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Adresa redakcije - Address of Editorial Office
Univerzitet PIM, Despota Stefana Lazarevića bb, 78000 Banja Luka
Phone/Fax: +387 (0)51 378 300; e-mail: stedj@univerzitetpim.com;

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S poštovanjem,

Dr Dejan Kojić, docent
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EDITORS' INTRODUCTION

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On the last pages of the journal, there is also the bibliography of papers published in second issue in 2022.

We thank the reviewers of papers whose professionalism and critical approach have greatly contributed to the quality of published papers.

With best wishes,

Dr Dejan Kojić, docent
Editor-in-Chief

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INTERAKCIJA PORODIČNE AFEKTIVNE VEZANOSTI I PASIVNE ZAVISNOSTI U PARTNERSKIM ODNOSIMA

Tijana Bogdanić[1], Snežana Samardžić[2]

[1]Univerzitet PIM, Filozofski fakultet, despota Stefana Lazarevića bb, 78 000 Banja Luka, BiH
[2]JZU Specijalna bolnica za psihijatriju Sokolac, Podromanija bb, 71 350 Sokolac, BiH, nenasok@yahoo.com

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Snežana Samardžić, JZU Specijalna bolnica za psihijatriju Sokolac, Podromanija bb, 71.350 Sokolac, BiH, nenasok@yahoo.com

SAŽETAK

Rad ima za cilj da utvrdi da li postoji statistički značajna povezanost između ranih afektivnih veza roditelja i djece i nivoa pasivne zavisnosti u kasnijim partnerskim vezama. Istraživanje je sprovedeno na ukupnom uzorku od 136 ispitanika, od kojih je 75 žena i 61 muškarac. Za svakog ispitanika bili su primijenjeni sljedeći mjerni instrumenti: Strukturirani upitnik za sociodemografske i porodične podatke (podaci o polu, obrazovanju, bračnom statusu, potpunosti porodice, funkcionalnosti porodice, načinu vaspitanja, alkoholizmu u porodici tokom djetinjstva i psihijatrijskim bolestima), Upitnik porodičnog afektivnog vezivanja (PAVb) i Skala pasivne zavisnosti u partnerskim odnosima P-ZUPO, a podaci su prikupljeni preko društvenih mreža. Rezultati istraživanja potvrdili su očekivanu raspodjelu učestalosti četiri tipa obrazaca afektivne vezanosti na našem uzorku. Takođe, djelimično je potvrđeno da se ispitanici različitih obrazaca porodične afektivne vezanosti razlikuju u odnosu na nivo pasivne zavisnosti u partnerskim odnosima. Ispitanici sa okupiranim obrascem vezanosti pokazuju značajno veći nivo pasivne zavisnosti u partnerskim relacijama u odnosu na ispitanike sa sigurnim obrascem vezivanja, dok razlike u odnosu na ispitanike sa odbacujućim i plašljivim obrascem vezivanja nisu statistički značajne.

Ključne riječi: porodična afektivna vezanost, pasivna zavisnost, partnerski odnosi.

UVOD

Teorija afektivnog vezivanja najčešće se definiše kao teorija o porijeklu i prirodi čovjekove osjećajnosti (Stefanović-Stanojević, 2005). Kao osnovnu funkciju afektivnog vezivanja možemo navesti obezbjeđivanje opstanka. Riječ je o sistemu ponašanja koji se javlja i oblikuje u interakcijama sa primarnim figurama vezanosti i koji igra važnu ulogu u izgrađivanju kognitivnih modela socijalnog života (Nikić i Travica, 2007).

Bowlby afektivnu vezanost definiše kao specifičan, neravnopravan odnos koji se u najranijem djetinjstvu formira između majke i djeteta i traje kroz čitav život (Stefanović-Stanojević, 2005). Prema njemu, afektivna vezanost je zapravo sistem ponašanja koji

funkcioniše po principu traženja i održavanje blizine sa drugom jedinkom gdje se pritom razvijaju snažna osjećanja. Bowlby je smatrao da je, kada se jednom uspostavi, emocionalno vezivanje trajno i relativno nepromjenljivo i predstavlja stalnu težnju djeteta za uspostavljanjem kontakta sa drugim osobama. Djetetovo iskustvo u porodici, interakciju sa majkom u prvim mjesecima života, ali i tokom djetinjstva i adolescencije, Bowlby smatra najvažnijim za razvoj (Bowlby, 1969). On navodi da dijete, tokom prve tri godine života, konstruiše radne modele o sebi i o drugima, te o njihovim uzajamnom odnosima. Ovi modeli mogu biti pozitivni i negativni, a zasnivaju se na sjećanjima na rana iskustva, stečena u relaciji sa figurama afektivnog vezivanja. Faktorskom analizom je utvrđeno da, u osnovi ovog četvorokategorijalnog modela, stoje dvije dimenzije: dimenzija anskioznosti i dimenzija izbjegavanja (Samardžić, 2021). Kombinacijom ove dvije dimenzije dobijaju se četiri obrasca afektivne vezanosti (Stefanović-Stanojević, 2005):

1. *Sigurni obrazac afektivne vezanosti* odlikuje majčina dostupnost i senzitivnost za potrebe djeteta, koja čini da dijete gradi pozitivnu sliku o sebi i o drugima, pa ova djeca odrastaju u samopouzdane, sigurne i komunikativne osobe;
2. *Okupirani (ambivalentni, zavisni) obrazac afektivne vezanosti* se stvara iz iskustva majčine nedosljednosti u reagovanju na djetetove potrebe, usljed čega dijete formira negativnu sliku o sebi i bira strategiju intenzivnog vezivanja za majku, čija je funkcija kontrolisanje i obezbjeđivanje majčine prisutnosti;
3. *Odbacujući (izbjegavajući) obrazac afektivne vezanosti* se razvija ukoliko je dijete tokom razvoja suočeno sa iskustvom majčinog kontinuiranog i dosljednog nereagovanja na njegove potrebe. U tom slučaju ono postepeno formira odbrambeno uljepšanu sliku o sebi i sliku o drugima kao osobama koje su odbacujuće, nesigurne i na njih se ne može osloniti;
4. *Plašljivi (dezorganizovani) obrazac afektivne vezanosti* stvaraju djeca koja su odrastala uz duševno oboljele roditelje, ili djeca koja su bila fizički zlostavljana. Karakteriše ih negativna slika i o sebi i o drugima, kao i ambivalentan odnos prema vezivanju.

Empirijska provjera navedenog teorijskog modela ide u prilog njegove primjenljivosti i na partnerske odnose odraslih. Prema Stefanović-Stanojević (2007), osobe koje su razvile sigurni obrazac afektivne vezanosti karakteriše povjerenje i lako stupanje u bliske, partnerske relacije. Za razliku od njih, osobe sa okupiranim obrascem afektivnog vezivanja imaju malo samopouzdanja i generalno lošu sliku o sebi, pa ostaju nezreli, nesamostalni i skloni pretjeranom uključivanju u afektivni odnos. Odbacujuće vezane osobe grade nepovjerenje prema drugima i izbjegavaju bliskost, investirajući samo u sebe. Za osobe sa plašljivim obrascem karakteristično je da je njihova potreba za vezivanjem prožeta strahom od istog, pa ostaju izrazito ambivalentni u relacijama sa partnerom.

Pasivna zavisnost u partnerskim odnosima može se shvatiti kao pretjerano pasivno ponašanje osobe u relaciji sa emotivnim partnerom, praćeno prevelikom odanošću, potrebom za odobravanjem i velikim strahom od napuštanja (Leko, 2018). Na način na koji su definisani, nesigurni obrasci djeluju konceptualno bliski manifestacijama pasivne zavisnosti u partnerskim odnosima. Mićanović-Cvejić, Šakotić-Kurbalija i Kurbalija (2009), navode da se radi o okupiranom ili ambivalentnom obrascu afektivnog vezivanja, koji podrazumijeva pojačano vezivanje za partnera, kontinuirano provjeravanje njegove odanosti i potrebu da se partner kontroliše, a sve u cilju da se preduprijedi mogućnost napuštanja.

Shaver, & Hazan (1988), su takođe uočili da partnerski odnosi odraslih imaju sličnu dinamiku prethodno opisanom odnosu između roditelja i djeteta. Oni razlikuju anksioznu i izbjegavajuću dimenziju partnerske afektivne vezanosti. Istraživanja su pokazala da su anksiozno vezane osobe sklone traženju stalne pažnje i potvrde ljubavi od partnera, dok osobe sa izbjegavajućim obrascem partnerskog vezivanja potiskuju

sopstvene potrebe za bliskošću i skloni su održavanju distance u odnosima sa partnerom (Fisher, & Hammond, 2019). Osobe sa visokim nivoom anksioznosti i izbjegavanja u bliskim odnosima takođe su i manje samopouzdane u svojim interpersonalnim relacijama (Pedović, 2010).

Prema Šakotić (1996), osobe sa ambivalentnim obrascem u romantičnim interakcijama partnersku ljubav izjednačavaju sa smislom života, te je shvataju kao žrtvovanje, potpunu odanost i potpuno razumijevanje, koje ima odlike simbiotskog stapanja sa partnerom. U istraživanju Mićanovićeve (2005), utvrđena je prevaga nesigurnih oblika afektivnih veza kod depresivnih osoba kako u ranim afektivnim odnosima sa roditeljima, tako i u partnerskim vezama, pri čemu se, kao najzastupljenija, javlja ambivalentna afektivna vezanost. Nalazi studija koje se bave istraživanjem afektivne vezanosti odraslih i njihovog eventualnog uticaja na partnerske odnose nagovještavaju vezu između sigurnog stila vezivanja i samopouzdanja i povjerenja u partnerskim vezama, implicirajući da će, ukoliko roditelji nisu na adekvatan način zadovoljavali emocionalne i druge potrebe djeteta, ono u odraslom dobu razvijati nesigurne obrasce partnerskog vezivanja i ulaziti u disfunkcionalne veze (Robinson, Segal, & Jaffe, 2022; Leko, 2018; Tianyuan, & Chan, 2012; Nikić, 2011).

Problem i cilj istraživanja

Problem ovog rada je da se ispita interakcija rano stvorenih afektivnih relacija između roditelja i djece i zavisnost u partnerskim odnosima u odrasloj dobi. U tom kontekstu, cilj istraživanja jeste da utvrdimo postoji li statistički značajna povezanost između stila afektivne vezanosti, koji je uspostavljen u djetinjstvu između roditelja i djeteta, i pasivne zavisnosti u partnerskim odnosima.

Hipoteze

Očekujemo da će se i na našem uzorku potvrditi postojanje četiri obrasca porodične afektivne vezanosti. Očekujemo da će se ispitanici različitih obrazaca PAV razlikovati u odnosu na nivo pasivne zavisnosti u partnerskim odnosima. Ispitanici sigurnog obrasca porodične afektivne vezanosti reflektovaće taj obrazac i na partnerske odnose i na taj način pokazati niži stepen pasivne zavisnosti u partnerskim odnosima u odnosu na ispitanike nesigurnog stila vezivanja.

METOD

U istraživanju je primenjen Strukturirani upitnik za sociodemografske i porodične podatke, koji je konstruisan za potrebe ovog istraživanja, a kojim smo prikupljali o starosti ispitanika, polu, obrazovanju, bračnom statusu, potpunosti porodice, funkcionalnosti porodice, načinu vaspitanja, alkoholizmu u porodici tokom djetinjstva i eventualnim psihijatrijskim bolestima.

Za ispitivanje usvojenih obrazaca porodične afektivne vezanosti (PAVb) koristili smo Brennanov Upitnik za procjenjivanje PAV (Brennan, Clark, & Shaver, 1995). Upitnik se sastoji od 18 tvrdnji, koje se odnose na osjećanja ispitanika u porodičnim odnosima. Pri tom, 9 tvrdnji mjeri anksioznost, a drugih 9 mjeri izbjegavanje, pri čemu su obje dimenzije bipolarne. Dimenzija anksioznosti reprezentuje unutrašnji radni model sebe, s tim da na pozitivnom polu ona predstavlja internalizovan osjećaj sopstvene vrijednosti, a na negativnom anksioznost i odbacivanje bliskosti. Dimenzija izbjegavanja reprezentuje radni model drugih, a pozitivan pol ove dimenzije odnosi se na prihvatanje bliskosti, dok negativan pol označava stepen neprihvatanja i izbjegavanja bliskosti. Rezultati su svrstani u jedan od četiri obrasca afektivne vezanosti: sigurni, okupirani, odbacujući i plašljivi (Samardžić, 2021b). Da bismo izračunali koeficijent pouzdanosti našeg testa, koristili smo Cronbach α koeficijent, koji je pokazao da upitnik u globalu ima umjerenu pouzdanost ($\alpha = 0.80$). Provjera pojedinačnih subsakala pokazala je visoku pouzdanost subskale anksioznosti ($\alpha = 0.86$), dok je subskala izbjegavanja umjereno pouzdana ($\alpha = 0.73$). Na osnovu dobijenih podataka možemo reći da je PAV upitnik valjan instrument za mjerenje porodične afektivne vezanosti na našem uzorku.

Za ispitivanje pasivne zavisnosti u partnerskim odnosima, koristili smo P-ZUPO skalu Pasivne Zavisnosti u Partnerskim Odnosima, koja sadrži 30 ajtema, a predstavlja operacionalizaciju hipotetskog konstrukta „bolesne zavisnosti u partnerskim odnosima“, koji potiče iz teorije Karen Hornaj (Mićanović-Cvejić i saradnici, 2009). Instrumentom su obuhvaćeni svi (kontradiktorni) aspekti pasivno-zavisne ličnosti (ličnosti koja je “bolesno zavisna” u partnerskim odnosima), a koji su pomenuti u uvodu (partnerska ljubav je smisao života, podrazumeva stapanje sa partnerom, zahteva žrtvovanje, potpunu odanost, potpuno razumijevanje, „čitanje misli“, postoji neprestana sumnja u partnerovu ljubav i izraziti strah od gubitka partnera, raskid veze je sopstveni neuspjeh, i td) (Mićanović-Cvejić i sar., 2009). Pouzdanost skale P-ZUPO provjerena je Cronbach α koeficijentom. Ukupan koeficijent pouzdanosti ovog upitnika je α = 0.91 što nam ukazuje na to da je pouzdanost ovog upitnika veoma visoka.

Uzorak i procedura

Uzorak čini 136 ispitanika, od kojih je 75 žena i 61 muškarac. Ispitanici su, prema starosti, podijeljeni u sljedeće starosne grupe: mladi ispitanici (18-30 godina), ispitanici srednjih godina (31-45 godina) i stariji ispitanici (46-60 godina), s tim da najveći dio uzorka (67%) pripada grupi mladih ispitanika, dok je prosječna starost ispitanika 30 godina. Ispitanici sa završenom srednjom (45%) i višom ili visokom školom (48%) se relativno jednako raspoređuju, dok je u uzorku najmanje onih sa završenim magisterijem, doktoratom ili specijalizacijom (7%). U odnosu na bračni status najviše je neoženjenih/neudatih ispitanika (62%). Ispitanici uglavnom potiču iz potpunih porodica (93%), u kojima nije bilo alkoholizma (63%) niti psihijatrijskih oboljenja (95%) i u kojima je odnos između roditelja, prema doživljaju ispitanika, bio dobar i topao (65%).

Istraživanje je sprovedeno u nekoliko faza. U prvoj fazi, prethodno navedene upitnike pretvorili smo u online formu, uz pomoć aplikacije Google Forms. U narednoj fazi, odredili smo uzorak istraživanja. U istraživanju su mogli učestvovati ispitanici stariji od 18 i mlađi od 60 godina, oba pola, bez dodatnih kriterijuma. U posljednjoj fazi usmjerili smo se na prikupljanje podataka. Kreirani upitnik podijeljen je ispitanicima preko društvenih mreža (Facebook, Instagram, Viber). Ispitanicima je ukratko objašnjena svrha istraživanja, kao i to da je istraživanje potpuno anonimno. Upitnik se popunjavao relativno brzo, s obzirom na to da je za popunjavanje bilo potrebno oko deset minuta. Nakon što je prikupljen dovoljan broj ispitanika, pristupljeno je obradi podataka u skladu sa postavljenim hipotezama.

Metode obrade podataka

Prilikom obrade podataka koji se odnose na proveru metrijskih karakteristika upotrebljenih skala korišćena je mjera koja pokazuje nivo pouzdanosti testa (Cronbach's Alpha). Analiza distribucije odgovora ispitanika na tvrdnjama upotrebljenih skala provedena je preko mjera centralne tendencije (aritmetička sredina) i mjera varijabilnosti (standardna devijacija, skjunis, kurtozis). Za testiranje značajnosti razlika između ispitanika različitih obrazaca PAV u odnosu na nivo pasivne zavisnosti u partnerskim odnosima primjenjen je postupak ANOVE, kao i Post Hoc testiranje, uz korišćenje Turkey naknadnog testa. Obrada podataka je vršena SPSS 20 statističkim paketom.

REZULTATI

Prva hipoteza odnosila se na očekivanje da će se u našem uzroku pojaviti četiri obrasca afektivne vezanosti: sigurni, okupirani, odbacujući i plašljivi. U tabeli 1 prikazane su statističke vrijednosti varijabli Upitnika PAV za ukupni uzorak. Analiza skjunisa i kurtozisa ukazuje da je distribucija normalna i po x i po y osi.

Tabela 1. Deskriptivne statističke vrednosti varijabli Upitnika PAV za ukupni uzorak
Table 1. Descriptive statistical values of variables from the PAV Questionnaire for the total sample.

	N	***M***	***SD***	***S***	***K***	***Min***	***Max***
Izbjegavanje	136	21.32	7.47	0.31	-0.96	9	37
Anksioznost	136	19.37	5.77	0.46	-0.06	9	37

Napomena: N – veličina uzorka, M – aritmetička sredina, SD – standardna devijacija, S – skjunis, K – kurtozis, Min – minimum, Max – maximum

Provjera prve hipoteze provedena je analizom upitnika PAV. Kako se Upitnik porodične afektivne vezanosti sastoji iz dvije subskale, subskale Izbjegavanje i subskale Anksioznost, ukrštanjem ove dvije dimenzije pojavila su se sva četiri obrasca afektivne vezanosti (tabela 2). Ovim je prva hipoteza potvrđena. Iz tabele je vidljivo da u uzorku dominira sigurni obrazac afektivnog vezivanja, dok su okupirani i plašljivi obrazac relativno jednako i malo zastupljeni.

Tabela 2. Struktura ispitanika prema stilu afektivne vezanosti
Table 2. Structure of respondents according to affective attachment style.

Obrazac afektivne vezanosti	***N***	***%***	***Kumulativni %***
Sigurni	95	69.85	69.85
Okupirani	5	3.68	73.53
Odbacujući	30	22.06	95.59
Plašljivi	6	4.41	100
Ukupno	136	100	

Drugom hipotezom ispitivali smo razlike između ispitanika različitih obrazaca PAV u odnosu na nivo pasivne zavisnosti u partnerskim odnosima. U tabeli 3 prikazane su statističke vrijednosti varijabli Upitnika P-ZUPO za ukupni uzorak.

Druga hipoteza provjeravana je primjenom postupka analize varijanse. Dobijeni rezultati prikazani su u tabeli 4 i ukazuju da postoji statistički značajna razlika između ispitivanih varijabli.

Tabela 3. Deskriptivne statističke vrijednosti varijabli Upitnika P-ZUPO za ukupni uzorak.
Table 3. Descriptive statistical values of variables from the P-ZUPO Questionnaire for the total sample.

	N	***M***	***SD***	***S***	***K***	***Min***	***Max***
P-ZUPO	136	78.853	18.8324	.609	.317	43.0	146.0

Napomena: N – veličina uzorka, M – aritmetička sredina, SD – standardna devijacija, S – skjunis, K – kurtozis, Min – minimum, Max – maximum

Tabela 4. ANOVA test razlike između stila porodične afektivne vezanosti i skora na Upitniku pasivne zavisnosti u partnerskim odnosima.
Table 4. ANOVA test of differences between the style of family affective attachment and the score on the Questionnaire of passive dependence in partner relationships.

	ANOVA	***df***	***F***	***p***	***η²***	***ω²***
AV	3545.13	3	3.52	0.017	0.07	0.05
P-ZUPO	44333.93	132				

Napomena: AV – skor na Upitniku porodične afektivne vezanosti, PZPO – skor na Upitniku pasivne zavisnosti u partnerskim odnosima, df – broj stepeni slobode, F – veličina efekta, p – stepen značajnosti, η² i ω² -standardizovane mjere veličine efekta za analizu varijanse

Da bismo utvrdili razlike između ispitanika različitih obrazaca porodične afektivne vezanosti u odnosu na pasivnu zavisnost u partnerskim odnosima odlučili smo se na Post Hoc testiranje, koristeći Tukey test naknadnog poređenja (tabela 5).

Dakle, na osnovu naknadnog Tukey testa uviđamo da se statistički značajna razlika registruje između okupirano vezanih i sigurno vezanih ispitanika (M = 22.88, p = 0.04) i to tako da okupirano vezani ispitanici pokazuju veći stepen pasivne zavisnosti u relacijama sa partnerom nego što je to slučaj sa sigurno vezanim ispitanicima. Nađeni rezultati potvrđuju da je u grupi sigurno vezanih ispitanika stepen pasivne zavisnosti u partnerskim relacijama niži i u odnosu na ostale tri grupe, ali registrovana razlika ne dostiže nivo statističke značajnosti.

Tabela 5. Naknadni Tukey test međusobnog poređenja obrasca porodične afektivne vezanosti u odnosu na skor na Upitniku pasivne zavisnosti u partnerskim odnosima
Table 5. Follow-up Tukey test of mutual comparison of the pattern of family affective attachment in relation to the score on the Questionnaire of Passive Dependence in Partner Relationships.

		M	***SE***	***T***	***Koenovo d***	p_{tukey}
Odbacujući	Okupirani	-21.77	8.85	-2.5	-1.19	0.07
	Plašljivi	-13.6	8.2	-1.66	-0.74	0.35
	Sigurni	1.12	3.84	0.29	0.06	0.99
Okupirani	Plašljivi	8.17	11.1	0.74	0.45	0.88
	Sigurni	22.88	8.5	2.72	1.25	0.04*
Plašljivi	Sigurni	14.72	7.71	1.91	0.80	0.23

*Napomena: M – aritmetička sredina, SE – standardna greška, T – vrijednost T testa, p_{tukey} – stepen značajnosti (*p < .05)*

DISKUSIJA

Osnovne pretpostavke ovog istraživanja bile su da će se ispitanici različitih obrazaca porodične afektivne vezanosti razlikovati u odnosu na nivo pasivne zavisnosti u partnerskim odnosima, te da će sigurno vezani ispitanici imati niži stepen pasivne zavisnosti u odnosu na nesigurno vezane ispitanike.

Kao što smo već ranije napomenuli, dijete na osnovu ponavljanih interakcija sa majkom (ili njenom zamjenom), a kroz svakodnevna iskustva, formira sigurnu ili nesigurnu afektivnu vezanost, odnosno jedan od modela afektivnih veza: sigurni, okupirani, odbacujući i plašljivi obrazac afektivne vezanosti. S druge strane, zavisnost od druge osobe ima svoje porijeklo u

emocionalnoj prošlosti osobe i odrastanju uz roditelje koji nisu adekvatno zadovoljavali potrebe djeteta tokom dužeg vremenskog perioda (Leko, 2018).

Dobijeni rezultati potvrdili su očekivanje da će se u našem uzorku pojaviti četiri obrasca porodične afektivne vezanosti. Pokazalo se da u uzorku dominira sigurni obrazac vezivanja (70%), što je u skladu sa teoretskim okvirom i većinom dosadašnjih istraživanja kako na našim prostorima (Stefanović-Stanojević, 2002; Stefanović-Stanojević, 2007), tako i u svijetu (Bartholomew, & Horowitz, 1991; Brennan et al., 2001). Ovakav rezultat se može objasniti činjenicom da živimo u društvu u kojem su porodične veze još uvek tradicionalne i jako čvrste, a dijete je u fokusu pažnje. Ipak, treba pomenuti da postoje istraživanja sa drugačijim rezultatima. Naime, neke studije sprovedene u Njemačkoj pokazale su odbacujući obrazac afektivne vezanosti kao dominantni afektivni obrazac (van Ijzendoorn, & Bakermans-Kranenburg, 2003; van Ijzendoorn, & Bakermans-Kranenburg, 2008), za razliku od našeg istraživanja, gde se kod samo 22% ispitanika pojavio navedeni obrazac. Ovakvu istraživačku razliku svakako možemo objasniti upravo razlikom između naše dvije kulture: u zapadnim zemljama se naglasak stavlja na pojedinca, na njegova lična postignuća i na priliku da se osamostale (Stefanović-Stanojević, 2002).

Drugom hipotezom provjeravali smo razlike ispitanika različitih obrazaca porodične afektivne vezanosti u odnosu na nivo pasivne zavisnosti u partnerskim odnosima. Pri tom su statistički značajne razlike nađene jedino između okupirano vezanih i sigurno vezanih ispitanika. Okupirano vezani ispitanici, prema našim rezultatima, pokazuju značajno veći stepen pasivne zavisnosti u partnerskim odnosima u odnosu na sigurno vezane ispitanike. Razlika između ispitanika sa okupiranim i ispitanika sa odbacujućim obrascima vezivanja u odnosu na nivo pasivne zavisnosti postoji ali nije statistički značajna, dok razlike između odbacujuće vezanih i sigurno vezanih ispitanika gotovo da i nema.

Dobijene rezultate možemo objasniti ukratko se osvrćući na teorijski pristup istraživanju. Dakle, iz perspektive Teorije afektivnog vezivanja, objašnjenje bi moglo biti u tome da unutrašnji radni modeli, kao specifične kognitivne sheme u osnovi obrazaca afektivnog vezivanja, vode tome da osobe sebe i druge opažaju na specifičan način. U slučaju pasivnosti i zavisnosti, one sebe vide kao manje vredne, a druge kao neprocjenjive. To vodi odustajanju od ličnih granica i održavanju odnosa „po svaku cijenu“. Samim time, na empirijskom nivou je moguće očekivati povezanost nesigurnih obrazaca ponašanja i pasivno-zavisnih težnji u partnerskim odnosima. Teorija afektivne vezanosti govori o sklonosti okupirano vezanih da negativno procjenjuju sebe, te im je potrebno bezuslovno prihvatanje drugih da bi se osjećale sigurno i bezbjedno (Samardžić, 2021a). Kako, po teoriji, ove osobe i u odrasloj dobi pokazuju tendenciju da stvaraju isti okupirani obrazac i u partnerskim odnosima, ovakav istraživački rezultat može se obasniti kroz činjenicu da okupirane osobe nose osjećaj nevoljenosti iz ranog djetinjstva, na kome počiva njihov doživljaj lične inferiornosti i manje vrednosti. Moguće je da osobe sa okupiranim obrascem partnerske vezanosti, zbog negativne slike o sebi, imaju strah da će biti ostavljene (jer nisu dovoljno dobre), pa zbog toga pretjerano investiraju u vezu, a od partnera očekuju stalne potvrde ljubavi.

Ovi nalazi su u skladu sa rezultatima do kojih je došla Nikić (2011), a prema kojima su osobe sa okupiranim stilom vezivanja u partnerskim vezama posesivne, impulsivne, sklone ljubomori i opsesivnoj ljubavi. Slično, Stefanović-Stanojević (2007), je utvrdila da su okupirano vezane osobe sklone da u konfliktnim situacijama ispoljavaju anksioznost i strah od napuštanja, koji je do te mere preplavljujući da one ne uspijevaju da se fokusiraju i da rješavaju sam konflikt.

Ograničenja rada

Kao jedno od ograničenja ovog rada može se pomenuti relativno mali uzorak, zbog čega rezultate ovog istraživanja ne možemo uopštavati, posebno iz razloga što u uzorku dominiraju mlađi ispitanici, starosti

od 18 do-35 godina. Razlog ovome vidimo u činjenici da su mlađi ispitanici skloniji da koriste društvene mreže pa samim tim su i češće popunjavali ponuđene upitnike. Ovo naš uzorak čini nedovoljno reprezentativnim, pa stoga dobijene rezultate ne možemo prezentovati kao čvrsto dokazane tvrdnje.

Drugo ograničenje odnosi se na činjenicu da, s obzirom da je popunjavanje upitnika bilo online, nismo bili u mogućnosti da pratimo način odgovaranja svakog ispitanika u istraživanju, pa ostaje otvorena mogućnost da su neki od ispitanika popunjavali upitnike bez dovoljno razumijevanja i interesovanja, što u krajnjoj liniji može obezvrijediti istraživanje i dovesti do neočekivanih rezultata.

Buduća istraživanja trebalo da se provedu na većem uzorku, sa ravnomjernije raspoređenim starosnim grupama i ravnomjernijim raspoređivanjem u obrasce afektivnog vezivanja. Dalja istraživanja bi mogla da idu i u pravcu ispitivanja uticaja pola na nivo pasivne zavisnosti u partnerskim odnosima.

ZAKLJUČAK

Rezultati ovog istraživanja su u saglasnosti sa većinom istraživanja na temu odnosa afektivne vezanosti i partnerske pasivne zavisnosti. Potvrđeno je očekivano prisustvo četiri obrasca afektivne vezanosti na našem uzorku, pri čemu je najdominantniji sigurni obrazac porodične afektivne vezanosti. Nađene su statistički značajne razlike između ispitanika različitih obrazaca porodične afektivne vezanosti u odnosu na nivo pasivne zavisnosti u partnerskim odnosima. Ove razlike se prevashodno odnose na ispitanike sa okupiranim obrascem vezanosti, koji su pokazali značajno veći nivo pasivne zavisnosti u partnerskim odnosima u odnosu na ispitanike sa sigurnim obrascem vezivanja. S druge strane, razlike u odnosu na ispitanike sa odbacujućim i plašljivim obrascem vezivanja nisu se pokazale statistički značajnim.

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THE INTERACTION OF FAMILY AFFECTIVE ATTACHMENT AND PASSIVE DEPENDENCE IN PARTNER RELATIONSHIPS

Tijana Bogdanić[1], Snežana Samardžić[2]

[1]University PIM, Faculty of Phylosophy, despota Stefana Lazarevića bb, 78 000 Banja Luka, BiH
[2]PHI Special hospital for psychiatry, Podromanija bb, 71 350 Sokolac, BiH, nenasok@yahoo.com

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Corresponding Author:
Snežana Samardžić, JZU Specijalna bolnica za psihijatriju Sokolac, Podromanija bb, 71.350 Sokolac, BiH, nenasok@yahoo.com

ABSTRACT

The paper has the main goal to determine whether there is a statistically significant connection between early created affective relationship between parents and children and later partner relationships. The research was conducted on a sample of 136 respondents, 75 women and 61 men. The following questionnaires were used in this research: a structured questionnaire for sociodemographic and family data (gender, education, marital status, completeness of the family, family functionality, upbringing, alcoholism in the family during childhood and psychiatric diseases), a questionnaire about family affective attachment and the scale of passive dependence in partner relationships. The data were collected via social networks. The research results confirmed tre expected frequency distribution of the four patterns of affective attachment in our sample. Also, it was shown that respondents of different patterns of family affective attachment discriminate in the level of passive dependence in partner relationships. According to the data obtained through statistical processing, respondents with an occupied attachment pattern achieve the highest scores on the Questionnaire of Passive Dependence in Partner Relationships, while securely attached respondents achieve the lowest scores. Although insecurely attached subjects achieved higher scores on the mentioned questionnaire than securely attached subjects, this difference was not statistically significant, and that is why our third hypothesis was rejected.

Keywords: family affective attachment, passive dependence, partner relationships.

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ПОВЕЗАНОСТ ИЗМЕЂУ МОБИНГА И БЛАГОСТАЊА НА РАДУ ЗАПОСЛЕНИХ ЖЕНА

Сњежана Станар

Универзитет у Источном Сарајеву, Филозофски факултет, Алексе Шантића 1, 71 420 Пале, Босна и Херцеговина, snjezana.stanar@ffuis.edu.ba

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Сњежана Станар, Универзитет у Источном Сарајеву, Филозофски факултет, Алексе Шантића 1, 71 420 Пале, Босна и Херцеговина, snjezana.stanar@ffuis.edu.ba

САЖЕТАК

Мобинг је понашање чији је циљ подцјењивање и деградација других људских бића преко злонамјерног језика и прикривених окрутних дјела, која постепено подривају адекватно функционисање и утиче како на психичко тако и на физичко здравље особе (Kostelić-Martić, 2005). Благостање на раду се односи на све аспекте живота на радном мјесту запослених, од тога како се осјећају, какво је њихово радно окружење, сигурност на послу, укључујући и физичку и психичку сигурност, задовољство послом, укљученост у посао и позицију коју имају у организацији. Проблем истраживања се односи на испитивање повезаности између перцепције мобинга и благостања на раду запослених жена. Индивидуе које мобинг перципирају као присутан у организацији и које су изложене таквој врсти стреса, имају нарушено благостање. Према ранијим налазима, мобинг значајно утиче на благостање на раду појединаца на начин да га нарушава, при чему запослени доживљавају различите психолошке сметње, те бивају избачени из радних активности, јер престају адекватно обављати радне задатке. Такође, особе које доживљавају мобинг имају и пад мотивације, радне ефикасности, пад осјећаја испуњености, губитак повјерења, жале се на умор, осјећај љутње и фрустрирности. У истраживању су кориштени мјерни инструменти задовољавајућих мјерних карактеристика, односно: скала перцепције мобинга и *Work Well-being Scale* – WBWS. Испитивање је вршено путем анонимне онлајн анкете, чиме је добијен пригодни узорак запослених на просторима Босне и Херцеговине (n=273). Добијени подаци указују на то да је перцепција мобинга статистички значајно негативно повезана са благостањем на раду (rho=-.382, p<.01) и са његова три аспекта: позитивни афекти (rho=-.531, p<.01), осјећај испуњености (rho=-.337, p<.01) и позитивно повеана са аспектом негативни афекти (rho=.592, p<.01), чиме је потврђена полазна хипотеза и њене три подхипотезе. Перцепција мобинга на радном мјесту негативно дјелује на благостање на раду, односно, више нивое субјективне перцепције мобинга прате нижи нивои благостања. Такође, више нивое перцепције мобинга прате и нижи нивои позитивних афеката и осјећаја

испуњености, док су негативни афекти више изражени. Иако се посљедице мобинга очитавају, у највећој мјери, на индивидуалном плану, неминовне су негативне посљедице и на плану организације. Како мобинг негативно дјелује на благостање на раду појединца, то се неповољно одражава и на рад и резултате цјелокупне организације.

Кључне ријечи: мобинг, благостање на раду, запосленице.

УВОД

Феномену мобинга све више придаје пажња у свакодневнм говору, медијима и у стручној литератури, посебно када је ријеч о подручју рада. С обзиром да не постоји јединствена дефиниција овог феномена, у стручној литератури се могу срести различита појмовна одређења, при којима се нагласак ставља на различите аспекте проблема (Станар, 2017). Без обзира на различитости аспеката проблема мобинга, то је понашање чији је циљ подцјењивање и деградирање другог или других људских бића преко злонамјерног језика и прикривених окрутних дјела, која постепено негативно утичу на адекватно функционисање, те како на психичко тако и на физичко здравље особе, систематски и кроз дужи временски период (Kostelić-Martić, 2005).

Проблему мобинга на радном мјесту се интезивније приступило крајем прошлог вијека и најчешће се везује за име Ханца Лејмана [*Heinz Leymann*] који је овај појам прецизно дефинисао и одредио његова основна обиљежја, фазе и његове посљедице. Према Leymann (1990), мобинг или психолошки терор на радном мјесту се односи на непријатељску и неетичну комуникацију која је систематски усмјерена од стране једног или више појединаца према, углавном, једном појединцу који је због мобинга гурнут у позицију у којој је беспомоћан и у немогућности одбранити се. У тој ситуацији се стално држи помоћу учесталих мобингујућих активности. Да би се те активности окарактерисале као мобинг, потребно је да се одвијају с високом учесталошћу (барем једном седмично) и у дужем периоду (најмање шест мјесеци). Због високе учесталости и дугог трајања непријатељског понашања то малтретирање може да доведе до значајне менталне, психосоматске и социјалне патње.

Мобинг такође представља један од облика кршења људских права уз примјену метода дискриминације, а резултат је повреда достојанства, интегритета, части и угледа личности (Lubarda, 2008). Мобинг нарушава једно од основних људских права, тј. право на рад (Rittossa, Trbojević-Palalić, 2007), а у правном систему Босне и Херцеговине мобинг је дефинисан као облик дискриминације (Vuković, 2013). Појавио се као проблем савременог друштва, који обухвата сва малтретирајућа понашања у оквиру неке пословне групе (Đelmo, Selimić, 2011; Karić, 2019), те је његово проучавање почело са циљем побољшавања односа између радника.

Конкурентност на тржишту, глобализација, несигурност радних мјеста, погоршање међуљудских односа и опште радне климе и разне кризе су довели до повећања осјећања несигурности, што временом може довести до појаве мобинга (Pražetina Kaleb, 2012). Atman (2012), дефинише мобинг као низ мулти-димензионалних социјалних и психолошких акција, које се сусрећу у пословним окружењима.

Мобинг суштински постоји на нашим просторима у свим друштвеним и привредним субјектима у којима је ауторитарност хијерархијски изнад вриједности и значаја људског достојанства (Bajraktarević, 2010). „У културолошким оквирима попут нашег, у којем се патријархалност заснива на градњи култа личности, са или без потребних вредности, сасвим је разумљиво да се инфериорност и снисходљивост сматрају потребним, а самосвесност угрожавајућим вредностима за структуисање свих облика микро и макро заједнице, почев од породице па до државе. На таквом плодном тлу, давно је посејано сјеме силе којем неостварене, фрустриране и неинтегрисане личности

владају онима који пристају да своју асертивност замене подобношћу и у избегавању конфликта виде своју улазницу за пословни мир. На жалост, тај мир жртве пословног и породичног насиља никада не добију, а своје одустајање од борбе за право на достојанство често плате животом“ (Bajraktarević, 2010, стр. 7).

ПРЕГЛЕД ИСТРАЖИВАЊА МОБИНГА

Резултати великог истраживања које је извршила *European Foundation for the Impovement of Living and Working Conditions* (2000). на 21.500 запослених у земљама чланицама ЕУ, показују да је 2% или 3 милиона радника било жртва физичког насиља на радном мјесту, 4% или 6 милиона је било жртва физичког насиља ван радног мјеста и 9% или око 13 милиона радника је било жртва мобинга (Kostelić-Martić, 2005). Исто тако, резултати опсежног истраживања проведеног у Шведској показали су да од 2.400 испитаника обухваћених узорком, 3,5% њих одговара датој дефиницији мобинга. Опсежније, а уједно и једино веће истраживање на подручју Републике Хрватске, проведено 2002, године на узорку од 700 испитаника (49% жена и 51% мушкараца), од чега је запослених било 349 (37% у приватним, а 63% у државним фирмама), је показало да је од 15,4% до 53,4% испитаника било изложено неком од облика мобинга (Kostelić-Martić, 2005).

Истраживање проведено у Сплиту 2003. године је показало да се пацијенти због мобинга јављају у 11% случајева, а због стреса на послу у 89% случајева тражећи помоћ љекара у добијању боловања и/или као покушај рјешавања симптома за које није утврђено постојање неког органског узрока (Koić, Apostolovski, 2005).

ПОСЉЕДИЦЕ МОБИНГА

Постоји неколико категорија у које се могу разврстати организационе посљедице мобинга. То су: пад мотивације, задовољства и креативности запослених, смањење ефикасности и продуктивности, стварање негативне организационе климе, апсентизам, флуктуација, честа боловања, привремено или стално запошљавање нових радника, нарушавање имица организације, као и велики материјални трошкови као посљедица свега наведеног (Bajraktarević, 2010).

Осим организационих, много важније посљедице мобинга се очитавају на плану психолошког, социјалног и физичког стања појединца, али и цјелокупне организације. С обзиром да изложеност мобингу изазива менталну узнемиреност, физичке и емоционалне проблеме, код жртава мобинга се често јавља и синдром сагоријевања на послу. Однос са људима је нарушен и манифестује се неповјерењем и непријатељством према околини. Жртва се често, усљед страха и стреса, повлачи у себе и отуђује или улази у конфликте са другима (Einarsen, Hoel, Zapf, Cooper, 2003).

Посљедице које мобинг оставља на жртву су: стид, љутња и проблем контроле љутње, кривица, ниско самопоуздање, конфузија итд. Све наведене посљедице могу да проузрокују појаву депресије, анксиозности као и многе друге поремећаје, па су самим тим видљиве и по цјелокупно благостање на раду свих запослених.

БЛАГОСТАЊЕ НА ПОСЛУ

Концепт благостања на раду има дуг историјски развој и подразумијева испуњавање важних потреба појединца, испуњавање циљева и планова зацртаних за живот. Опште благостање на раду се односи на субјективно и на психолошко благостање. Субјективно благостање је фокусирано на добробит која је произашла из пријатних и позитивних искустава, док је психолошко благостање фокусирано на људски потенцијал и испуњење. Према томе, субјективно благостање представља преваленцију позитивних емоција и расположења и задовољство животом, а психолошко благостање укључује самоприхватање, развој добрих социјалних односа, одређени степен аутономије, контроле средине и

могућности за лични раст и развој (Diener, 1984; Ryff, 1989; Paschoal, Tamayo, 2008). Психолошки аспект благостања на раду укључује нека психолошка стања као што су: депресија, анксиозност, напетост, фрустрација, узбуђење, ентузијазам, радост, нервоза, мотивација, смиреност, активација, те самопроцјене које укључују процјену запосленог у којој мјери остварује свој потенцијал на послу, колико може да развија своје способности, напредовање до постављених циљева, остваривање вриједних резултата, љубав према послу. Благостање на раду се, усљед пораста истраживања општег благостања, може дефинисати и операционализовати у афективном (позитивна и негативна афективност) и когнитивном смислу (испуњеност). Афективно искуство, које је окарактерисано позитивним и негативнм емоцијама које се јављају на послу, се показало као битан елемент у просуђивању благостања на послу (Paschoal, Tamayo, 2008; Paschoal, Torres, Porto, 2010; Taris, Schaufeli, 2015). Такође, за благостање на послу су важни осјећај испуњености и лично изражавање, различите позитивне емоције, те перцепција испуњења као темељи за срећу (Paschoal & Tamayo, 2008; Taris, Schaufeli, 2015; Warr, 2007; Warr, 2013; Waterman, Zamboanga, Schwartz, Ravert, 2010).

Према већини дефиниција, благостање на раду превазилази пуко суочавање, већ укључује оптимизам, живот са смислом, просперитет, успјех и напредовање. Благостање на раду се односи на све аспекте живота на радном мјесту запослених, од тога како се осјећају, какво је њихово радно окружење, сигурност на послу, укључујући и физичку и психичку сигурност, задовољство послом, укљученост у посао и позицију коју имају у организацији (Bennett, Weaver, Senft, Neeper, 2017).

Многи су аутори у својим истраживањима пронашли повезаност између изложености мобингу (злостављању на послу) и здравља и благостања на послу. У различитим истраживањаима се показало да злостављање на послу доводи до повећаног нивоа психолошких тегоба, депресије, сагоријевања, анксиозности и агресије, те психосоматских и физичких тегоба (Björkqvist, Österman, Hjelt-Bäck, 1994; Einarsen, Raknes, 1997; Niedl, 1996; Zapf, Knorz, Kulla, 1996). Нека друга истраживања су показала да је међу испитаним жртвама мобинга идентификовано највише оних са посттрауматским стресним поремећајем и општим анксиозни поремећајем (Björkqvist, Österman, Hjelt-Bäck, 1994; Groeblinghoff, Becker, 1996; Leymann, Gustafsson, 1996). Истраживања која су радили (Einarsen, Raknes, Matthiesen, Hellesøy, 1996; Zapf, Knorz, Kulla, 1996) су показала да су напад на приватност особе и укидање права запосленог најјаче и најдосљедније повезана са психолошким благостањем, односно са проблемима у смислу психичког здравља.

Истраживање које је спровела Vartia (2001), је показало да мобинг на послу представља пријетњу по психолошко благостање на раду, односно, испитаници који су били жрве мобинга су имали готово све реакције на стресне ситуације изражене у много већој мјери него остали. Интересантно је споменути да су резултати истог истраживања показали да мобинг не утиче само на благостање жртава мобинга него и на посматраче, јер су испитаници који су пријављивали да су били свједоци или посматрачи мобинга осјећали промјене усљед стреса, тј. осјећали су менталне реакције на стрес. Средишње питање овог истраживања је било у којој мјери је лоше психичко благостање на раду резултат мобинга и колико је повезано са другим факторима радне средине. Показало се да постоји значајна повезаност између мобинга и симптома стреса након контролисања фактора радне средине. Малтретирање, кратки рокови, давање тешких радних задатака, нејасна упутства за обављање посла, непозивање на састанке пред обављање важних послова су биле важне варијабле које су објашњавале доживљавање и реакције на стрес.

Већина споменутих истраживања, такође, говори да различити облици

мобинга доводе до различитих субјективних симптома. Истраживање које су спровели Zapf, Knorz, Kulla (1996), показало да је угрожавање приватног живота у снажној корелацији са тегобама психичке природе. Исте резултате је показало истраживање које је спровела Vartia (2001), али и то да је обезвређивање или погрешно осцјењивање нечијег рада, давање бесмислених задатака, ограничавање изражавања мишења, оговарање иза леђа снажно повезано са реакцијама на психолошки стрес што доводи до смањења благострања на послу. Давање бесмислених задатака, ограничавање изражавања свог мишљења, игнорисање и изолација од других су били најјаче повезани са ниским осјећајем самопоуздања.

У истраживању које су спровели Vega и Comer (2005), мобинг на радном мјесту негативно дјелује на благостање на раду у смислу да руши самопоуздање, нарушава и уништава слику о себи, особи шаље поруку да је беспомоћна и да мора радити дуже и више како би заслужила поштовање које свакако заслужује. Слично томе, истраживања која су спровели Hoel, Rayner, Cooper (2002), и Ciby и Raya (2014), су показала да је мобинг на радном мјесту изазвао или створио низ негативних емоција као што су љутња и фрустрација које су убрзо прерасле у дугорочну емоционалну штету што је укључивало стални осјећај понижења, емоционално мучење, промјене расположења, недостатак спремности и елана за рад, депресивна стања и суицидалне идеје. Метаанализа коју су спровели Verkuil, Atasayi и Molendijk (2015), је показала да је мобинг на послу тијесно повезан са лошим психолошким благостањем запослених. Резултати студије која је рађена на медицинским сестрама је показала да мобинг на радном мјесту значајно утиче на њихово ментално здравље у смислу да су медицинске сестре које су биле изложене мобингу имале нижи ниво позитивног менталног здравља од оних које нису (Harb, Rayan, Al Khashashneh, 2021). Може се још поменути и истраживање, које је рађено на радницима у малим и средњим предузећима у Кини, чији су резултати показали да злостављање на радном мјесту негативно утиче на иновативно радно понашање запослених што изазива негативне емоције међу запосленима. Емоције које долазе са злостављањем су штетне, те доводе до тјескобе, стреса, раздражљивости, пада радне ангажованости и ефикасности и смањења мотивације. У овом истраживању се показало да благостање запослених може утицати на њихову перцепцију ресурса које имају за превладавање злостављања на послу. Као значајан психолошки извор, благостање на раду може бити ресурс који ће запослени добити својим радом, што може мотивисати запослене да раде (Zhou, Rasool, Ma, 2020).

Резултати студије, која је урађена у Њемачкој (N=2476, распон година од 31 до 60), а која је трајала 5 година, су показали да је мобинг на радном мјесту фактор ризика за дуготрајно одсуство са посла због блести. Тако се показало, и након што су аутори увели контролишуће варијабле (стручна спрема, пушење или физички услови на послу). У почетним фазама појаве мобинга жртва покушава очувати своје благостање користећи различите конструктивне стратегије рјешавања сукоба и узвраћање. Тек касније, када се ти покушаји покажу неуспјешним жртве развијају осјећај психолошке немоћи што нарушава њихово благостање и излаз виде у дуготрајном одсуству са посла (Burr, Balducci, Conway, Rose, 2022).

Истраживање на љекарима, које су спровели Asrar, Amen, Sumayya, Butt (2022), је показало да је мобинг на радном мјесту имао значајне штетне учинке на психолошко благостање љекара и да су жене у много већој мјери биле жртве мобинга и да се суочавају са штетнијим психолошким учинцима у поређењу са мушкарцима.

ЕКСПЕРИМЕНТАЛНИ ДИО

Циљ истраживања

На темељу расправа из увода и прегледа доступне литературе о испитиваним појавама формулисан је

проблем истраживања који се односи на испитивање повезаности између перцепције мобинга и благостања на раду запослених жена. У складу са тако формулисаним проблемом, проблемско истраживачко питање гласи: да ли перцепција мобинга статистички значајно негативно корелира са благостањем на раду запослених жена? У складу са овако дефинисаним проблемским питањем, полазна хипотеза истраживања гласи:

X1. Перцепција мобинга је статистички значајно негативно повезана са благостањем на раду запослених жена.

На темељу уводног дијела и наведених претходних емпиријских налаза (Asrar, et al., 2022; Burr, et al., 2022; Vartia, 2001; Vega, Comer, 2005; Zhou, et al., 2020; Hoel, et al., 2002; Harb, et al., 2021; Ciby, Raya, 2014), може се претпоставити да је перцепција мобинга на радном мјесту статистички значајно и негативно повезана са благостањем на раду запослених и свим његовим аспектима. У складу са наведеним су постављене и три подхипотезе:

X1.1 Перцепција мобинга је статистички значајно позитивно повезана са негативним афектима.

X1.2 Перцепција мобинга је статистички значајно негативно повезана са позитивним афектима.

X1.3. Перцепција мобинга је статистички значајно негативно повезана са осјећајем испуњености.

Узорак

Истраживање је спроведено на узорку запослених у Босни и Херцеговини. Узорак чине 253 испитаника женског пола, запослених у државним и приватним предузећима која се баве различитим дјелатностима. Распон година се кретао од 20 до 64, а просјечна старост износи 42 године. Највећи број испитаника је завршило вишу школу или факултет 61,7%, средњу школу 26,5%, а најмањи број је магистара наука 11,8%. Када је у питању позиција у организацији, највећи број је радника 70,0%, службеника 17,0% и руководилаца 13,0%. На неодређено вријеме је запослено 81,0%, а на одређено 19,0% испитаница. Највећи број испитаника је запослено у јавном сектору, њих 81,4%, док је у приватном сектору запослено 18,6%. Од укупног броја испитаника њих 38,2% је одговорило да је било жртва мобинга док 61,8% одговара да није, 51,0% њих одговара да познаје неког другог ко је био жртва мобинга, а 49,0% не познају такву особу. Истраживање је спроведено анонимно путем онлајн платформе „Google Forms“.

Мјерни инструменти

Перцепција мобинга је мјерена помоћу скале перцепције мобинга (Станар, 2017) која садржи 20 ајтема са петостепеном Ликертовом скалом одговора 1= “никад“ до 5= “врло често“, (примјер ајтема: „Омаловажава и исмијава оно што радим“, „Игноришу ме и искључују из заједничких активности“, „Мој рад и залагање су изложени константним критикама“). Скала има задовољавајући ниво поузданости унутршње конзистенције (Кронбах алфа коефицијент), α=.93 што је показала и у овом истраживању α=.93.

Благостање на раду је мјерено помоћу *Work Well-being Scale* – WBWS, коју су конструисале Пасквал и Тамајо (Paschoal & Tamayo, 2008). Скала садржи 29 ајтема који су организоавни у три субскале или три фактора благостања на раду: позитиван афекат - 9 ајтема, негативан афекат - 12 и осјећај испуњености - 8. Утврђени коефицијенти интерне конзистенције три субскале показују задовољавајуће вриједности. Ниво поузданости (Кронбах алфа коефицијент) цјелокупне скале благостања на послу износи α=.74, док су поузданости њених субскала такође високе и износе: позитивни афекти α=.94, негативни афекти α=.94 и осјећај испуњености α=.93, што је у складу са оригиналним истраживањем аутора скале, гдје су такође утврђени високи коефицијенти поузданости за сва три фактора: позитивни афекти α=.92, негативни афекти α=.94 и осјећај испуњености α=.92.

РЕЗУЛТАТИ И ДИСКУСИЈА

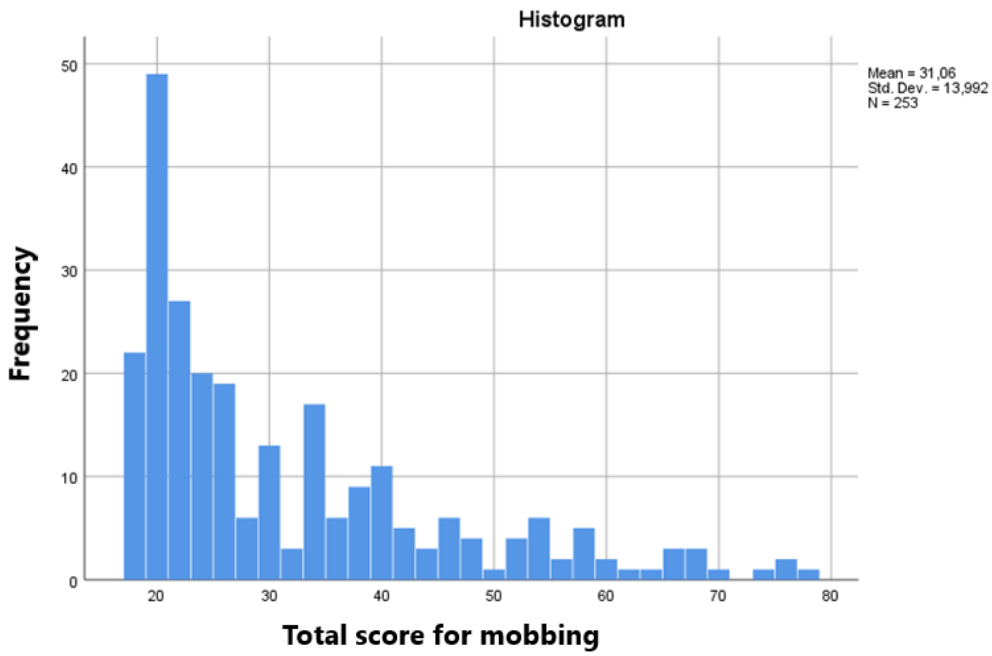
У табели 1 се може видјети приказ основних параметара кориштених мјера. Описни показатељи из Табеле 1 указују на расподјелу вриједности непрекидних промјењивих. Индекс симетричности (*skewness*) за варијаблу перцепција мобинга износи 1.345 што указује на то да је већина добијених резултата помјерена улијево од своје средње вриједности, међу ниже вриједности, а за варијаблу благостање на раду -.140, што указује на негативну асиметрију, односно, да је већина резултата помјеран удесно, међу више вриједности. Индекс спљоштености (*kurtosis*) за обје варијабле има позитивну вриједност што указује на расподјелу која је оштрија од нормалне.

Табела 1: Дескриптивни параметри варијабли кориштених у истраживању
Table 2. Descriptive parameters of the variables used in the research

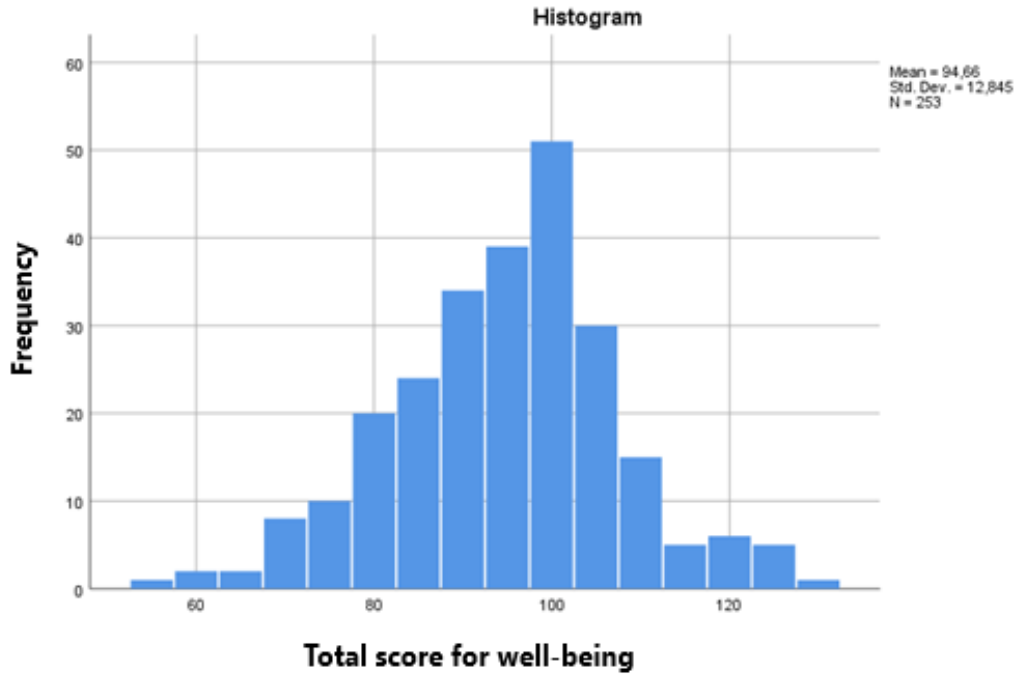
Варијабле	***Min***	***Max***	***M***	***SD***	***Sk***	***Ku***	***K-S***	***p***
Перцепција мобинга	18	89	31.40	14.24	1.345	1.396	.183	.00
Благостање на раду	55	128	94.75	12.87	-.140	.203	.049	.200

Напомене: Min – минимална емпиријска вриједност; Max – максимална емпиријска вриједност; M – аритметичка средина; SD – стандардна девијација; Sk - skjunis; Ku – kurtozis; K-S – Колмогоров-Смирнов тест.

Резултати испитивања нормалности расподјеле варијабле мобинга су показали значајност мању од 0.05, па се може закључити да расподјела ове варијабле статистички значајно одступа од нормалне расподјеле, док расподјела варијабле благостање на послу одговара нормалној расподјели, на шта нам указује и Колмогоров-Смирнов тест нормалности. На Графиконима са слика 1 и 2 се може видјети нормалност расподјеле обје варијабле.



Слика 1. Нормалност расподјеле на скали мобинга
Figure 1. Normality of distribution on the mobbing scale



Слика 2. Нормалност расподјеле на скали благостања на послу
Figure 2. Normality of distribution on the well-being at work scale

С обзиром да расподјела резултата за варијаблу перцепције мобинга статистички значајно одступа од нормалне расподјеле, повезаност између перцепције мобинга и благостања на раду је изражена уз помоћ Спирмановог коефицијента корелације (Табела 2).

На основу резултата приказаних у Табели 2 се види да је добијена статистички значајна негативна корелација средњег интезитета између перцепције мобинга и укупног благостања на раду, rho=-.382, N=253, p<.01 и перцепције мобинга и осјећаја испуњености rho=-.337, N=253, p<.01, статистички значајна негативна корелација високог интезитета између перцепције мобинга и позитивних афеката rho=-.531, N=253, p<.01 и статистички значајна позитивна корелација између перцепције мобинга и негативних афеката rho=.592, N=253, p<.01.

Табела 2: Коефицијенти корелације перцепције мобинга и Скале благостања на раду.
Table 2. Correlation coefficients of the perception of mobbing and the Work Well-being Scale.

	Благостање на раду (укупно)	Позитивни афекти	Негативни афекти	Осјећај испуњености
N	253	253	253	253
rho	-.382*	-.531*	.592*	-.337*
p	.000	.000	.000	.000

Напомене: *- p<.01

Резултати овог истраживања показују да се штетни утицаји мобинга на послу у значајној мјери одражавају на укупно благостање на раду запослених жена. Такође се може рећи да се мобинг на послу може посматрати и као претходник

нарушеног благостања на раду, што значи да он до те мјере ремети психофизичко функционисање запосленица да им преостаје јако мало емоционалних ресурса, капацитета и времена да се инвестирају у обављање посла, те им остају само негативни афекти што уништава њихово цјелокупно благостање.

Основна хипотеза овог истраживања је била да ће перцепција мобинга статистички значајно негативно корелирати са укупним благостањем на послу запослених жена. Другачије, што испитанице у вишој мјери перципирају постојање мобинга, било да су жртве, било да знају да је неко други жртва мобинга, њихово благостање на раду ће бити ниже, тј. лошије. Исто тако, висока негативна корелација мобинга са позитивним афектима говори о смањеном степену кориштења вјештина, знања и свих оних ресурса који воде ка личном расту, напредовању на послу и изградњи адекватних и стабилних социјалних мрежа. Висока позитивна корелација између мобинга и негативних афеката говори о утицају мобинга на развој свих оних негативних емоционалних стања (туга, љутња, страх, кривица, презир, итд.), која репрезентују негативни афекти. С обзиром на то да позитивни и негативни афекти имају значајан утицај на свакодневни живот, посебно на мишљење, радни учинак, способности, тај утицај се у значајној мјери одражава и на благостање на раду као један од сегмената људске свакодневнице. Негативни афекти, под утицајем мобинга, могу довести и до друштвене искључености и до губитка приступа свим ресурсима потребним за цјелокупно благостање те тако и благостање на послу.

Такође, резултати овог истраживања су у складу са емпиријским налазима различитих аутора наведених у уводном дијелу овог рада, да су мобинг и благостање на раду статистички значајно негативно повезани (нпр. Asrar, et al., 2022; Burr, et al., 2022; Verkuil, et al., 2015; Zapf, et al., 1996; Zhou, et al., 2020; Rayner, et al., 2002; Harb, et al., 2021; Ciby, & Raya, 2014).

Поред свих породичних обавеза које жене испуњавају, доживљавање мобингујућих активности, као нпр. давање бесмислених задатака, избјегавања, причање иза леђа, ограничавање нечије могућности да изрази своје мишљење, изоловање од других, и др. облици негативних понашања су тијесно повезани са позитивним и негативим афектима, у смислу да ће запосленице које у вишој мјери перципирају мобинг имати смањене позитивне, а повећане негативне емоције, те престају доживљавати осјећај испуњености послом или га доживљавају у знатно смањеној мјери. Усљед овога, жртва почиње да се фокусира на очување свог личног интегритета, покушава да „се спаси“ те усљед смањења ресурса за борбу са мобингом њихово благостање на послу се урушава.

С обзиром да се мобинг може посматрати као организациони извор малтретирања које за посљедицу има смањено благостање, ово истраживање је важно, прије свега, због могућности идентификовања и превенирања мобингујућих активности у раној фази њиховог настанка. Такође је важно и за мотивацију менаџмента организације да пружи и подржи помоћ запосленима или да пронађе неке друге приступе превенцији и корекцији мобинга у сврху јачања благостања на послу.

Иако, можда, није лако постати организацијом која је оријентисана на запослене и те исте запослене ставити на прво мјесто, ова опција је апсолутна потреба када узмемо у обзир вријеме у којем живимо. Пандемија COVID-19, која је погодила цијели свијет је нарушила и ментално здравље, са огромним порастом стреса, страха и неизвјесности на радном мјесту, те је самим тим имала и велики утицај на благостање на раду. Када су запослени задовољни својим радним условима и организацијом, кад су у добром стању на послу, тада ће бити и способни да развију своје потенцијале, биће продуктивни, бољих радних перформанси, креативни, градити позитивне и контструктивне односе да другима, боље и лакше се носити са

стресом и самој организацији давати значајнији допринос. Све ово би заједно допринијело и њиховом бољем благостању на раду.

За благостање на раду је потребно одсуство свих негативних и присуство позитивних психолошких и физичких аспеката благостања, како би се повећали мотивација и радне перформансе запослених. Нарушено благостање не дјелује негативно само на психолошко и физичко здравље запослених него и на шире аспекте живота особе, као што су породични живот и цјелокупни социјални односи како на послу тако и ван њега, и подразумијева нарушен баланс између дистреса (лошег стреса) и еустреса (доброг стреса). Оно што организација може да уради како би допринијела благостању на раду запослених је дизајнирање радног система, евалуација рада запослених, редизајн посла, мотивисање запослених, успјешно лидерство, јер добар лидер својом доборм организацијом посла, у великој мјери, може да допринесе спречавању стреса и сагоријевања на послу, мобинга, односно, свих патолошких понашања која се могу јавити у радном окружењу (Barling, Inness, Gallagher, 2016).

ЗАКЉУЧАК

Фокус овог истраживања је на проблему од глобалног интереса, с обзиром на то да је мобинг данас окарактерисан као један од најштетнијих стресора у савременом пословном окружењу. Како је мобинг негативна појава која може узорковати озбиљне негативне посљедице, како за жртву тако и за цјелокупну организацију, веома је важно бавити се овим проблемом ширећи свијест о њему, јер само тако се може сачувати најважнији ресурс сваке организације, а то су запослени.

Ипак, ово истраживање има и неколико ограничења на која треба обратити пажњу. На првом мјесту је било мање испитаника него у сличним истраживањима, те се резултати не могу генерализовати на све запослене у БиХ и у другим земљама, без обзира што су налази показали да је мобинг негативно повезан са благостањем на послу, јер нису укључене никакве модератор варијабле које би указале на још неке факторе који би, можда, могли значајно утицати на благостање на послу. Могуће је и да је код испитаника био присутан страх од последица због давања и размјене информација и мишљења, тј. због учествовања у истраживању на осјетљиву тему као што је мобинг. Исто тако, могуће је да је, с обзиром да је истраживање спроведено као онлајн истраживање, те имајући у виду да је БиХ прилично дигитално неразвијена земља, то утицало и на доступност анкете. Такође, фокус на испитаниццима женског пола не даје могућност поређења група испитаника према полу.

Нека од будућих истраживања би могла укључити и неке модерирајуће варијабле, на личном и организационом нивоу, како би се пронашли ресурси за спречавање мобинга или ублажавање негативних учинака мобинга. Такође, требало би укључити и испитанике мушког пола како би се могло доћи до сазнања о утицају мобинга на њихово благостање на раду и направити компарација са подацима добијеним на испитаницима женског пола. С обзиром да рад може представљати значајан извор багостања на раду, руководиоци могу, мотивишући раднице да раде, тако развијати и јачати њихово благостање на раду као значајан психолошки ресурс за превладавање мобинга на послу.

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THE CONNECTION BETWEEN THE PERCEPTION OF MOBBING AND WELL-BEING AT WORK FEMALE EMPLOYEES

Snježana Stanar

University of East Sarajevo, Faculty of Philosophy, Alekse Šantića 1, 71 420 Pale, Bosnia and Herzegovina, snjezana.stanar@ffuis.edu.ba

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Corresponding Author:
Snežana Stanar, University of East Sarajevo, Faculty of Philosophy, Alekse Šantića 1, 71 420 Pale, Bosnia and Herzegovina, snjezana.stanar@ffuis.edu.ba

ABSTRACT

Mobbing is a behaviour whose aim is to underestimate and degrade other human beings by means of malevolent language and obscure cruel acts, which gradually undermine one's proper functioning and affect both one's mental and physical health (Kostelić-Martić, 2005). Well-being at work refers to all aspects of employees' workplace life, from how they feel, what their working environment is like, safety at work including physical and psychological safety, job satisfaction, involvement in work and the position they have in the organization. The research problem refers to the examination of the connection between the perception of mobbing and the well-being at work of employees. Individuals who perceive mobbing as present in the organization and who are exposed to this type of stress, have impaired well-being. According to earlier findings, mobbing significantly affects the well-being of individuals at work in a way that impairs it, whereby they experience various psychological disturbances and are thrown out of work activities, because they stop adequately performing work tasks. Also, people who experience mobbing have a decline on motivation, work efficiency, a drop in the feeling of fulfillment, loss of trust, they complain of fatigue and feelings of anger and frustration. Two measurement instruments were used in the research: the mobbing perception scale and the Work Well-being Scale - WBWS, which have satisfactory measurement characteristics. The survey was conducted via an anonymous internet questionnaire, and a representative sample of employees in Bosnia and Herzegovina was used (n=273). The data thus obtained indicates that, statistically, the perception of mobbing is significantly negatively related to well-being (rho=-.382, p<.01), and its two aspects: positive affects (rho=-.531, p<.01), a feeling of fulfillment (rho=-.337, p<.01), and positively related to the negative effects aspect (rho=.592, p<.01), which confirms both the starting hypothesis and its sub-hypotheses. The perception of mobbing in the workplace negatively affects the well-being at work, i.e. higher levels of subjective perception of mobbing go hand in hand with lower levels of well-being at work. Furthermore, higher levels of the perception of mobbing are accompanied with lower levels of positive affects and feeling of fulfillment, and higher levels of negative affects.

Although the consequences of mobbing are felt, to the greatest extent, on an

individual level, there are inevitable negative consequences on the organizational level as well. As mobbing has a negative effect on the well-being at work of an individual, it also adversely affects the work and results of the entire organization.

Keywords: mobbing, well-being at work, female employees.

Džino, J., & Džino, S. (2023). Digitalization of public administration in Bosnia and Herzegovina with a special focus on the field of it staff management and ICT infrastructure management. *STED Journal*, *5*(1), 25-43.

DIGITALIZATION OF PUBLIC ADMINISTRATION IN BOSNIA AND HERZEGOVINA WITH A SPECIAL FOCUS ON THE FIELD OF IT STAFF MANAGEMENT AND ICT INFRASTRUCTURE MANAGEMENT

Jefto Džino[1], Stefan Džino[2]

[1]Pan-European University Apeiron, Faculty for Information Technologies, POB 51, 78102 Banja Luka, Bosnia and Herzegovina, jefto.m.dzino@apeiron-uni.eu
[2]PR SYSTEMFINITY, 11000 Beograd, Republic of Serbia, dzino.stefan93@gmail.com

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Corresponding Author:
Jefto Džino, Pan-European University Apeiron, Faculty for Information Technologies, POB 51, 78102 Banja Luka, Bosnia and Herzegovina, jefto.m.dzino@apeiron-uni.eu

ABSTRACT

Digitization of public administration is a choice that has no alternative. The analysis of public administration in Bosnia and Herzegovina was research through the trends of changes in public administration and refers to: working conditions, access to work execution, developments with IT personnel, business conditions, investments, needs for new technologies, equipment and security. The key factor in every public administration is personnel. In the paper, we have presented an analysis of the employment of IT personnel at the level of B&H and the facts that emerged from the conducted analyses. Management of IT personnel, their need, recruitment and stimulation in public administration is a big challenge. An analysis of the current situation, trends and solutions is given through the available data. In order to digitize public administration, investments are also needed, of course these investments should be well thought out and guided by examples of good practice. Based on available data, analyses of investments in ICT in public administration at the level of institutions of B&H and Brčko District were carried out. An example of good practice was presented and solutions were given.

Keywords: Public administration, data warehouses, self-service, service provision, digitalization, IT personnel, Digital technologies, Digital transformation.

INTRODUCTION

The impact of digital technologies on our lives, work and communication is increasing every day. Information technologies play a major role in all fields of human activity. In the most of the developed countries digital transformation of public administration is rather slow; the development is far behind of the officially defined and announced schedules (Sidorenko, Bartsits, & Khisamova, 2019). Companies that can best respond to rapidly and frequently changing markets have better competitive advantages than those that fail to

keep up with the pace dictated by the globalization process (Kale, 2020). Regardless of the industry sector, regardless of the user base, web technology will be the main driving force for change (De Kare-Silver, 2020). We expect faster response times, faster delivery and personalization. This change in attitudes means that public administration must adapt and innovate like all other organizations. And where industries do not keep up, they risk lose market share in favor of smaller and more agile new players (Rowles, & Brown, 2017). In all sectors of society and economy, digital transformation is a catalyzer for new transformations that bring new functionalities, services, products, models and experiences. Today, even the concept of electronic business has been overcome to, for the reason that it implies that outdated, non-electronic business also exists as a parallel analog way of doing business.

Digitization, apropos is the transformation of public administration, enables new, faster, more networked and better quality of the work with citizens, the economy, but also with all organizational units of public administration.

In Public Administration, development directions must be aligned with the Agenda for Sustainable Development (United Nations, General Assembly [UNGA], 2015).

METHODOLOGY, HYPOTHESES AND RESEARCH OBJECTIVES

The approach to the selection of research questions and the setting of hypotheses is guided by the desire to obtain missing information about the way human resources are managed in the field of IT at the level of institutions of B&H, as well as investments in ICT. The researchers have defined access to publicly available data from the field of employment of IT personnel and implementation of public procurement for ICT at the level B&H institutions. As the main sources for collecting data from the domain of human resource management from the field of IT, the Agency for Civil Service (2022) was taken, and the collection of data on public procurement included 75 institutions that are on the budget of B&H. The data were collected from the websites of institutions from public procurement plans or public procurements which have been carried out. The main goal and the general initial reason was the effort to obtain an assessment of the actual situation in the institutions of B&H, that is, to obtain an overview and missing information about the management of IT personnel and public procurement for ICT in the institutions of B&H.

The researchers agreed on the following research questions and problems:

Q1: Have the institutions of B&H been exposed to changes in work and functioning since the appearance of the Corona virus (COVID19).

Q2: Do the institutions of Bosnia and Herzegovina have a defined policy for hiring IT personnel?

Q3: Do the institutions of Bosnia and Herzegovina invest in ICT in a planned way?

The goal of data collection and their analysis are the changes to which public administration has been exposed since the emergence of the Corona virus (COVID19), as well as the purchase of information on the quality of IT personnel management and the justification of investment in ICT infrastructure.

The following research hypotheses were set:

H1: The Public Administration has been exposed to changes in work since the appearance of the Corona virus (COVID19) in several areas.

H2: In the set of collected data on published public advertisements and internal competitions published by B&H institutions through the Agency for Civil Service, there are a small number of positions for IT personnel.

H3: In the set of the institutions at the B&H level from which data on investments in ICT were taken, investments were made in fragmented ICT infrastructure.

RESEARCH CONDUCTED AND RESULTS OBTAINED

The research that was conducted and presented in the paper was conducted on publicly available public administration data for the level of institutions of Bosnia and Herzegovina. The goal of the research is to collect data on the changes to which the Public Administration in B&H has been exposed since the emergence of the Corona virus (COVID19) and to perform an analysis of trends in public administration. In the continuation of the paper, an analysis of the collected data related to the employment of personnel as well as data on procurement and investment in ICT for the level of institutions of B&H is presented.

An example of good practice from the surroundings is given. A solution for the improvement and digitization of the Public Administration at the level of the institutions of Bosnia and Herzegovina was presented.

For authorities and organizations in B&H institutions and the public sector, digital transformation brings an approach to develop public administration as a digital public administration in such a way that it engages its employees, optimizes its operations, transforms its services, creates new services and improves interaction with users.

We propose the implementation of appropriate infrastructure that could ensure this. We believe that the next period should be marked by a greater connection of all administrations, administrative organizations and local self-government units, and that the proposed concept could be implemented.

AREAS - TRENDS OF CHANGES IN THE PUBLIC ADMINISTRATION IN BOSNIA AND HERZEGOVINA

In order for the Public Administration in B&H to take the first step towards digitization, it is necessary to recognize the importance of information and communication technologies (ICT) and information technology (IT) staff as the bearers of these changes within the Public Administration bodies and organizations. Since the emergence of the Corona virus (COVID19), the Public Administration in Bosnia and Herzegovina has been exposed to major changes in nine areas (trends):

- The first is the way of working, where unlike the previous traditional way of going to work, office, equipment and the like, the performance of work is reoriented to work from a remote location in the home environment. This posed a challenge for employees: additional space for work, equipment for work, as well as high-speed Internet connections that enabled this kind of work, and a great challenge for the Public Administration institutions to provide access to their resources, Internet connection, security, continuous work process, etc.
- Another trend that has emerged is the sudden great need for different profiles of IT personnel. This is due to the fact that the change in the way of doing business was conditioned by the adaptation of the Public Administration in terms of IT and communication for this, IT personnel were necessary, which the Public Administration had in smaller numbers or did not have.
- The third trend that emerged is the departure of IT personnel from the Public Administration. The Public Administration in Bosnia and Herzegovina has its own complex organization that has established systematization and salaries. The outflow of IT personnel is significant due to the fact that the same or similar jobs are paid multiple times on the market. The incoming staff do not have many years of work experience and many do not have experience in the public sector.
- The fourth trend is that, despite the lack of IT personnel at the level of B&H institutions, no vacancies for IT personnel have been published, both for those who are missing and for those who have left.
- The fifth trend, is not adopting the budget of the institutions of B&H, where the level of IT needs is reduced to maintenance during 2020, 2021 and half of 2022.The budget for 2022 was adopted at the end of the year, so that public

procurements related to capital investments had a very short period for initiating the procedure and for the realization of public procurement. Public administration is not as flexible as the private sector and adjustment to existing circumstances is very difficult. Public administration is subject to budget planning, which requires a period of one year and is called the budget calendar (Ministry of Finance and Treasury of Bosnia and Herzegovina [MFTBH], 2022), which is prescribed by the Law on the Financing of Institutions of Bosnia and Herzegovina. Procurement is carried out through the Public Procurement System, and the time that passes from the day when the planning of the budget item is started until the time when the public procurement is realized is more than one year (in the best circumstances) and up to two years from the point of view of daily market movements and price changes. This is an inflexible and strictly focused approach. To be clear, the transparency, economy and justification of public procurement in the Public Administration are not disputed, but the existing legal framework cannot ensure a flexible and functional public administration, which can respond to all challenges. Processes in public procurement are managed according to the waterfall model.

- The sixth trend is the priority of human health, which arose in the circumstances of Corona virus COVID19. Observing now, from a shorter time distance, although we have not yet come out from the aforementioned circumstances of the infection, we can say that everything was subordinated to the main priority - human health.
- The seventh trend is the need for software's that were necessary for work and that facilitated work processes. The need for SaaS, SaaP, IaaS and Cloud services are expressed.
- The eighth trend, the need for hardware, different types of equipment for ICT infrastructure and
- The ninth trend, security, which gained great importance in this period.

With this, we proved the first hypothesis H1: The Public Administration was exposed to changes in work since the appearance of the Corona virus (COVID19) in several areas. These changes had a great impact and the further work of the public administration was marked by these trends.

The Council of Ministers of Bosnia and Herzegovina adopted the Decision on the adoption of the interoperability framework of Bosnia and Herzegovina, which was published in the Official Gazette of Bosnia and Herzegovina, number 53/18, as well as the Information Society Development Policy of Bosnia and Herzegovina for the period 2017 - 2021, which was published in the Official Gazette of Bosnia and Herzegovina, number 42/17.

PERSONNEL

As personnel management is a key aspect of every company, like that the Public Administration must have access to personnel planning and employment of the personnel at the highest level, for the purpose of improving public administration. To that end, we conducted a survey of publicly available data on the employment of personnel with higher vocational education in the Public Administration at the B&H level. The admission of personnel with a higher vocational education to employment in the public administration in the institutions of Bosnia and Herzegovina is carried out through the Agency for Civil Service, which is an independent administrative organization responsible for ensuring the employment processes of civil servants' request of institutions at the B&H level. Through this agency, employment is not carried out for positions for which a high school diploma is required, so this research does not include their employment, which is carried out by the institutions individually.

The research is conducted on publicly available data found on the website of the Civil Service Agency Bosnia and Herzegovina.

On the website of the Civil Service Agency, you can find information on:

- Ongoing competitions and
- Competitions that are closed.

For the purpose of research, the period from January 01, 2020 until October 07, 2022 was taken. Every single announcement posted on the website was opened, analyzed and a data set downloaded for this research. By analyzing the displayed data for the period from January 01, 2020 until October 07, 2022, we note that 277 announcements were published (both public announcement and internal announcement) for 666 jobs. Which is shown in Figure 1.

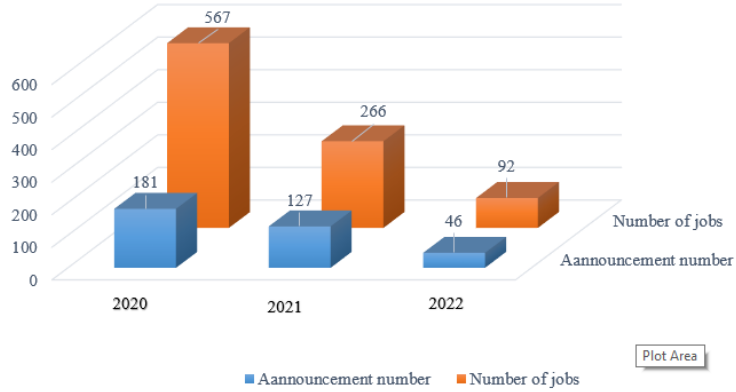

Figure 1. The relationship between the number of published announcement and the number of jobs

For every published advertisement, there are 2.61 vacancies which have been announced. There has been a noticeable steady decline in published announcement over the last three years.

In the mentioned period, 78 internal announcements for 260 jobs were published, which is presented in Figure 2. - Published internal announcements and the number of jobs. For every published announcement there are 3.31 vacancies which are announced. When we compare the number of published public and internal announcement, it looks like as on the Figure 3 - the relationship of published public and internal announcement.

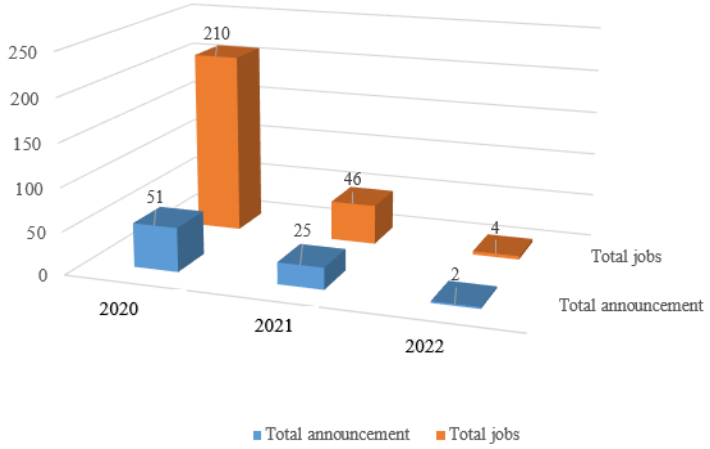

Figure 2. The Published internal announcements and the number of jobs

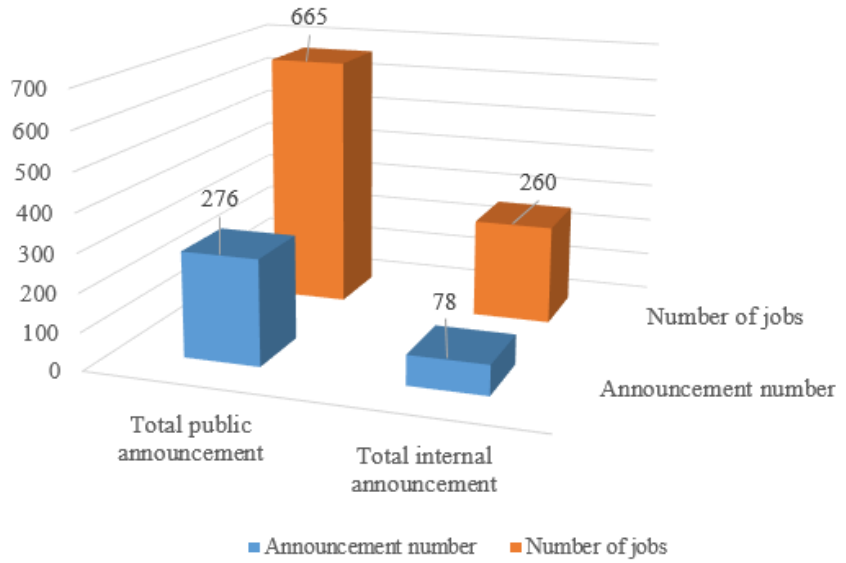

Figure 3. The relationship of published public and internal announcement

We can state according to the Figure 3, that the number of internally advertised announcements is evidently smaller compared to published public announcements.

From all published announcements, data was collected on announcements published for interns and volunteers, which is presented in Figure 4. – The number of announcements and positions for volunteers.

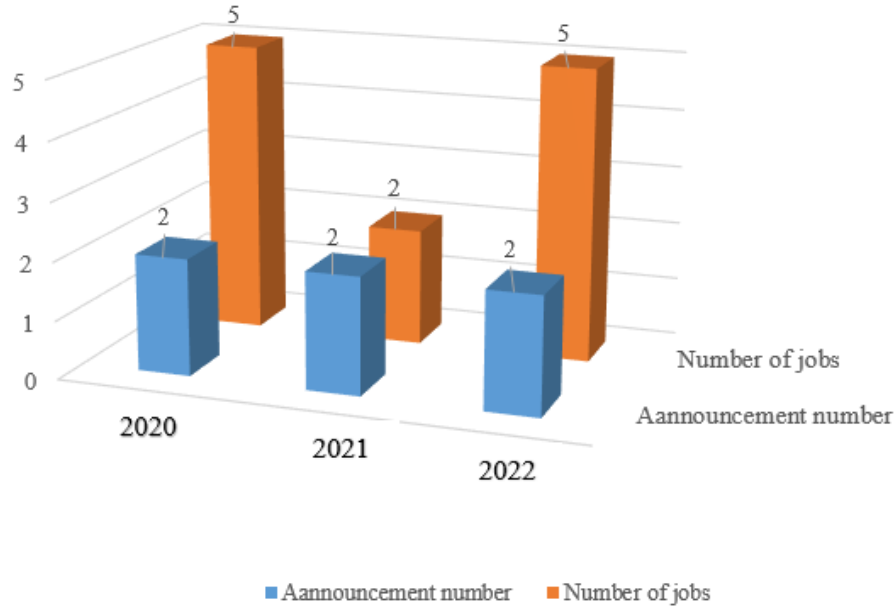

Figure 4. The number of announcements and positions for volunteers

The total percentage of positions for volunteers for three years according to the total number of jobs is 0.01%, and as can be seen from the overview by years from Table 1 - The number of announcements and jobs for volunteers in the last three years.

Table 1. The number of announcements and jobs for volunteers in the last three years

	Year			
Announcement for volunteers	2020	2021	2022	Total
Number of announcements	2	2	2	6
Number of positions	5	2	5	12

Based on the data that we have obtained and which are shown in the previous figures and tables, we state that the number of both announcements and positions for volunteers is very small.

The number of published positions for trainees, which is presented in Figure 5, has had a constant growth in the last three years.

From the data in Table 2, it can be concluded that according to the number of published announcements, the number of positions for each announcement is 1.92. The percentage of participation of the total number of positions for trainees for three years according to the total number of published jobs is 14.71%. From the obtained data, we note that the number of published positions for trainees is small.

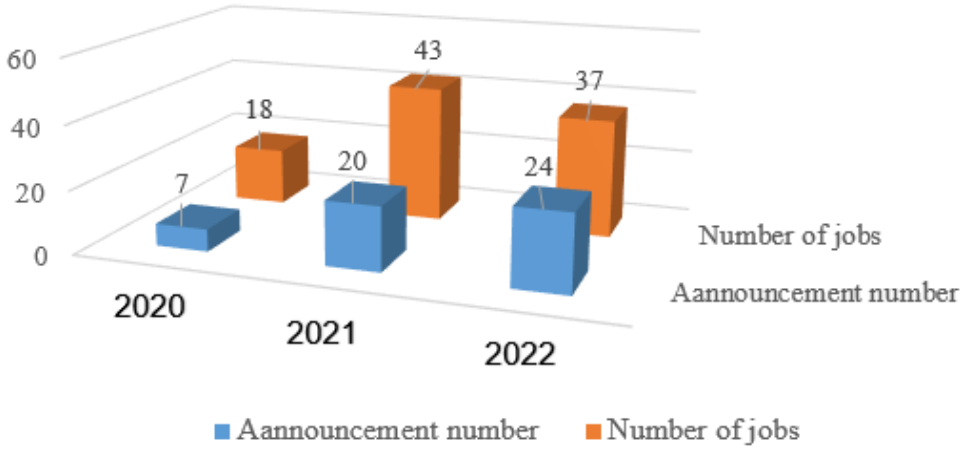

Figure 5. The number of published positions for trainees

Table 2. The number of announced positions for trainees in the last three years

	Year			
Trainees	2020	2021	2022	Total
Number of announcements	7	20	24	51
Number of positions	18	43	37	98

The reason for completing the analysis of announcements for volunteers and interns is that you cannot be employed in the Agency for Civil Service if you do not have at least one year of work experience. The question is, how will someone gain work experience, and above all it refers to the field of IT, if the institutions do not provide the opportunity to gain work experience for interns?

From the analysis, we conclude that it is necessary for institutions to enable the acquisition of work experience for interns in order to give the opportunity to gain work experience in IT after completing their studies and to choose the best for their needs from those who have successfully completed it.

Furthermore, an analysis of public advertisements for IT was carried out, according to the positions held by civil servants, as follows from the lowest to the head of the organizational unit: expert associate, senior expert associate, expert advisor, and head of the organizational unit. The analysis includes interns and volunteers for whom an IT qualification is required, as shown in Figure 6.

Table 3. shows an overview of published announcements for IT positions for the last three years.

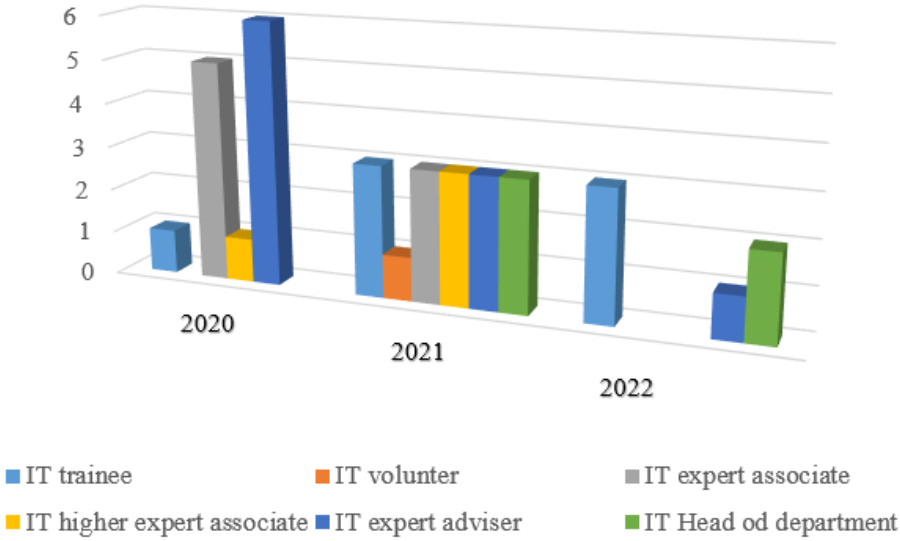

Figure 6. The number of the published public announcement for IT positions

Table 3. The overview of published announcements for IT positions by position and year

		Public announcements for IT positions per year		
No.	Position	2020	2021	2022
1	IT trainee	1	3	3
2	IT volunteer		1	
3	IT expert associate	5	3	
4	IT higher expert associate	1	3	
5	IT expert adviser	6	3	1
6	IT Head od department		3	2
Subtotal		13	16	6
Total				**35**

In accordance with the collected data, which are shown in Table 3, it can be concluded that the number of announcements in 2022 is significantly lower. In total, in three years, public announcements were published for 35 IT positions, that is, for permanent employment, 27 IT positions. When comparing the number of published IT positions to the total number of published working places, we come to the data that announcements for IT positions took part in a percentage of 4.05% of the total published jobs.

On Figure 7 - internal ads for IT positions, we see by year the number of IT positions that have been announced. How it looks by age and position it can be seen in Table 4. In accordance with the collected data, which are shown in Table 4, it can be concluded that the number of internal advertisements has been declining since 2020.

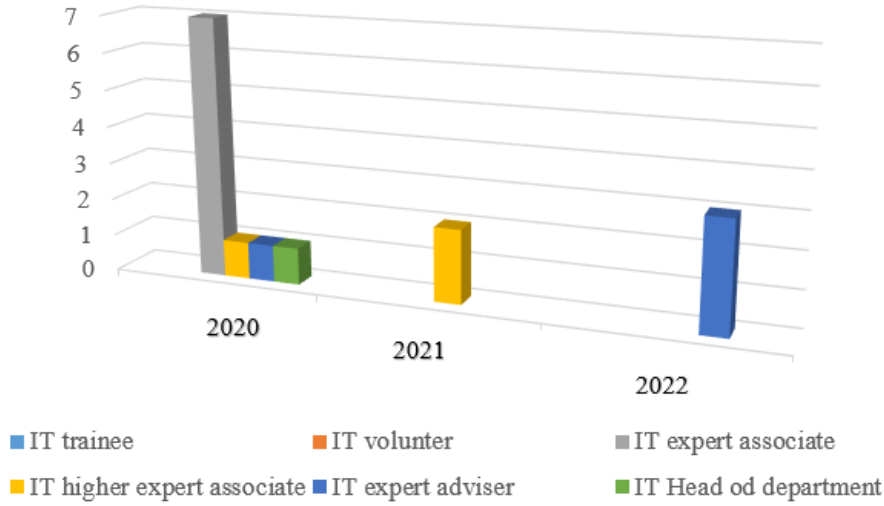

Figure 7. The Internal announcements for IT positions

Table 4. The internal announcements for IT positions per years

		Internal announcements for IT positions per years		
No.	Position	2020	2021	2022
1	IT expert associate	7		
2	IT Higher expert associate	1	2	
3	IT Expert adviser	1		3
4	IT Head of department	1		
Subtotal		10	2	3
Total				**15**

In total, internal advertisements for 15 IT positions were published in three years. When comparing the number of internally published IT positions to the total number of published jobs, we come to the data that published internal IT positions accounted for 2.25% of the total published jobs.

From the previous research, it can be clearly concluded that the Public Administration required a very small number of personnel.

In accordance with the conducted research and the facts we come to, we also proved hypothesis H2: In the set of collected data on published public advertisements and internal competitions published by B&H institutions through the Civil Service Agency, there are a small number of positions for IT personnel. It would be very interesting to analyze all the regulations on the systematization of jobs in all institutions of Bosnia and Herzegovina, because in order for competitions to be announced for IT positions, it is necessary to include them in the systematization. We believe that this is one of the causes of such a small number of advertised IT positions, of course it also speaks to the understanding of the importance, need and role of IT personnel in the Public Administration.

We state that the management of IT personnel at the level of B&H institutions must receive a completely different approach. The need for IT personnel will neither stagnate nor decrease, but the opposite - the need for IT personnel is constantly increasing. The platform that encourages one's workplace to action may not yet be clearly visible, but as science fiction writer William Gibson said, “the future is already here-it's just not evenly distributed” (Greenway, Terrett, Bracken, & Loosemore, 2018).

IT personnel are generators of development and improvement in the Public Administration. People who have an IT profile in today's modern market are desirable and needed in a large number of countries of the world, and for their employment and relocation, special advantages are created in our environment, such as in the European Union and in other countries of the world. This enables great mobility of people in the IT profession. On the domestic market there is a certain number of domestic and foreign IT companies that offer good salaries and favorable conditions compared to the Public Administration in Bosnia and Herzegovina.

Investments that are initiated through the introduction of new technologies must be accompanied by investment in knowledge.

The fact is that in the area of investments, the key is investing in people. Competent personnel in which the Public Administration invests will be able to better control costs, to better recognize the real needs of the Public Administration, citizens and the economy, and to extract the maximum from technologies with minimum investment.

DIGITALIZATION OF THE PUBLIC ADMINISTRATION FOR THE PURPOSE OF IMPROVING ITS SERVICES

The Public Administration that is able to use all the advantages and strengths of new technologies will become more agile and create conditions for more efficient work, transformation of its services and employer’s engagement.

Digitally mature organizations focus on integrating technologies to transform the way they operate as a whole, while those that are less digitally mature will use individual technologies to solve discrete problems as they arise or when they reach a level of pain that requires a solution. Strategy drives innovation, not technology (Fenton, Fletcher, & Griffiths, 2020).

The dynamic development of new technologies, a large increase in the amount of data, advanced analytics, machine learning, artificial intelligence and augmented reality bring numerous functionalities but also enormous opportunities for public administrations of all levels. Catching up with these challenges is the right way for new solutions and improvements in the functioning and work of the Public Administration. Beyond efficiency, the digitalization of public services in developed countries in Europe and beyond sends a strong signal at the international, national, and local level on the need for change and digital transformation to move into an era of transparency, quality of public services, and the fight against corruption (Androniceanu, Georgescu, & Kinnunen, 2022).

The Public administration that introduces new technologies in its work increases its functionality, efficiency, introduces new services and products. Citizens ask the Public Administration to reduce the price of its services and thereby reduce budget funds, as well as to simplify its work so that users can use certain services regardless of the location and working hours of the Public Administration and in accordance with their needs. These directions of constant requests of users of the Public Administration are essentially both a strategy and a guideline for the improvement of Public Administration services. The results in the Public Administration can be great, a public administration that introduces new technologies on its way to digital transformation simplifies both its work and enables users to meet their needs in a simple, cheap and easy way - digital. Digital transformation has its phases, and as shown in Figure 8 - digital transformation, where the basic role and challenge is represented by the demands of public administration users, which the public administration should recognize and create new services and, of course, enable easy and simple use of those services.

We performed an analysis of publicly available data from public procurement plans or, where there were no public procurement plans, implemented public procurements. The data that was processed are not standardized, machine-readable and available in one location, so it was a big challenge to collect, process and analyze the data. The research was very extensive because the level of Bosnia and Herzegovina has 75 institutions.

Analyzing public administration and recognizing digital improvements in public administration can increase productivity, enable mobility, as well as create new digital services that can be applied to bodies and organizations in public administration, toward the economy and various users who are interested in digital public administration services. In order to achieve this in the Public Administration, it must recognize the aspirations of its employees and their interests to, respond to cyber threats and recognize how to manage the series of challenges facing it. In order for the Public Administration to succeed in facing a large number of challenges, it must significantly improve the skills of its employees.

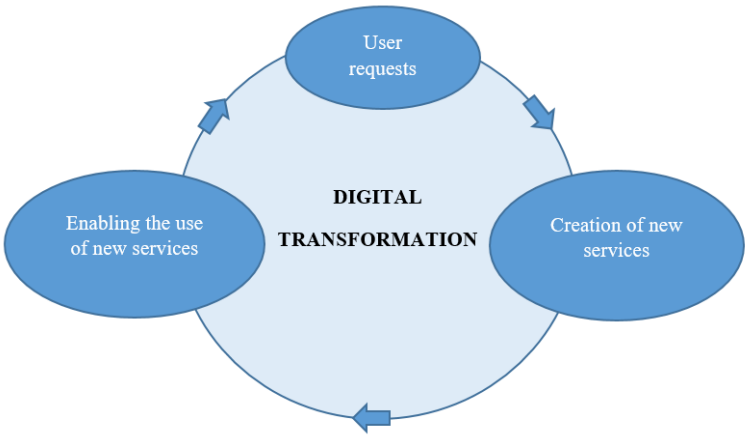

Figure 8. The Digital transformation

Challenges of the Public Administration in the processes of digitalization and interoperability

By improving business processes, public administration introduces new tools that should be used by its employees. The modern world of business today operates in an environment of high degree of uncertainty and inability to predict the future. Currently on the market, supply far exceeds demand, and in a dynamic and turbulent business environment, as well as competition on the one hand and growing expectations of customers and service users on the other, there is a growing need for more efficient work of public administration also (Radivojević, Džino, Radivojević & Džino, 2022).

It is very important that employees recognize the meaning and values that digital transformation brings. The modern employee does not always know and does not understand how to deal with the plenty of information. And after a while, he might realize how much resource he was unable to use (Vasilenko, & Zotov, 2020). The introduction of digital transformation brings huge amounts of data, for which an infrastructure that can support such data exchange and storage should be provided first of all. The same data should be integrated with quality and then used purposefully and safely.

Of course, the key challenge in public administration in Bosnia and Herzegovina is to provide such an infrastructure, which represents the first challenge regarding the establishment of digital services in public administration.

Another challenge is electronic data, data access and ownership. In public administration in Bosnia and Herzegovina, there are Regulations that regulate the rights of access to electronic data, which essentially are not completely in line with the Decision on the adoption of the interoperability framework of Bosnia and Herzegovina, published in the Official Gazette of Bosnia and Herzegovina, number 53/18. The fact is that interoperability cannot exist if authorities and organizations have databases, that is, they collect data from their jurisdiction, which are quite understandably regulated by the Regulations on access and handling of data and which in essence do not allow data interoperability. In practice, it is evident, but it is difficult to explain, and to introduce changes - that alone represents a big challenge. Where is the essence of the problem? Accessing! From the position of the authority or organization that collects data from its jurisdiction, it must provide resources and personnel for this. It understands this data as his property. It protects them in the best possible way for reasons of security, data protection laws and a number of other legal and internal rules. In order for another body or public administration organization to use a part of the data set for its own needs without collecting it again, it is necessary to tackle a series of problems and obstacles.

Public administration has a large number of applications and services, its users use a large number of different devices - from smartphones, tablets, laptops and computers, and it is also connected to social networks, which means that a huge amount of data is exchanged. By increasing the number of employees, applications and services, the amount of data also increases greatly. As the needs grow, so do the procurements that service the fragmented infrastructure are growing.

The Investments in ICT in public administration at the level of B&H institutions

We conducted a survey of investments in ICT at the level of B&H institutions, according to the Expenditure Schedule by budget users, which was published in the Official Gazette of B&H No. 42, based on publicly available data found on the institutions' websites.

As shown in Table 5. – The overview of the availability of publicly available data on investments in ICT for institutions that are on the B&H budget, we see that out of 75 institutions, 63 institutions have publicly available data for public procurement for ICT in 2022 or 84,00%. The 12 institutions have

no data or no website, i.e. 16.00%. Eight institutions have very little publicly available data, which are not complete but still exists. Three institutions do not have a website, or do not have a publicly available PP plan. It is graphically presented in Figure 9, where we see that the largest number of institutions at the B&H level have publicly available data on their websites.

According to publicly available data, after collecting data, sorting and grouping it into categories, we came to the results shown in Figure 10. – The Participation of individual items in procurement for ICT, 75 institutions which are on the B&H budget.

Table 5. The overview of the availability of publicly available data on investments in ICT for the B&H level

No.	Availability of publicly available data on ICT investments	Number of institutions
1	Data exist	55
2	Small amount of data	8
3	There is no data	9
4	Do not have Web page or PPP (public procurement plan)	3
Total number of institutions included in survey		**75**

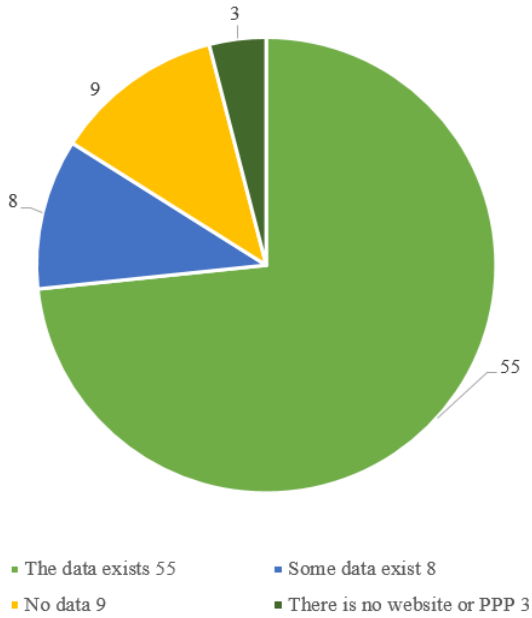

Figure 9. The institutions at the B&H level that have publicly available data and those that do not

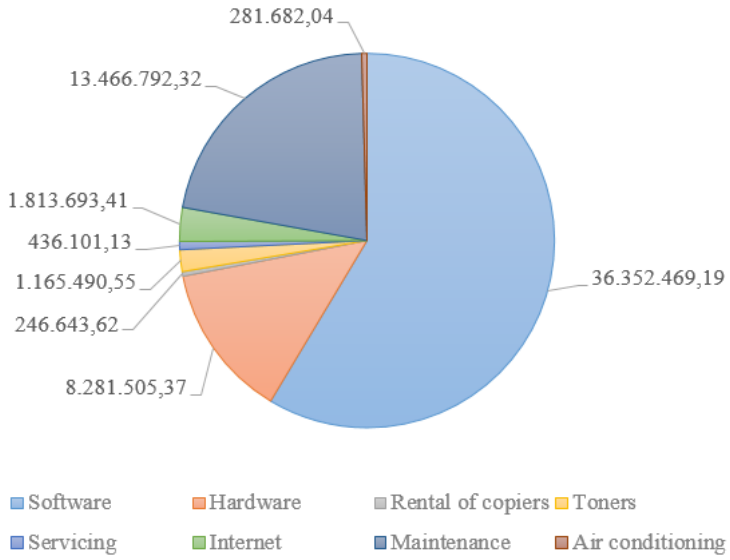

Figure 10. The participation of individual items in procurement for ICT, institutions which are on the B&H budget

And how it looks according to items and amounts can be seen in Table 6. – The overview by amounts and the total amount of investment in ICT for institutions of B&H.

Table 6. The overview by amounts and the total amount of investment in ICT for institutions of B&H

No.	Participation of individual items in procurement for ICT, institutions which are on the B&H budget	Amount (KM)
1	Software	36,352,469.19
2	Hardware	8,281,505.37
3	Rental of copiers	246,643.62
4	Toners	1,165,490.55
5	Servicing	436,101.13
6	Internet	1,813,693.41
7	Maintenance	13,466,792.32
8	Air conditioning	281,682.04
Total		**62,044,377.63**

The data are grouped into the above 8 categories, according to the principle of the most frequent occurrence in the data. For the purpose of grouping the data into categories, after consultation with the researchers, several related data were included in one category.

The total amount of the budget of B&H institutions is 1,073,600,000.00 KM and the allocation, according to publicly available data, for ICT at the level of B&H institutions is 62,044,377.63 KM or 5.78%.

From diagram number 9 and table number 6, it can be seen that the largest allocations are for software or percentage

58.59%, then for maintenance 21.71%, for hardware 13.35%, procurement of toner 1.88%, servicing 0.70 %, for air conditioners 0.45% and rental of copiers 0.40%.

For the sake of comparison, we took publicly available data for Brčko District. According to publicly available data, after collecting data, sorting and grouping it in the same way as with the institutions of B&H, we came to the following data, which are shown in Figure 11. – The Participation of individual items for the procurement of ICT in the budget of Brčko District.

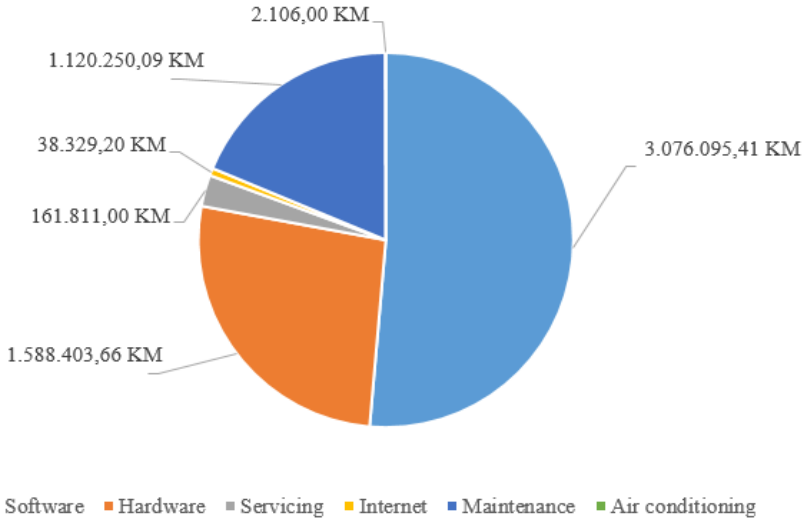

Figure 11. The participation of individual items in procurement for ICT, in budget of District Brčko

We did not find data for the purchase of copier rental and the purchase of toner, so they did not need to be displayed. From Table 7. - The overview of amounts for individual items and total allocation for ICT in the Brčko District, it can be seen that the largest allocations are for software or percentage 51.38%, for hardware 26.53%, maintenance 18.71%, for servicing 2.70% and air conditioners 0.04%.

Table 7. The overview of amounts for individual items and total allocation for ICT in Brčko District

No.	Participation of individual items in procurement for ICT, in budget of District Brčko	Amount (KM)
1	Software	3.076.095,41
2	Hardware	1.588.403,66
3	Servicing	161.811,00
4	Internet	38.329,20
5	Maintenance	1.120.250,09
6	Air Conditioning	2.106,00
Total		**5.986.995,37**

The total amount of the Brčko District budget is 261,163,267.00 KM and the allocation, according to publicly available data, for ICT for the Brčko District is 5,986,995.37 KM or 2.5%, as shown in Figure 12 - Allocation for ICT in the budget of Brčko District institutions.

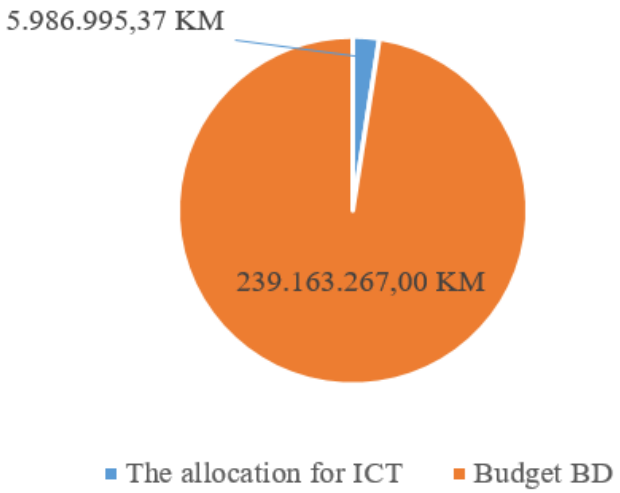

Figure 12. The allocation for ICT in the budget of Brčko District institutions

When we compare the number of fifty-five institutions at the level of B&H or 73.33% that have publicly available data to twenty institutions or 26.66% that have no data or have very little data, we can state that up to the size of 26.66% are increasing the funds allocated for ICT. In essence, this fact is important in this research from the point of view of spending funds for ICT, apropos, that there are available funds that we believe can be invested in the data center. We have also provided an example of approximate costs for the construction of a data center, and we conclude based on the research and facts that it is a worthwhile investment. There is also the fact that various types of ICT equipment were donated by various international organizations for the work of institutions of Bosnia and Herzegovina, but these data were not recorded, because public procurement was carried out by the organizations that allocated the equipment. Of course, the work of institutions requires both hardware - computers, and software - licenses, servicing, maintenance and other types of ICT equipment, and together with the data center, it all forms one functional unit.

In accordance with the conducted research and presented facts, we also proved the hypothesis number H3: In the set of institutions at the B&H level, from which data on investments in ICT were taken, investments were made in fragmented ICT infrastructure.

From the conducted research, we can conclude the following:

- That the mentioned categories are necessary for the work of all institutions, and that the allocation of funds is multiplied.
- That the largest allocations are for software, with that we mean that allocations for project tasks for new software, software, licenses and the like.
- That allocations for maintenance of software, hardware, networks, ICT infrastructure are very significant.
- Procurement of hardware is a necessity and the quality of work and the possibilities of public administration depend on it. We emphasize here that

the life of hardware obsolescence is getting shorter, and thus the need for its replacement is more frequent.

- Servicing is a service that requires specific knowledge and skills that must be in accordance with technologies.
- Based on the comparison of allocations for ICT at the level of institutions of B&H and Brčko District that the allocations are in line with the possibilities of the public administration level - bigger budgets, bigger possibilities.

What we highlight in particular are data for renting copiers and purchasing toner. We note that one of the purposes of digital transformation is to make these two categories disappear or be reduced to the smallest possible need.

The Example of good practice

According to the conducted research of good practices that work, we give an example of the Data Center of the Government of Serbia, called the State Center for Data Management and Storage - Data Center, which is located in Kragujevac and was put into operation in the middle of 2022, and it cost 30,000.000.00 euros. The facility of the State Data Center in Kragujevac covers a plot of four hectares and is a complex of two facilities with a total of 14,000 square meters. About 50 personnel from the fields of IT, mechanical engineering and energy take care of its work. In this center, a super computer that cost 2,000,000.00 euros, a national platform for artificial intelligence in Serbia, etc. was put into operation. All this opens up enormous opportunities in development. In addition to its purpose for state administration, the data center also has a commercial side, so that it can provide services for all interested clients, which greatly supports its profitability, sustainability and creates opportunities for further development and improvements independent of the budget. The data center in Kragujevac won contracts with Oracle and Huawei, which is an argument in favor of the profitability of the data center.

CONCLUSION

Where is the solution? And that is the third challenge of the Public Administration - based on the analyzes carried out and the facts presented, in our opinion the solution lies in a large data center of public administration, in the form of "big data" or "data leak", where public administration data would be collected on the institution servers, where, according to established procedures, rules and established approaches, access to a defined set of data through the service would be approved. This would ensure that institutions use certain sets of data for their needs and in accordance with the given rights, without possessing, store or maintain these data at all. In this way, data redundancy would be ensured, as well as the collection, storage and maintenance of personal and other data in one place. This solution represents a pragmatic, simple, safe, economical and organizationally acceptable approach, which, in all the mentioned aspects, enables the public administration to lower its costs and spend less budget funds. To conclude, the vision of the establishment and development of the data center, as well as its project task, should be broadly set so that the data center can develop and improve. Public administration, the economy, citizens, universities, scientific institutions, etc. benefit from this approach.

What would be the opposite of that - the current situation, where data collection is multiplying, the necessary infrastructure, hardware, security and a number of other factors for that, which when they get together according to the institution costs, give a set of funds that exceed the required funds on an annual level for the proposed solution.

Based on the conducted research and analysis, we come to the conclusion that investment in ICT of each individual institution or organization exceeds its capabilities, if it achieves this, with great efforts, investments and enthusiasm of employees, the same resources are not able to be used by other institutions or organizations. Institutions with small budgets or organizations in this case remain on the margins, and are unable to follow the pace of

development. Multiple repetition of individual investment in ICT resources leads to repetition of the same costs and requirements for their maintenance and functioning.

Digitalization is transforming traditional business and opening up new opportunities to increase efficiency and revenue while providing better customer service. Digitalization affects many industries and changes the corporate landscape and the rules that apply (Milani, 2019). The digitalization of public administration institutions is successful to the extent that its smallest link is digitized and is able to adequately respond to the demands of citizens, business and public administration.

In work, it is important to adhere to standards, and one of the guidelines should be ten good reasons for Standardization (Institute for Standardization Bosnia and Herzegovina [IFSBH], 2020).

The solution that we believe would be the most acceptable is that for institutions at the B&H level: Perform the construction of a data center or data centers, which are designed and built according to the most modern standards; Consider the investments based on public-private partnership. As investments in infrastructure are extremely large and demanding, here we would recommend joint investments according to the best practices that have proven themselves in the IT world; Establish professional informal or formal bodies at the level of institutions of B&H that would deal with needs and investments in ICT; Support through investment funds in scientific research in this area.

In accordance with the facts obtained on the basis of the research carried out in this work, the public administration at the level of institutions of B&H should: Recognize the role and importance of IT personnel; Every institution recognizes both the jobs and the role of IT staff and includes them in its systematization of jobs; Special wage categories for IT positions are established through regulations or other acts and find a way to provide funds for education and training.

We believe that through these proposals, further development and improvement of the Public Administration in the direction of digitalization of public administration would be enabled, both to preserve and attract new IT personnel. The improvement of digital transformation is the connection of employees, business processes and new technologies. Digital business transformation is the process of leveraging digital technologies and support capabilities to create a powerful new digital business model. Through this approach, both employees and public administration are improved. Understanding how new technologies can improve business is also the creation of a starting point for the transformation of public administration. This approach aims to enable digitalization at every step, from small institutions to large institutions, and to realize interoperability in full capacity. Such an approach would enable the creation of a multitude of services for citizens as well as for the economy and the public administration itself, and accordingly enable further sustainable development.

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NOTE

During the research, the authors, in order to collect freely available data, accessed a number of 74 web addresses that are not individually listed here, but can be forwarded on request to anyone interested in the research.

Radojčić, V. & Cvetković, A.S. (2023). Development of new sensors and technologies for precision agriculture. *STED Journal*, *5*(1), 44-49.

DEVELOPMENT OF NEW SENSORS AND TECHNOLOGIES FOR PRECISION AGRICULTURE

Vesna Radojčić, Aleksandar Sandro Cvetković

University Sinergija, Raje Banjičića bb, 76300 Bijeljina, vradojcic@sinergija.edu.ba

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Corresponding Author:
Vesna Radojcic, University Sinergija, Raje Banjičića bb, 76300 Bijeljina, vradojcic@sinergija.edu.ba

ABSTRACT

Precision agriculture is becoming increasingly important in modern agriculture as it allows farmers to optimize production and increase yields. This includes the use of sensors and technologies to collect and analyze data on soil, crops, weather, and other relevant factors. However, existing technology still has limitations such as accuracy and coverage over large areas. In order to solve this, new sensors and technologies are being developed, especially those based on artificial intelligence and machine learning, which allow for greater accuracy in data collection. In addition, new technologies such as drones and satellite imagery are being used to map crops and optimize agricultural production. This paper analyzes some of the latest developments in precision agriculture, providing insight into the future development and application of this technology. This work is particularly relevant to farmers, researchers, and companies involved in the development of sensors and technologies for precision agriculture.

Keywords: Technology, sensors, machine learning, artificial intelligence, agriculture.

INTRODUCTION

With the rapid advancement of technology and the decreasing size of sensors, their use is now expanding into almost all areas of life. One such domain is agriculture, where sensors and their networks are effectively used to achieve numerous benefits (Rehman, Abbasi, Islam, & Shaikh, 2014). Precision agriculture or PA is a concept that involves the use of information technology to improve production and crop quality (Milićević, Zdravković, Jović, & Jagličić, 2022). One technology that plays an important role in this area is a wireless sensor network or WSN. This technology is used to collect and analyze data from agricultural fields, enabling more accurate and efficient monitoring of various factors such as pest and disease control, crop strength, and animal monitoring (Kumar, & Ilango, 2017). Using WSNs can improve crop productivity while maintaining high-quality standards. This paper explores the importance of sensors in precision agriculture and the critical role that WSN technologies play in remote monitoring in various agricultural applications. In addition, drones are being considered for crop observation as well as yield optimization management (Shaikh, Rasool, & Lone, 2022).

THE IMPORTANCE OF SENSORS AND TECHNOLOGY IN PRECISION AGRICULTURE

The term precision agriculture is known worldwide as a significant factor in the improvement of crop production technology. However, its practical application is limited to large farms. This state-of-the-art technology relies on an innovative systems approach and combines several core technologies such as Geographic Information System (GIS), Global Positioning System (GPS), computer modeling, ground/aerial/satellite remote sensing, variable speed technology, and advanced information processing. These elements facilitate timely crop management within and between seasons (Liaghat, & Balasundram, 2010).

Sensors and technologies play a key role in precision agriculture, as they enable more precise and efficient management of agricultural resources. By collecting and analyzing data on various factors such as soil moisture, temperature, and nutrient levels, sensors can provide valuable insights into crop health and growth. This information can then be used to optimize irrigation and fertilization schedules, reduce waste and increase crop yields.

In addition to sensors, other technologies such as drones, GPS systems, and machine learning algorithms are used in precision agriculture. Drones can provide high-resolution images of crops, enabling early detection of pest and disease infestations. GPS systems can be used to map fields and track equipment in real-time, optimizing resource use and reducing costs.

Machine learning algorithms can be trained on large data sets to predict crop yields and identify patterns that can be used to improve management practices. Overall, the importance of sensors and technologies in precision agriculture cannot be overstated. They enable farmers to make informed decisions, optimize resource use and ultimately increase profitability and sustainability.

Figure 1. Connection of GIS tools in precision agriculture (Digital Agro, 2022)

DEVELOPMENT OF NEW SENSORS FOR PRECISION AGRICULTURE

Precision agriculture has emerged as an innovative solution to solving current challenges in agriculture. Precision agricultural sensors are an important tool in modern agriculture because they allow farmers to collect data about their crops and livestock in an efficient way. These sensors help farmers monitor and improve the quality of their produce, and stay abreast of changes in the field and environment.

Intelligent agricultural sensors are used to identify animals, monitor their health and detect heat. This facilitates the isolation and treatment of sick animals, as well as the monitoring of the entire herd. Smart sensors can also be used to monitor crops and their effectiveness remotely, solve pest problems and protect crops from potential environmental risks. Overall, precision

agricultural sensors represent a very useful technology that can improve the quality of food production, save time and money for farmers, and at the same time contribute to the preservation of the environment.

Overview of current sensor technologies for precision agriculture

There are a variety of sensors currently in use in precision agriculture, each with its own advantages and limitations. One type of sensor commonly used in precision agriculture is the soil moisture sensor, which measures the amount of moisture in the soil. This information is used to determine when and how much to irrigate crops.

Other sensors used for soil analysis include pH sensors, nutrient sensors, and electrical conductivity sensors. Weather sensors are also important in precision agriculture as they provide information on temperature, humidity, wind speed, and precipitation. This data is used to optimize crop growth and reduce the risk of damage caused by extreme weather conditions.

Remote control technologies such as satellites and drones are also used in precision agriculture. They provide a bird's-eye view of fields and can be used to gather information on crop health, yield, and other important factors. In addition to these sensors, there are also specialized sensors for monitoring plant growth, detecting pests and diseases, and even monitoring the movement of livestock.

These sensors can provide valuable data that can be used to optimize crop yields, reduce the use of pesticides and other chemicals, and improve animal welfare. Overall, the use of sensor technologies in precision agriculture is rapidly evolving, and new sensors and technologies are constantly being developed and refined to meet the ever-changing needs of farmers and agricultural professionals. Some examples of these sensors are GPS sensors, agricultural temperature sensors, property monitoring, and accelerometer sensor (GeoPard Agriculture, 2022)

New sensors based on artificial intelligence and machine learning

The information technology of the agricultural sector is currently considered a problem to deal with the many difficulties that arise in this area. The development of efficient and more profitable agricultural systems and instruments is increasing rapidly with environmental monitoring and remote control in agriculture.

Wireless sensor technology based on artificial intelligence improves the efficient functioning of all sectors and solves the problems faced by many sectors in the agricultural industry, such as crop harvesting, irrigation, and soil content sensitivity. AI technology enables the diagnosis of plant diseases, pests, and malnutrition on farms, and AI sensors can monitor and control agricultural parameters (Murugamani et al., 2022). This cutting-edge technology, driven by machine learning (ML), enables machines to learn without explicit programming. ML, along with the Internet of Things (IoT)-enabled agricultural machinery, is a key component of the agricultural revolution.

One application of ML in precision agriculture is through computer vision to classify different crop images for crop quality monitoring and yield estimation. This approach can also be integrated for improved livestock production by predicting fertility patterns, diagnosing nutritional disorders, and monitoring animal behavior using ML models based on data collected by collar sensors.

Intelligent irrigation, such as drip irrigation, and intelligent harvesting techniques are also being developed and revised, significantly reducing the need for human labor. This technology offers great potential for improving agricultural efficiency and sustainability in the future. New products, practices, and new technologies are in demand in the agricultural industry. To meet these diverse needs, farmers must use precision agriculture.

Figure 2 (a) and (b) presents a pictorial representation of the farm management system enabled by traditional agriculture and technology.

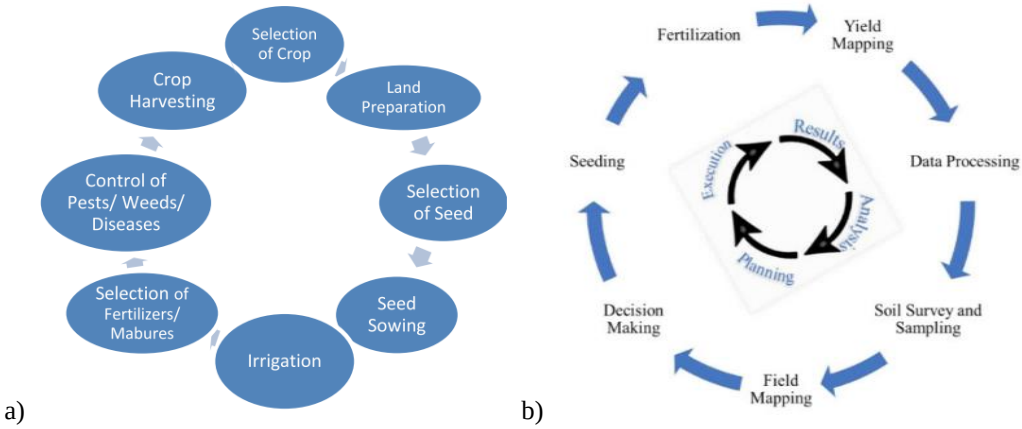

Figure 2. (a) Traditional agricultural cycle, (b) Precision agriculture cycle (Sharma, Jain, Gupta, & Chowdary, 2020)

USE OF DRONES AND SATELLITE IMAGES FOR OPTIMIZATION OF AGRICULTURAL PRODUCTION

In recent years, smart sensors, big data and machine learning, non-invasive technologies, and information technologies have been combined to derive reliable plant physiological parameters with increasing throughput for precision agriculture (Qiao, Valente, Zhang, Su, & He, 2022). Recently, drones have been increasingly used in agriculture. Drones, equipped with various cameras and sensors, can be used for terrain mapping, nutrition monitoring, plant health monitoring, detection of harmful organisms, and localized application of biological plant protection agents.

Satellite and drone data offer a new perspective on previously overlooked fields - a bird's eye view. This unique aspect of precision agriculture allows farmers to identify problems that were once difficult to detect. Drones and satellites can provide valuable information about crop pests and diseases, nutritional status, yield forecasting, and more.

The process of working with a drone involves collecting data, usually through multispectral imaging fields, although RGB images are increasingly used. The next step is to process the data using specialized software such as Pix4dFields, which can be done in the field without an internet connection. This creates the basis for more detailed vegetation indices.

After the data has been recorded and processed, the next step is to generate and interpret the index. This includes clearly marking the edge areas to be cultivated and identifying areas that are subject to flooding, erosion, or other features such as ground elevation. Multispectral images can reveal irregularities such as pests, diseases, or nutrient deficiencies, which enables the planning of further activities based on multispectral analysis.

Application maps can be created to apply irrigation resources or techniques precisely to marked areas of fields with water or nutrient deficiencies. In the end, the created application maps are performed by inputting them into a machine equipped for precision agriculture, such as a tractor with GPS guidance and a console, or an agricultural drone like the AGRAS T30, designed specifically for precision agriculture. Figure 3 shows the use of drones in precision agriculture (Elashmawy & Uysal, 2023).

Figure 3. Use of drones in precision agriculture (Sela, 2022)

CONCLUSION

In the world of big data, where sensor networks have become ubiquitous, artificial intelligence (AI) and machine learning (ML) are creating significant opportunities in multidisciplinary fields such as healthcare, financial services, and precision agriculture. In conclusion, precision agriculture is a rapidly developing field that relies heavily on advances in sensors and technology. Wireless sensor networks, drones, GPS systems, and machine learning algorithms play a key role in collecting and analyzing data on various factors such as soil moisture, temperature, and nutrient levels to optimize crop management.

Despite existing sensor technologies, precision agriculture still faces limitations in terms of accuracy and coverage of large areas. In order to solve this, new sensors based on artificial intelligence and machine learning are being developed, which enable greater precision in data collection. In addition, drones and satellite imagery are used to map crops and optimize agricultural production. Overall, precision agriculture provides numerous benefits, including increased crop productivity, reduced resource wastage, and increased profitability and sustainability. The continuous development and improvement of sensors and technologies in precision agriculture are of crucial importance to meet the ever-changing needs of farmers and agricultural experts.

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CLIMATE VARIABILITY AND CHANGE IMPACTS ON VEHICULAR FUEL CONSUMPTION AND EMISSIONS – A SYSTEMATIC OVERVIEW IN AFRICA

Janet Appiah Osei[1], Rabani Adamou[1], Amos T. Kabo-Bah[2], Satyanarayana Narra[3,4]

[1]WASCAL Climate Change and Energy, Abdou Moumouni University, Niamey, Niger, janetoseiappiah@gmail.com
[2]University of Energy and Natural Resources, Sunyani, Ghana
[3] Department of Waste and Resource Management, University of Rostock, Rostock, Germany
[4] Coordinator for Bioeconomy, German Biomass research center, Leipzig, Germany

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Corresponding Author:
Janet Appiah Osei, WASCAL Climate Change and Energy, Abou Moumouni University, Niamey, Niger, janetoseiappiah@gmail.com

ABSTRACT

Increasing energy demand has become a major issue of concern globally. Addressing the issue requires the sustainable development of the transportation sector of every nation. Sustainable transport system will meet basic and developmental needs while ensuring equity within and between generations. Fuel consumption and emissions are key issues of importance when considering the sustainability of road transportation. In order to actualize the SDGs, overarching factors impacting on transport vehicle fuel consumption and emissions should not be compromised. Weather being one of such factors is understudied especially in Africa based on the authors knowledge from literature. Consequently, the review accentuates on how weather parameters affect fuel consumption and emissions throwing more light on similar studies that have already been conducted to facilitate replicability in Africa. 'Google scholar and Scopus' were used to obtain relevant literature database from 2000-2022. In total, 111 articles were systematically reviewed, out of which 41 were from Europe, 38 from America, 23 from Asia and 7 from Africa. Among the weather parameters reviewed, temperature was the most pronounced with percentage share of 46 % followed by air pressure 16%, precipitation 15%, humidity 12%, wind 11%. All the weather factors strongly impacted on vehicular fuel consumption and its concomitant greenhouse gases emissions based on the results depicted by the review. Climate variability and change is detrimental to fuel consumption and emissions and should not be overemphasized when making road transport policies and decisions.

Keywords: climate change, fuel consumption, road transport, simulation tools, vehicular emissions.

INTRODUCTION

Fuel consumption is of major concern to passenger car users due to the volatile fuel prices and thus, information on their consumption rates will play substantive role in policy design and evaluation (Huo, He, Wang, & Yao, 2012; Predić, Madić,

Roganović, Karabašević, & Stanujkić, 2018). Fuel consumption and emissions are strongly correlated - the concentration of carbon dioxide emitted is proportionate to the quantity of fuel consumed for a trip (Kopfer Schönberger, & Kopfer, 2014). It is a significant cost element in vehicle operation and represent about 50% of transport cost per production unit (Ivković Kaplanović, & Milovanović, 2017) hence, estimating vehicle fuel consumption serves as the basis for enhancing energy savings and cost as well as reducing negative environmental effects caused by fuel combustion (Predić et al., 2018). Minimizing fuel consumption is beneficial to emission reduction programs (Parajuli, 2005) and the introduction of fuel consumption rate regulations will curb vehicular greenhouse gas (GHG) emissions (Zhao, Liu, Lui, & Hao, 2019). In four of the biggest automobile markets - United States of America (USA); European Union (EU); China and Japan, governments have created and implemented fuel economy regulations to tackle fuel consumption in order to reduce greenhouse gases (Mbandi et al., 2019).

Estimation of vehicle fuel consumption in practice is complex due to the numerous variables that affect their outcome. Recently, machine learning approaches have been used to estimate the fuel consumption of vehicles. Artificial Neural Networks (ANN), Support Vector Machine (SVM), and Random Forests (RF) are powerful machine learning tools for regression analysis. Most proposed mathematical models consider diverse parameters from different categories like vehicle type, vehicle engine, roadway, weather, traffic and driver related factors. Artificial Neural Networks (ANNs) are mostly applied by researchers for modeling these interrelated variables during fuel consumption estimation. ANNs are computational models that are inspired by human brain functionalities. The model consists of simple processing elements called neurons that operate in parallel and capable of obtaining, keeping and using experiential knowledge that exceeds the possibilities of most conventional modelling methods (Predić et al., 2018; Perrotta, Parry, Neves, & Mesgarpour, 2018; Sun, Chen, Dubey, & Pugliese, 2021). It is able to capture relationships and model phenomena which are likely to be difficult or impossible to explain (Zhu, Gonder, Bjärkvik, Pourabdollah, & Lindenberg, 2019; Zhao et al., 2019). SVM is a biased classifier technique for machine learning with the capacity to regulate decision function. An extension of this technique is Support vector regression (SVR) which is commonly used as an alternative to traditional linear/non-linear regression models. Random Forest depends on decision tree concept normally used for classification. The outcome of this technique relies on the prediction of the decision trees, hence adding more trees can improve the model's accuracy (Mbandi et al., 2019; Predić et al., 2018; Perrotta et al., 2018; Katreddi, & Thiruvengadam, 2021).

Obtaining reliable data on real-world fuel consumption and emissions of on-road vehicles are very complicated. Vehicles do not record fuel consumption volume unlike vehicle kilometer per time which is read from odometers. This creates difficulties in obtaining on-road vehicular fuel consumption rates (Huo et al., 2012). According to Dror, Qin, & An (2019), on-board emissions measurements; tracing measurements; dynamometer and bench testing; tunnel tests and remote sensing are the five major methods normally used in calculating fuel consumption and CO_2 emission factors from passenger vehicles. The most pronounced methods in literature are: on-board emissions measurement, dynamometer testing and remote sensing. Dynamometer testing uses standardized driving cycles in a regulated environment to measure vehicles emissions. The driving cycle consists of a distinctive profile of stops, starts, steady-speed cruises, accelerations and decelerations and is typically distinguished by a total time-weighted average speed (Frey, Unal, Rouphail, & Colyar, 2003). Two different dynamometer types are normally employed to measure fuel consumption – chassis dynamometer and engine dynamometer. In chassis dynamometer testing, lots of variables can be held constant allowing high experimental repetition and control whilst engine dynamometer is applicable in

regulations and does not account for transmission efficiency and air conditioning (Mills, 2019). Remote sensing approach utilizes absorption spectroscopy to evaluate exhaust pollutants of test vehicles by placing an optical instrument at an appropriate roadside (Borken-Kleefeld, 2014). They are capable of measuring emissions from large number of vehicles and are also cost effective making them more desirable relative to the other techniques (Cadle, Gorse, Bailey, & Lawson, 2003). The major drawback in this technique is that, it exclusively provides an immediate estimate of emissions at a particular site (Frey, Unal, Rouphail, & Colyar, 2002). Vehicles equipped with on-board instruments enable for data collection under real-world settings at any weather conditions and location that is traveled (Frey et al., 2003). This technique makes predictions about when exhaust emissions are likely to exceed norms using emission control parameters and engine monitoring rather than taking a direct measurement of them (Faah, 2008). On-board measurement is not widely utilized because is expensive and thus, focus on small number of vehicles (Frey et al., 2002). Inter alia, current smartphones have inbuilt sensors that are capable of measuring the position of vehicles, speed, acceleration and altitude. Kanarachos, Mathew, & Fitzpatrick (2019), successfully estimated vehicle instantaneous fuel consumption using smartphone measurements which was processed by the use of Recurrent Neural Networks (RNNs).

According to Lois et al. (Lois, Wang, Boggio-Marzet, & Monzon, 2019), fuel consumption/emission depends not solely on traffic, driving and road conditions but also on weather conditions. Weather conditions influence fuel consumption by impacting on driving patterns and the rolling and aerodynamic resistances (Predić et al., 2018). Evaluation of fuel consumption and GHG emissions under varying weather conditions is very crucial in quantifying energy cost and air pollution caused by road transport (Hien, & Kor, 2022) and also for enhancing efficient development of short, medium and long-term transportation planning policies (Mehrotra et al., 2011). Data on fuel consumption can serve as a blue print to modify government subsidies to attain energy efficiency goal in vehicles (Ehsani, Ahmadi, & Fadai, 2016). There are adequate data on road transport impact on climate change but minimal attention is given to the reverse case. Most of the studies conducted on climate and weather-related impacts on road transport focus on the physical impacts like road infrastructure (Gelete, & Gokcekus, 2018). From the authors experience and research, there is no review paper emphasizing on the area of 'climate impacts on vehicular fuel consumption and emissions' in Africa and previous reviews conducted in other continents have focused extensively on other related factors (excluding climate) affecting fuel consumption and emissions. Few available review papers have integrated climate factors; hence this review will accentuate exclusively on weather parameters impact on fuel consumption and emissions to broaden and augment knowledge and understanding in this area whilst concurrently serving as the premier review paper from Africa**.** The main objective is to review the impacts of weather factors on fuel consumption and emissions and the various approaches used to ascertain the impacts. The review is structured into four parts: Part 2 highlights the search methodology and literature database. Part 3 elucidates the approaches and findings of weather parameters (temperature, humidity, precipitation, wind and air pressure) effects on vehicle fuel consumption and emissions as well as various simulation models utilize in estimating vehicle fuel consumption and emissions. Conclusions and recommendations are provided in part 4.

METHODOLOGY

Search methodology

A systematic search for relevant literature database was conducted using online database (Scopus and google scholar). Boolean search using keywords and phrases were utilized to navigate via scientific search engines. Keywords and phrases used were *road transport systems*, *climate and road transport*, *climate modelling/simulations*, *fuel consumption modelling tools*, *emissions*

modeling/simulation tools, vehicle fuel consumptions, vehicular emissions, real-world vehicle fuel and emissions estimations, laboratory vehicle fuel and emissions estimations, fuel consumption measuring tools, vehicle emissions measuring tools, factors affecting fuel consumption, influence of weather factors on fuel consumption, weather impacts on vehicle emissions. Related articles from regional, country and global level were included in the database to get a broader overview. The articles were systematically reviewed and the database was structured using pre-determined list in (table 1) to compile meta-data. The method considered all pertinent articles from 2000-2022. In total, 111 articles published between 2000-2022 were reviewed and added to the database. Figure 1 illustrates how the 111 articles were selected and figure 2 depicts the number of articles reviewed per publication year.

Table 1. List of meta-data for systematic review

Item	Definition
Title	Title of the document being reviewed
Objective	Study objective
Methodology	Approach used to attain the study objective
Weather parameters	Temperature, humidity, precipitation, wind and air pressure
Keys notes/summary	Study findings
Authors	Author (s) of the study
Continent/country	Continent / country of study
Journal type	Name of journal
Document type	Research article, review paper, conference proceedings etc.

Literature database

The methodology applied and findings of the selected 111 papers were taken into consideration. Key information on temperature, precipitation, humidity, wind and altitude (air pressure) effects on fuel consumption and emissions of gasoline and diesel vehicles; approaches employed for the evaluations and their gaps which identified areas for further studies were reported. Some obtained information on electric and hybrid vehicles and various modelling tools used for ascertaining fuel consumption and emissions were included in the database.

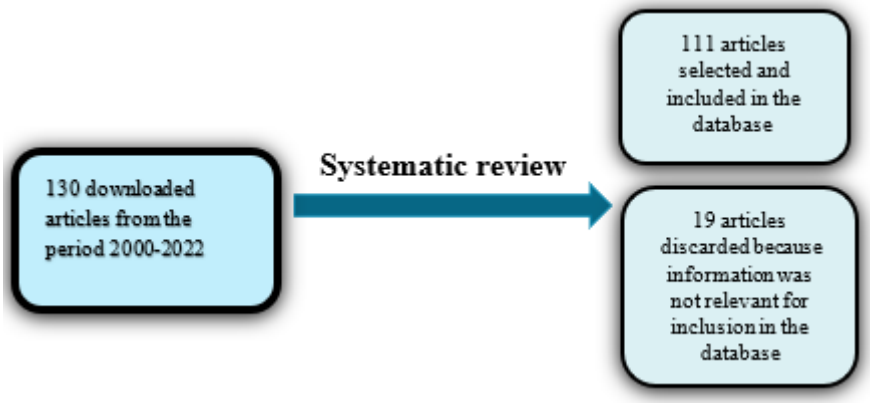

Figure 1. Flow chart depicting article selection process

RESULTS AND DISCUSSION

Database creation

The study location of most of these reviewed papers were in Europe and America. Out of the 111 papers that were reviewed; 41 were from Europe, 38 from America, 23 from Asia, 7 from Africa and 2 from Australia. Per country level, most of the papers selected were from USA (29), China (15), United Kingdom (6) and Canada (6). Full list of countries is in appendix figure a1. Temperature was the most pronounced factor in this review with a percentage share of 46% followed by air pressure/altitude 16%, precipitation 15%, humidity 12% and wind 11%. The number of reviewed weather variables (temperature, precipitation, air pressure, wind and humidity) per continent is provided in figure 3.

Articles retrieved were published in 49 journals with most of the publications from Transportation Research Part D: Transport and Environment (13), Energies (10) and Sustainability (5). Complete list of journals is shown in appendix table. a1. Majority of the retrieved published documents were research articles (84) whilst the remaining were conference proceedings (9), thesis (5), review papers (4), assessment reports (4), technical papers (4) and workshop paper (1).

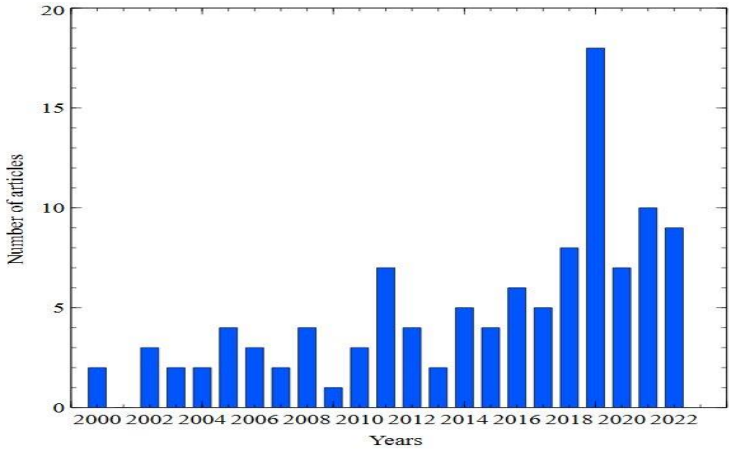

Figure 2. Number of articles reviewed per year

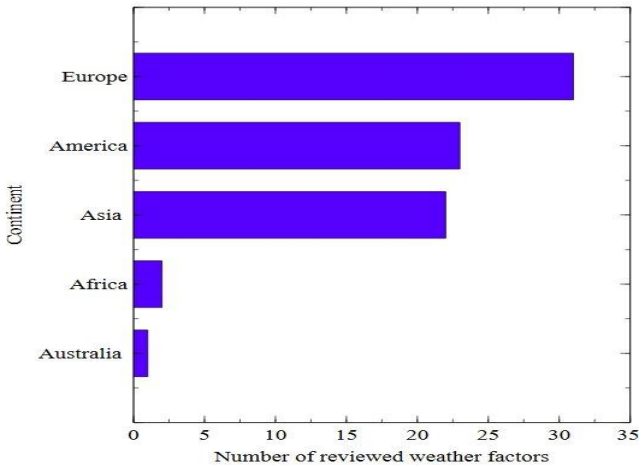

Figure 3. Weather variables reviewed per continent

Climate factors affecting vehicle fuel consumption and emissions

According to Zhou, Jin, & Wang (2016), the major factors influencing fuel consumption and emissions are weather/climate, vehicle type, road type, traffic, travel and driver related conditions. They described the travel factors as distance and trips made within a specific period; the vehicle factors as the speed and acceleration of the vehicle, engine type and driver factors as the driver's behavior and aggression determined by the acceleration and speed profiles. Faah (2008), also asserted vehicle technology, pavement conditions, weather and road conditions as parameters that affect fuel consumption and emissions. Amongst these factors, climate and weather conditions are given less attention globally. Handful researches have been conducted in this area with most of these few studies relying solely on expert opinions **(**Mansur, Mendelsohn, & Morrison, 2008). According to Gelete & Gokcekus (2018), road transport activities and climate change are distinctively connected – "one is the cause and the other is the effect and vice versa". Climate change has acute (through extreme events) and chronic (through gradual change) impacts on road transport. Aside its direct impact, climate change can indirectly affect road transportation by causing disruption in the electric power sector which is strongly interconnected with transport. Electric power is the main contributor to traffic signals and gasoline pumps operations and so on thus, interruption in these transport components ultimately leads to increased congestions, inadequate availability of fuel etc. Electricity also serves as a vital source of power for electric vehicles (EVs) (Markolf, Hoehne, Fraser, Chester, & Underwood, 2019). The number of EVs globally has increased from virtually zero to more than 16 million in 2021 with majority being battery EVs (Dioha, Lukuyu, Virgüez, & Caldeira, 2022). Electric vehicles are prominent in places like China (45%), Europe (24%) and USA (22%). In Africa, countries like South Africa had 5000 electric vehicles in use as of 2020, Mauritius had 17000 as of 2021 and Ghana imported 5,400 between 2017-2020 with majority being plug-in hybrid-electric vehicles (PHEV). Currently Mauritius is leading the African continent in terms of the importation of electric vehicles (Ayetor, Opoku, Sekyere, Agyei-Agyeman, & Deyegbe, 2022; Montmasson-Clair, Dane, & Moshikaro, 2020). With the increasing prevalence of electric vehicles, interconnection between transport and electricity will continually upsurge. Consequently, outages in electric power induced by climate change will augment vulnerability in the transport system (Markolf et al., 2019). Road transport systems are sensitive to the variations in weather factors hence, varying weather conditions will affect fuel efficiency because just a small change in weather parameters can have substantial impacts on fuel consumption (Wang et al., 2019; Jeon, 2019). Weather parameters - temperature, precipitation, humidity, wind, air pressure strongly affect fuel consumption and pollutant emissions in on-road vehicles (Choi, Beardsley, Brzezinski, Koupal, & Warila, 2010). These factors play independent roles in influencing fuel consumption and emissions (Wu et al., 2020). Intuitively, fuel efficiency is one of the channels that is both directly and indirectly affected by weather conditions (Jeon, 2019).

Temperature effects

Temperature affects drivers' behavior and causes changes in speed and acceleration of vehicles which alter fuel consumption and emissions (Ehsani et al., 2016). It also affects the car tires' resistance and necessitates usage of auxiliary loads like air conditions and fans in hot seasons and heater and seat heating components in cold seasons which ultimately increase fuel consumption and thus emissions (Nouri, & Morency, 2015). The utilization of heating, ventilation and air conditioning (HVAC) significantly affect vehicle efficiency (Yuksel, Tamayao, Hendrickson, Azevedo, & Michalek, 2016). They add extra loads to the engine causing it to consume more fuel during operation (Zöldy, & Zsombók, 2018). Weilenmann, Vasic, Stettler, & Novak (2005), studied the effects of air conditioning operation on fuel consumption and emissions of passenger

vehicles. Findings revealed rise in emissions and fuel consumption when air condition (a/c) was on. According to the study of Nouri, & Morency (2015), temperature affected emissions in two states - cold start and hot running. They recorded high emissions with increasing low temperatures (-10, -20, -30, -40ºC) and high temperatures (0, 10, 20, 30ºC). They attributed their results to long warm-up of engines due to cold temperatures and use of air conditions at high temperatures (Nouri, & Morency, 2015). The study by Carlson, Wishart, & Stutenberg (2016), determined the impact of temperature on auxiliary loads and fuel consumption using on-road and laboratory measurement. On-road measurements were conducted by instrumenting vehicles with voltage and current detectors together with Controller Area Network (CAN) message tracking devices and On-board Data Acquisition (DAQ) equipment to record the voltage, current and CAN signals whilst the laboratory measurements were undertaken by the chassis dynamometer. High and low temperatures had greater impacts on auxiliary loads due to the use of air conditioners and heating systems in hot and cold temperatures respectively and hence, higher fuel consumption. Li, Li, Miwa, & Morikawa (2019), estimated driver's daily fuel consumption using CAN data obtained from private cars in Toyota city. The study defined the days with temperatures less than 10ºC as (cold days), higher than 25ºC as (hot days) and the remaining days as (comfortable). Fuel consumption increased significantly in the cold and hot days comparatively to the comfortable days due to the usage of air conditioners and heating devices during the hot and cold days respectively. Savostin-Kosiak et al. (2020), discovered high fuel consumption at high temperatures during their experimental analysis using Physical Emissions Rate Estimator (PERE) mathematical model to establish the relationship between ambient temperatures (-15ºC to 30ºC) and fuel consumption of diesel buses. They attributed the findings to two factors- fuel evaporation increase which affected the fuel combustion efficiency and air conditioning use during the hot temperatures. US Environmental Protection Agency (EPA) analysis on vehicles fuel economy depicted a reduction in the country's fuel economy by approximately 5-25% due to operating air conditioners during hot temperatures (Jeon, 2019). Choi, et al. (2010), estimated on-road vehicles emissions in conventional fuel vehicles utilizing Motor Vehicle Emission Simulator (MOVES) 2010 model. The model was run by keeping all other parameters constant except temperature. The percentage changes in emissions were calculated using 75 degrees as the base temperature. Emissions increased at temperatures below and above the base temperature. The effect of temperatures from start emissions resulted in increased emissions at temperatures below 75 degrees whilst the high emissions recorded at temperatures above 75 degrees were due to the operations of air conditions. The increase in emissions were more significant in gasoline vehicles compared to diesel vehicles. Giechaskiel, Komnos, & Fontaras (2021), evaluated the impacts of extreme ambient temperatures (ranging from -30 to 50ºC) on Euro 6d – Temp gasoline vehicle's carbon dioxide (CO_2) emissions. Energy consumption from the operation of air conditioning systems had significant impacts on the emissions after simulation using Carbon dioxide Model for Passenger And commercial vehicles Simulation (CO_2MPAS). With 23ºC as base temperature, there was 10% and 30% significant increases in CO_2 emissions at 35ºC and 45ºC respectively due to the use of air conditions. At low temperatures, there was (5 to 20%) rise in emissions at -25ºC primarily as a result of the maximum contributions of cold-start. Jeon (2019), used simple log-linear specification model to estimate weather impacts on gasoline fuel consumption. Results revealed an increase in gasoline consumption in hot days but statistically insignificant impact during cold days. The simulated climate change effects on fuel consumption depicted 4% increase in fuel consumption under "business-as-usual" Representative Concentration Pathways (RCPs) 8.5 scenario. The study findings of (Keramydas et al., 2018), revealed an

increase in fuel consumption in summer months over winter due to the increase usage of a/c loads.

There is decrease in fuel economy at cold temperatures mainly as a result of engine and transmission friction and other technical factors (Jeon, 2019). According to a 2019 report by the US Energy Department, the fuel economy of gasoline vehicle at 20ºF is 15% lower than it would be at 77ºF. For hybrids and electric vehicles, the fuel economy can reduce at about 30% and 39% respectively considering the same temperatures. Low temperatures increase air density and aerodynamic resistance whilst high temperatures decrease aerodynamic resistance (Zacharof et al., 2016). Force of resistance depends on air density. Warm air has lesser density than cold air and hence, higher resistance in cold temperatures than hot temperatures. Resistance force at -10ºC is about 12% greater than 20ºC. The variations in air density between high and low temperatures account for relatively higher fuel consumption in cold temperatures compared to hot temperatures (Savostin-Kosiak et al., 2020). Rahimi-Gorji et al. (Rahimi-Gorji, Ghajar, Kakaee, & Domiri Ganji, 2017) also posited that the lower densities of high temperatures reduce fuel volumetric efficiency which in turn decrease fuel consumption. According to Lujan et al. (Lujan, Climent, Ruiz-Rosales, & Moratal 2019), fuel consumption and emissions are very critical under low temperatures as a result of combustion instabilities. Also, engine and catalyst require more time to warm up at lower temperatures resulting in increased rate of emissions (Suarez-Bertoa et al., 2017; Nouri, & Morency, 2015). Li et al. (2005), analyzed the impact of ambient temperature (-2ºC and 31ºC) on exhaust thermal emissions employing engine dynamometer test. They reported increase in fuel consumption at cold winter temperature (-2ºC) and attributed it to the rise in mechanical frictions, extra over-fueling and higher heat losses which occurred at the cold temperatures. The study by Payri et al. (Payri, Martin, Jose Arnau, & Artham, 2022) analyzed temperature (20ºC, -7ºC) impacts on energy balance during Worldwide harmonized Light vehicles test Cycles (WLTC) by experimental measurements and simulations. When ambient temperature was reduced from 20ºC to -7ºC, the brake performance decreased by 1% and fuel consumption increased by 4% due to higher friction caused by greater oil viscosity. Komnos et al. (Komnos, Tsiakmakis, Pavlovic, Ntziachristos, & Fontaras, 2022) reported higher fuel consumption at cold temperatures comparative to warm temperatures after simulating the impacts of real-world factors- ambient temperatures (-10 to 40ºC) on fuel consumption of European passenger car fleets using Passenger car fleet emissions simulator (PyCSIS) simulation tool. Ambient temperature has substantive effects on exhaust and evaporative emissions - cold start emissions surge due to the longer time vehicles' engines take to warm up at cold temperatures. A 1ºF increase in ambient temperature will cause a reduction of 1.3% in CO and 2.8% in HC emissions (Abo-Qudais, & Qdais, 2005). Bielaczyc, Szczotka, & Woodburn, (2011) reported significant extra carbon monoxide (CO) and hydrocarbon (HC) emissions over New European Driving Cycle (NEDC) at cold-start temperature (-7ºC) compared to temperature at 24ºC in spark ignition (SI) vehicles. Dardiotis, Martini, Marotta, & Manfredi (2013), determined fuel consumption and emission of gasoline and diesel vehicles over NEDC at 22ºC and -7ºC test temperatures. CO and HC emissions increased remarkably at the low temperature (-7ºC) comparative to 22ºC. Weilenman et al. (2009) examined the impact of temperatures (23, -7 and -20ºC) on cold-start emissions of diesel/ petrol cars using a developed cold start extra emissions (CSEE) model. Cold-start additional fuel consumption was (0.18, 0.13 and 0.039 liters/start) for temperatures (-20, -7 and 23ºC) respectively. CSEE of HC and CO at -20ºC were 35 and 15 times greater than at 23ºC. CSEE of gasoline cars were significantly higher than in diesel cars. Li et al. (Li, Andrews, & Savvidis, 2010) determined the effects of cold-start and ambient temperatures (7ºC, 10ºC, 21ºC, 26ºC, 30ºC) on real-world fuel consumption/ emissions using Maxim (MAX) 710 fuel flow

measurement system and Fourier Transform Infrared (FTIR) spectrometer for fuel and emission measurement respectively. Fuel consumption was higher at lower ambient temperatures compared to high temperatures and hence, higher emissions of CO_2 and methane (CH_4) except nitrous oxide (N_2O) which was not affected by ambient temperatures because of absence of cold start peaks. Ammonia (NH_3) and nitrogen oxides (NOx) emissions from light-duty conventional vehicles were quantified using Portable Emissions Measurement System (PEMS) during real on-road driving under ambient temperatures (-7ºC and 23ºC). From their results, NOx and NH_3 emissions were greater when vehicles were examined at -7ºC and 23ºC respectively (Suarez-Bertoa et al., 2017). Lujan et al. (2019), after determining the effects of ambient temperatures (-7ºC and 20ºC) on pollutant emissions under WLTC and NEDC driving cycle reported increase in CO, HC and NO_x emissions at -7ºC temperature. Under the NEDC driving, -7ºC temperature led to 270%, 125% and 250% increase in (HC, CO and NOx) respectively with an observed 10% rise in fuel consumption. Joumard et al. (2006), reported decrease in exhaust emissions (CO, HC, NO_X and CO_2) with increasing temperature (10-20ºC) for petrol and diesel cars with maximum impacts on diesel cars during laboratory testing using chassis dynamometer.

Wu et al. (2020), employed Real-world Fuel Consumption Rate (RFCR) model data to determine light-duty vehicles' fuel consumption in different cities in China. They reported variations in temperature across different regions as the main cause of regional variability in fuel consumption in China. Lower temperature increased the period needed for internal combustion engine to attain its optimal state and thus high fuel consumption. Predić et al. (2018), used ANN model to determine the relationships between independent factors (city location, day time, week day) and passenger car fuel consumption during summer and winter periods. Findings showed that during summer periods, fuel consumption rose in the late afternoon hours mainly because of high rate of traffic delays and congestions but during the winter periods, fuel consumption was greater in the morning hours due to the longer period taken to pre-heat the engine as a result of low ambient temperatures. The study by Ehsani et al. (2016), used mechanistic model to ascertain vehicular fuel consumption. Temperature was categorized into cold region (T<67°F), warm region (T>87°F) and Federal Test Procedure (FTP) region (68°F<T<86°F) taken as the moderate temperature region. Cold and warm temperature regions caused 5.57% and 1.71% rise in fuel consumption respectively. Mbelle, Paune, Youmene, Tambere, & Talla, (2020), used Matrix laboratory (MATLAB)/ Simulink to simulate vehicular fuel consumption with respect to ambient temperatures (-15, 30, 45ºC). Every 15% drop in temperature resulted in 0.04 liters increase in fuel consumption. Yusuf and Inambao (2019), investigated the effects of changing ambient temperature on the cold start emissive behavior of gasoline direct injection (GDI) and port fuel injection (PFI) cars. Decreasing temperature from +30ºC to -7ºC resulted in a ten-fold rise in vehicle emissions. Fuel consumption also increased as temperatures dropped, and was more significant in PFI cars compared to GDI cars. In terms of emissions, GDI emitted more particulate matter compared to PFI cars.

Temperature has a significant impact on electric vehicles because it greatly affects battery capacity (Zacharof et al., 2016). Battery efficiency is significantly impacted by using 'heating, ventilation and air conditioning' (HVAC). Battery electric vehicles are estimated to expend 15% more energy in hot and cold areas in USA due to the use of HVAC (Yuksel et al., 2016). Lohse-Busch et al. (2013), determined the impact of ambient temperatures (20°F, 72°F and 95°F) on energy consumption of plug-in hybrid electric vehicle (PHEV) and battery electric vehicles (BEV). Energy consumption rise at 20°F in comparison with 72°F ranged from 2% to 100% whilst energy consumption increases at 95°F ranged from 2% to 70% due to additional energy needed to operate the air conditioning system to keep the cabin at 72°F. Aside the use of HVAC, cold temperatures have relatively strong impacts

on battery energy performance compared to hot temperatures. Christenson, Loiselle, Karman, & Graham (2007), experimentally determined fuel consumption and emissions in gasoline-electric hybrid vehicle and a conventional gasoline vehicle under ambient temperatures (20ºC and -18ºC) using chassis dynamometer. The cold temperature (-18ºC) resulted in increased fuel consumption in all the test vehicles with greater impacts in the hybrid vehicle comparative to the conventional vehicle. Tulpule, Marano, & Rizzoni (2011), developed a vehicle model by using validated models of individual components to determine the correlation between PHEV energy performance and weather conditions. Increasing temperatures from -25 to 50ºC resulted in 23% reduction of air density which caused 5% and 10% decreased in vehicle energy demand in terms of urban and highway driving respectively. An experimental investigation using chassis dynamometer was carried out by (Alvarez, & Weilenmann, 2012) to determine the impact of ambient temperatures (23ºC, 8ºC and -7ºC) on the amount of fuel consumed and pollutants emitted by hybrid electric vehicles (HEV). The lower temperatures affected the operating efficiency of the hybrid system battery used in the hybrid electric vehicles' powertrain and thus, resulted in increased fuel consumption and cold start extra emissions. Zahabi et al. (Zahabi, Miranda-Moreno, Barla, & Vincent, 2014) employed Random-Effect Log-linear Regression Modeling (RELRM) method to determine the relationship between real world conditions and fuel economy. They discovered low temperatures (below 0ºC) during winter in Quebec cities in Canada to be detrimental to vehicle fuel economy. The fuel efficiency in wintertime dropped by 20% comparative to summertime. Increase in 10% average ambient temperature resulted in 0.3% reduction in fuel consumption rate of HEV. Laurikko and Pellikka (2010), also reported high fuel consumption in electric vehicles at low ambient temperatures under Nordic driving conditions. Jung and Li (2018), characterized emissions from PHEV under cold temperatures (-7ºC ~ -0ºC) during real world driving. High rate of NO_X emissions was recorded at the tested cold temperatures.

Table 2. Some key approaches for evaluating temperature effects on fuel consumption and emissions

Key method	Study objective	Gap	Reference
Simulation program was built using MATLAB software. Eight different road types and sets of ten car models were selected to run the simulation. Only parameters of (temperature, drag coefficient and coefficient of rolling resistances) were subjected to changes during each simulation. Simulation results were analyzed and interpreted using Microsoft Excel	Evaluate vehicle fuel consumption with respect to ambient temperature	Further studies to include other external factors	Mbelle et al., 2020.
Data on driving behavior factors and factors affecting fuel consumption of passenger vehicles in real world driving conditions were initially collected followed by exploratory and regression analysis. Simple descriptive techniques and graphics such as box plots etc. were generated under the exploratory analysis. Regression analysis was carried out by using (RELRM) method.	Determine the effects of winter season and low temperatures on fuel economy of hybrid and conventional gasoline vehicles	Further study should consider using disaggregate fuel consumption measures to validate the results and also regenerate data and analysis to measure flexibility of the findings in terms of data collection.	Zahabi et al., 2014.

On road and laboratory vehicle tests were done using PEMS and chassis dynamometer respectively. Vehicle simulations were performed with CO_2MPAS model to quantify the effects of temperature on emissions. Extreme operating conditions like (a/c fuel consumption at high temperatures and efficiency of low torque converter at low temperatures) were also simulated by the model.	Measured CO_2 emissions of a Euro 6d-temp gasoline direct injection (GDI) vehicle with a three-way catalyst and a gasoline particulate filter	Future improvement of the model to incorporate more new vehicle technologies and environmental parameters	Giechaskiel et al., 2021.

Humidity effects

Humidity affects the performance of vehicle tires and the driving style of drivers, hence causing frequent changes in speed and acceleration of vehicles (Ehsani et al., 2016). Increase in temperature is accompanied with decrease in humidity. Hence, at high temperature and consequent low humidity, there is vaporization of air which increase the engine pressure resulting in high fuel consumption. High humidity reduces flame speed making it unconducive for combustion (Soares, & Sodré, 2002). This is attributed to high moisture content during high humidity which tend to lower air density resulting in decrease engine combustion efficiency due to low oxygen content in the air. Relative humidity alongside temperature affects emission particles transformation processes. Low temperature and high humidity increase nuclei mode emission particles and cause the growth of already formed particles by increasing their condensation (Jamriska, Morawska, & Mergersen, 2008). Jamriska et al. (2008), reported increase in emission particle concentrations at low temperatures and high humidity when 'tree regression' was used to determine the relation between relative humidity/ temperature (RH/temp) and emission particle sizes. High humidity is known to result in low NOx emissions because it reduces the oxygen content in the air absorbed by the vehicle internal combustion engine (Yanowitz, McCormick, & Graboski, 2000; Zalakeviciute, López-Villada, & Rybarczyk, 2018). Lindhjem et al. (Lindhjem, Chan, Pollack, & Kite, 2004) determined the impacts of humidity on NOx emissions for both on- and off- road vehicles and engines and subsequent adjustment of emission estimates in eight-county Houston-Galveston nonattainment area (HGA). Counties closer to the coast as well as evenings and early mornings recorded low NOx emissions due to high humidity levels. Toback, Hearne, Kuritz, Marchese, & Hesketh (2004), also reported reduction in NOx emissions as relative humidity increased from 37 to 90% after simulating the idling emissions of school buses in an environmental chamber. Kihara, Tsukamoto, Matsumoto, Ishida, Kon, & Murase (2000), created and installed (on-board measurement system) in diesel vehicles to measure NOx emissions. Results revealed a decrease in mass emissions of NOx at high humidity supporting the findings specified in emission standards which states that NOx concentration should be modified using ambient humidity. Wimmer and Schnessl (2006), experimentally investigated the effects of specific humidity on engine efficiency and NOx emissions. They observed 60% decrease in NOx emissions with rise in specific humidity from (8 g/kg to 25 g/kg). This was attributed to increase in losses due to partial and actual combustion resulting from reduced burn rate. Reduction in burn rate which resulted in longer combustion duration retarded the ignition time and lowered engine efficiency which ultimately decreased fuel consumption.

Table 3. Approaches to estimate humidity effects on fuel consumption and emissions

Key method	Study aim	Gap	Reference
On-road data set was collected over a period of six months and subsequent statistical analyses comprising -(exploratory correlation analysis to locate pairwise linear relationships; factor analysis to evaluate multivariate effects and nonparametric regression tree techniques to examine interactions) were conducted	Analyze the impacts and interaction of temperature and relative humidity on emissions with particle sizes between 15 nm and 850 nm	More studies to be conducted for the sake of clarification	Jamriska et al., 2008.
Experimental research was conducted on a natural gas fueled research engine with one cylinder. A gas-scavenged pre-chamber approach was used for lean-burn operations.	Determine the effects of specific humidity on engine performance of a lean-burn natural gas engine	More studies to be conducted	Wimmer, & Schnessl, 2006.
On-board measurement system was developed using zirconia (ZrO_2) detectors in combination with other detectors and data recorders. Measurements were taken on a chassis dynamometer after the system was fitted in a diesel vehicle.	Measure real-time mass emission of NOx, fuel consumption using on-board system	Further research should include more external factors	Kihara et al., 2000.

Precipitation effects

Rain and snow alter the characteristics of road surface which impacts the grip and rolling resistance of vehicles. Snow and ice decrease the grip of tires and increase fuel consumption. Rain forms water layers that wheels of moving vehicles must overcome (Zacharof et al., 2016; Wu et al., 2020). Based on the research by Karlsson et al. (Karlsson, Carlson, & Dolk, 2012), water depths of 1, 2 and 4 mm resulted in 30%, 90% and 80% fuel consumption rise respectively. Lower rate in fuel consumption at 4 mm compared to 2 mm was attributed to reduced vehicle speed due to increase resistance of water. A USA study conducted by (Cummins, 2014) indicated an increase in fuel consumption with rain in heavy duty vehicles. Golbasi and Kina (2022), reported 15-25% variation in haul truck's fuel consumption depending on the precipitation effect. The highest fuel consumption was recorded in the month of April which had the maximum precipitation of 90 L/day whilst the lowest fuel consumption was in the month of July with the least precipitation of 80 L/day after simulation using discrete-event simulation (DES) model. Precipitation condition had more significant effects on the truck's rate of fuel consumption comparative to other studied variables (distance travelled and total payload). Shang, Zhang, & Shen (2021), used Comprehensive modal emission model (CMEM) to ascertain the impacts of rainy-weather conditions on on-road fuel consumption and emissions of taxis. Fuel consumption factor in rainy weather was 3.9 % to 6.7% lower than that of clear weather and 3.8% to 5.2% in terms of emissions for various road types (main roads, expressway, main and secondary road). The findings were attributed to less aggressiveness in drivers driving style during rainfall. Gong, Shang, Li, Zhang, He, & Ma (2021), also reported precipitation within the range of 1 mm and 8 mm to cause 4.9% decrease in fuel consumption in heavy-duty diesel trucks compared to a case of no rainfall. The reason is because of the attentiveness of drivers during light rains which cause driving process to be steady balancing the useful impacts between fuel consumption and precipitation. Heavy snowfall deteriorates road surface which in turn increase emissions and fuel consumption due to increase number of stops and traffic non-uniformity (Zakharov, Zakharov, Magaril, & Rada, 2018). Experiment conducted by Zakharov et al.

(2018), using Vissim traffic flow simulation model obtained 23% increase in average delay time, 17% reduction in average speed and 13.8% emissions (CO, NO_X, Volatile organic carbons (VOC)) increase under worse road conditions caused by heavy snowfall (snow with thickness more than 7 cm). According to Ferreira, de Almeida, & da Silva (2015), a relationship exists between traffic and severe precipitation events. Extreme precipitation events reduce vehicle's speed and thus, increase traffic delays (Pyatkova et al., 2019). Min (2015), discovered 1.3 km/h decrease in average speed for any additional centimeter of precipitation which in turn increase traffic volume and hence fuel consumption and emissions. Rain and snow recorded high traffic flow which led to increased fuel consumption when different weather parameters (clear, cloudy, overcast, foggy, aerial dust, light rain, shower and sleet) effects on fuel consumption were evaluated by (Yao, Zhao, Zhang, Chen, & Rong, 2020) using On-Board Diagnostics (OBD) for the real-world instantaneous fuel consumption and linear mixed model to establish the relationship between the parameters.

Table 4. Methodologies used by some selected articles to ascertain precipitation effects on vehicle fuel consumption and emissions

Key method	Study aim	Gap	Reference
Simulation modeling was applied and carried out by the use of Planung Transport Verkehr (PTV) Vissim program -timestep-based, microscopic model that treats driver-vehicle units as basic entities.	Sustainability of transport system with respect to the influence of amount and intensity of precipitation	Further studies should gear towards obtaining correcting coefficients for mathematical models of traffic parameters under adverse weather and climate conditions.	Zakharov et al., 2018
Analysis and summary description of collected 1153 naturalistic driving data from 34 heavy-duty diesel trucks. Binary logistic regression model was established to quantitatively explore the impact of key variables on fuel consumption.	Prediction of fuel consumption of heavy-duty diesel trucks	Future study should expand data collection in terms of quantity and type and model prediction accuracy should be improved by trying other data mining methods.	Gong et al., 2021
Driver's fuel consumption was directly collected by using on-board diagnostics (OBD) unit. Linear mixed model was constructed to determine the external conditions fixed-effects and the drivers' random effects.	Explore external factors affecting driving safety and fuel consumption	Further studies should include truck drivers and non-professional drivers as well as driver's age gender, income in combination with the already considered external factors	Yao et al., 2020

Wind effects

The influence of wind on fuel consumption is basically due to differences in direction between vehicle and wind strength thus, driving with wind minimizes fuel usage whilst driving against wind increases fuel consumption (Almér, 2015). Wind is affected by objects along the roadside and other vehicles that results in an uneven airflow and turbulence. It has a significant effect on vehicle aerodynamics- there is a linear correlation between aerodynamic resistance variations and emissions. The term "vehicle aerodynamics" describes the car's shape and design and projected frontal area. Increase in 30% aerodynamic resistance will cause 7% increase for NEDC. Crosswind (wind perpendicular to a moving vehicle) affects drag, lift and pitching of vehicles causing instability (Zacharof et al., 2016). Tailwind enhances vehicle movement and, therefore consume less energy but headwind requires

more energy to resist against the wind (Ehsani et al., 2016). Zachiotis and Giakoumis (2021) asserted that the negative effects of headwinds far outweigh the advantages of tailwinds. The assertion was based on their study which used 'Monte Carlo Simulation' technique to examine how ambient wind affects light-duty car fuel consumption and emissions. They reported maximum increases of 28%, 22% and 13% in CO_2, nitric oxide (NO) and soot emissions respectively and 41% in specific energy consumption with strong headwinds. At tailwind environment, vehicle wind drag decreased which led to reduction in engine load and consequent fuel consumption/ emissions. Reduction in fuel consumption and emissions at tailwinds were not sufficient to balance the significant rise caused by the headwinds. Strong wind force causes greater air resistance leading to higher fuel consumption and emissions (Ehsani et al., 2016). Yang et al. (Yang, Gong, Xie, & Liu, 2022) reported increase in air resistance with increasing wind speed after using machine learning models to predict fuel consumption rate of light-duty gasoline vehicles under real-world conditions in China. Strong wind decreases vehicle speed due to poor visibility which increase traffic volume and affects fuel consumption and emissions. Wind speed influences the amount of air resistance encountered by the vehicle and this effect is more profound at higher speed (Khayyer Wollaeger, Onori, Marano, Özgüner, & Rizzoni, 2012). The study by Khayyer et al. (2012) reported the effect of wind speed on fuel consumption to be greater than temperature and air density after studying weather (wind, temperature and air density) impacts on PHEV fuel consumption using vehicle simulator developed in MATLAB/Simulink environment. According to the study of Min (2015), every 10 km/h rise in wind speed caused a 0.8 km/h decrease in average car speed. Wind speed of 12.5 mph and wind direction of -45 degree resulted in 8.5% reduction in the amount of vehicle fuel consumed as determined by the study of Lee, Fulper, McDonald, & Olechiw (2019), which used real world emission (RWE) vehicle model to estimate relationship between environmental factors and fuel consumption and emissions. They concluded that estimating wind direction is difficult because vehicle direction is changing constantly along the road. Increasing wind speed from (5 to 10 m/s) increased PHEV energy consumption by 21% and 16% in urban and highway driving respectively whilst change in wind direction caused large energy demand changes (56% for urban driving and 114% for highway driving) based on the findings of (Tulpule et al., 2011).

Table 5. Methods employed for assessing the effects of wind on vehicle emissions and fuel consumptions

Key method	Study objective	Gap	Reference
Simulation was done using vehicle model developed at (Center for Automotive Research) in Ohio State University. Model was developed using verified models of each individual components. Energy management algorithm was incorporated into the vehicle using 'Equivalent Consumption Minimization Strategy' (ECMS)- a strategy grounded on the idea that, a hybrid vehicle's battery energy usage should be recharged by burning the fuel	Estimate impacts of weather on the energy demand of PHEV vehicles	Further studies need to be conducted in this area	Tulpule et al., 2011.
Simulation was done by using vehicle simulator developed in MATLAB/ Simulink setting and impact variables were also assessed for diverse standard highway and urban driving cycles.	Determine the impacts of factors that influence energy consumption in PHEV vehicles	Further study should focus on other new vehicle technologies like solar vehicles etc.	Khayyer et al., 2012.

Sites were selected and primary data was collected, integrated and processed. Exploratory data analysis using correlation analysis and single variable analysis were conducted. Speed distribution and variation models were developed using multiple linear regression after which they were coupled with the engine emission models incorporated in MOVES emission estimation model.	Explore the relationship between weather and vehicular fuel consumption and emissions	Future research to consider model structures like time series cross section models and multilevel models. And also, monetary indicators like unit cost of fuels and various types of pollutants should be used to evaluate the impacts of vehicular emissions and energy consumptions	Min, 2015.

Altitude/ Air pressure effects

Altitude indirectly influences fuel consumption and emissions by causing changes in air pressure which is directly linked to vehicle fuel combustion. Variation in altitudes which implies different ambient pressures significantly affect fuel combustion and gas exchange processes (Bermúdez, Serrano, Piqueras, & Diesel, 2021). Air pressure directly affects tire pressure which tends to affect fuel consumption. The larger the tire pressure, the lower the fuel consumption and vice versa. A study by Yang et al. (2022), identified air pressure as the most significant climate factor impacting the consumption of fuel among other variables like temperature, wind, precipitation and sunlight after simulating real world fuel consumption using machine learning models. Increase in air pressure increases air density which augments intake charge of engines improving volumetric efficiency and thus higher fuel consumption (Rahimi-Gorji et al., 2017). According to Karnaukhov, Karnaukhova, Karnaukhov, & Ryndina (2022), combustion is a significant process to engine performance/ fuel consumption and increasing pressure surges combustion. Abdullah, Shahruddin, Mamat, Ihsan Mamat., & Zulkifli (2014), investigated engine efficiency, fuel economy and tailpipe emissions by varying in-let air pressure using air filter. They reported increase in engine efficiency and higher consumption of fuel, CO_2 and NOx emissions in the experiment void of air filter comparative to the one having air filter. This was due to efficient fuel combustion as air pressure increased without the use of the air filter. Soares and Sodré (2002), determined the effect of temperature, humidity and pressure on vehicle performance. Pressure was reported to be the most important parameter affecting vehicle efficiency. Theoretically, higher altitudes have lower air resistance resulting in lower air density and pressure (Wang et al., 2022). The lower air density and pressure cause changes in vehicle aerodynamics and decrease oxygen concentration leading to deterioration of engine combustion and thus, decrease in power output which ultimately lowers fuel consumption (Zervas, 2011; Hao et al., 2019; Wu et al., 2020). Hao et al. (2019), determined fuel consumption at different altitudes of 842, 1520, 2676 and 3030 m. Coast down test was used to ascertain the roadway load force of the test vehicle at the varying altitudes after which road resistance and the vehicle fuel consumption was measured using developed vehicle fuel economy model. Findings revealed an increase in fuel consumption/100 km with vehicle speed irrespective of altitude. The work of Zervas (2011), had similar findings when the effects of altitudes (70 m and 2200 m) on fuel consumption were studied over three controlled driving cycles (NEDC, FTP and the Highway driving cycle). He concluded that the effects of higher altitudes are not evident and fuel consumption is not always reduced. Experimental data from Al-Momani, & Badran (2007), revealed an increase in fuel consumption with increasing altitude. This was due to fluctuations in atmospheric pressure as altitude increased resulting in

destabilization of the combustion process. Increasing altitudes also led to a decrease in vehicle performance due to reduction in vehicle's available horsepower. Payri et al. (2021), also reported 2.5% increase in fuel consumption by increasing altitude from 0 m to 1000 m in their study that focused on altitude impacts on energy balance during (WLTC). The results obtained were attributed to the change in pumping that decreased brake efficiency.

Wang et al. (2022), tested twenty-one light-duty vehicles over WLTC and real-driving emissions (RDE) at different altitudes between 26.7 and 2264.7 meters above sea level (masl). They reported strong linear correlation of CO_2 emissions in vehicle 2 (which was naturally aspirated) with altitude - every 1000 m rise in altitude resulted in 4.45%, 5.31% and 6.62% for low, high and extra-high speed respectively decrease in CO_2 emissions. Turbo-charged vehicles 1 and 3 had no linear correlation with altitudes and the rise in CO_2 emissions was as a result of the varying performance of the turbo-chargers at the different altitudes. For both tests (WLTC and RDE), there were no consistent patterns between the various altitudes and vehicle CO_2 emissions. This was attributed to the presence of more variables (driving patterns, road types etc.) during real test driving which might have impacted the emissions rather that the altitude growth and also the air-fuel variations at transient cycles and engine operation variations during the WTLC laboratory tests. The study by Fang, Lou, Hu, & Tan (2019), measured diesel cars cold-start emissions at various altitudes (0, 1000, 2000, 3000, 3750 and 4500 meters) with their concomitant pressure (kPa) 101.3, 90.1, 79.2, 70.1, 63.5 and 57.6 respectively. CO, CO_2 and NOx emissions decreased with rising altitude due to poor fuel combustion cause by less air taken into the cylinder at high altitudes. He et al. (2011), analyzed the variation of exhaust emissions of diesel engines at different altitudes (0, 1000, 2000 m) and reported increase in emissions (HC, CO and NOx) with rising altitudes. High HC and CO emissions were as a result of decrease in the in-take of air pressure and mass of oxygen with rising altitude which minimized air-fuel ratio and hence aggravated fuel combustion. Increase in combustion temperature due to ignition delay as a result of rising altitude led to more NOx emissions. Altitude effects on (HC and CO) emissions were higher than (NOx) emissions due to the distinct decrease in oxygen-fuel ratio influencing the HC and CO as compared to the slight increase in combustion temperature which influenced the NOx emissions.

Table 6. Key methodologies for determining the impacts of altitudes/air pressure on vehicle fuel consumption/ emissions

Key method	Study aim	Gap	Reference
Experimental research using engine test bench with altitude simulation system	Effects of altitude on particles number emission of diesel engines	Further study should measure simultaneously the magnitude of combustion temperatures and (NOx) emissions for the interest of high altitudes' NOx emission factor	He et al., 2011.
Experimental research was conducted on a direct-injection intercooled turbocharged diesel engine (with 14.25 compression ratio) by utilizing (combustion analysis/ emission measurement and plateau simulation systems).	Determined start-up emissions of heavy -duty low compression -ratio diesel engine at different altitudes	Future studies should focus on combustion, spray, chemical kinetics, emissions on the extreme environments	Fang et al., 2019.

Vehicles were first tested over WLTC and CO_2 data obtained from the WLTC test was employed for Moving Average Window (MAW) calculation. The resistance coefficients used for chassis dynamometer setting during lab testing were provided by the manufacturer. For RDE tests, PEMS was used to estimate emissions as vehicle was driven by a professional driver.	Evaluate altitudes impact on battery vehicle CO_2/pollutant emission	Real world testing introduced more variables (speed, driving patterns etc.) and the quantitative relationships between the variables and emissions are unclear, hence more further studies to analyze the impact of these variables and real driving emissions before assessing real driving emissions at different altitudes	Wang et al., 2022.

Table 7: Summary of key articles of the considered climatic variables

Reference	Purpose of study	Weather parameter(s) considered	Method/model	Gaps
Alvarez, & Weilenmann, 2012.	Determine fuel consumption rate and emissions in hybrid vehicles	Temperature	Chassis dynamometer testing	Further investigation on 'Initial State of Charge' (SOC) of hybrid system battery (HSB) to enhance detailed evaluation of temperature influence on HEVs
Wu et al., 2020.	Measure real-world fuel consumption of light duty vehicles	Temperature, humidity, altitude/air pressure	Big data retrieved from BearOil app to construct real-world fuel consumption rate (RFCR) model	Further research should gear towards the study of public green low-carbon driving behavior
Jeon, 2019.	· Investigates the relationship between weather and gasoline vehicle fuel consumption and · Simulate climate change impact on gasoline consumption	Minimum and maximum temperature, precipitation RCPs 4.5 and 8.5 for periods 2020–2039, 2040–2059, 2060–2079, 2080–2099.	Fixed-effect model NASA Earth Exchange Global Daily Downscaled Projections (NEX-GDDP) dataset	Future research to consider technological improvements like solar and biofuels vehicle consumption
Choi, et al., 2010.	Examine the relationships between weather parameters and gasoline / diesel vehicles emissions	Temperature and humidity	MOVES2010 model	Future analysis should address impacts of additional parameters like fuel supply, road type distribution, ramp fraction, speed distribution, vehicle type
Ehsani et al., 2016.	Determine fuel consumption and fuel efficiency for different types of vehicles	Temperature, wind	Mechanical model	Future study should consider amount of humidity and sunroof impacts on the changes in wind power.

Yang et al., 2022.	Forecast the real-world fuel consumption rate of light-duty gasoline vehicles based on big data from BearOil app	Temperature, wind, air pressure, precipitation	Five regression models- linear regression, naïve Bayes regression, neural network regression, random forest regression, and LightGBM models	Further study to apply the Monte_Carlo function of the ForecastTB package for better comparison of models
Savostin - Kosiak et al., 2020.	Determine the effects of ambient temperature on city diesel bus fuel consumption	Temperature	Physical Emission Rate Estimator (PERE) mathematical model	Further study to estimate polynomial coefficients for city bus models
Hao et al., 2019.	Estimate fuel economy of light-duty vehicles in high altitude zones.	Altitude (air pressure)	Vehicle fuel economy model	Further research to elucidate the effects of higher altitudes on vehicle fuel consumption
Karlsson et al., 2012.	Estimate the effects of precipitation on road surface and vehicle fuel consumption	Precipitation (rain, snow and ice)	Virtual environment for test optimization (VETO) model	Further study - to determine if the impact of rain/ ice/ snow is primarily due to its impact on tire temperature or rolling resistance or both. - to ascertain actual water depths during dry spells, as well as the impact of rutting severity and topology
Shang et al., 2021.	Investigate the effects of road type and rainy-weather condition on fuel consumption and emission	Rain	CMEM model	Future study should include finer and detailed data in the database for the model to be more general and applicable.
Zachiotis, & Giakoumis, 2021.	Determine fuel consumption and emissions for light-duty cars operating in simulated ambient wind setting.	Wind	Monte Carlo simulation methodology	Study is an improvement to current homologation procedure which excludes ambient wind in road load calculation

Simulation models for vehicle fuel consumption and emission estimations

Fuel consumption and emission models are fundamental instruments used to assess the impacts of regional transportation and develop transportation technologies (Faris, Rakha, Kafafy, Idres, & Elmoselhy, 2011). Silva, Farias, Frey, & Rouphail (2006), used and evaluated the efficacy of different simulation models on the prediction of road infrastructure impact on vehicle fuel consumption/emissions. Based on the findings, they concluded that available models can effectively be utilized to predict fuel consumption and emissions. During modeling, the user defines the kind of vehicle, period of time, geographic regions, pollutants, kind of road and vehicle operating features to be modeled (Moradi, 2021). Different kinds of models – (white-box, grey-box and black box models) have been used by researchers globally. White-box models are comprehensive physical models developed by automobile or engine manufacturers. Grey-

box models are combinations of non-complex physical models and data derived from experimental research. Typical example of this model is CMEM. Black-box models exclusively utilize information obtained from realistic driving tests. They are grouped into average and instantaneous fuel consumption models (Kanarachos et al., 2019). Models can also be categorized into macroscopic, microscopic and mesoscopic models based on their scale and purpose. The macroscopic estimate transport energy consumption and emissions over a wide area by the use of average aggregate network parameters. Examples are; Mobile Energy Emission Telematics System (MEET), Computer Program to compute Emissions from Road Transport (COPERT), Ecological Transport Information Tool (ECOTRANSIT), Emission Factor (EMFAC), Mobile source emissions factor (MOBILE), and MOVES. Microscopic models describe the energy consumption and emissions of vehicles by linking fuel consumption and emission rate to vehicle operating across a number of brief time steps. They compute data on a single vehicle's instantaneous energy consumption and emission using instant variables. Examples are; Instantaneous fuel consumption model (IFCM), Vehicle specific power (VSP), Virginia tech microscopic energy and emission model (VT-Micro), Comprehensive power-based fuel consumption model (CPFM), Passenger car and heavy-duty emissions model (PHEM) and CMEM. Microscopic models are useful at the micro scale but are not suitable for huge number of cars at the city scale due to the requirement of considerable estimations (Shang et al., 2021; Vallamsundar, & Lin, 2011).

Most fuel consumption models previously developed used speed as the only influencing parameter but currently developed models have included other parameters (Parajulii, 2005). Modeling of fuel consumption/ emissions are normally conducted by using physical and empirical based methods. The empirically based method is represented by MOVES developed by USA EPA to replace MOBILE in the estimation of vehicular fuel consumption whilst the physically based modal uses PERE to estimate second- by-second rate of fuel consumption by the use of vehicle specifications as well as second-by-second driving records as inputs (Wang, Fu, Zhou, & Li, 2008). MOVES utilizes VSP as an engine running status indicator (Lyu, Bao, Wang, & Matthews, 2020). VSP is the power of an engine per unit mass of vehicle exemplifying the demand of power on a vehicle operating under various conditions and speed. It is calculated using the instantaneous speed of vehicles and force an engine need to overpower to operate smoothly which includes (aerodynamic resistance, rolling resistance, engine inertia resistance, gradient force) (Min, 2015; Guensler et al., 2017). Key emission models include but not limited to MOBILE, MOVES, EMFAC, PHEM, CMEM, Corridor Flow (CORFLO), Verkeerssituatie (VERSIT), Emissions from Traffic (EMIT), Vehicle dynamics model, Vehicle transient emissions simulation software (VeTESS), Vehicle Energy Consumption Calculation Tool (VECTO), VT-microscopic model, Network Simulator (NetSim), Watson model, Virtual environment for test optimization (VETO) model, Advanced light-duty powertrain and hybrid analysis (ALPHA), Signalized Intersection Design and Research Aid (SIDRA) TRIP and COPERT.

MOBILE was created by US EPA. Inputs for this model were; age of the vehicle, ambient temperature, fuel variables and vehicles mode of operation. The model generally evaluated the following pollutants: HC, CO, NOx, NH_3, particulate matter (PM), sulfur dioxide (SO_2) and hazardous air pollutants (Faris et al., 2011). MOBILE estimated car emissions based on average speed and vehicle distance traveled, but overlooked the factors relating to the driver, traffic and roadway (Ahn, Rakha, Trani, & Van Aerde 2002). This model has now been replaced with MOVES which has more distinct features and functions (Vallamsundar, & Lin, 2011). PHEM computes road vehicles fuel consumption and emissions in 1Hz for a specific driving cycle using longitudinal dynamics of the vehicle and emission maps (Weller et al., 2019). COPERT was created by European

Environment Agency (EEA) and normally use in applications involving emission inventories and dispersion modeling (Faris et al., 2011). It is usually developed from several emissions tests conducted on new and old vehicles. It uses algorithms and emission factors to estimate emissions under conditions like speed, ambient temperature, vehicle technology etc. (Faah, 2008; Chen, Zhu, Gonder, Young, & Walkowicz, 2017). VETO is a simulation tool used to estimate fuel consumption and emission using roads, vehicles, weather characteristics and driving behavior as input parameters. It is a mechanistic model based on physical interactions and capable of accurately describing vehicles and given road segments (Karlsson et al., 2012). The European Commission created VECTO to measure their fuel usage and carbon emissions. The primary inputs for this model are: air resistance, tire rolling resistance, vehicle mass, axle/gearbox torque loss maps and engine maps. Fuel consumption is measured by interpolating from fuel usage map along with instant engine torque and speed (Zeng et al., 2021). CMEM model is access-coded program with specific humidity, vehicle characteristics and activity data as key inputs. The instantaneous engine load is calculated for a given driving cycle and used to evaluate the fuel consumption. Emissions are computed from fuel consumption and catalytic converter efficiency correlations (Silva et al., 2006). CMEM uses physical approach to break emissions processes into parts relating to physical phenomena that are connected to vehicle performances and emission productions (Cadle, et al., 2003). CMEM parameters depend on vehicle types instead of specific vehicle specifications (Donkers, Yang, & Viktorović, 2020). ALPHA is a modeling tool developed by USA EPA to estimate vehicle operations, fuel consumption and GHG emissions of light-duty gasoline and diesel vehicles as well as battery and hybrid electric vehicles. EMIT is a simple statistical model developed for estimating commercial vehicles' fuel consumption and emissions (Cadle, et al., 2003). SIDRA TRIP is a component of SIDRA software package. It is a power-based model that expresses the rate of instantaneous fuel consumption based on the required tractive power (Yeow, & Cheah, 2021).

CONCLUSIONS

This review stresses on climate variability and change impacts on vehicular fuel consumption and emissions. It depicts that most studies conducted on *weather parameters impact on fuel consumption and emissions* are from Europe, America and Asia. Temperature is revealed to be the most pronounced weather parameter compared to the other variables proving the assertion by (Zacharof et al., 2016) which posited that "temperature is the most studied weather parameter in relation to vehicle fuel consumption and emissions". The review unravels the massive impacts of weather parameters on vehicle fuel consumption and emissions and hence engenders the replication of such studies in Africa to ameliorate the transportation system and preclude any anticipated mishaps related to road transport in the continent. From the review the authors recommend that: Climate variability and change should be considered as threats to vehicle fuel consumption and emissions and hence, countries should adhere and comply rigorously to climate policies in order to reduce global climate change and its concomitant effects on automobiles; Climate variability and change impacts on vehicles should be incorporated in national transportation policies in Africa and accordingly addressed to curb their effects; There should be replication of numerous studies under this area in Africa to provide data that can be utilized in the formulation of optimal road transport policies and decisions.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

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VAŽNOST STAVOVA LOKALNOG STANOVNIŠTVA ZA ODRŽIVI RAZVOJ TURIZMA NA PRIMJERU GRADA MALINSKE

Sandra Šokčević

Libertas međunarodno sveučilište, Trg J.F. Kennedy 6b, 10000 Zagreb, Republika Hrvatska, ssokcevic@libertas.hr

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Sandra Šokčević, Libertas međunarodno sveučilište, Trg J.F. Kennedy 6b, 10000 Zagreb, Hrvatska, ssokcevic@libertas.hr

SAŽETAK

Turizam je počeo relativno sporo rasti kroz povijest, počevši od sredine XX stoljeća. Turizam se danas u cjelini nametnuo kao jedan od najpropulzivnijih gospodarskih aktivnosti, za Republiku Hrvatsku, gdje turizam sudjeluje s više od petine BDP-a nacionalne ekonomije. Cilj ovog rada je usmjeren na prikaz potencijala i koncepcije razvoja otočnog turizma s naglaskom na otok Krk, odnosno njegovu najrazvijeniju općinu Malinska. U radu je provedeno empirijsko istraživanje stavova lokalnog stanovništva o elementima turističke ponude općine Malinska, te utjecaju turizma na razvoj iste. Ovo istraživanje ima za cilj u interpretaciji dobivenih rezultata pronaći relevantne odgovore na razini turističke destinacije Malinska o stavu lokalnog stanovništva prema turizmu, prema pojavama u okruženju od značaja za turizma, prema razvoju turističke destinacije te ocjeni ponude i kvalitete turističke ponude. Generalni rezultati istraživanja dali su zaključiti da je turizam navedene destinacije napredovao ali da još ima prostora za napredak i razvoj ponude u cilju izgradnje konkurentnijeg i tržišno prepoznatljivijeg turističkog proizvoda.

Ključne riječi: otočni turizam, koncepcija razvoja, turistička ponuda, stavovi lokalnog stanovništva, otok Krk, grad Malinska.

UVOD

U proteklih dvadesetak godina turizam je postao prava lukarativna gospodarska aktivnost diljem svijeta. Brojne poslovne i negospodarske djelatnosti doprinose zahtjevima domaćih i stranih turista u području turizma Republike Hrvatske. Koristi koje turizam donosi su brzi ekonomski razvoj budući da dovodi do novog kapitala, rješavanja nezaposlenosti, stvaranja pozitivnog imidža, razvijanje lokalne infrastrukture. Problemi koji se uočavaju u razvoju turizma jedne destinacije poput problema sa prometnim gužvama, zagađenjem okoliša te otežavanje života lokalnog stanovništva, mogu se izbjeći pravilnim razvijanjem i upravljanjem turizmom na održiv način. Turistička destinacija predstavlja mjesto na kojem su povezana turistička mjesta, u kojima se realizira turistička ponuda različitih međusobno povezanih turističkih uslužnih sadržaja. Opći cilj razvoja općine Malinska je poboljšanje kvalitete života lokalnog

stanovništva. To se može postići na način da se osigura ekonomski prosperitet i postigne osjećaj blagostanja. Danas se ova destinacija nalazi na svojevrsnoj razvojnoj prekretnici, a njeni stanovnici svjesni su mogućnosti koje im kvalitetan i osmišljeni razvoj turizma može donijeti. Svrha ovog istraživanja je (1) uočiti potencijale razvoja turizma grada Malinske na otoku Krku, te (2) analizirati odnos i percepciju lokalnog stanovništva grada Malinske o razvoju turizma i turističke ponude navedene destinacije.

TEORETSKA PODLOGA I PREGLED LITERATURE

Koncepcija je pojam koji u svakodnevnom govoru znači zamisao, projekt, nacrt, shvaćanje ili predodžbu o nečemu. Koncept razvoja i odlučivanja usko su povezani. Stipanović (2006) tvrdi da koncept služi kao temelj za određivanje dugoročnih učinaka odluka vezanih uz kretanja u kratkom i srednjem roku. Nadalje, isti autor ukazuje da se koncept razvoja koristi u odabiru aktivnosti koje imaju za cilj postizanje odluka s dugoročnim učincima (Stipanović, 2006). Odabir strategije kao dinamičke discipline, sustava i poslovne politike koja ostvaruje ciljeve i misiju organizacije ovisi o ideji koncepcije razvoja, dokumentu na temelju kojeg se definiraju ostali aspekti modela.

Pojam koncepta razvoja, prema Dulčiću i Petrić (2001), je kontekst u kojem se odvija proces razvoja turizma i u kojem je moguće postaviti strateške i operativne ciljeve razvoja, odnosno kreirati plan i politiku za njihovo postizanje. On smatra da su uz koncept razvoja postavljeni i operativni ciljevi. Organizacije nastoje uspješno prilagoditi svoje poslovanje izazovima dinamične turističke industrije koja nosi rizik i neizvjesnost, koristeći pojam razvoja kao dokument. U takvom okruženju ključno je aktivno oblikovati budućnost kroz stvaranje visokokvalitetnog turističkog proizvoda i diverzifikaciju proizvoda koja se temelji na održivom razvoju. Koncept razvoja nudi viziju budućnosti kojoj su podređene ostale komponente modela kako bi se stvorila poznata i razumljiva budućnost, moguće i izvjesne aktivnosti te sigurna pozicija destinacije na turističkom tržištu.

Nastavno, postoje dvije temeljne analize, kvantitativna i kvalitativna analiza sadašnjeg stanja, uključene u metodologiju analize stanja u kontekstu pojma razvoja. Analiza ponude i potražnje u aktivnosti turizma ključna je za kvantitativnu analizu. Prema autorima Čavlek, Kesar, Prebežac i Bartolucci (2011), glavne komponente kvantitativne analize ponude turističke destinacije su broj i struktura ugostiteljskih objekata, broj smještajnih kapaciteta (hoteli, apartmani, kampovi i slično), kategorizacija i struktura smještajnih kapaciteta, te njihova iskorištenost. Složenost i prilagodljivost razvojnih ciljeva jasno odražava suvremenost turističkih zahtjeva kao pokretača promjena. Složenost i prilagodljivost razvojnih ciljeva omogućuje postizanje konkurentnosti i najboljeg razvojnog smjera u uspješnoj turističkoj industriji. Misija, vizija i svrha organizacije uključuje se u razvojne ciljeve. Njihov odnos je vrlo važan.

Prema Guzovski, Rudančić i Akmačić (2020), ciljevi razvitka turističke destinacije predstavljaju željena buduća stanja koja se najčešće razlikuju od postojećih, ostvarena kao rezultat planirane i svrhovite akcije. Oni određuju podrijetlo i smjer aktivnosti, te služe kao temelj za korporativnu kontrolu i povratne informacije. Odabir plana razvoja turizma podrazumijeva odabir ciljeva, smjerova djelovanja i alata koji će se koristiti za postizanje ciljeva. Prema Rudančić (2018), na promjene u sustavu upravljanja razvojem turizma prvenstveno utječu tržišni trendovi. Danas svaka suvremena turistička destinacija, bila to zemlja, regija, grad ili manje mjesto, mora razmišljati kako osigurati dugoročno održiv razvoj, znati što je njezin pravi turistički atrakcijski potencijal, imati viziju i ciljeve kojima stremi, biti u stanju kontrolirati i revidirati zadovoljstvo posjetitelja i lokalnih stanovnika, koristiti koncept klastera koji je povezan s iskustvenim strukturiranjem destinacija i stvaranjem njezinih konkurentskih prednosti.

U stvarnosti, opće dobro ili koristi smatraju se krajnjim kriterijem za odabir ciljeva i pravaca djelovanja. Kriteriji odabira stalno se mijenjaju, što znači da kako se

mijenjaju, tako se mijenjaju i djela koja u svakom trenutku ukazuju na najbolji način djelovanja (Magaš, 2000). Autori Marušić, Prebežac i Mikulić (2019), navode da strateška odluka također podrazumijeva usklađivanje odnosa koji se mijenjaju s razvojem, s obzirom na to da izbor uzrokuje neke društvene probleme. Stvaranje mjerila za mjerenje i uspoređivanje ishoda koji slijede iz odabira radnji ključan je korak u procesu odabira. Sve to upućuje na zaključak da plan razvoja turizma (uz ostale strategije gospodarskog razvoja) treba promatrati i kao način odabira najboljih razvojnih pravaca prema zadanim kriterijima odabira. Ako se započne sa širokom premisom da je primarni kriterij za odabir društvena dobrobit, tada će provedba takvog kriterija podrazumijevati odabir ciljeva, mjera i alata koji će stvoriti ravnotežu između tri interesne skupine. Interesi uključuju zahtjeve turista koji koriste turističke usluge, kao i očuvanje prirodnih resursa, društvenog okoliša koji je oštećen proizvodnjom i korištenjem turističkih usluga, te poduzeća. Cilj donošenja strategije razvoja je uspostaviti ravnotežu između navedenih interesa, a za to je važno procijeniti rezultate korištenja različitih kriterija odabira kako bi se utvrdio odgovarajući omjer između tih interesnih skupina (Marušić i sar., 2019).

Stipanović, Rudan i Zubović (2020), u svome radu ukazuju da ako se želi maksimizirati privlačnost destinacije tada se u obzir mora uzeti sinergijsko djelovanje svih sudionika ponude usmjerene na obogaćivanje ponude stalnim inovacijama.

Kvalitativni preustroj turističke ponude je nužan zbog sve oštrije tržišne utakmice među konkurentskim državama, promjena u makro i mikro okruženju, te brzog stvaranja novih turističkih potreba. Na pojedinim tržišnim sektorima razvijaju se novi ciljani oblici turizma. Istodobno, teži se personaliziranom turizmu koji zadovoljava specifične zahtjeve svakog posjetitelja. Fokus je na "soft" turizmu koji je usmjeren na spontanost, sofisticiranost, te sve raznolikije i neočekivanije želje turista.

Nadalje, turizam na otocima predstavlja izazov za mnoge destinacije, jer su otoci često udaljeni i teško dostupni, što znači da je potrebno razviti strategije koje će privući turiste, ali i pridonijeti održivom razvoju destinacije. U svjetlu navedenog a i današnjim trendovima prema održivosti turizma, u nastavku rada daje se pregled novijih znanstvenih istraživanja, vezano uz podlogu razvoja turizma na otocima. Autori Zolfani, Sedaghat, Maknoon, & Zavadskas (2015), su u svome radu sistematizirali različite pristupe i okvire održivog turizma te primjere primjene u praksi. U svom pregledu literature, autori su zaključili da održivi turizam uključuje ekološku, ekonomsku i društvenu održivost i da se održiv turizam može postići samo ako se uzmu u obzir svi ovi aspekti. U članku su također predloženi različiti okviri za održivi turizam, kao što su okvir za održivi turizam, model održivog turizma i ostali. U primjerima primjene održivog turizma, autori su ukazali na važnost uključivanja lokalnog stanovništva u planiranje i razvoj turizma, kao i na važnost osiguravanja pravedne raspodjele ekonomskih koristi. Konačni njihov zaključak je da se održivi turizam može postići samo ako se uzmu u obzir svi aspekti održivosti i ako se pristupi turizmu s integriranog i sveobuhvatnog stajališta.

Nadalje, autori Yan, et al. (2022), istražuju načine na koje se može unaprijediti turistička ponuda na otoku Tianheng u Kini. Na temelju anketa provedenih među turistima koji su posjetili otok, autori su identificirali ključne faktore koji utječu na turističko iskustvo, uključujući prirodu, kulturne znamenitosti, ugostiteljske objekte i kvalitetu usluge. Također su prepoznali nedostatke u turističkoj ponudi i predložili niz mjera za njihovo rješavanje, uključujući poboljšanje komunikacije s turistima, poboljšanje turističke infrastrukture i usluga, te poboljšanje kvalitete proizvoda i usluga koji se nude turistima. Konačni zaključak je da se unapređenje turističke ponude temeljeno na iskustvu turista može pokazati ključnim za razvoj održivog turizma na otoku Tianheng i u drugim sličnim destinacijama. Tako su primjerice autori Puška, Šadić, Maksimović, & Stojanović (2020), istraživali razvoj modela podrške odlučivanju za određivanje atraktivnosti ruralne turističke destinacije u Brčkom. Cilj istraživanja bio je da se

identificiraju ključni faktori koji utječu na privlačnost ruralnih turističkih destinacija i da se razvije model koji bi omogućio bolje upravljanje ovim destinacijama. Korišten je MCDA model uz primjenu DEX metode. Rezultati su pokazali da su najvažniji faktori turistička ponuda, prirodne i kulturne atrakcije, te cijene. Razvijeni model podrške odlučivanju mogao bi pomoći u donošenju odluka o razvoju ruralnih turističkih destinacija u Brčkom i šire.

PREDUVJETI RAZVOJA TURIZMA DESTINACIJE MALINSKA KAO OTOČNE DESTINACIJE

Prirodno-geografska obilježja destinacije Malinska

Općina Malinska prostire se od rta Čuf na sjeveru do uvale Čavlena na jugu na sjeverozapadnoj obali otoka Krka. Nijedno naselje nije udaljeno više od četiri kilometra od obale na području općine, koja se nalazi na dubini od oko tri kilometra od zaljeva luke Malinska. Mali obalni pojas širi od jednog kilometra proteže se od odredišta Haludovo na sjeveru do Porta na jugu, gdje živi više od dvije trećine stanovništva (Blažević, 2007).

Iz perspektive upravljanja prostorom, koncentracija stanovništva u obalnom području, ne daljem od četiri kilometra od glavnog naselja Malinska, može se smatrati povoljnom jer omogućuje konsolidaciju svih potrebnih funkcija na jednom mjestu. Velika graditeljska gužva, posebice u stambenim područjima, problem je koji štetno utječe na izglede za gospodarski rast, posebice rast turizma (Turistička zajednica Malinske [TZM], 2022). Malinska ima submediteransku klimu kvarnerskog tipa koju karakteriziraju umjerene zime i općenito više oborina od tradicionalne mediteranske klime s izrazito sušnim ljetima. Blagoj klimi pridonosi i položaj koji sugerira zaštićenost od nevremena s kontinenta i nešto manje oborina od obalnih kvarnerskih sela.

Glavni problem destinacije Malinska je što je šire priobalno područje gotovo u potpunosti prekriveno izgrađenim objektima, bez ikakvih planiranih, slobodnih ili otvorenih javnih prostora (parkovi, trgovi, šetnice, drvoredi itd.). Manje od polovice malinske obale, duge oko 13 kilometara, pogodno je za kupanje. Porat-Čavlena, krajnji južni dio obale je nenaseljen i uglavnom je dostupan samo brodom (Blažević i sar., 2015). U općini nema puno uređenih plaža. Ljeti po kupaču dolazi samo oko 2 metra plaže ili oko 4 četvorna metra, što je znatno manje od maksimalnog kapaciteta koji se smatra primjerenim za kupališta srednjih kategorija, a koji se procjenjuje na oko 6 četvornih metara (Blažević i Peršić, 2012).

Cestovna infrastruktura destinacije Malinska

Cestovna mreža Općine Malinska sastoji se od državnih, županijskih, lokalnih i nerazvrstanih pravaca. Postoje autobusne linije koje povezuju općinu s Rijekom i drugim naseljima na otoku Krku, ali valja napomenuti da na području općine nema drugih oblika javnog prijevoza. Promet se uz cestovnu infrastrukturu treba smatrati nužnim za mnoge korporativne aktivnosti, kao i za kvalitetu života (Hamzić, 2019). Promet utječe na kvalitetu zraka i može imati dodatne negativne učinke na okoliš, stoga je vezan i za zaštitu okoliša (emisije CO_2, buka). Preporuke Prometne studije predviđaju vjerojatnost jednosmjernog prometa vozila unutar ograničenijeg područja destinacije (Općina Malinska–Dubašnica, 2022).

Prema Radiću (2009), problem parkiranja posebno je izražen u kontekstu općinske cestovne infrastrukture, a za njegovo rješavanje nužno je donošenje strateških smjernica prometne politike. Dodatno otežava rješavanje ove problematike činjenica da je dio cestovne infrastrukture propisima kategoriziran kao županijske ili državne ceste. Prema Strategiji razvoja turizma općine Malinska-Dubašnica 2015.-2020., ukazuje se da su u uvjetima realnog predviđanja stalnog porasta broja vozila na cestama, te uz realizaciju projekata koji će utjecati na značajniji rast atraktivnosti kao turističke destinacije, što ima za posljedicu dodatan pritisak na cestovnu infrastrukturu, nužna nova ulaganja u unapređenje cestovne infrastrukture općine (Blažević i sar., 2015). U okviru općinske cestovne infrastrukture posebno se naglašava problem parkirališta, a rješavanje tog problema se zahtijeva uz

provedbu odrednica strateške prometne politike. Složenosti rješavanja ovog problema dodatno pridonosi činjenica da je dio cestovne infrastrukture sukladno regulativi razvrstan u županijske ili državne ceste.

Stanovništvo

Prema Državnom zavodu za statistiku Republike Hrvatske [DZS] (2021), u popisu stanovništva za destinaciju Maslinska se nalaze 826 stanovnika. Zbog većeg udjela osoba starijih od 65 godina, dobna struktura stanovništva grada Malinska 2021. godine se nije promijenila u odnosu na strukturu stanovništva iz 2011. godine (DSZ, 2021).

Na otocima Krku i Kvarneru, grad Malinska poznata je turistička destinacija. Ova lokacija ima dugu povijest kao turističko mjesto i uspješno se prilagodila izazovima koje postavljaju promjenjivi turistički obrasci, kao i ekonomske i političke promjene u našem društvu u proteklih 20 godina. Resurs prostora, koji je osebujan spoj prirodnih vizura i ljupkih krajolika koji služe kao ključna turistička resursna baza i atrakcija, temelj je na kojem se dobrim dijelom temelji turistički razvoj destinacije Malinske (Škvorc i Šulc, 2021).

Kvantitativna analiza sadašnjeg stanja turizma destinacije Malinska

Prema pokazateljima Turističke zajednice Malinska (TZM, 2022), kvantitativni pokazatelji razvoja turizma destinacije Malinska pokazuju da smještajnu ponudu čini privatni smještaj i to čak više od 80% ukupne strukture smještaja. Ovi smještajni kapaciteti ostvaruju više od dvije trećine svih noćenja, kojih godišnje iznosi oko 350.000 s tendencijom rasta kako u broju noćenja tako i u broju stalnih ležajeva. Na drugom mjestu je hotelski smještaj koji je u posljednje četiri godine ostvario 25% noćenja. Apartmanska naselja imaju između 15.000 i 20.000 noćenja, odnosno 4,5% udjela. Sa 6000 noćenja kampovi i hosteli ostvarili su razmjerno skroman postotak ukupnih noćenja. Posljednjih se godina na isti način nudi i mjeri smještajni kapacitet u kampovima i domovima (TZM, 2020). Sveukupno gledano, privatni smještaj je imao najveću dinamiku kretanja u ponudi smještaja koja je administrativno zabilježena, naglašavajući značaj malog poduzetništva i obiteljskog turizma u gradu Malinska (tablica 1).

Iz tablice 1 je vidljivo je da je najviše dolazaka, kao i noćenja zabilježeno 2019. godine, dok je za 2021. zabilježen pad, što i ne čudi s obzirom da je 2020. godine nastupila pandemija COVID-19 zbog koje su uvedene razne restriktivne mjere, a jedna od njih je bila i zabrana putovanja, što se može vidjeti i iz prikazanih podataka za navedenu godinu. Naredne godine, tj. 2021. turizam je se počeo polako oporavljati, ali tek je 2022. godine sezona bila zapravo kako treba, što prikazuju i brojke dolazaka i noćenja, koje su kako se vidi u porastu. Od toga, najviše dolazaka, kao i noćenja zabilježeno je za objekte u domaćinstvima, zatim u hotelima te ostalim ugostiteljskim objektima za smještaj.

Iz podataka prikazanih u tablici 2 vidljivo je kako u razdoblju od 2020.-2022. godine najviše turista dolazi i noći iz Njemačke, dok su drugi po broju turisti iz Austrije, nakon čega slijede turisti iz Slovenije, Hrvatske, Italije, Mađarske, Češke, Poljske, te Nizozemske. Također, vidljivo je kako je tijekom 2020. godine značajno manji broj dolazaka i noćenja u odnosu na 2021. i 2022. godinu, što je rezultat pandemije COVID-19 zbog koje je bio otežan dolazak stranih turista.

Tablica 1. Dolasci i noćenja za grad Malinsku u vremenskom razdoblju 2019.-2022. godine. Preuzeto 23.02.2023. sa https://www.visitmalinska.com/statistika/statistika-2022-godina/.
Table 1. Arrivals and overnight stays for the city of Malinska in the period 2019-2022.

VRSTA SMJEŠTAJA		DOLASCI				NOĆENJA			
		DOMAĆI	STRANI	UKUPNO	%	DOMAĆI	STRANI	UKUPNO	%
Hoteli	2022.	3.077	26.429	29.506	23,84	7.315	120.619	127.934	12,88
	2021.	4.030	18.891	22.921	22,12	12.057	89.602	101.659	11,32
	2020.	4.562	10.167	14.729	23,85	/	/	/	/
	2019.	3.551	28.724	32.275	25,11	9.496	128.354	137.850	10,71
	INDEKS 22/21	76,4	139,9	128,7		60,7	134,6	125,8	
	INDEKS 22/19	86,7	92,0	91,4		77,0	94,0	92,8	
	%	10,43	89,57	100,00		5,72	94,28	100,00	
Objekti u domaćinstvu	2022.	6.099	63.998	70.097	56,64	35.488	446.776	482.264	48,57
	2021.	7.388	49.783	57.171	55,16	44.898	360.695	405.593	45,18
	2020.	7.293	32.821	40.114	64,96	/	/	/	/
	2019.	6.370	61.841	68.211	53,07	40.915	429.272	470.187	36,54
	INDEKS 22/21	82,55	14,14	122,61		79,04	123,87	118,90	
	INDEKS 22/19	95,75	103,49	102,76		86,74	104,08	102,57	
	%	8,70	91,30	100,00		7,36	92,64	100,00	
Ostali ugostiteljski objekti za smještaj	2022.	955	9.668	10.623	8,58	6.284	57.775	64.059	6,45
	2021.	899	7.648	8.547	8,25	5.862	50.569	56.431	6,29
	2020.	1.240	5.357	6.597	10,68	/	/	/	/
	2019.	1.688	11.786	13.474	10,48	9.696	67.869	77.565	6,03
	INDEKS 22/21	106,23	126,41	124,29		107,20	114,25	113,52	
	INDEKS 22/19	56,58	82,03	78,84		64,81	85,13	82,59	
	%	8,99	91,01	100,00		9,81	90,19	100,00	

Tablica 2. Struktura turista prema zemlji porijekla. Preuzeto 23.02.2023. sa https://www.visitmalinska.com/statistika/statistika-2022-godina/
Table 2. Structure of tourists by country of origin.

DRŽAVA	2022.			2021.			2020.		
	dolasci	noćenja	% noćenja	dolasci	noćenja	% noćenja	dolasci	noćenja	% noćenja
Njemačka	29.045	229.072	33,85	26.197	205.053	36,25	7.912	40.037	12,26
Austrija	16.212	85.175	12,59	11.616	63.460	11,22	6.585	34.037	11,26
Slovenija	10.035	50.315	7,44	8.074	45.399	8,03	4.201	24.398	7,47
Hrvatska	10.137	49.100	7,26	12.293	62.750	11,09	3.739	24.131	3,51
Italija	8.782	48.744	7,20	3.649	22.072	3,90	3.362	17.490	5,36
Mađarska	8.331	42.938	6,35	6.047	32.039	5,66	3.175	19.631	6,01
Češka	5.209	33.976	5,02	4.463	29.055	5,14	2.938	19.417	5,95
Slovačka	4.826	31.158	4,60	3.508	22.920	4,05	2.182	14.352	4,40
Poljska	4.067	28.275	4,18	3.441	24.948	4,41	1.760	10.942	3,35
Nizozemska	1.677	8.995	1,33	1.239	6.393	1,13	7.912	40.037	12,26

Kvalitativna analiza sadašnjeg stanja turizma destinacije Malinska

Uz kvantitativnu analizu ponude i potražnje turizma destinacije Malinska, potrebno je paralelno izvršiti i kvalitativnu analizu. Inicijalna stepenica kvalitativne analize vrši se kroz SWOT analizu. SWOT analiza predstavlja sintezu ključnih strateških čimbenika. Pri tome se donose ključne prednosti i prilike koje se nude u okolini.

Osim toga, analiza snaga i slabosti (elementi SWOT analize) jedan je od važnijih preduvjeta ocjene trenutne kompetitivnosti destinacije uz procjenu budućih prilika i rizika koji mogu odrediti njezin daljnji smjer razvoja. Identificirane slabosti pokušavaju se riješiti politikama i aktivnostima, te ih pretvoriti u prednosti. Na temelju kvantificirane analize potencijala turizma destinacije Malinska, izdvojene su osnovne snage, slabosti, mogućnosti i prijetnje prikazane kroz SWOT matricu (tablica 3).

Tablica 3. SWOT analiza turizma destinacija Malinska (Škvorc i Šulc 2021).
Table 3. SWOT analysis of Malinska destination tourism

UNUTARNJE OKRUŽENJE	
Prednosti	**Nedostaci**
• puno sunčanih dana, toplo, čisto Jadransko more, • ugodna mediteranska klima, • raznolikost biljaka i životinja, • dobra kvaliteta zraka, • bogatstvo materijalne i nematerijalne kulturno-povijesne ostavštine i sigurnost • popularno i primamljivo mjesto s visokokvalitetnim smještajem i umjerenim lokalnim stanovništvom	• neadekvatno gospodarenje otpadom, • nedovoljna cestovna povezanost, te sadržaji koji su ključna sastavnica turističkog. • nizak stupanj inovativnosti u kreiranju turističke ponude, • nizak stupanj brige i zaštite kulturno-povijesnih dobara te • gužve u sezoni • Nedostatak plažnih površina
VANJSKO OKRUŽENJE	
Prilike	**Prijetnje**
• perspektiva korištenja EU fondova • veća edukacija građana, • širenje ponude u okolici te korištenje obnovljivih izvora energije • poljoprivreda i stvaranje novih sadržaja	• negativni učinci brodova za putovanja, koji osim što zagađuju okoliš uzrokuju i gužve, • ne postoje standardi koji određuju kako se grade nove zgrade • gube se tradicionalne vrijednosti • zasićenost tržišta i razvoj standardne usluge koja nije nova

Sigurnost turista, ugodna i blaga mediteranska klima, te slikovita razvedena obala među adutima je, odnosno snagama turizma destinacije Malinska. Temperatura Jadranskog mora i obilje sunčanih dana uvjetuju dulju sezonu kupanja. Pozornost turista namjernika privlače važne kulturno-povijesne građevine i artefakti. Spremnost lokalnog stanovništva na interakciju s turistima dokaz je privlačnosti i popularnosti grada Malinske kao turističke destinacije.

Slabosti su u području mobilnosti. U općinu ne ulazi niti jedna autocesta, a grad je vrlo slabo cestovno povezan s ostatkom zemlje. Općenito, može se reći da se u ovom segmentu negativno apostrofiraju slabosti vezane uz prostor i prostornu politiku kao jedan od ključnih razvojnih resursa, kao i neprimjerenost plažnih površina u odnosu na dobrobiti, gdje je, osim geoprometnog položaja, i značajna značajka prostorne politike. te bogatom kulturnom i turističkom baštinom prevladava kvalitetno izgrađena

komunalna infrastruktura. Prilike koje se pravilno iskoriste, poput inicijativa financiranja novcem iz fondova EU-a, mogu rezultirati korisnim dugoročnim razvojem događaja. Brojne subvencije osiguravaju sredstva za zaštitu i obnovu ne samo kulturnog i nematerijalnog blaga, već i flore i faune. Prostrana, gostoljubiva naselja nude potencijal za razvoj novih oblika turizma, poput seoskog turizma. Stanovnici će živjeti u boljim uvjetima ako se koristi što više obnovljivih izvora energije i unaprijedi infrastruktura grada. Prijetnje uključuju dolazak velikih brodova koji stvaraju prometne gužve u gradu. Gužve ometaju svakodnevni život i lokalnog stanovništva i turista u gradu. Osim toga, porast dolazaka štetno utječe na kvalitetu zraka, okoliša i mora.

METODOLOGIJA ISTRAŽIVANJA

Pri konceptiranju razvoja turizma u destinaciji već je uobičajena praksa utvrđivanja stavova lokalnog stanovništva prema njegovu razvoju. Tamo gdje turizam nije podržan može se očekivati otpor stanovnika prema takvim ulaganjima. S druge strane gostoljubivi domaćini jedan su od ključnih faktora u formiranju cjelokupnog zadovoljstva posjetom, a time, indirektno doprinose promociji usmenom predajom, te stimuliraju ponovnu posjetu. Svrha ovog dijela rada je prije svega uključiti lokalno stanovništvo, te analizirati njihove stavove o razvoju turizma grada Malinske. Ova analiza pruža mogućnost otkrivanja koji su pozitivni i negativni utjecaji razine turističkog razvoja na kvalitetu života najjače izraženi u destinaciji Malinska na otoku Krku.

Za potrebe ovog rada izvršilo se anketiranje lokalnog stanovništva grada Malinske koje odvijalo se u razdoblju od 01. studenog i 03. prosinca 2022. godine. Cjelokupna obrada i analiza podataka provedena je na uzorku od 185 ispitanika. Glavni cilj istraživanja bio je dobivanje analize stavova lokalnog stanovništva o elementima ponude turističke destinacije i utjecajima turizma. Osnovni instrument prikupljanja podataka u istraživanju bili su anketni upitnici. Anketni upitnik je bio zatvorenog tipa, stupnjevanim Likertovom ljestvicom. Ispitanici su morali ocijeniti svoje zadovoljstvo ocjenama od 1-5 (1-izrazito loše, 2-loše, 3-zadovoljavajuće, 4-dobro, 5-izrazito dobro). Ispitivanje je bilo u potpunosti anonimno i dobrovoljno, te je kriterij uključenja u ispitivanje bio da su ispitanici stanovnici grada Malinske. Za formiranje pitanja sadržanih u anketnom upitniku koristila se forma anketnog upitnika dviju institucija Fakulteta za turizma i ugostiteljstvo u Opatiji i Instituta za turizma u Zagrebu, koje vrše istraživanja na razini destinacije Kvarner kao i na razini Republike Hrvatske (Marušić, Čorak i Sever, 2018; Marušić, Čorak, Ivandić, Beroš i Ambrušec, 2020; Blažević, & Peršić, 2007). Autorica je prilagodila anketni upitnik s obzirom na destinacijske specifičnosti Malinske uz prethodno pilotsko istraživanje u navedenoj destinaciji. Anketni upitnik je ukupno sadržavao 7 pitanja, te 49 varijabli kod ocjenjivanja Likertovom stupnjevanom ljestvicom. Prvi dio anketnog upitnika sadrži sociodemografske varijable ispitanika poput spola, starosne dobi i stručne spreme. Drugi dio anketnog upitnika sadrži pitanja specifična za zadovoljstvo stanovništva elementima ponude turističke destinacije te se dio anketnog upitnika vezao za ocjenu navedenih utjecaja turizma (stav domicilnog stanovništva prema: turizmu u destinaciji; pojavama u okruženju od značaja za turizma destinacije Malinska; razvoju turizma destinacije, kao i o ocjeni turističke ponude njene kvalitete, raspoređeno kroz 49 varijabli unutar glavnih segmenata istraživanja). Podaci koji su dobiveni kroz anketne upitnike su statistički obrađeni pomoću MS Excel-a.

REZULTATI ISTRAŽIVANJA

U prvom dijelu dobivenih rezultata, prikazuje se sintetizirani prikaz koji se odnose na sociodemografsku strukturu ispitanika. Od ukupnog uzorka (N=185), više od polovine ispitanika je muškog spola (121; 65.4%), dok je 87 ispitanika (34.6%) ženskog spola. Najčešća dobna skupina je od 18-25 godina (87; 47%), a slijedi je skupina 26-35 godina (64; 34.6%). Starosna dob ima veliku važnost zbog različitog reagiranja i percepcije

pojedinog segmenta na različite turističke pojave. %). Struktura prikazuje da je anketu popunjavalo mlađe stanovništvo što može iskriviti pravu sliku o zadovoljstvu stanovništva elementima turističke ponude. Mlađe stanovništvo preferira različite oblike zabave i doživljaja, dok je starije stanovništvo okrenuto prema mirnijem načinu suživota s turistima. Najviše ispitanika, njih 124 (64%) je navelo kako imaju završen fakultet. Obrazovnu strukturu je potrebno ispitati jer se različiti profili stanovništva na različiti način odnose prema turizmu. Znanje i ljudski potencijali predstavljaju jednu od nezaobilaznih komparativnih prednosti ove turističke destinacije, te je istu potrebno poticati i sustavno unaprjeđivati. Za uspješan razvoj turizma neophodni su kvalitativni trendovi u upravljanju turizmom.

Tablica 4. Sintetizirani prikaz sociodemografske strukture ispitanika
Table 4. Synthesized presentation of the sociodemographic structure of the respondents

		Ukupni uzorak	
		N	**%**
Ukupno ispitanika		185	100
Spol	Muškarci	121	65.4
	Žene	64	34.6
Dob	18-25	87	47
	26-35	64	34.6
	46-55	21	11.4
	56-65	11	5.9
	više od 65 godina	2	1.1
Stručna sprema	Srednja škola	14	7.6
	Fakultet	124	67
	Magisterij	45	24.3
	Doktorat	2	1.1

Nadalje, anketirano stanovništvo definiralo je odgovornost turističkog menadžmenta u destinaciji, te je ocijenilo rad turističke zajednice u destinaciji. Stanovništvo smatra da je za kvalitetu turističkog menadžmenta najzaslužnija turistička zajednica, te njih 97 (52.4%) pozitivno ocjenjuju rad turističke zajednice u destinaciji Malinska, dok je njih 53 (28.6%) rad turističke zajednice ocijenilo kao nedostatan, a 35 ispitanika (18.9%) nezadovoljavajućim.

Ispitivanjem lokalnog stanovništva ukazuje se na jake i slabe strane turističke ponude Malinske. Stanovništvo je svoje mišljenje ocjenom od 1 kao najlošije, do 5 kao najbolje dalo za sljedeće elemente: klima, ljubaznost stanovništva, ljubaznost zaposlenih u turizmu, znanje stranih jezika zaposlenih u turizmu, prometna dostupnost destinacije, lokalni promet, parkirališna mjesta u destinaciji, informiranost, signalizacija te ponuda turističkih događaja (tablica 5).

Iz podataka prikazanih u tablici 5 je vidljivo da ispitanici varijable poput klime, ljubaznosti stanovništva, ljubaznosti zaposlenih u turizmu, turističke informacije prije dolaska u destinaciju, događaje i ponudu suvenira ocjenjuju kau najbolje, dok postoje i elementi kojima stanovnici nisu zadovoljni, a to se odnosi na znanje stranih jezika zaposlenih u turizmu, prometnu dostupnost, lokalni promet, parkirališta i turistička signalizacija u destinaciji i ove elemente ocjenjuju kao najlošije. Može se zaključiti

kako bi upravo elemente koje je lokalno stanovništvo ocijenilo s najvišom ocjenom trebalo istaknuti, te u njima prepoznati potencijale, dok elemente koji su ocijenjeni najnižom ocjenom poboljšati, te uložiti velike napore kako bi se ti nedostaci ispravili.

Sljedeća grupa ocjena stanovništva o elementima odnosi se na: uređenost mjesta, urbanu skladnost, zelene površine mjesta, povijesno kulturna baština, urednost i čistoća plaža, gužve na plažama, očuvanost okoliša, čistoća mora i sadržaji za djecu (tablica 6).

Tablica 5. Stupanj zadovoljstva ispitanika elementima turističke ponude grada Malinske
Table 5. Degree of satisfaction of the respondents with the elements of the tourism offer of the city of Malinska

ELEMENTI TURISTIČKE PONUDE	NAJLOŠIJE	ZADOVOLJAVAJUĆE	NAJBOLJE
Klima	7 (3.7%)	11 (5.9%)	167 (90.2%)
Ljubaznost stanovništva	24 (12.9%)	21 (11.4%)	140 (75.5%)
Ljubaznost zaposlenih u turizmu	28 (15.1%)	29 (15.7%)	128 (69.2%)
Znanje stranih jezika zaposlenih u turizmu	94 (50.8%)	75 (40.5%)	16 (8.6%)
Prometna dostupnost	118 (63.8%)	56 (30.3%)	11 (5.9%)
Lokalni promet	130 (70.3%)	42 (22.7%)	13 (7%)
Parkirališta	39 (21.1%)	27 (14.6%)	9 (4.9%)
Turističke informacije prije dolaska u destinaciju	80 (43.3%)	56 (30.3%)	90 (48.7%)
Turistička signalizacija u destinaciji	41 (22.2%)	52 (28.1%)	53 (28.6%)
Događaji	23 (12.4%)	57 (30.9%)	87 (47%)
Suveniri	7 (3.7%)	68 (36.8%)	94 (50.8%)

Tablica 6. Stupanj zadovoljstva ispitanika elementima turističke ponude grada Malinske koju koristi i lokalno stanovništvo
Table 6. The degree of satisfaction of the respondents with the elements of the tourism offer of the town of Malinska, which are also used by the local population

ELEMENTI TURISTIČKE PONUDE	NAJLOŠIJE	ZADOVOLJAVAJUĆE	NAJBOLJE
Uređenost mjesta	39 (21.1%)	56 (30.3%)	90 (48.6%)
Urbana skladnost	149 (80.6%)	27 (14.6%)	9 (4.9%)
Šetnice	118 (63.8%)	56 (30.3%)	11 (5.9%)
Parkovi i zelene površine	130 (70.3%)	42 (22.7%)	13 (7%)
Povijesno kulturna baština	41 (22.2%)	57 (30.9%)	87 (47%)
Uređenost i čistoća plaža	39 (21.1%)	56 (30.3)	90 (48.6%)
Gužve na plažama	136 (73.5%)	21 (11.4%)	28 (15.1%)
Ljepota krajolika	26 (14.1%)	45 (24.3%)	114 (61.2%)
Očuvanost okoliša	40 (21.7%)	62 (33.5%)	83 (44.9%)
Čistoća mora	29 (15.6%)	95 (51.3%)	71 (38.3%)
Sadržaji za djecu	84 (45.5%)	51 (27.6%)	50 (27%)

Uočljivo je u tablici 6 kako najviše stanovnika grada Malinske uređenost mjesta, povijesno kulturnu baštinu, uređenost i čistoću plaža, ljepotu krajolika i očuvanost okoliša ocijenilo s najboljim. Nasuprot tome, stanovništvo je urbanu skladnost, šetnice, parkove i zelene površine, gužve na plažama te sadržaj za djecu ocijenila kao najlošije, dok je samo nekolicina njih čistoću mora navela kao zadovoljavajućom.

U tablici 7 su prikazani rezultati ocjena stanovništva o elementima odnosi se na: osjećaj sigurnosti i zaštite, radno vrijeme uslužnih djelatnosti i ugostiteljskih objekata, kulturni i zabavni sadržaj, ponudu izleta, lokalnu gastronomiju, odnos cijene i kvalitete, ponuda sportskih sadržaja, skupovi i kongresi, sadržaji za zdravstveni turizam i nautička ponuda.

Tablica 7. Stupanj zadovoljstva ispitanika elementima turističke ponude grada Malinske
Table 7. Degree of satisfaction of the respondents with the elements of the tourism offer of the town of Malinska

ELEMENTI TURISTIČKE PONUDE	NAJLOŠIJE	ZADOVOLJAVAJUĆE	NAJBOLJE
Osjećaj sigurnosti i zaštite	28 (15.1%)	21 (11.4%)	136 (73.5%)
Radno vrijeme uslužnih djelatnosti (banke, pošta, trgovina i sl.)	26 (14.1%)	45 (24.3%)	114 (61.2%)
Radno vrijeme ugostiteljskih objekata	39 (21.7%)	56 (30.3%)	114 (48.6%)
Objekti za smještaj	40 (21.1%)	62 (33.5%)	83 (44.9%)
Kulturni sadržaji	31 (1.,8%)	54 (29.2%)	100 (54%)
Zabavni sadržaji	30 (16.3%)	49 (26.5%)	106 (57.3%)
Sportski sadržaji	104 (56.2%)	37 (20%)	44 (23.8%)
Skupovi i kongresi	82 (44.3%)	75 (40.5%)	28 (15.2%)
Sadržaji za zdravstveni turizam	114 (61.6%)	38 (20.5%)	33 (17.8%)
Nautička ponuda	138 (74.6%)	21 (11.4%)	26 (14.1%)
Ponuda izleta	31 (16.8%)	73 (39.5%)	81 (43.3%)
Lokalna gastronomija	23 (12.5%)	14 (7.6%)	108 (58.4%)
Odnos cijene i kvalitete	45 (24.4%)	19 (10.3%)	100 (54%)

Rezultati ocjene ispitanika prikazani u tablici 7 pokazuju kako je stanovništvo osjećaj sigurnosti i zaštite, radno vrijeme uslužnih djelatnosti i ugostiteljskih objekata, kulturni i zabavni sadržaj, ponudu izleta, lokalnu gastronomiju te odnos cijene i kvalitete ocjenilo kao najbolje ili pak zadovoljavajućim. No, postoje i elementi kojima lokalno stanovništvo nije zadovoljno, a to je ponuda sportskih sadržaja, skupovi i kongresi, sadržaji za zdravstveni turizam i nautička ponuda i ocjenjuju ih kao nezadovoljavajuće Sukladno prikazanim ocjenama o zadovoljstvu elementima turističke ponude od strane lokalnog stanovništva, može se zaključiti kako su stanovnici zadovoljni većinom elemenata, ali naravno postoje i oni kojima stanovništvo nije zadovoljno. Stoga, u budućnosti je potrebno pozornost posvetiti njihovu unapređenju, što bi zasigurno rezultiralo i boljim zadovoljstvom stranih turista, a naravno i povećanjem zadovoljstva lokalnog stanovništva.

U anketnom upitniku bilo je postavljeno 15 tvrdnji na koje je lokalno stanovništvo trebalo odgovoriti sa odgovorima „ne slažem se nimalo“ do „potpuno se slažem“ (tablica 8). Svi odgovori su se saželi u izjave u dvije skupine, odnosno na "ne slažem se" i "slažem

se". Točnije, ispitanici smatraju kako je dosadašnji razvoj turizma poboljšao životni standard, da bi trebali stanovnici biti uključeni u donošenje razvojnih planova za turizam te da je turizam unaprijedio izgled i uređenost mjesta i da on pomaže u očuvanju kulturnog identiteta i naslijeđa. No, postoje i određena problematika koju razvoj turizma nosi, a ispitanici se slažu da razvoj turizma nosi i povećanje cijena te da se u destinaciji bilježi značajan rast zagađenja koji donosi buka. Sukladno prikazanom zaključuje se da lokalno stanovništvo smatra da razvoj turizma sa sobom donosi više prednosti.

Tablica 8. Ocjene stanovništva o razini turističkog razvoja i njegovom utjecaju na kvalitetu života
Table 8. Assessments of the population on the level of tourism development and its impact on the quality of life

TVRDNJE	NE SLAŽEM SE		NEUTRALNO		SLAŽEM SE	
	n	%	n	%	n	%
Dosadašnji razvoj turizma značajno je poboljšao standard stanovništva	6	2.7	25	13.5	155	83.8
Sigurnost stanovništva dovedena je u pitanje razvojem turizma	156	84.3	19	10.3	10	5.4
Rast broja turista izazvat će zaoštravanje odnosa lokalnog stanovništva i turista	119	64.3	42	22.7	24	13
Zbog razvoja turizma rastu cijene, što izaziva negodovanje stanovništva	63	34.1	33	17.8	89	48.1
Kontakti stanovništva i turista su rizični za zdravlje posebno u pandemijskom razdoblju	120	64.9	7	3.8	58	31.3
Lokalno stanovništvo treba biti uključeno u donošenje razvojnih planova za turizam	3	1.6	17	9.2	165	89.1
Turizam je utjecao na rast organiziranog kriminala	148	80	24	13	13	7
U destinaciji se bilježi značajan rast buke	68	36.8	38	20.5	79	42.7
Turistički razvoj povećao je izgradnju i kvalitetu objekata za rekreaciju dostupnih i stanovništvu	6	3.3	28	15.1	151	81.6
Turizam je potaknuo ulaganja u infrastrukturu	101	54.6	21	11.4	63	34.1
Razvoj turizma je unaprijedio izgled i uređenost mjesta	1	0.5	22	11.9	162	87.5
Interes turista je potaknuo revitalizaciju običaja i tradicionalnih aktivnosti lokalnog stanovništva	1	0.5	27	14.6	157	84.9
Turizam pomaže u očuvanju kulturnog identiteta i naslijeđa	13	7	27	14.6	145	78.4
Stanovništvo mijenja zanimanja te se sve više orijentira na zanimanja vezana uz turizam	61	33	18	9.7	106	57.3
Mali broj stanovnika ima ekonomske koristi od turizma	80	43.3	28	15.1	77	41.6

n – broj ispitanika

ZAKLJUČAK

S obzirom na svoju površinu, destinacija Malinska zaista nudi odličnu turističku ponudu kojom je i zadovoljno lokalno stanovništvo, ali naravno postoji i mjesta za poboljšanje. Naime, zbog kontinuiranog razvoja turizma dolazi do prekomjerne izgradnje apartmana koja se treba regulirati u budućnosti. Značajnije bi bilo da se pozornost posveti proširenju plaža s obzirom da je to jedna od slabih točki turizma. Točnije, plaže su male, stoga dolazi do velikih gužvi tijekom ljetne sezone. Uz to, potrebno je poboljšati i prometnu infrastrukturu, posebice u vidu lokalnog javnog prijevoza, kao i proširenju parkirališta s obzirom da ih na području

općine zaista ima malo. Analizom prikazanih odgovora lokalnog stanovništva, utvrdilo se je kako su oni zadovoljni trenutačnom turističkom ponudom i razvojem turizma te da je sam razvoj turizma poboljšao životni standard stanovništva, ipak ima prostora za napredak prema njihovu mišljenju. Naime, lokalno stanovništvo smatra da je potrebno poboljšati prometnu infrastrukturu, urediti prekomjernu gradnju apartmana što ujedno povećava i novi buke te pozornost posvetiti poboljšanju turističke signalizacije, proširenju plaža te sadržajima za razvoj zdravstvenog i nautičkog turizma.

Rezultati ovog istraživanja bi trebali potaknuti i nositelje turističke politike na što bolju organizaciju turizma u gradu Malinskoj na otoku Krku, kao i stvaranja što boljeg imidža destinacije. Stavovi lokalnog stanovništva, zasigurno mogu promijeniti dosadašnju sliku Malinske kao turističke destinacije, odnosno pomoći u stvaranju prepoznatljive ponude, te se istaknuti na što oštrijem konkurentom tržištu. Ograničenja koja dolaze do izražaja u ovome radu se odnose na relativno mali uzorak ispitane populacije, kratak vremenski rok provođenja anketiranja, te da je istraživanje provedeno jednokratno. Ipak, rezultati ovog istraživanja bi mogli dati uvid u polazišta temeljena na realnim problemima i suvremenim trendovima, te pružiti korisnicima uz teorijsku podlogu, ponuditi i relevantne praktične odgovore, čime će se osigurati viši stupanj učinkovitosti u turističkom djelovanju.

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THE IMPORTANCE OF THE ATTITUDES OF THE LOCAL POPULATION FOR THE SUSTAINABLE DEVELOPMENT OF TOURISM ON THE EXAMPLE OF THE CITY OF MALINSKA

Sandra Šokčević

Libertas International University, Trg J.F. Kennedy 6b, 10000 Zagreb, Croatia,
ssokcevic@libertas.hr

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Corresponding Author:
Sandra Šokčević, Libertas International University, Trg J.F. Kennedy 6b, 10000 Zagreb, Croatia, ssokcevic@libertas.hr

ABSTRACT

Tourism began to grow relatively slowly throughout history, starting in the middle of the 20th century. Today, tourism as a whole has imposed itself as one of the most propulsive economic activities. For the Republic of Croatia, where tourism accounts for more than a fifth of the GDP of the national economy. The aim of this work is focused on the presentation of the potential and concept of tourism development of island tourism with an emphasis on the island of Krk, i.e., its most developed municipality of Malinska. The paper conducted an empirical investigation of local residents' attitudes about the elements of the tourism offer in the municipality of Malinska and the impact of tourism on its development. The purpose of this research, in the interpretation of the obtained results, is to find relevant answers at the level of the tourist destination of Malinska about the attitude of the local population towards tourism, towards phenomena in the environment of importance for tourism, towards the development of the tourist destination and the assessment of the offer and quality of the tourist offer. The general results of the research led to the conclusion that the tourism of the mentioned destination has progressed, but that there is still room for progress and development of the offer in order to build a more competitive and market-recognizable tourist product.

Keywords: Island tourism, concept of development, tourist offer, attitudes of local population, island of Krk, city of Malinska.

GUIDELINES TO AUTHORS FOR WRITING PAPERS

Dejan Kojić[1]*, Marijana Žiravac Mladenović[1], Jelena Pavličević[2]

[1]PIM University, Technical Faculty, Despota Stefana Lazarevića no number, 78 000 Banja Luka, kojic.d@hotmail.com
[2]Universty in Novi Sad, Technological Faculty, Bulevar cara Lazara 1. 21 102 Novi Sad, Serbia

ABSTRACT

Guidelines to the authors on the manner of preparation of the article are designed in accordance with the best world publishing practice and the Rulebook on publishing scientific publications (Official Gazette of the Republic of Srpska, No. 77/17). The instruction was created in order to unify the style of publishing articles in all issues and editions of the scientific magazine "STED JOURNAL". The magazine is published semi-annually (May-November) in printed versions, with a circulation of 200 copies, and the electronic version of the issue is published at https://stedj-univerzitetpim.com/. All articles must be formatted in accordance with this Instruction and delivered to the email address of the journal. Each paper undergoes a preliminary elimination review, after which it is rejected or referred to the blind review process by two independent reviewers. Papers that have at least two positive reviews are published in the journal. The list of reviewers is adopted by the Editorial Board of the journal. The identity of the reviewer is not revealed to the authors and vice versa.

Keywords: STED Journal, review, publication, scientific publications.

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A table example:

Table 1 The curing data for NR/CSM rubber blend compounds with different content of waste rubber powder

WRP content (phr)	Curing characteristics					
	M_l, dNm	M_h, dNm	ΔM, dNm	t_{s2}, min	t_{c90}, min	*CRI*
0	4	40	36	6	15	11.0
20	5	42	37	8	16	12.5
40	5	45	40	9	16	14.3
60	7	46	39	9	17	12.5
80	7	47	40	10	17	14.3
100	7	47	40	10	17	14.3

A chart example:

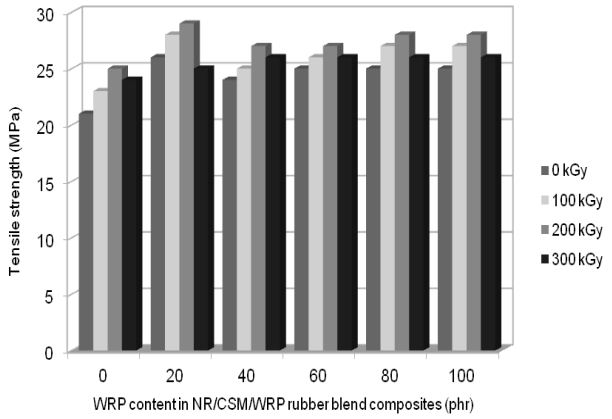

Figure 1 The effect of waste rubber powder content on tensile strength for the NR/CSM/WRP composites irradiated with different doses.

Equation

Equations should be written in the graphic editor for equations, specifically in the Microsoft Equation and they should be placed at the beginning of the text. On the right edge of the text in the row in which the equation is written one should indicate its number in parentheses beginning with number 1.

$$m_r = m_s\left(1 - e^{k_s t_{maks}}\right) - m_d\left(1 - e^{-k_d (t - t_{maks})}\right) za \quad t > t_{maks} \qquad (1)$$

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Figures have to be prepared for black-and-white printing, that is, if the original figure is in colours which cannot be distinguished in black-and-white printing, the colours have to be replaced by "raster", that is, different graphic signs which need to be explained in the legend. We insert in figures only the most essential text necessary for understanding, such as measure variables with their dimensions, short explanation on curves and similar. The rest is stated in the legend under the figure (Figure 2). The maximum size of a figure is 13 cm x 17 cm.

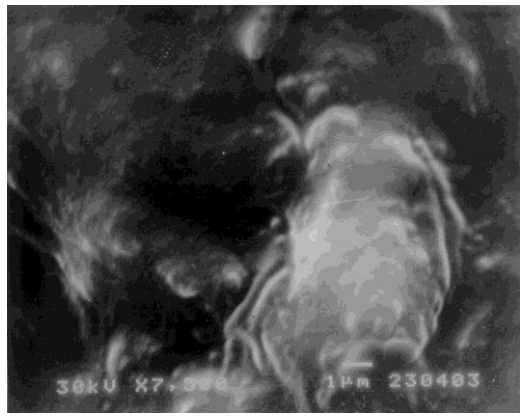

Figure 2 The SEM micrograph of NR/CSM/WRP composites filled with 20 phr waste rubber powder at 7500X magnification.

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An example of citing laws, regulations, court decisions in text:

- laws and regulations: first citing in text (Zakon o krivičnom postupku [ZKP], 2014); second and every next citing (ZKP, 2014);
- court decisions: first citing in text (Vrhovni sud Srbije [VSS], Rev. 1354/06); second and every next citing (VSS, Rev. 1354/06);

In the reference list:

Zakonik o krivičnom postupku, Službeni glasnik RS, 72/2011, 101/2011, 121/2012, 32/2013, 45/2013, i 55/2014; Regulation (EU) No. 1052/2013 establishing the European Border Surveillance System (Eurosur), OJ L 295 of 6/11/2013, 1; Directive 2013/32/EU on common procedures for granting and withdrawing international protection (recast), OJ L 180 of 29/6/2013, 60.

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CONCLUSION

The papers not written strictly according to these guidelines shall not be accepted.

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