discover the conflicts in watershed management and planning, which may be considered unique in using this method. Watershed planning and management as an interdisciplinary process needs to be integrated with different dimensions and sectors. Therefore, water basin and drinking water management and protection decision-makers are required to have comprehensive knowledge of the related factors and dimensions. These results proved that there are critically different views on the sustainability dimensions among experts, especially in weighting ecology and land use. The professionals considered factors, such as ecosystem functions, infrastructure planning, land use impacts, management, and other natural sources, as less important for the SWMP. The two groups were mostly in agreement on weighting economy and society, water management, and land use factors (Figure 4). Professionals that have inappropriate information on ecosystem functions, land use impacts, management techniques, social and economic requirements, and so on, are not able to provide a sustainable watershed management plan. As a result, in order to define an evaluation model for watershed plans in terms of sustainability principles (which can be applied to all watershed planning and management projects), the views of various types of experts should be harmonized.

## 4 Conclusion

Water resource management and planning are associated with various sustainability factors, including ecology, economy, society, land use, and management. This makes watershed or water resource planning much more complicated, and thus it requires a dynamic, comprehensive, and cooperative approach. The participation and involvement of different groups of water users and stakeholders has been recognized as a critical factor in the decision-making process for watershed management strategies and planning approaches. Cooperation among various local and government agencies and public institutions should be established at the first step of the planning process. However, sometimes there is a great discrepancy in views between professionals and academics, public users and stakeholders, and regional planners and local managers, or even among various groups of experts such as landscape architects, land-use planners, environmentalists, economists, and watershed managers. This discrepancy can occur at all stages of the decision-making process, whereas its effect on preparing the allocation plans for sources of water, land, and finance can be very adverse.

This article shows that there can be a critical contradiction among knowledge holders and decision-makers in some aspects of prioritizing water resource sustainability factors, which may lead to failing to achieve sustainability objectives. It seems that before taking any serious steps toward watershed planning, the gaps among the perspectives of target groups should be identified. Determining the areas of contradicting views can help understand the primary challenges that will appear during the decision-making process, management programming, and implementation efforts. This issue can be eliminated or mitigated through organized meetings, educational workshops, and introductory programmes that allow for discussion among different groups of decision-makers including researchers, university teachers, knowledge holders, and governmental managers. These programmes can be managed for each phase of watershed planning, such as goal determination and prioritization, problem identification, determination of management strategies, suggesting solutions, allocating sources, and so on. At the end of the discussion meetings, it is likely that the participants' perspectives and choices are much more harmonized, which would contribute to the achievement of comprehensive solutions.

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# Accommodating the informal economy in public space: The intricate political and spatial arrangements at an Indonesian street market

The immense wave of urbanization and the limited formal job opportunities available in large Asian cities have led to the proliferation of street vending activities, which are often controversial and sometimes illegal due to their occupation of public space. The Kutek Sunday Market in Depok municipality, Indonesia was forced to move from a busy university location to a relatively secluded residential neighbourhood. Despite this disadvantage, the market has continued to attract sizeable business. This case study, based on extensive field observation and interviews, describes how the market location was selected and how it is spatially arranged to meet the needs of vendors, residents, and shoppers. The paper shows how local residents and vendors creatively developed an open-ended, self-organized system to manage the complex tasks involved in operating the market and to adapt to fluctuations in the number and characteristics of vendors and shoppers. Although the system is highly praised as an effective tool for informal economy survivability, its limited planning capacity requires cooperation with other parties to overcome unanticipated challenges. Cooperation among stakeholders has maximized the benefits and minimized the drawbacks of informal economic activities in a public space.

**Keywords:** street market, street vendors, informal economy, public space, Indonesia

# 1 Introduction

## 1.1 Proliferation of street vendors in an urbanizing world

Regional development disparities and lack of good governance have contributed to the problem of uncontrolled, massive urbanization in many developing countries (Hossain, 2004). The rapid population growth of urban centres has made it hard for many residents to find employment in the formal economy (Ligthelm & van Wyk, 2004). One consequence of urban growth is the proliferation of street vendors (Chirisa, 2009), who have been greatly increasing in number and occupying public spaces all over major cities in developing countries, seeking to obtain enough income to survive (Faruque & Haque, 2010; Dunn, 2014). After the monetary crisis of 1998, the number of street vendors grew substantially in many Asian countries, because many workers previously employed in the formal sector lost their jobs (Indira, 2015). Selling goods on the street has become a major source of employment, services, and income for poor urban households (Fidler & Webster, 1996; Iyenda, 2005; Suriansyah, 2005; Estrada & Hondagneu-Sotelo, 2011). The term 'street vendor' encompasses vendors in organized marketplaces, sellers who set up booths in the kerb lanes of streets, mobile street hawkers, and home-based vendors (Cohen et al., 2002). Their operations are often considered illegal, but they distribute legal goods and services (ILO, 2002). Therefore, their economic activities do not operate in separate economic circuits but are interrelated with the formal sector (Chen, 2007; Hossain, 2014).

The presence of street vendors in public spaces offers positive impacts, not only in developing countries but also in developed ones. For example, street vendors have become an unavoidable feature of the urban landscape in Los Angeles, New York, and Chicago (Munoz, 2012). In New York (Roy, 2005) and Mumbai (Anjaria, 2006), they contribute to public safety and enhance quality of life in the neighbourhoods where they operate, although city authorities still tend to regard them as a public nuisance. They are recognized as an integral part of certain neighbourhoods (Deguchi, 2005), community members often rely on them for access to food (Kabeer, 2004), and they add liveliness to urban places (Deguchi et al., 2005). The transformation of public spaces by informal street businesses represents an innovation that effectively accommodates the needs of city dwellers and encourages people to engage in social interaction (Jimu, 2005; Rojas, 2008), despite the fact that the presence of these businesses usually violates municipal regulations (Danesh, 1999). Despite its various positive outcomes, street vending is still neglected in urban policy in developing countries (Jimu, 2005). Through the lens of modernist planning, this economic activity is generally viewed as inimical to public order and state control (Cross, 2000). For this reason, street vending has been widely discouraged in Latin American countries such as Colombia (Donovan, 2008) and Asian countries such as Indonesia (Harjoko & Adianto, 2012).

The mounting desire to create attractive global cities (Robins & Askoy, 1996) has mesmerized many governments in developing countries, leading them to disregard aspects of the informal economy such as street vending in their city planning and regulatory activities (Parthasarathy, 2003). As a result, their development plans are unresponsive to the needs of informal urban activities (Perera & Amin, 1996) and contribute further to spatial problems in developing cities (Yankson, 2000). Local municipalities often lack the political will, administrative expertise or innovative management strategies needed to incorporate street vending activities effectively within the urban economic system (Morrell et al., 2011). This failure to plan thoughtfully for the inclusion of street vendors can result in immense occupation of public spaces and substantial environmental problems, such as congested pavements and obstruction of pedestrian traffic (Loukaitou-Sideris & Ehrenfeucht, 2011), as well as poor sanitation (Rakodi, 2005), due to littering of the streets, pavements, and open drains that exceeds the authorities' capacity to keep their cities clean (Satterthwaite, 2003; Yankson, 2007). Many empirical studies conducted in Asian capitals have viewed the informal economy, including street vendors, as something simply to be managed (Ong, 2006; Jiang et al., 2010) while a city pursues advanced development as a global city (Yeo et al., 2012). Methods of regulating street vendors have included designating a single area for their activities (Chai et al., 2011) or a licence procurement system for vending activity (Lincoln, 2008; Chiu, 2013). In these ways, the state acknowledges the existence of street vending as creating a survival system for the urban poor and thus ensuring social order. However, this survival system reveals a highly distinctive dynamic of self-regulation that lacks formal control over planning (Dovey, 2012). Therefore, it is imperative to understand street vendors' spatial production in urban areas for accommodating the informal urban economy.

## 1.2 The hidden social system underlying the spatial arrangements of street markets

Street vending occurs in public spaces (Satterthwaite, 2003), on street pavements (Jimu, 2005), along footpaths (Suharto, 2004), around marketplaces (Brown, 2006), at bus stops (Cohen et al., 2002), and at other venues in public spaces (Yankson 2000). How they occupy the street space varies as widely as the locations themselves, depending on what activities are nearby (Suharto, 2004), such as pedestrian traffic (Dewar & Watson, 1990) or proximity to transport and commuter

nodes (Bhowmik, 2005). According to Yankson (2000), customer attraction is the primary factor in site selection, followed by availability of access roads and lack of suitable alternative sites. The eviction of street vendors from certain public spaces can effectively block them from functioning (Idayanti, 2007), because the location is the determining factor of the stalls' rental price and revenue-generating capacity (Susilo, 2011). Moreover, studies in Indonesia have shown how the character of particular places and their ability (largely due to the activities occurring in the surrounding area) to attract prospective customers are crucial considerations in the location decisions of street vendors (Suparwoko & Sriyana, 2006; Suparwoko, 2008). Therefore, a relocation programme, without a comprehensive understanding of the vendors' location preferences, will fail to achieve its intended goals.

Research conducted previously by Adianto (2009) at five traditional markets in Jakarta and by Libratono (2012) at the Bekasi traditional market in West Java demonstrated that the location, types of commodities sold, and hours of operation of street vendors conform to the activity patterns of shoppers and producers. All these studies noted that the social system, which produces rules for the management and use of available resources, plays a pivotal role in the spatial arrangement of street vendors in public spaces. The social system manufactures self-organization to construct spatial arrangements (Koolhaas, 2005; Mörtenböck & Mooshammer, 2007) through appropriation and re-appropriation of public spaces (Isin, 1999; Boeri, 2003), based on deliberative planning (Koolhaas & Cleijne, 2007) and creative calculations (Franke, 2006). Due to their lack of access to formal institutions, street vendors must either develop new arrangements or make use of existing arrangements or unwritten rules as sources for their self-organization, governance, and economic activity (Lindell, 2008). A study by Peters (2013) in Surabaya (Indonesia) describes the formidable strength of informality and its contribution to modern urban development through the spirit of collectivity of the underprivileged and proletariats. It shares a similar argument with Obeng-Odoom (2011), who studies the agility and survivability of the informal sectors under the constant threat of eviction in Ghana. Despite the stigmatization, informality creates a delicate governance that works within the framework of formal governance (Dovey, 2012), and the spatial arrangements are one of these delicate results. This delicacy encourages the agility and survivability of the informal economy in the modernized city under constant eviction threats. These studies underscore the observation that space is social, because it is produced in reciprocal relations that both shape and are shaped by social relations (Lefebvre, 1991; Shields, 1998). Thus, the production of urban space is not simply about planning specific uses of material space; rather, it involves producing and reproducing all aspects of urban life (McCann, 2002). Based on Lefebvre's insights, how street vendors organize their spaces represents a concealed social order, applied to the organization of a shared arena (Ostrom, 2005). The street vendors, along with shoppers and other parties that benefit from their presence, create suitable vending arrangements.

This study aims to clarify the location preferences that guide street vending activities and how vendors create spatial arrangements through self-organization. Specifically, by uncovering the social system behind the production of street vending space in Indonesia's Kutek Sunday Market, we seek to enrich architectural discourse on urban informality.

## 2 Method

The study location was the Kukusan Teknik area of Depok, West Java as shown in Figure 1. It was selected because of the street vending activity that took place in this area's housing complex on Sunday mornings. Street vendors from all three major traditional markets in Depok come to Kukusan to sell consumer goods each Sunday from 6:00 to 10:00 a.m. On a regular basis, from 80 to nearly 200 street vendors sell various commodities along an alley of 300 metres in length, constituting a temporary market at the edge of a residential neighbourhood.

We applied a qualitative approach in three stages. In the first stage, during February and March 2015, we completed a literature review to establish the state of the art in this field. We then conducted preliminary observation in mid-March 2015, to structure our case study in alignment with our theoretical framework. During our preliminary observation, we identified several prominent local actors, such as the head of the Neighbourhood Association (NA), the head of the local Vendors Association (VA), and long-time local residents. We introduced ourselves to these individuals and obtained their consent to participate in this study.

Field observations and interviews were the main features of the project's second stage, from April to June 2015. One advantage of conducting interviews relative to other alternatives, such as questionnaires, is that it allows the interviewees to construct their own accounts of their experiences, describing and explaining their lives in their own words (Valentine, 2005: 111). The fluctuating number of vendors, the commodities sold and their spatial arrangements were documented during field observation. Based on the commodities being marketed, we classified the vendors into three categories: food, goods, and services (Suharto, 2004).

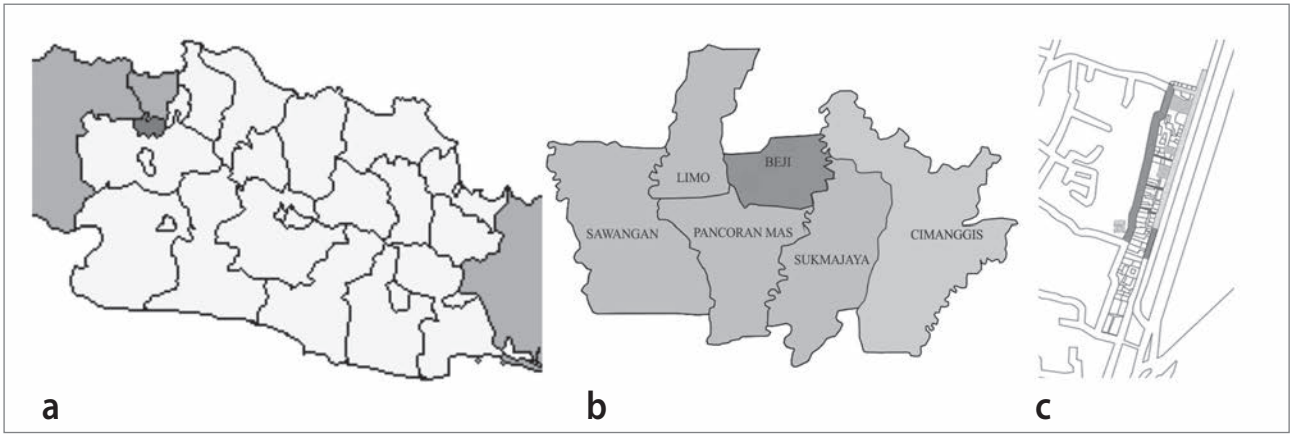


**Figure 1:** a) the Depok municipality; b) the Beji district; c) the study location (source: Internet 1).

The interviews took place in two waves. First, in early May 2015, we interviewed the NA head, VA head, and knowledgeable residents in the neighbourhood, who explained the history of street vending activity in this area along with the self-organization process carried out by all involved actors. The second wave of interviews comprised a random sampling of vendors, residents that live in the alley-turned-market, and shoppers. Vendors and residents shared information regarding their reasons for trading at this location, as well as concerning the construction and implementation of vendors' self-organization in cooperation with local residents. The shoppers gave their reasons for purchasing goods at this location and their perspectives on the spatial implications of street vendors' presence in their neighbourhood. The number of respondents in each subgroup varied. Only fifty vendors consented to interviews. We also interviewed fifty families residing in the alley—a significant number considering that there are fifty-seven houses in the alley, seven of which contain rental units. Finally, we spoke with three hundred shoppers in the course of twelve weeks of field observation and interviews. The respondents were of various ages, occupations, monthly income levels and housing types.

The third stage of the study, from July to September 2015, consisted of data analysis, discussion, and writing. Triangulation was employed to verify the accounts of the various interviewees (Valentine, 2005). The findings were discussed with academic colleagues at peer meetings to enrich and refine the results. Several additional field observations and interviews were carried out during August 2015 to further clarify particular issues.

# 3 Results

## 3.1 The history and present condition of the Kutek Sunday Market

Since 2001, the University of Indonesia has opened their facilities for public recreational activities every Sunday. The participants come mostly from the immediately surrounding municipality of Depok, but also from the nearby metropolis of Jakarta. The huge crowds flocking to this area lured vendors who provided a range of commodities, from food and beverages to electronic gadgets and various services. According to the heads of the NA and VA, vendors were allowed to trade within the University of Indonesia complex if they made a financial contribution, even though they were unregistered. Therefore, their presence was not technically illegal, and it was profitable for all parties – the university, vendors, and shoppers.

This lucrative cooperation ended due to a fatal accident caused by vendors in 2003. Since then, the University of Indonesia has prohibited all trading activities by vendors on Sunday. Despite a series of demonstrations seeking renewed permission to operate on campus, the vendors were rebuffed. As an alternative way to resolve the dispute, the university discussed with the heads of the NA and VA the possibility of relocating the vendors to a neighbourhood immediately outside the campus, along the university's perimeter wall. Although this street is narrower than the previous location, all parties agreed to make it the new trading location for vendors. Two main factors made this new location preferable. On the one hand, it is still very close to the University of Indonesia, making it easy for large crowds to visit the site. On the other hand, because it is a blind alley, the presence of vendors does not disturb the circulation of residents in the neighbourhood. The NA head was appointed as area manager to administer the trading and supportive activities.

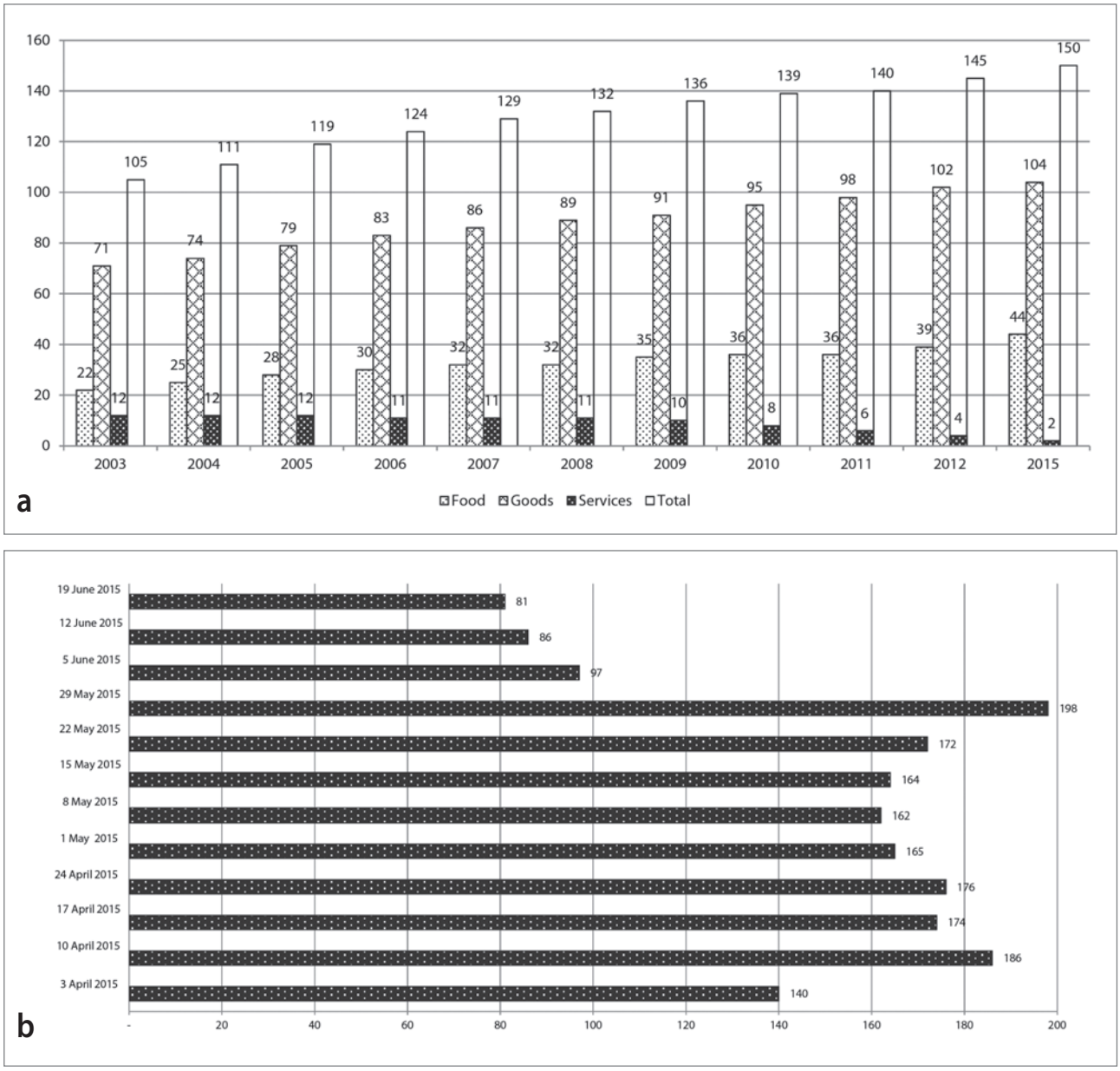


**Figure 2:** a) the total number of vendors by type of commodity from 2003 to 2015; b) the total number of vendors each Sunday from 3 April to 19 June, 2015 (illustration: Mitchell Edbert Suryanto).

At first, the residents of the alley objected to the presence of vendors in front of their houses. Privacy disturbances, loud noise, piled-up rubbish, and restricted circulation were among the results of the market's relocation to the alley. After intense deliberations, the residents consented to vending activities in their neighbourhood with several conditions: (1) the activity may occur only from 6:00 to 11:00 a.m. on Sundays; (2) the vendors make payments to the NA to fund local improvements; (3) local residents are allowed to participate in the vending activity; (4) vendors reimburse the cost of any electricity they use from the houses of local residents; and (5) any misconduct will lead to the termination of street vending activity in the neighbourhood. For security reasons, all vendors must register with the head of the NA. To maintain order, each vendor has a permanent trading spot. In 2003, there were 105 registered vendors, but the number has increased each year, reaching 198 vendors in 2015 as shown in Figure 2.

During our twelve weeks of observation, the number of vendors fluctuated from eighty-one to 198. Courses at the University of Indonesia were in session from February to June 2015; the number of vendors increased from 140 in early April to 198 at the end of May. After finishing their examinations in early June 2015, most students vacated their rented rooms and returned to their permanent residences, reducing traffic in the area considerably; accordingly, the number of vendors dropped precipitously and was under one hundred for the last three weeks of our observation, dropping to eighty-one in the

final week. This fluctuation reveals the direct impact of the presence of students on the number of vendors selling at the Kutek Sunday Market.

### 3.2 The mutual benefits for all involved actors

The vendors indicated that their main trading locations were the three traditional markets in Depok municipality: the PAL Market (34.15%), Kemiri Market (36.59%), and Jaya Depok Market (29.27%). Most of them stated that their reason for trading at the Kutek Sunday Market was to avoid fierce competition at the traditional markets on weekends. Although the traditional markets attract very large numbers of visitors on weekends, profits do not increase because of the substantially greater number of competitors. Instead, to enhance their profits, these vendors choose to come to the Kutek Sunday Market, where the number of vendors is lower. Low administrative costs are another key consideration. Fourteen vendors stated in their interviews that the administrative fee at the major traditional markets is three to five times higher than the costs at the Kutek Sunday Market. This factor also helps to make coming to Kutek on Sundays an attractive option.

Although local residents also engage in trading activities as vendors, not all of them are delighted with the presence of the Kutek Sunday Market on their alley. Family members at nine houses (18%) stated that they were annoyed by the market's presence, despite the several advantages they receive from it. Rubbish is a major disturbance. Although an appointed officer picks up all the rubbish after the market closes, the unpleasant sights and smells bothered several respondents. Blocked circulation is another main inconvenience. For local residents, the huge crowd creates an exceptionally displeasing environment to walk through. Family members identified noise as a third problem. Furthermore, several family members commented that the huge crowd of people in such close proximity to residents' houses compromises the privacy of people living along the alley. Despite all these problems, most of the residents that expressed dissatisfaction still accepted the Kutek Sunday Market's presence on their street. Vending activities yield financial benefits for the community as a whole and for many individuals. Local residents provide a wide range of supportive services to vendors, such as electricity access, stall tables, and storage space, thereby earning additional income. Moreover, the payments remitted by each vendor in exchange for the trading space and the rubbish disposal service cover the market administrator's salary as well as neighbourhood improvements.

The market provides several benefits to the community. Twenty residents (40%) said they could obtain items to meet their immediate needs within walking distance. Twelve people (24%) said they were amused and entertained by the presence of the crowd and the various commodities offered. Nine respondents (18%) noted that the market brought with it job opportunities and additional income for local residents. Not only do some of the residents participate in the market as vendors, but many of them gain additional income to improve their livelihood by providing needed services.

Each vendor is obligated to contribute to a fund for neighbourhood improvements. According to the NA and VA heads and local leaders, the community has used this money to overhaul the alley, improving the drainage channel along the alley and maintaining the border wall that separates it from the university. Before the market opened in 2003, the residents had no joint account for neighbourhood improvement. Since then, thanks to effective management of the funds contributed by vendors, the neighbourhood's physical condition has been improved without any help from government programmes. Thus, although the market brings with it several environmental problems – rubbish, restricted circulation, loud noise, and lack of privacy – it also offers substantial social and economic benefits. Although the market is located in an enclosed area – on a narrow, dead-end alley where large numbers of people would not normally pass – it has attracted shoppers from all over Depok municipality and even from Jakarta. Most of the respondents (44.33%) said they visited the market regularly every Sunday.

Geographically, the largest portion of shoppers (44.67%) lives in Depok municipality outside the immediate Kukusan area. Kukusan itself provides nearly as many customers (41.67%), and 13.67% live in Jakarta. Nearly half of the visitors (49.67%) said they come to fulfil needs and already have in mind what kinds of commodities they intend to purchase; the others stated that their main interest was to enjoy the atmosphere (28.67%) or sightseeing with their friends (21.67%). These shoppers found the market enjoyable despite the huge crowds and the somewhat messy scene while the market is functioning. In summary, the Kutek Sunday Market delivers benefits to all involved actors – vendors, shoppers, and local residents. These mutual benefits are possible because the participants abide by accepted rules, as a product of negotiation in social relations. The rules regulate the rights and obligations of all participating actors so as to allow the vending activities to be orchestrated harmoniously.

### 3.3 Spatial self-organization: From well-ordered to scattered zoning

In the process of implementing the vendor registration system from 2003 to 2012, the heads of the NA and VA reached agreement on the spatial arrangement of the Kutek Sunday Market. This arrangement situates the location of trading spaces based

**Figure 3:** Vending activities by residents in front of their houses (photo: Mitchell Edbert Suryanto).

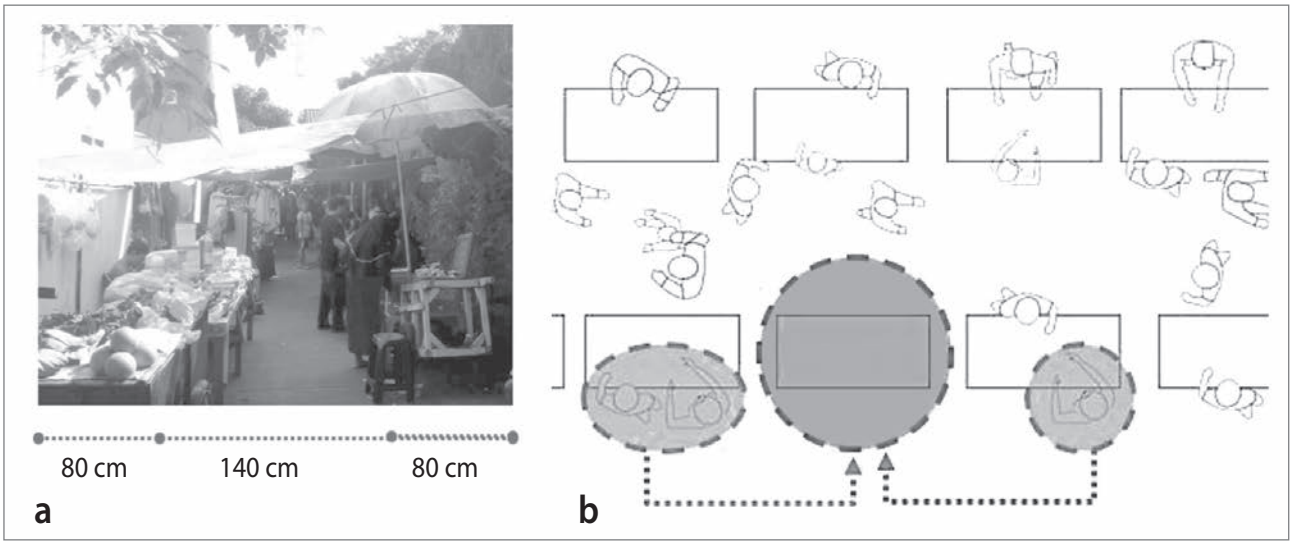


**Figure 4:** a) the size of the stalls and the width of circulation space; b) a diagram showing how adjoining space is controlled by surrounding vendors (photo and illustration: Mitchell Edbert Suryanto).


**Figure 5:** Circulation arrangements for pedestrians (photos 1 and 2) and vendors (photos 3, 4, and 5) (photo and illustration: Mitchell Edbert Suryanto).


**Figure 6:** Parking space on the south side (photos 1 and 2) and north side (photo 3) of the Kutek Sunday Market (photo and illustration: Mitchell Edbert Suryanto).

on the types of commodities sold, as well as identifying parking, storage, and loading areas. The arrangement represents a consensus of the two association heads, all vendors, and residents of the alley. The spatial arrangement has successfully accommodated each party's interests without compromising neighbourhood security as shown in Figure 3.

As the number of vendors continued to grow and many occasional vendors started participating, the NA and VA heads were overwhelmed and struggled to register the new members and allocate market sites to them. The penetration of occasional vendors into the Kutek Sunday Market started in 2010. These are ambulatory vendors who use wheeled carts or bicycles to move from one market to another in the course of a day. They do not trade at the Kutek Market regularly every Sunday, so they cannot be assigned a permanent trading spot. However, the NA head allowed them to operate in the market because they agreed to pay the prescribed contribution. Since the number of vendors was fluctuating, the NA head discontinued new registrations in 2012. Many local residents, mainly people living in the alley, also began to engage in occasional trading activities, using their front terraces as a trading space and turning the interior of the house into a production space. In 2010, six local residents were participating in this way, but by 2015 this number had tripled. At first, they operated on a occasional basis, but now they have become permanent sellers. Figure 4 shows the presence of ambulatory vendors and local residents among the traders at the Kutek Sunday Market, which complicates the development of spatial arrangements. Their fluctuating numbers and flexible locations compel the NA and VA heads to locate them in any available vacant spaces, such as between stalls of permanent vendors. This series of ever-changing incursions obnubilates the regulated spatial arrangements.

Remarkably, the permanent vendors and residents allow and accept the additional vendors, even though their presence reduces everyone else's trading space. The permanent vendors tolerate the others as a token of appreciation for their profession. They recognize that their survival as street vendors depends on mutual support and cooperation. Furthermore, they hope that the presence of occasional vendors can increase everyone's profit because they sell complementary commodities that can draw additional customers; this factor also encourages their mutual cooperation. Rather than seeking to bar the occasional sellers, the permanent traders become the decision-makers that determine possible locations for new occasional vendors. Therefore, despite the negative impact on visible spatial order, vendors do not object to the presence of additional occasional vendors inside the Kutek Sunday Market, as long as they provide complementary commodities to generate more shoppers and avoid engaging in direct competition with already-established sellers. The market has north and south gates, which allow visitors to enter from two directions as shown in Figure 5. Security is an important concern because various criminal acts have occurred in the university area. On the other hand, the north gate is an opening in the university's perimeter wall, created by local residents to access the university area whenever the south gate was closed. Consequently, all shoppers travel from the south end of the market to the north end and then return south when they wish to leave the market. This circulation pattern causes severe blockages and a high density of people in the market during the peak hours of 8:00 to 11:00 a.m.

To alleviate these density and circulation difficulties, the NA and VA heads and local residents reached an agreement to use the west street for service access for loading and unloading commodities. This area has also become a vehicle parking space for vendors. Many visitors ride motorcycles to visit this market. According to the NA head, about 100 motorcycles enter the market every Sunday. This large number of vehicles requires provision of considerable parking space that can be easily monitored for security purposes, but without complicating pedestrian circulation throughout the market as shown in Figure 6.

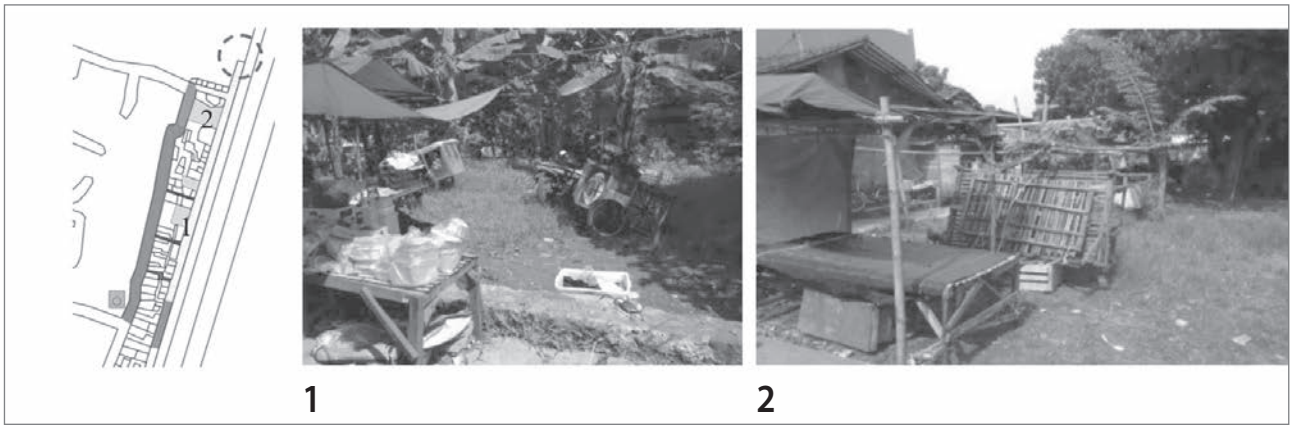


**Figure 7:** Storage of wooden stalls along the street (photo and illustration: Mitchell Edbert Suryanto).

Vending activities require stalls for displaying commodities. The size of each stall depends on the number of commodities that a vendor wishes to sell, and the larger stalls are not easy to move. The administrator, which consists of the NA and VA heads and local residents, provides rental stalls, made from second-hand wood and bamboo by unemployed young residents. Initially, the NA and VA heads and local residents decided to place the rental stalls at the north end of the alley, where pedestrians and motorcycles do not pass through. As the number of rental stalls has grown, small green spaces have been repurposed as additional rental stall storage areas, so that the stalls do not disturb circulation on weekdays or on market days as shown in Figure 7.

The land where the rental stalls stand belongs to the community. The administrator, as the stall owners, make the consensual agreement with the residents, which brings mutual benefit for all parties. The sellers have space for selling their goods to earn income. The residents also earn income, from the electricity fee paid by the sellers. The neighbourhood, which is represented by the NA head, earns income as well to fund the self-help neighbourhood improvement. It also provides employment opportunities for the unemployed residents to earn income for their families. Meanwhile, for the shoppers, the market provides various goods and services they need within walking distance in the neighbourhood. Therefore, the obtained mutual benefits to all parties from the consensual agreement allow the public space and some parts of the individual properties to be utilized for the market.

Although vendors have generally adhered faithfully to the market's rules, several matters sparked conflict. As the VA head admitted, vendors failed to keep up with the abundant rubbish they were generating. Not only did they have inadequate time and staff to handle their rubbish, the waste disposal bins in the area were insufficient. Eventually, local residents filed complaints with the VA head, demanding an immediate solution. To overcome this impediment, the NA and VA heads and local residents deliberated on the issue and agreed to hire a waste disposal officer, who would be paid by additional contribution from vendors. The service is carried out by local residents, providing a job opportunity for unemployed persons. Meanwhile, each vendor accesses electricity, if needed, from the nearest resident's house. While setting up their stalls, the vendors install cables to access electricity and pay the residents for it directly.

## 4 Discussion

Mutual benefits, which are shared with all involved parties, become the main consideration for producing vending space within a neighbourhood. The space is produced and developed through social relations, as described by Lefebvre (1991), through consideration of the economic and quality-of-life considerations of vendors, residents, and shoppers. To achieve the expected benefits, all involved parties created spatial self-organization and appropriated the available existing space for vending activities. Local residents provide vending space, parking, circulation management for pedestrians, goods, and vehicles, waste disposal service, and rental stalls in exchange for affordable compensation from vendors. The low price of various service provisions allows vendors to sell commodities within the purchasing ability of the designated shoppers. The mutual benefits also compensate for the negative outcomes the market imposes on the community, such as piles of rubbish, circulation blockages, loud noise, and privacy transgressions. The social relations, which are manifested in agreements to achieve the concurred mutual benefits, are also refined as issues arise that require immediate solutions. The increasing number of ambulatory and occasional vendors in the market led to changes in the registration system and the regulations governing selling locations. The increasing number of vendors has also compelled spatial expansions, which have required more residents to agree to permit vendors to trade in front of their houses. Originally, the Kutek Sunday Market took advantage of the crowds participating in other recreational activities at a university complex. Today, however, the vending activities

are themselves a primary destination. Despite having a less advantageous location ever since the tragic accident of 2003, the market has continued to attract increasing numbers of vendors and shoppers. This case study shows that the number of pedestrians already coming into a particular area does not always determine the locations selected by street vendors, but that accessibility and proximity to large numbers of people are essential to make a street market possible.

This study demonstrated the ability of local residents to engage in spatial self-organization to deal with the adversities presented by the market. The spatial provisions for relocating vending activities were accommodated through the establishment of social relations among the involved parties, which resulted in a mutually acceptable agreement. Social relations, in this case, are not neutral but involve careful economic calculations that enable all parties to benefit. Without the possibility of achieving shared benefit, the social relations could not lead to viable spatial arrangements. However, the potential of mutual benefit has motivated efforts to create and preserve a harmonious spatial order among commercial and domestic activities, all occurring in a narrow alley. This finding shows how informality operates in the framework of its formal counterparts, as mentioned by Dovey (2012). This self-regulation transforms the public space and some parts of individual property to a shared arena (Ostrom, 2005) with a distinctive and delicate "new social order". It also works to encourage mutual benefits for all involved parties as positive outcomes, and simultaneously minimizes the negative impacts to the surrounding neighbourhood. It is the agility and survivability of informality, as stated by Obeng-Odoom (2011) and Peters (2013) in the modernized city.

However, informality should not be considered as the act of agility and survivability itself, as Obeng-Odoom (2011) and Peters (2013) describe, but the act of accommodating the various interests of the involved actors. The location of the market was selected according to a consensual agreement between the head of neighbourhood, residents, and vendors, which brought a new weekly activity to an isolated alley. The created spatial and social system connects the isolated alley with points of access for the shoppers, which profits the vendors and residents, as does the waste removal service. It brings employment for the residents and vendors, and also funding for neighbourhood improvement. It alternates with the zero-sum approach of formality to attain a consensual spatial and social system for accommodating the interests of the involved actors, then creates a new contiguous space that connects with its formal counterparts. Therefore, in this case, informality is not just an alternative, contested space but rather one that is interconnected and interdependent with the formal system. This cooperation brings mutual benefits, thus minimizing the negative impacts of the informal sector. It gradually becomes an integral part of the whole social and economic system, with only blurred lines separating the formal and informal.

## 5 Conclusions

The presence of the informal economic sector, including street vendors, in urban spaces has generated environmental problems despite its immense contribution to urban livelihoods. Therefore, it is critical to seek ways to integrate the informal economy into the urban environment so as to maximize the benefits and reduce the downsides. Street vending plays a pivotal role in sustaining livelihoods, not only for traders but also for local residents and regional shoppers. Prohibiting vending activities completely is certainly an undesirable solution, because doing so would negatively affect many people's livelihood and sustenance. In this case, after the market was evicted from its previous location, vendors pursued the Kutek area as a new location that would still be accessible to their customers. The market's occupation of a residential street in Kutek area has required extensive cooperation and negotiation to achieve mutual benefits for both vendors and local residents. Vendors have preserved their livelihoods and residents have received job opportunities and other ways to earn additional income. To achieve their desired objectives, vendors and local residents operate a self-organized system to manage vending and its supportive activities. The system determines the space, circulation and utility arrangements, as well as managing other issues. It evolves in accordance with local conditions to maintain the benefits sought by each stakeholder group. This case study shows that communities can display considerable capacity to construct a self-organized system that meets their immediate needs.

However, self-organized systems tend to have limited capacity and often require cooperation with outside parties to succeed. This cooperation is important because the formal and informal are interdependent and become an integral economic system with a vague distinction. Suitable interventions in social development, urban planning, and design can help to enable the informal economy to function lucratively and beneficially in urban areas. Such interventions must accommodate the interests of all involved parties so as to avoid resistance or new impediments in the future. Further multidisciplinary studies on how to integrate the informal and formal economic sectors in urban space are needed to validate the benefits of informal sectors to urban communities and to explore multiple ways to reduce their possible downsides.

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# Key challenges of climate change adaptation in the building sector

This paper addresses the main challenges in climate resilience of the building sector, including climate adaptation schemes, energy efficiency, and mitigation approaches. These challenges are evaluated with regard to the state of the art, research interest, and regulatory issues, providing an assessment of the advances and defining research gaps in the literature review. The review shows that climate resilience mainly deals with larger systems, whereas the field is still developing at the building level. One of the main challenges identified is the institutional response. Many publications state that it is necessary to revise policies and develop legislation; however, this is sometimes hindered by uncertain climate change predictions. The EU legislation currently provides partial coverage of resource efficiency and climate mitigation in the building sector, while the national legislation is delayed. The current situation can impair the competitiveness of the national building sector, causing it to lag behind the goals set for achieving sustainability. From the cost perspective, immediate short-term actions are seen as more expensive, because delays can result in increased risks for major investments. The authorities are currently choosing between rapid and delayed actions, balancing the costs of early actions and the reciprocal costs of delay.

**Keywords:** buildings, climate change, climate resilience, economy, climate change adaptation

## 1 Introduction

The scientific evidence shows that the speed of climate change has significantly increased due to human activity (ARSO, 2018). Since the end of the nineteenth century, the air temperature on Earth has risen by 0.8 °C, and in the past twenty-five years it has been rising by 0.2 °C per decade (UKCP, 2009; WMO, 2018). At the current level of preventive measures, by the end of the century, the global average temperature will have risen by more than 4 °C relative to the pre-industrial era (UNEP, 2018) and a similar rise will take place in Slovenia (Bertalanič et al., 2018). This will have a severe impact on the built environment. Even if some previously set mitigation measures are applied, the global average temperature will rise by more than 3 °C relative to the pre-industrial era (UNEP, 2018), resulting in new requirements and use patterns in buildings. Global warming already influences the built environment by challenging building energy demand and energy supply systems (Olonscheck et al., 2011; Wang et al., 2014; Pérez-Andreu et al., 2018). Ocean warming results in higher surface water temperatures, a rising sea level, changed patterns of sea currents (WMO, 2017; MOP, 2018), and flooding of densely populated coastal regions (UNEP, 2018). Since the 1950s, changes have also been observed in the frequency of extreme weather events, contributing to significant damages in the built environment (IPCC, 2012; 2014; Dolinar, 2014; ARSO, 2018; Bertalanič et al., 2018). At the local level, the effects of urban heat islands further increase ambient temperatures and cause overheating (Wandl & van der Hoeven, 2018; Kaplan, 2019). It is therefore essential to take more intensive action on climate change mitigation and adaptation of the built environment, or else it will not be possible to limit these effects to a manageable level in the coming decades.

As a result of population growth, the increasing volume of residential buildings is a high-priority area in climate change mitigation due to its large share of $CO_2$ emissions, significant energy saving opportunities, and rising expectations regarding occupant comfort (Andrić et al., 2019; Dino et al., 2019). The results of measures introduced in previous years are to some extent already visible. In the EU the building sector has contributed most to absolute reductions of emissions. Although the majority of member states are currently not on track regarding the 2030 targets, they all plan to achieve largest decreases of emissions in the building sector. The reasons for such an approach are the market availability of suitable technologies for reducing energy use and the integration of renewables (EEA, 2019). This means that the sustainability measures in the building sector will continue in the future.

This article assesses climate change adaptation approaches in the built environment that many researchers believe have great potential for reducing greenhouse gas emissions. The most important areas of dealing with climate change impacts and mitigation strategies are climate change governance adaptation approaches, the improvement of resilience in urban areas, and mitigation approaches at the building level. The holistic approach is important, based on cross-disciplinary and complex decision-making, accentuating the fact that at present these decisions are often carried out within the framework of the influence of the involved stakeholders and the requirements that need to be addressed (Kristl et al., 2019). City planners and decision-makers need to clarify and communicate their approaches to the problem, intervention methods, available resources, and possible decision-making procedures (Gohari et al., 2020). The study was carried out as a systematic literature review, dealing with three main subjects of climate adaptation in the building sector: governance measures, adaptation of urban areas, and buildings. In the article's state-of-the-art section, research interest and regulatory issues are considered, providing a valuation of the advances and defining research gaps and trends in various aspects. An overview of the main challenges provides a good starting point for further investigation in this area.

## 2 Study design

The systematic literature review (Punch, 2014) is structured as a gradual process in which the individual components are combined into a whole. At first, the separate fields of governance measures, urban areas, and buildings are studied, after which they are cross-combined with sustainability and climate mitigation approaches. This method allows the literature to be assessed from various viewpoints and enables an evaluation of problems that are not widely considered and could remain unnoticed. To include as much relevant information as possible, a range of various sources were searched to detect studies associated with climate change–related topics and buildings. The literature search encompassed various literature types (books, articles, studies, project reports, guidelines, statistical data, directives, standards, regulations, etc.) and research fields, such as climate adaptation strategies (strategic documents, regulations), energy efficiency in a changing climate (methods and calculations), and climate resilience and financial burden (influences on systems and buildings).

An article search was carried out of various scientific databases (e.g., Science Direct, WorldWideScience, and Emerald) for peer-reviewed publications from 2000 to 2020 written in English, with the keywords "climate change", "climate change strategy", "climate adaptation", "climate mitigation", and "climate resilience" combined with "building", "urban", "city", "real estate", "energy use", "energy retrofitting", "energy efficiency", "heating", "cooling", "management", and "financial". Examples

**Table 1:** Number of hits and relevant studies for selected combined search terms

| Search term | Database | Hits | Title + kw | Abstract | Article |
|---|---|---|---|---|---|
| Climate change Urban | Science Direct | 78,938 | 321 | 16 | 8 |
| | WorldWideScience | 1,430 | 370 | 18 | 9 |
| | Emerald | 5,289 | 26 | 4 | 2 |
| Climate mitigation City | Science Direct | 30,034 | 76 | 7 | 3 |
| | WorldWideScience | 897 | 128 | 6 | 3 |
| | Emerald | 2,088 | 52 | 0 | 0 |
| Climate adaptation Building | Science Direct | 23,638 | 116 | 8 | 7 |
| | WorldWideScience | 1,394 | 151 | 5 | 5 |
| | Emerald | 1,862 | 2 | 0 | 0 |
| Climate resilience Energy | Science Direct | 13,545 | 5 | 5 | 5 |
| | WorldWideScience | 1,013 | 25 | 7 | 6 |
| | Emerald | 1,354 | 0 | 0 | 0 |
| Climate change strategy Policy | Science Direct | 78,268 | 117 | 5 | 3 |
| | WorldWideScience | 1,038 | 87 | 4 | 2 |
| | Emerald | 13,922 | 27 | 2 | 2 |

of the basic keyword combinations used in the search and their relevant results are presented in Table 1. "Search term" describes what word combination was used to perform the search, "Database" is the database used for the search, "Hits" reveals how many results the search produced, "Title + kw" shows how many of the hits that were reviewed comprised titles and keywords relevant to this review, "Abstract" refers to how many of the abstracts fitted this review's mandate, and "Article" describes the number of general articles whose content is relevant to this review. To find legal and standardization references, various internet engines were run. Also, other relevant web sources were manually searched for project information and legal documents.

In the initial search the amount of hits was generally quite high (Table 1). Where possible the database search was set to search for articles according to relevance and publishing year. However, when the search advanced by using the selected keyword combinations, it was more difficult to find an appropriate number of articles with high relevance, especially in the fields of climate resilience/energy and climate adaptation/building. This was quite surprising, since the number of articles on energy use in buildings and similar topics is quite high in the literature. In this stage forward snowballing (Wohlin, 2014) was used in some cases to find the most recent publications. The selected articles were scanned for relevant keywords or terms. Many keyword combinations resulted in a considerable number of hits; however, in most cases only few initial pages gave relevant results. Furthermore, some databases produced very similar results, which diminished the need to use all the databases continually. The articles were culled and filtered based on the articles' title, keywords, abstract, or title content relevance. The final selection was based on the research topics stated in the introduction. The search resulted in a substantial quantity of studies and other publications from which more than 200 were selected for consideration. After examining their relevance and applicability, the culling process resulted in more than eighty sources that were used in the review. The selected articles were discussed from the perspective of three approaches to climate change adaptation: governance measures, urban areas, and buildings.

# 3 Review of climate change adaptation approaches

## 3.1 Governance measures

Authorities play a key role in adaptation processes. These further influence various stakeholders from national institutions to local players, NGOs, consulting companies, researchers, and insurance companies (Torabi et al., 2018). The system functions on the basis of the strategic and regulatory documents implemented in the decision-making process. In this context, one of the most important international agreements with a global impact is the Paris Agreement (UN, 2015b). An overview on climate change vulnerability and adaptation readiness in the 192 UN countries, by Sarkodie et al. (2019), shows that the developed countries have integrated climate adaptation plans and policies into their developmental agendas and are less vulnerable to climate change due to strong economic, governance, and social adaptation readiness. The developed countries have to commit assistance to developing countries and international assistance is needed to strengthen their resilience.

At the EU level the strategy for adapting to climate change (European Commission, 2013a) has been oriented toward further guidelines for governing bodies, civil society, the private sector and individuals working in environmental protection in order to ensure the full activation of ecosystem-based adaptation approaches. After the adoption of the Paris Agreement, the European Council stated that "the Agreement remains a cornerstone of global efforts to effectively manage climate change and is no longer negotiable" (European Council, 2017: 6). The EU also played a prominent role in the process that led to the adoption of the 2030 Agenda for Sustainable Development (UN, 2015a). A joint statement was adopted (European Commission, Council & Parliament, 2017), establishing a common framework for the development policies and implementation of the 2030 Agenda. The latest document in this line is the European Green Deal (European Commission, 2019) which sets out how to make Europe the first climate-neutral continent by 2050. The growing recognition of the impact of urban areas on climate adaptation and mitigation strategies has initiated several policy schemes (Pasimeni et al., 2019). The European Parliament has made a commitment to reach carbon neutrality by 2050 (European Commission, 2018) and directed the EU countries to prepare national energy and climate plans and climate policies. In Slovenia, the original version of the climate plan (Vlada Republike Slovenije, 2019) was criticized for its lack of ambition (C 4424 final, 2019; Zgonik, 2019) but in the final version the government strengthened the commitment and the goals were set more boldly (Vlada Republike Slovenije, 2020). The Slovenian government has also adopted the Ordinance on the Climate Change Funding (Odlok, 2020). At the local level, the Covenant of Mayors for Climate and Energy (Internet 1) connects cities committed to reaching the EU's climate and energy targets.

Various forecasts suggest that the price of insisting on an existing pattern of performance will be much higher than a timely and sufficiently comprehensive response. The Stern Review (Stern, 2007) suggested that the overall costs and risks of climate change would be equivalent to losing at least 5% of global annual GDP. The current forecasts have not considerably changed. In central and southern Europe, including Slovenia, the economic losses at the current rate of climate adaptation are projected to exceed 4% of annual GDP in the last third of the twenty-first century (Internet 2). The rapid decarbonization of the energy system and the reduced consumption of natural resources requires 1 to 2% of annual GDP (Internet 2; IPCC, 2018). Such evaluation is approximate, considering the uncertainty of the various factors in play, which include but are not limited to climate evolution, frequency of extreme weather events, and variation in energy prices. In any case, the result of a 1% of GDP investment in reducing emissions for a few decades will still have a positive effect regardless of the science being right or wrong.

The "no regrets strategies" (UNEP & UNFCCC, 2001: 50) can minimize the costs of climate change and represent a meaningful action, economically and environmentally. They can be an opportunity to remove market imperfections and create new benefits through greater industrial competitiveness in energy efficiency. According to several authors, carbon footprint is the most effective measure to mitigate climate change (Nordhaus, 2017; Freire-González, 2018). The carbon tax, which is expected to rise steeply over the years, should be enacted in the context of a green tax reform. Even though the carbon pricing serves several important purposes, the global commitment requires acknowledging the vital role of instruments other than carbon pricing (Tvinnereim & Mehling, 2018).

At the building level, the most important climate change mitigation measure is increased energy efficiency of the existing building stock. The economic assessments of energy retrofitting measures are traditionally based on the investment rate and the reduction of energy costs. Apart from the institutional level (European Commission, 2012) future financial benefits of mitigating climate change are seldom considered in the evaluation of the retrofitting investments at the project level. Nydahl et al. (2019) emphasize that the evaluation of various energy retrofitting measures may become financially sound investments if the reduced future costs of mitigated life cycle greenhouse gas emissions are included in the analysis. They can be based on standards (e.g., oSIST prEN 17472, 2020) or schemes, such as the Level(s) tool (Dodd et al., 2017). For this reason, the investment processes should encourage a balance between financial success of the business and social success and welfare of residents in the community (Boge et al., 2018, Salaj et al., 2018). In addition, more reliable models that evolve from investing only in the building to also investing in social security and regional development are needed (Temeljotov et al., 2011).

The information presented above shows that climate change mitigation will probably result in lower energy consumption, overall greater savings, and a change in established consumer preferences (IPCC, 2014). The changes will also affect the amount of income that users or individual households spend for building heating and cooling. Clarke et al. (2018) note that many studies on socioeconomic and energy system changes address the statistical economic relationship between climate variables and energy consumption. They argue that such a general approach based on information from past periods has limitations regarding the changing energy systems in future periods. Particularly challenging is the calculation of the impact of energy consumption on the share of household income

spent. According to Olonscheck et al. (2011), the net global use of energy resources will increase by 0.1% if the temperature rises by 2 °C. If users try to maintain the same level of thermal comfort, they will spend an additional share of their income on energy (Clarke et al., 2018). Aiming toward energy independence by having control over energy consumption can have a highly positive impact on such economies. It guarantees that energy consumers are less dependent on a volatile market in the context of scarce fossil resources. Furthermore, the geopolitical benefit is significant in a world where the suppliers of petroleum hydrocarbons are heavily polarized on the political stage.

### 3.2 Urban areas

Generally, the effects of urban climate change are reflected as climatic events that affect the fundamentals of urban systems (population, built environment, and infrastructure). The consequences can be physical (e.g., damage to objects) and/or socio-economic (e.g., loss of income, health effects; Wandl & van der Hoeven, 2018). The past extreme weather events have above all exposed the vulnerability of major urban areas with a large population and complex infrastructure. Although resilience to climate change can be linked to the core priorities of city authorities, such as economic growth and social well-being, adaptation processes in most urban areas are evolving extremely slowly (Carter et al., 2015).

Resistance to climate change is a key concept, but in the context of cities this is a complex process including a number of various factors (Torabi et al., 2018). Given the intertwining nature of urban systems, it is difficult to accurately determine the effects of climate change on certain sectors and systems, because the consequences are often more extensive than immediately comprehended (Carter et al., 2015). According to Rastandeh (2015), the analyses of alternative future scenarios offer a good starting point to study probable influences of mitigation strategies on the future development in the changing conditions. This approach can be a crucial political instrument for including climate change in decision-making. However, more methods and technologies are needed to transform these presumptions into realistic development patterns. For example, Truong et al. (2018) propose a new model for selecting investments in climate adaptation, which takes into account the unreliability of climate change forecasts. The authors note that this framework significantly increases the value of investment adjustments compared to previous practices. In particular, it is important to take into account the proper sequence of investments in order to maintain the flexibility of investment in the uncertain climate change conditions. Furthermore, in their comprehensive study Mata et al. (2019) calculate the variations in the energy-saving potentials and costs for a series of energy-saving features in five climate change scenarios and compare the obtained uncertainty due to climate change to other uncertainties, such as the boundaries for emission inventories and energy system development. They find that the financial effectiveness of the retrofitting measures is often founded on the relationship between annualized investments and energy-saving potentials. Future climate conditions have a less decisive role. Measures that primarily affect heating energy need are more robust than changes in electricity use. The strategies for building retrofitting should focus on prioritizing energy savings and mobilizing investments that may not be profitable based on the current techno-economic standpoint.

Deep and rapid decarbonization of the building sector requires energy demand reductions and the integration of renewable energy sources (EPBD 844, 2018). As already mentioned above, energy retrofitting of buildings is an efficient and cost-effective approach. Bunten & Kahn (2017), however, believe that the durability of real estate capital can hamper the climate change adaptation process. In this type of scenario, Dafermos et al. (2018) provide an assessment of the consequences of climate change on financial stability using an analysis of the value of financial assets and the financial position of companies and banks. The simulations are carried out using the global data from 2016 to 2120. They find that climate change, due to the destruction of capital and the consequent reduction in profits is likely to gradually exacerbate companies' liquidity, which can lead to a higher level of defaults and thus have a negative impact on both the financial and non-financial sectors. The damage caused by the consequences of climate change can lead to the migration of capital, which may result in a gradual decline in share prices of the affected companies. Financial instability as a result of climate change can have a negative impact on lending. Furthermore, the economic and social aspects of short-term approaches to the issue may result in growing problems in the future (Champagne & Aktas, 2016).

Matko et al. (2016) also find that introduction of methods that allow for risk assessment influences the reduction of damages due to extreme weather events. A good example of such an approach is a study by Pasimeni et al. (2019), which analyses the synergy between adaptation and mitigation actions at the urban level in Italy and Spain (urban adaptation and health, transport, infrastructure, and energy). Urban management measures were classified as soft (focused on environmental information), grey (focused on buildings), and green (focused on nature-based solutions). The overall comparative analysis shows that in large and medium-sized Italian cities, mainly soft (52%) and green (28%) adaptation measures have been integrated into local energy, environmental, and climate mitigation planning. This is in line with the EU Communication (European Commission, 2013b), which states that green approaches are one of the most widely used, economically

sustainable, and effective tools to combat the effects of climate change. Certain problems can be mitigated or adapted to climate change using green infrastructure (e.g., use of biodiversity and different ecosystems) which are being increasingly implemented (Ravnikar & Goličnik Marušić, 2019); however, further measures at the level of buildings should also be employed.

Adaptations (green infrastructure) affect health (cleaner air, better water quality, fewer diseases), social contacts (strengthening the sense of community, avoiding the feeling of exclusion), allow for physical, psychological, emotional and socio-economic benefits, link urban and rural areas, create an attractive environment for living and working, and strengthen regional and urban development (European Commission, 2013b). Indicators for the design effectiveness and local climate resilience can be used to monitor the degree of adaptation. As an example of such an approach, a project of eight Asian cities can be mentioned, in which a common conceptual framework was set up, within which the individual cities carried out the local alignment process (Tyler et al., 2016). The adaptation processes should be as multidimensional and synergic as the cities themselves, with mitigation strategies integrated into the very core of city planning and management (Carter et al., 2015).

### 3.3 Buildings

This review of the relationship between climate change and the built environment shows that the building sector represents a significant potential for climate change mitigation and reaching the sustainability goals (Andrić et al., 2019; Kristl, 2019). However, a building adapted to climate change is still not a well-defined term (Grynning et al., 2017). Currently, the literature reviewed is not comprehensive and mostly relates to general legislative levels and planning strategies. The findings are to some extent generic and are therefore not applicable to actual situations. Also, the specific impacts of climate change on buildings are somewhat difficult to assess, because they depend on local anomalies. Very useful is the study by Antonopoulos et al. (2019), which finds that the impact of urban micro-climates on energy use depends on local temperature variation and microthermal anomalies as well as urban and social differences. This corresponds to the results of a review on building energy use, which finds that urban heat islands can increase cooling loads by 19% and decrease heating loads by 18.7% (Li et al., 2019). It can be noted that the available studies mainly address the impacts of climate change on energy consumption in buildings, greenhouse gas emissions, and thermal comfort (Kershaw et al., 2011; Olonscheck et al., 2011; de Wilde & Coley, 2012; Esteves, 2014; Wang & Chen, 2014). In most cases they demonstrate that the future shifts in energy use will be substantial and that the historical weather data are not adequate for accurate assessment of buildings' energy performance (Farah et al., 2019). For instance, a study by Dolinar et al. (2010) examining a low-energy building located in two typical climates in Slovenia, pre-Alpine and Mediterranean, predicts a temperature increase of 1 to 3 °C and a solar radiation increase of 3 to 6%. In the pre-Alpine region the heating energy use would be reduced by 6 to 25%. In the coastal region, the change would not be significant. This information is instructive, because a favourable configuration of the building would enable a significant reduction in heating energy consumption. However, the cooling requirements would increase by about six times in the pre-Alpine region and around twofold in the coastal region, compared to the current situation.

Many other studies also predict that the share of energy consumption for heating and cooling in relation to the current situation can significantly change. Thus potential change in the energy mix, notably a significant reduction of traditional heating energy sources, is likely to occur (Clarke et al., 2018). One recent study predicts that annual heating energy will decrease by 21 to 22% and annual cooling energy will increase by 29 to 31%. Combined heating and cooling energy will decrease by 4 to 5% compared to current energy use (Farah et al., 2019). Moreover, the temperature extremes will have a significant impact on building performance. The preliminary results based on energy simulations show that noticeable overheating will occur in the future, which will have a strong effect on cooling energy use and/or occupant comfort (Dino & Akgül, 2019). It is estimated that the relative variation in peak load for cooling demand under near-future extreme conditions may be up to 28.5% higher than in typical conditions (Moazami et al., 2019a, 2019b). The energy robustness of buildings thus cannot be assessed solely based on typical future conditions.

Several studies also indicate substantial differences between cooler and warmer climates. Although the decreasing rate of heating hours in cooler climates is almost negligible, the decreasing rate in warmer climates may be significant (0.8% and 43% of heating hours respectively in 2050 compared to 2010, for the medium weather scenario (Andrić et al., 2017). This means that the heating energy demand may decrease and overheating may intensify, especially in buildings planned for today's moderate climates (Košir et al., 2018). This aligns with findings by Weng (2017) dealing with thermal comfort in UK residential buildings, using climate scenarios for 2030, 2050, and 2080. By 2050, building overheating can be prevented by intensive ventilation and, later, night ventilation can be used. However, passive cooling has limitations, and by 2080 a combination of shading and artificial cooling will have to be used. In northern Europe, adaptation to climate change relates primarily to better moisture resistance due to the expected increase in precipitation and slight rise in temperatures (Lisø et al., 2017).

This means that it is predominantly necessary to address typical building-physics issues, such as waterproofing and water vapour diffusion through the building envelope (Grynning et al., 2017). In the context of climate change, the paradigm of well-insulated buildings in temperate climates certainly needs some reconsideration. In warmer climates the heating energy consumption will probably significantly decrease, whereas the demand for cooling and the risk of overheating will significantly increase in all scenarios. Strategies like natural and mechanical ventilation will have a limited impact, whereas thermal insulation and reduction of infiltration will have larger impact on energy demand (Pérez-Andreu et al., 2018). Furthermore, Bruno et al. (2017) stress that well-insulated buildings in warmer climates are likely to overheat throughout the year and suggest a thorough examination of the building's geometry and the concept of the building envelope. It is also important to shade openings and employ night ventilation (Blecich et al., 2016), as well as carefully study the solar exposure of the building envelope (Košir et al., 2014).

Some stakeholders are already reviewing various adaptation options, such as finding alternative locations and adjusting maintenance of the current building stock. However, these measures are not sufficiently comprehensive in order to effectively mitigate all the consequences of climate change (Bunten & Kahn, 2017), such as the heat island effect and urban population resilience. Above all, it is necessary to ensure that the new buildings will not be affected by the negative impacts and burdens caused by the changed weather patterns, and that it will be possible to easily repair the damage caused by extreme weather events (Champagne & Aktas, 2016). Regarding existing buildings, appropriate and climate-adapted building management and maintenance measures, including plans for the improvement and upgrading of the existing systems, must be developed (Grynning et al., 2017). Furthermore, some authors feel that it is necessary to immediately initiate the preparation of measures to mitigate the effects of climate change, and that these should be multidisciplinary with integrated engineering and socio-environmental aspects (Pisello et al., 2017). The support of decision-making aimed at reducing risk and climate vulnerability in the built environment has to be universal, consisting of national building acts, national and international standards, certification schemes, and design guidelines (Lisø et al., 2017).

## 4 Discussion

The effects of climate change are numerous and reflect on the natural and built environment. Because buildings and infrastructure have a long lifespan, they are exposed to the climate not only during the time of their construction, but also to climate change over their subsequent decades of service. In this regard, the buildings that are currently being designed and also the existing buildings have to be taken into consideration. The review shows that the three areas considered (regulatory measures, urban environment, and buildings) have significant potential for climate change mitigation. They can also be considered as three levels of actions that can potentially be taken, but they must be the result of a concerted strategy, or they will not have the desired effect. Despite numerous significant developments, there are not many comprehensive studies dealing with the selected questions. Especially, three key challenges can be defined: the lack of specific climate adaptation strategies, energy use predictions in the changing climatic conditions, and resilience to climate change with a special focus on the financial burden.

One of the important challenges is institutional response. Many studies claim that development of policies and legislation are necessary but are sometimes hindered by inaccurate climate change predictions. This reflects in an uneven level of readiness. Although many developed countries include climate change challenges in their strategic developmental documents, the existing infrastructure and building regulations are adapted to the earlier climate patterns, whereas estimation methodologies for longer future periods of time are still being developed. Insufficient information about the consequences of climate change and the associated unreliability of the forecasts makes adaptation measures difficult to choose.

At the urban level the high complexity presents an important challenge, which makes adaptation only one of the problems that planners and decision-makers encounter daily. For this reason, the adaptation processes often advance extremely slowly. Such a situation reduces the competitiveness of the sector and increases lagging behind the goals of achieving sustainability. Often nature-based solutions are suggested as a suitable strategy for introducing adaptation and mitigation schemes. Nevertheless, some strategic documents that form the basis for further development of environmental policies have already been prepared; still, it is essential to increase the extent of research in order to create a suitably large pool of information that various stakeholders can use to prepare adaptation strategies.

At the building level, there are no clear guidelines for climate adaptation yet, though standards for the sustainable evaluation of buildings are being developed and the common EU framework of core sustainability indicators was developed. Furthermore, strong research activity has been set out by the European Commission (2020), supporting the development of climate modelling, methods, and standards, improvement of understanding the economics of climate change, and de-

velopment of technological options and strategies to improve air quality and reduce the carbon footprint of European cities and create climate change networks. Combined, these activities have a strong potential of firmer guideline positioning in the future. At the level of new buildings, for example, guidelines with a clear objective for nZEB in early 2021 (EPBD 31, 2010) have already been defined, and in the field of the existing buildings accelerated investment in energy retrofitting is supported (EPBD 844, 2018). These measures already show results. However, the field of climate resilience at the building level is still evolving. The evidence shows that in the developed countries, where many of the buildings were built before 1980, attention should be further focused on creating adequate guidelines for renovating the existing building stock, adapted to future climatic conditions. Future building services may depend on a significantly different energy mix than that of today, as global temperature increase and local temperature anomalies can significantly affect energy use. In developing countries with rapid urban growth, the focus should be on strategies and policy development.

In the financial field, immediate actions are seen as more expensive, but delaying could result in increased risks and therefore larger long-term costs. It is estimated that the overall costs and risks of climate change will be much higher than the cost of action towards reducing greenhouse gas emissions (Stern, 2007). As a result, the state of the economy at home and abroad, as well as international trade flows may be affected (IPCC, 2014; NIJZ, 2016; WMO, 2018). This adds to the increasing amount of income that users or individual households will have to allocate to energy expenses and should encourage authorities to gradually introduce changes in planning as well as in evaluation processes. The future financial benefits of limiting climate change are rarely included in the evaluation of retrofitting investments. The choice faced by the authorities between a rapid or a delayed action must be guided by the balance between economic costs of early actions (such as the risk of retiring some still usable capital stocks prematurely) and the reciprocal costs of delay. Delaying involves the risk of locking in today's model of high-emissions capital equipment for decades. If the need to reduce emissions rapidly becomes an absolute priority, prematurely retiring those investments would be at a large cost. Acting early would allow an increased long-term flexibility of approaching the stabilization of atmospheric concentrations of greenhouse gases.

## 5 Conclusion

The systems will have to globally adapt to climate change, circular production processes, ageing population, urbanization, immigration, and vulnerable infrastructure. This means that the upcoming strategies for raising the competitiveness of the building sector will have to include new environmental, economic, and social approaches, which also constitute the three main pillars of sustainability. Although concrete climate change mitigation measures are increasingly favoured by professionals, the general public is in favour of adaptation processes only in general terms. Climate change will inevitably affect people's current lifestyle and quality of life. It is also becoming increasingly clear that significant financial investments will be required in individual areas. For this reason, awareness raising and informational campaigns on the impact of climate change on life, society, and adaptation strategies should be stepped up. Climate neutrality can be achieved only by transforming the existing sociotechnical structures, including energy and urban systems (EEA, 2019). This information is crucial for preparing concrete measures to address the upcoming climate change challenges in the built environment.

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# Calculating the speed of city bus trips: The case of Ljubljana, Slovenia

In promoting the use of public transport, an understanding of the passengers' perspective on the provided service plays an important role. A series of factors influence people's selection of transport mode, among which the competitiveness of travel time, or travel speed, is vital. Thanks to the widespread use of electronic payment systems, data collected through user validation can be used to calculate this speed. Thus, the actual trips made can be used to estimate their speed. This study focused on the Ljubljana bus system to analyse all trips made on a typical day. The input and output trip data were used to calculate the distance travelled, and the time and speed of the trips. In addition, an estimate was also made of how quickly the distances travelled by bus could have been travelled by bicycle or on foot. The findings showed that the speed of the bus trips analysed depends on the length of the journey: it increases with longer journeys. Bicycles are generally faster for all distances, but they become a less acceptable choice for longer distances. With regard to distances shorter than 2 km, in terms of speed, walking is competitive on only a few routes. The analyses performed using the data collected through the electronic service payment system provided useful insight into the efficiency of the public transport system from the passenger perspective, which in the future may prove useful in planning system improvements.

**Keywords:** public transport, travel speed, effective travel speed, electronic payment system, speed comparison

# 1 Introduction

Understanding the residents' travel habits and reasons for them is an important factor in promoting sustainable mobility. The goals of sustainable mobility measures are often directed towards changing people's travel habits, especially reducing the use of cars and promoting the use of public transport, cycling, and walking as different modes of making daily trips. People's decisions to use public transport are heavily influenced by its quality (Vanhanen & Kurri, 2007). Studies of travel habits examine the factors influencing the choice of travel mode or the indicators defining how a public transport system operates. The quality indicators of a public transport system can be divided into two major categories: the transit capacity and the quality of the actual service provided (KFH Group, 2013). Quality of service is defined using user perceptions or actual numerical measurements (Carreira et al., 2014). If the service is of good quality, then frequency, availability, travel time, price, and staff quality are especially important in deciding to use public transport (Stradling et al., 2007). The key indicators, which are also important factors in selecting the travel mode, are the speed and consequently the time the user spends to make a trip. There are only a few Slovenian studies in this area and the ones that do exist do not provide detailed insight into the conditions that influence the passengers' motivation to use public transport (Statistični urad RS, 2017; Ljubljanski potniški promet, 2019). Travel time is one of the most important elements of public transport quality (KFH Group, 2013) because all the other factors influencing the choice of travel mode only come to the fore when the user is provided with a competitive selection of various travel modes in terms of travel times. Longer travel times (e.g., of commuting to work) are directly connected with reduced user satisfaction (Loong & El-Geneidy, 2016), as well as poorer wellbeing and social inclusion (Morris & Guerra, 2015).

Various methods are used to calculate public transport speed. The speed over a specific stretch, including all stops and delays, is referred to as commercial speed. This indicator is primarily important from the operator's point of view because it makes it possible to calculate a vehicle's travel time on a line, set up timetables and drivers' schedules, and effectively distribute vehicles across the system. From the passengers' point of view, commercial speed is not enough because they compare the travel times of various transport modes from a door-to-door perspective. More important for them are the time and speed that also include the time of reaching the station, waiting, in-vehicle travel, any transfers, and ultimately reaching the destination (Munizaga et al., 2016; Constantinescu et al., 2018). This speed is referred to as the effective total travel speed below.

Data collected through passenger validation enabled by digitalized payment systems provide great potential for acquiring data on and analysing these speeds. Such data allow a much better understanding of passenger travel habits and it also makes sense to use them in improving the public transport systems (Schmöcker, 2016). Smart card data can also be used to calculate the key indicators of a system's operation (Trépanier & Morency, 2016), as well as conduct many other analyses in addition to those focusing on travel speeds (Jang, 2010).

This article presents a method for analysing the speed of public transport trips in Ljubljana using the data on the trips actually made. The study examines the time parameters of trips without the analyses of perceived times. It proceeds from the hypothesis that the available payment system and timetable data can be used to determine the speed of actual public transport trips that is more accurate than the data available to date. The second part of the study compares the public transport travel speeds with the speeds of traveling the same routes by bicycle or on foot. Comparisons of individual travel modes in a city are a frequent research topic (Ellison & Greaves, 2011; Andersen, 2014), but most of these are unsystematic. The literature review revealed no study that would provide a comparison between a public transport mode and cycling based on a sufficiently large sample and comparable routes. Based on the available data on the relatively short distance of an average trip, this study proceeds from the hypothesis that an average public transport trip would take less time by bicycle.

## 1.1 The case of Ljubljana

Public transport in Ljubljana is operated by Ljubljanski Potniški Promet (hereinafter: LPP), which carries nearly 40 million passengers a year. In recent years, the number of passengers has been falling despite many improvements to the service and passenger comfort, such as revamping the bus fleet and the bus arrivals system, improving the quality of bus stops, and introducing separate bus lanes on some arterial roads. The main reason for the falling number of passengers is not entirely clear (Ljubljanski potniški promet, 2019). The accessibility of public transport is good within the city perimeter (Gabrovec & Bole, 2006; Kozina, 2010; Gabrovec & Razpotnik Visković, 2012, 2018; Tiran et al., 2015).

Travel times have been poorly studied to date. Celcer (2009) analysed the travel times on selected lines and compared them to cars, but she did not calculate the travel speeds. She established that travel times for cars were significantly shorter on all the routes studied. Travel times on specific lines were also studied by Šabič (2015), but he only calculated the commercial speed, which does not take into account waiting and

walking. Similarly, LPP also only measures the commercial speed (Šmajdek, 2011). Vehicle tracking data were used to calculate the travel speed on line 1, which exceeds 22 km/h throughout the day (Čelan & Lep, 2020). Low travel speed as a key problem in public transport has also been highlighted in strategic documents (Milovanović, 2017; Gojčič, 2018), in which, however, no current or target values are provided, which is most likely the result of this topic being understudied.

The electronic payment system, which Ljubljana introduced in 2010, has good potential for analysis. When entering the bus, every passenger validates their card or uses the Urbana app on their smart phones to pay for the fare. The validation data are sent to the central server together with the information on the bus stop retrieved from the Automatic Vehicle Location (AVL) system (Šmajdek, 2011). Except for keeping records of the total number of passengers for the annual reports, these types of data, except for certain exceptions (Koren, 2016; Koblar, 2017; Koblar & Žebovec, 2018), have not been analysed in detail. However, they proved to be very useful in analysing user travel patterns (Koblar & Žebovec, 2018; Koblar & Mladenovič, 2020) and planning potential changes to the network (Koblar, 2017).

## 2 Methods

The payment system data were analysed to calculate the travel times. Because only the boarding bus stop is recorded in the payment system, one of the challenges was determining the alighting stops and merging individual trips into a journey. A trip refers to a ride on an individual line validated in the payment system. A journey refers to one or several trips together by taking account the boarding stop of the first trip and the alighting stop of the last trip. These data provided the basis for further analyses.

### 2.1 Determining the alighting stops and calculating the travel times

Travel times and speeds were analysed based on the trips made and recorded in the payment system used by LPP. The 2015 and 2016 validation data retrieved were first used to select a typical day on which an average number of trips (validations) were made, the weather was nice (no rain) and there were no school holidays, roadblocks or other special events. Wednesday, 18 May 2016, was selected, with 142,181 trips recorded.

Because most public transport payment systems are designed so that they only record the entry into the vehicle, just like this one, a considerable number of authors have so far sought to determine the alighting stops (Cui, 2006; Trépanier et al., 2007; Zhao et al., 2007; Farzin, 2008; Lu, 2008; Wang, 2010; Li et al., 2011; Wang et al., 2011; Alsger et al., 2016; Mosallanejad et al., 2019; Yan et al., 2019; Assemi et al., 2020). To define the alighting stops on individuals' journeys they generally used a simple algorithm that compared two daily trips and took account of two criteria: the alighting stop on the first trip is the same as the boarding stop on the next trip and the alighting stop on the last trip of the day is the same as the boarding stop on the first trip. In addition to determining alighting stops, the reconstruction of journeys also requires merging individual trips into complete journeys. Here, it is vital to accurately determine when a person changes lines and continues their journey and when they end it. This can be determined based on the distance between the alighting stop on the previous line and the boarding stop on the next line and the time between alighting and the next boarding (Alsger et al., 2016). Due to the lack of appropriate data, most researchers did not check the accuracy of their results. Alsger et al. (2016) made an important step toward improving the algorithms and checking the quality of results. They used the smart card data of the South-East Queensland public transport network, in which passengers also validate their cards when alighting, to check the accuracy of results. By modifying established algorithms and including data from the public transport schedules, they managed to additionally improve the quality of origin-destination estimation algorithms. Later additional improvements were introduced, using more complex methods (machine learning) to more successfully determine the alighting stops (Yan et al., 2019; Assemi et al., 2020). Due to its simpler implementation and satisfactory results, we decided to use the algorithm proposed by Alsger et al. (2016).

To determine the alighting stops based on this algorithm, the smart card validation data must contain the card identifier, travel time, and the stop and line used. The data obtained include all the necessary information; in addition, a bus schedule database was obtained that was suitably structured for linking with the validation data. Before running the analysis, trips without the required data were eliminated from the database. Some trips were part of long-distance (inter-city) lines and so were not included in the city public transport schedule, and for some the wrong line or stop was recorded. Because the alighting stop can only be determined for passengers that took more than one trip on the same day, data on users with only one trip on a selected day were also eliminated from the database (17,614). The basic conditions for inclusion in the analysis were met by 113,985 or 80.2% of all the trips made. A matrix of distances between the stops is required to determine the alighting stops and transfers. For stops less than 800 m apart, the distances were modelled based on the road network, which resulted in more accurate calculations. For distances between other stops, the Euclidean distance was calculated because the

calculation for the 840 × 840 matrix of the stops analysed would have taken too much time.

The alighting stops were determined using our own software, which followed the algorithm applied (Alsger et al., 2016). The software first analyses the consecutive trips of the same person and orders them into journeys. One journey can be composed of several trips with transfers in between. The potential alighting stops were determined based on the bus schedule, from which the potential alighting stop is selected according to the line used. From among the stops selected in the previous step, the stop closest to the next boarding stop is defined as the alighting stop. To determine the alighting time, the travel time between both stops as provided in the bus schedule is added to the boarding time. If the next boarding stop is less than 800 m away and less than 60 min have passed in between, the trip is defined as a transfer; otherwise, it is treated as an independent journey. In the event of a transfer, the software continues to analyse the user's card validations until the last trip in the journey. If this is the last trip of the day, the stop closest to the boarding stop of the first trip of the day is selected as the alighting stop, and the software then continues by analysing the next user's trips. The alighting stops were determined for 110,069 or 96.5% of validations that met the conditions for inclusion in the analysis. The result of the analysis is a consecutively numbered list of trips with additional information on the alighting stop and the alighting time. Trips that continued with a transfer to the next line also contain information on the distance to the next boarding stop. These data were then merged into individual trips, for which the travel times were calculated.

## 2.2 Calculating the average waiting time

One of the factors affecting the travel time is also the time of waiting for the bus to arrive. Assuming that passengers arrive at the stop randomly, the average waiting time depends on the frequency of bus trips on all lines that are heading in the selected direction and are available at the time of travel. Therefore, the difference in the travel times of the current, previous, and next trips were calculated for the specific line used. If this was the first or last trip of the day, only the difference to the next or previous trip was taken into account. The same method was used to calculate the waiting times for other lines that could have been used between the two selected stops. In this, only the lines on which the nearest scheduled departure was less than 5 min before or after the actual trip made were taken into account. To calculate the average waiting time, the waiting times on individual lines were converted into frequencies and summed up. The sum was then converted into waiting time and divided by 0.5. For journeys in which the waiting time was longer than 4 min, it was assumed that passengers checked the bus schedule before the trip and, therefore, an average waiting time of 4 min was determined for these 16,771 trips. According to the initial estimate, the average waiting time on these trips was 6.1 min.

## 2.3 Calculating the travel time and speed

Because the calculations and definitions of travel speed vary significantly, to ensure better comparability with research to date, the travel speed was calculated in four different ways, taking into account different distances and travel times, as shown in Table 1.

## 2.4 Walking and cycling speed

Cycling and walking travel times were modelled in OpenTripPlanner (Morgan et al, 2019). using the transport network created from the OpenStreetMap database (OpenStreetMap contributors, 2015). These data are of sufficiently high quality for Ljubljana to obtain sufficiently accurate results. In the OpenTripPlanner program, the default speed and weighting settings for individual road categories were used. The cycling speed was set at 17.7 km/h. Various estimates of the average speed of urban cyclists are used in the literature, ranging from 15 to 19 km/h (Ellison & Greaves, 2011; Andersen, 2014; Kager et al., 2016). Because no data are available on the average speed of cyclists in Ljubljana, it is assumed that the above speed estimate is suitable. The walking speed was set at 4.8 km/h. Calculations were made for all origin-destination pairs. For walking and cycling, too, another 400 m were added to the distance between stops to calculate the effective travel speed, which added up to 1 min 30 s for cycling and 5 min for walking. We added another two minutes for cycling, as the time required to lock and unlock the bicycle.

## 2.5 Data merging and quality analysis

After conducting individual analyses, the data were merged into a joint database, in which the data analysed is collected for every journey. Journeys for which it was assumed that there were errors in the calculations were deleted from the database. It turned out that the criterion for merging trips into journeys that allows for less than 60 min for the transfer and a distance of less than 800 m between stops was insufficiently accurate. Thus, to control for the quality of data, the coefficient and difference between $l_{\text{LPP line distance}}$ and $l_{\text{shortest}}$ were calculated. Where the $l_{\text{LPP line distance}}$ was significantly greater then $l_{\text{shortest}}$, this indicated that a transfer was wrongfully assigned instead of two separate journeys. Thus, all journeys in which $l_{\text{LPP line distance}} / l_{\text{shortest}} < 0.8$ or $> 4$ and $l_{\text{LPP line distance}} - l_{\text{shortest}} < -100$ m or $> 100$ m were eliminated from the database. Additionally,

**Table 1:** Method of calculating the travel speed.

| | Presumed distance | Presumed travel time |
|---|---|---|
| Effective total travel speed | Effective distance travelled: $l_{shortest} + l_{walking}$ | Total travel time: $t_{trip} + t_{waiting} + t_{walking}$ |
| Total travel speed | Distance travelled: $l_{LPP\ line\ distance} + l_{walking}$ | Total travel time: $t_{trip} + t_{waiting} + t_{walking}$ |
| Effective travel speed | Effective distance travelled: $l_{shortest}$ | Travel time: $t_{trip}$ |
| Actual travel speed | Actual distance travelled: $l_{LPP\ line\ distance}$ | Travel time: $t_{trip}$ |

Whereby:

$l_{shortest}$: the shortest distance between the first and last stops calculated as the walking distance along pedestrian routes

$l_{walking}$: 400 m distance – the total walking distance to the first stop and from the last stop to the destination

$l_{LPP\ line\ distance}$: distance travelled by bus; in the event of a transfer, the walking distance between the two transfer stops is taken into account

$t_{trip}$: time between boarding the bus on the first trip and alighting from the bus on the last trip of the journey; it also includes the time of transferring to the next line

$t_{waiting}$: average time of waiting for the bus to arrive on the first trip in a journey

$t_{walking}$: 5 min – the time required to walk 400 m, which is added as $l_{walking}$. This is an estimate based on how much time people are willing to spend walking to a bus stop (Tiran et al., 2019).

journeys were eliminated in which the actual travel speed was lower than 5 km/h or higher than 50 km/h. This way, errors were eliminated that might have occurred due to mistakes in the bus schedule or mistakes in merging individual trips into a journey where the waiting times were too long. In this situation, in reality a passenger can perform other activities in the meantime, such as go to a bar or shop, and then continue their journey. Such journeys are irrelevant in terms of studying travel speeds. After eliminating these inadequate ones, 70,768 trips remained out of the initial 74,085, based on which further analyses were performed.

# 3 Results

Based on the data analysed it is possible to conduct a series of analyses. Because the main purpose of this article is to analyse the travel speeds, the main results of analyses related to travel speed are presented below: first, the results of the city bus analyses, followed by a comparison with walking and cycling travel speeds.

## 3.1 City bus

The main findings of the city public transport analysis are presented in Table 2. Detailed information is presented in the subsections.

**Table 2:** Key results of the city public transport analysis.

| Indicator | Value |
|---|---|
| Effective total travel speed | 10. km/h |
| Average actual distance travelled | 4.8 km |
| Average effective distance travelled | 4.1 km |
| Average waiting time | 2.9 min |

### 3.1.1 Average waiting time

One of the factors affecting the effective travel speed is the average time of waiting for the bus to arrive on the first trip in the journey. The average waiting time is 2.9 min (SD = 1). Figure 1 shows the average waiting times and the share of waiting in the total travel time, depending on the length of the journey. With longer journeys, on average passengers had to wait longer for the bus to arrive. One of the reasons for this is also that longer journeys had to start outside the city centre, where bus arrivals are less frequent. The longer the journey, the smaller the share of time spent waiting compared to the time spent for the entire journey.

### 3.1.2 Transfers

Users generally dislike transfers. The LPP network originated at a time when tickets were paid each time the passenger boarded the bus and hence one of the goals in designing the network was to reduce the need for transfers (Koblar, 2017).

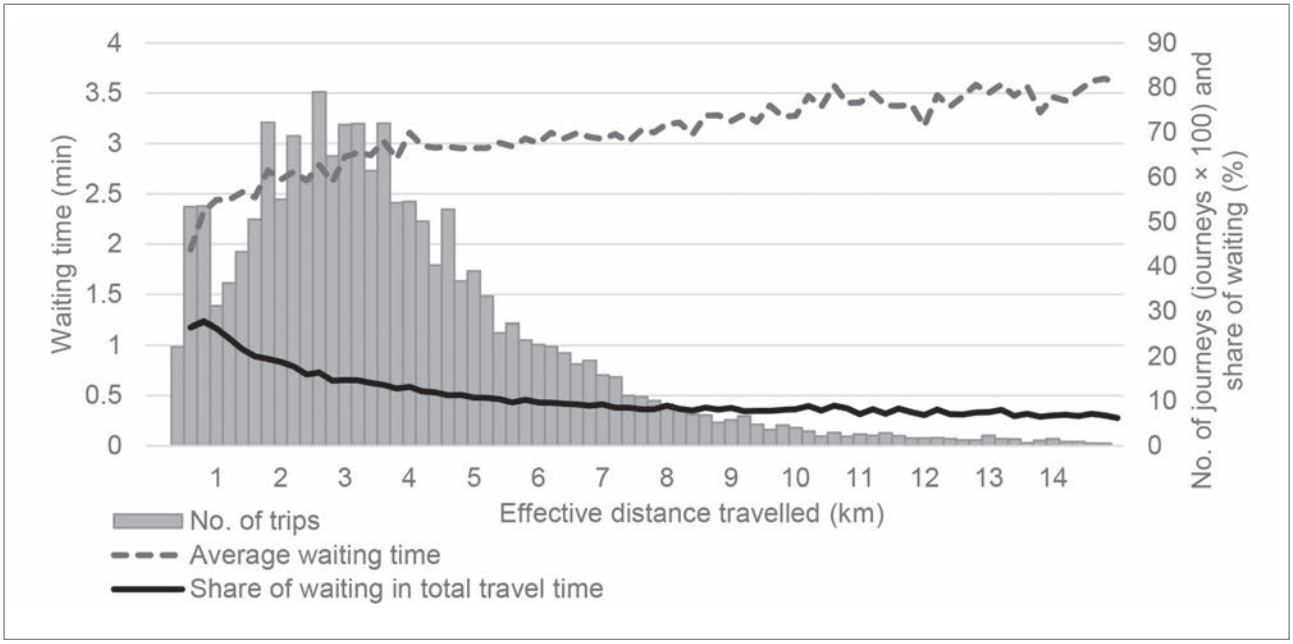


**Figure 1:** Average waiting time and number of trips, depending on the length of the journey (author: Simon Koblar).

**Table 3:** Number of journeys based on the number of transfers made.

| No. of transfers | No. of journeys | Share of all journeys (in %) |
|---|---|---|
| 0 | 70,146 | 79.1 |
| 1 | 16,459 | 18.6 |
| 2 | 1,682 | 1.9 |
| 3 | 311 | 0.4 |
| 4 | 69 | 0.1 |
| 5 | 14 | 0.0 |
| All journeys | 88,681 | 100.0 % |

**Table 4:** Calculated bus travel speeds.

| | Average speed (km/h) | SD (km/h) |
|---|---|---|
| Effective total travel speed | 10.0 | 3.3 |
| Total travel speed | 11.3 | 3.4 |
| Effective travel speed | 15.7 | 6.2 |
| Actual travel speed | 17.6 | 5.7 |

In more developed networks, transfers are conceived as an important part of travel routes because they provide a combination of various operators and systems and hence better public transport coverage (Mees, 2010; Dodson et al., 2011). In addition to 70,768 journeys, for which other analyses were also performed, the transfer analysis also included 17,614 user journeys that only made one trip on the day studied and hence their trips were unsuitable for calculating the alighting stops. Table 3 shows the number of journeys based on the number of transfers made.

### 3.1.3 Travel speeds

Travel speed is one of the factors that determine the quality of the public transport system. Table 4 shows the travel speeds based on the various criteria used and presented in Table 1.

In addition to the average speed, the distribution of the number of journeys shown in Figure 2 is also important. The histogram has a normal distribution shape, with slightly higher values on the right side.

Travel speed also depends on the length of the journey. In longer journeys, the waiting and walking times reduce the impact on travel speed and so the speeds increase with the length of the journey. The effective travel speed curve is interesting: it is very high for short distances, resulting from the fact that the differences between the distance travelled and the shortest distance are smaller with shorter trips. In addition, these calculations do not account for the walking time to the bus stop and the waiting time.

## 3.2 Comparison with cycling and walking

To have a better idea of public transport travel speeds and to better understand the competitiveness of public transport over other forms of sustainable mobility, a comparison was also made with bicycle and walking travel speeds. In com-

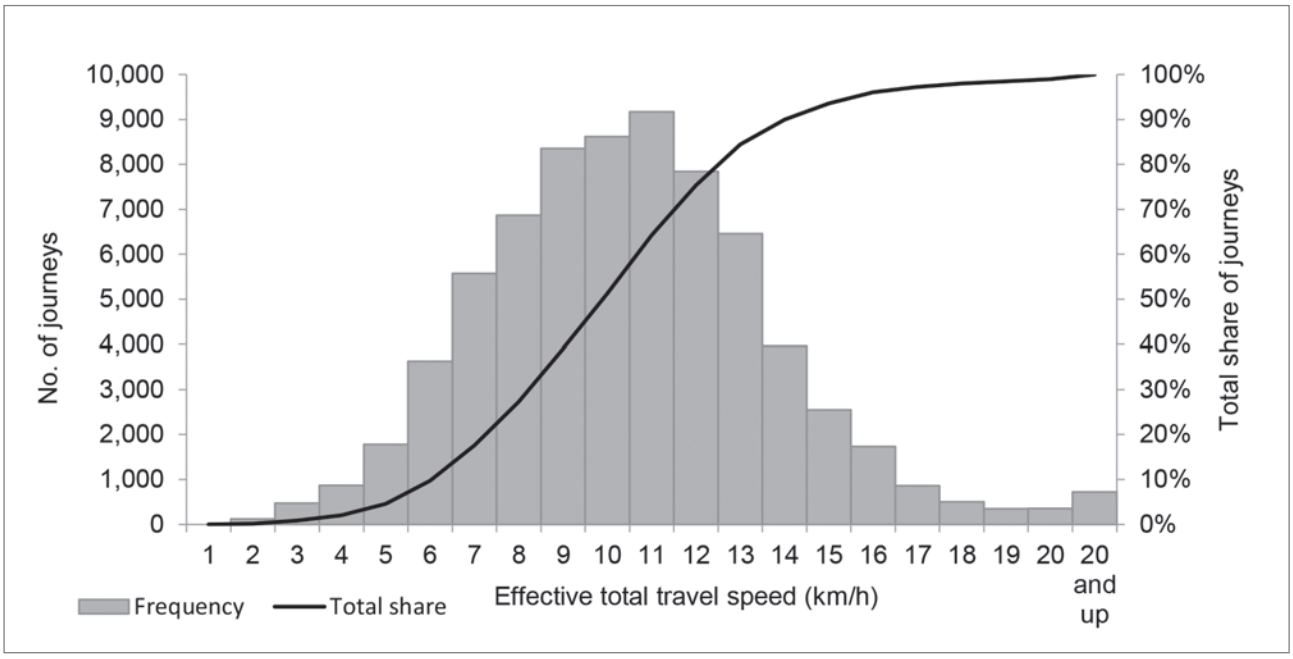


**Figure 2:** Number of journeys by effective bus travel speed class (author: Simon Koblar).

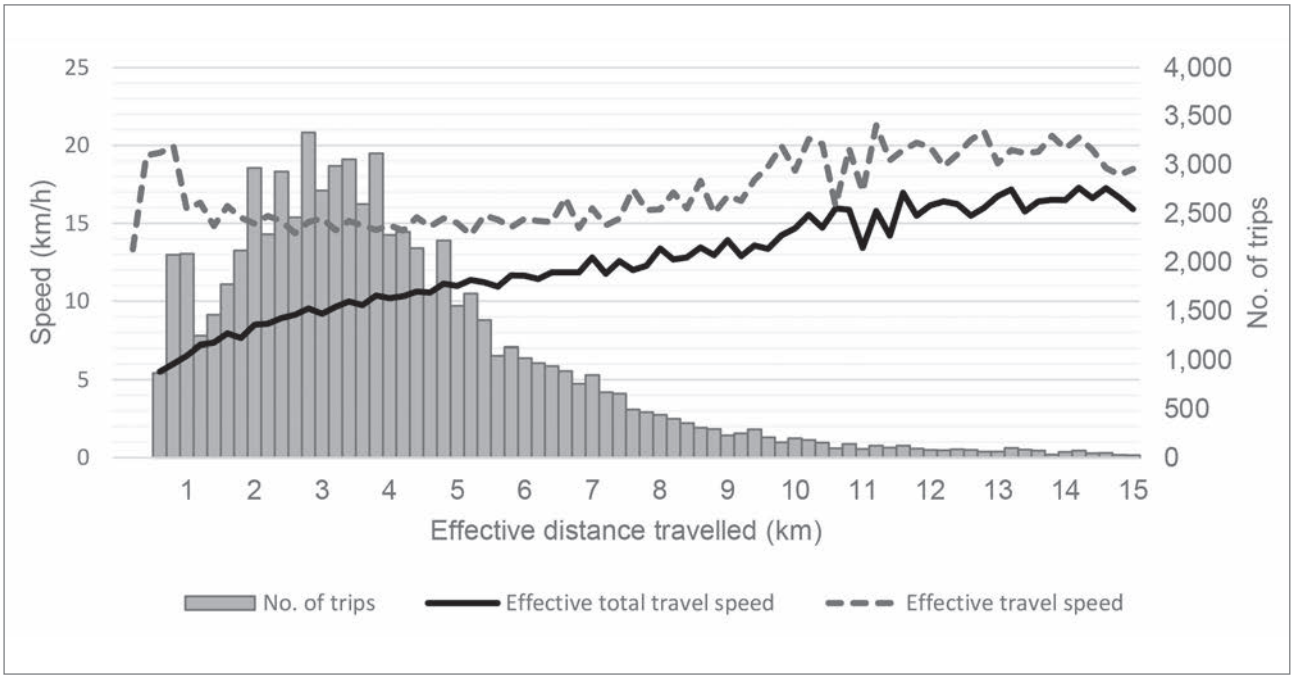


**Figure 3:** Travel speed in correlation with the length of the journey (author: Simon Koblar).

paring the bus and bicycle travel speeds, effective total travel speeds were taken into account because they best reflect the user experience. Effective total travel speeds increase with the length of the journey, due to a reduced impact of waiting and walking times for buses and a reduced effect of the additional time required to lock and unlock the bicycle. Bicycles are the fastest on all distances, with the difference being the greatest in shorter journeys. On average, a bicycle would be 7.5 min faster than the bus. Only 8% of the journeys would have been faster with the bus and 46% of journeys would have been 5 min faster with the bicycle.

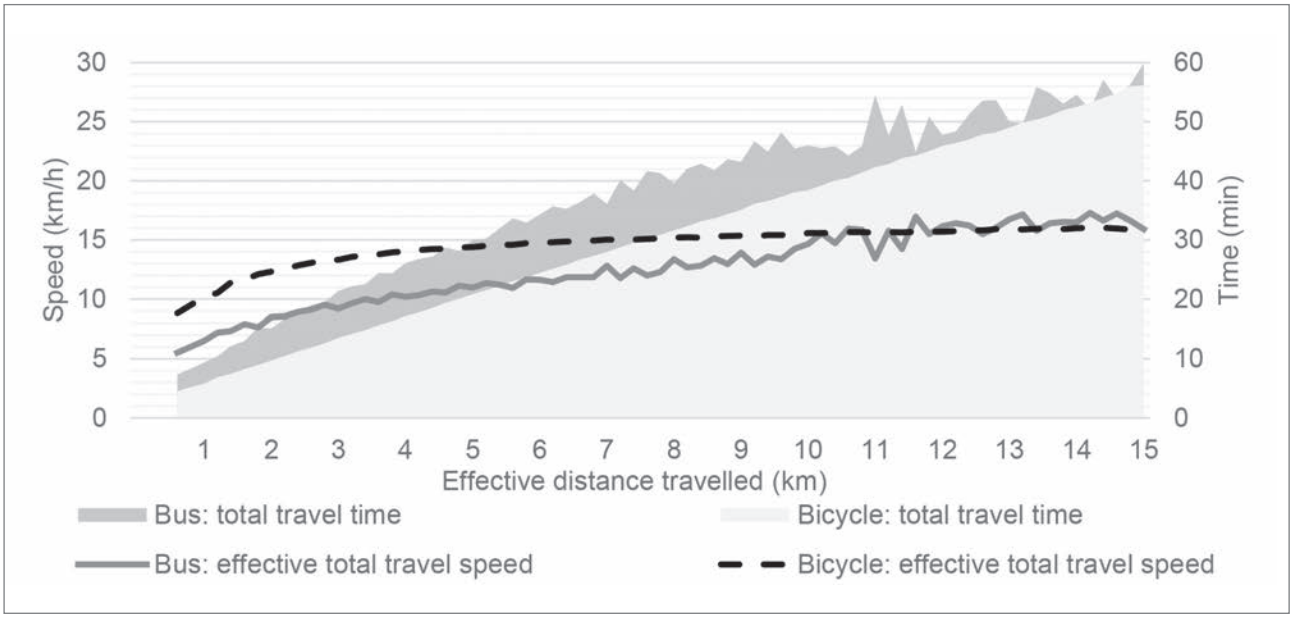


**Figure 4:** Comparison of bus and bicycle speeds and travel times (author: Simon Koblar).

Due to the low speed of walking, only journeys up to 2 km were taken into account. On stretches shorter than 2 km, 926 journeys (i.e., 7% of the total journeys shorter than 2 km) would have taken less time on foot than by bus. Also taking into account the journeys that are less than 1 minute faster by bus, the total number of these journeys adds up to 1,783 or 13%.

## 4 Discussion

This article presents new findings related to the measurement of public transport quality and reveals great potential of the electronic payment system data for conducting further analyses. Because analyses are performed based on the trips made, the results are especially interesting from the user perspective because they reflect the user experience and provide insight into passenger behaviour. Because the payment system does not provide information on the alighting stop, determining the alighting stops represented a significant challenge. To this end, available data were applied to a well-tested algorithm (Alsger et al., 2016), whereby the distance between stops was modelled in the GIS environment using pedestrian routes. This resulted in greater accuracy compared to the straight-line distance applied by Alsger et al. (2016). To determine the travel speeds the waiting time at the stop, the travel time, and the distance travelled were also calculated for each trip. The applied method for calculating the waiting time that also takes into account the time of day and relevant lines, yields more realistic results from the passenger perspective than the method of counting arrivals at peak times frequently used in other studies of public transport quality in Ljubljana (Bole, 2004; Tiran et al., 2015). Because the shortest distance between the origin and destination is especially important from the passenger perspective, the shortest distance in the transport network was also modelled in addition to the distance travelled on a public transport line. Various methods are used to calculate the travel speed and hence four different methods were applied, using different distances and times. From the user perspective and compared to other travel modes, the most relevant is the effective total travel speed, which on average amounts to 10.0 km/h; this is significantly lower than the average actual travel speed of 17.6 km/h. Commercial speed is the only information that has been available for the entire network in comparable form to date. According to the LPP data, the commercial speed, which only takes into account the individual trip without transfers to other lines, is 18 km/h (Šmajdek, 2011), demonstrating the accuracy of the analyses conducted. The substantial differences in results indicate the importance of selecting the travel speed calculation method.

By calculating the travel speeds, the first hypothesis was also confirmed. Based on the electronic payment system data and bus schedules it is possible to determine the travel speed of bus trips. A comparison of bus travel speeds with walking and cycling showed that the bus is poorly competitive with bicycles. On average, equivalent trips took 7.5 min longer by bus than by bicycle. This also confirmed the second hypothesis. An average bus trip would have taken less time if made by bicycle. Some shorter routes would even have been travelled faster on foot, which points to frequently irrational passenger decisions. Most of these shorter trips are made in the city centre, where buses are very full as it is. The ratio between the bus and cy-

cling travel speeds is most likely one of the reasons for the increase in cycling (Klemenčič et al., 2014) and the decline in the number of bus passengers in recent years (Ljubljanski potniški promet, 2019). In addition to travel speeds, insight was also provided into passenger behaviour in terms of transfers. It turned out that despite changes to the payment system, which allows free transfers within 90 min after the first validation, only 20.9% of journeys include transfers. This probably results from the network's design, which is supposed to reduce the number of required transfers as much as possible, and partly also from the fact that (predominantly elderly) users tend to only accept change and change their habits slowly.

The method applied also has certain deficiencies and some could be eliminated through further research and more complex methods. Due to the large quantity of the electronic payment system data, complete control over their quality cannot be guaranteed. Certain errors can already arise in determining the alighting stops, whereby additional parts of the trips for which there are not suitable data are eliminated. In terms of data quality, what is especially problematic is merging several trips into a journey, which could be improved through more complex methods (Assemi et al., 2020). The key step in this study was the elimination of outliers from further calculations. Unfortunately, the accuracy of the alighting stops determined cannot be estimated, which, modelling on Wang et al. (2011), could have been done through field research and by comparing the results. In addition, using different presumptions about the random passenger arrival at the bus stop would have yielded somewhat different results in calculating the average waiting time (Amin-Naseri & Baradaran, 2015). In determining the walking distance, a uniform value of 400 m was used because no data are available on what distance the users of the Ljubljana public transport system actually walk. The cycling speed applied in the study was a mere estimate, too. Due to many elements that affect it (e.g., the quality of the cycling infrastructure, waiting at traffic lights, and ultimately the type of cyclist and bicycle used), the results could have been different if a different assumed speed have been used. By improving the quality of the cycling infrastructure and increasing the share of electric bicycles the average cycling speeds can be expected to rise. A certain degree of error also occurs in calculating the bus speed, which was determined based on the available bus schedules. The actual speeds always deviate from these, especially at the stops close to the end of the lines. A solution would be to use the data from the vehicle tracking system, based on which the bus speeds could be determined more accurately (Wang et al., 2011).

The public transport payment system data also make it possible to conduct a series of other analyses (Pelletier et al., 2011; Ali et al., 2016; Trépanier & Morency, 2017), which would be prudent in the future. Good familiarity with the public transport system and passenger behaviour may be of great help in introducing improvements to the system, which are vital for Ljubljana due to the poor competitiveness of its public transport and the inappropriate design of its network (Koblar et al., 2018). Specifically, it is vital to reverse the decreasing trend in the number of passengers because only this way the targeted share of public transport trips can be achieved (Milovanović, 2017), which would contribute to a reduced environmental impact. On the other hand, improvements in the public transport system alone are not enough; a better integration of spatial and transport planning is also required (Plevnik, 1997), which especially applies to the well-served public transport corridors (Šašek Divjak, 2004).

## 5 Conclusion

The method of analysing the public transport payment system and measuring the travel speed presented and applied to Ljubljana is one of the few attempts to measure the quality of the public transport network based on trips actually made. The effective total travel speed reflects the user experience significantly better than the more widely used commercial speed measurements. In turn, comparing the bus trips to cycling and walking suitably contextualizes these speeds. Calculating the speeds also yielded other important information, such as the travel time, the distance travelled, the average waiting time, and the number of transfers. In the future, the actual distance walked to the bus stop should be taken into account, the bus speed should be calculated from the vehicle tracking system, and greater attention should be dedicated to quality control, especially in determining the alighting stops and merging trips into journeys. In addition, analysis should cover a longer period. The method applied is very useful for monitoring the use of the public transport system and improving it, which could reverse the falling trend in the number of passengers. The current findings for Ljubljana alone can be used by transport planners and LPP to introduce changes that would increase the competitiveness of the public transport systems.

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Daniela Angelina JELINČIĆ

# KEEP ON: Effective policies for durable and self-sustainable projects in the cultural heritage sector

How can cultural heritage be made durable and sustainable? Although the largest share of cultural budgets in most countries is spent on heritage, and despite the fact that a number of European Union programmes cover heritage, thus providing substantial funds, this does not necessarily ensure the sustainability of heritage assets. Many cultural institutions still have difficulty covering even basic maintenance costs. This issue is of great importance to the whole EU area, in which the recent economic downturn and COVID-19 pandemic crisis have put cultural heritage lower on the priority list.

The concept of sustainability is complex and does not necessarily relate to funding; nor does funding necessarily ensure sustainability. It largely depends on the modality of heritage asset management, local community involvement, environmental issues, safeguarding of heritage values, and so on. KEEP ON is an Interreg Europe project spanning from 2018 to 2023 and funded by ERDF. It aims to improve public policies in the cultural heritage sector in terms of delivering high-quality projects that allow the results to remain sustainable with reasonable public funding. It should have a long-lasting impact on regional development. The policies addressed and improved by the project should bring to an end the shameful but customary approach to heritage sustainability: "When the project is over, everything is over." Surprisingly, few cultural institutions are thinking explicitly about sustainability as yet. Sustainability planning needs to begin long before project implementation, and it should be carefully addressed by the funding authorities in their policy documents. On the other hand, it is also important to activate private resources apart from public sources of funding, especially against the backdrop of a sharp decline in public and private investments in many EU member states and the implications of globalization. The main questions addressed by the project are the following: When the public funding is over, how do institutions sustain their work for the future? How do they secure funds for their future operational costs? What impact do sustainable heritage projects have on broader aspects of society (economy, urban planning, community, etc.) and how can public policies support beneficiaries in keeping their projects self-sustainable? An EU-wide, interregional perspective is taken to find answers.

Partners from seven countries (Croatia, Greece, Italy, the Netherlands, Poland, Portugal, and Spain) work on the project, addressing six policy instruments (three ERDF programmes and three regional/local strategies) through concrete action plans to be prepared. The countries involved are extremely rich in cultural heritage, but most of them also have the most vulnerable economies (i.e., Spain, Portugal, Italy, and Greece). They are accompanied by Poland as the largest EU cohesion policy beneficiary, the Netherlands with its cultural policy model with high involvement of local communities (which may have a strong impact on sustainability), and an advisory partner from Croatia. So far, experience gained within the partnership shows that there are substantial differences between the countries' approaches to heritage sustainability. For most countries, the greatest challenge still lies in securing sustainable cultural heritage funding, accompanied by insufficiently innovative knowledge of cultural heritage management. Some countries, on the other hand, have overcome those challenges; one of them is the Netherlands. There the sustainability of heritage funding is sought, for example, in adaptive reuse of cultural heritage assets, often aimed at wider markets. One of the challenges frequently addressed in the Netherlands is specifically related to religious heritage; due to the decreasing

number of religiously observant people, churches are finding new uses as concert halls, hotels and restaurants, educational centres, or student housing (Figure 1). This not only ensures steady funding, but also impacts the building's durability because it is in regular use. This also enhances control of moisture and all the other natural phenomena that may affect the building's longevity. Examples of such adaptive reuse of heritage assets may be inspirational for other countries but are sometimes very context-dependent. For example, in countries whose populations are closely tied to their religion, such practices may seem inappropriate.

**Figure 1:** Mariënburg Convent: a former monastery complex in the Municipality of 's-Hertogenbosch (source: Internet 1).

Apart from specific practices, the Dutch experience may also be inspirational for other countries in terms of policy planning: heritage policies are usually long-term policies (spanning 20–30 years), reflecting sustainability, and are independent from political influence even when the ruling parties change. On the other hand, the greatest challenge the Dutch face is environmental and ecological sustainability. Rising carbon emissions have made a big impact on the water levels in many Dutch cities. This also represents a direct threat to heritage and is a serious challenge in the long term. This is why public policies often focus on decreasing carbon emissions and energy consumption, using resistant materials and insulation in heritage restoration, and the use of renewable energy sources. These issues are not addressed only by cultural policy but rather involve a holistic approach with contributions from urban planning, education, industry, science, and so on. Special attention is also paid to raising public awareness. This, however, requires a long-term approach.

Examples from other countries also show interesting approaches. The Polish case of the Royal Castle in Chęciny is a good example of a cultural tourism boost, whereas the Portuguese Eco-Museum of Flax in Ribeira de Pena (Figure 2) can be commended for its participatory approach to museum planning and management. As in the Dutch case, reuse of religious buildings, especially in rural areas, is also one of the urgent topics in Spain. The project to restore and reuse the old monastery in the Ribeira Sacra region (Figure 3) was an answer to the problem of creating a new use for this historic space. By restoring the historic monastery building for a hospitality function, turning it into hotel, the safeguarding of built heritage is ensured, the monastery has maintained its architectural value, and it has also now become a new driving force for the tourism development of the whole area. There are several main stakeholders involved, including Paradores de Turismo de España, a public, state-owned chain of Spanish luxury hotels in adapted castles, palaces, fortresses, convents, monasteries, and other historic buildings. This company invested funds in the monastery conservation, with additional funding provided by the Spanish Ministry of Culture and its General Directorate of Cultural Heritage.

The interregional learning approach adopted within the KEEP ON project partnership may benefit the preparation of action plans, which are considered as interventions in policy instruments that address previously detected gaps in ensuring heritage sustainability. Once introduced, they should ensure that future projects funded under these instruments would justify the investments and result in durable and sustainable heritage projects.

The whole process is participatory in nature and involves stakeholders in each country that contribute with their knowledge and expertise. It started with a comprehensive summary of the relevant policy instruments, which served as a basis for the policy instruments and experiences benchmark exercise. Analysis of policy instruments from the six countries showed that cultural heritage is not always clearly identified as a priority, but there is an awareness of its developmental potential. This is why it is integrated into the respective development plans through some wider topics. Policy improvements, however, are needed in the sense of setting up clear and specific indicators that will show the funded projects' impacts on their local communities and regional development. If policy instruments fail

to measure their impacts according to previously set indicators, it is extremely difficult to evaluate the success of the intervention and to plan future development accordingly.

Cultural heritage managers were then surveyed in order to detect good practices in heritage sustainability. In additional, good practices already funded within the existing policy instruments were analysed and collected. The latest deliverable produced by the project is a practical guide on durability and sustainability of cultural heritage, which first detects challenges and threats to cultural heritage sustainability and then responds with "how-tos" in order to provide solutions to those challenges. The greatest challenges are seen in economic, environmental, socioculturral, and political pressures, but they also concern heritage values and heritage standardization. Heritage management challenges are specifically addressed, because good governance is a key factor in ensuring sustainability and durability of heritage projects and justifying the investments.

The work carried out thus far serves as a basis for preparing the action plans in each country. The final four semesters of the project are reserved for implementing and monitoring the action plans and, in this way, important feedback on the project results will be provided. The project should thus ensure better understanding of the importance of self-sustainability as a smart tool to ensure a long-lasting return on investment. Public policies can serve as catalysts in achieving improved durability and self-sustainability of heritage assets while also striving for excellence. Because good practices spread among policy makers, beneficiaries, and stakeholders, this should have impact on their increased capacities. In the end, better understanding and activation of private funding in cultural heritage projects could be ensured.

**Figure 2:** Museum of Flax in Ribeira de Pena (source: Internet 2).

**Figure 3:** Saint Stephen's Monastery in the Ribeira Sacra region (source: Internet 3).

The KEEP ON project intends to provide a valuable input to all EU stakeholders with a special focus on the forthcoming post-2020 cohesion policy. The new 2021–2027 EU Cohesion Policy sees the key role of cultural heritage in addressing social and economic challenges and has a strong focus on results in order to facilitate monitoring and measuring project outcomes and to introduce changes. The plan is to ensure a substantial budget increase for culture (17%), in which heritage is set as one of the priorities. Also, synergies between culture and education are advocated, which is an opportunity for remedying insufficient knowledge of cultural heritage management. Thus, the plan is to double the Erasmus+ budget. The economic dimension is again in focus, alongside social and identity aspects which, again, offer new opportunities for heritage. One of the reasons for poor sustainability of heritage projects so far has been their poor evaluation and inadequate success indicators. The new cohesion policy prioritizes setting up concise and appropriate indicators,

so that sustainability of heritage might finally be achieved. Strategic planning, therefore, should not be only a buzzword, but an instrument for enhancing and sustaining heritage values for present and future generations. The era following the COVID-19 crisis might, however, set up new priorities and give birth to new challenges for heritage. This may require even greater creativity and innovation for ensuring heritage durability and sustainability, whereby the role of action plan preparation within the KEEP ON project may be even more important and challenging.

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## Project information and sources

Project homepage: https://www.interregeurope.eu/keepon/

Internet 1: https://commons.wikimedia.org/wiki/File:Voorkant_Mari%C3%ABnburg_%27s-Hertogenbosch.jpg.

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