ANALIZA TRŽIŠNOG NATJECANJA PRIMJENOM HUFFOVA MODELA – PRIMJER TRGOVAČKIH CENTARA U NASELJU ZADRU

APPLICATION OF HUFF MODEL IN ANALYSING MARKET COMPETITION – EXAMPLE OF SHOPPING CENTRES IN THE SETTLEMENT OF ZADAR

IVAN MARIĆ[1], ANTE ŠILJEG[1]

[1] Sveučilište u Zadru, Odjel za geografiju, Trg kneza Višeslava 9, 23 000 Zadar /
University of Zadar, Department of Geography, e-mail: imaric1@unizd.hr, asiljeg@unizd.hr

Predmet istraživanja rada je tržišno natjecanje između trgovačkih centara u naselju Zadru. Osnovu istraživanja čine prostorni podatci prikupljeni različitim metodama i tehnikama, analizirani primjenom alata geografsko-informacijskog sustava (GIS) uz uvažavanje specifičnih tržišnih zakona. Prema kategorizaciji trgovačkih centara, definirano je šire tržišno područje unutar kojeg je analizirano tržišno natjecanje između trgovačkih centara. Izvođenjem demografskog rastera definirana je gustoća potencijalnih kupaca unutar šireg tržišnog područja. Analiza natjecanja uključivala je određivanje tržišnih zona trgovačkih centara, pojavu potencijalnoga tržišnog kanibalizma te definiranje dominantnog centra prema varijabli vjerojatnosti odabira. Tržišne zone određene su na temelju atributa vremena vožnje (min). Metodama terenskog istraživanja, izračunom nelinearne udaljenosti te analizom gustoće trgovačkih centara zaključeno je da se između centara javlja tržišni kanibalizam. U svrhu predviđanja tržišne dominacije, primjenom Huffova modela, izračunate su srednje vrijednosti odabira centara unutar zona preklapanja i šireg tržišnog područja. Rezultati Huffova modela potvrđuju tržišnu stvarnost, odnosno da veći broj kupaca unutar zona preklapanja i šireg tržišnog područja odabire atraktivniji trgovački centar. Preklapanjem demografskog rastera i Huffova modela kvantificirana je razlika u broju ljudi koji posjećuju atraktivniji trgovački centar.
Ključne riječi: Huffov model, tržišni kanibalizam, tržišne zone, indeks atraktivnosti

The object of the research is market competition between the shopping centres in the settlement of Zadar. The research is based on the spatial data collected by using various methods and techniques, which were analysed by applying the tools of geographic information system (GIS) with respect to specific laws of market economy. A categorization of shopping centres was made in order to define a broad trade area where the competition between the centres was analysed. A demographic raster was used to define the density of potential consumers within a broad market area. The competition analysis included the determination of the centres' market zones, the occurrence of potential market cannibalism and the definition of the dominant shopping centre according to a variable of choice probability. The market zones were determined based on the attribute of duration of drive (min). On-site research, calculation of non-linear distance and the analysis of shopping centres' density, led to a conclusion that market cannibalism occurs between the centres. For the purpose of predicting market dominance, Huff model was used to calculate average values of preference of centres within the zones of overlapping and the broad trade area. The results of Huff model confirm the market reality that a larger number of consumers within the zones of overlapping and the broad trade area prefer a more attractive shopping centre. The difference in number of people that visit a more attractive shopping centre was quantified by overlapping the demographic raster and the Huff model.
Keywords: Huff model, market cannibalism, market zones, attraction index

Uvod

Trgovina je nekoliko posljednjih desetljeća doživjela snažan zamah u razvoju, očitovan u povećanju broja zaposlenih, površini prodajnog prostora te prometu robe (Keenan, 2005.; Burnett, 2008.; Kotler, Armstrong, 2010.; Grey, 2014.). Trgovina je više od gospodarske djelatnosti i nije isključivo predmet proučavanja ekonomske struke (Grimshaw 2000.; Baray, Cliquet, 2007.; Cannon, 2007.; Hungari, 2009.). Trgovina se odvija na tržištu koje se definira kao skup svih stvarnih i potencijalnih kupaca nekoga proizvoda ili usluge (Kotler, 2002.). Ono kao kompleksna pojava uključuje interakciju ljudi i institucija unutar ograničenoga prostorno-vremenskog okvira (Kotler, Armstrong, 2010.). Razumijevanje tržišne stvarnosti usmjereno je prema proučavanju prostornog odnosa kupaca i trgovine. Na temelju mjerljivih i preciznih informacija o strukturi i obilježjima tržišta donose se odgovarajuće marketinške odluke (*GIS for Customer and Market Analytics*, 2007.).

Razvoj GIS-a omogućio je snažnije uključivanje geografa u poslovne i tržišne analize (*business and trade analysis*) (Grimshaw, 2000.; Keenan, 2005.; Pick, 2008.). U literaturi se uglavnom analiziraju mogućnosti primjene GIS-a unutar maloprodajne industrije (Van Eck, De Jong, 1999.; Badea i dr., 2008.; Mishra, 2009.). Analize tržišnog natjecanja i prostorne distribucije trgovina spadaju u najčešće korištene analize unutar znanstvene discipline geomarketinga (Van Eck, De Jong, 1999.; Dramowicz, 2005.; Suárez-Vega i dr., 2011.; Roig-Tierno i dr., 2013.). Geomarketing se može definirati kao znanstvena disciplina čiji je objekt proučavanja tržište i njegove dinamične sastavnice, a temelji se na integraciji informacijsko-komunikacijskih tehnologija, marketinških strategija i znanja te geografskog poimanja prostora (Sl. 1.).

Tržišno natjecanje analizirano je na primjeru trgovačkih centara jer se manje trgovine pri donošenju odluka uglavnom oslanjaju na iskustvo stručnih osoba. Veliki centri odluke donose na temelju višekriterijskih analiza (Cheng i dr., 2005.; Zolfani i dr., 2013.), a njih je moguće jedino sustavno modelirati (Sapaj, 2013.).

Prostorni obuhvat istraživanja je naselje Zadar koje je prema službenom Popisu stanovništva, kućanstava i stanova 2011. godine imalo 71 471 stanovnika. Razina obrade, analize i vizualizacije
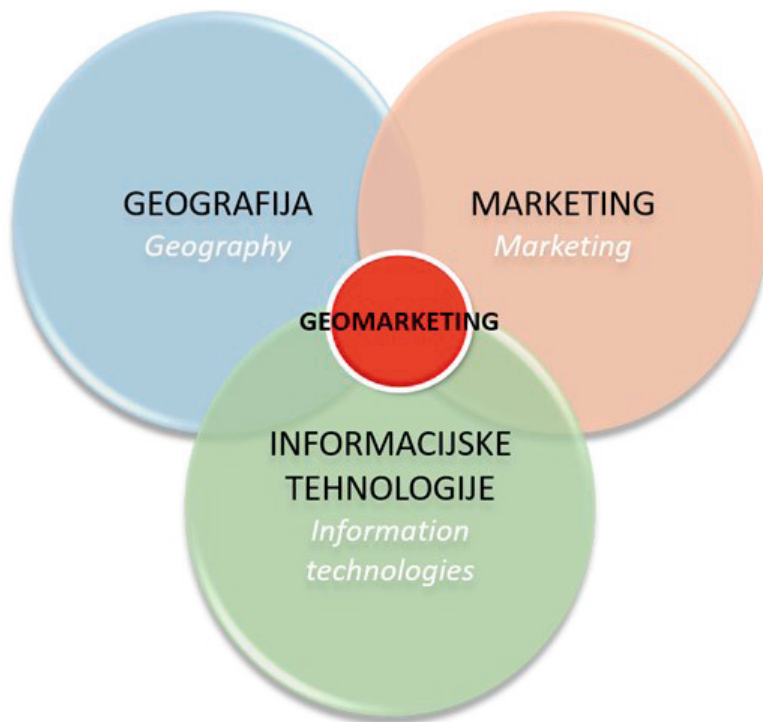
Introduction

Over the last several decades there has been a significant development of trade, which is reflected in the increase of the number of the employed, sales area and traffic of goods (Keenan, 2005; Burnett, 2008; Kotler, Armstrong, 2010; Grey, 2014). Trade is much more than just an economic activity and is therefore not an exclusive object of interest of economy (Grimshaw 2000; Baray, Cliquet, 2007; Cannon, 2007; Hungari, 2009). Trade takes place on the market which is defined as an aggregate of all the real and the potential consumers of a product or a service (Kotler, 2002). As a complex phenomenon, it includes an interaction of people and institutions within a limited spatial-temporal frame (Kotler, Armstrong, 2010). Understanding market reality was directed towards researching spatial relations between consumers and shops. Based on measurable and precise information about structure and features of the market, corresponding marketing decisions are made (*GIS for Customer and Market Analytics*, 2007).

The development of GIS technology has enabled a more prominent inclusion of geographers into business and trade analysis (Grimshaw, 2000; Keenan, 2005; Pick, 2008). The application of GIS within the retail industry is what is mostly analysed in the available literature (Van Eck, De Jong, 1999; Badea et al., 2008; Mishra, 2009). The analyses of market competition and spatial distribution of shops are the most commonly used analyses within the scientific discipline of geomarketing (Van Eck, De Jong, 1999; Dramowicz, 2005; Suárez-Vega, et al., 2011; Roig-Tierno et al., 2013). Geomarketing can be defined as a scientific discipline whose object of research is the market and its dynamic components, and is based on an integration of informational-communication technologies, marketing strategies and geographic understanding of space (Fig. 1).

Market competition was analysed through the example of shopping centres, since smaller shops tend to rely on the experience of experts when making decisions. On the other hand, in order to reach decisions, shopping centres use multi-criteria analyses (Cheng et al., 2005; Zolfani et al., 2013) that can be modelled only systematically (Sapaj, 2013).

The research area is the settlement of Zadar, a city with 71,471 inhabitants according to the official census of population, households and residences. The level of data processing, analysis

Slika 1. Sastavnice geomarketinga
Figure 1 Components of geomarketing

podataka je statistički krug.[1] Osnovni cilj istraživanja je primjenom GIS-a predstaviti suvremen način analize tržišnog natjecanja. Sekundarni ciljevi ovoga istraživanja su sljedeći:

1. Kreirati tržišne zone ili područja utjecaja trgovačkih centara na temelju definiranih varijabli;

2. Izračunom gustoće trgovačkih centara, terenskim istraživanjem te definiranjem nelinearne udaljenosti utvrditi javlja li se tržišni kanibalizam između centara;

3. Generirati indeks atraktivnosti centara te primjenom Huffova modela analizirati vjerojatnost odabira centara unutar tržišnih zona i zona preklapanja;

4. Na temelju izvedenih podataka utvrditi dominantan trgovački centar.

and visualization is a statistical circle.[1] The main objective of the research is to present a modern way to analyse market competition by using GIS. Secondary objectives of the research are the following:

1. To create market zones or areas of influence of centres based on defined variables;

2. To determine whether market cannibalism appears between the centres by using calculation of shopping centres density, field work and the definition of non-linear distance;

3. To generate an index of attractiveness of shopping centres and to use the Huff model to analyse the probability of choosing a centre's within market zones and overlapping zones, and

4. To determine the dominant shopping centre based on the data processed.

[1] Statistički krug je najmanja korisniku dostupna statistička prostorna jedinica. Statistički krugovi su nastali 1959. godine, a revidirani su dijeljenjem pri svakom dosadašnjem popisu stanovništva. Predstavljaju stalnu mrežu prostornih jedinica, koja pokriva cjelokupno kopneno područje Republike Hrvatske. Naselje Zadar sastoji se od 41 statističkog kruga.

[1] A statistical circle is the smallest statistical spatial unit available to a user. Statistical circles were formed in 1959 and were revised by division in each of the following censuses. They represent a permanent network of spatial units that covers the whole land territory of the Republic of Croatia. The settlement of Zadar consists of 41 statistical circles.

Metodologija istraživanja

Metodologija znanstvenog rada temelji se na primjeni općih znanstveno-istraživačkih i specifičnih GIS metoda koje uključuju: proces vektorizacije i interpolacije, statističke metode te kartografsku vizualizaciju. Na temelju proučene literature, u primarnoj fazi procesa modeliranja izrađen je konceptualni model istraživanja iz kojeg su slijedila logička i matematička faza (Šiljeg, 2013.). Logička faza odnosi se na odabir najprimjerenijih metoda s obzirom na obilježja ulaznih podataka i definirane ciljeve istraživanja. Matematička faza uključuje upotrebu funkcija i formula te, ako je potrebno, izmjenu za potrebe istraživanja (Šiljeg, 2013.). Ona se u radu očituje u primjeni Huffova modela, mjeri gustoće trgovačkih centara te izračunu indeksa atraktivnosti. Proces istraživanja izveden je kroz četiri faze.

Prikupljanje podataka

Putem službenog dopisa uspostavljen je kontakt s upravama trgovačkih centara Supernova i City Galleria koje su osigurale dio podataka potrebnih za generiranje indeksa atraktivnosti. Uprava trgovačkog centra City Gallerie osigurala je tlocrte svih razina centra koji su poslužili u procjeni nedostavljenih parametara (broj i površina aktivnih prodavaonica).

Za potrebe izvođenja indeksa atraktivnosti te utvrđivanja pojave tržišnog kanibalizma provedeno je terensko istraživanje u razdoblju od 10. do 13. srpnja 2015. Fotografirane su infrastrukturne razlike između centara te odraz pojave tržišnog kanibalizma na centar City Galleria. Na temelju dostupnih tlocrta izvršeno je terensko kartiranje centra. Njime su utvrđeni točan broj aktivnih prodavaonica kao i površina svake zatvorene prodavaonice. Dobiveni podatak je oduzet od ukupne površine prodajnog prostora namijenjenog za iznajmljivanje koji je dostavljen od uprave centra, čime je generiran podatak o površini aktivnih prodajnih prostora.

Za potrebe izvođenja modela tržišnih zona na temelju varijable vremena vožnje (*drive time*) sa stranica Geofabrika (URL 1) preuzeti su detaljni podatci o cestovnoj mreži unutar naselja Zadra i šireg tržišnog područja. Pomoću alata integriranih unutar *ArcGIS for Desktop* softverskog paketa izvršena je topološka korekcija podataka na temelju odgovarajućih

Research methodology

The methodology in this scientific paper is based on the application of general scientific research methods and specific GIS methods that include the process of vectorization and interpolation, statistical methods and cartographic visualization. Based on the researched literature, a conceptual model of research was made in the initial phase of the modelling process, followed by a logical and a mathematical phase (Šiljeg, 2013). Logical phase refers to the selection of the most suitable methods with respect to features of input data and defined research objectives. Mathematical phase includes the usage of functions and formulas and, if necessary, a change for the purpose of research (Šiljeg, 2013). In the paper it is reflected in the application of the Huff model, the measurement of shopping centres density and the calculation of the attractiveness index. The research was conducted in four phases.

Collecting data

A contact with managements of the shopping centres "Supernova" and "City Galleria" has been made through an official letter, and they have provided a part of data needed for generating the attractiveness index. The management of "City Galleria" has provided layouts of all the levels of the centre that have been used in the assessment of the undelivered parameters (number and area of the active stores).

For the purposes of deriving the attractiveness index and determining the occurrence of market cannibalism, a field research was made in the period from 10 July to 13 July, 2015. Infrastructure differences among the centres were photographed, as well as the impact of market cannibalism on "City Galleria". Based on the available layouts, field mapping of the centre was executed in order to determine the exact number of active shops, as well as the area of each closed shop. The acquired data was subtracted from the total retail area designated for rent that was provided by the centre's management, which resulted in generating the data about the area of the active shops.

For the purpose of creating a model of market zones based on the variable of drive time, a detailed set of data about road network within Zadar and the broad trade area was downloaded from the Geofabrik website (URL 1). With the help of tools integrated into the software package *ArcGis for Desktop*, a topological correction of data was

pravila kako bi *Dijkstra* algoritam generirao vjerne modele tržišnih zona.

Geodetska tvrtka Teodolit d.o.o. je za potrebe izvođenja demografskog rastera, odnosno modela gustoće potencijalnih kupaca, osigurala podatke o urbanoj infrastrukturi za 2015. godinu na području Zadarske županije. Za potrebe izvođenja tržišnih zona te Huffova modela, na temelju DOF[2] predloška (URL 2) vektorizirane su lokacije trgovačkih centara u naselju Zadru.

Organiziranje baze podataka

Prikupljeni podatci organizirani su u jedinstvenu prostorno-orijentiranu bazu podataka te su potom na temelju jedinstvene šifre povezani s novokreiranom bazom unutar *ArcCataloga*. Iako ArcGIS podržava mnoge formate spremanja podataka, odabran je *file geodatabase* zbog strukturne i izvedbene prednosti u upravljanju nad ostalim formatima.

Analiza i interpretacija

Preklapanjem sloja statističkih krugova sa zonom utjecaja definiranom na temelju metode linearne udaljenosti u iznosu od 9 km, koja je određena prema kategorizaciji trgovačkih centara, utvrđeno je šire tržišno područje. Slijedeći kategorizaciju OSM-a (OpenStreetMap), svakom tipu prometnice pridodana je brzina kretanja vozila. Koristeći ekstenziju *Network Analyst*, točnije alat *New Service Area* izrađeni su modeli tržišnih zona trgovačkih centara na temelju definiranih parametara.

Slijedeći pristup N. T. Donthua i R. T. Rusta (1989.), E. M. Jansenbergera i P. Staufer-Steinnochera, (2004.), N. Roig-Tiernoa i dr. (2013.), primjenom alata *Kernel density* (KDE[3]) generiran je model gustoće potencijalnih kupaca (demografski raster) za uže i šire tržišno područje. Metoda Kernel odnosi se na fokus metodu analize susjedstva kod kontinuiranih podataka prikazanih rasterom. Glavna pretpostavka te metode je da uzorak ima određenu gustoću na bilo kojoj lokaciji unutar uzorka, a ne samo tamo gdje se pojava nalazi (Pahernik, 2013.). Na temelju podataka o ukupnoj dostupnoj površini

made based on the appropriate rules, so that the *Dijkstra* algorithm could create faithful models of the market zones.

For the purpose of creating a demographic raster and a model of density of potential buyers, a geodetic survey company Teodolit d.o.o. provided data about urban infrastructure in Zadar County for the year 2015. In order to determine market zones and Huff model, locations of shopping centres were vectorized on the basis of a DOF[2] template (URL 2).

Organizing the database

The acquired data were organized into a single space-oriented database, and were connected to the newly created database within the *ArcCatalog* through a unique code. Although ArcGIS supports many formats for saving data, file geodatabase format was selected due to its structural and implemental advantages over other formats when it comes to managing data.

Analysis and interpretation

A broad trade area was determined by overlapping the layer of statistical circles with the zone of influence defined by a method of linear distance of 9 km, which was set according to the categorization of shopping centres. Following the OSM (OpenStreetMap) categorization, vehicle speed was assigned to each road type. By using the extension *Network Analyst*, and its tool *New Service Area*, models of the shopping centres' market zones were made based on defined parameters.

Following the approach of N. T. Donthu and R. T. Rust (1989), E. M. Jansenberger and P. Staufer-Steinnocher, (2004) N. Roig-Tierno et al. (2013), a model of density of potential consumers (demographic raster) for both narrow and broad trade area was generated by using a *Kernel Density* (KDE[3]) tool. Kernel method is a focal method of neighborhood analysis of continuous data displayed with a raster. The main assumption of this method is that a sample has a specific density in each location within it, regardless of where the phenomenon is located (Pahernik, 2013). Based on the data on the total available area for rent within

---

[2] Digitalni ortofoto
[3] Kernel Density Estimation (procjena Kernel gustoće)

[2] Digital Ortophoto
[3] Kernel Density Estimation

za iznajmljivanje unutar trgovačkih centara, izračunata je mjera gustoće za šire i uže tržišno područje, što može upućivati na potencijalnu zasićenost tržišta ponudom trgovačkih centara.

Alatom *Market Analysis Toolset* (URL 3) izvedeni su Huffovi modeli vjerojatnosti odabira trgovine na razini geoobjekata urbane infrastrukture. Analiza je provedena na temelju varijable nelinearne udaljenosti. Pri generiranju modela uspoređene su tri determinističke metode interpolacije: inverzna udaljenost (IDW), prirodni susjed (NN) i triangulacijska nepravilna mreža (TIN). Huffov model nadograđen je upotrebom više parametara atraktivnosti koji su detaljnije navedeni u radu, čime je kreiran indeks atraktivnosti za svaki centar. Alatom *Intersect* određene su zone preklapanja dobivene na temelju parametra vremena vožnje. Preklapanjem Huffova modela s modelima tržišnih zona i zona preklapanja utvrđena je srednja vrijednost odabira za svaki centar. U konačnici je identificiran tržišno dominantan centar te je kvantificirana razlika u broju ljudi koji ga posjećuju.

Vizualizacija

Vizualizacija se definira kao „srce geografske prakse" (Craine, Aitken, 2005.), a važan je korak u procesu modeliranja jer primjenom vizualnih oblika jasnije objašnjava varijabilnost kompleksnih prikazanih prostornih pojava. U svrhu interpretacije izlaznih rezultata izrađene su odgovarajuće tematske karte. Radi lakšeg utvrđivanja prostorne varijabilnosti proučavane pojave između modela korištena je ista skala boja te su postavljene jednake granice klasa.

Trgovački centri naselja Zadra

Trgovački centar definira se kao skupina maloprodajnih i drugih specijaliziranih komercijalnih objekata koji nude zabavne, kulturne i uslužne sadržaje koji omogućuju odmor i socijalizaciju, privlačeći kupca, a istodobno mu štedeći vrijeme. Planirani su i razvijani kao jedinstvena cjelina, s osiguranim velikim parkirnim prostorom (Jakovčić, Spevec, 2004.; Stanić, 2009.). U srpnju 2015. godine u Zadru su poslovala dva trgovačka centra: Supernova i Trgovački centar Relja (City Galleria). City Galleria je prvi trgovački centar izgrađen u Zadru, smješten u Ulici Murvička 1. Dovršen je 2008. godine kada je

shopping centres, a density for narrow and broad trade area was calculated, which can indicate the potential saturation of the market with the shopping centres' offer.

Market Analysis Toolset (URL 3) was used to make Huff models of the store choice probability on the level of features of the urban infrastructure. The analysis was conducted based on the variable of non-linear distance. In the process of generating the model, three deterministic methods of interpolation were compared: inverse distance (IDW), natural neighbour (NN) and triangular irregular network (TIN). The Huff model was upgraded by additional attraction parameters which are listed in the paper, and an attraction index for each centre was derived. By using the tool *Intersect*, overlapping zones were determined based on the drive time parameter. Through overlapping the Huff model with the models of market zones and overlapping zones an average value of choice for each centre was determined. Finally, the dominant centre was identified and the difference in number of visitors was quantified.

Visualization

Visualization is defined as "the heart of geographic practice" (Craine, Aitken, 2005) and it represents an important step within the process of modelling, because it uses visual shapes in order to give clear explanations of the variability of complex spatial phenomena. For the purpose of interpreting the output results, a set of thematic maps was made. In order to facilitate the determining of spatial variability of the research phenomena among the models, the same scale of colours and the limits of classes were set.

Shopping centres in the settlement of Zadar

A shopping centre is defined as a group of retail and other specialized commercial outlets with various entertainment, culture and service offer providing relaxation and socialization that attract a consumer and, simultaneously, save his/her time. Shopping centres are usually planned and developed as unique complexes with available parking spaces (Jakovčić, Spevec, 2004; Stanić, 2009). In July of 2015, two shopping centres operated in Zadar – Supernova and the Shopping centre Relja (City Galleria). City Galleria is the first shopping centre built in Zadar, located on the street Murvička 1.

Slika 2. Zatvorene prodavaonice u starom dijelu centra City Gallerie, srpanj 2015.
Izvor: terensko istraživanje
Figure 2 Closed shops in the old part of the City Galleria, July 2015.
Source: field research

nadograđen drugi dio centra naziva City Galleria 2, s dodatnim trgovačkim i zabavnim sadržajima (Jakovčić, Rendulić, 2008.). Trgovački centar Supernova otvoren je 11. studenog 2010. Nalazi se u blizini važnoga cestovnog čvorišta na rubu grada u Ulici Akcije Maslenica 1. Njezin oblik i smještaj posljedica su velike slobodne površine za izgradnju te dobre prometne povezanosti sa zadarskim zaleđem.

U Supernovi su prostori kompaktniji i veći, a time i atraktivniji za poznatije „osovinske" (Jakovčić, Rendulić, 2008.) ili „sidraške" (*anchor*) trgovine koje privlače veći broj kupaca. Iako je, prije otvaranja centra Supernove centar City Galleria imao u potpunosti iznajmljen prostor, danas je većina trgovina u starom dijelu centra zatvorena. Jedan od razloga je tip gradnje, odnosno veličina prodajnih prostora za iznajmljivanje, koje u starom dijelu centra nisu dovoljno velike za privlačenje „osovinskih" trgovina (Sl. 2.).

Rezultati i rasprava

Određivanje užega i širega tržišnog područja

Tržište je, kao višedimenzionalan koncept dobavljača, kupca i proizvoda, odnosno fizičko mjesto okupljanja kupca i prodavača (Kotler, 2002.; Burnett, 2008.; Kim, Canina, 2010.), za potrebe analize tržišnog natjecanja prepoznato na razini užeg (naselje Zadar) i šireg područja. Šire tržišno područje određeno je na temelju kategorizacije centara prema autoru H. C. Mautneru (1996.) (Tab. 1.). Na temelju parametra

It was finished in 2008 when the second wing of the centre called City Galleria 2 was built, with additional stores and entertainment facilities (Jakovčić, Rendulić, 2008). The shopping mall Supernova was opened on 11 November, 2010. It is located in the vicinity of an important road node at the edge of the city on the street Akcije Maslenica 1. Its shape and location are a result of a huge available construction site and a good transport communication with the hinterland of Zadar.

In the shopping centre Supernova the spaces are more compact, bigger, and thus more attractive for famous key tenants (Jakovčić, Rendulić, 2008) or anchorstores that attract larger numbers of consumers. Although City Galleria has had all of its spaces rented before the opening of Supernova, most of the stores in the old part of the mall are today closed. One of the reasons is their design, i.e. size of retail spaces for rent, which are not big enough to attract anchor stores (Fig. 2).

Results and discussion

Defining narrow and broad trade areas

The market, as a multi-dimensional concept of supplier, consumer and product, i.e. a physical location where consumers and vendors meet (Kotler, 2002; Burnett, 2008; Kim, Canina, 2010), is analysed on the level of narrow (Zadar settlement) and broad area regarding competition. According to H. C. Mautner (1996), the broad trade area was determined on the basis of categorization of shopping centres (Tab. 1). Based on the parameters of classification of gross area for lease

Tablica 1. Kategorizacija trgovačkih centara prema parametru GLA
Table 1 Categorization of shopping centers according to the GLA parameter

Varijabla *Variable*	Tipovi trgovačkih centara *Types of shopping centers*			
	Susjedstva *Neighbourhood*	Zajednice *Community*	Regionalni *Regional*	Nad-regionalni *Super-regional*
GLA (m²)	3 000 – 10 000	10 000 – 30 000	30 000 – 80 000	80 000 – 150 000
Broj trgovina *Number of stores*	15 – 20	40	100	200 – 225
Stanovništvo naselja *Population of settlement*	2 500 – 40 000	40 000 – 150 000	150 000 – 300 000	> 30 0000
Udaljenost (km) *Distance (km)*	2,25	4,5 – 9,0	12,0	18,0
Vrijeme putovanja (min) *Travelling time (min)*	5 – 10	10 – 15	15 – 20	30 – 45

Izvor: Mautner, 1996.
Source: Mautner, 1996

klasifikacije bruto površine za iznajmljivanje (GLA[4]), trgovački centri Supernova (27 400 m²) i City Galleria (20 546 m²) spadaju u tip centra zajednice (Uprava trgovačkog centra Supernova, m2 Center management d.o.o., Uprava Trgovinski centar – Zadar d.o.o.). U slučaju klasifikacije na temelju parametra ukupne površine spadali bi u kategoriju regionalnog centra.

Na temelju maksimalne vrijednosti varijable udaljenosti (9 km) koja reprezentira gravitacijski utjecaj trgovačkog centra tipa zajednice te preklapanjem statističkih krugova definirano je šire tržišno područje (Sl. 3.). Uže, primarno tržišno područje prepoznato na razini naselja Zadra, broji 41 statistički krug i 71 471 stanovnika. Šire tržišno područje (primarno + sekundarno) ukupno broji 71 statistički krug i 85 715 stanovnika.

Izrada demografskog rastera

Iz perspektive proizvođača tržište čine ljudi s jasnim ili skrivenim željama koje se ogledaju kroz potražnju za određenim proizvodom (Burnett, 2008.). Potražnja se odnosi na količinu proizvoda ili usluga koje su potrošači spremni kupiti po određenoj cijeni (Rodrigue i dr., 2013.). U GIS-u se naglasak stavlja na gustoću kupaca i njihovu kupovnu moć u odnosu na tržišno područje, odnosno gravitacijski utjecaj određene trgovine (Roig-Tierno i dr., 2013). Proces izrade demografskog rastera opisan je u metodologiji istraživanja. Izvedeni model (Sl. 4.) poslužio je pri utvrđivanju dominantnoga tržišnog centra.
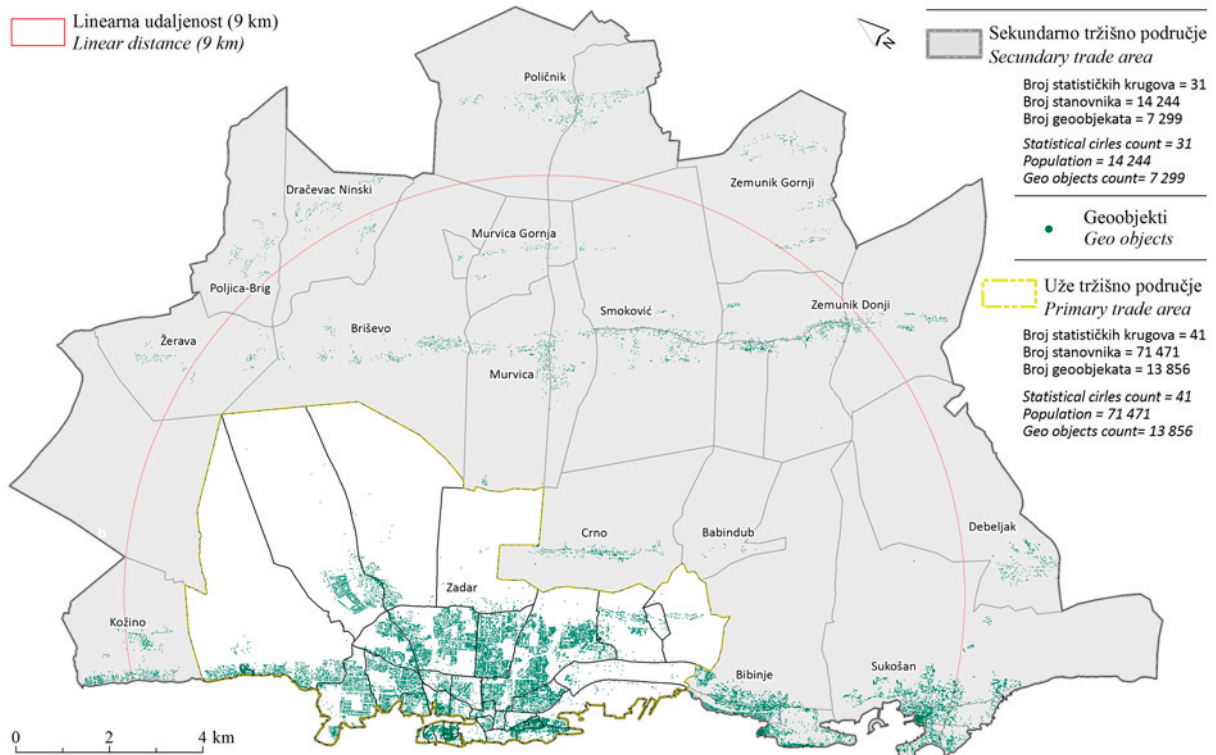
(GLA[4]) the shopping malls Supernova (27,400 sq m) and City Galleria (20,546 sq m) can be classified as communal centre type (Uprava trgovačkog centra Supernova, m2 Center management d.o.o., Uprava Trgovinski centar – Zadar d.o.o.). If classified based on the total area parameter, they would be categorized as regional centres.

Based on the maximum value of distance variable (9 kilometres) that represents the gravitational influence of the community type shopping centre, and through the overlapping of statistical circles, the broad trade area was defined (Fig. 3). A narrow, primary trade area recognized on the level of Zadar settlement consists of 41 statistical circles and 71,471 inhabitants. Broad trade area (primary + secondary) consists of a total of 71 statistical circles and 85,715 inhabitants.
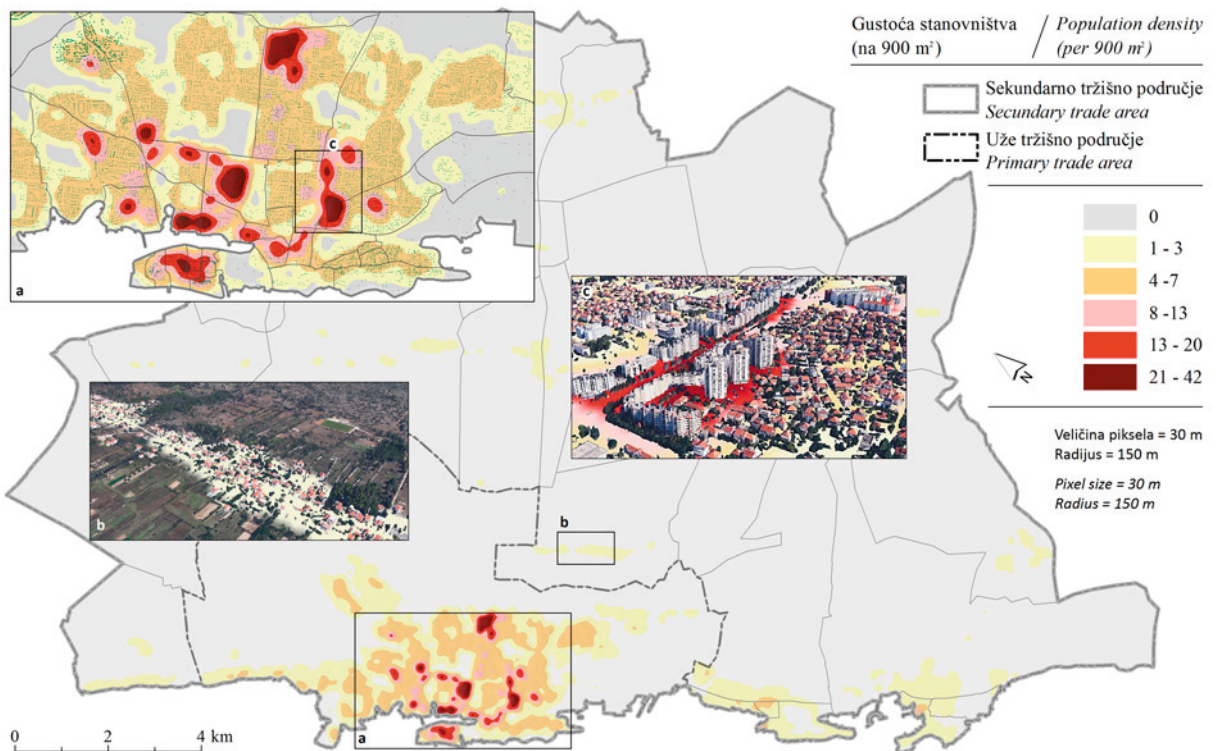
Creating the demographic raster

From the perspective of producers, a market consists of people with clear or hidden wants that manifest through a demand for a specific product (Burnett, 2008). The demand refers to the quantity of products or services that the consumers are willing to buy for a price (Rodrigue et al., 2013). GIS puts the emphasis on the density of consumers, as well as on their purchasing power in relation to the trade area, i.e. gravitational influence of a store (Roig-Tierno et al., 2013). The process of creating a demographic raster was described in the chapter on the research methodology. The final model (Fig. 4) was used in determining the dominant trade centre.

[4] Gross Leasable Area (bruto površina za iznajmljivanje)

[4] Gross Leasable Area

Slika 3. Definirano primarno i sekundarno tržišno područje natjecanja
Figure 3 Primary and secundary trade area of competition

Slika 4. Gustoća stanovništva šireg tržišnog područja
Figure 4 Population density within broader market area

Utvrđivanje tržišnog kanibalizma

Tržišni kanibalizam je stvarna tržišna prijetnja svim proizvodima i trgovinama koji se nalaze na zasićenom tržištu. Ne postoji velik broj znanstvenih radova koji kvantificiraju tu prijetnju ili ispituju mjere koje pomažu u njegovu opisivanju (LOMAX I DR., 1996.). U literaturi ne postoji općeprihvaćena definicija tržišnoga kanibalizma. Uglavnom se definira kao pojava kojom određeni proizvod ili trgovina stječu dobit koja je preusmjerena iz postojećega proizvoda ili druge trgovine (LOMAX I DR., 1996.). Javlja se kada novi proizvod ili trgovina „jede" prodajni volumen i potražnju postojećeg proizvoda ili trgovine, onoga trenutka kada nova trgovina ili proizvod prodire na tržište starijeg proizvoda ili trgovine (URL 4).

Pojam tržišnog kanibalizma često se navodi pri određivanju tržišnih zona. Naime, kada se zbog svoje blizine dvije ili više tržišnih zona određenih trgovina preklapaju, taj prostor stječe moć privlačenja koji je jednak njihovu zbroju. Dakle, potencijalni kupci koji žive u tom području izloženi su većoj komercijalnoj ponudi, čime taj tržišni prostor postaje snažnije okupiran tržišnom ponudom (ROIG-TIERNO I DR., 2013.). U tom prostoru između istih profila trgovina dolazi do borbe za pokroviteljstvo kupca, odnosno tržišnog natjecanja (KELLY I DR., 1993.; ROIG-TIERNO I DR., 2013.).

U GIS-u se mjerenje tržišnoga kanibalizma odnosi na izračun preklopljene površine tržišnih zona dviju ili više trgovina (CISNEROS, 2015.). Snažan i dug tržišni kanibalizam može imati negativan utjecaj na proizvod ili trgovinu prisiljavajući ih, zbog smanjenja volumena prodaje i tržišnog udjela, na povlačenje s tržišta ili zatvaranje. Pojava tržišnog kanibalizma zabilježena je na primjeru centra City Gallerie koji je u najvećoj mjeri zbog pojačane konkurencije (otvaranje trgovačkog centra Supernove) već 2010. godine počeo bilježiti zatvaranje poslovnih prostora (Sl. 5.) (BABAJKO JAMIČIĆ, 2010.; BURICA, 2012.). Pojava zvana „sindrom izloga u bijelom papiru" najuočljivija je u starijem dijelu centra, gdje prevladavaju prodavaonice manjih površina, dok se noviji dio zahvaljujući otvorenoj tržnici, kinodvoranama, prostranim kafićima i nekoliko trgovina modnih marki uspijeva održati na životu (BABAJKO JAMIČIĆ, 2010.; BURICA, 2012.).

Do pojave tržišnoga kanibalizma moralo je doći ako se promatraju tri sljedeća parametra. Prvi se odnosi na mjeru gustoće trgovačkih centara koja služi za izračun zasićenosti tržišta
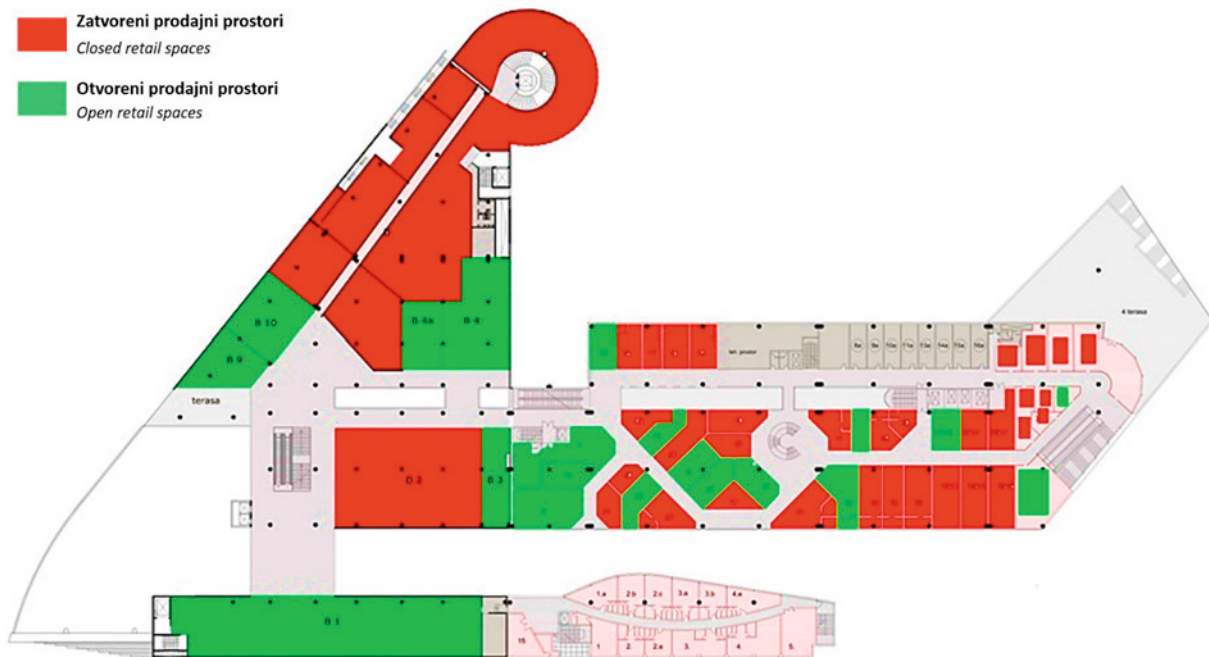
Determining market cannibalism

Market cannibalism is a real market threat to all products and shops that are present on a saturated market. There are only a few scientific papers that quantify that threat or examine the measures that help its description (LOMAX ET AL., 1996). A generally accepted definition of market cannibalism does not exist in literature. It is mostly defined as a phenomenon in which a product or a store gains profit that is redirected from the existing product or another store (LOMAX ET AL., 1996). It occurs when a new product or store "eats" the sales volume and the demand of the existing product or store, at the moment when a new store or product penetrates the market of an older product or store (URL 4).

Market cannibalism is often mentioned when trade zones are being determined. When two or more trade zones of certain stores overlap due to their vicinity, that area gains a power of attraction that is equal to their sum. Therefore, potential buyers living in such area are exposed to a bigger commercial offer, which makes the trade area with a rich market offer (ROIG-TIERNO ET AL., 2013). A battle for customers, i.e. market competition, between similarly profiled stores occurs in that area (KELLY ET AL., 1993; ROIG-TIERNO ET AL., 2013).

In GIS the measuring of market cannibalism refers to calculation of an area where trade zones of two or more stores overlap (CISNEROS, 2015). Strong and lasting market cannibalism can have a negative influence on a product or a store, forcing them to retreat from the market or close down due to a decrease in sales volume and market share. An occurrence of market cannibalism was perceived in the example of shopping centre City Galleria that has begun closing its retail spaces as early as 2010 due to the increased competition (opening of the centre Supernova) (Fig. 5) (BABAJKO JAMIČIĆ, 2010; BURICA, 2012). The occurrence called "papered shop windows syndrome" is the most visible in the old part of the centre with smaller shops, while the new part remains active due to open-air market, cinemas, coffee shops and several stores with clothing brands (BABAJKO JAMIČIĆ, 2010; BURICA, 2012).

The occurrence of market cannibalism among the centres was to be expected if three following parameters are observed. The first one refers to the measurement of shopping centres density and is used for calculating saturation of the market

Slika 5. Otvoreni i zatvoreni prodajni prostori u centru City Galleria (nivo +11.50), srpanj 2015.
Izvor: Uprava Trgovinski centar – Zadar d.o.o., terensko istraživanje
Figure 5 Open and closed retail spaces in the City Galleria (level +11.50), July 2015
Source: Uprava Trgovinski centar – Zadar d.o.o., field research

trgovačkim centrima. Računa se kao bruto površina za iznajmljivanje svih trgovačkih centara (GLA) po stanovniku određenoga tržišnog područja. Formula navedene mjere iznosi (EPPLI, LAPOSA, 1997.):

$$GLAPC_i = \frac{\sum_{i=1}^{n} GLA_i}{POP_i}$$

gdje je:

$GLAPC_i$ = bruto površina za iznajmljivanje trgovačkih centara po stanovniku unutar tržišnog područja i

GLA_i = ukupna bruto površina za iznajmljivanje svih trgovačkih centara unutar tržišnog područja i

POP_i = ukupna populacija unutar tržišnog područja i

Prema podatcima tvrtke *RegioData Research GmbH*, najznačajniji porast navedene mjere u posljednjih nekoliko godine zabilježen je u Republici Hrvatskoj, gdje je varijabla GLA_i na razini države od 2011. do 2013. godine porasla za 300 000 m², uzrokujući rast gustoće trgovačkih

with shopping centres. It is calculated as gross leasable area in all the shopping centres (GLA) per inhabitant of a trade area. The formula of this measurement is (EPPLI, LAPOSA, 1997):

$$GLAPC_i = \frac{\sum_{i=1}^{n} GLA_i}{POP_i}$$

Where:

$GLAPC_i$ = gross leasable area of shopping centres per inhabitant within a trade area i

GLA_i= total gross leasable area in all shopping centres within a trade area i

POP_i = total population within a trade area i

According to the data of the company *RegioData Research GmbH*, the most significant increase of the mentioned measurement in the last several years was recorded in the Republic of Croatia, where on national level the variable GLA_i grew 300,000 sq m, causing an increase in shopping centres density from 240 to 310 sq m per 1,000 inhabitants (URL 5). The saturation of

centara s 240 na 310 m² na 1000 stanovnika (URL 5). Izračunata je zasićenost trgovačkih centara za uže i šire tržišno područje prema podatcima za 2015. godinu (prodavaonice manje od 5 000 m² nisu uključene u jednadžbu):

shopping centres for narrow and broad trade area according to 2015 data (stores with an area under 5,000 sq m were not included into the equation) was calculated:

$$GLAPC_i = \frac{27400 \ (S) + 20546 \ (CG)}{71471 \ stanovnika} = \frac{47946}{71471} \times 1000 = 670,84 \ m^2 \text{na } 1000 \ stanovnika$$

$$GLAPC_i = \frac{27400 \ (S) + 20546 \ (CG)}{85715 \ stanovnika} = \frac{47946}{85715} \times 1000 = 559,37 \ m^2 \text{na } 1000 \ stanovnika$$

$$GLAPC_i = \frac{27400 \ (S) + 20546 \ (CG)}{71471 \ inhabitants} = \frac{47946}{71471} \times 1000 = 670,84 \ m^2 \text{per } 1000 \ inhabitants$$

$$GLAPC_i = \frac{27400 \ (S) + 20546 \ (CG)}{85715 \ inhabitants} = \frac{47946}{85715} \times 1000 = 559,37 \ m^2 \text{per } 1000 \ inhabitants$$
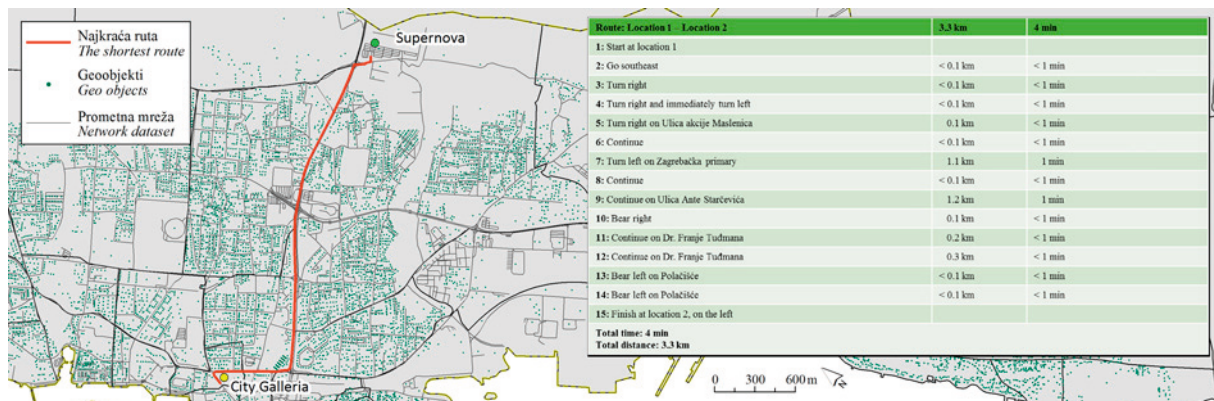
Na temelju dobivenih vrijednosti može se zaključiti da u odnosu na državni prosjek iz 2013. godine, prostor užega tržišnog područja bilježi više od dvostruko veće vrijednosti, dok šire tržišno područje gotovo dvostruke vrijednosti gustoće trgovačkih centara što može upućivati na zasićenost prostora ponudom trgovačkih centara. Zadar prema ovoj mjeri ne zaostaje za vodećim gradovima u Europi. Tako je Prag 2012. godine bilježio 680 m² na 1000 stanovnika, a Zagreb 500 m², s procjenom rasta kroz nekoliko godina na 840 m² na 1000 stanovnika (URL 5). Međutim, demografski potencijal, odnosno gustoća potencijalnih kupaca unutar širega tržišnog područja ljetnih mjeseci raste zbog pojačanog priljeva turista, što u konačnici smanjuje zasićenje tržišta.

Tržište ne mora biti nužno zasićeno ako ima visoke vrijednosti gustoće trgovačkih centara zato što ovisi o kupovnoj moći stanovništva. S obzirom na to da su iz analize isključeni sekundarni i tercijarni konkurentni (kupovni centri s površinom manjom od 5 000 m²), uz relativno malen raspoloživ dohodak stanovništva za 2014. godinu (79 843 kn po kućanstvu) (URL 6), ova mjera ipak dijelom objašnjava negativni trend zatvaranja poslovnica unutar trgovačkog centra City Gallerie. Upravo je visoka gustoća prodajnog prostora čest indikator tržišnog sukoba i konkurencije između centara. Dovoljno je da u gradu postoje dva trgovačka centra, a demografski i kupovni potencijal nije dovoljan da osigurava oboje, jači centar će uvijek pokušati „izbaciti" slabijega s tržišta.

Based on the calculated values, it can be concluded that, in comparison to national average from 2013, the narrow trade area recorded more than double values, while the broad trade area recorded nearly double values, which can indicate a saturation of space with shopping centres' offers. According to this measurement, Zadar does not fall behind the leading cities of Europe. Namely, in 2012 the city of Prague recorded 680 sq m per 1,000 inhabitants, while Zagreb recorded 500 sq m per 1,000 inhabitants, with a growth estimate of 840 sq m per 1,000 inhabitants in the several following years (URL 5). However, the demographic potential, i.e. the density of potential consumers within the broad trade area during summer months is growing due to an increased inflow of tourists, which ultimately reduces the market saturation.

A market does not necessarily need to be saturated if its values of shopping centres density are high, because it depends on the purchasing power of the inhabitants. Given that secondary and tertiary competitive centres (those with an area under 5,000 sq m) are excluded from the analysis, with a relatively low income of population in 2014 (79,843 kn per household) (URL 6), this measurement partially explains the negative trend of closing the retail spaces within the shopping centre City Galleria. It is the high density of retail space that is commonly an indicator of a market conflict and a competition among the centres. Two shopping centres in a city are sufficient, and as the demographic and the purchasing potential

Slika 6. Nelinearna udaljenost između trgovačkih centara (3,3 km)
Izvor: URL 1
Figure 6 Nonlinear distance between the shopping centers (3.3 km)
Source: URL 1

Treći parametar odnosi se na udaljenost centara koja je relativno mala (Sl. 6.). Iako je prema kategorizaciji trgovačkih centara (Tab. 1.) predviđeno da minimalna udaljenost između centara bude 4,5 km ≈ 10-15 min vožnje, ona iznosi tek 3,3 km ≈ 4 min vožnje, što generira velike površine preklapanja tržišnih zona (> 60,55 %) (Tab. 2.).

Određivanje tržišnih zona preklapanja

Tržišne zone (*trade areas*) definiraju se kao prostori u kojima trgovina na malo generira svoju prodaju tijekom određenog vremena (MYLES, 2004.). D. Huff (1964.) ih opisuje kroz statistički prošireni koncept, odnosno kao geografski definirane regije koje sadrže potencijalne kupce čija je vjerojatnost kupnje određenog proizvoda, posjećivanja trgovine ili korištenja usluge neke tvrtke veća od 0 % (BARAY, CLIQUET, 2007.). Proces izrade tržišnih zona opisan je u metodologiji. Potrebno je razumjeti nedostatke izvedenih modela. Naime, modeli tržišnih zona zahvaćaju veće površine zbog pretpostavke da se vozilo kreće maksimalnom dozvoljenom brzinom bez vršnih prometnih opterećenja (čekanje na semaforima, gužva u prometu itd.). Stoga izvedeni modeli najbolje reprezentiraju situaciju u zimskim mjesecima, kada su manje gužve te čekanja na raskrižjima (Sl. 7.).

Iz generiranih modela tržišnih zona izvedena je deskriptivna statistika (Tab. 2.). Dobivene

are insufficient to secure both of them, the stronger centre will always attempt to "suppress" the weaker one off the market.

The third parameter refers to a relatively small distance between the centres (Fig. 6). Although the categorization of shopping centres anticipates that the minimal distance between the centres is 4.5 km ≈ 10-15 minutes of drive, it is merely 3.3 km ≈ 4 minutes of drive, which generates large areas of trade zone overlapping (> 60.55%) (Tab. 2).
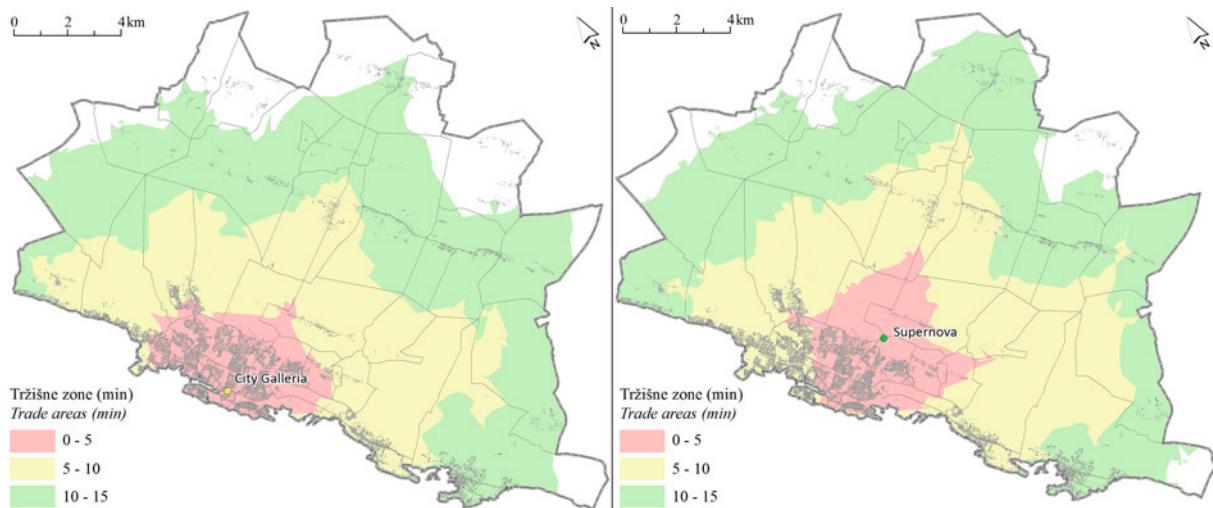
Defining the trade zones overlapping

Trade areas are defined as places where retail generates its sale during a period of time (MYLES, 2004). D. Huff (1964) describes them through a statistically expanded concept, as geographically defined regions that contain potential consumers whose probability of buying a product, visiting a store or using a service of a company is above 0 % (BARAY, CLIQUET, 2007). The process of creating trade zones has been described in the methodology. It is necessary to understand the drawbacks of the created models. Namely, they include bigger areas due to an assumption that a vehicle moves with the highest allowed speed, without peak traffic load (waiting at traffic lights, traffic jams, etc.). Therefore, the models are the most suitable for representing the situation in winter months, when traffic is lighter (Fig. 7).

Descriptive statistics are derived from the generated trade zone models (Tab. 2). The acquired

Tablica 2. Udio preklopljenih tržišnih zona trgovačkih centara
Table 2 Proportion of overlapping trade areas of shopping centers

Naziv centra Name of the mall	Preklopljena površina tržišnih zona (%) The overlapped area of trade areas (%)		
	0 – 5 (km)	0 – 10 (km)	0 – 15 (km)
Supernova	60,55	79,97	92,58
City Galleria	73,28	91,91	99,00

Slika 7. Tržišne zone Supernove i City Gallerie
Figure 7 Trade areas of Supernova and City Galleria

vrijednosti rezultat su relativne blizine (3,3 km ≈ 4 min vožnje) centara što se očituje u visokim vrijednostima preklopljenih zona (> 60,55%) u njihovoj ukupnoj površini (Tab. 2.).

Izrada Huffova modela

Huffov model je penetracijski pristup proučavanja tržišta (*market penetration approach*) koji uzima u obzir konkurenciju, a pretpostavlja postojanje prostornih varijacija u udjelima kućanstava koja posjećuju određenu trgovinu. U njemu je tržišna zona zamišljena kao površina vjerojatnosti koja upućuje na mogućnost da će kupac na određenoj lokaciji odabrati „pokroviteljstvo" nad trgovinom. Kreiranje površine vjerojatnosti temelji se na prostorno-interaktivnom modelu koji podrazumijeva varijable: udaljenost kupca i atraktivnost trgovačkog centra (DRAMOWICZ, 2005.). Temelji se na pretpostavci da je vjerojatnost posjeta i kupnje u trgovačkom centru u funkciji s udaljenošću toga mjesta, njegovom

values are a result of relative vicinity (3.3 km ≈ 4 minutes of drive) between the centres, reflected in high share of the overlapped zones (> 60.55%) in their total area (Tab. 2).

Creating the Huff model

The Huff model represents a market penetration approach that takes the competition into consideration, and assumes the existence of spatial variations in the shares of households that visit a store. Within it, the trade area is conceptualized as a probability surface, which represents the likelihood of customer "patronage". The creation of probability surface is based on a spatial-interactive model that includes the following variables: distance of consumer and attractiveness of a shopping centre (DRAMOWICZ, 2005). It is based on the assumption that a probability of visiting and shopping in a centre is in function of the centre's location distance, its attractiveness, and the distance and the attractiveness of its

atraktivnošću te udaljenošću i atraktivnošću njegovih konkurenata (Huff, McCallum, 2008.). Osnovna pretpostavka je da će osoba suočena s nizom alternativa odabrati onu koja je izravno proporcionalna percipiranoj korisnosti te alternative. Izbor ponašanja te osobe je vjerojatan (Huff, McCallum, 2008.). Vjerojatnost da će potrošač koji se nalazi na lokaciji *i* odabrati trgovinu *j* može se procijeniti Huffovom formulom (Myles, 2004.; Huff, McCallum, 2008.):

$$P(C_{ij}) = \frac{\frac{S_j^a}{T_{ij}^b}}{\sum_{j=1}^{n} \left(\frac{S_{ij}^a}{T_{ij}^b} \right)}$$

gdje je:

$P(C_{ij})$ = vjerojatnost da će pojedinac *(i)* odabrati alternativu (trgovinu) *(j)*

S_j = indeks ili atribut atraktivnosti *(j)*

T_{ij} = udaljenost ili vrijeme vožnje između kupca *(i)* i trgovine *(j)*

a = ponder koji se odnosi na atraktivnost, a procjenjuje se empirijski

b = ponder koji se odnosi na udaljenost, a procjenjuje se empirijski

N = ukupan broj trgovina uključujući trgovinu *j*

   Ponderi povezani s varijablama rijetko se procjenjuju statistički, a često se dodjeljuju proizvoljno (Huff, McCallum, 2008.) ili na temelju Reillyeva gravitacijskog zakona maloprodaje (Yrigoyen, Otero, 1998.). Spomenuti zakon temelji se na Newtonovu općem zakonu gravitacije, a tvrdi da je privlačna moć trgovine izravno proporcionalna njezinoj atraktivnosti, a obrnuto proporcionalna udaljenosti od koje se nalazi kupac. Kao tipičnu vrijednost pondera za parametar atraktivnosti uzima se vrijednost 1, dok se za parametar udaljenosti uzima vrijednost 2 (Yrigoyen, Otero, 1998.; Dramowicz, 2005.). Parametar *(b)* u Huffovoj formuli odnosi se na koeficijent raspada povećanjem udaljenosti (*distance-decay effect*) koji određuje snagu inverznog odnosa između vjerojatnosti da će kupac odabrati trgovinu i udaljenosti ili vremena vožnje koju kupac mora svladati do te trgovine. Veći koeficijent znači da je kupac spreman manje putovati da bi posjetio trgovinu. Prema ESRI-u, vrijednost zadanog parametra udaljenosti iznosi 1,5 s naglaskom da najčešće korištene vrijednosti

competitors (Huff, McCallum, 2008). The initial assumption is that a person confronted with a series of alternatives would choose the one which is directly proportional to its perceived usefulness. That person's choice of behaviour is probable (Huff, McCallum, 2008). The probability that a consumer located on a location *i* would choose a store *j* can be estimated by using the Huff formula (Myles, 2004; Huff, McCallum, 2008):

$$P(C_{ij}) = \frac{\frac{S_j^a}{T_{ij}^b}}{\sum_{j=1}^{n} \left(\frac{S_{ij}^a}{T_{ij}^b} \right)}$$

where:

$P(C_{ij})$ = probability that an individual *(i)* would pick an alternative (store) *(j)*

S_j = index or attribute of attractiveness *(j)*

T_{ij} = distance or drive time between a consumer *(i)* and a store *(j)*

a = weighting factor that refers to attractiveness, and is estimated empirically

b = weighting factor that refers to distance, and is estimated empirically

N = total number of stores including store *j*

   Weighting factors related to variables are rarely estimated statistically, but are commonly assigned arbitrarily (Huff, McCallum, 2008) or based on the Reilly's law of retail gravitation (Yrigoyen, Otero, 1998). This law is based on the Newton's law of universal gravitation, and states that the power of attraction of a retail store is directly proportional to its attractiveness, and inversely proportional to the distance of a customer. The value 1 is used as a typical value of weighting factor for the attractiveness parameter, while the value 2 is used as a distance parameter (Yrigoyen, Otero, 1998; Dramowicz, 2005). The parameter (b) in the Huff formula refers to a coefficient of decay with distance (the distance-decay effect) that determines the strength of an inverse relation between the probability that a consumer would choose a retail store and a distance or a drive time that a consumer must overcome to reach it. A higher coefficient would mean that a customer is willing to travel less in order to visit a retail store. According to ESRI, the value of the set distance parameter is 1.5, since the mostly used values vary between 1 and 3. The highest values are set for

variraju između 1 i 3. Najveće vrijednosti postavljaju se za manje nespecijalizirane trgovine, jer kupci nisu voljni svladati veliku udaljenost za namirnice svakodnevne namjene. Najmanji koeficijenti dodjeljuju se trgovinama koje imaju rijetku i specifičnu robu za koju su kupci spremni svladati veće udaljenosti (tehnika, markirana roba). Trgovački centri sadrže velik raspon različitih tipova trgovina, od onih svakodnevne namjene do specifične i rijetke robe, ali uglavnom prevladavaju trgovine odjeće i obuće, koja se ne kupuje na dnevnoj bazi zbog čega je vrijednost parametra postavljena prema ESRI-evoj zadanoj vrijednosti.

Indeks atraktivnosti centara

Trgovački centar posjeduje mnogo atributa koji ga čine atraktivnim potrošačima. U literaturi se najčešće koristi samo veličina, odnosno ukupna površina prodajnog prostora kao mjera koja

less specialized stores, because consumers are not willing to overcome great distances to buy common merchandise and groceries. The lowest coefficients are assigned to stores that offer rare and specific merchandise that can motivate consumers to overcome greater distances (technical merchandise, famous brands, etc.). Shopping centres contain a big range of various types of retail stores, from those of convenient purpose to those with specific and less common merchandise, but shoe and clothing stores are in the majority since their merchandise is not purchased daily – that is why the value of the parameter is set according to ESRI's default value.

Index of centres' attractiveness

A shopping centre has many attributes that make it attractive to consumers. Only a centre size (total area of retail) is most commonly used in literature as a measure that indicates the attractiveness of a store (SCHÜRMANN, 1999; HUFF,

Tablica 3. Parametri atraktivnosti trgovačkih centara
Table 3 The parameters of the shopping centers attractiveness

Broj parametra *Parameter number*	Trgovački centri *Shopping centers*	Parametri atraktivnosti *Parameters of attractiveness*
1		Ukupna površina (m²) prodajnog prostora (GLA) *Total area (m²) of retail space (GLA)*
	Supernova	27 400
	City Galleria	20 546
2		Broj aktivnih trgovina *The number of active stores*
	Supernova	95
	City Galleria	69
3		Površina aktivnih prodajnih prostora (m²)* *The area of active retail spaces (m²) *
	Supernova	27 400
	City Galleria	15 416
4		Broj parkirnih mjesta *Number of parking spaces*
	Supernova	1 219
	City Galleria	394
Ukupna z vrijednost *Total z value*	Supernova	240 209
	City Galleria	127 073
Indeks atraktivnosti *Index of attractiveness*	Supernova	**1,000**
	City Galleria	**0,529**

Izvor: Uprava Trgovinski centar – Zadar d.o.o., m2 Center management d.o.o., terensko istraživanje
* težinski koeficijent (1,2) (SCHÜRMANN, 1999.)
Source: Uprava Trgovinski centar – Zadar d.o.o., m2 Center management d.o.o., field research
*weight coefficient (1,2) (SCHÜRMANN, 1999)

upućuje na atraktivnost trgovine (SCHÜRMANN, 1999.; HUFF, 2003.; MITRÍKOVÁ I DR., 2015.), što nije dobar pristup. Naime, kako bi se postigla što veća prediktivna točnost modela, potrebno je uključiti više različitih parametara koji opisuju atraktivnost trgovine. Atraktivnost se izražava kao funkcija onih atributa koji opisuju određenu pojavu, a mogu se kvantificirati. Indeks atraktivnosti upućuje na to koliko je određeni trgovački centar atraktivan u odnosu na konkurente (DRAMOWICZ, 2005.). Za centre Supernova i City Galleria određen je na temelju osnovnih podataka koji su dostavljeni od uprave centara i prikupljeni terenskim istraživanjem. Oni obuhvaćaju četiri parametra: ukupna površina prodajnog prostora za iznajmljivanje (GLA), broj aktivnih trgovina unutar centra, površina aktivnoga prodajnog prostora te broj parkirnih mjesta (Tab. 3.).

Indeks atraktivnosti trgovačkih centara izračunat je na temelju pristupa autora E. Dramowicz (2005.) i C. Schürmann (1999.). Slijedeći metodologiju C. Schürmanna (1999.), parametru površine aktivnoga prodajnog prostora pridodan je težinski koeficijent 1,2. On uzima u obzir činjenicu da ne postoji linearan odnos između površine prodajnog prostora i doživljene korisnosti za kupca. Potom je, prateći pristup E. Dramowicza (2005.), izračunata ukupna z vrijednost parametara atraktivnosti oba centra. Prema dolje navedenoj formuli, izračunat je indeks atraktivnosti za oba trgovačka centra:

$$I_j = GLA_j + N_{at} + P_{at}^\alpha + N_p$$

gdje je:

I_j = suma vrijednosti koje upućuju na atraktivnost određenog centra na lokaciji j

GLA_j = ukupna bruto površina za iznajmljivanje (GLA) centra j

N_{at} = broj aktivnih trgovina u centru j

P_{at}^α = površina aktivnoga prodajnog prostora s težinskim koeficijentom (α) centra j

N_p = broj parkirnih mjesta centra j

Dobivena vrijednost upućuje na sumu privlačnih obilježja specifičnog centra. Ako se z vrijednost centra Supernove postavi kao indeks aktraktivnosti 1, postavljanjem u odnos sa z vrijednošću centra City Gallerie, dobije se njezin indeks:

2003; MITRÍKOVÁ ET AL., 2015), and that is not a good approach. Namely, in order to accomplish the highest possible predictive accuracy of a model, it is necessary to include various parameters that describe a store's activity. The attractiveness is expressed as a function of those attributes that describe a phenomenon and can be quantified. The attractiveness index shows the level of attractiveness of a shopping centre in comparison to its competitors (DRAMOWICZ, 2005). For the centres Supernova and City Galleria, this index was determined using the basic data delivered by the centres' managements and collected through the field research. They include four parameters: the total area for retail space for lease (GLA), the number of active stores in a centre, the area of active retail space and the number of parking spots (Tab. 3).

The index of attractiveness of the shopping centres was calculated based on the approach of E. Dramowicz (2005) and C. Schürmann (1999). Following the methodology of C. Schürmann (1999) the weight coefficient 1.2 was added to the parameter of the area of active retail space. He takes into consideration the fact that there is no linear relation between the retail space area and the customer's perception of usefulness. After that, following the approach of E. Dramowicz (2005), a total z value of attraction parameters was calculated for both centres. According to the formula below, the index of attractiveness was calculated for both shopping centres:

$$I_j = GLA_j + N_{at} + P_{at}^\alpha + N_p$$

where:

I_j = sum of values that indicate the attractiveness of a centre on location j

GLA_j = total gross leasable area (GLA) of the centre j

N_{at} = number of active stores in the centre j

P_{at}^α = area of active retail space with a weight coefficient (α) of the centre j

N_p = number of parking spaces in the centre j

The derived value indicates the sum of attractive features of a centre. If the z value of the centre Supernova is set as the attractive index 1, putting it into a relation with the z value of the centre City Galleria results in its index:

$$I_s : x = \mathbf{1} : I_{cg}$$

$$x = \frac{127,072.5214}{240,209.278} = \mathbf{0.529}$$

gdje je:

I_s = z vrijednost atraktivnosti centra Supernove

I_{cg} = z vrijednost atraktivnosti centra City Gallerie

1 = indeks atraktivnosti Supernove

x = indeks atraktivnosti centra City Gallerie

U svrhu kreiranja Huffova modela vjerojatnosti odabira trgovačkog centra, s internetskih stranica ERSI-a preuzet je alat *Market Analyst Toolset* (URL 3). Primjenom preuzetog alata, na temelju vektoriziranih lokacija trgovačkih centara, prometne mreže šireg tržišnog područja te lokacija geoobjekata, izvedeni su Huffovi modeli vjerojatnosti odabira trgovine za šire tržišno područje (Sl. 8. i Sl. 9.).

$$I_s : x = \mathbf{1} : I_{cg}$$

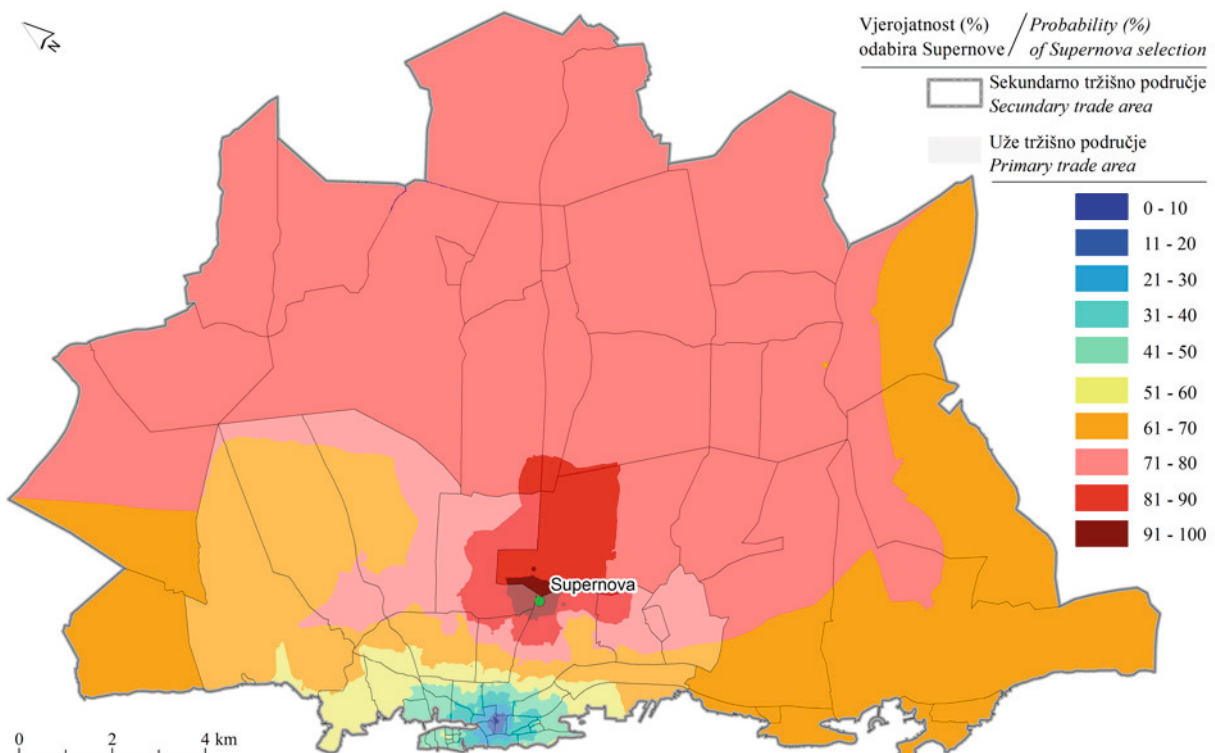$$x = \frac{127,072.5214}{240,209.278} = \mathbf{0.529}$$

where:

I_s = z value of attractiveness of the centre Supernova

I_{cg} = z value of attractiveness of the centre City Galleria

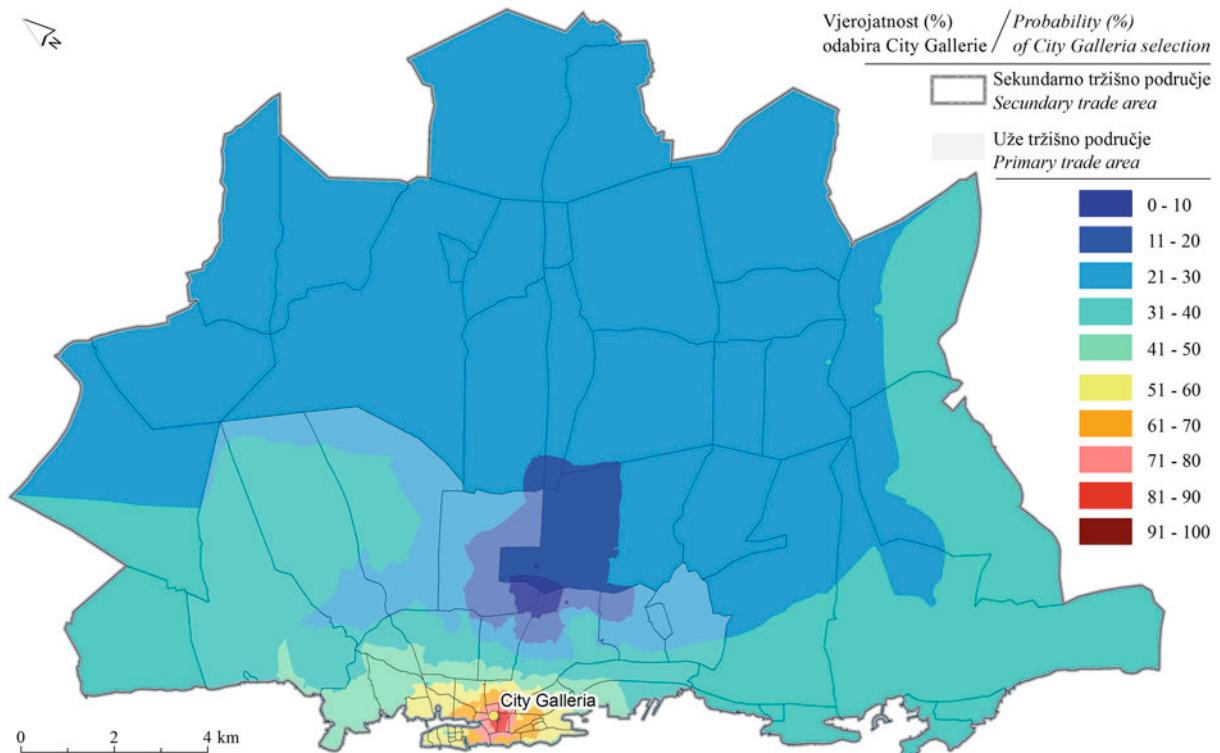1= index of attractiveness of the centre Supernova

x = index of attractiveness of the centre City Gallerie

In order to create the Huff model of probability of a shopping centre selection as a place of purchase, the tool *Market Analyst Toolset* was downloaded from ESRI's pages (URL 3). Using the downloaded tool, Huff's models of probability of a shopping centre selection were derived for the broad trade area based on the centres' vectorized location, transportation network of the broad trade area and the location of features (Fig. 8 and Fig. 9).

Slika 8. Vjerojatnost odabira centra Supernove kao mjesta kupnje
Figure 8 The probability of Supernova shopping center selection as a place of purchase

Slika 9. Vjerojatnost odabira centra City Gallerie kao mjesta kupovine
Figure 9 The probability of City Galleria shopping center selection as a place of purchase

Analizom Huffova modela, odnosno srednjih vrijednosti odabira centra unutar širega tržišnog područja te zona preklapanja, prepoznat je dominantan trgovački centar. Prema srednjim vrijednostima odabira trgovine, uočljive su dvije pojave. Prva je dominacija trgovačkog centra Supernova koji unutar svih definiranih zona ostvaruje veće srednje vrijednosti odabira trgovine. Te vrijednosti rastu s povećanjem tržišne zone, odnosno atributa vremena vožnje (min) na temelju kojeg je zona generirana. To je posljedica specifičnog položaja Supernove (rubni dio grada) te njezina jačega gravitacijskog utjecaja na okolna manja naselja. Dominantnost se očituje u tome da u tržišnim zonama centra City Gallerie (CG) veću vjerojatnost odabira ima centar Supernova (S) (Tab. 4.).

Srednja vrijednost odabira nije najbolji pokazatelj dominacije trgovačkog centra zato što su različiti tipovi stambenih objekata (zgrade, obiteljske kuće) prikazani na isti način (točkasti podatak) te svaki ima jednu vrijednost postotka vjerojatnosti odabira iako u njima živi različit broj stanovnika. Kako bi se preciznije utvrdio dominantan trgovački centar, potrebno je spojiti

Using the Huff model analysis, i.e. average values of a shopping centre choice within the broad trade area and the overlapping zones, the dominant shopping centre was identified. With respect to mean values of shopping centre choice, two occurrences can be seen. The first one is the dominance of the shopping centre Supernova that shows higher mean values of shopping centre choice within all defined zones. These values grow with the enlargement of the trade zone, i.e. of the attribute of drive time (min) based on which the zone was generated. It is a result of the specific position of Supernova (periphery of the city) and its stronger gravitational influence on the surrounding smaller settlements. The dominance is reflected in the fact that even in the City Galleria (CG) centre's trade zones, Supernova (S) has a higher probability of being chosen (Tab. 4).

However, mean choice value is not the best possible indicator of shopping centre dominance because various types of residence buildings (apartment buildings, family homes) are represented in the same way (point data) and each of them has a single value of probability percentage even though they are occupied by a different number

Tablica 4. Srednja vrijednost odabira unutar tržišnih zona i zona preklapanja
Table 4 Mean selection value of shopping center within trade areas and overlapping zones

Naziv centra Name of the mall	Srednja vjerojatnost odabira (%) Mean selection probability of shopping center (%)		
	Tržišne zone (min) Trade areas (min)		
	0 – 5	0 – 10	0 – 15
Zona (S) – (CG) Area (S) – (CG)	(60,13) – (39,86)	(60,72) – (39,29)	(62,58) – (37,42)
Zona (CG) – (S) Area (CG) – (S)	(42,43) – (57,56)	(39,63) – (60,37)	(37,35) – (62,46)
	Srednja vjerojatnost odabira (%) Mean selection probability of shopping center (%)		
Naziv centra Name of the mall	Zone preklapanja (min) Overlap zones (min)		
	0 – 5	0 – 10	0 – 15
Supernova	59,31	60,30	62,45
City Galleria	40,69	39,70	37,55

podatke demografskog rastera i Huffova modela čime će se utvrditi broj stanovnika unutar šireg tržišnog područja s vjerojatnošću odabira većom od 50 % za svaki trgovački centar. Na temelju toga podatka preciznije će se odrediti tržišna dominacija određenog centra.

Prema izvedenim podatcima, trgovački centar Supernova unutar šireg tržišnog područja bilježi 34 743 stanovnika više s vjerojatnošću odabira većom od 50 % u odnosu na centar City Galleriu (Tab. 5.). To potvrđuje dominaciju centra Supernove i odraz je stvarne tržišne situacije koja je dokazana terenskim istraživanjem.

Pri interpretaciji Huffova modela potrebno je poznavati određena ograničenja njegove primjene. Naime, izvedeni indeks atraktivnosti nekoga centra nikad nije u potpunosti točan jer nije moguće kvantificirati sve društvene i subjektivne čimbenike (ugodna atmosfera, doživljaj prostora, prozračnost, potreba za druženjem, percepcija marketinške dominacije) koji se u glavi potencijalnog kupca oblikuju kao čimbenici atraktivnosti te trgovine. Nadalje, prostorna pokretljivost i ponašanje potrošača ne slijede uvijek tržišna pravila koja počivaju na gravitacijskim zakonima.

Iako autori J. Mitríková i dr. (2015.) navode da Huffov model ne pruža objektivne rezultate u identificiranju preferencija velikih trgovina u

of residents. In order to determine the dominant shopping centre more precisely, it is necessary to merge the data of both demographic raster and the Huff model, which would provide the number of inhabitants within the broad trade area with the probability of choice above 50% for each shopping centre. Based on this data, the market dominance of a centre is more precisely defined.

According to the derived data, shopping centre Supernova has 34,743 inhabitants more, with a choice probability higher than 50 % in comparison to the City Galleria centre (Tab. 5). This confirms the dominance of the Supernova centre and reflects the actual market situation observed through the field research.

When the Huff model is interpreted, it is necessary to know the limits of its application. Namely, the derived attractiveness index of a centre is never completely accurate since it is not possible to quantify all of the social and subjective factors (pleasant environment, perception of place, ambience, need for socializing, and perception of marketing dominance) that occur in the mind of a potential consumer as factors of a shopping mall's attractiveness. Furthermore, spatial mobility and behaviour of consumers do not always follow the market rules that are based on gravitation laws.

Although the authors J. Mitríková et al. (2015) claim that the Huff model does not provide objective

Tablica 5. Broj stanovnika s vjerojatnošću odabira (> 50%) za oba centra unutar šireg tržišnog područja
Table 5 Population with the selection probability (> 50%) for both shopping malls within a wider market area

Naziv centra *Name of the mall*	Vjerojatnost odabira (> 50 %) *Selection probability (> 50 %)*	
	Broj geoobjekata *Number of geoobjects*	Broj stanovnika *Number of population*
Supernova	17 635	60 229
City Galleria	3 520	25 486

urbaniziranom prostoru, u ovome istraživanju dokazana je njegova primjenjivost. Naime, unutar istraživanja spomenutih autora zadan je isti parametar udaljenost (1) za sve tipove kupovnih centara (hipermarket, supermarket, maloprodajna trgovina i trgovački centar) iako po prirodi oni sadrže različit raspon tržišnih proizvoda po namjeni te kao takvi nisu usporedivi. Jedinstveni parametar udaljenosti može se postaviti jedino u slučaju ako se analiza tržišnog natjecanja provodi za isti tip kupovnih centara ili za isti tip proizvoda.

Nadalje, jedini parametar atraktivnosti koji je korišten u izradi modela preferencije, odnosno vjerojatnosti odabira trgovine, je površina prodajnog prostora, što je u konačnici moglo dovesti do otežane interpretacije izlaznih rezultata.

Zaključak

Svi modeli, pa tako i tržišni, pojednostavljena su slika stvarnosti te imaju svoje prednosti i ograničenja. Prostorne pojave su presložene tako da bi izvedeni modeli u potpunosti mogli odražavati vjeran prikaz stvarnosti. Kvaliteta modela rezultat je preciznosti i točnosti prikupljenih podataka te primjene specifičnih metoda, tehnika i procedura pri modeliranju.

U ovome radu dokazana je primjenjivost Huffova modela u analizi tržišnog natjecanja. Primjenom alata integriranih unutar GIS-a generirane su tržišne zone za oba trgovačka centra prema varijabli vremena vožnje. Na temelju izvedenih zona definirane su zone preklapanja u kojima se odvija borba za pokroviteljstvo kupca. Zaključeno je da se između trgovačkih centara u naselju Zadru javlja tržišni kanibalizam. S obzirom na stvarnu tržišnu situaciju, odnosno na zatvaranje velikog broja prodavaonica u centru City Galleria, za očekivati je bilo da će srednja vrijednost vjerojatnosti odabira centra Supernova

results in identifying the preferences of large stores in an urbanized environment, this research actually proves its applicability. Namely, in the mentioned authors' research the same distance parameter (1) was set for all types of shopping malls (hypermarket, supermarket, retail store and shopping centre), even though they contain different varieties of trade products in the context of their purpose, and are not comparable as such. The unique parameter of distance can be set only in case of analyzing market competition for the same type of shopping centres or the same type of product.

Furthermore, the only parameter of attractiveness used in the preference model, i.e. shopping mall choice probability, is the area of retail space, which could finally have led to more difficult interpretation of the output results.

Conclusion

All models, including the market ones, represent a simplified image of reality and have their advantages and limits. Spatial phenomena are too complex for the derived models to reflect the actual reality completely. Quality of a model is a result of accuracy and precision of the collected data and of the usage of specific methods, techniques and procedures in modelling.

This paper proves the applicability of the Huff model in the analysis of market competition. By using the tools integrated within GIS, trade zones for both shopping malls were generated according to the drive time variable. Based on the derived zones, the overlapping zones in which the competition for consumer patronage occurs were defined. It was concluded that market cannibalism occurs between the shopping centres in the settlement of Zadar. Given the actual market situation of a large number of stores in the City Galleria centre being closed, it was to be expected that the mean value

unutar zona preklapanja i tržišnih zona biti veća od vjerojatnosti odabira centra City Galleria, što je rezultatima istraživanja i potvrđeno. U svim tržišnim zonama i područjima preklapanja centar Supernova bilježi veću srednju vrijednost vjerojatnosti odabira u odnosu na konkurentski centar. Nadalje, ako se promatra broj kupaca unutar širega tržišnog područja koje ima vjerojatnost odabira veću od 50 %, atraktivniji centar bilježi 34 743 potencijalnih kupca više.

U svrhu poboljšanja svoje trenutačne tržišne situacije, centru City Galleri preporučuje se provedba procesa okrupnjivanja manjih prodajnih površina za iznajmljivanje čime bi se otvorila mogućnost privlačenja većeg broja osovinskih trgovina koji privlače veći broj kupaca.

of choice probability for the centre Supernova within the overlapping zones and the market zones would be higher than the choice probability of the City Galleria centre, which was confirmed by results of the research. In all the market zones and overlapping areas the centre Supernova records a higher mean value of choice probability in comparison to its competitor. Furthermore, if a number of consumers within the broad trade area that has a choice probability higher than 50%, the more attractive centre is estimated to have 34,743 potential consumers more.

In order to improve its current market situation, the centre City Galleria is advised to begin a process of enlarging its small retail spaces for lease, which would open a possibility for attracting more anchor stores that attract higher numbers of consumers.

IZVORI I LITERATURA / SOURCES AND BIBLIOGRAPHY

Babajko Jamičić, T. (2010): Mračni hodnici i pusti poslovni prostori, *Zadarski list*, dostupno na: http://www.zadarskilist.hr/clanci/28102010/mracni-hodnici-i-pusti-poslovni-prostori, 7. 7. 2015.

Badea, R., Moise, C., Voicu, V. (2008): Ways to improve sales management for Romanian retailers using geographical information systems, u: *The 9th WSEAS Int. Conf. on Mathematics and Computers In Business Amd Economics (MCBE'08)*, Bukurešt, 131-134.

Baray, J., Cliquet, G. (2007): Delineating store trade areas through morphological analysis, *European Journal of Operational Research*, 182 (2), 886-898, doi: 10.1016/j.ejor.2006.09.012

Burica, I. (2012): Sve pustija City Galleria, *Zadarski list*, dostupno na: http://www.zadarskilist.hr/clanci/14022012/sve-pustija-city-galleria, 7. 7. 2015.

Burnett, J. (2008): *Core Concepts of Marketing*, John Wiley and Sons Ltd, New York, pp. 300.

Cannon, M. K. (2007): *Using GIS to Analyze Areas for Business Retail Expansion*, Department of Resource Analysis, Saint Mary's University of Minnesota, Minneapolis, dostupno na: http://www.gis.smumn.edu/GradProjects/CannonK.pdf, 7. 7. 2015.

Cheng, E. W., Li, H., Yu, L. (2005): The analytic network process (ANP) approach to location selection: a shopping mall illustration, *Construction Innovation*, 5 (2), 83-97, doi: 10.1108/14714170510815195

Cisneros, A. D. (2015): *Population disaggregation for trade area delineation in retail real estate site analysis*, doktorska disertacija, University of Southern California, Los Angeles, pp. 62.

CRAINE, J., AITKEN, S. (2003): Visual Methodologies: What You See Is Not Always What You Get, u: *Methods in Human Geography: a guide for students doing a research project*, second edition, (ur. Flowerdew, R., Martin, D.), Longman, Harlow, 250-269.

DRAMOWICZ, E. (2005): Retail Trade Area Analysis Using the Huff Model, *Directions Magazine,* 2, dostupno na: http://www.directionsmag.com/entry/retail-trade-area-analysis-using-the-huff-model/123411, 20. 5. 2015.

DONTHU, N., RUST, R. T. (1989): Note—Estimating Geographic Customer Densities Using Kernel Density Estimation, *Marketing Science,* 8 (2), 191-203.

Geodetska tvrtka Teodolit d.o.o., Zadar.

GIS for Customer and Market Analytics, 2007., ESRI, Redlands, pp. 34.

GREY, A. C. (2014): *Spatial delineation of market areas: a proposed approach*, doktorska disertacija, University of Southern California, Los Angeles, pp. 64.

GRIMSHAW, J. D. (2000): *Bringing geographical information systems into business*, John Wiley and Sons, New York, pp. 362.

HUFF, D. (1964): Defining and estimating a trading area, *The Journal of Marketing*, 28 (3), 34-38, doi: 10.2307/1249154.

HUFF, D., MCCALLUM, B. M. (2008): *Calibrating the Huff Model Using ArcGIS Business Analyst*, ESRI White Paper, Redlands, pp. 31.

HUNGARI, R. (2009): *Geomarketing And Geographic Information System For Urban Decisions: Indication Of The Best Location For A Convention Center In Belo Horizonte*, Universidade Federal de Minas Gerais, Belo Horizonte, pp. 10.

JAKOVČIĆ, M., SPEVEC, D. (2004): Trgovački centri u Zagrebu, *Hrvatski geografski glasnik*, 66 (1), 47-66.

JAKOVČIĆ, M., RENDULIĆ, I. (2008): Razvoj i funkcije kupovnih centara u Zadru, *Geoadria*, 13 (1), 97-117.

JANSENBERGER, E. M., STAUFER-STEINNOCHER, P. (2004): Dual kernel density estimation as a method for describing spatio-temporal changes in the upper Austrian food retailing market, u: *7th AGILE Conference on Geographic Information Science*, Heraklion, 29, 551-558.

KEENAN, P. (2005): Concepts and theories of GIS in business, u: *Geographic information systems in business*, (ur. Pick J. B.), Idea group publishing, Hershey, 28-46.

KELLY, J. P., FREEMAN, D. C., EMLEN, J. M. (1993): Competitive impact model for site selection: the impact of competition, sales generators and own store cannibalization, *The International Review of Retail, Distribution and Consumer Research*, 3, 237-259, doi: 10.1080/09593969300000017

KIM, J-Y., CANINA, L. (2010): 15 Featured Chapter: On the Importance of Market Identification, u: *The Cornell School of Hotel Administration Handbook of Applied Hospitality Strategy*, (ur. Cathy A. Enz), Sage, Los Angeles, 216-242.

KOTLER, P. (2002): *Marketing Management*, Millenium Edition, Prentice-Hall, Inc., Boston, pp. 816.

KOTLER, P., ARMSTRONG, G. (2010): *Principles of marketing*, Prentice Hall, London, pp. 720.

LOMAX, W., HAMMOND, K., EAST, R., CLEMENTE, M. (1996): The measurement of cannibalization, *Marketing Intelligence and Planning*, 14 (7), 20-28, doi: 10.1108/02634509610152673

MAUTNER, H. C. (1996): The Investment Structure and Investors in Retail Real Estate, u: *Shopping centers and other retail properties: investment, development, financing, and management* (ur. White, J. R., Gray, K. D.), John Wiley & Sons, New York, 54-72.

MISHRA, S. (2009): GIS in Indian retail industry as strategic tool, *International Journal of Marketing Studies*, 1, 50-57, doi: 10.5539/ijms.v1n1p50

MITRÍKOVÁ, J., ŠENKOVÁ, A., ANTOLIKOVÁ, S. (2015): Application of the Huff Model of Shopping Probability in the Selected Stores in Prešov (Prešov, the Slovak Republic), *Geographica Pannonica*, 19 (3), 110-121, doi: 10.18421/GP19.03-03

MYLES, A. E. (2004): Understanding Your Trade Area: Implications for Retail Trade Analysis, *International Council of Shopping Centers: Research Quarterly*, 11, 3, dostupno na: http://www.southeastern.edu/admin/sbrc/publications/economic_reporter_pd/mylesnrdccollage.pdf, 27. 7. 2015.

Pahernik, M. (2013): Prostorna gustoća ponikava na području Republike Hrvatske, *Hrvatski geografski glasnik*, 74 (2), 5-26.

Pick, J. B. (2008): *Geo-Business: GIS in the digital organization*, John Wiley and Sons, Hoboken, pp. 416.

Rodrigue, J. P., Comtois, C., Slack, B. (2013): *The geography of transport systems*, Taylor and Francis, Routledge, pp. 454.

Roig-Tierno, N., Baviera-Puig, A., Buitrago-Vera, J., Mas-Verdu, F. (2013): The retail site location decision process using GIS and the analytical hierarchy process, *Applied Geography*, 40, 191-198, doi: 10.1016/j.apgeog.2013.03.005

Sapaj, S. C. (2013): *Measuring cannibalization in distribution networks: an approach to optimize store locations*, doktorska disertacija, Massachusetts Institute of Technology, Boston, pp. 99.

Schürmann, C. (1999): New Shopping Centres and Retail Supply Quality: A GIS based Micro-Analytical Model, u: *6th Interantional Conference on Computers in Urban Planning and Urban Management (CUPUM)*, (ur. Rizii, P.), FrancoAngeli, Venecija, 1-20.

Stanić, S. (2009): Socijalni kontekst trgovačkog centra, *Zbornik radova Filozofskog fakulteta u Splitu*, 2/3, 135-152.

Suárez-Vega, R., Santos-Peñate, D. R., Dorta-González, P., Rodríguez-Díaz, M. (2011): A multi-criteria GIS based procedure to solve a network competitive location problem, *Applied Geography*, 31 (1), 282-291, doi: 10.1016/j.apgeog.2010.06.002

Šiljeg, A. (2013): *Digitalni model reljefa u analizi geomorfometrijskih parametara – primjer PP Vransko jezero*, doktorska disertacija, Sveučilište u Zagrebu, Prirodoslovno-matematički fakultet, Geografski odsjek, Zagreb, pp. 187.

Uprava trgovačkog centra Supernova, m2 Center management d.o.o. (*podatci o broju aktivnih trgovina, ukupnoj površini centra te bruto površini namijenjenoj za iznajmljivanje (GLA)*).

Uprava Trgovinski centar – Zadar d.o.o. (*podaci o ukupnoj površini centra te bruto površini namijenjenoj za iznajmljivanje (GLA), tlocrti trgovačkog centra City Galleria*).

URL 1: *Geofabrik*, http://www.geofabrik.de/, 20. 6. 2015.

URL 2: Državna geodetska uprava (DGU), https://geoportal.dgu.hr/, 20. 6. 2015.

URL 3: *Market Analyst Toolset*, http://arcscripts.esri.com/details.asp?dbid=15999, 4. 5. 2015.

URL 4: http://www.investopedia.com/terms/m/marketcannibilization.asp, 3. 7. 2015.

URL 5: *Regio Data Research*,

http://www.regiodata.eu/en/shopping-center-density-higher-ever, 27. 7. 2015.

URL 6: Pokazatelji siromaštva u 2014., Državni zavod za statistiku – konačni rezultati, http://www.dzs.hr/Hrv_Eng/publication/2015/14-01-02_01_2015.htm, 1. 6. 2015.

Van Eck, J. R., De Jong, T. (1999): Accessibility analysis and spatial competition effects in the context of GIS-supported service location planning, *Computers, Environment and Urban Systems*, 23 (2), 75-89, doi: 10.1016/S0198-9715(99)00016-2

Yrigoyen, C. C., Otero, J. V. (1998): Spatial interaction models applied to the design of retail trade areas, u: *38th Congress of the European Regional Science* Association, Beč, dostupno na: http://www-sre.wu-wien.ac.at/ersa/ersaconfs/ersa98/papers/81.pdf, 20. 6. 2015.

Zolfani, S. H., Aghdaie, M. H., Derakhti, A., Zavadskas, E. K., Varzandeh, M. H. M. (2013): Decision making on business issues with foresight perspective; an application of new hybrid MCDM model in shopping mall locating, *Expert systems with applications*, 40 (17), 7111-7121, doi: 10.1016/j.eswa.2013.06.040