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Journal of Urban and Regional Analysis 14–2 (2022): 159–186, https://doi.org/10.37043/JURA.2022.14.2.1

THE EFFECTS OF SPATIAL DEPENDENCE AND RESOURCE AVAILABILITY ON RURAL DEVELOPMENT PLANNING PROJECTS IN THE HETEROGENEUOS MICRO-REGIONS OF THE SOUTHERN TRANSDANUBIAN REGION, HUNGARY

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Abstract: Applied methods and materials to support regional planning vary; planners update their analytical frameworks based on the newly available data. Development goals, priorities and strategies need to be based on available (local) resources, which are identified as either comparative advantages or uniform development goals at a certain planning level. This paper presents a novel analytical framework for the Rural Development Programme of the South Transdanubian Region (Hungary) for the period of 2021-2027. Descriptive, cross tabulations and indicators of spatial autocorrelation were applied to the number of projects supported under the Rural Development sub-measures in 2014-2020. Large variation was observed in the LEADER development areas, and we confirmed that the pull effect of the regional centres is unclear. The results warn on the location-determined peripheries in the region. Agriculture oriented, even small settlements are better acceptors of rural development funds than other clusters of resource availability.

Keywords:

spatial autocorrelation;
territorial planning model;
rural development;
local resources;
regional clusters

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Introduction

The EU defines regional level as an optimal spatial scale for the redistribution of resources, hence for regional development planning. However, due to the heterogeneity of the administration configuration, the spatial governance or the planning systems of the EU, regional development on this spatial scale raises challenges (Cotella et al. 2021). Besides, there are numerous on-going discussions on the ideal territorial scale for the development policy, including local economic development (LED), where the interactions of local stakeholders and the mobilisation of internal resources are taking place (Varjú et al. 2020).

In rural development, areas delineated by LEADER – that is actually a bottom-up approach of territorial cooperation – is often seen as a proper spatial unit to use for other regional development planning. LEADER created Local Action Groups (LAGs) which successfully brought local actors together and allowed for the development of local governance capacities, therefore the spatial action area of LAGs can be a development unit for rural development. The theory of local resource based local development emphasises the endogenous and bottom-up approach as well, constituting the set of opportunities and providing value to developers (Ministry of Internal Affairs 2018).

Following the mentioned two approaches, applying a novel methodological approach, the authors argue that, in regional planning, there is a need to revisit this (LEADER) delineation based on the analysis of available resources. Horváthné et al. (2017) underlined that the centres of development zones or micro regions do not fulfil the gravity role expected in the Southern Transdanubian region. Studying the recent territorial resources of the Southern Transdanubian settlements, Horváthné et al. (2021a) found that Strong and capable cities (n=31) are accompanied by mainly Agricultural villages (small villages with agricultural and processing industrial capacities, n=155) and that there are settlements (n=170) with Concentrated capacities (areas with significant livestock and processing industry, and a relatively high number of large and medium sized enterprises). However, the majority of the region's area (n=299) has Limited resources (small villages with very limited resources).

The aim of this paper is to present a novel analytical framework that was tested under the preparation of the Rural Development Programme for the South Transdanubian Region (Hungary), for the period of 2021-2027. The planning procedure differed from the ones before. Beside the bottom-up approach, where the regional plan takes into consideration the lower level (county) plans, planners had to deal with the central expectation of the South-Transdanubian Economic Development Zone (Hungarian Government 2020), and they had to take into consideration the development priorities of the cross-administrative plan of Balaton Lake Region, too. In the authors' point of

view, the new period of rural development funds shall be better tailored to the needs and opportunities of the local communities, economies, and businesses.

The intention of the analysis is to illustrate the dispersion and spatial dependence of the resource absorption capacity and the resource availability of settlements across the planning areas of LEADER associations in the Southern Transdanubian region of Hungary. The authors conclude by arguing that the development strategy of the region needs to consider the diverse endowments and to understand the possible roles of the centres of micro regions, which may not be necessarily following the delineation of LEADER areas.

Approaches of rural regional development

The LEADER initiation

The Liaisons Entre Actions de Développement de l'Économie Rurale (LEADER) initiative has been at the heart of European rural development policy for the last 20 years, embracing the principles of bottom-up endogenous development and community empowerment (Navarro et al. 2016). In the European Union, LEADER was launched as an experimental programme under Community Initiatives in 1991, and it gave up the practice of former centralised rural development of top-down management and it included a method not applied before in rural developmental programming – bottom-up initiatives. As the main characteristics of the program, local level partnership, transparency, subsidiarity, accountability and promoting local initiatives can be determined (G. Fekete 2013).

The LEADER is part of the comprehensive territorial development approach that is based on the strengths, weaknesses, opportunities for, and threats to, a region. It employs a bottom-up, participatory approach (May et al. 2019) in which stakeholders from different institutions form together a Local Action Group (LAG) as a kind of a public-private partnership that makes decisions about the financial support for development projects (Pollermann et al. 2013). Those projects must contribute to the objectives of the Local Development Strategies formulated by the LAG members. Since 2007, LEADER has been integrated with other rural development measures in the Pillar 2 of the CAP through rural development programmes (Ward and Lowe 2004, Bonfiglio et al. 2016).

Based on the European Parliament and the Council of the European Union (2013), Hungary allocated 192 million EUR to the LEADER approach in the Rural Development Program for the period 2014-2020, contributing to the focus area 6.B Promoting social inclusion, poverty reduction and economic development in rural areas, with a focus on fostering local development in rural areas (European Parliament and Council of the European Union 2013). This means that almost 5% of the total

expenditure of the rural development programme was allocated to the 103 recognised LAG who developed their own local development strategy which are consistent with both the national rural development programme and the Common Strategic Framework (Prime Minister 2014). Promoting employment, growth, social inclusion, and local development in rural areas, including bio economy and sustainable forestry is one of the nine key objectives of the new Common Agricultural Policy for the programming period 2021-2027. LEADER will remain part of the rural development programs as it has successfully brought local actors together and allowed for the development of local governance capacities. However, steps must be taken to preserve its innovative bottom-up approach, which was in some cases compromised in the period that just ended.

Foreign Direct Investments

The Foreign Direct Investment (FDI) is seen as a major mechanism for development. The effects on employment associated with FDI are both direct and indirect. The creation of employment opportunities – either directly or indirectly – remains one of the most prominent impacts of FDI on the host country's economy (Dall'Erba and Le Gallo 2008, Kurtishi-Kastrati 2013, Strat et al. 2015). Having regarded the latest EU member states, this correlation finds confirmation in Hungary, Malta, Bulgaria and Estonia. Another phenomenon also reveals from the unemployment towards the inflows of FDI. It means (in the case – for instance – of Romania, Czechia and Slovakia) that foreign investors search the locations where the availability of the workforce would not be a problem (Strat et al. 2015).

The most important progress of FDI in many transition economies was the large amount of inflow and its role in the privatisation of the state-owned companies. However, one should also take into account the non-economic drawback of FDI, which is the often seen phenomenon that the local enforcement of environmental protection legislation is negligent or weak in relation to foreign firms (Kurtishi-Kastrati 2013). The negative impact on the land cover and land use changes seems to have appeared on those territories in ex-socialist countries where economic transitions were taking place (Petrișor et al. 2020). This transition amplified regional disparities (Ianoș et al. 2013) where local solutions were needed.

Local resource-based development

The local resource-based economic development concept endeavours to use all local resources as efficiently as possible. The multi-layered efficiency of the development policy depends not only on the economy of scale but also on the governance capacities, its social embeddedness, complexity, and its open or closed, hierarchical or horizontal nature (Varjú et al. 2020). According to the followers of local resource-based (rural) development (earlier: Capello 2011, Stimson et al. 2011, Camagni 2017, and neo-

endogenous: Biczkowski 2020, Cejudo and Navarro 2020, Pollermann et al. 2020), the development goals, priorities and strategies are supposed to be based on the resources that can be allocated, and they are identified as either comparative advantages or uniform development goals. The resources are considered as factors that constitute the set of opportunities that provide value to developers (Ministry of Internal Affairs 2018, Mezei and Varjú 2020, Varjú 2021).

The project absorption capacity of settlements also depends on the availability of local capital (e.g. resources). For most local developments, a territorial scale that goes beyond the boundaries of a particular municipality would be ideal for implementation (Mezei and Varjú 2018).

As it was mentioned above, local development is socially embedded. Besides, adaptive, bottom-up local development has (among others) an important condition that is the mobilisation of locally available community (and private resources). However, to integrate or mobilise the poor part of a community into local/regional (rural) is a challenge.

The role of socially backward community

An important issue in regional rural planning is how to integrate poor people so that they do not remain marginalised and lead to rural decline due to less investments. From an investment, the local community can gain benefits, however, globalised technological culture, old traditions and path-dependent 'development culture' or heritage (such as corruption) and over-politicization can be a pitfall in recent rural development. In this context, Rîșteiu et al. (2022) draws attention to the fact that local rural development has to respect the impacted local community, not only from their opinion but it has to consider the value in being able to maintain their heritage by continuing their economic activity (in the cited particular case, the mode of extracting resources/mining), as it can be a solution for the threat of depopulation (Rîșteiu et al. 2022). O'Brien and Crețan (2019) pointed out that the advocacy capacity of those living in rural areas, especially of the shepherds, is low compared to those living in urban areas, therefore, it is essential to support the local population to participate in the development of local development programs.

Although local political actors often play a leading role in the Local Action Groups, it is important to maintain the politically neutral position of a LAG as various authors have identified the apolitical character of the rural population in post-socialist countries. Mamonova and Visser (2014) demonstrated that post-socialist rural residents tend to distrust any political action and to assume that the hidden self-interest lies behind every form of collective action. Hajdu and Mamonova (2020) found that social estrangement from politics and from civil mobilisation defines the apolitical character of rural social movements.

Spatial modelling of rural development

In the context of spatial model applications (more specifically spatial autocorrelation) on the analysis of rural development, a range of recent results are available internationally. From the viewpoint of our article's focus, we summarised the most relevant ones and their contribution to the topic under research (Table 1).

Table 1. Spatial correlations in rural development articles (literature review)

Author, Year	Territorial scope	Method	Main outcome	Relevance
Wang et al. (2018)	Region of Mao'er Mountain forest	Global autocorrelation analysis and local autocorrelation analysis; multiple linear regression model of biomass; geographical factors and biological factors; geographically weighted regression model.	Forest biomass – positive spatial autocorrelation; AIC value of Geographically Weighted Regression Model worse than multi-regression model; R square values increased, GWR model had higher fitting accuracy.	Modelling natural resources
Creţan et al. (2005)	West Region of Romania	Descriptive, case analyses	Policy recommendations	Addressed the role of central functions in predominantly rural areas.
Berbecar et al. (2020)	South-East of Romania	PCA, cluster analysis, composite index.	Settlements clusters based on QoLI	Cluster analysis on the development of rural and urban settlements.
Zasada et al. (2018)	Eastern Europe, Southern Europe	Analysing the variances and spatial dependencies of regional socio-economic, environmental and agricultural framework conditions and applying statistical logit models.	Environmental variables correspond to high NC expenditures; agricultural structures and conditions have a larger influence; the Regional RDP expenditure depends strongly on spatial association factors.	Natural capital as RDP asset in relation to social-economic factors of regions.
Libang et al. (2020)	Gansu Province China	Importance-performance analysis (IPA), information entropy, equalisation index and model of urban-rural integration degree.	Quality of urban and rural life: positive spatial autocorrelation, spatial agglomeration; close correlation between quality of urban and rural life, suggesting polarisation effect.	Spatial patterns of quality of urban and rural life as well as urban-rural integration degree.

Author, Year	Territorial scope	Method	Main outcome	Relevance
Bakucs et al. (2019)	Less developed regions LAU1 HU	Multi-dimensional, local-variables-based RD Index & migration-based index as a proxy for perceived quality of life; generalised propensity score matching, and difference-in-differences estimation techniques.	Impact was not significant, and sometimes even negative; doubts on the effectiveness of Rural Development Policy in Hungary.	To measure the overall impact of all of the Rural Development Funds.
European Commission (2018)		Regions, ESIF payments (ERDF, ESF, EAGGF and CF) 1989-2015; Index of regional specificity Iq; linear regression.	Generally: less evident time gap between the payments remitted and the actual expenses for the areas with a low index of specificity; opposite to the areas with a high index of specificity.	Development payments at regional level analysed with time gap.

The recent evidence of spatial models in the research targeting rural development prove that regional acceptors of development funds, including the natural capital (Wang et al. 2018) as available asset of development, tend to correspond and agglomerate along with geographical location. Namely, agricultural structures, regional rural development programmes expenditures (Zasada et al. 2018), and, as a response variable, the quality of life (Libang et al. 2020) were found spatially determining or determined, and polarisation is perceived as well. There are suggestions on exploiting core central functions when planning the development of rural regions, at least for differentiating rural areas where certain ethnic groups (e.g. the Roma people) are marginalised or othered (Creţan et al. 2021). As being spatially determined – suggesting the presence of further influential factors – it might not be surprising that Bakucs et al. (2019) found that rural development expenditures do not correspond with the quality of rural life according to many models. According to the European Commission (2018), the efficiency of expenses is varying for regions with different features (index of regional specificity).

Methodology

For the analysis in this article, a two-step method was used. Firstly, after the identification and achievement of the necessary data, an overview is given on the Rural Development projects and the spatial analytical framework is presented. The spatial heterogeneity of the LEADER areas is illustrated with the project absorption capacity (in the period of 2014-2020) and the resource availability (year 2018 cross-section data) of settlements across LEADER areas.

Introduction to the sample region

The targeted area for analysis and for planning was the South Transdanubian Region in the south-west part of Hungary; it includes three counties: Somogy, Tolna and Baranya, and it is very heterogeneous from a development point of view. It is made up of a number of development areas at the administrative level. Altogether, 656 settlements (41 towns and 615 villages) can be found in the region on a 14,198 km² large territory with 894,223 inhabitants, more than half of which (333 settlements) are social, economic, and infrastructural beneficiaries, while 265 (40.4%) belong to the group of settlements with significant unemployment [105/2015. (IV. 23.) Government Regulation].

Territorial delineations in the Southern Transdanubian Region are formed by heterogeneous development areas according to resource maps based on settlement statistics (Horváthné et al. 2021b). The delineation (Horváthné et al. 2021a) is influenced by the development concept of the three counties that make up the region, as well as the development goals, priorities and strategies formulated in them (Baranya County Local Government 2021, Somogy County Local Government 2021, Tolna County Local Government 2021). Diversification proposals can be made for the development areas of the region, and for the central areas and development directions in the light of settlement-level data. The definition of such micro regions can contribute to the development of future program priorities, their efficient use, ultimately through the identification of "local led" development type regions and communities that can be established for green, smart, social, and connected rural development.

Database development

The database of rural development projects was assembled in the following way. The Hungarian Ministry of Innovation and Technology maintains the web-based database of project calls and results for the development operational programmes of Hungary (Széchenyi 2020 Development Programme – Rural Development Programme). In the case of the Rural Development Programmes (2014-2020) and implemented projects (hereby after referred as RDP), the webpage can be accessed through a registry and individual entry system (sso.fair.gov.hu) in order to get the data of implemented projects. The sub-measures of the RDP are grouped according to their main scope: *M01* – Knowledge transfer and information actions; *M02* – Advisory services, farm management and farm relief services; *M03* – Quality schemes for agricultural products and foodstuffs; *M04* – Investments in physical assets; *M05* – Restoring agricultural production potential damaged by natural disasters and catastrophic events and introduction of appropriate prevention actions; *M06* – Farm and business development; *M07* – Basic services and village renewal in rural areas; *M08* – Investments in forest area development and improvement of the viability of forests; *M09* – Setting-up of producer groups and organisations; M10 – Agri-environment-climate; *M11* – Organic farming;

M12 – Natura 2000 and Water Framework Directive payments; *M13* – Payments to areas facing natural or other specific constraints; *M14* – Animal Welfare; *M15* – Forest environmental and climate services and forest conservation; *M16* – Co-operation; *M17* – Risk management; *M19* – Support for LEADER local development.

The projects' data was available for each sub-measure (70 sub-measures) in branches of 300's at various spatial aggregation levels (district, county, region). The spatial aggregation level has to be chosen to meet the downloadable upper limit of the number of projects within a sub-measure; sometimes the whole of the South Transdanubian region was selected, and, in many times, even within districts, several files of 300 records had to be downloaded. Only those sub-measures were selected that supported activities related to production and those targeting the capacity development of the administrative system of the support scheme were skipped. Altogether, 56 csv files of maximum 300 records of projects were downloaded, merged and converted to Microsoft Excel spreadsheet format (.xlsx) format before analysis. The final cross-section database contained the following variables: name of settlement, name of project, name of the organisation/person that submitted the projects, total requested amount, amount granted, and amount paid in the given year. It covered 6909 projects on 590 settlements of the South Transdanubian region in the period of 2014-2020 (128,756 is the total number for the whole country and the South Transdanubian region represents 5.5%). We also used the clip of the regional shape file of settlements, merged with the borders of LEADER areas (the source was the OSM).

Analytical framework

The number of projects supported under the sub-measures in the Széchenyi 2020 Development Programme (2014-2020) and the distribution of the most frequent ones were used to give an overview of the rural development programme implementation in the region in a descriptive way first. Then, in order to analyse the spatial distribution of the total numbers of RDP projects, the cross-section database of RDP projects was merged with an own developed shape file of the region, which contains the settlements and the LEADER associations boundaries, too. The spatial data file and the illustration of the spatial pattern of data was based on QGIS 3.16 (QGIS Development Team). The spatial pattern, clusters, and outlier settlements, as well as the spatial determination of the projects' number was analysed with the Local Moran's Indicator and LISA statistics (Anselin 1995, Dusek 2004), with the GeoDa software (Anselin et al. 2006). The next parts of the analysis focus on further determining the factors of LEADER areas heterogeneity from various points of view. We considered first the Resource settlement clusters and next the RD project clusters distribution over LEADER areas by applying crosstabulation.

A multinomial logistic regression model was used to determine the effect of Spatial dependence of RD projects ($Spat\ Dep\ CL$) and the Resource availability ($Resource\ CL$) on

the settlements RD project number (y_{RD}). The following model was applied, both for the coefficients and for the relative risk ratio (RRR) values:

$$y_{RD} = \beta_0 + \beta_1 Spat\ Dep\ CL + \beta_2 Resource\ CL + \varepsilon \quad (1)$$

Results

The overall description of the rural development projects supported in the South Transdanubian region in the period between 2014-2020 is followed by the analysis of the spatial pattern of the distribution of projects at settlement level. A multinomial logistic regression model is given to formulate the effect of spatial dependence and resource availability.

Overview of rural development projects in the region

In this section, we discuss first the overall availability and implementation of rural development projects in the region in the period of 2014-2020, then the spatial distribution of the projects is analysed across the settlements of the region.

In the region, there were 56 settlements without any rural development projects in the period of 2014-2020. Most of the projects supported belong to the sub-measures of the followings (Figure 1): Implementation of Local Rural Development Strategies (RD_19), Agri-environmental payments (RD_10), Natura 2000 Subsidies (RD_12), and those of RD_4 group. The number of subsidies provided for forestry-based production (RD_8) is also high.

The most frequent sub-measures are the RD_10.1.1-15 Agri-environmental payments, the RD_19.2.1.17 Implementation of Local Development Strategies, and within the group of RD_4 projects, the RD_4.1.3. projects supporting medical herb production and horticulture (Figure 2). Beside horticulture related investments, many projects target animal husbandry (RD_4.1.1) and agricultural value added and vine production developments (RD_4.2.2), as well.

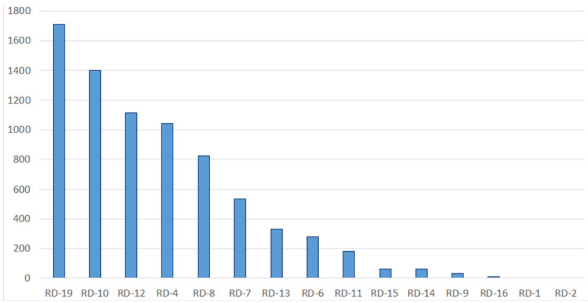

Figure 1. Distribution of supported projects under RD sub-measures in South Transdanubian region, in the period of 2014-2020. Source: own calculation on the basis of HCSO data

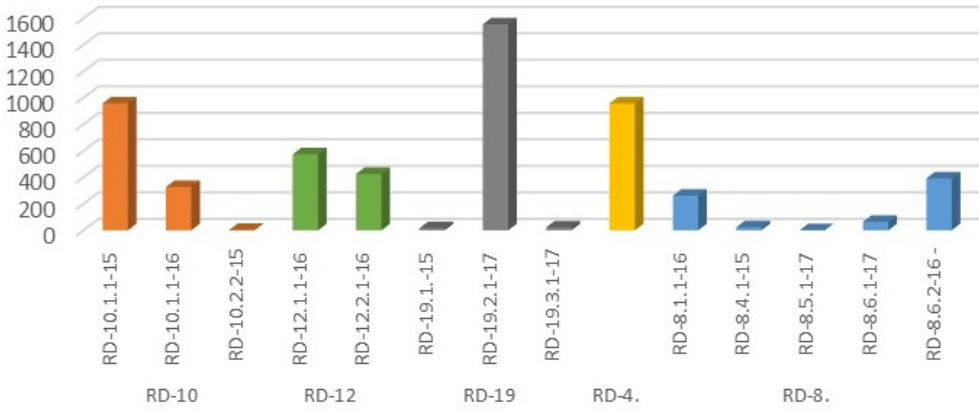

Figure 2. The distribution of projects within the most frequent measures in the Southern Transdanubian region, in the period of 2014-2020. Source: own calculation on the basis of HCSO data

Spatial distribution of rural development projects

Altogether, 6909 projects were supported. Referring to the number of RD projects in relation to the resource availability cluster membership of settlements (Figure 3), at a first approach, the most eye-catching is that larger settlements seem to reach more of the projects, and it is also associated with Cluster 1 membership.

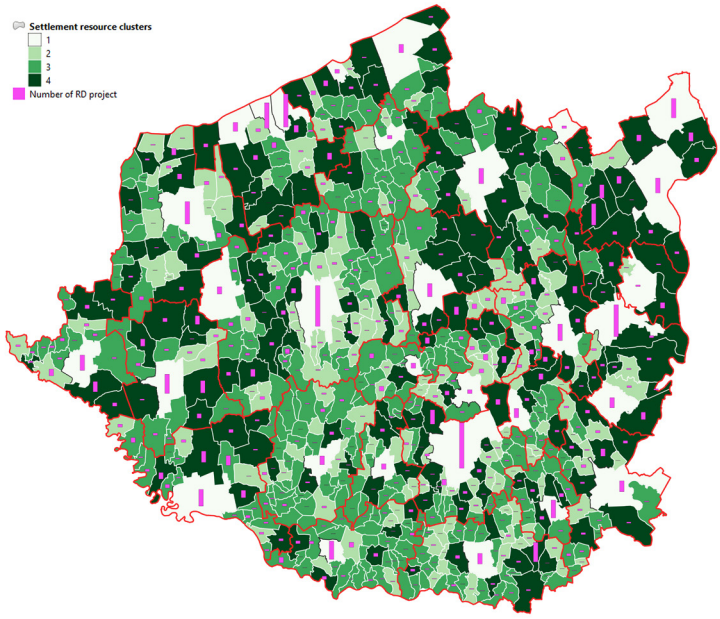

Figure 3. Spatial distribution of RD projects and the Resource clusters of settlements. Source: own calculation on the basis of HCSO data

Indicators of spatial dependence

The spatial distribution of the rural development projects supported in the South Transdanubian region is analysed with the help of spatial autocorrelation indicators. The Local Moran Statistics was used to analyse the spatial autocorrelation of RD projects. Figure 4 indicates the regression of the standardised values of the project number of settlements and the lagged values defined by the neighbouring settlements' project number *(Queen 1st order continuity)*.

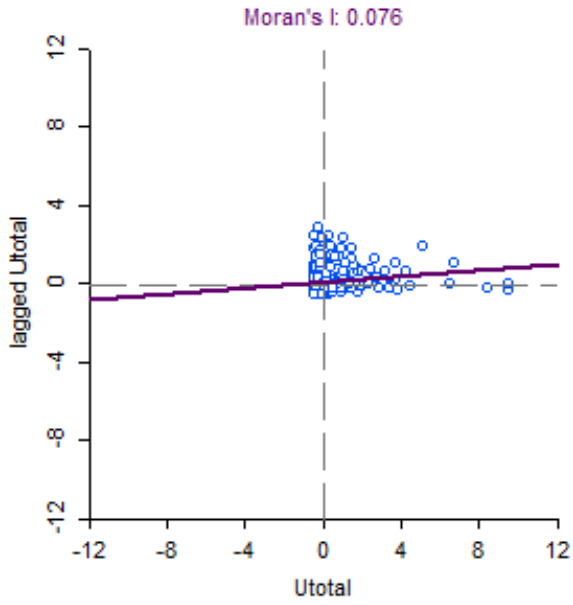

Figure 4. Moran scatter plot of RD projects of settlements. Source: own calculation on the basis of HCSO data

The spatial distribution of local Moran's scores defines the clustering settlements (of either low or high values) and the outliers (with either higher or lower values than their surroundings). The pseudo significance is p<=0.05.

Generally speaking of RD projects, the low number of the projects is seen in settlement clusters (blue) on the southern periphery (1) of the region (Figure 5). High values tend to cluster around industrial and/or major cities of the counties (2) and on the middle southern bank of lake Balaton (3). It is an eye-catching pattern that the neighbourhoods of major cities are heterogeneous (4).

Accordingly, the slope of the regression line in the Moran's scatter plot is flat – high settlements' values pair low lagged values (4), some high settlement values pair high lagged values (2, 3) and the plots crowd in the left bottom quarter (1) indicates low settlement values with low lagged values.

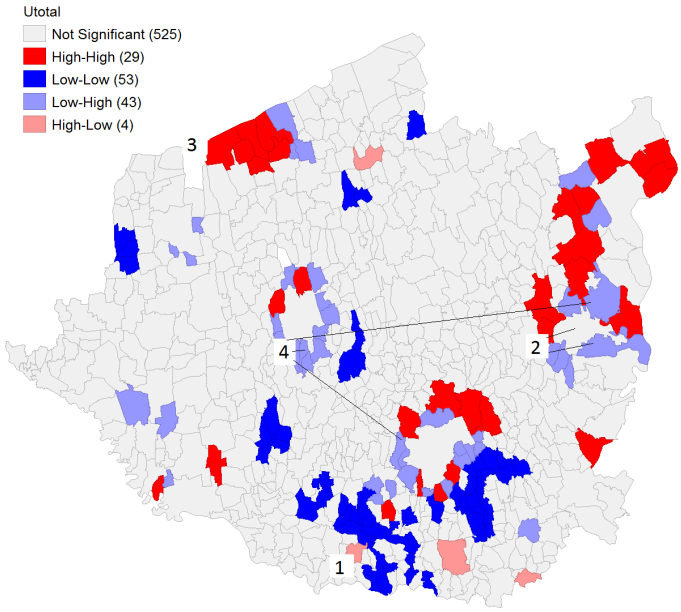

Figure 5. Local Indicator of Spatial Association cluster map of RD projects of settlements in the South Transdanubian Region. Source: own calculation on the basis of HCSO data

Considering the total RD project number of the settlements, the spatial autoregression is quite moderate (Moran's *I* is 0.076) at the level of the whole region.

Typical RD sub-measures and spatial dependence on the settlements of Southern Transdanubian region

As we saw, the spatial distribution of the total number of RD projects is spatially auto-correlated. Next, we try to classify the settlements on the basis of the most relevant types of RD projects. The structure of the most frequent sub-measures was calculated and illustrated on the following map (Figure 6).

RD 10, 13, 19, 4 and 8 were the most frequent sub-measures in terms of the number of projects supported in the period 2014-2020 (Table 2). The spatial dependence of the typical RD projects in the settlements is measured by the Moran's index and it is compared along the five most common sub-measures.

Compared to the spatial dependence of RD projects in general (as seen above: $I = 0.076$), RD sub-measures RD 10, RD 19, RD 8 (0.174; 0.144; 0.139, respectively) are more, while RD 13 and RD 4 (0.073; 0.063, respectively) are less dependent on the geographical location of the settlements. The most heterogeneous is the number of projects per settlement in the case of RD 13 and RD 4. From the point of view of our survey's

objectives, the fact that the supports linked to the Implementation of LEADER Local Development Strategies (RD_19) are more determined by spatial patterns than the other RD (with an exception of RD_10. Agri-environmental payments, which are dedicated to certain areas) must warn the planners and policy makers.

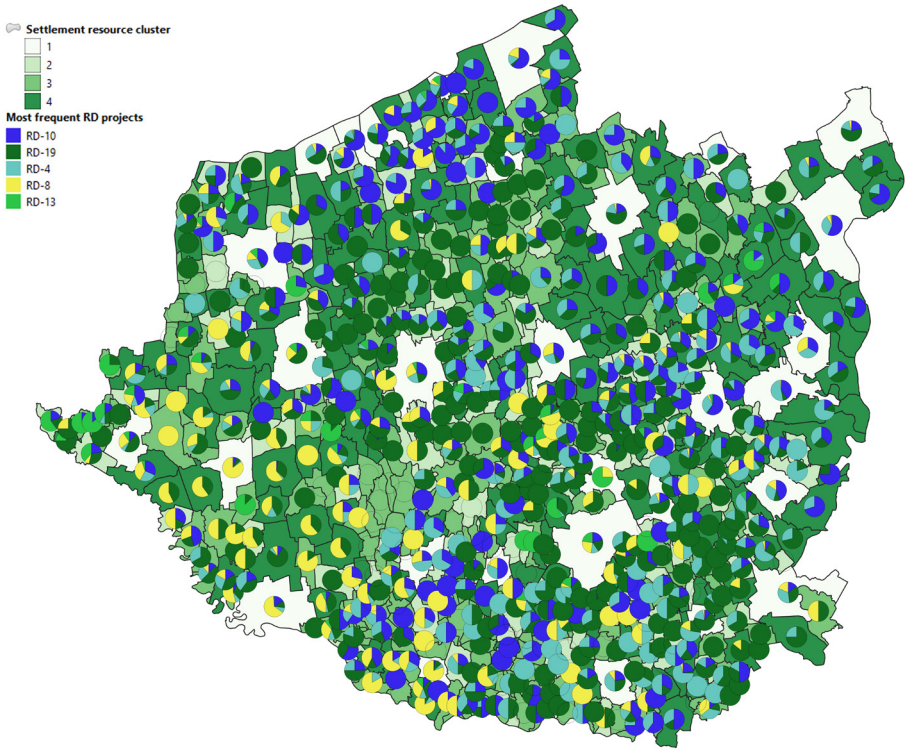

Figure 6. Distribution of the most frequent RD sub-measures in the settlements of Southern Transdanubian region and the resource availability clusters of settlements. Source: own calculation on the basis of HCSO data

Table 2. Frequency and spatial dependence of the typical RD projects in the settlements of the Southern Transdanubian region

	RD projects	*Settlements*	*Average number of projects per settlement*	*St. dev. of project per settlement*	*Moran's I*
RD-10	1287	316	4.07	7.02	0.174
RD-13	284	49	5.80	10.90	0.073
RD-19	1592	398	4.00	5.19	0.144
RD-4	957	283	3.38	5.65	0.063
RD-8	740	180	4.11	6.79	0.139
Total	***4860***	***540***	***9.00***	***15.16***	not applicable

LEADER areas heterogeneity

In the following, we demonstrate that the diversification of LEADER areas is according to resource availability (Resource clusters), the RD projects absorption capacity (RD project clusters) and the spatial dependence (clusters) of the settlements.

Resource settlement clusters and LEADER area

The formerly mentioned resource clusters of settlements that were defined by their resource classification is considered in this session. The analysis uses a classification (Horváthné et al. 2021b) of the South Transdanubian settlements according to their resource availability, such as Strong and capable cities (CL1); Agricultural villages (Small villages with agricultural and processing industrial capacities) (CL2); Limited resources (Small villages with very limited resources) (CL3); Concentrated capacities (Areas with significant livestock and processing industry, relatively high number of large and medium sized enterprises) (CL4).

The spatial dispersion of settlement Resource clusters across the LEADER areas of the region (Figure 7) is analysed and it shows that the LEADER Initiative Development Associations of the region consist of settlements of various and mixed resource availability (indicated by cluster membership), as well as of different capability of attracting rural development projects.

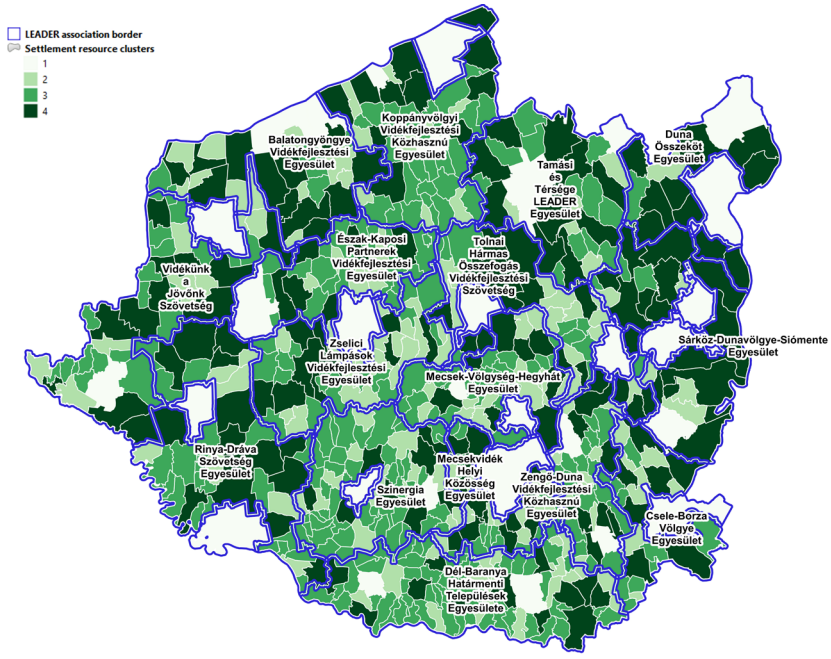

Figure 7. The spatial dispersion of settlement Resource clusters across the LEADER areas of the Southern Transdanubian Region. Source: Horváthné et al. (2021b)

The LEADER areas vary from each other in terms of the resource availability of their constituting settlements (Figure 8).

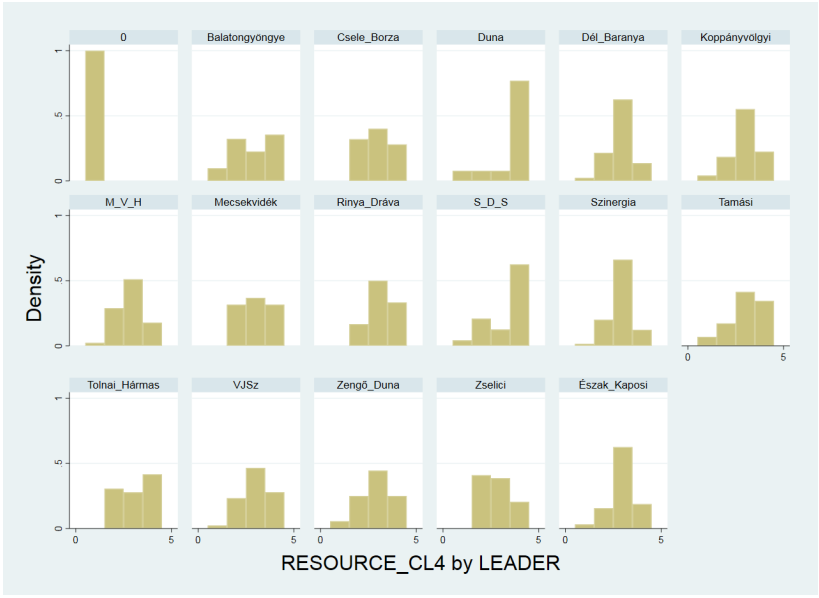

Figure 8. Distribution of the Resource clusters of settlements in LEADER areas

In the case of LEADER regional rural development strategies, the formulation of comparative development objectives may be justified, based in part on the different resource endowments of the settlements. Not surprisingly, LEADER centres (indicated by group 0) belong to Cluster 1 (Capable cities); many of the LEADER areas are characterised with diversity (e.g. Zengő-Duna), while some areas are defined by the majority of only one cluster. The Pearson chi-square value was 387.4846 (P = 0.000).

Duna Összeköt (Danube is Connecting), S_D_S (Sárköz-Dunavölgye-Siómente), Tolnai Hármas Összefogás (Tolnai Triple Alliance), and Balatongyöngye are benefitting from a high or relatively high number of settlements in the Concentrated capacities cluster. Those LEADER areas where the distribution of the resource clusters is dominated by the Limited resources settlements are: Dél (South) Baranya, Koppányvölgyi, MVH (Mecsek-Völgység-Hegyhát), Rinya-Dráva, Észak (North) Kaposi and Szinergia (Synergy); however, this cluster is higher in most LEADER areas. The difference can be made according to the ratio of other resource clusters.

Agricultural small villages are mostly present in the area of the following LAGs: Zselici Lámpások (Lanterns of Zselic), Balatongyöngye, Csele-Borza, Mecsekvidék, Tolnai Hármas Összefogás (Tolnai Triple Alliance); but in some other areas characterised by different clusters, agricultural villages form the second highest cluster.

It is worth mentioning that Capable cities – as possible micro centres of development – can be found on the area of almost two third of the LAGs: Balatongyöngye, Duna Összeköt, Koppányvölgye, MVH (Mecsek-Völgység-Hegyhát), Dél (South) Baranya, SDS (Sárköz-Dunavölgye-Siómente), Zengő-Duna, Tamási, Szinergia (Synergy), and VJS (Our Area is Our Future).

RD projects clusters and the LEADER area

In this part, the settlement clusters based on the number of RD projects and LEADER associations areas are analysed. First, the clusters of settlements per RD project number were defined (Table 3). K-means (++) methods with a maximum of 1000 iterations, and the Euclidean distance with the standardisation transformation were applied. The clusters (groups) explain 91% of the RD projects number total variance (Annex 1).

Table 3. Settlement clusters by RD projects number

Number	Name	Cluster centres	Ratio of projects
1	RD_ CL1 (n=319)	6.051	28.87%
2	RD_ CL2 (n=304)	29.191	35.90%
3	RD_ CL3 (n=28)	77.235	23.70%
4	RD_ CL4 (n=5)	174.8	11.52%
	CLUSTERS TOTAL	11.6	100.00%

The majority of settlements (48%) had a very low project availability, while almost 35% of the projects were supported on only less than 5% of the region's settlements. And the distribution of RD project clusters is compared across LEADER areas (Figure 9). The difference between LEADER areas is visible; only one of them (VJSz) has an almost even distribution of the four clusters, while many areas contain one or two clusters. The Pearson chi-square value is 648.2434 (P= 0.000). The centres of districts are not part of the LEADER areas, and these are indicated with 0.

CL3 settlements (where the number of RD projects is higher) are visibly present only in the LEADER centre towns. CL4 settlements (n=5) can be seen only in Sinergy, Balatongyöngye and in a high ratio in LEADER centre towns (outstanding potential in the number of projects). The associations of Rinya-Dráva, Dél-Baranya, Mecsekvidék, M_V_H, Szinergia, and Zselici have many settlements in CL1 (lowest number of projects) and, with the exceptions of Mecsekvidék and M_V_H, this cluster is almost the only one present. In the case of 9 LEADER associations, we can see a higher representation of CL2 (with the second lowest number of projects). The Pearson chi-square value was 648.2434 (P = 0.000).

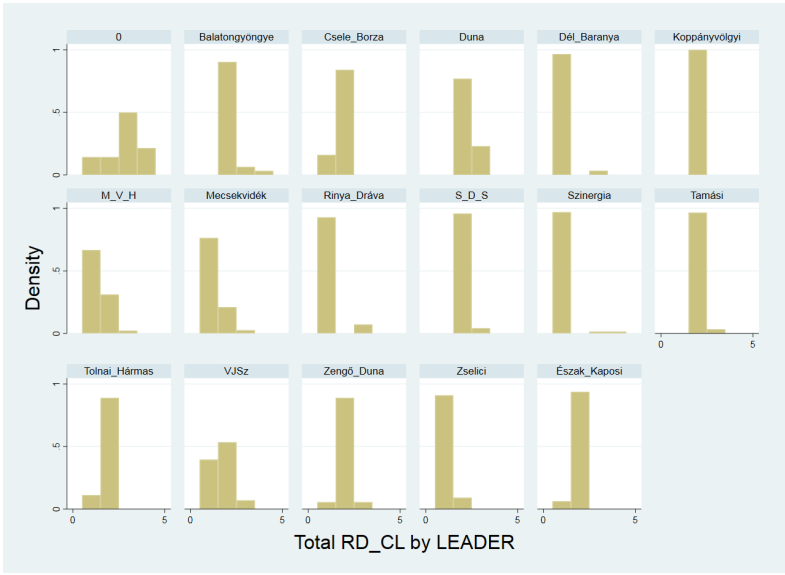

Figure 9. Distribution of RD project clusters of settlements in LEADER areas

Influence of spatial dependence and resource availability on RD projects

The spatial dependence of RD projects of settlements is defined by the Moran indicator; each settlement is allocated by its RD score and the lagged RD score. The lagged RD score indicates the neighbouring settlements' potential effect, interpreted as the spatial effect. The lagged scores are used to define the clusters of settlements (four clusters, k-means) and they are included in the model as explanatory category variables.

Spatial Dependence Clusters of settlements

The algorithm that defines the settlements individual scores and the lagged values (originating from the neighbouring settlements scores) provides the opportunity to cluster the settlements (Table 4).

Table 4. Settlement clusters by the Moran scores

Number	Name	Mean Std Score	Mean Lag Score
1	SPATIAL DEP_ CL1 (n=504)	-0.23	-0.11
2	SPATIAL DEP_ CL2 (n=109)	-0.05	1.2
3	SPATIAL DEP_ CL3 (n=36)	2.27	0.35
4	SPATIAL DEP_ CL4 (n=5)	8.05	0.5

K-means (++) methods with a maximum of 1000 iterations, and the Euclidean distance with the standardisation transformation were applied (Annex 2). The clusters (groups) explain 75% of the Moran scores' total variance (Figure 10).

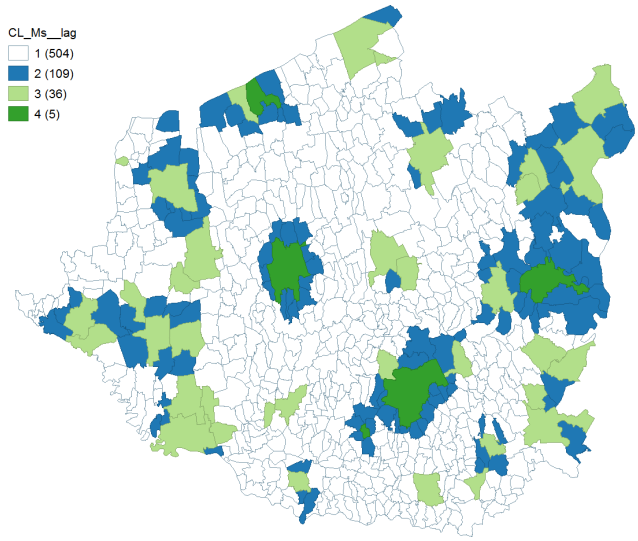

Figure 10. Spatial Dependence Clusters settlements (by Moran's scores of total number of RD projects)

On 109 settlements (blue), CL2 low scores are seen but the surrounding is higher. The light green represents those settlements (CL3) where the number of RD projects is higher than the general and the surrounding is also strong in RD projects; while dark green represents the 5 settlements with outstanding potential in the number of projects in their neighbourhood (CL4). The majority of the settlements (unfilled) belong to CL1 with both low standard scores and low lag scores.

Multinomial regression model of project number

The PROJECT NUMBER CLUSTERS was taken as nominal outcome variable, while RESOURCE CLUSTERS and SPATIAL DEPENDENCE CLUSTERS were taken as explanatory category variables. A multinomial model of these variables gives the following results (Annex 3). The variance inflation factor was appropriate (1/VIF: 0.64; 0. 94 for SPATIAL DEP_CL, and RESOURCE CL, respectively). The likelyhood ratio chi-square test (0.00) indicates that the fit of the model with the involved predictors is significantly better than the intercept-only (nul) model. The Pseudo R-square indicates that the model (with predictors included) better fit to the null model by 21.99 per cent.

Taking RD cluster #1 as base outcome, the risk to fall into RD cluster#2 is increasing (by 22.5 percent) if a settlement belongs to a higher number of RESOURCE CLUSTER and it is increasing by 68.9 per cent if a settlement belongs to a higher number of SPATIAL DEPENDENCE CLUSTER (Table 5).

Table 5. Level of significance and the risks to fall into other clusters if either the resource cluster or the spatial dependence cluster membership changes – compared to RD Project Cluster #1 (as baseline)

	RD Project Cluster #2		RD Project Cluster #3		RD Project Cluster #4
	Sign.	Risk	Sign.	Risk	Sign.
Spatial dependence cluster membership	0.006	+22.5%	0.000	4-times higher	Not significant
Resource cluster membership	0.059	+68.9%	Not significant		Not significant

The slope of regression is positive, and the risk is increased by 67.6 percent to fall into RD cluster#3 (compared to base outcome group) if the settlement belongs to a higher number of SPATIAL DEPENDENCE CLUSTER. None of the further coefficients are significant, which means that entering the further clusters of resource availability or spatial dependence does not influence the number of RD PROJECTS. In summary, physical location has a significant effect between cluster 1, 2 and 3 of RD project number, which calls attention to the necessity of handling peripheries. A settlement, in general, can achieve a significant shift (the risk is increasing for falling into the second cluster of RD projects compared to the first cluster) if the resource availability is better.

Discussion

The capability of the Southern Transdanubian settlements for absorbing rural development projects (funds) was found both heterogeneous and determined by the settlements' geographic location and the local resources in the period 2014-2020. The findings partly agree with the legal classification of the development "zones", which identifies half of the region's settlements as social, economic, and infrastructural beneficiaries and 40% of them with significant unemployment [105/2015. (IV. 23.) Government Regulation]. The authors however argue that the proper level of planning is the micro regional development units of the region and that the simple role of 'central' cities in the growth of their micro region is the key component that planning shall rely on (Mohl and Hagen 2010).

Both Wand et al. (2018) and Zasada et al. (2018) confirmed that natural capital being highly dependent on spatial patterns must be considered when planning rural development, which agrees with the point that we made that other than administrative aspects of development units are needed for policy making. Libang et al. (2020) were also successful when applying the specific "evaluation units" to find agglomeration and spatial effects in the quality of urban vs. rural life. Much more on local human capital lies when targeting rural development programmes, which implies that other than spatially defined units can be acceptors of development funds (O'Brien and Creţan 2019, Rîșteiu et al. 2022).

We have found that local resources, the specialisation (in specific RD projects), and the geographic proximity and identity (defined by LAGs) have important and significant effects on the level and the variability of the absorption capacity of rural development funds on the settlements in the region. These factors (identity, specialisation, synergy and geographic proximity) are also listed by Lengyel and Reichnitzer (2004) for approaching dissimilarity or proximity methods when defining development clusters. More precisely, Rahmat and Sen (2021) identified in their multiple models of competitiveness index that the common effects of the critical components of the economic infrastructure are stronger, and that regional competitiveness is mostly sensitive to the variable of rural roads. Moreover, findings from Bakucs et al. (2019) suggest that further factors have to be considered when assessing the effectiveness of rural development funds. Our results correspond with the findings of the European Commission (2018) too, hence the specialisation of regions or territorial units influence the response capacity for development funds.

Creţan et al. (2005) adds that county plans in respect of small towns and communes with central place functions, and integrated local programmes shall be addressed by the rural development policy in relation to FDI. Earlier research findings (Horváthné et al. 2016) on the questionable role of development centres (in the region) are confirmed however again; we did not prove the pull effect of the LEADER centres' gravity. Further research is needed to classify the possible central cities' role and their relationship with the surrounding settlements, which may contribute to a better tailored regional development model (Jia et al. 2020). The typology of urban poles and the classification of relations that disadvantageous areas have with the advantaged areas can also add further information to the solution of the problems deriving in the gravity in order to remove the obstacles in the development of rural areas (Ancuța 2010).

Conclusions

A large variation was observed in the LEADER development areas, and our previous findings have confirmed that the function of the regional centre is clear when assessing the pull effect on the complex development of the surrounding settlements. The results warn on the location determined peripheries in the region. Agriculture oriented and even small settlements are better acceptors of rural development funds than other clusters of resource availability.

The limitations of the research are seen in the one-sided approach of taking only the variable number of RD projects as the response variable; the results may be more specific if the amount of grants is included in the model. Further research objectives may include the identification of clusters "concentrating" in space and the identification of factors (e.g., natural geographic units) that significantly contribute to the definition and delimitation of coherent development areas. The possibilities of accessing rural and

other development funds based on empirical data from the past programming period may also be examined, as well as the identification of regional (complex) good practices that could influence the future resource allocation policies (Camaioni et al. 2016).

The search for and the implementation of good practices that target a different group of beneficiaries than the "traditional" ones in the granting constructions, or that extend the range of development programmes that can be submitted in cooperation, can serve to make greater use of resources in areas with lack of entrepreneurial capacity or resources.

We propose to reconsider the level of LAGs as micro regional development units as the proper one for planning. Our study proved that LAGs are heterogeneous, and this heterogeneity has a negative effect on the effectiveness of the development programs' realisations. We also warn that development strategies must not explicitly rely on the simple role of 'central' cities as a gravity factor in the growth of their micro region as the pull effects of the centres cannot be identified in some cases. To sum it up, the new period of rural development funds shall be better tailored to the needs and opportunities of the local communities taking the diverse endowments into consideration as well. In the future, rural development policies shall find a more suitable territorial unit, or a new structure based on which development plans will target the local communities' social and economic cohesion.

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Annex 1: Output table for clusterisation by the total number of RD projects

Method:	KMeans
Number of clusters:	4
Initialization method:	KMeans++
Initialization re-runs:	150
Maximum iterations:	1000
Transformation:	Standardize (Z)
Distance function:	Euclidean
RD	**Cluster centres:**
C1	6.05
C2	29.19
C3	77.24
C4	174.80
The total sum of squares:	653
Clusters	**Within-cluster sum of squares**
C1	27.75
C2	12.28
C3	9.87
C4	8.18
The total within-cluster sum of squares:	58.08
The between-cluster sum of squares:	594.92
The ratio of between to total sum of squares:	0.91

Annex 2: Output table for clusterisation by Moran scores

Method:	KMeans	
Number of clusters:	4	
Initialization method:	KMeans++	
Initialization re-runs:	150	
Maximum iterations:	1000	
Transformation:	Standardize (Z)	
Distance function:	Euclidean	
Cluster centres:	**MORAN STD**	**MORAN LAG**
C1	-0.231351	-0.11146
C2	-0.0489192	1.20453
C3	2.26964	0.349761
C4	8.04522	0.150742
The total sum of squares:	1306	
Clusters	**Within-cluster sum of squares**	
C1	129.544	
C2	118.067	
C3	66.1112	
C4	11.5793	
The total within-cluster sum of squares:	325.302	
The between-cluster sum of squares:	980.698	
The ratio of between to total sum of squares:	*0.751*	

Annex 3: Output tables of the Multinomial model of spatial dependence and resource availability on RD projects in the settlements of South Transdanubian region

Multinomial logistic regression		Number of obs = 656				
LR chi2(6) = 252.96						
Prob > chi2 = 0.0000						
Log likelihood = -448.57702		Pseudo R2 = 0.2199				
	RD_project CL	**COEF. STD. ERR.**	**Z**	**P>Z**	**95% CONF.**	**INTERVAL**
#1		(base outcome)				
#2	Spatial dep_CL	.5245087 .1910424	2.75	**0.006**	.1500724	.8989451
	Resource_CL	.2034697 .1076211	1.89	**0.059**	-.0074637	.4144031
	_cons	-1.277496 .4016838	-3.18	0.001	-2.064782	-.4902102
#3	Spatial dep_CL	6.026208 1.078669	5.59	**0.000**	3.912056	8.14036
	Resource _CL	-.3918903 .2962357	-1.32	0.186	-.9725016	.1887209
	_cons	-14.77876 3.154415	-4.69	0.000	-20.9613	-8.596222
#4	Spatial dep_CL	38.8533 1690.623	0.02	0.982	-3274.707	3352.413
	Resource _CL	-.4869833 654.6406	-0.00	0.999	-1283.559	1282.585
	_cons	-129.8954 5976.941	-0.02	0.983	-11844.48	11584.69

	RD_project CL	**RRR STD. ERR.**	**z**	**P>z**	**95% CONF.**	**INTERVAL**
#1		(base outcome)				
#2	Resource _CL	1.225648 .1319056	1.89	**0.059**	.9925641	1.513467
	Spatial dep_CL	1.689629 .3227908	2.75	**0.006**	1.161918	2.45701
	_cons	.2787344 .1119631	-3.18	0.001	.126846	.6124977
#3	Resource _CL	.6757782 .2001896	-1.32	0.186	.3781359	1.207704
	Spatial dep_CL	414.1416 446.7216	5.59	**0.000**	50.00165	3430.151
	_cons	3.82e-07 1.20e-06	-4.69	0.000	7.88e-10	.0001848
#4	Resource _CL	.6144773 402.2618	-0.00	0.999	0	.
	Spatial dep_CL	7.48e+16 1.26e+20	0.02	0.982	0	.
	_cons	3.86e-57 2.31e-53	-0.02	0.983	0	.

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DISTRIBUTION OF HOME-BASED WORK IN CITIES: IMPLICATIONS FOR PLANNING AND POLICY IN THE PANDEMIC ERA

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Abstract: The rapid growth of home-based work raises questions about its long-term impacts on neighbourhoods and cities. By removing the need to commute, home-based work has the potential to advance the New Urbanism aspirations of walkable neighbourhoods in an urban village format where people live, work and play. Nonetheless, the uneven distribution of this emerging work practice, strongly associated with the socio-economic status of neighbourhoods, is exacerbating the risk of increased urban inequalities. This paper presents pre- and post-COVID data for the City of Gold Coast, Australia, and it discusses the urban distribution of home-based work by analysing the home-based workers' locational preferences, their daily movement patterns, the preferred built environment outcomes, and the urban design features. The findings suggest that certain social and economic interactions tend to increase with the growth of remote work. These interactions, magnified by the COVID pandemic, offer opportunities to advance the New Urbanism aspirations of cohesive, walkable communities and neighbourhoods.

Keywords:

home-based work;
urban inequalities;
walkable neighbourhoods;
COVID-19;
New Urbanism

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Introduction

Since early 2020, cities around the world have frequently endured strict lockdowns implemented as COVID-19 disaster management responses. The streets quickly emptied, with shops closed and office employees working flexibly from home, free from the burden of daily commutes to the office. With the gradual ease of lockdown restrictions, home-based work has become a choice again, rather than a directive, and many employers have chosen to introduce it as a permanent work arrangement option for their staff. Whilst post-pandemic data on the volume of home-based work in cities is still emerging, there is a broad consensus amongst researchers, economists, and policymakers that remote work, particularly work from home, has grown significantly (Bartik et al. 2020, Batty 2020). It has become an attractive alternative to office-based work, potentially permanently changing the work location landscape of cities. Home-based work has shifted from being a niche, but a desirable way of working, towards the mainstream, and in the process, it has created, among other things, an interesting research space for socio-economic studies concerning its impact on productivity, work–life balance, mental health, and gender diversity.

Another interesting, yet insufficiently explored, field of research is to investigate the impact of home-based work on cities through an urban planning perspective — for example, whether home-based work advances the ideals of New Urbanism, a planning movement promoting diversity of land use, pedestrian scale, and self-contained neighbourhoods (De Villiers 1997, Smith 2002). Other areas of investigation include whether local shopping centres can be retrofitted as hubs for collaboration and networking to address home-based workers' need for social interaction and digital connectivity, and how home-based work affects the demand for road infrastructure upgrades. Finding answers to these and many other urban planning and policy questions requires developing insights into (i) the distribution of home-based work in cities, and (ii) understanding how workers' daily routines, patterns and destinations change once they begin to undertake work from home.

The distribution of home-based work is difficult to measure due to challenges in obtaining accurate data on the volumes of the workforce engaged in this type of work. In Australia, pre-pandemic figures are available through the 2016 Census (Australian Bureau of Statistics 2017), which reveals an uneven distribution in Australian cities: in some neighbourhoods, this particular type of work accounts for over ten per cent of the local workforce, whilst in other residential parts of the same city, home-based work is almost non-existent. Prior to the pandemic, this distribution was attributed to access to technological innovations — such as broadband internet access and teleconferencing capabilities — enabling remote work, and locational preferences of knowledge workers who tend to concentrate in certain kinds of regions or clusters (Moos and Skaburskis 2007, Brennan-Horley 2010, Hearn 2020, Rodríguez-Pose and Storper 2020).

One scenario for post-pandemic cities is that the rapid growth of remote, home-based work will enable planning for compact, walkable neighbourhoods (Moreno et al. 2021). Yet, as mentioned in the previous paragraph, this growth is unlikely to be evenly distributed, bringing a risk of spatially inscribed inequalities, which could limit the capacity of cities and neighbourhoods to advance sustainable economic, environmental, and social processes (Sampson 2017). Prior to the pandemic, the problem of inequalities within cities was described as pervasive and persistent (Sampson 2017), with post-pandemic growth of home-based work in certain parts of cities being likely to trigger further divergence amongst urban neighbourhoods. In this scenario, neighbourhoods with a high proportion of home-based work may evolve over time towards being attractive environments delivering the New Urbanism aspirations of walkable urban villages — cohesive, self-sustainable places able to cater for residents' needs in place. At the same time, neighbourhoods less likely to host a substantial proportion of home-based workers are likely to miss out. In this context, planning deliberations on the topic of home-based work require an additional theoretical focus on the social structure of cities and their neighbourhoods.

Our paper makes a step in this direction by analysing the pre-pandemic spatial distribution of home-based work and by assessing home-based workers' daily movement patterns, urban interactions, aspirations, and needs. The overarching research questions of this paper are as follows:

1. Which socio-economic factors influence the distribution of home-based work in cities?
2. To what extent does home-based work exacerbate geographic inequalities in cities?
3. What is the impact of COVID-19 on these questions and the future of home-based work?

The paper offers a timely analysis of the distribution of home-based workers against key socio-economic dimensions using two sources: (1) pre-COVID-19 data as captured in the most recent (2016) Australian census, and (2) post-COVID-19 data from a survey carried out in October and November 2020. In the census-based analysis, we address the theory formulated by Reuschke and Houston (2016), who linked the distribution of home-based businesses to shared trajectories leading certain people to the same location (selection effect), rather than the spill-over effects enabled by the virtue of spatial clustering. The second part of the paper provides an analysis of a survey (n=887) undertaken in the City of Gold Coast in Queensland, Australia, in October and November 2020. The survey invited local home-based workers to share their experiences, particularly the benefits and barriers, the frequency of certain daily activities, and the preferences for future changes to the built environment of cities.

Literature review

The purpose of this literature review is to situate our research question in the context of the current academic discourse on the contemporary urban planning agenda, the ongoing economic restructuring of cities and the recent impacts of the COVID-19 pandemic. Throughout this paper, we use the definition of home-based work proposed by Chen and Sinha (2016: 343): "home-based workers produce goods or services for the market from within or around their own homes".

The rise of New Urbanism in the 1990s attempted to push back against the consequences of car-oriented modernist planning, especially the daily commute and its associated traffic congestion, environmental costs and negative impact on the lifestyle. The New Urbanism paradigm offered an evolving set of planning and design principles promoting walkability, density, mixed-use and quality design (Smith 2002). One of the New Urbanism concepts — the 'urban village' — has gained popularity for its embedded notion that people should have the opportunity to live and work within one neighbourhood (Biddulph et al. 2003, Carroll et al. 2007, Foth et al. 2008). In the context of Australian car-dependent cities, the New Urbanism offers opportunities to reduce urban sprawl and car dependency and to improve societal well-being through urban renewal towards pedestrian-oriented streets and neighbourhoods (Falconer et al. 2010, Trudeau 2013).

Moreover, regardless of the intellectual efforts of researchers and planners advancing the New Urbanism agenda, cities are subject to ongoing dynamics, or mega trends (Hajkowicz et al. 2012), with one of these being economic restructuring from industrial to post-industrial labour markets (Burgers and Musterd 2002). This restructuring, fuelled by the globalising economy, and the increasing role of knowledge and technological innovation (Hearn et al. 2014) is democratising production by lowering barriers to entry (Thomson and Jakubowski 2012) for small-scale entrepreneurs. The result is that work is encroaching into suburbia (Glaeser and Kahn 2003, Flew et al. 2012), and remote — particularly home-based — work continues to grow in popularity, and it has become spatially significant (Holliss 2015), somewhat irrespective of the urban village aspirations promoted by the New Urbanism agenda.

In the social sciences, the growth of home-based work is often attributed to several interrelated processes: technological advances, changing lifestyle preferences, empowered individuals, and globalising networks of knowledge (Glaeser 2012, Moretti 2012). Economists, on the other hand, often position technological advances as facilitators of contingent work, as they enable firms to outsource non-core parts of their activities (De Stefano 2016) and to assist their employees to work flexibly (Houghton et al. 2018). From either perspective, work has been facing unprecedented locational flexibility, fostering the ongoing spatial deconcentration of economic activities and

changing the urban landscape of entrepreneurship by spreading away from the cities' traditional central business districts towards residential suburbs and new genres of mixed-use knowledge precincts (Reuschke et al. 2015, O'Hare 2016, Mengi et al. 2020). One dimension of the increased popularity of work across different locations is the growth of work performed from home (Felton et al. 2010, Mason et al. 2011, Holliss 2015, Reuschke and Houston 2016).

According to the 2016 Australian Census of Population and Housing (Australian Bureau of Statistics 2017), approximately 5.55% of the workforce in Australia worked from home before the COVID-19 pandemic. This figure does not account for part-time home-based businesses established as a secondary source of income and home businesses focused on providing services away from home (e.g. tradespeople). When these are included, the figure has been estimated at around 20 percent of the workforce (Burgess and Strachan 2002). However, the spatial distribution of home-based work in Australian cities is not even: certain neighbourhoods have substantially greater proportions of home-based workers than others. Exploring this phenomenon, Moos and Skaburskis (2007) found that the distribution generally follows sectoral occupational classifications. A similar conclusion was reached by Brennan-Horley (2010) in an analysis of the spatial distribution of creative self-employed entrepreneurs based in Darwin.

In a comprehensive review of contemporary theories explaining the location of workers, Storper and Scott (2009) noted that people make locational decisions chiefly in response to 'amenities,' that is, certain features of the urban environment (Chen and Rosenthal 2008). These include the housing choice, the amenities of the local environment, the quality of urban design, the availability of public spaces of a certain kind, opportunities for local interactions, educational institutions, safety, and the broad economic prosperity of the area or city. Similar observations have been offered by Buch et al. (2014), who also pointed to the significance of natural attractiveness, and the availability of consumer facilities and public goods. Some further insight into locational preferences (Table 1) has been offered by Kim et al. (2005), in an examination of how places vary in their attractiveness to people who are relocating, including in terms of offering different types of residential stock and house prices. In an older study, Weisbrod et al. (1980: 9) noted that the factors influencing locational decisions are "often beyond the scope of public policy," and include, for example, the desire for single-family detached homes among the families with children and the reduced frequency of location change for older persons and families with several children. These findings have been echoed in more contemporary studies by Cheshire and Sheppard (1995), Lee et al. (2019), Letdin and Shim (2019).

The COVID-19 pandemic forced firms into an enormous experiment concerning home-based work. At times during the pandemic, over a third of workers who had previously

commuted to the office shifted to working from home (Brynjolfsson et al. 2020). This shift was more common amongst the employees with higher earnings (Kramer and Kramer 2020, Messacar et al. 2020). It is yet to be determined to what extent this new work arrangement will impact on productivity and the creativity of workers; however, the emerging literature indicates that, in the future, work will be split between the office and a remote (predominantly home) location (Bartik et al. 2020, Batty 2020). There is an expectation that many people who have been working from home because of the pandemic may well continue to do so in a full-time or part-time capacity, with estimates that up to 40% of all workers are able to perform their work from home (Batty 2020). Delventhal et al. (2022) modelled the scope of changes in large urban areas, such as Los Angeles, if telecommuting becomes popular in the long run. Their research found substantial changes to wages, the city structure, real estate prices, and commuting patterns.

Table 1. Key factors influencing locational preferences

Factor	Source
Socio-economic status of the area	Kane and Clark (2019)
House price	Kim et al. (2005)
Education	Chen and Rosenthal (2008), Letdin and Shim (2019)
Income	Letdin and Shim (2019)
Family composition	Weisbrod et al. (1980), Letdin and Shim (2019)
Housing choice, amenities, safety, quality urban design	Storper and Scott (2009)
Natural attractiveness, cultural infrastructure, city size	Buch et al. (2014)
Coastal areas	Chen and Rosenthal (2008)

The combined effects of these processes — continuing economic restructuring, the growth of remote work, urban–regional mobility and, more recently, the COVID-19 pandemic — suggest that the importance of geographical and historical place-specific factors is likely to grow (Mengi et al. 2020). The argument here is that globalisation, instead of leading to homogeneity among locations, deepens the differences between them, and in an age of rapidly increasing mobility, 'place' becomes more, not less, important. Local or regional conditions may produce markedly different situations in terms of social inequality and social patterns in cities (Massey 1995, Burgers and Musterd 2002, Storper 2018) and the effect of inequality decreases the absolute incomes of low-income neighbourhoods and it increases the absolute income of high-income neighbourhoods, due to the effects of inequality on the individual income distribution (Modai-Snir and Van Ham 2020). What follows is that the divergent new geography of income and jobs is also becoming a divergent new geography of lifestyle and economic opportunities (Moretti 2012, Horner and Hulme 2017).

Methodology

Study area

The case study city is the City of Gold Coast in Queensland, Australia. With a population of just over 600,000 people, it is the second largest city in Queensland and one of the fastest growing cities in Australia, with a population forecast to reach over 730,000 people by 2026, an increase driven by its pleasant subtropical climate and relaxed lifestyle (City of Gold Coast 2022).

The City of Gold Coast is located in the South-East Queensland region of over 22,000 km2 and 3,800,000 residents (Australian Bureau of Statistics 2021), centred on the state's capital city Brisbane (Figure 1). It originates from a network of beachside villages, which have been a destination for local, Brisbane-based holidaymakers since the 1870s. The rapid growth of the South-East Queensland region has resulted in its key urban centres (Brisbane, Ipswich, Sunshine Coast and the City of Gold Coast), forming one large agglomeration accommodating approximately 75,000 new residents each year, with about 33% of residents born overseas (Dedekorkut-Howes and Bosman 2015). The popularity of the City of Gold Coast as a desirable, relaxed place to live results in a high ratio of home-based work compared with other major Australian cities (Australian Bureau of Statistics 2017).

Figure 1. Location of the City of Gold Coast, Australia.
Source: after Dedekorkut-Howes and Bosman (2015)

The opportunity to work from home, facilitated by the ongoing technological advances, has been made available to many residents who in the past commuted to Brisbane for work. Today, the City of Gold Coast is widely regarded as Australia's most

popular holiday hotspot, attracting approximately 5.3 million visitors each year (Destination Gold Coast 2019). Tourism accounts for 13.8% of the gross regional product to the local economy and it employs one in six residents. In recent years, the city's popularity as an amenity-driven destination has had a role in diversifying the city's economy (O'Hare 2016), with strong employment growth observed in sectors such as digital creative services, freelancers/sole traders, and consulting organisations, which compete for large public sector tenders (Houghton et al. 2018). These new businesses and jobs are often part of the local community of co-working hubs (Bilandzic and Foth 2013), which were becoming increasingly common across the city before the COVID-19 pandemic.

Method

As mentioned above, this study draws upon two empirical data sources: (1) pre-COVID-19 data originating from the most recent (2016) Australian census (Australian Bureau of Statistics 2017), and (2) post-COVID-19 data from an October/November 2020 survey of home-based work. The first component of the research, based on the 2016 Australian Census (Australian Bureau of Statistics 2017), involved the statistical univariate analysis of variance of the socio-economic neighbourhood features that are related to the frequency of home-based work. The number of home-based workers in Australia is recorded in the Census 'Journey-to-work' data, sourced from the ABS 'Table Builder' online tool. Data on the method of travel to work records the method(s) that a person used to get to work on the Census Day (9 August 2016), for all employed persons aged 15 years or older. One of the suggested responses in the census form was "worked from home." The census features associated with the socio-economic status of the neighbourhoods were chosen based on the literature review. The geographical unit of analysis is the Australian Statistical Geographical Standard's Statistical Area 1 (SA1), a fine-grained level of detail enabling the analysis at a localised neighbourhood level. Some data items were simplified to enable a more straightforward interpretation of the analysis: housing, car ownership and education categories were collapsed into one indicator variable (Table 2).

An initial exploration of the independent variables showed that there were strong correlations between several socioeconomic descriptor variables. Examining the nature of the relationships between the socioeconomic variables revealed the following:

1. There is a strong relationship between the variable internet access and the socio-economic variables (the OLS regression relationship between Internet access and the full set of socioeconomic variables resulted in an R squared of 0.766). As we wish to explore the direct relationship between the socioeconomic indicators and home-based work, we have excluded the internet access variable from the analysis.

2. There were high and significant Pearson correlations (greater than +/– 0.5) between two-plus cars and internet access, owning a home or having a mortgage, detached housing, mid-rise housing, and high-rise housing. Three-plus bedrooms had high correlations with the same set of variables.

3. Testing these variables using ordinary least squares collinearity statistics showed that the following variables had high VIF statistics (greater than 10): detached housing, mid-rise housing, and high-rise housing. Two-plus cars was greater than 9.

Table 2. Variable definitions and descriptive statistics

Name of variable	N	Minimum	Maximum	Mean	Std. Deviation
Home-based workers (proportion of workforce)	1188	0.0000	0.2476	0.0638	0.0389
Distance to beach (m)	1188	0	33761	7511	6839
Population	1188	63	3522	461	203
Median weekly income (A$, 2016 dollars)	1188	462	1521	869	145
Median hours worked	1188	14	34	27	2
Median age	1188	24	76	40	7
Median monthly mortgage repayment (A$, 2016 dollars)	1188	900	3200	2018	403
Internet access (proportion of people)	1188	0.2798	1.0000	0.7569	0.1146
Owns home or has mortgage (proportion of dwellings)	1188	0.0000	1.0000	0.6629	0.2094
Two-plus cars (proportion of dwellings)	1188	0.0973	1.0000	0.6275	0.1887
Three-plus bedrooms (proportion of dwellings)	1188	0.0140	1.0000	0.7888	0.2873
Post-high school education (proportion of residents)	1188	0.0340	0.7500	0.3001	0.0888
High school education (proportion of residents)	1188	0.3787	0.9660	0.6984	0.0871
Employment managers and professionals (proportion of workers)	1188	0.0087	0.3030	0.1464	0.0455
Employment sales (proportion of workers)	1188	0.0000	0.1111	0.0571	0.0167
Detached housing (proportion of dwellings)	1188	0.0000	1.0000	0.6510	0.3805
Mid-rise housing (proportion of dwellings)	1188	0.0000	1.0000	0.2704	0.3227
High-rise housing (proportion of dwellings)	1188	0.0000	1.0000	0.0621	0.1930
Five-year mobility (proportion of residents)[1]	1188	0.1304	1.0000	0.3817	0.1185

Considering these observations, we have minimised the potential for multicollinearity to bias this analysis by excluding two-plus cars, detached housing, mid-rise housing and high-rise housing. This leaves us with the following model:

$$HBW = Beach + Pop + Inc + WkHrs + Age + MtgPymt + OwnHome + 3PlBeds + PostHSEd + Mgr + Sales + Mobile \quad (1)$$

where, HBW is proportion of employed people working from home, $Beach$ is distance to the beach, Pop is population, Inc is Median income in 2016 Australian dollars, $WkHrs$ is median hours worked, Age is median age, $MtgPymt$ is median monthly mortgage payment, $OwnHome$ is proportion of dwellings owned or mortgaged by their residents, $3PlBeds$ is proportion of dwellings with three or more bedrooms, $PostHSEd$ is proportion of residents with post-high school education, Mgr is proportion of workers who are classified as managers or professionals, $Sales$ is proportion of workers in sales roles, and $Mobile$ is proportion of residents who have moved in the last five years.

To minimise the risk of the modifiable areal unit problem (MAUP), the analysis presented in this paper was focused on spatial areas available at the smallest possible meaningful geographical scale of SA1 (Tuson et al. 2019), which is considered the most likely to isolate neighbourhood effects (Learnihan 2011, Hanigan et al. 2017).

The second component of the research involved an online survey post-COVID-19. In October 2020, the City of Gold Coast Council, in collaboration with Queensland University of Technology, launched an online survey asking the city's residents to share their experiences of how working from home has changed their daily interactions with their neighbourhood and the city. The sampling targeted the city's residents who, at the time of the survey, worked from home at least one day a week. A specific engagement plan was prepared to increase participation rates, and council marketing and engagement channels were deployed to promote the survey amongst the local community. A total of 887 surveys were completed. The timing of this research was aligned with the Queensland state government's gradual easing of COVID-19-related restrictions. In Australia, a nation-wide lockdown including a work from home order was in place from April to May 2020. Strict border control helped Australia avoid the recurring waves of the pandemic at that time, and lockdown restrictions were gradually lifted in the weeks following May 2020. By August 2020, the economy had largely reopened, and whilst the tourism and education sectors continued to suffer due to international border closures remaining in place, resident Australians were generally able to return to their pre-pandemic lifestyles. In this context, the home-based work survey was scheduled to take place in October 2020, because by that time, life in the case study city had largely already returned to the pre-pandemic norm, whilst home-based work remained available as a conscious choice for many employers and employees.

The survey comprised three sections: experience, daily interactions, and big ideas for the future of home-based work. The survey was led and managed by the local council,

with the authors of this research paper engaged to assist in the preparation of the survey format and questions and the data analysis.

To determine whether the survey delivered statistically significant results, it was conservatively assumed that the number of home-based workers peaked during the lockdown at about 70% of that part of the working population which could work from home (Bick et al. 2020). It was further assumed that five months after the lockdown was lifted, when the survey was undertaken, this figure had decreased from 70% to 45% (Barrero et al. 2021) — that is, from approximately 90,000 employees to just over 60,000. Under this assumption, the results of the survey can be considered representative of the population of the City of Gold Coast with a 95% probability ratio. The results of the survey were analysed using the Marascuilo (1966) procedure, which allows simultaneous testing of the differences of multiple pairs of proportions in multiple populations.

Results

Pre-COVID-19 results

The analysis of variance of the Australian Census data set, as revised above, reveals some strong statistical relationships between most of the remaining independent variables and the proportion of residents doing home-based work (HBW) — albeit with some small numerical effects. The analysis of variance itself is significant at the 0.001 level, with an R square of 0.460. Heteroskedasticity tests (White, Modified Breusch-Pagan, Breusch-Pagan and F Test) were also all significant at the 0.001 level. The visual examination of a plot of predicted versus standardised residuals shows an evenly distributed cloud of data points, truncated by those cases where HBW is zero.

Of the variables that most closely describe the nature of the SA1 (the distance to the beach and the population), only the distance to the beach demonstrates a significant relationship with HBW, which increases by a small margin of 0.00007 per cent with each kilometre further from the ocean (note that if we exclude those SA1 areas where HBW is zero from the analysis, the population has a significant but small negative effect at the 0.05 level, with each unit increase in population associated with a 0.00001 percent decrease in HBW).

Larger, significant, and positive effects are apparent with the socioeconomic variables describing employment, education, age, income and mortgage. One of the most significant HBW relationships is with employment as a manager or professional: for each unit increase in employment as a manager or professional, HBW increases by 17.6 per cent. In comparison, for each unit increase in post-high school education, HBW increases by 5.8 per cent and for each year in median age, HBW increases by 0.02 per cent. The wealth-associated effects are positive, but relatively small, with each unit

increase in median income associated with a 0.005 per cent increase in HBW, and each unit increase in median monthly mortgage repayments associated with a 0.003 increase (Table 3).

Table 3. Parameter estimates, dependent variable: log (Home-based workers (proportion of residents))

					95% Confidence Interval	
Parameter	**B**	**Std. Error**	**t**	**Sig.**	**Lower Bound**	**Upper Bound**
(Intercept)	-0.1264	0.0147	-8.6173	2.2E-17	-0.1551	-0.0976
Distance to beach (m)	7.3E-07	1.6E-07	4.4965	7.6E-06	4.1E-07	1.0E-06
Population	-5.5E-06	4.5E-06	-1.2307	0.2187	-1.4E-05	3.3E-06
Median income ($A, 2016 dollars)	4.9E-05	1.0E-05	4.7126	2.7E-06	2.9E-05	7.0E-05
Median hours worked	3.7E-05	0.0004	0.0980	0.9219	-0.0007	0.0008
Median age	0.0019	0.0002	10.9584	1.1E-26	0.0016	0.0023
Median monthly mortgage repayment ($A, 2016 dollars)	-1.9E-05	3.0E-06	6.1150	1.3E-09	1.3E-05	2.5E-05
Owns home or has mortgage (% of dwellings)	-0.0090	0.0076	-1.1805	0.2380	-0.0239	0.0059
Three-plus bedrooms (% of dwellings)	0.0124	0.0048	2.5891	0.0097	0.0030	0.0218
Post-high school education (% of residents)	0.0579	0.0161	3.5966	0.0003	0.0263	0.0895
Employment managers and professionals (% of workers)	0.1761	0.0373	4.7178	2.7E-06	0.1029	0.2494
Employment sales (% of workers)	-0.0890	0.0540	-1.6480	0.0996	-0.1949	0.0170
Five-year mobility (% of residents)[1]	-0.0341	0.0108	-3.1586	0.0016	-0.0553	-0.0129

[1]*This variable indicates if all, some, or none of the residents of a household have address in the previous five years changed*

The only variable with a significant negative relationship with HBW is the five-year mobility. Each unit increase in five-year mobility (i.e., the proportion of households with residents who have changed address in the previous five years) is associated with a 3.4 per cent decrease in HBW.

Post-COVID-19 results

The first part of the survey included several introductory questions enquiring about the likelihood of continuing to work from home in the future, and the level of satisfaction, benefits and barriers associated with this type of work. The results of the survey point to a very high level of satisfaction associated with working from home.

Approximately 91% of the respondents stated that they were either satisfied or very satisfied with home-based work. Home-based work is also expected to continue, with over 80% of the participants expecting that they will continue this form of work for at least some of their working hours (Table 4).

Table 4. Key benefits and barriers of home-based work

Benefits		**Barriers**	
Saves time	775	Inadequate workstation at home	268
Allows better work/family balance	687	Poor internet connectivity	244
Increases productivity	650	Social isolation, not mitigated by virtual meetings	193
Saves money	640	Nowhere to meet with a client	164
Helps lead a healthier life	556	Limited space to accommodate work	150
Improves mental health	470	Hard to separate work from private time	132
		No barriers at all	128

Source: City of Gold Coast Council survey, 2020 (multiple responses were available)

The responses indicate that home-based work is undertaken predominantly from detached dwellings (66% of responses), followed by apartments and townhouses (25%). Next, the survey asked about the activities done more often or less often since the residents started to work from home. A set of 22 activities was included in the survey. For each activity, six possible responses were provided in a single-choice option: less often, slightly less often, about the same, slightly more often, more often, and not applicable. In our analysis, the responses "less often" and "slightly less often" were combined, as were "slightly more often" and "more often." This simplification of responses was considered necessary for the ease of interpretation and implementation of findings into the further policy work of the local council. The results have been analysed with consideration of the location of each respondent, grouped into three types: coastal location, central location and hinterland location (Table 5). This information was obtained through one of the survey questions.

The influence of working from home on the way that the research participants were undertaking their daily activities was most visible in the coastal part of the city, where higher building density and good public transport enable better access to recreation areas, shops, dining venues and services. Here, respondents reported a noticeable increase in visiting local cafés, shopping within their neighbourhoods, choosing to walk or ride a bicycle instead of driving a car, and accessing local open spaces, including more frequent trips to the beach (Figure 2). More frequent interactions with the neighbours were also reported. Somewhat different responses were reported in the central suburbs, where the built form largely includes low density residential neighbourhoods. No visible increase in shopping locally was observed outside of the coastal suburbs. Interactions with the neighbours and a more frequent use of locally

available open spaces were observed in this part of the city. The city's hinterland areas, located to the west of the Pacific Motorway (M1), are dominated by a high proportion of large rural residential estates. Here, the respondents reported more frequent walking and cycling trips and the frequent use of locally available open spaces. Interestingly, the frequency of shopping locally decreased. Regardless of the location, the survey participants reported an increased frequency of walking and cycling, and a reduced use of vehicles and less frequent trips on the Pacific Motorway, which is the main motorway connecting the city with Brisbane to the north and Sydney to the south.

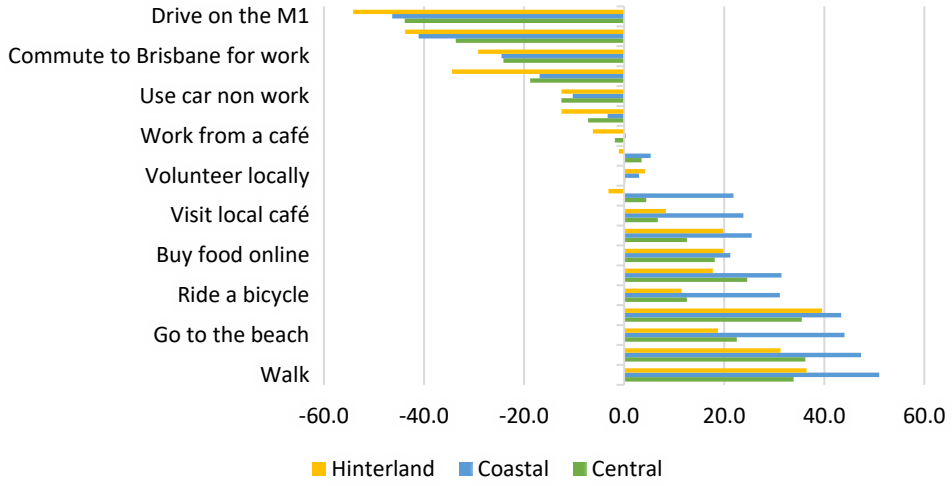

Figure 2. Survey results — impacts of home-based work on daily activities, by location.
Source: Home-based work survey (n=887) by City of Gold Coast Council, Oct–Nov 2020

Table 5. Survey results – significant differences, by location

Activities that are not significantly different across the three areas	Driving on the M1, commuting to Brisbane for work, using vehicles during non-workdays, working from a café, working from a co-working space, buying food online, walking kids to school, volunteering locally, interacting with neighbours
Activities where the coastal area is significantly different from the central and hinterland areas	Walking, going to the beach, exercising locally, visiting local cafés, riding a bicycle, using local parks, shopping locally
Activities where the central and hinterland areas are significantly different from each other	Dining locally, shopping locally, using local parks

Source: Home-based work survey (n=887) by City of Gold Coast Council, Oct–Nov 2020

The final part of the survey collected feedback on the future of home-based work in cities. Here, apart from a common plea for better quality internet, survey participants identified several opportunities related to the built environment of their neighbourhoods (Figure 3). These included a need for more co-working spaces in their neighbourhoods. The need for more local places for collaboration and shared work was also echoed in the suggestions to furnish open spaces and parks with enabling infrastructure, including wi-fi, seating and shaded areas. The respondents also pointed to the need for incentives encouraging home-based work and access to training, events and meetings.

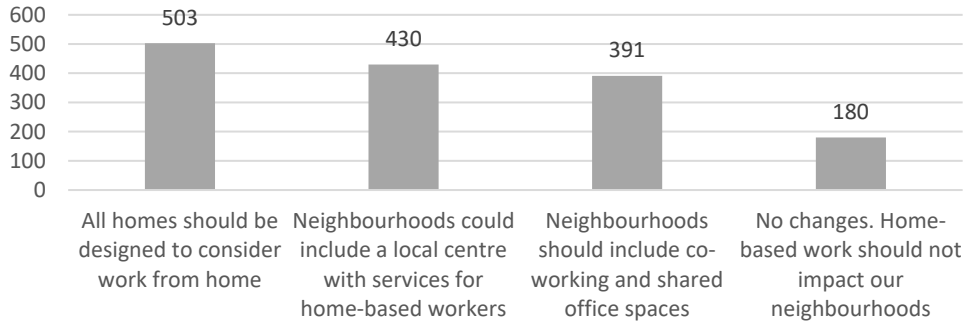

Figure 3. Participants' ideas for the future of home-based work.
Source: City of Gold Coast Council survey (2020)

Discussion

Our 2016 Australian Census analysis points to a significant relationship between the frequency of home-based work and the socio-economic status of neighbourhoods across the City of Gold Coast. It has identified a positive relationship between home-based work and the type of employment, particularly occupations classified as managerial or professional. For each unit increase in the proportion of the residents working as a manager or professional, home-based work increases by 17.6 per cent.

There is also a significant relationship with education, where each unit increase in the proportion of Gold Coast residents with post-high school education, home-based work increases by 95 per cent. As far as the built environment features of the neighbourhoods are concerned, home-based work is associated with larger homes and higher-than-average mortgages, located in well-established areas with low levels of mobility. Home-based work was highly correlated with affluent suburbs often perceived as desirable residential locations, which are either close to the beach or in the rural hinterland. Knowledge work is most suited to home-based work, and it is enabled by higher levels of education and associated with higher incomes. These factors enable the choice of desirable amenity-driven locations.

The results support the notion that attractive amenity-driven destinations, such as the City of Gold Coast in Australia, feature neighbourhood pockets with high proportions of home-based workers. In the City of Gold Coast, these neighbourhoods are concentrated in the affluent beach-side suburbs and in hinterland valleys (Figure 4). Our research provides evidence that these shifts in the city's urban and economic fabric are not evenly distributed but they are the products of desirable neighbourhoods that attract educated and experienced professionals.

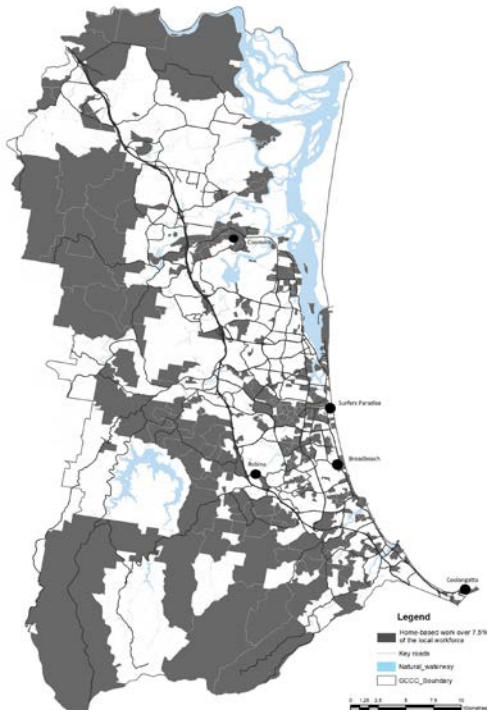

Figure 4. Pre-pandemic distribution of home-based work in the City of Gold Coast

The spatial distribution of home-based workers provides a necessary context for the analysis of potential changes to urban neighbourhoods. The findings of the survey component of our research point to the increased engagement of home-based workers with their neighbourhoods post-COVID-19.

The influence of working from home on the way research participants undertake their daily activities is most visible in the coastal part of the city, which has a higher urban density and better access to recreation areas, shops, dining venues and services. Here, respondents reported a noticeable increase in visiting local cafés, shopping within their neighbourhoods, choosing to walk or ride a bicycle instead of driving a car, and accessing local open spaces, including more frequent trips to the beach. More frequent interactions with the neighbours were also reported.

Slightly different responses were reported in the central part of the city where the built form largely includes low density residential suburbia (the City of the Gold Coast's business districts are spread along the coast, with no dominant CBD). No visible increase in shopping locally was observed; however, the participants pointed to a stronger preference for walking and cycling. Interactions with the neighbours and the more frequent use of locally available open space areas were observed in this part of the city. Lastly, in the city's hinterland, located to the west of the Pacific Motorway, an area dominated by a high proportion of large rural residential estates, the respondents reported more frequent walking and cycling trips and the frequent use of locally available open spaces, but the frequency of shopping locally decreased.

Further, the findings of this research suggest an opportunity, and need, to propose a new way of positioning residential suburbs. Certain residential neighbourhoods will continue to evolve away from being dormitory suburbs towards mixed, or multi-use, where life and work functions occur together, triggering a growth of activity in certain aspects of urban life, such as social interactions, recreation, and access to services. In this context, the planning efforts should focus on exploring whether there is a need to rethink the role of the local neighbourhood centres — many of which continue to be focused on basic services and affordable takeaway meals — as this research suggests that, in the near future, the neighbourhood centres located in pockets of high remote work may become attractive hubs, combining work, shopping and leisure.

Haskel and Westlake (2018) argue that the rise of knowledge work mirrors the rise of private and public investments in intangible capital. That is, relatively speaking, buildings and equipment are now relatively no longer as important to economic development as software, R&D, business processes and creative innovation. The intangibility of these assets makes them more subject to geographical flight, putting pressure on local governments to maintain attractive conditions to avert growth in inequality (Haskel and Westlake 2018).

Our results should also trigger consideration of social divides and growing inequalities within cities, with concomitant issues of gentrification and housing affordability. Many workers do not have the option to undertake work from home, as the nature of their work requires them to attend workplaces, be it industrial establishments, logistics centres or shops. Census data points to a concentration of those workers in certain suburbs, which will continue to perform the role of dormitory suburbs. Further, in the context of recurring waves of COVID-19, those workers will be most vulnerable to and most likely to spread the disease.

Policies fostering home-based work in specific neighbourhoods should be paired up with planning and economic response maximising economic opportunities available for the residents of other urban areas, where home-based work is less likely to emerge. It is yet to be determined to what extent the urban fabric of cities will be impacted by the

increase in home-based work and any associated productivity and creativity of workers. As indicated earlier in this paper, the emerging literature indicates that, in the future, work will be split between the office and home (Bartik et al. 2020, Batty 2020). Should that be the case, this research points to a potential socio-economic challenge at the urban neighbourhood scale. The uneven spatial distribution of jobs that are carried out from home, which was identified and mapped in this paper, highlights the risk of a growing divide between residential areas which, due to the growth of home-based work, will evolve towards being vibrant, multi-use urban environments, and residential areas which, due to the lack of home-based work, will retain their dormitory status.

Conclusions

Cities around the world compete for skilled migrants and economic investment, offering attractive incentives to independent professionals who can bring employment and certain spill-over effects related to higher expenditure in local areas. Due to the growing popularity of flexible and remote work, amenity-driven cities and neighbourhoods are well placed to attract those professionals, as evidenced in our research.

Our paper points to a preference of home-based workers for attractive, prosperous neighbourhoods. These results suggest the necessity for further urban analysis examining employment dynamics in cities, particularly the need to rethink the design of residential neighbourhoods where not just home-based work but also remote, nomadic, and co-working practices are becoming more and more common. As we identified in the literature review, the knowledge economy requires cities to operate as knowledge hubs.

Our research highlights that home-based workers are concentrated in certain areas of the city, yet this spatial proximity per se does not necessarily enable direct contact between them, and therefore additional design interventions, incentives and policies are required to foster the transfer of knowledge and ideas (Casadevall et al. 2018). Further, our paper offers important insight into how people's behaviours, urban interactions and movement patterns change in consequence of undertaking work from home. Importantly, these changes have strong synergies with the built environment aspirations advanced as part of the New Urbanism: our paper finds that home-based workers' preferences for living locally are much stronger in dense, walkable, attractive neighbourhoods. Urban environments shaped in that way appear to benefit from the growth of home-based work resulting from the COVID-19 pandemic. This, on the other hand, raises concerns with respect to the urban divide between the suburbia where the residents do have the option to work from home and the suburbia where workers will continue to commute to work.

This paper has certain limitations, which in turn provide opportunities for further research: it is based on a quantitative analysis of the Australian Census and of survey data. Exploratory methods, such as design charrettes, may be useful to complement the spatially and statistically grounded mapping of data in our analysis. Further limitations relate to the difficulties in measuring the complexity of factors influencing a person's decision to work from home. There is a need to undertake further research in this field, with a particular focus on engagement with home-based and remote workers to measure their impact on their neighbourhoods, as well as their needs and aspirations for their work. Such qualitative data, combined with the type of quantitative analysis presented in this paper, should assist in the formulation of appropriate urban planning and economic strategies in a post-pandemic reality, where home-based work is likely to remain a feature of employment in cities for good. Further work advancing findings of this research should focus on optimising the synergy between the New Urbanism aspirations and the ongoing growth of home-based work. This paper draws attention to the risk of spatial inequalities within cities, which should also be explored further.

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TOURISM IMPACT MODELS AS SUSTAINABLE DEVELOPMENT PLANNING TOOLS FOR LOCAL AND REGIONAL AUTHORITIES

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Abstract: Tourism is considered by the local inhabitants and businesses as an activity that could bring economic development to a very isolated and underdeveloped area such as the Danube Delta, UNESCO protected natural wetland. The aim of this study is to propose the Tourism Impact Model (TIM) as a tool that could be used by the local and regional authorities in managing tourism in such fragile ecosystems so that to maximise its positive effects while the honeypot sites of the delta to attract tourists without provoking irreparable damage to the environment. The results of the TIM analysis applied for Sfântu Gheorghe commune, Romania, evidence that the Danube Delta is under tourism pressure and at high risk of surpassing its human carrying capacity. The conclusions of the analysis show that TIM could be a very useful administrative and policy supporting tool in sustainable development governance if data collection improves in the future.

Keywords:

human pressure;
tourism impact assessment;
planning tools;
sustainable development goals;
Danube Delta

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Introduction

Deltas usually represent fragile ecosystems whose management is a challenging task (Cioaca et al. 2007, Gâștescu 2009, Văidianu 2013, Văidianu et al. 2015, Anfuso et al. 2021). The susceptibility of the delta ecosystem to pollution is high, in all its forms, but especially for possible soil and water pollution (Suaria et al. 2015, Gati et al. 2016, Stoica et al. 2016, Constantin et al. 2017, Despina et al. 2020, Garcés-Ordóñez et al. 2020, Landrigan et al. 2020, Llorca et al. 2020, Thushari and Senevirathna 2020, Paltineanu et al. 2022). Finding the right balance between economic development and environmental protection often leads to conflicts between the involved stakeholders (the inhabitants and/or economic developers) and the environmental authorities (Văidianu et al. 2014, Văidianu et al. 2015, Teampău 2020, Yuxi and Linsheng 2020). Service provision is quite a challenging task in such restrictive and remote areas (Profiroiu et al. 2021) and establishing their carrying capacity is still a very delicate planning mission (Association of Ecotourism in Romania 2014, Blaga and Josan 2019, Liu et al. 2020b). Even maintaining the quality of public services at the adequate level to satisfy the needs of the local inhabitants can be difficult (Văidianu 2015, Buză and Posteucă 2020, Sarpong et al. 2020).

Tourism is expected to re-establish the close relations between social and ecological systems in a manner that would allow a more stable coexistence of people and nature (Phelan et al. 2020). Tourism is a tool for promoting territorial resources (Almeida-García et al. 2020), but it is also a driving force which could affect the environmental quality (Jahani et al. 2020). The relationship between visitation and human impact in a fragile ecosystem is not clearly understood, but the impact increases exponentially with each additional tourist (Blaga and Josan 2019, Akadiri et al. 2020). If made wisely, investments in tourism would represent an optimal solution to both provide additional resources for the local authorities to develop and to improve the local living standards (Ghani et al. 2013, Herman et al. 2020), and to reduce the human harm on the natural landscape (Shackleford 1985).

However, the increasing tourist flows put pressure on the local infrastructure and the public service provision (Jovanović and Ilić 2016). As tourism is an important economic activity, if it is sustainably managed, due to its potential to bring benefits to the area's economy (Văidianu et al. 2015, Kubo et al. 2020, Lai et al. 2020), a responsible local development policy based on attracting tourists must consider the future impact of investments in tourism (Fang 2020, Hoang et al. 2020, Nesticò and Maselli 2020, Arabadzhyan et al. 2021). Among other critical issues, the determination of the right size of the provided public services and infrastructure is of paramount importance for such a policy (Murphy 1983). Ultimately, failing to adequately address the challenges caused by the tourist phenomenon will not just contribute to the degradation of service provision for the local community, but it is likely to threaten the achievement of the Sustainable Development Goals (SDGs) (Kimbu and Tichaawa 2018).

The Danube Delta is a fragile space, characterised by several physical and administrative features with a restrictive role, rendering many human activities difficult (Popescu et al. 2020), while the existing ones have already altered and scarred the wetland ecosystem, locally and upstream (Gómez-Baggethun et al. 2019, Petrișor et al. 2020). For these reasons, the Danube Delta represents a strong case study for the assessment of tourism impact, mostly due to the particular landscape that shaped and constrained to a large extent what is possible in terms of human habitation and activities (Tănăsescu and Constantinescu 2020). But the history of human settlements in the Danube Delta is long, varied, and complex, bringing together several ethnic, cultural, and religious groups while the legislative restrictions imposed in the 1990s by declaring the delta a biosphere reserve did not change its ecological reality, although it imposed severe limitations to the traditional and new human uses (Iordachi and Van Assche 2015, Tănăsescu and Constantinescu 2020).

Tourism, specifically ecotourism, was promoted as the solution for the Danube Delta (Tătar et al. 2017, Dima et al. 2020) to conserve its natural assets and to allow its sustainable development by preserving its human history and cultural diversity too (Hontuș 2013, Ghermandi et al. 2020). The previous de-industrialisation of some upstream areas, and the maintaining lower population levels, as well as the new trends in the tourism industry would make ecotourism a promising development strategy for the area (Association of Ecotourism in Romania 2014, Ministry of Regional Development and Public Administration 2016, Dima et al. 2020). However, the Danube Delta in Romania is currently facing an under-regulated tourism development, while the approach of the local elite politics, the hurried tourists, and the under-skilled and the under-financed locals make it hard at this point to see tourism as a driver of community building (Alecu et al. 2016, Phelan et al. 2020, Van Assche et al. 2020).

In this context, the Tourism Impact Model (TIM) could emerge as a data driven strategic planning tool that would sharpen a field-proof instrument for all the stakeholders involved in the decision-making process (Earp and Liconti 2020) aiming at a sustainable (tourism) development (Grilli et al. 2021). Hence, the aim of this paper is to analyse the Tourism 4.0 technologies through TIM in order to unlock the collaboration potential of key enabling technologies from the Industry 4.0 and to build a smart tourism ecosystem for the Danube Delta in which not the tourists, but the local residents and their quality of life is primarily put in the centre of the strategic planning process (Ramkissoon 2020). In this sense, the TIM assessment is made for the village of Sfântu Gheorghe in the Romanian Danube Delta aiming to lead the local and regional authorities involved in the sustainable development process towards the right steps for a future with automatic data collecting in high frequency to allow dynamic real data simulations of possible scenarios for a quick and competent response in all planning situations.

Methodology

Study area

Sfântu Gheorghe is a village located on the seashore in the Danube Delta, and it represents a left-over space in deterioration, being abandoned or marginalised in relation to its development potential (Jucu and Pavel 2019). The village is one of the least accessible settlements in Romania (Man et al. 2015) and it is only reachable by water (Figure 1). Thanks to its remoteness and wildness, it represents an exotic attraction for many tourists who value its wetland landscape, including river canals and large and wild beaches with sand dunes (Tătar et al. 2017, Stoleriu et al. 2019). Since the beginning of its human inhabitation, fishing has been the main source of food and income for the local community (Damian and Dumitrescu 2009) and a tourist activity. So, the natural tourist resources of Sfântu Gheorghe are diversified with cultural attractions such as traditional fish-based cuisine or film festivals (Damian and Dumitrescu 2009, Văidianu 2015).

Figure 1. Local transport infrastructure in Sfântu Gheorghe. Source: Văidianu (2018)

As a tourist location, Sfântu Gheorghe is rather an accommodation or transit point, while most tourists are coming by their own boats or by renting motorboats to visit different popular areas of the Danube Delta during the day (Figure 2), after which they return to their accommodation in the village in the evening (Văidianu 2015, Teampău 2020). Besides this, the local weather conditions strongly induce a very high seasonality of tourism in July and August and almost no tourists arrive in Sfântu Gheorghe during the winter (Ivan 2017, Tătar et al. 2017).

Sfântu Gheorghe stands out as a territory where, on a relatively small area, there are diverse and unique habitats specific to both the coastline and the Danube Delta (Gâștescu 2021). The sea beach in Sfântu Gheorghe is a high tourist attraction by the fact that it is very wide and with a wild landscape of the coastline (Vespremeanu-Stroe

and Tătui 2011, Tătui 2015). Sand dunes up to 2 m high mark the boundary of a wetland made up of marshes, which is margined to the interior of the land by a forest planted in the years 1950-1960 (Vespremeanu-Stroe and Tătui 2011, Tătui 2015). The dunes in the northern part of Sfântu Gheorghe are mobile (Vespremeanu-Stroe et al. 2016), and their movement can be evidenced by the burying of willow bushes or the *Convolvulus persicus* (sand turf), whose habitat is reduced only to the seaside area, where human interventions are very limited or even inexistent (Strat and Holobiuc 2018).

Figure 2. Different ways of tourist transport used in Sfântu Gheorghe. Source: Văidianu (2018)
Legend: top left – international cruise ship on the Danube (Austrian flag); top right – tourists from the cruise ship embarking on local boats for a two-hour trip in the Delta; bottom left – tourist boat on a Delta channel; bottom right – land transport from the village to the beach.

In terms of other biodiversity and natural attractions, the territory of Sfântu Gheorghe offers the ideal habitat for lizards (*Eremias arguta*), which are also found only in this type of sunburned habitat, or specimens of *Vipera ursinii* (steppe viper), a rarity in many regards (Cogălniceanu et al. 2013). The birds in the area include also unique or rare species, and in addition to the omnipresent gulls, there are either flocks of terns of several types (*Sterna hirundo, Sterna sandvicensis*, *Chlidonias niger*, *Chlidonias hybrida*) or much rarer specimens of *Recurvirostra avosetta* (knockback) or *Haematopus ostralegus* (eurasian oystercatcher) (Baciu 2020).

The area where Sfântu Gheorghe's arm spills into the Black Sea is also characterised by another attraction, namely the ever evolving and reconfiguration split known as Sacalin Island (Gâștescu 2009). This territory, formed by low sea beams, is partly covered with grassy vegetation (Niculescu et al. 2016) and it is home for a wide range of pond or seabirds (from the terns and gulls to common and dalmatian pelicans) which find a sheltered nesting place here (Gâștescu 2021). Also, near the mouth of Sfântu Gheorghe's arm into the sea, a compact forest of black alder (*Alnus glutinosa*) has developed over time, covering an area of more than 50 hectares, and representing the only place in the country where it keeps its wild character intact (Doroftei and Covaliov 2007, Niculescu et al. 2016, Romanescu et al. 2018). In this forest, there are large and small flocks of cormorants, *Alcedo atthis* (kingfisher), and *Haliaeetus albicilla* (white-tailed eagle) (Alexe et al. 2020).

Towards the interior of the land, the forest that extends to the canal and northward to Sulina town offers a landscape that resembles the bushes of the African savannahs (Gâștescu 2021). Unique plants, such as areas covered by *Ephedra distachya*, an archaic plant, related to conifers, can also be seen in areas with trees and shrubs (Schneider-Binder and Kuhlke 2015). Of the animals, especially in spring, there are specimens of golden jackal, raccoon dog, wild boar (Murariu 2010) or specimens of *Lacerta agilis* (sand lizard) (Cogălniceanu et al. 2013). And because sandy areas are home to a rich insect fauna, a number of insectivorous birds or even some predator species can also be seen in the area (Gâștescu 2021).

Although Sfântu Gheorghe does not have the official status of a tourist resort, it is a popular place among the tourists during the summer, which has an impact on the local infrastructure and facilities (Văidianu et al. 2015). The local authorities try to take advantage of this popularity and to set tourism projects based on the local heritage, while promoting tourism activities among the priority directions of the future local development (Town Hall of Sfântu Gheorghe 2011). But the decision makers must then be prepared for the increasing tourist demand, and they should provide adequate public services for both the locals and the visitors (Pavel-Nedea and Dona 2017, Stoleriu et al. 2019, Carvache-Franco et al. 2020).

Territorial challenges assessment

To make a comparable assessment for the territorial challenges that Sfântu Gheorge is facing in relation to how the authorities address them, the data included three analysis groups: (1) Sfântu Gheorghe, (2) other rural settlements located entirely or partially within the Danube Delta, and (3) the rest of Tulcea county's villages. For the sake of comparability, all the data were weighted by the corresponding number of inhabitants; in addition, the data for the latter two groups were averaged to address the scale effect. To illustrate the relevant territorial challenges, such infrastructure indicators as drinking water supply and consumption, wastewater network, and construction

permits issued for building new tourist accommodation units were considered. Additionally, the yearly and monthly tourist flows illustrated the tourism activity of each analysed territory.

As evidenced by the data, Sfântu Gheorghe is different from both Tulcea county and the Danube Delta. While there is little difference in the analysed indicators between the rural settlements in the Danube Delta and the other rural areas in Tulcea county, Sfântu Gheorghe stands out for its high values, as well as for its significant fluctuations in some cases.

The tourism activity in Sfântu Gheorghe has a fluctuant trend: there are two local maximums in 2011 and 2019, as well as data gaps before 2005 and in 2015 (Figure 3). Given the increasing number of tourist arrivals, one can expect an increased demand for the local public services in the peak years. So, the local authorities must address this demand to secure the adequate service provision for both the local community and the tourist accommodation units located in the commune (campings, villas, and pensions).

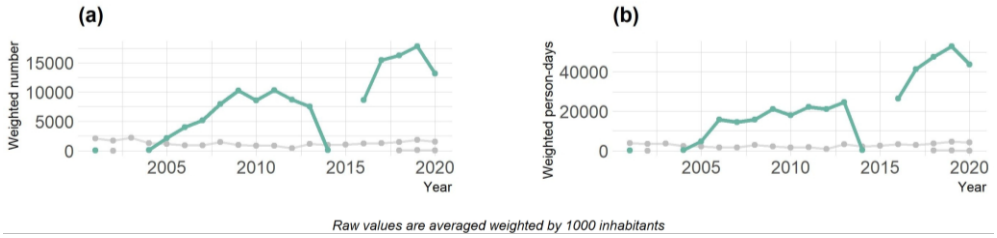

Figure 3. Dynamics of tourist arrivals (a) and overnight stays (b) – yearly data.
Source: National Institute of Statistics (2021)
Legend: green line and dots – Sfântu Gheorghe; grey lines and dots – other rural settlements in the Danube Delta, and the rural settlements in Tulcea county without the first two groups

Thus, the length of the drinking water supply network in Sfântu Gheorghe significantly increased in 1998 and it is superior to the Delta's and county's averages (Figure 4a). The extended network has allowed the enhancement of the capacities of drinking water production, which was made in two phases: 2002 and 2006 (Figure 4b). And there is a huge gap between Sfântu Gheorghe and the other rural settlements. The figures which reflect the water consumption level are also superior in Sfântu Gheorghe compared to the rest of the analysed rural communities (Figure 4c). So, there is an evident parallelism between the local water consumption, with maximums in 2011 and 2020, and the tourist flow fluctuations.

At the same time, it seems that the wastewater network modernization of Sfântu Gheorghe lags behind, despite its increasing tourist arrivals. Only recently, in 2019, this network was significantly extended, throwing Sfântu Gheorghe much higher above the average of the other Danube Delta and Tulcea county's rural communities (Figure 5a).

The high popularity of Sfântu Gheorghe among the tourists feeds the demand for new tourist accommodations. To address this demand, the commune's local authorities issued a number of new building permits for tourist accommodation which is superior to the Delta's and county's averages, registering a peak value in 2018 (Figure 5b).

Generally, the tourist flow has an increasing trend in Sfântu Gheorghe, while the local public administration tries to address the resulting demand in specialised tourist and general public services. But, sometimes, the required investment is being made with quite a long-time lag (such as in the case of the wastewater network).

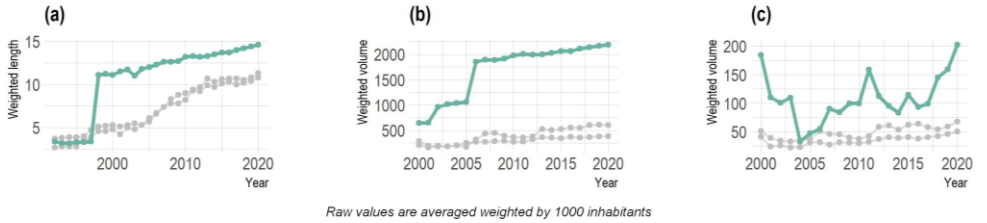

Figure 4. Dynamics of the drinking water supply infrastructure – network length (a), capacity of drinking water production facilities (b), and water consumption (c). Source: National Institute of Statistics (2021)
Legend: see Figure 3

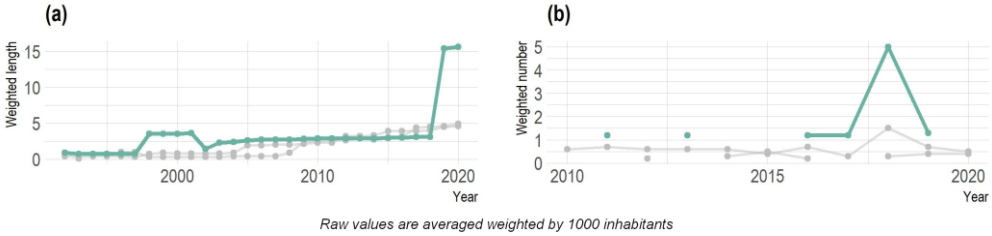

Figure 5. Dynamics of wastewater network (a) and the number of construction permits issued for building new tourist accommodations (b). Source: National Institute of Statistics (2021)
Legend: see Figure 3

Among the European Union members, Romania is one of the countries with the highest seasonality of tourism development (Ferrante et al. 2018). The case of Sfântu Gheorghe is even more contrasting as there is no reported tourism activity in the low season while the tourist flows in the summer season outpass the average values by thousands of times (Figure 6). Taking into consideration the high seasonality of local tourism, the public authorities must be prepared to address the seasonal peaks in the service demand. The pressure on the provided services can be skyrocketing in the several summer months of high tourist activity. As for example, in 2019, the last pre-COVID19 year with the highest annual tourist flow, the number of tourist arrivals (14185 people) exceeded the local population (797 persons) by almost 18 times.

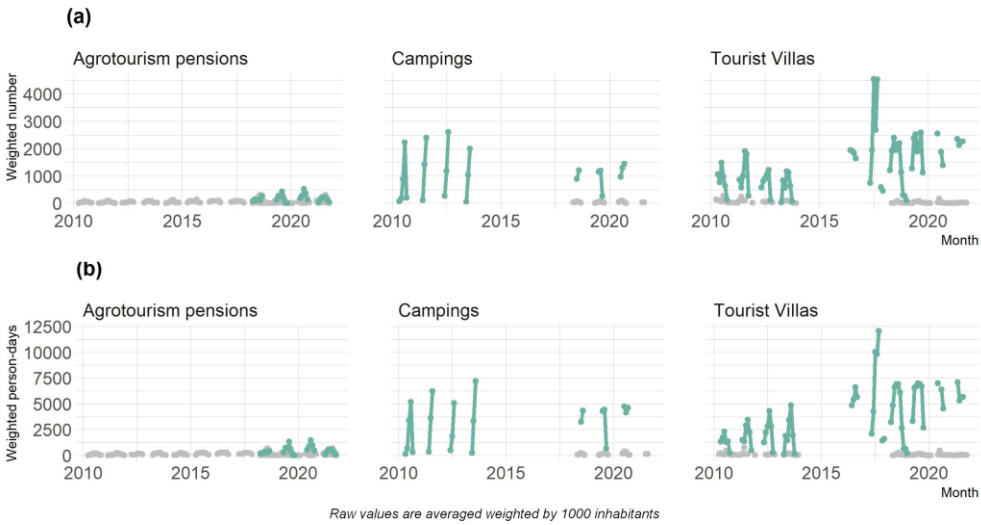

Figure 6. Dynamics of tourist arrivals (a) and overnight stays (b) by accommodation types – monthly data. Source: National Institute of Statistics (2021)
Legend: see Figure 3

As Sfântu Gheorghe relies on its tourism income, as stipulated in the development strategy (Town Hall of Sfântu Gheorghe 2011) and its popularity among the tourists increases (as shown by the recent trends of tourist flows), the local public administration requires a planning tool to properly assess the future local service demand. Only with reliably projected tourist flows and an accordingly dimensioned public service provision, the local authorities can be able to address all territorial challenges in a sustainable manner. Modern modelling approaches allow making such predictions and simulating different scenarios (Mou et al. 2020, Tian et al. 2020), among which the Tourism Impact Model – TIM (Goriup and Ratkajec 2021).

Tourism Impact Model

TIM is a comprehensive tool for modelling and optimising the impact of tourism on a local ecosystem through fostering collaboration between different stakeholders and data providers (Goriup and Ratkajec 2021). It enables the assessment of the impact of tourism on different societal aspects (Environment, Economy, Culture, Health, Education etc.) in order to reach sustainable development in a specific geographical area by following the UN Sustainable Development Goals (Goriup and Ratkajec 2021, Goriup et al. 2022).

The methodology is anchored in the Multi-Attribute Decision Making (MADM) theory (Chankong and Haimes 1983, Saaty 1988, Dyer et al. 1992, Keeney and Raiffa 1993). These methods are based in the decision theory utility theory, and they are well accepted in solving real life complex decision problems (Cestnik and Bohanec 2001,

Leben and Bohanec 2003, Bohanec et al. 2004, Taškova et al. 2007, Montemurro et al. 2018, Kljajić Borštnar and Ilijaš 2019).

The idea of multi attribute decision modelling (DEXi) is based on the decomposition of a large complex problem into smaller problems of less complexity (Bohanec and Rajkovič 1999, Montemurro et al. 2018, Bohanec 2021). The decomposition process is presented with a hierarchical tree of attributes and each alternative is evaluated by each attribute and later on composed back to a single value; so that, the final alternative value is gained through the aggregation of the attribute values from the tree leaves towards the root of the attribute tree (Bohanec and Rajkovič 1999, Montemurro et al. 2018). The DEXi model is developed according to the expert systems modelling (if-then rules) which provides transparent explanations of the evaluation, and it is, compared to the linearly weighted sum, more suitable for expressing nonlinearities in decision knowledge and easier to understand (Bohanec and Rajkovič 1999). The qualitative attribute scales are described by discrete descriptive attribute values, and they are more understandable to the decision maker (Bohanec and Rajkovič 1999, Montemurro et al. 2018). Thus, the hierarchical tree of attributes and the set of decision rules (utility functions) that are defined by an expert (or a group of experts) represent the knowledge base of the analysis (Bohanec and Rajkovič 1999, Bohanec 2021).

The DEXi methodology is an iterative process of the following steps (Bohanec and Rajkovič 1999, Montemurro et al. 2018, Bohanec 2021):

- Problem definition – decision makers have to define the problem, the objective, and the stakeholders. In the following step, the attributes are defined.
- Attributes identification – the attributes are variables or parameters that impact the decision problem. In relation to the tree, they can be: (1) Basic attributes (terminal nodes, leaves of the tree) which represent the input of the model; options are described by their values; (2) Aggregated attributes (internal nodes in the tree) and their values are derived by an aggregation rule from the basic attributes.
- Hierarchical tree of attributes – from the list of attributes, the hierarchical tree of attributes is constructed based on the decomposition of the problem principles and the similarity of attributes. A model can have one or more root attributes which can be further decomposed into descendant attributes.
- Attribute scales – the scale includes the possible values of each attribute, and it needs to be individually defined. The qualitative and discrete DEXi scales include categories like excellent, good, bad. The scales can be unordered or ordered (increasing, decreasing) in relation to their influence on the existing options. The ordering preferences are modelled by an expert (or a group of experts).

- Aggregation rules (utility functions) – they delineate the aggregation of the option evaluation. Every aggregate attribute Y has the X1, X2, …, Xn descendants in the tree of attributes and the corresponding utility function f defines the mapping f=X1, X2, …, XnY. In DEXi, the values of Y include all the combinations of the lower-level attribute values mapped by the utility function. A decision table is used to present the mapping and each row indicates the value of f for one combination of the lower-level attribute values. The rows are thus called decision rules and such rules are called elementary rules. An interval is a subset of consecutive scale values (i.e. value "*« denotes that any value from the scale list is possible; value ">=« denotes "better than or equal to« etc.). Intervals are used together with utility functions, especially when they are edited or represented by complex rules. The complex rules represent utility functions in a more compact and comprehensible way than the elementary rules and they are obtained by joining several elementary rules which have the same function value. Then, weights are used to model the importance of attributes for the final evaluation, and they represent numbers normalised to the sum of 100 maximum. In the qualitative multi-attribute models, attributes are symbolic, and utility functions are defined by decision rules. DEXi provides a link between the weighted sum and the decision rules. Weights are an approximation and not very precise, but they link both ideas, and they are thus more user oriented. There are two types of weights in the DEXi model: local (they refer to a single aggregate attribute and a corresponding utility function), and global weights (considering the structure of the tree and the relative importance of its sub-trees). Weights can be normalised or not, and this is because some scales have more values than others.
- Options – options (alternatives) are basic entities studied in a decision problem. They are evaluated and analysed by a multi-attribute model. An option is presented by its name and a set of values, so that one value is assigned to each attribute in the tree. The option is described by a basic attribute value and the final evaluation result is derived by aggregating the basic values by the utility functions developed. DEXi does work with incomplete and missing data, therefore the final evaluation of an option is derived even if a certain value of a basic attribute is missing or not clear.
- Evaluation of options – each option is represented by a vector of basic attribute values. The defined structure of the model and the utility functions influence the bottom-up aggregation of each option value. The evaluation of each option depends on the value of one or more root attributes of the model. Then, the decision maker can compare, rank, and select the preferred option. In the evaluation, the undefined values of basic attributes are denoted "*« and they are interpreted as a set of all possible

values that can be assigned to the corresponding attributes. DEXi evaluates the options by using all these values and it keeps track of the evaluation results which can be represented by a single value or by a set of values.

TIM is built using the Arctur's AAT (Automated Assessment Tool) platform and it is composed of an online questionnaire, a database, a MADM (Multi-Attribute Decision Making) model and an automatically generated TIM report (Goriup and Ratkajec 2021). The TIM assessment process includes these steps (Goriup and Ratkajec 2021): (1) definition of the geographical area for the TIM assessment; (2) mapping data sources; (3) completing the questionnaire and launching the AAT; (4) validation of results in the form of an automatically generated TIM report.

The TIM assessment can be repeated at any time intervals, and, in this way, it enables the constant monitoring and evaluation of the progress of the tourism impact at the selected location. The assessments are done under the supervision of a TIM certified expert who helps, explains, and guides the user by properly completing the questionnaire and by explaining the results in the report (Goriup and Ratkajec 2021).

The TIM questionnaire includes 310 questions or indicators grouped into 23 categories and 5 groups (Goriup and Ratkajec 2021):

1. Basic info about a specific geographical location (surface, types of tourism, number of tourists);
2. Environment (air quality, consumption of drinking water, disposal and treatment of wastewater and waste treatment, traffic related data etc.);
3. Economy (income, seasonality, employment, local economy etc.);
4. Society and Culture (satisfaction of tourists and local residents, health and safety, cultural and natural heritage etc.);
5. Collaboration (nature and level of collaboration between key stakeholders in tourism – local government, local residents, including NGOs and vulnerable groups, tourism providers and national government).

Beside the above-mentioned indicators, it also includes 138 Standard Data Accuracy Questions (SDAQ) grouped into question sets (one set is composed of three standardised questions) to measure the accuracy of the data provided for the indicators. All in all, the TIM questionnaire is composed of more than 700 questions, but it is a practical and easy to use digital tool (Goriup and Ratkajec 2021).

MADM (Multi-Attribute Decision Making) is a model for question analysis in which different types of questions (qualitative and quantitative) are combined and easily organised into a tree-like structure to enable the generation of the main results (Goriup and Ratkajec 2021). The TIM report visualises the main results of the MADM model in

a custom-made TIM Destination Character Chart (TIM DCC) with the positive (Benefits) and negative (Resource Consumption) effects of tourism and the general condition of the selected location (coloured circle) (Figure 7).

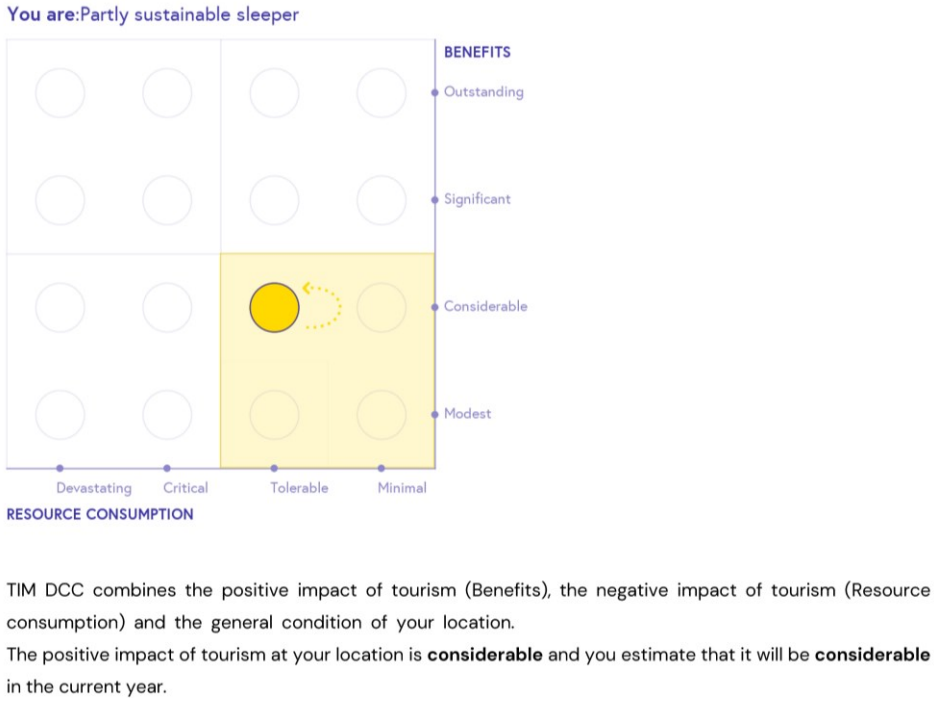

Figure 7. Destination Character Chart (DCC) example. Source: Arctur (2019)

The TIM report visualises the data accuracy results in the form of a Standard Environment Data Accuracy Question (SDAQ) bar too (Figure 8). As the TIM AAT is the perfect tool in measuring the SDGs on a local level because it facilitates the collecting of information relevant for the SDGs assessment, it gives an insight into the destination position on the global scale. Each section includes the list of one or more SDGs and their targets most closely related to the content that follows.

For the Sfântu Gheorghe tourism impact model (TIM) assessment, 2019 existing data and 2020 estimated data were used (Goriup et al. 2022). But there is a caveat regarding data accuracy, which, in general, is low, as much of the data is missing from the official reports and documents. To compensate for the lack of official records, the missing data were replaced by the estimations of local experts with detailed knowledge of the topic and the area.

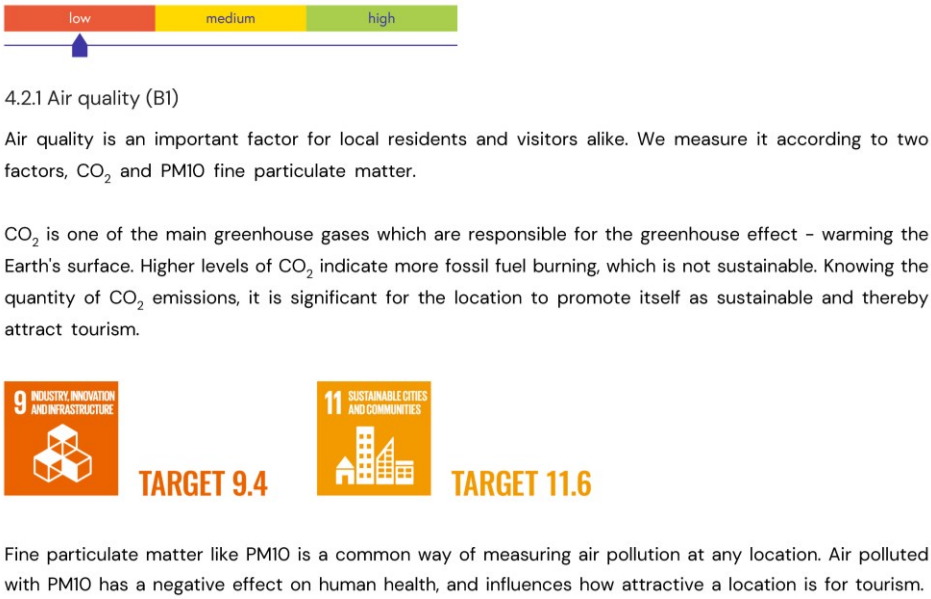

Figure 8. Standard Environment Data Accuracy Question (SDAQ) bar and its relationship with the UN SDGs. Source: Arctur (2019)

Results

The analysis results of TIM assessment evidenced that Sfântu Gheorghe is a partly sustainable sleeper: it gains considerable benefits (2 on a scale of 4) and it has a tolerable resource consumption (2 on a scale of 4) (Table 1). The sleepers stand out for low benefits, but also for low resource consumption. In other words, the environment is not yet under high stress, but neither are the socio-economic gains. This should be a well-established starting point for Sfântu Gheorghe's future development. As the environment is still not excessively altered, no massive investments are needed to bring it back to a sustainable level. However, all future economic and tourism developments should be realised preserving the current environmental conditions.

The implementation of TIM in Sfântu Gheorghe has had the following output:

- The environmental Destination Character Chart (DCC from where onwards) is a misuser: which means that the benefits for the environment are low (2/4), while the resource consumption is high (3/4).
- Air quality DCC for Sfântu Gheorghe is a misuser: the benefits are low (2/4), while the resource consumption is very high (4/4).
- Sewage system DCC is a champion: the benefits are high (3/4), while the resource consumption is low (2/4).

Table 1. Destination Character Chart break-down for Sfântu Gheorghe

	Analysed chapter	Benefits (out of 4)	Resource Consumption (out of 4)	Primary characters
1	Environment	2	3	misuser
2	Air Quality	2	4	exploiter
3	Sewage system	3	2	champion
4	Bathing waters	4	1	champion
5	Drinking water	3	4	exploiter
6	Energy management	2	4	misuser
7	Waste Management	1	4	misuser
8	Sustainable transportation	1	1	sleeper
9	Public transport	4	2	champion
10	Tourism infrastructure	3	1	champion
11	Economy	2	1	sleeper
12	Tourism income	2	1	sleeper
13	Investments	1	1	sleeper
14	Informal economy	1	1	sleeper
15	Tourism accommodation	1	1	sleeper
16	Jobs	2	2	sleeper
17	Local economy	3	1	champion
18	Real estate and consumer goods	1	1	sleeper
19	Society and Culture	3	2	sleeper
20	Events and happenings	2	1	sleeper
21	Collaboration	1	1	sleeper

Legend: Benefits – 1 (red) Modest; 2 (orange) Considerable; 3 (light green) Significant; 4 (dark green) Outstanding.
Resource consumption – 1 (dark green) Minimal; 2 (light green) Tolerable; 3 (orange) Critical; 4 (red) Devastating

- Bathing waters DCC is a champion: the benefits are high (4/4), while the resource consumption is low (1/4).
- Drinking water DCC is an exploiter: the benefits are high (3/4), while the resource consumption is low (4/4). There is high pressure on the drinking water as 40% of the consumption is concentrated in four months (June-September).
- Energy management DCC is a misuser: the benefits are low (2/4), while the resource consumption is very high (4/4). Up to 40% of all the electricity is used by tourism service providers, while in the tourist season this percentage goes up to 75.38%.
- Waste management DCC is a misuser: the benefits are very low (1/4), while the resource consumption is very high (4/4). Tourism operators generate more than 70% of the overall waste produced at Sfântu Gheorghe.
- Sustainable transportation DCC is a sleeper: both the benefits and the resource consumption are very low (1/4).
- Public transport DCC is a champion: the benefits are very high (4/4), while the resource consumption is low (2/4). In the tourist season, 61% of all arrivals in the port are tourism related.
- Tourism infrastructure DCC is a champion: the benefits are high (3/4), while the resource consumption is very low (1/4).
- Economy DCC is a sleeper: the benefits are low (2/4), while the resource consumption is very low (1/4).
- Tourism income DCC is a sleeper: the benefits are low (2/4), while the resource consumption is very low (1/4). More than 80% of the tourism businesses are owned by non-locals.
- Investments DCC is a sleeper: both the benefits and the resource consumption are very low (1/4).
- Informal economy DCC is a sleeper: both the benefits and the resource consumption are very low (1/4). Local experts estimate the volume of the informal economy between 15% and 30%.
- Tourism accommodation capacity DCC is a sleeper: both the benefits and the resource consumption are very low (1/4). There is very high pressure on tourism accommodation in the peak season.
- Jobs DCC is a sleeper: both the benefits and the resource consumption are low (2/4). Official records show a very low number of people employed in tourism.
- Local economy DCC is a champion: the benefits are high (3/4), while the resource consumption is very low (1/4), even if the local experts concluded that tourism has no positive effect on the establishment and the

performance of local supply chains between tourism service providers and the providers of goods and services.

- Real estate and consumer goods DCC are a sleeper: both the benefits and the resource consumption are very low (1/4).
- Society and culture DCC are sleeper: the benefits are high (3/4), while the resource consumption is low (2/4).
- Preservation of heritage DCC is a champion: the benefits are high (3/4), while the resource consumption is low (2/4).
- Events and happenings DCC are a sleeper: the benefits are low (2/4), while the resource consumption is very low (1/4). The majority of events are associated with cultural aspects.
- Collaboration DCC is a sleeper: both the benefits and the resource consumption are very low (1/4).

Discussion

Assessing the carrying capacity of the Danube Delta is crucial to tailor policies and administrative measures for its management (Association of Ecotourism in Romania 2014, Blaga and Josan 2019, Liu et al. 2020b, Wang et al. 2020). The Danube Delta Biosphere Reserve Administration and the local authorities are under a lot of pressure to allow development, but not at the expense of losing the quality of the environment (Sánchez-Arcilla et al. 2016). Especially as the Danube Delta represents a dynamic space under continuous natural transformation, together with its previous stages of human changes of the landscape and local communities (Preoteasa et al. 2016, Vespremeanu-Stroe et al. 2017, Teampău 2020, Petrișor et al. 2020, Tănăsescu and Constantinescu 2020). The pattern of natural landscape change became less predictable overall, with some places now closer to the sea than before, some farther, and some areas getting wetter, while lakes dry up (Constantinescu 2015, Romanescu et al. 2018). The Danube Delta landscape itself and its particularities constitutes a major asset for tourism development, but what was a sign of development in an earlier perspective, now looks more like a negative material dependency which requires further care and sustainable planning (Petrișor et al. 2012, Van Assche et al. 2020).

It is difficult to precisely measure which economic branch or human activity causes negative impacts on the environment in Sfântu Gheorghe (Goriup et al. 2022) as this analysis showed that the economic chapters create a low pressure on the consumption of resources, although the benefits are also low. So, there is a lot to improve in how the economic activity is currently being managed to increase its output.

On the one hand, out of the 21 chapters analysed in our study, in six cases, the benefits are as low as they could have been (modest on our scale), and in the other seven cases,

the benefits are marginal. Only in two cases, the benefits are at maximum according to our scale. On the other hand, when we measure the resource consumption or which pressures experience the different parts of the environment, a maximum resource consumption has resulted in just four cases while in other eleven cases this level was close to minimal. We can thus conclude that the environment is not particularly under high pressure, but the gains are also negligible.

When focusing on the chapters with direct impact on the environment (Air Quality, Sewage system, Bathing waters, Drinking water, Energy management, Waste Management), we notice that the pressure is at its maximum in four out of seven cases while the benefits are maximal only in the case of bathing waters. Public and private investments in this area are very costly, with a depreciation rate that spans over decades. But the benefits are minimal. Thus, some public utilities run close to their capacity as the benefits are low while the necessary investments to expand the network will burden the investors (in many cases local or national authorities) for decades.

An important issue with impact on the sustainability of tourism development in the Danube Delta is that it does not clearly contribute yet to the improvement of the locals' quality of life as envisaged by the government (Ministry of Regional Development and Public Administration 2016), and there are conflicts between the local stakeholders as the beneficiaries of related state support are mainly resourceful non-local investors (Văidianu 2015, Teampău 2020): "the problems range from simpler building designs to a complex process of competing for a 'primitive accumulation of capital' - especially land; from unfair, politically decided, discriminatory proprietorship over land towards incapacitating infrastructure development" (Iorga 2015: 36). Also, the environment and the local tourist entrepreneurs offering traditional accommodation and services face the pressure of tourist demand for ensuring the modern urban comfort to their guests (air conditioning, laminated floors, PVC windows etc.) and a complete visiting experience of the Delta in a short amount of time (Iordachi and Van Assche 2015, Newton et al. 2020, Teampău 2020). Both locals and tourists lack a proper understanding of the wild nature conservation requirements for the Danube Delta as biosphere reserve while the protected area administration is ineffective in ensuring the respect of ecological restrictions (Teampău 2020).

So that, the nature conservation policy of the Danube Delta can be successfully implemented only by applying a proper process of area monitoring in relation to its support capacity, as well as by employing suitable management measures for using the support of ecotourism in this sense (Borja et al. 2020, Kongbuamai et al. 2020). Extremely important for defining and monitoring the carrying capacity of the space in relation with the impact generated by the tourist activities (Pavel-Nedea and Dona 2017, Wang et al. 2020) is the correlation of a complex of factors and not considering only the quantitative presence of the visitors. Thus, in order to study the impact of

tourism in the Danube Delta, it is crucial to analyse and monitor: the number of visitors; the visitor behaviour; their presence as duration and season in relation to the pattern of activity of the fauna and the seasonality of the flora; the type of tourists and recreational activities; the type of local offer and recreation; the performance and characteristics of the management and public administration systems (Association of Ecotourism in Romania 2014, Stoleriu et al. 2019, Liu et al. 2020a, Partelow and Nelson 2020, Rather 2021, Sultan et al. 2021).

Conclusions

The Tourism Impact Model has the potential to act as a strategic planning tool with its built-in transparency in terms of methodology and as it includes the inhabitants, the authorities, and the economic agents in the consultation. TIM has a supervised collecting of data from various sources and their transformation into valuable planning information is aligned with the UN SDGs. All these lead to the creation of a field-based model of the whole spectrum of positive and negative impacts that tourism generates based on the existing data (Mou et al. 2020, Tian et al. 2020). The Tourism Impact Model aims to transpose the complex concepts behind the UNSDGs and to make them easier to perceive by visualising the results and the sets of recommendations for planning improvements. But the most significant advantage of TIM is the possibility of using dynamic real-data simulations of possible scenarios for quick and competent response in all situations of territorial planning and development.

Tourism is the new trend of sustainable development, but its current chaotic growth in the Danube Delta may increase environmental degradation (Ianoș et al. 2012, Gurran et al. 2020, Koçak et al. 2020, Melet et al. 2020). One of the safest directions to avoid the pressures and conflicts generated by tourism and recreation in a protected area (Hjalager 2020) consists in "slowing down" the visitor's experience, especially given the current context of covid pandemic restrictions, activity reconfiguration and supplementary need for ensuring human health (Borja et al. 2020, Sigala 2020, Uğur and Akbiyik 2020, Škare et al. 2021, Williams 2021, Yang et al. 2021). Thus, by promoting the slow visit as a tourism brand of the Danube Delta, the negative impact on the environment will be minimal (Association of Ecotourism in Romania 2014, Almeida-García et al. 2020).

As argued by Schvab et al. (2021), researchers have been trying for a long time to solve the problems related to mass tourism and to provide adequate solutions for the management of tourist flows in protected natural areas or the areas vulnerable to tourist pressure (Iorga 2015, Blaga and Josan 2019, Jahani et al. 2020, Yuxi and Linsheng 2020). As well as to provide strategic urban planning solutions to address the traditional challenges caused by tourism development, such as the management of parking lots in crowded tourist resorts, the municipal waste control and planning

(especially in overpopulated cities), and the post-event or real-time assessment of the number of visitors/tourists in a given area (Schvab et al. 2021). In this context, the Tourism Impact Model (TIM) is one of the Tourism 4.0 technologies that can tackle such problems and provide adequate solutions (Peceny et al. 2020, Goriup and Ratkajec 2021, Goriup et al. 2022).

Although it requires further refinement to better manage the challenges brought by tourism development, Tourism 4.0, and TIM, in particular, represent strategic planning tools for the local, county, or national public authorities. They often develop strategies or urban plans based on the available data which, frequently, in Romania are outdated (in the best-case scenario, the data on which they rely upon is only one year old) or incomplete for a complex analysis (e.g. the multi-annual series or certain types of data are non-existent or very difficult to access. Thus, the decisions taken in the framework of development strategies or other spatial planning documents should be based on today's technologies that allow for almost real-time data collection and adapting the administrative measures of policy scenarios in a much quicker time.

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ANALYSIS OF LANDSCAPE TRANSFORMATIONS IN THE URBAN-RURAL GRADIENT OF THE METROPOLITAN DISTRICT OF QUITO

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Abstract: The relocation of services in the peripheries and the new urban expansion patterns have dramatically altered the periurban landscapes. However, due to its transformation speed, there is limited knowledge regarding the spatiotemporal changes of these interstitial territories. By calculating landscape metrics in high resolution satellite images, this research analyses spatiotemporal transformations in the Metropolitan District of Quito urban-rural gradient, testing a novel and accurate method to identify urbanisation tendencies. The results evidence the main role that new road infrastructures have had in urban expansion. Also, the analyses reveal significant changes in agricultural coverages (related to the subdivision of rural lots) and the processes of vegetation fragmentation, evidencing the environmental fragility of these territories in transformation. Finally, the Markov chains modelling technique was applied, exploring the landscape change probabilities in the following years. This methodology can be particularly useful in land-use planning policies since it provides precise knowledge about the main tendencies of urbanisation.

Keywords:

urban-rural gradient;
landscape metrics;
spatiotemporal analyses;
Latin-American urbanisation

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Introduction

During the past century, the urban world's population has rapidly increased, drastically transforming landscapes around the planet. Furthermore, the limits of the entity known as "city" have tended to be diluted, forming territories with urban attributes but expanding in an unlimited and diffuse pattern. According to De Mattos (2016), this metamorphosis of the city happens as a result of financial globalisation, economic restructuring (deindustrialization and neoliberal development) and the information and communication revolution. This has resulted in the relocation of urban services in the peripheries, which are increasingly better connected by new road infrastructure and the increased access to private motorization. Similarly, Borsdorf (2003) associates the dispersed pattern of contemporary cities with the increase of new interurban highways and the relocation of artefacts of globalisation, such as malls, airports, industrial and technological platforms in areas that were previously mainly rural.

This expansion model has particularly promoted the localization of new residential units for elite classes in the peripheries (Smith 2012, UN Habitat 2013). In Latin-America, these units are typically gated communities (Hidalgo et al. 2007, Frediani 2013), and sometimes they adjoin pre-existent informal settlements, showing complex patterns of socioeconomic segregation (Da Cunha and Rodríguez Vignoli 2009, Durán et al. 2016, Ortiz Báez et al. 2020). These new residential units are also characterised for their low building density and monofunctional activities, representing an antagonistic model to the central and compact city (Albarracin 2017, Serrano and Durán 2020). In this sense, the functional fragmentation of the urban structure, the unequal provision of services, and the lack of connectivity complicates the spatial mismatch between the residents of peripheral areas and their places of employment. Their need to commute to workplaces generates a saturation of road infrastructures, increasing the levels of vehicular pollution and travel times (Ávila Sánchez 2001, Cruz-Muñoz 2021).

Furthermore, the expansion of human activities over rural and natural territories alters the landscape structure, affecting this socio-ecological system (Gallopín 2003). From an ecological perspective, the landscape composition and configuration determine the capacity to provide, manage and sustain the quality of resources indispensable for human life (Lee et al. 2015, Vizzari and Sigura 2015, Inkoom et al. 2018). One of the most severe impacts in landscape structure has been fragmentation, either due to the land covers' subdivision, the conversion from native to designed covers or the development in a non-contiguous pattern. As Shrestha et al. (2012) state, fragmentation can significantly alter ecological functions and processes, reducing habitat and wildlife corridors, decreasing agricultural and forest productivity and, finally, affecting ecosystem services.

In this sense, quantifying the landscape structures facilitates a better understanding of the urban-rural conditions of a territory, the land use patterns, and the transformation

of land use through time. The quantification of the landscape structure is also useful for evaluating the ability of the landscape to perform ecological functions and processes, and for monitoring the provision of ecosystem services (Inkoom et al. 2018). Landscape metrics have been widely used for measuring the landscape composition and configuration and for evaluating landscape mosaics (Antrop and Van Eetvelde 2000, Solon 2009, Buyantuyev et al. 2010, Liu and Weng 2013, Fan and Myint 2014, Lee et al. 2015). Although landscape metrics were originally developed from an ecological perspective, they are more and more frequently used in studies with broader approaches (Xing and Meng 2020) and they have shown to be useful for sustainable strategies in territorial planning (Weng 2007, Lee et al. 2015, Vizzari and Sigura 2015). Finally, since landscape change is a dynamic process and the direction and magnitude can vary depending on each environment, analysing the urban-rural gradient has shown to be a useful tool to capture the spatiotemporal complexity of urban dynamics (Yu and Ng 2007, Shrestha et al. 2012, Wadduwage et al. 2017).

Several authors have developed theories in order to understand and characterise the complexity of these interstitial territories. Concepts such as "exopolis" (Soja 2008), "fragmented city" (Borsdorf 2003) or "postborder city" (Dear and Leclerc 2003) have been explored, presenting valuable but generalised approximations. Although the limitless expansion of contemporary cities is a common phenomenon, the specific spatial patterns of this development and its rhythm of transformation may vary between regions, countries, and their particular environments.

In this article, the transformation of the spatial patterns in the Metropolitan District of Quito (MDQ) is analysed. This metropolitan area has shown the fastest urban population growth in the Ecuadorian context in the last years, and the city of Quito (the urban area of MDQ) spatially tends to follow a dispersed and fragmented pattern (Municipality of the Metropolitan District of Quito 2011, Serrano and Durán 2020). However, there is a lack of research regarding the patterns and spatiotemporal transformation along the urban-rural gradients of the city. The goal of this research is to quantify the last decade of transformation for the MDQ urban-rural landscape patterns, and to forecast the probabilities of future tendencies of land cover changes.

Our hypothesis is that, due to its current pattern of expansion, natural and agricultural covers are being particularly affected by fragmentation processes. However, these impacts have dissimilar levels of intensity depending on the infrastructure and other urban services implemented (differently) in various sectors of the MDQ periurban area. In this sense, we also present a discussion about the main drivers of these spatiotemporal changes and formulate some recommendations focused on territorial planning.

Methodology

Study area

The MDQ is located in the Andes region, and it is administratively organised into 65 parishes, 32 being urban and 33 rural (Figure 1). This metropolitan area encompasses the city of Quito, the Ecuadorian political-administrative capital. The MDQ economic dynamism and its national and international connectivity constitutes an important attractor node of people and activities. In the last decade, its population has increased from 2 239 191 people in 2010 to 3 059 097 people in 2020, according to the Municipality of Quito (2016), and it is currently the most populous city in Ecuador. Due to its marked altitudinal variation (500 m to 4780 m above the sea level) and its complex topography, the MDQ has more than 15 types of ecosystems, presenting a great biodiversity along its climatic floors, rivers and streams (Municipality of Quito 2016).

From the Spanish foundation of Quito in 1532 until the end of the decade of 1990, the city grew following a clear north-south longitudinal axis, which topographically corresponds to the plateau located between the Pichincha volcano and the eastern valleys of the district. However, in recent years, the urban limits have overgrown (Figure 2), moving towards the eastern valleys, which are experiencing an accelerated transformation in relation to the gradual growth of the upper plateau (Municipality of the Metropolitan District of Quito 2015). This phenomenon may have also been influenced by the location of the new International Airport of Quito (Mariscal Sucre Airport), inaugurated in 2012 and located in Tababela, one of the rural parishes of the MDQ in the eastern valleys. This new urban expansion zone is in permanent transformation and, depending on the ecological and socioeconomic conditions, this expansion can present diverse characteristics.

Definition of transects and study samples

Based on the previous study of Ortiz-Báez et al. (2021) and in order to cover the extension and diversity of the MDQ periurban expansion in a very detailed scale, six transects were defined. These transects started from two urban centralities[1] and they move towards the eastern rural parishes in 10°, 45° and 90° angles, covering the whole expansion area from the north to the south, allowing us to have a wide perspective of the complexity of the MDQ urban-rural gradient but avoiding eventual underlying patterns (Figure 3). Within the transects, a total of 64 sample polygons of 1 square

[1] MDQ has two main urban centralities: one is the old "historical centre" where central and local government offices are located (locations related to political-administrative activities); the second centrality is the "modern centre" (central business district) where the most important economic activities (public and private) are located.

kilometre each (Wadduwage et al. 2017) were defined in order to identify Land Use-Land Covers (LULC) in a very high resolution (1 pixel = 1 m²) through the visual identification of satellite images (ESRI World Imagery) and confirmed by field visits (Figure 4a). The identified LULC classes were: Built-up (all artificial constructions including detached houses, high-rise buildings, or sheds); Road infrastructure (including mega road infrastructure like highways and expressways and local roads); Tree and Shrub Vegetation, Agriculture (all recognizable plots with agricultural land production); and Bare Soil and Grassland (Figure 4b). Satellite images from two years, 2010 and 2017, were analysed and systemised in order to evaluate the spatiotemporal transformations (Figure 5).

Figure 1. MDQ location. Source: Gobierno Abierto (2021)

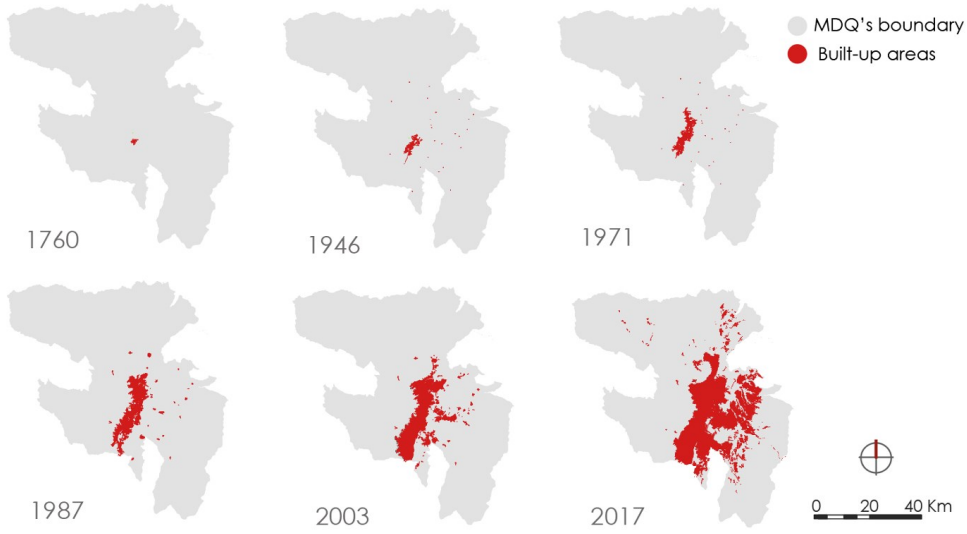

Figure 2. MDQ location and evolution of built-up areas from 1760 to 2017. Source: Municipality of the Metropolitan District of Quito (2021)

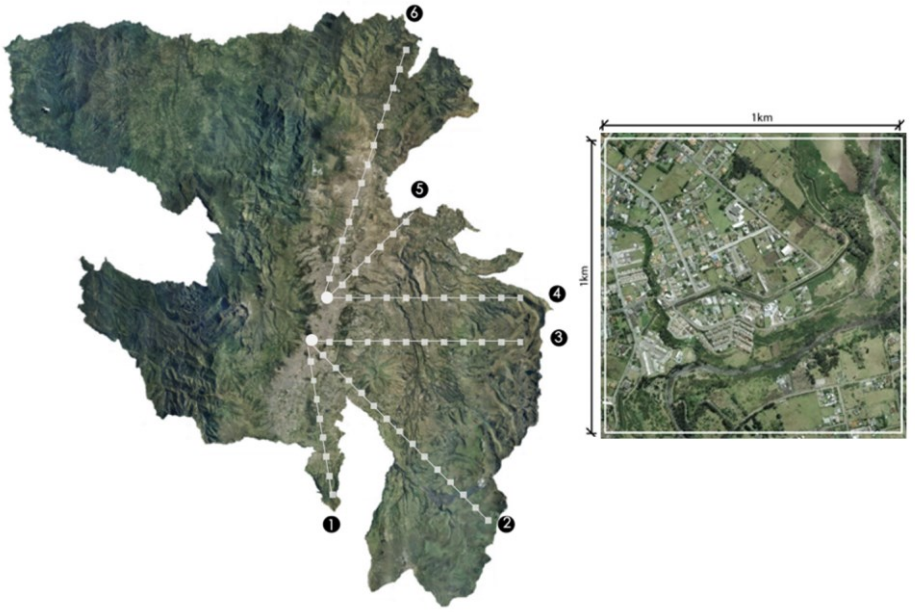

Figure 3. Transects and samples definition (the location of the 6 transects and the 64 samples; the dimension and scale of one of the samples)

a

b

Figure 4. Satellite interpretation process and the construction of raster images with Land Use Land Covers

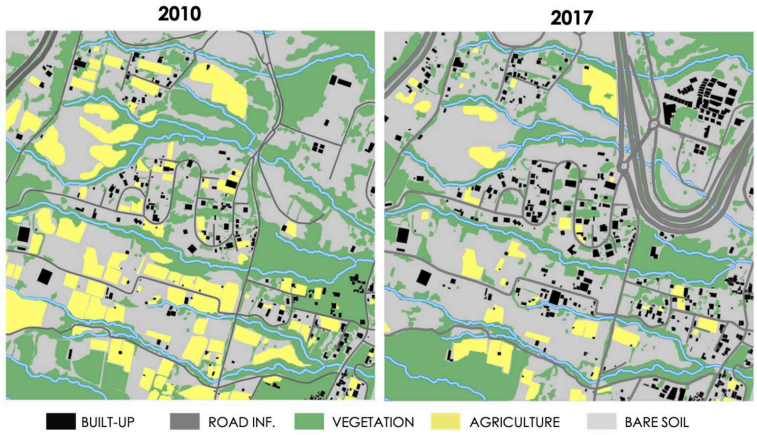

Figure 5. Sample of raster images and LULC identification for the years 2010 and 2017

Landscape metrics calculation

Since there is a strong effect of patterns over processes (Bogaert et al. 2015), the landscape metrics have shown to be a strategic tool to quantify specific spatial patterns such as area, density, dominance, diversity, and isolation, among others (Shrestha et al. 2012, Liu and Weng 2013, Kumar et al. 2018). In order to prove our spatiotemporal hypotheses, five metrics were calculated using the software FRAGSTATS 4.2.1: (1) Percentage of Landscape (PLAND); (2) Patch Density (PD); (3) Average Area (A_MN); (4) Larger Patch Index (LPI) which represents the area of the largest patch and it is an indicator of spatial dominance; and (5) Euclidean Nearest-Neighbour Distance (ENN_MN) which calculates the average distance between two patches, showing the levels of isolation (Table 1).

Table 1. Landscape metrics and their calculation formula

Name	Description	Calculation Formula	Notes
Percentage of Landscape (PLAND)	PLAND equals the sum of the areas (m^2) of all patches of the corresponding patch type, divided by the total landscape area (m^2), multiplied by 100 (to convert to a percentage)	$PLAND = P_i = \frac{\sum_{j=1}^{n} a_{ij}}{A}(100)$	P_i = proportion of the landscape occupied by patch type (class) i. a_{ij} = area (m^2) of patch ij. A = total landscape area (m^2).
Patch Density (PD)	PD equals the number of patches of the corresponding patch type divided by the total landscape area (m^2), multiplied by 10,000 and 100 (to convert to 100 hectares)	$PD = \frac{n_i}{A}(10.000)(100)$	n_i = number of patches in the landscape of patch type (class) i. A = total landscape area (m^2).

Name	Description	Calculation Formula	Notes
Average Area (A_MN)	A_MN equals the sum of the areas (m²) of all patches of the corresponding patch type, divided by the number of patches of the same type, divided by 10,000 (to covert to hectares)	$A\_MN = \frac{\sum_{j=1}^{n} a_{ij}}{n_i}\left(\frac{1}{10.000}\right)$	a_{ij} = area (m²) of patch ij. n_i = number of patches in the landscape of patch type (class) i.
Larger Patch Index (LPI)	LPI equals the area (m²) of the largest patch of the corresponding patch type divided by the total landscape area (m²), multiplied by 100 (to convert to a percentage)	$LPI = \frac{(a_{ij})}{A}(100)$	a_{ij} = area (m²) of patch ij. A = total landscape area (m²).
Euclidean Nearest-Neighbour Distance (ENN_MN)	ENN equals the sum of the distance (m) to the nearest neighbouring patch of the same type, based on the shortest cell centre-cell centre distance, divided by the number of patches of the same type.	$ENN\_MN = \frac{\sum_{j=1}^{n} h_{ij}}{n'_i}$	h_{ij} = distance (m) from patch ij to nearest neighbouring patch of the same type (class), based on patch edge-to-edge distance, computed from cell centre to cell centre.

Assessment of landscape metrics

First, a Wilcoxon Rank-Sum test was performed to evaluate the differences of landscape metrics between the two years of study, for each one of the LULC categories. This test is also known as the Mann Whitney Wilcoxon test, and it is a non-parametric statistic applied to evaluate whether two paired samples are statistically different. In the present research, we are evaluating the differences in landscape metrics between 2010 and 2017 of the same LULC class (e.g., Built-up). In this sense, we are analysing two paired samples: the same LULC class for 2010 and 2017. The null hypothesis of the test is having differences between the pair members equal to zero. Additionally, we calculated the Kruskal-Wallis test to assess if landscape metrics differences exist along the transects as we move away from the city centre. This test is also known as One Factor ANOVA of Kruskal-Wallis for k samples. The test variables were the landscape metrics, and the grouping variable was the kilometrage categories (nominal variable). Thus, with this test we evaluated whether statistically significant differences of landscape metrics values exist between the different kilometrages for all the transects of the study area. The null hypothesis of the Kruskal-Wallis test is having the same distribution of the landscape metrics values between all kilometrage categories. This analysis was separately applied for the two years of the study. Finally, in order to have

a more specific outlook of the pattern's transformation in each transect and sample independently, an analysis of the normalised metrics variation (percentage of change comparing the two years) was developed.

Land change transition probability

The Markov chain modelling technique was applied, as a method to forecast the tendency of LULC's transformation in the MDQ urban-rural gradient. This tool has shown to be one of the most effective in quantitative simulations and it has been widely applied in land use change evolution studies (Guan et al. 2011, Mansour et al. 2020, Da Cunha et al. 2021, Rahnama 2021, Wang et al. 2021). This technique is a stochastic model based on computing a probability matrix of transition and it randomly simulates the changing covers, calculating the rates of all possible transitions between various land covers. The Markov chain's analysis describes land cover changes from one period to another and it predicts future tendencies of change (Mansour et al. 2020, Cunha et al. 2021, Rahnama 2021). Using the software Idrisi 17.0, a Markovian transition estimation was developed for the year 2024.

Results

For the general LULC transformation between 2010 and 2017 (Table 2), the Vegetation cover shows the greatest reduction in this time period, with -2.23%, followed by Bare-soil and Agriculture covers with -1.57% and -1.29 respectively. In contrast, the covers show an increase are Built-up and Roads, confirming that this study area is undergoing transformations due to urban expansion. The Built-up cover shows the highest net percentage of increment, with 12.43%, followed by Road infrastructure with 9.09%.

Table 2. LULC general changes between 2010 and 2017

	2010		2017		2010-2017 Changes
	Area (Ha)	**% of total area**	**Area (Ha)**	**% of total area**	**% of change**
Built-up	515.7	8.1	579.8	9.1	12.43
Road	374.9	5.9	409.0	6.4	9.09
Vegetation	1392.0	21.7	1360.9	21.3	-2.23
Agriculture	571.9	8.9	564.5	8.8	-1.29
Bare-soil	3459.8	54.1	3405.5	53.2	-1.57

Differences of landscape metrics between the two years

When comparing the differences of metrics between years, interesting outcomes were obtained. Regarding the land cover of built-up, the results are striking – significant differences or changes were identified for all the metrics, with 99% of confidence for

PLAND, PD, LPI and A_MN, and 95% of confidence for ENN_MN, showing that the quantity and spatial structure of built-up land use has had an important dynamic and it changed through the time. These results also suggest an advance of urban frontier between the two years considered. Furthermore, in the case of the category of roads, significant changes were identified for the metrics PLAND and LPI. In the case of the agricultural cover, there is a statistically significant difference (90% of confidence) of the metric percentage of landscape (PLAND) between 2000 and 2017 (Table 3).

Table 3. Wilcoxon test comparing the metrics between 2010 and 2017 for each land use-land cover considered

	PLAND	PD	LPI	A_MN	ENN_MN
Built-up	0.000***	0.005***	0.001***	0.000***	0.029**
Roads	0.006***	0.928	0.016**	0.929	0.995
Vegetation	0.646	0.531	0.760	0.695	0.335
Agriculture	0.080*	0.464	0.347	0.343	0.791
Bare-soil	0.206	0.414	0.127	0.792	0.321

Differences on landscape metrics along the transects

For the two years of study, statistically significant differences (95% and 99% of confidence) in all the landscape metrics along transects were identified for the LULC classes of Built-up and Roads Results (Table 4). For the metric LPI, Vegetation and Agriculture did not change for the year 2010, while for the year 2017 these LULC classes experienced significant differences (95% of confidence) along the transects. PD in Agriculture did not change in 2010, while it significantly changed (99% of confidence) in the year 2017, showing greater dynamics in this last period. In 2010, Bare-Soil only changed along transects in PD and LPI, and in 2017, only changed in PD along transects.

Table 4. Kruskal-Wallis test results to assessing the differences of landscape metrics along the transects (distance to the centre), for 2010 and 2017

		PLAND	PD	LPI	A_MN	ENN_MN
	Built-up	0.000***	0.006***	0.005***	0.006***	0.000***
	Roads	0.000***	0.018**	0.001***	0.048**	0.008***
2010	**Vegetation**	0.036**	0.027**	0.051	0.005***	0.245
	Agriculture	0.046**	0.061	0.080	0.023**	0.099
	Bare-Soil	0.722	0.007***	0.031**	0.084	0.063
	Built-up	0.000***	0.006***	0.020**	0.013**	0.000***
	Roads	0.000***	0.006***	0.000***	0.036**	0.006***
2007	**Vegetation**	0.040**	0.008***	0.024**	0.004***	0.281
	Agriculture	0.005***	0.010***	0.019**	0.014**	0.056
	Bare-Soil	0.673	0.003***	0.105	0.053	0.097

Analysis of landscape structure temporal variation along the transects

While observing the percentage of change between the two years along each gradient, some relevant and more specific features were found. For the Agriculture cover, when comparing the PLAND variation between the two years, this land cover tends to be reduced in most samples, especially in those closest to the urban centre (Figure 6). However, there are some peaks where an increase in the percentage of agricultural land is observed; these coincide with the sectors with strong agricultural potential such as Puéllaro, Pifo or Cotogchoa. On the other hand, the agriculture cover tends to reduce its AREA_MN and LPI in almost all samples, regardless of their distance to the urban centre. This shows a tendency of plots fragmentation as a result of land use changing from rural to urban (where lots can be smaller).

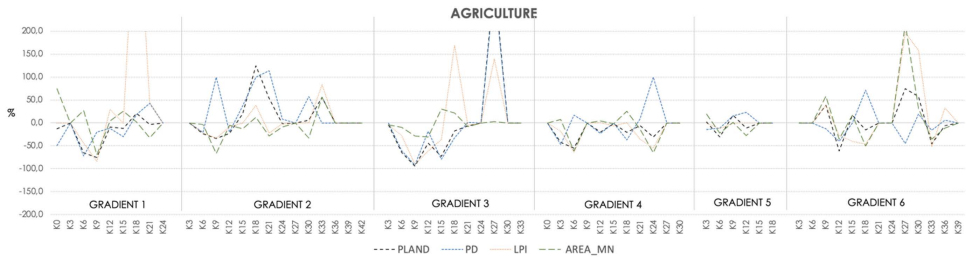

Figure 6. Metrics percentage of change for Agriculture cover along gradients.
Note: for the following graphics, K refers to Kilometres away from the urban centre

When observing the Vegetation cover and the metrics temporal variation, processes of fragmentation can be identified in various sites. This can be deduced, on the one hand, for the reduction of the patches mean area (A_MN) and the larger patch index (LPI), and on the other hand, due to the increase of the number of patches (PD) at the same spot (Figure 7). This is particularly evident in the Kilometre 24 in gradient 2 (Conocoto) and at the beginning of gradients 3 (Cumbayá), 4 (Nayón) and 5 (Pomasqui). If we compare all these samples with the PLAND of the Built-up cover (Figure 8), we can confirm that all these sectors present a high building increment in the analysed period of time.

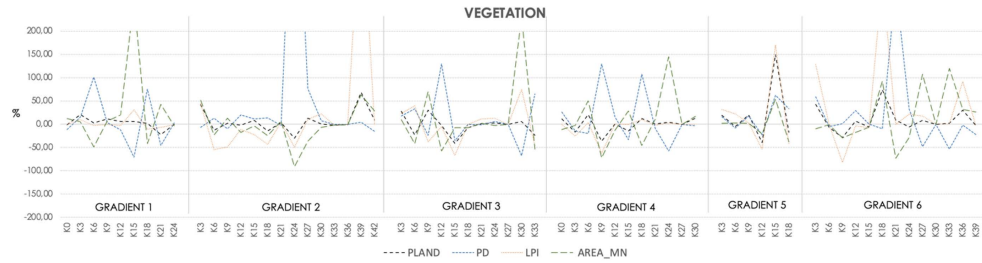

Figure 7. Metrics percentage of change for Vegetation cover along gradients

When analysing the temporal variation of PLAND for the Built-up cover, we can see that there is an overall tendency to increase buildings in all gradients, although at different levels of intensity and distances from the urban centre. The highest intensity of built-up growth tends to match the location of traditional rural settlements (cabeceras parroquiales) situated in the periurban area. On the other hand, when analysing the temporal variation for the ENN_MN for the Built-up cover, in most samples, the distances tend to be reduced. This shows that there is a general propensity to densification and agglomeration through all the urban-rural gradients in the MDQ.

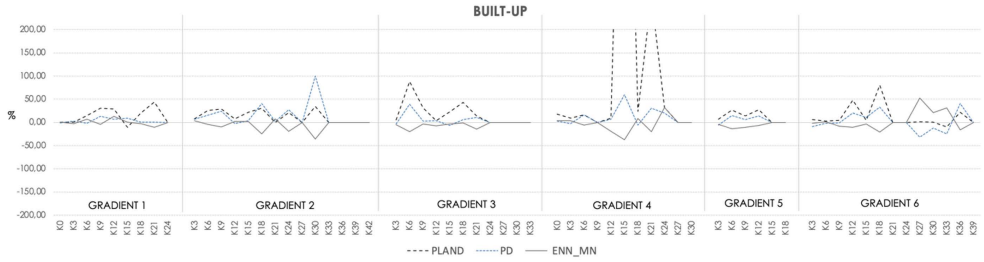

Figure 8. Metrics percentage of change for Built-up cover along gradients

Finally, when comparing the Built-up PLAND variation with the Roads PLAND variation (Figure 9), we can observe a tendency of a correspondence with the increment of roads and the increment of buildings in all gradients. In fact, applying the Spearman test , a correlation coefficient of 0.34 and a p value of 0.005 were found, which indicates a 34% strength of association between the two variables; this association is positive (directly proportional) and highly significant (99% confidence). However, what happens in gradient 5 is striking, since there is a significant increase in buildings but without an important increase in roads. Additionally, it is important to mention that the highest growth point of Built-up (Gradient 3, Kilometre 9) coincides with the intersection of the highway named Ruta Viva, which was built to connect the city of Quito with the new international airport.

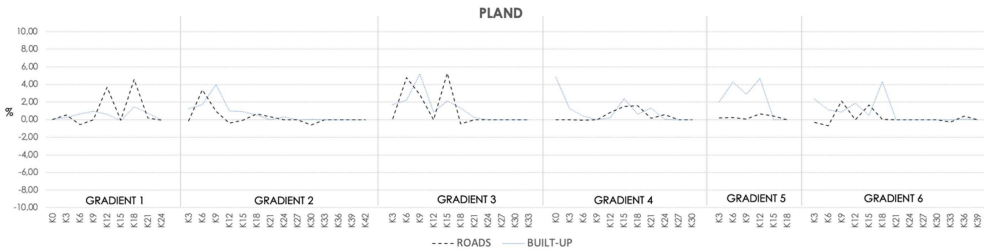

Figure 9. Comparison of temporal variation of PLAND between Roads and Built-up covers

Land change transition probability matrix

In the Markov transition probability matrix (Table 5), the higher values can be identified on the diagonal, which means that the highest probability is that coverage will remain stable in the same class until 2024. Regarding the probabilities of change, based on the previous transformations of 2010-2017, there is a probability of 0.02 that the vegetation covers will become roads and a probability of 0.15 of becoming bare-soil. There is also a probability of 0.21 that agriculture covers will become bare-soil. Finally, the probability of bare-soil becoming vegetation is 0.08, in built-up is 0.03 and in agriculture is 0.06.

Table 5. Transition probability matrix between 2010 and 2017 for predicting the LULC transformation in 2024

	Vegetation	Built-up	Roads	Agriculture	Bare-soil
Vegetation	**0.8094**	0.0078	0.0201	0.0038	0.1565
Built-up	0.0012	**0.9628**	0.0049	0.0004	0.0030
Roads	0.0043	0.0035	**0.9550**	0.0007	0.0035
Agriculture	0.0174	0.0137	0.0048	**0.7251**	0.2178
Bare-soil	0.0819	0.0318	0.0138	0.0552	**0.8162**

Discussion

In a previous research, current landscape patterns in the MDQ urban-rural gradient have been addressed (Ortiz-Báez et al. 2021). However, analysing the spatiotemporal dynamics in the last years has allowed us to have a more precise understanding of the transformation trends that will determine the territorial development in the coming years. The analysis of the temporal variation in various landscape metrics, enables a richer visualisation of the landscape composition and configuration, and their transformation tendency. Additionally, the use of transects and the detailed scale of the samples allowed us to make a very meticulous and detailed assessment of the landscape features along transects, without losing the general perspective of the MDQ, which facilitates the analyses of territorial diversity within the urban-rural gradient.

Land use change in the MDQ is a key topic, since its demographic development has evolved significantly since the decade of 1970 and with greater intensity in recent years, but particularly because its physical urban tissue has shown to be expanding in an accelerated and intensive way. There are important socioecological implications in this expansion tendency. On the one hand, there are several impacts on the natural and agricultural areas that are not always perceptible but they are threatening the territorial environmental sustainability. And, on the other hand, new urban peripheral settlements are producing socioeconomic problems such as the proliferation of low density gated communities or the concentration of poverty settlements in peripheral areas (Sabatini

et al. 2001, Sabatini 2003, Municipality of the Metropolitan District of Quito 2014, Serrano and Durán 2020, Herrero Olarte 2021).

Our results provide clear evidence of significant changes in the Built-up cover, in all landscape metrics between the two years of study, which confirms the urban expansion of the city of Quito towards the eastern valleys of the MDQ. In these valleys, there are some parishes that administratively are considered rural (e.g., Cumbayá, Tumbaco, Conocoto), but that have become practically urban in structure and in function. These territories, that were previously considered distant and inaccessible, have become the new areas of dispersed urbanisation. However, this process of urban expansion is not linear, it presents various peaks which can be observed in the PLAND variation. These peaks are directly associated with the presence of traditional rural settlements (cabeceras parroquiales) which were once in the outskirts of the city, but now they are facing micro extension/conurbation processes (Ortiz-Báez et al. 2021). Since these settlements are geographically separated, we can confirm a fragmented urbanisation pattern in the MDQ periurban areas.

Furthermore, the significant change of Roads´ PLAND between 2010 and 2017 is also indicative of the landscape functionality driven urban expansion: the development of roads that connect the city of Quito with the eastern rural parishes. In this way, the statistical analyses of the transects suggested the high variation of landscape metrics for the Built-up and Roads LULC classes, which provides important evidence of the landscape dynamics involving the rural transformation to urban. Also, the analysis of the Euclidean Nearest Neighbour (ENN_MN) metric 2010-2017 variation evidences a tendency towards building densification along all gradients. Various authors have affirmed that the new road infrastructure tends to accelerate the urban expansion (Aguilar 2002, Borsdorf 2003, Serrano and Durán 2020). This hypothesis can be confirmed in the MDQ case since the Roads and Built-up PLAND increases in parallel. Also, the higher Built-up increment occurs in the samples crossed by the new highways that connect the central city with the new International Airport of Quito, opened in 2012. At this point, it is worth asking if the municipal planning of these mega road-infrastructures foresaw the impact that they would have on urban expansion. Along with the impact of new road infrastructure on urban expansion, the diffuse pattern, and the lack of efficient public transport in periurban areas, increases the dependency on private motorization. In fact, in the MDQ, the private automotive fleet has increase in 7% in the last years (Municipality of the Metropolitan District of Quito 2021) and the daily commuting from the rural valleys of Cumbayá, Tumbaco and Los Chillos to the city centre has increased from 40 000 in 2008 to 140 000 in 2019 (Municipality of the Metropolitan District of Quito 2009, La Hora 2019). This not only affects traffic congestion and travel times, but it has important environmental effects: in the MDQ, 56% of the carbon footprint is caused by the emissions from transport vehicle emissions (Municipality of the Metropolitan District of Quito 2015).

Despite the fact that the new road infrastructure has demonstrated to be a main driver of urban expansion as mentioned above, this study presents a particular case that deserves to be discussed from a socioeconomic perspective. Gradient 5, which corresponds to the rural parish of Calderón, shows one of the most pronounced increases in buildings in the period 2010-2017. However, this parish does not have a direct influence of new road infrastructure during that period of time. In this case, the noticeable urban intensification would be associated with other drivers. Informal building growth has been one of the main challenges of urban expansion in the MDQ. Speculation and high land prices in central parishes have led to the informal and deregulated occupation of nearby rural parishes (Guerreo Miranda 2011). This is the case of Calderón, where until 2010, 90% of its settlements were illegal (Municipality of the Metropolitan District of Quito 2011). Evidence has shown that irregular growth processes lack infrastructure, facilities, economic opportunities and basic services which affect the price of the land (Cabrera and Plaza 2016, Weku et al. 2019). Currently, Calderón has one of the lowest land prices on the market, which makes it an attractive place for the migration of low socioeconomic classes. On another hand, facing the high density of the parish, the local government has made efforts to provide new urban services and facilities such as the 2015 inaugurated Calderón Hospital, among others, making the parish more attractive for new migrants.

Furthermore, in the studied period of time, private agents have also seen an opportunity to promote real estate projects focused on middle and low economies, which are focused in guaranteeing housing but not always in an adequate urban context. Thus, the mix of these factors: irregular growth, low land prices, new social services, and speculation in the real estate market with a focus on the middle and lower classes, appear to be accelerators of urban expansion in the parish of Calderón. This development pattern seems to be recurrent in Latin-American realities. According to Frediani (2009), the diffuse city in Latin-America presents enclaves of poverty in its peripheries, which also present accelerated rates of expansion. This is consistent with the study of Herrero Olarte (2021) for the city of Quito, where it is stated that there is a direct relationship between multidimensional poverty and the distance to the city centrality.

Regarding the environmental implications in the 2010-2017 period, Agriculture and Vegetation covers significantly varied along the transects, suggesting the modification of ecological systems during the last years. This statistical evidence corresponds with other transformations in the territory, such as the alterations of rural livelihoods due to development of new highways connecting the city to the Airport. Regarding the Agriculture cover, the analysis confirms that it has been reduced in the last decade and, according to the Markov's probability matrix, it tends to be reduced even more in the following years. This is particularly critical, since the area where the urban tissue is expanding, is also the area with more concentration of soil with agricultural vocation

in the MDQ (Municipality of Quito 2016). Another relevant finding is the reduction of the Patch Mean Area (A_MN) and the Larger Patch Index (LPI), revealing a tendency of plot fragmentation which can be a result of the land use change from rural to urban.

Indeed, despite the metropolitan land use regulation, in which rural land use has particular restrictions in order to protect it (such as a minimum lot size), there are several regulatory and legal gaps that continue allowing the division of lots. One of them is the legal tool of "acciones y derechos" (shares and rights) in which a percentage of the property can be sold without legally changing the plot size, but this allows the new owner to change the use within its percentage of land. Another frequently used legal mechanism, especially by real estate companies, is the "horizontal property", where a dwelling unit is sold as a percentage share within a large lot. The latter is the most common method to implement gated communities and it has started to be used more frequently (Quito Metropolitan Institute of Urban Planning 2018). In this scenario, agricultural practices may tend to weaken even further, considering that by 2014 only 5% of the population living in rural parishes was engaged in agricultural production which has a socioeconomic impact (Municipality of Quito 2016).

Finally, regarding the Vegetation cover, after analysing the 2010-2017 metrics variation, processes of fragmentation were identified in various sites. This can be inferred due to the reduction of the Patch Mean Area (A_MN) and the Larger Patch Index (LPI), while there is an increment of Number of Patches (PD). Fragmentation is one of the major environmental concerns, due to its effects on the ecological functions and processes which can result in the damage of natural habitats, the reduction of ecosystem services and consequently of basic human needs (Shrestha et al. 2012, Kumar et al. 2018). The sites that present the most evident processes of fragmentation match areas with higher increase in Built-up covers. Observing the Built-up ENN_Mean metric, we can also relate these areas with "medium to low" density patterns of built expansion, related for example with the accelerated suburban sprawl in the parishes of Cumbayá, Nayón and Conocoto. According to Shrestha et al. (2012), the low-density developments contribute to increasing the level of land fragmentation and they typically happen on the urban-rural fringe.

Conclusions

The MDQ is undergoing a process of intensive urban expansion towards its eastern valleys. However, the level and patterns of transformation are different between the gradients and along the gradients, showing the diversity within this periurban territory. The calculation of landscape metrics has proven to be an effective tool to assess the spatial patterns of these territorial transformations and to identify such diversity, and it can be a key tool to formulate and implement land use planning policies with an environmental and socioeconomic perspective.

There are important socioecological implications in this expansion pattern. The implementation of new road infrastructure appears to be one of the major factors accelerating urbanisation, since there is a correspondence between the increase of roads and buildings in the studied time period. This is particularly evident with the Ruta Viva highway, built to connect the new airport of Quito and where one of the highest levels of increase in buildings were found. However, as a result of the diversity of patterns and processes in the periurban area of the MDQ, the particular case of the parish of Calderón stands out, where (unlike the rest of the study areas) there has been a significant increase in buildings without a corresponding increase in roads. Other socioeconomic drivers, such as informal settlements, low land price, new public investment and low class-focused real estate speculation seems to explain the accelerated urban growth of this rural parish. The variety of dynamics within the MDQ evidence the complexity of the urbanisation phenomenon, where specific plans should be part of the agenda. Calderón's urban development model is a recurrent pattern in Latin-American diffuse cities, where enclaves of poverty in the peripheries are growing rapidly.

Finally, our analysis demonstrates the vulnerability of the natural and agricultural ecosystems in the MDQ. The tendency of Agriculture PLAND, A_MN and LPI reduction, as well as the increment of fragmentation processes in the Vegetation cover, show the fragility of territorial environmental sustainability. The results of this study can be a key input for the formulation of more specific policies for the conservation and recovery of ecosystems affected by these accelerated and little-known processes of urban expansion.

Research on the landscape dynamics is particularly important for sustainable development and the results for the MDQ could give key information for the formulation of development policies and planning strategies in the long term. Furthermore, the analysis of changes of MDQ urban-rural landscapes, can contribute to a better understanding of the urban expansion of Latin American metropolitan areas, considering that Latin America is a continent facing a rapid urbanisation process in a context of extreme inequality.

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Necessity Determination of Relocating the Capital City with a Defensive Planning Approach

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Abstract: This study evaluates the necessity of moving the capital city of Iran within a defensive planning approach and its impact on the national economic, social, and environmental aspects. Data consist of statistical documents and questionnaires, supplemented with 26 demographic, economic, environmental, infrastructure, health, and security-defence indices. To analyse the data, the statistical methods of spatial autocorrelation of Moran and Ripley's K function are used. The results show that centralization in the demographic, economic, and political dimensions of Tehran as capital city, along with natural threats, has led to under-development and environmental issues. In addition, the unequal distribution of services in Iran's provinces and the centralization of services and facilities in Tehran has raised the need to move the capital as a development strategy. In this strategy, the government should pay more attention to the country's macroeconomics, especially the per capita GDP, including long-term forecasts and development plans for the provinces because only macroeconomic stability can lead to more stable economics in all parts of the country. Under such circumstances, any future policy regarding the relocation of the capital will be easier, and the economic and political stability of the country will not be disrupted.

Keywords:

population growth;
underdevelopment;
environmental issues;
capital relocation;
Tehran

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Introduction

The capital city is defined as the urban centre of any country that has a leading position in the government of that country and it is selected by the law (Rukmana 2010). Capital cities are the national symbols of their countries and they hold the country's seat of the government and thus the political power; also, in most cases, they represent the main social and economic centre as well (Schatz 2004, Ghalib et al. 2021). So, in addition to playing a political-administrative role and being the government headquarters, most capitals are also the country's economic, social, and cultural hubs. Besides, such capitals are often the centre of capital accumulation (growth hub) and the rest of the land forms their surrounding areas (Mousavi and Bagheri Kashkooli 2015). But, creating growth hubs as a tool for economic growth in these cities will not have a beneficial effect on the prosperity of the surrounding areas whereas it will cause an imbalance in the development between regions, due to an intense demographic, economic, social, political and administrative centralization and the improper distribution of facilities and services in the country (Mousavi and Rahimi 2017). Due to the high concentration of functions, governments have faced many problems in terms of social, cultural, economic, environmental, and physical issues and they are looking for solutions such as shifting the activities (Ebrahimzadeh et al. 2016).

Congruently, the experience of capital cities in the world shows that, for the past fifty years, dozens of countries in South America and Africa have planned to relocate their capital city or to build an entirely new capital in the style of Washington or Canberra, in a green place or a small existing city (Gordon 2006). This transfer includes a variety of reasons and constant political motives but usually, the density and most importantly the previous inefficiency in various social, economic, environmental, and other aspects have been mostly taken into consideration regarding the old capitals (Quesnel 1993). Some of them were logical and even necessary because relocating the capital city in these countries has led to many positive developments, but many others were very ambitious in terms of available financial and organisational resources and they eventually failed (Miyakawa 1983, Anonymous 1988).

Generally, the relocation of a capital is considered to be illogical at first (Paquet 1993). However, there are several well-known experiences in this regard, such as the relocation of Russia's capital from Moscow to Saint Petersburg in 1703, India's capital from Calcutta to New Delhi in 1911, and Kazakhstan's capital from Almaty to Astana in 1997 (Sartori 1970). In December 1997, Kazakhstan moved its capital from Almaty in the southeastern region to Akmola (later renamed Astana) in the north-central steppe (Köppen 2013). The general consensus was that this relocation was irrational and impossible, but the new capital acted as a showpiece of the Kazakh culture and identity and the city also became a symbol of economic prosperity and of the regime's geopolitical vision (Köppen 2013).

Besides, with the increasing problems of densely populated capitals, some countries have strong reasons for relocating the capital city (Shi 1998). For example, Indonesia has cited two main reasons for the relocation of the capital from Jakarta to Kalimantan (Ishenda and Guoqing 2019). Firstly, this shift will lead to the development of the outer islands, thus it will reduce the stable regional imbalance between Jakarta and these areas (Van de Vuurst and Escobar 2020). Secondly, the population and economic activities redistribution may control the migration and centralization of special economic zones while it is expected to reduce the pressure on Jakarta, which has a limited environmental capacity to support the further population growth (Van de Vuurst and Escobar 2020).

Tehran, the capital city of Iran, as the centre of growth innovation hub, has maintained its superiority in various fields with having the background of more than two centuries of administrative and political centrality of the country and more than half a century as the country's great metropolis (Khazaee et al. 2015, Ebrahimzadeh et al. 2016, Imani Shamlou et al. 2016). The economic, political, cultural, military, administrative, and service centralization in Tehran has provided a wide range of employment opportunities, and simultaneously, the relative stagnation in the activity of other areas of the country while Tehran's numerous services and facilities have uniquely accelerated its development (Dadashpoor and Alidadi 2017, Mousavi and Rahimi 2017). The dominance of this issue has caused the backwardness of other areas of Iran and, therefore, Tehran is considered a parasitic city (Dadashpoor and Alidadi 2017, Mousavi and Rahimi 2017). So, centralism has had adverse economic, social, cultural, political, and geographical effects, as it caused the centralization of the population in certain areas at national level and it prevented the optimal distribution of resources and facilities all around the country (Shakoori 2016, Mousavi and Rahimi 2017).

But, considering the recent crises of natural factors in Iran, such as flooding and earthquakes, metropolitan cities, especially the capital, have shown their incapability to handle them properly (Van de Vuurst and Escobar 2020). Therefore, the relocation of the capital can lead to optimal territorial management and governance, by creating a balance in the development of all provinces in the country (Zali et al. 2015). Overall, the relocation strategy is a promising approach for promoting regional sustainable development. The aim of this study is to determine the necessity of moving the capital of Iran with a defensive planning approach and its impact on the economic, social, and environmental characteristics of the national territory.

Theoretical foundation and literature review

A review of the relevant literature focuses on two main themes of trends and patterns of the relocation of capital cities (Paquet 1993, Rawat 2005, Gordon 2006) and of its impact on various demographic, economic, environmental, security and defence

dimensions that deal with the discourse of capital cities (Miyakawa 1983, Khazaee et al. 2015). Capital cities are considered social communities within a human settlement that occupies a central position in the country and this centrality distinguishes them from other cities (Alaev 1983).

Researchers have approached this centralism from several perspectives. Gottman and Harper (1990) see centrality linked to the political and administrative position of the capital, and as the seat of government, the central office of the administrations, and the representative of the political power. Quesnel (1993) introduces centrality in capital cities as the place of the host government relations with foreign agents which makes it a centre for the government's international relations. The literature also attributes various other functions to the capital cities which confirm their status as central cities. Von Beyme (1991) distinguishes between the political, economic, and cultural functions of a capital. Similarly, Paquet (1993) sees the capital as a socio-political centre, a centre for the production and distribution of economic goods and services; and also, as a symbolic centre that reflects the values of the nation. In this regard, the classification of Jaskova (2008), which distinguishes between the capital cities as dominant, rival, or functional centres, is useful.

Normally, one of the most important goals of moving the capital is to prevent centralism in the capital city, which is mainly political in nature (Shakoori 2016). Page (1991) sees centralism as the focus of government institutions and sources of political authority in the capital against the distribution of power and responsibilities among national, regional, and local authorities. Thus, it can be said that centralism, in the political sense, implies the concentration of the sources of power, and in the economic aspect, it focuses on the factors of human resources, capital, and other factors related to production, labour, and activity (Shakoori 2016). Centralism in the economic and political structure of a country leads to 'spatial centralism' too, which refers to the accumulation of government revenues, industries, trade, and population in one or more specific places (Shakoori 2016).

The existence of a centralised political-administrative system has been another challenge for the capital cities as all decision-making and management centres are located in the capitals (Campbell 2003, Jaskova 2008). The volume of accommodations, traffic of the employees working in these institutions, and political-administrative centres on a daily basis has caused a huge amount of land and air traffic for the capital cities (Ahmed et al. 2008). Furthermore, people coming from other parts of the country to handle their administrative and political affairs are intensively increasing (Rawat 2005). The result of such concentration and population density is the mass production of various types of household, commercial, industrial, hospital, and electronic waste (Gordon 2006). It also increases traffic congestion, which in addition to increasing the use of fossil fuels, causes adverse effects on the health of residents (Rukmana 2010).

Besides, the impact of this amount of concentration, population, and economic density in the capital cities limits the ability to provide timely services in the case of natural crises (Van de Vuurst and Escobar 2020).

In order to commence decentralisation in a country, four basic factors must be taken into consideration at the same time – political, administrative, financial, and economic factors, so that it is not possible to start financial decentralisation and to achieve comprehensive development without focusing on political decentralisation (Dadashpoor and Alidadi 2017, Ishenda and Guoqing 2019, Keshtkar et al. 2019). In connection with economic decentralisation, a study by Tosun and Yilmaz (2008) found that the economic growth of capital cities in developing countries was on average higher than in developed countries. The economic growth in such cities does not reflect the state of development of capital cities themselves, but it rather indicates the countries' economic centralism, providing the basis for social and environmental problems (Shakoori 2016).

The symbolic performance of a capital city has also been the focus of many researchers' studies (Paquet 1993, Schatz 2004). For instance, King (1993) saw the capital as the product of nationalism and highlighted its role in uniting the nation and providing a sense of belonging and identity. Besides, several authors have emphasised the importance of public architecture in the capital city in creating and shaping the symbolic identity of the nation (Campbell 2003, Anderson 2006, Vale 2008). Creţan and Matthews (2016) also believe that city text changes are important in urban spaces, especially when qualitative studies reflect the local people's opinions on such changes. Therefore, the population's responses to the capital city relocation could be a valuable tool for researchers in the future. So, there are examples worldwide where certain ethnic groups could choose their identity based on political changes. For example, based on a study about the Carasovan identity in Romania (Creţan et al. 2014), for the ethnic group of Carasovans it was important that Zagreb was designated the capital city of the newly state Croatia in 1991, because the formerly Yugoslavia's capital was Belgrade. This political change influenced the Catholic Carasovans to take a shift in their self-identification from Serbian to Croatian in the early 1990s (Creţan et al. 2014).

Moreover, place attachment is an important aspect for the local urban people, whether they are segregated or not (Imani Shamlou et al. 2016, Málovics et al. 2019). Therefore, the local people's place attachment in newly designated capital cities could be a variable that political actors have to take into consideration when changing a capital city. But besides the positive aspects brought by the local people's place attachment in the urban space, sometimes the corruption of the local political elites could be a barrier in the planning or in the progress of some urban areas from developing countries (Pourmohammadi et al. 2009, Creţan and O'Brien 2020).

Since the end of the Second World War, there were dozens of countries that have moved their capital cities (Ishenda and Guoqing 2019). The capital was moved for a variety of reasons, including socio-economic, political-security, and geographical considerations (Ishenda and Guoqing 2019). Moving the capital to a new city with appropriate design can be considered as a solution to different problems on a regional or national scale (King 1993). Brazil, Pakistan, Turkey (Valigholizadeh and Ahmadipour 2015), Switzerland, Germany (Figure 1) and Australia have the experience of transferring their capital, and some experts believe that the capital relocation plans in Switzerland (Bern), Germany (Berlin), and Australia (Canberra) have been successful and desirable (Von Beyme 1991, Ishenda and Guoqing 2019).

Figure 1. An example of the capital shift in the countries around the world. Source: Ishenda and Guoqing (2019)

However, these countries are industrial and advanced and they cannot be compared to Iran. A good case study for Iran could be Pakistan with its capital city Islamabad. In October 1959, the city was chosen as the new capital of Pakistan as a substitute of Karachi and the construction of the city began in 1961, but before the project was completed thoroughly, the capital was temporarily relocated to Rawalpindi, the centre of Army headquarters (Bin Abd Manan and Suprayitno 2020). The population of Islamabad increased from 204,000 people in 1981 to 380,000 people in 1995 and then to 2,098,000 inhabitants in 2017 (Bin Abd Manan and Suprayitno 2020). The population of Karachi (the former capital) has increased from 4 million in 1975 to 10 million in 1995 and to 14 million in 2018 (Bin Abd Manan and Suprayitno 2020) – so, the transfer of the capital has not prevented the growth of Karachi population (Mousavi and Bagheri

Kashkooli 2015). Islamabad, the new capital, has been added with a wide range of political functions at national and international scales, but Karachi remains the economic capital and its population is increasing steadily (Ahmed et al. 2008). Obviously, the concentration of population in this city reduces the possibility of adequately handling natural and human crises, so a large part of the population is constantly under threat (Ahmed et al. 2008).

In the case of Tehran, several internal surveys have been conducted on this issue. Mottaghi et al. (2015) have stated that capital transfer is necessary due to the overpopulation of Tehran together with the efforts for decentralisation as there are many natural and environmental crises that threaten the city. Mousavi and Bagheri Kashkooli (2015) have geographically analysed the socio-economic consequences of capital relocation and the necessary integrated management. The results of modelling the structural equations of the capital transfer demonstrate that if the capital is transferred, the economic focus will not happen in the new place due to the accumulation of investment in Tehran (Mousavi and Bagheri Kashkooli 2015). On the contrary, the transfer of some functions has a direct (0.73) and indirect (0.40) effect on the organisation of the city of Tehran in a way that the transfer of these functions reduces its concentration of population, traffic, investment, etc. (Mousavi and Bagheri Kashkooli 2015).

Finally, Mottaghi et al. (2015), in examining the dimensions of the political geography of a location selection and transfer of the capital in Iran, concluded that from the political geography perspective, the factors affecting the selection of the location of the capital include: core capabilities, spiritual value and cultural role of the capital's place, creating cultural unity and homogeneity or controlling cultural differences, the dominant national group or ethnic origin of the government, foreign communication, strategic and defence position, political compromise, geographical gravity centre position, access to internal communication and transportation routes, change in government approaches and policies, environmental conditions of the region, problems with optimal capital management, and security issues. Moreover, the most important factors of the capital's plan in Iran are the intensive population centralization, the economic focus, and its location on the earthquake fault (Ahmadipour and Valigholizade 2007, Ahmadypur et al. 2009).

Methodology

Study area

Tehran, the capital of Iran, is the largest city and the capital of Tehran Province with a population of 8,693,706 inhabitants (Figure 2). The area of the city is 751 square

kilometres and the population density in the capital is estimated to be 12,200 people per square kilometre (Statistical Centre of Iran 2016), making Tehran the twentieth most densely populated city in the world.

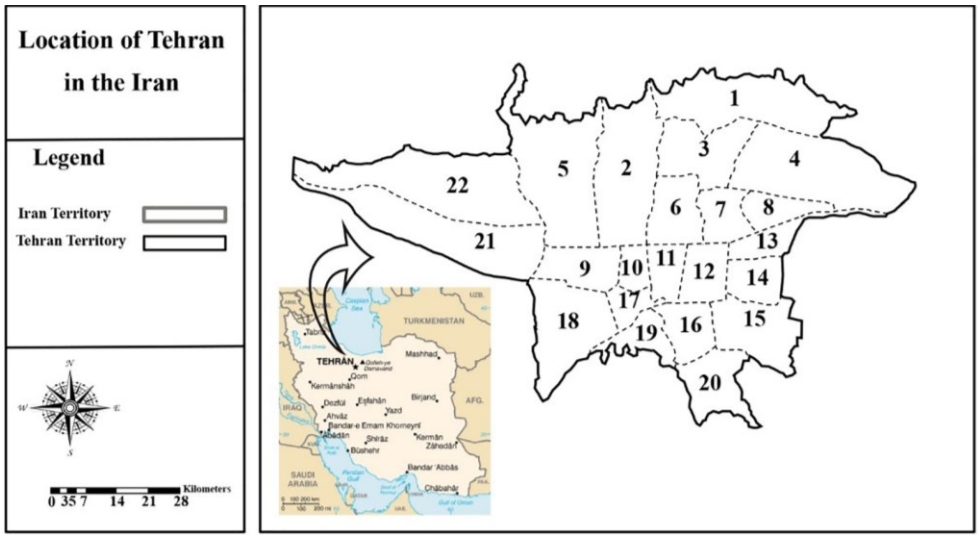


Figure **2.** *Location of Tehran at country level. Source: Statistical Centre of Iran (2016)*

The population of Tehran City has increased from 1,512,082 people in 1956 to 8,693,706 people in 2016, with a growth rate of 2.95% (Table 1). The rate of urbanisation has also reached 93.9% and, as a result, Tehran is increasingly crowded with immigrants from the surrounding provinces that are hoping to improve their economic life, leading to more urbanisation (Pilehvar 2021). Such population growth, in addition to social and economic problems, creates many political and security problems (Pilehvar 2021).

Table 1. *The population of Tehran City and the average annual growth (1956-2016)*

Year	Population	Average growth rate (percentage)		
		The period	Percentage	
1956	1,512,082	-	-	
1966	2,719,730	1956-1966	6.05	
1976	4,536,264	1966-1976	5.25	
1986	6,010,075	1976-1986	2.85	**2.95 %**
1996	6,758,845	1986-1996	1.18	
2006	7,864,682	1996-2006	1.53	
2011	8,154,051	2006-2011	0.73	
2016	8,693,706	2011-2016	1.29	

Source: Statistical Centre of Iran (2016)

The average annual population growth of Tehran during the periods of 1956-1966 and 1966-1976 has been higher than the average annual population growth of urban areas of the country. After a period of decline, the population growth rate has increased since 2006 (Figure 3). The demographic findings indicate that the population growth of Tehran has surpassed the growth of the implementation and the creation of various infrastructures so that it is currently facing many traffic problems, environmental pollution, and health, cultural, social, and economic problems (Ahmed et al. 2008, Mousavi and Bagheri Kashkooli 2015).

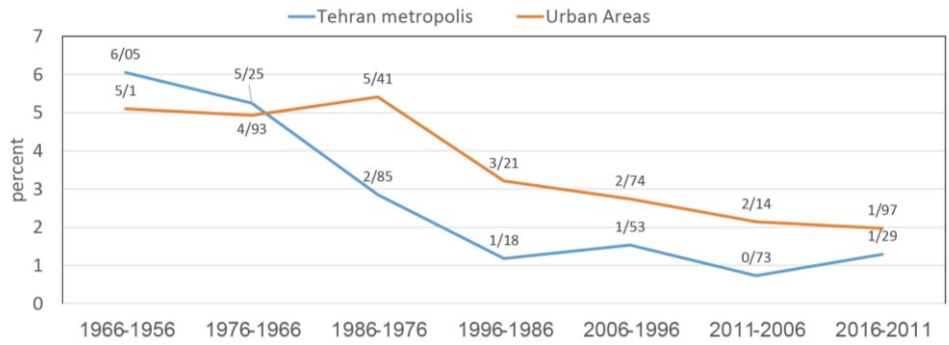


Figure 3. *Comparison of the average annual population growth in Tehran and the other urban areas of the country. Source: Statistical Centre of Iran (2016)*

Territorial assessment

According to the objectives of this paper and the studied components, this study is considered applied research and the method used is descriptive and analytical. Data collection tools are statistical documents and questionnaires. The examined indicators include: Demographic indicators (population, population growth rate, percentage of urbanisation); Economic indicators (GDP, employee rate, economic participation rate, number of industrial workplaces, value added of industrial workplaces, unemployment rate); Environmental indicators (gasoline consumption, volume of municipal waste, number of treatment plants); Infrastructure indicators (number of water branches, number of sewage network branches, number of electricity branches, amount of electricity sales, number of natural gas branches); Health indicators (number of ICU beds, number of CCU beds, number of health care and treatment networks, number of pharmacies, number of laboratories, number of patients with coronavirus); Defence and political indicators (number of military barracks, number of administrative-political centres, number of government employees). To analyse the data, statistical methods of spatial autocorrelation of Moran and Ripley's K function have been used. In order to analyse Moran and Ripley's K function, GIS software has been used. The research indicators were studied in the 31 provinces of the country.

Results and Discussion

Investigating the history of capital relocation in Iran

Iran is known as an ancient land that has repeatedly replaced and moved its central government since the Achaemenid period (Briant 2002). From the capital of Shush to Tehran, the centre has been relocated 13 times, during which 13 cities have been selected as the capital (Ahmadypur et al. 2009). Shush, Pasargad, Shiraz, Damghan, Ashkabad, Ctesiphon, Bishapour, Kazerun, Bukhara, Neishabour, Merv, Zaranj, Tabarestan, Isfahan, Hamedan, Rey, Ghazni, Samarkand, Herat, Gorganj, Maragheh, Tabriz, Ardabil, Qazvin, Sari, Mashhad, Kerman, and Tehran, have been the capitals of ancient Iran throughout history, some of which have been chosen as the capital only once and others as the capital several times (Ahmadypur et al. 2009). Governments such as the Achaemenids had several capitals for various uses (Briant 2002); and governments such as the Sassanians centralised their capital in one city (Table 2) (Mottaghi et al. 2015, Mousavi and Rahimi 2017).

Table 2. *The role of the effective factors in the location selection of the capital in the post-Islamic period in Iran*

Governments	Strategic position	Commercial – Economic	Communication position	Ethnic origin	Geographical factors
Abbasian	•	•			
Taherian		•	•	•	
Alawites	•			•	
Saffarian	•	•			•
Samanian		•	•		•
Ghaznavian			•		•
Seljuks	•	•	•		
Kharazmshahian		•			•
Ilkhanate	•	•	•		•
Timurids		•	•	•	
Safavid	•	•	•	•	•
Afsharid	•			•	
Zandian	•	•			•
Qajar	•	•	•	•	•

Source: Mousavi and Rahimi (2017)

In the Median period, Hegmataneh, or as it is called today Hamedan, was chosen as the capital and the city, in terms of its geographical security, was almost in an offensive and defensive position against the Urartians and the Arshaus; which means, it could control both fronts at the same time (Ahmadipour and Valigholizade 2007, Ahmadypur et al. 2009). Besides, Hegmataneh was located in an area almost central and neutral among other tribes inhabiting the Medes government – the city was located in the

centre of the national geographic gravity of the Medes (Ahmadipour and Valigholizade 2007, Ahmadypur et al. 2009). It also had the capability of a central zone in the country's geographic system and urban network as far as the total control of the Median capital on the geographical, political and cultural area of the country was the result of the special strategic position of Ekbatan in the political and spatial structure of the Median government (Ahmadipour and Valigholizade 2007, Ahmadypur et al. 2009). During the Achaemenid period, the reasons for choosing the capital to be the city of Shush was a result of its central position and its history of being the capital during the Elam period (Briant 2002). Choosing Babylon was partly due to its communication position and mainly due to its strategic position. The main function of this capital was to control the security of the country's western area, especially to control the separatist regions of Egypt, and choosing Ekbatan was mostly due to the control of the northern central regions as well as Asia Minor (Briant 2002).

Regarding the relocation and selection of the capitals, the Seleucid state pursued a policy that the later nineteenth-century European colonial governments used in their colonies, which was choosing their capitals in port cities to communicate with the mainlands (Mousavi and Rahimi 2017). Due to this fact, both capitals of this government had such a position. However, Antioch's choice was largely a matter of security and it had the feature of centrality for the Seleucids (Mousavi and Rahimi 2017). The Sassanian chose the cities of Ardeshir Khoreh and Madain (Ctesiphon) as their capitals (Mousavi and Rahimi 2017). When Khosro conquered the city of Antioch on the beach of the Antis River, in addition to the complete looting of this ancient capital, the Seleucids moved their population to Al-Madain to exploit their industrial skills for economic prosperity (Hafeznia 2002). The reason for choosing this city as the capital was to protect the western borders that were threatened by the Romans (Hafeznia 2002). Moreover, in this period, the selection of Ctesiphon as the main capital of the Sassanians is a reflection of the sensitive geopolitical position of this government and it was a strategic and geopolitical choice (Hafeznia 2002). Firstly, because of its history of being the capital during the Seleucid and Parthian periods having the high geopolitical central capability in the development of the urban network; secondly, it had a good offensive and defensive situation against the Romans and the Huns (Ahmadypur et al. 2009). In other words, due to its geographical location and geopolitical feature, this city played a crucial role in establishing the geopolitical balance against the Eastern and Western threats for the Sassanian government (Ahmadipour and Valigholizade 2007, Ahmadypur et al. 2009).

In general, in summarising the experience of transferring the capital in Iran, it can be stated that the most important reason for choosing and transferring the capital in ancient Iran was the security approach before anything else (Ahmadypur et al. 2009). In fact, the most important policy of the governments has been to control the country and to establish inter-territorial relations in the land. Respectively, the governments

would have to choose a location for the capital that could be responsible for maintaining and providing full control over their territory. The transfer of the capital in this period can also be the cause of this issue. In the different post-Islamic periods in Iran, from Taherian to Qajar, the main criterion for the location selection of capital cities in Iran has been based on the ethnic status of the ruling government. However, in some periods, such as during the Ghaznavid or Safavid governments, the capital selection, in addition to being close to the ruling ethnic group, was also influenced by the security and political conditions of its time.

When investigating the demographic and economic reasons for moving the capital in Iran, the macro purpose of relocating the capital is consciously and fundamentally related to state-building and the nation; the reasons for this conscious or subconscious action at the micro-level require necessary and obvious explanations. In other circumstances, the capital could be moved only to solve economic problems and crisis management in the country, in which case some national and regional conflicts may occur.

There are various reasons for relocating the capitals such as multipolar, historical, economic integration, national solidarity, and a lack of centralization. What matters in the country is the centralism that exists in Tehran, which has caused the central-peripheral situations (Shakoori 2016). The centralization of major economic, financial, and commercial resources and facilities such as large banking networks, money and currency, markets, companies, offices of companies and factories, capitalists, and large national and international traders has made Tehran to be the national economic leader. (Shakoori 2016) This economic focus is considered as the main factor in creating urban attraction for the immigrants to the capital.

Considering the country's gross domestic product, it indicates that Tehran Province is at the highest level of economic activities with 23.7%, equivalent to $89 billion, and it allocated a high concentration of economic activity to itself. The second province of Iran, counting oil resources, is Khuzestan Province with a share of 14.5% of GDP, and a revenue equal to 53 billion dollars. However, the development situation of this province has been overshadowed by the distance from the center, Tehran, and its peripheral locations. Isfahan Province is in the third place with a 5.7% share of GDP, equivalent to 21 billion dollars.

The comparison of the GDP of the provinces of Iran manifests the gap and inequality between the capital (Tehran) and other provinces. It can be said that these regional inequalities have created a wide range of unfavourable living conditions and adverse economic, social, and environmental consequences in the capital. Due to the occurrence of these conditions, incentive policies have been employed for economic activists to operate in less developed areas and industrial estates, especially for units operating 120 kilometres far from Tehran that have motivated them to distance themselves from

Tehran. However, it seems that capacities such as well-equipped transportation infrastructure, proximity to decision-making centres, large population, and great market of Tehran have made the economic activity to move to the neighbouring areas and not necessarily to the less developed regions. The result of such transfers has increased the average per capita income of the neighbouring provinces of Tehran (Figure 4).

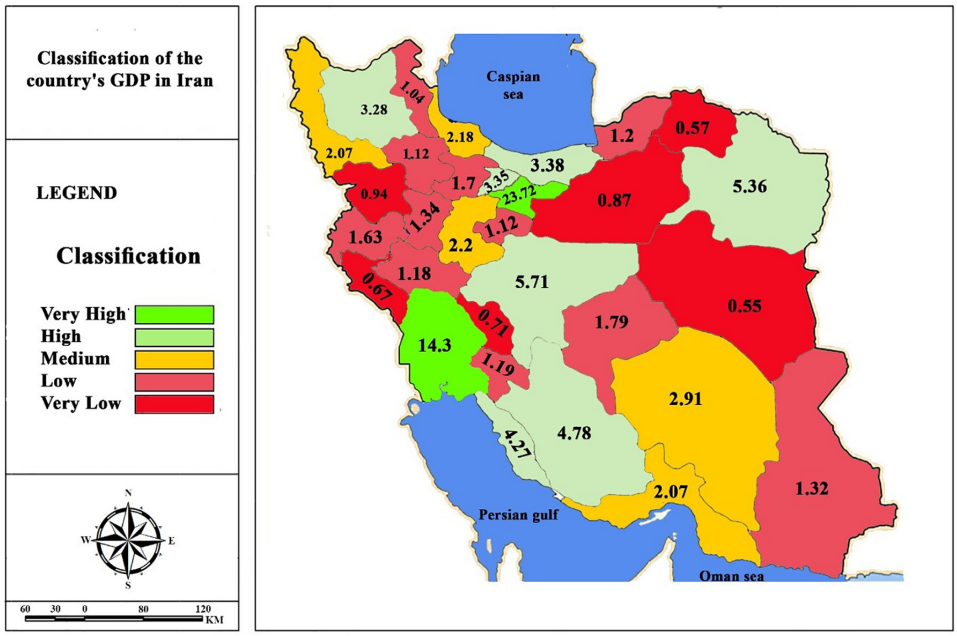


Figure 4. *Classification of provinces according to GDP values in 2016*

Another factor concerning the relocation of the capital is the alternative location for the old capital, which refers to a historical trend in the relocation of the capital. Overall, all of these factors are interrelated and they are also in line with the macro goals, namely government building and nation-building strategies (Keshtkar et al. 2019). Government building strategies have been taken into account with the idea of changing the structure of the government to improve the government ruling system and the relationship between the government and the effective units like Astana. This category includes economic integration strategies and decentralised political power in order to reduce economic inequality in the country (Rawat 2005).

What emerges from the economic situation of the provinces is that the economic activity has taken place only in the neighbouring provinces close to the city of Tehran, so the result has been the improvement of the economic situation of the neighbouring provinces, while the surrounding provinces are still economically underdeveloped. Also, the economic concentration formed in Tehran, which is the main goal of the

immigrants seeking for a job, has caused social crises such as the intense increase in immigration to Tehran, informal settlement, and social anomalies such as increased homeless people, increased poverty, crime, and unemployment. These reasons, along with the environmental and geophysical crises in Tehran are important reasons for relocating the capital to reorganise the current situation in Tehran. This happens because relocating the capital and getting close to underdeveloped areas can stimulate and accelerate the development of these areas (surrounding provinces). Another issue regarding the relocation of the capital is the decentralisation of political power. The argument is that relocating the capital will lead to the development of new transportation networks. It also makes the economic and social development of the surrounding areas possible and it improves the administrative capacities and capabilities of the centre and its surroundings.

Considering the strategies for nation-building related to redefining the idea of a nation, which means uniting the nation or creating a specific national identity within the country, is another issue that needs to be considered concerning the relocation of the capital. In the context of the capital's relocation from Tehran, government building strategies with nation-building features are of particular importance. Therefore, the strategies of unity and compatibility of the provinces with each other, and the integration of the government by locating in the right place to achieve the goals of all regions and historical identity are discussed. Provincial compatibility focuses on reconciling two or more ethnic, religious, and economic communities in the country. The argument and reason for the relocation of the capital from Tehran is its transfer to a neutral point considering rival groups, as it was the case with Washington in the United States, Montreal in Canada, and Canberra in Australia. Only then will regional tensions be reduced with the relocation of the capital.

The integrity of the state by being in the right place to achieve the goals of all regions is a response to the lack of clear boundaries defined between communities or groups in a cultural mosaic society. This is because the solution is not to find a geographical centre for the country, but to identify a place that can lead to the comprehensive development of the country and to solve the problems of the metropolitan city of Tehran and also to satisfy all political sides (Khazaee et al. 2015). Both the unity and compatibility of the provinces with each other and the integration of the government by being in the right place to achieve the goals of all regions play a significant role in creating a new national identity. In addition to being a tool for conflict management, moving from the capital city promotes national unity based on common interests in these cases.

Environmental and defence security reasons for relocating the capital in Iran

Although processes such as droughts, floods, and earthquakes can generally be classified as hazards caused by natural factors, their effects and damages depend

largely on human habitation and activity centres. According to the statistics available in the last four decades, 132 floods have occurred in the province and caused a lot of damage. The damage caused by floods and landslides is mostly caused by mistakes and non-observance of safety and scientific principles in the selection of settlements and facilities rather than by natural factors. Non-compliance with river boundaries and the development of settlements in flood-prone areas and sloping lands sensitive to landslides significantly increase the risks and damages caused by floods and landslides. Unlike floods and landslides, which are dangerous at the local level, the earthquakes threaten most areas of the province, especially Tehran city.

The density of the faults in the city of Tehran is higher than in other areas (Figure 5). At the eastern end of the province, fault lines are also seen. Most of the earthquakes in the province have also occurred on the fault strip in the direction of the Alborz mountain range in the northern half of the province. In some parts of the middle areas of the province, the faults are scattered and rarely seen. Therefore, fault sites are the most important areas with a high risk of earthquakes, and naturally, the areas close to the faults are also among the high-risk areas. The risk is generally reduced by getting distance from the faults. Due to non-compliance with the standards in construction and neglecting the seismic and landslide risks in the development of the city, as well as rising groundwater levels in the plain of Tehran, the damage caused by earthquakes and landslides in sensitive areas, and the damage caused by subsidence and liquefaction in the plains, can be associated with great disasters.

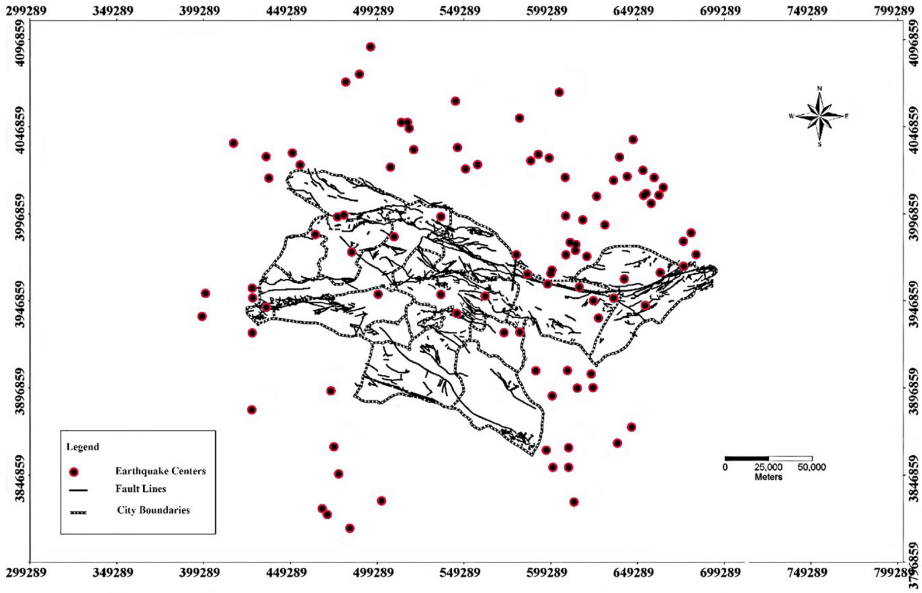


Figure 5. *Distribution of main earthquake centres relative to fault lines in Tehran Province*

Investigating the effectiveness of indicators in the need to move the capital

In order to study how to distribute the various demographic, economic, environmental, and security-defence indicators in the country, 31 indicators have been used separately from 31 provinces. Statistical studies show that Tehran, with a population of 13,267,637 people and an area of 13,640 square kilometres, has a population density of 972 people per square kilometre, which is the most densely populated province in the country. Furthermore, Tehran Province, with 3,864,188 people working in various economic sectors, has the highest employment rate in the country and it allocated a large share of GDP, 23.7% of the country's economic sections, to itself.

Studies of environmental indicators also show that the Tehran Province has a large share in the provincial transportation network with 4953 million litres of gasoline fuel so that more than 2.5 million vehicles cover about 70 000 kilometres of all types of intra-city roads in an area of 700 square kilometres of Greater Tehran. If the high share of the consumption of other fossil fuels, energy consumption of water, electricity, gas, etc. is taken into consideration, and all these cases are examined concerning the area of this province, it can be clearly understood that environmental issues such as air pollution, noise, and visual pollution will be the main concerns of the province in the coming years. Numerous factors are involved in the pollution of Tehran, among which geographical factors are more significant. On the one hand, human factors such as population and the establishment of factories in the city, especially in the west and southwest, have doubled the level of pollution in the city.

On the other hand, the city of Tehran has economically, politically, and administratively affected almost the entire country. In other words, the sphere of influence of the metropolis of Tehran engulfs the whole country, and all economic, political and administrative macro decisions are made in the city of Tehran. Economically, in Greater Tehran, macroeconomic benefits are obtained due to the concentration of production, with the special conditions of the metropolis of the Third World city. In this city, the return of capital with large profits is possible, and as a result, most of the capital flows to Tehran. Therefore, continuing this current situation leads to the backwardness of other geographical areas of Iran. Statistical studies demonstrate that in such circumstances, provinces with a common border with Tehran Province or provinces with the shortest distance from Tehran are in a better situation in terms of studied indicators. The findings indicate that the provinces of Isfahan, Markazi, Qom, and Semnan benefit the most from the advantage of the proximity to Tehran Province and they are in a favourable position in terms of indicators studied considering their population. Besides, provinces such as Khorasan Razavi, East Azerbaijan, Khuzestan, and Bushehr owe their development movements to their own capacities and potentials (e.g., pilgrimage sites, large commercial markets, and the use of oil and gas reserves). Thus, their regional impact for the surrounding provinces is less than in the capital.

Epidemic diseases are considered as another indicator that will lead to severe vulnerability of the city and ultimately the whole country if there is an imbalance in territorial planning and extreme centralism in a capital city (Narayan et al. 2022). The SARS-COV-2 virus has affected major cities, especially capitals (Figure 6). The most important reason for this is the intense concentration of population and economy in them. In addition, these problems have been fueled by an imbalance between focus and access to services (Zali et al. 2016).

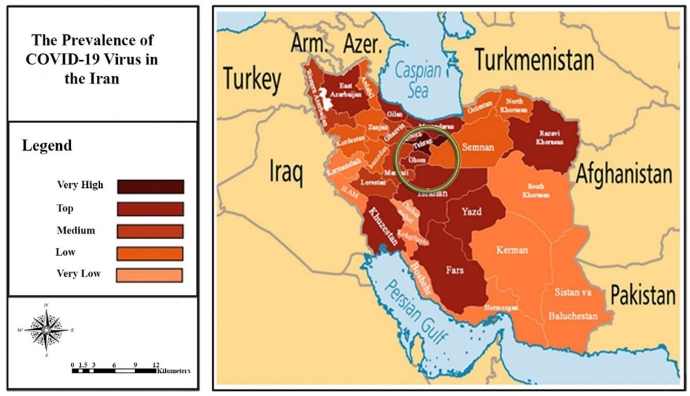
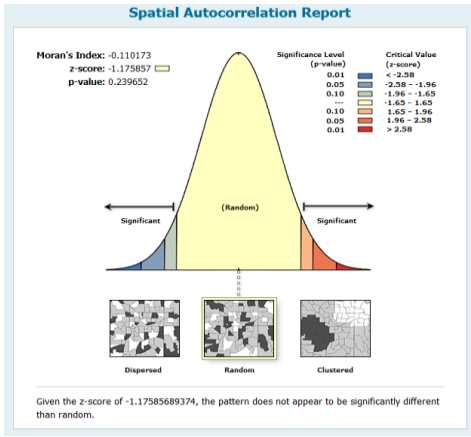


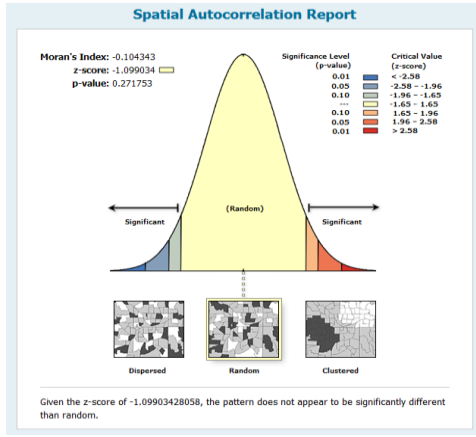
Figure 6. *The prevalence of SARS-COV-2 virus in the provinces of Iran*

The statistical study illustrates that Tehran Province has one ICU bed per 5870 people. In the current situation of the disease, it is possible to control these epidemic diseases, but in the case of a sudden outbreak of the disease, this province cannot certainly tackle the issue. These conditions are the same in all provinces of the country, with the difference that Tehran cannot be fully quarantined due to its capitalism and intense centralization of activities, while other provinces of the country can be fully quarantined. It can be said that if the distribution of activities in the country was formed in such a way that most economic and political activities were not concentrated in one city, it would be possible to deal with epidemic diseases much better, in a shorter period and with less vulnerability.

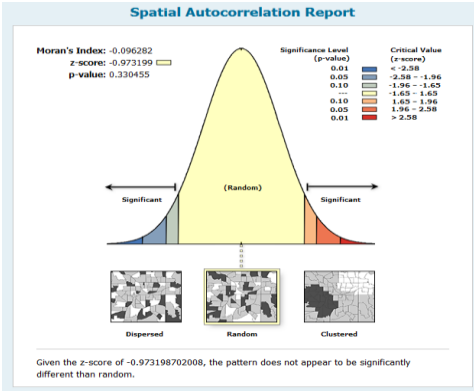
The Moran index and the spatial autocorrelation were used to analyse the distribution of demographic, economic, health, environmental, and defence activities in the country (Figure 7). The value of the Moran index for demographic indicators in 2016 is equal to -0.10 and the value of Z-Score is equal to 1.09, which is under the normalisation conditions. Since the amount of Moran index is negative, it can be said that the distribution of demographic indicators in the provinces of the country is not within a suitable distribution. Furthermore, inequality is increasing in demographic indicators with the centralization of services and facilities. Considering the economic indicators, the value of Moran is negative, which indicates the strong centralism of economic activities in Tehran and its surrounding provinces.



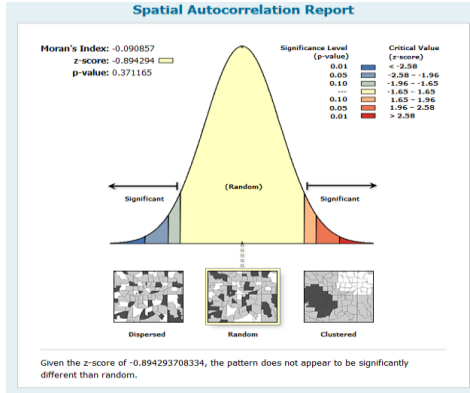
Demographic indicators in 2011



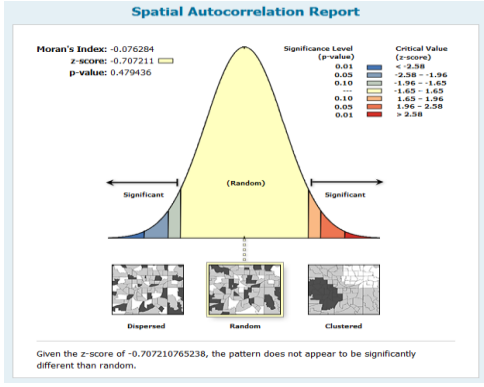
Demographic indicators in 2016



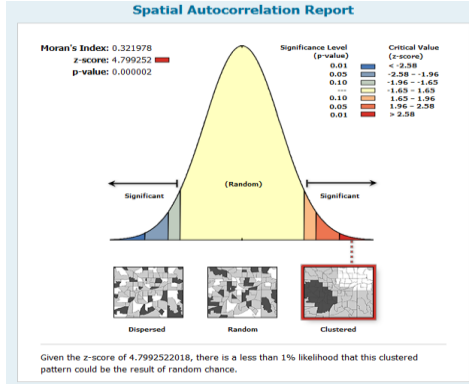
Economic indicators in 2011



Economic indicators in 2016



Defense-security indicators in 2016



Environmental indicators in 2016

Figure 7. *Moran spatial autocorrelation concerning different indicators in the country*

Environmental indicators also show the unfavourable situation of Tehran and the surrounding provinces. In 2016, Tehran played a crucial role in destroying the environment and in producing noise and air pollution by running 2224 industrial workshop units, producing 4953 million litres of gasoline per year, giving 14088 issued building permits, having 937546 urban wastewater subscribers. The aforementioned issues along with the probability of natural disasters like earthquakes and faults lead the way to human and environmental disasters.

Since the observed results are lower than the expected results curve (Figure 8), the data are more scattered at that distance which indicates a large gap between Tehran and other provinces in the examined indicators. This shows how spatial clustering (focusing on activity clusters) has shifted by getting distance from centrality, and the centre (capital) has faced intense centralism. However, the provinces surrounding Tehran have experienced positive economic and political consequences and they are in a better position regarding the development, but the surrounding provinces are still stuck with the phenomenon of centralism. Also, due to the weak mutual relations among the provinces, the movement towards development in these provinces is slow. The strategy of relocating the capital can improve the field of mutual communication among the provinces and it can provide the ground for the development of all provinces by decentralising the activities.

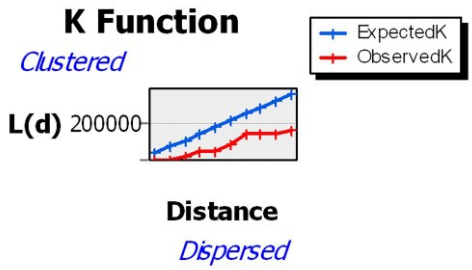


Figure 8. *The output of Ripley's K function*

Conclusions

One of the necessities of moving the capital from Tehran is to try to decentralise the urban system and to achieve the balanced development of the national territory (Dadashpoor and Alidadi 2017). The constant disharmony in the development of regions and regional inequalities has led to the complete separation and absence of apparent functionality of other cities of the urban system from the city of Tehran (Madanipour 2006). This is mainly due to the mechanisms governing the socio-economic and political structure of the country, as well as the accelerated urbanisation and disharmony in the development of large and small cities as a result of the

concentration of economic activities and service facilities in Tehran (Pilehvar 2021). Moreover, huge investments in Tehran have led to the expansion of various types of occupations, and the country's administrative-political centre has been concentrated in this city. These aforementioned factors can face Tehran with different problems including air pollution, noise pollution, traffic, and an increase in population density (Abareshi et al. 2020, Mirzahossein et al. 2021).

The Karachi-Islamabad model was in the middle of debates on moving the capital of Iran due to issues of national security and environmental degradation because of pollution and traffic congestion, while adding the risk of natural hazards (earthquakes, floods, landslides), in the context of intense urbanisation (Financial Tribune 2015, Mirzahossein et al. 2021). Considering also the current problem of economic centralization, decentralisation represents the best solution (Financial Tribune 2015) as only moving the capital to another location will in no way have positive consequences. If the capital is transferred, economic concentration will take shape in the new location and political decentralisation will not be achieved. Because of the geopolitical situation of Tehran, the segregation of political role-playing creates many crises. If the capital is transferred, population growth will intensify. Given that all facilities are concentrated in Tehran, environmental crises will intensify in a new place.

What needs to be considered in such a strategy is for the government to pay more attention to the country's macroeconomics, especially to the per capita GDP, as well as to long-term forecasts and programs for the development of the provinces because only macroeconomic stability can reach the stability in the economy of the whole country. Under such circumstances, any policy regarding the relocation of the capital will be easier in the future, and the economic and political stability of the country will not be disrupted.

Besides, during the relocation of the capital, giving the old capital new roles will reduce the development costs and it will make the resources of the old capital to be appropriately used continually. If part of the role of the new capital is maximised by the old capital, the responsibility of the old capital will be lessened and, consequently, the centralization of the activities will be reduced. The government should also plan a population policy in the form of population regulation and distribution, so that there is no population concentration in the new capital. Moreover, the government must decentralise the development to evenly distribute the economy and to prevent the recentralization of the economic activity in the new capital. On the other hand, the city of Tehran, as the largest centre of human, economic and political gathering in the country, is unsafe and unstable in terms of human and natural geopolitics, especially the possibility of earthquake occurrence. Thus, in terms of security issues, it is very sensitive and it is considered as a crisis centre in the country. Also, Tehran security is tied to national security, and any threat to Tehran can be a threat to the government.

Therefore, there is a close relationship between the national security and Tehran security. Tehran is considered as the capital city and one of the most important and strategic points of the country which is also the area of the concentration of Iranians' capital in terms of finance, specialised human resources, security, and politics. With the transfer of political centrality from this city, it is possible to take steps toward reducing its security burden and establishing permanent security in Tehran, followed by strengthening the national security.

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ACCESS TO WRITTEN CULTURE AS INDICATOR OF ECONOMIC DEVELOPMENT IN THE URBAN-RURAL INTERFACE OF BUCHAREST, ROMANIA

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Abstract: Written culture was always considered an indicator of civilisation. The aim of this paper is to analyse the distribution of development and of accessibility to written culture in the urban-rural interface (U-RI) of Bucharest, Romania, to assess their correlation and the impact of the current pandemic crisis. Based on the population's perception regarding their accessibility to written culture through the application of over 200 questionnaires, the analysis showed that bookstores and libraries are mostly competitors. The number of readers and read books is decreasing in the U-RI due to the lack of prioritisation of these services by the local authorities, as reflected in a general decreasing trend of the number of written culture users. The consumption of literature in new formats contributes to less place-dependent cultural services, especially in the high-income areas, while the Principal Component Analysis of cultural data demonstrates a clustering of localities in the U-RI that is strongly correlated with the economic and demographic characteristics of those areas. However, despite the increased accessibility to online, non-place-dependent written culture, the numbers of books read and bought in both physical and digital format had a generally decreasing trend during the pandemic.

Keywords:

written culture;
urban-rural interface;
cultural accessibility;
local development

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Introduction

Urban sprawl is currently changing the physical aspect of European countries at a growing rate, with over 480,000 km2 estimated to be transformed into urban space in the next 30-50 years (Piorr et al. 2011). This sprawl leads, however, to more problems, mainly by creating a new type of space, that is neither urban, nor rural, and in which the public administrations lack the necessary instruments to intervene and to generate development (Ianoș et al. 2016).

The urban-rural interface (U-RI), also called peri-urban area, suburban area, urban-rural fringe, rurban area, etc. (Ianoș et al. 2021), represents a unique type of human settlement, originating from the expansion of the city into its surroundings (Conzen 1960) and forming a transition zone between the urban and the rural environments that represents a new landscape in itself (Evert et al. 2010). Between the city, the U-RI and the rural hinterland, there are numerous flows, the population and capital flows being the most widely analysed (Tacoli 1998, Ianoș 2004, Ali and Varshney 2012, Yao et al. 2018), but cultural flows are also present (Repp et al. 2012, Ianoș et al. 2017, Merciu et al. 2019).

One of the main problems the U-RI faces is the fast growth of the population, which often causes problems for the municipalities that cannot provide the basic services at a so fast rate (López-Goyburu and García-Montero 2018), mainly due to the lack of legal and territorial instruments for intervention (Stoica et al. 2010, Suditu et al. 2014). This creates segregation problems and poverty cycles due to the lack of accessibility not only to physical infrastructure, such as transport, electricity, sewage systems, central heating, etc., but also to services like education, medicine, and culture (Ianoș et al. 2010). Those localities that can provide the urban services for the population will attract a higher income class of new residents, while lower income residents will move towards the less developed peripheries or to the ones with a lower environmental quality (Slemp et al. 2012, Iojă et al. 2014, Ianoș et al. 2017).

Culture is frequently associated with sustainable urban development, regeneration, and structural reconstruction (Ianoș et al. 2012, Bakogiannis et al. 2019). One of the predicting factors of the development level related to a settlement situated in the urban environment and the U-RI is the access to culture, because it can trigger sustainable, long-term development (Makropoulou and Gospodini 2016).

Cultural heritage represents the total tangible (monuments, old documents, individual collections, photographs, personal objects, newspapers, books, etc.) and intangible (history, stories, myths, poetry, music, foods, etc.) elements of an area (Corsale and Iorio 2014, Beel et al. 2017, Jenkins 2018). Cultural heritage is widely used as an economic instrument for local development (Felicetti 2016), as it can generate and communicate a strong symbolic meaning through different experiences (Scott et al.

2018), which in turn leads, among others, to a stronger local identity (Bamert et al. 2016), increased incomes at the local budget (Paresishvili et al. 2017), consolidation of administrative and political local power (Amit-Cohen and Sofer 2016), increased local resilience (Ianoș et al. 2014, Beel et al. 2017) and local economic diversification (Randeli and Martellozzo 2019).

Written culture stands on the fundamental act of writing, that itself stands at the intersection between material object, the social norm of contextualising it and the text itself (Lyons and Marquilhas 2017). It is one of the main indicators of the level of development of a civilisation since ancient history, where a preliminary form of writing appeared in Sumer and Egypt (Bywater 2013, Lyons and Marquilhas 2017). Albeit different, this evolved continuously until the invention of the printing press, when it accelerated in scope and distribution; based on the recent interpretations, it can be considered that a society is not civilised if it does not have writing at its core (Bywater 2013). One of the main solutions for reducing development gaps (including gender gaps) is to promote the improving of literacy inside societies by creating better educational structures shared through social interactions since the 1st grade (Genlott and Grönlund 2016).

Among the benefits of access to written culture we can name social and economic enhancement as follows. From the early progress registered at societal and commercial level by the introduction of mechanical machineries like the printing press (and its subsequent iterations), this shift in the written culture changed from a manual style of labour (actual transcription of text) to an industrial one, by also changing from local to global (De Grammont and Almada 2019). In the present day, access to new technologies is seen among the practices of written culture (Araújo et al. 2019). Moreover, access to written culture and education can act as a driver for creative and innovation sectors (Yiota 2020).

Based on the above, we can state that the main written culture output is the actual book itself. Perceived today at the crossroads of globalisation (via the exchange of titles and authors through translations and the ever-evolving methods of distribution) and new technologies (by evolving and transforming from the print format to an audio, electronic and a mix of experimental formats), the book is seen as a shape shifting object and the main access to getting books for an individual is either via the library or the bookstore (Crosby 2019, Mangen et al. 2019).

However, referring to access, the COVID-19 pandemic led to lockdowns and numerous restrictions all over the world (Murphy et al. 2022). Among the most affected sectors of the economy was the cultural sector. Museums, libraries, books stores, art galleries and other cultural edifices all over the world were closed and forced to move in the online environment (Flew and Kirkwood 2021, Kużelewska and Tomaszuk 2022).

The gaps between social classes widened as the access to culture was restricted, with the most vulnerable groups lacking access to the internet and technology or having limited skills in using them (Mojapelo 2020, Radermecker 2021). Those groups were also targets of conspiracy theories and lacked the necessary knowledge of differentiating between diverse information sources, or even of accessing the official information (Biddlestone et al. 2020). Amongst the most vulnerable groups in Central and Eastern Europe, there are the Roma people (Creţan and Turnock 2008, Creţan et al. 2020, Méreiné-Berki et al. 2021) but there are also other groups of disadvantaged people who do not have access to written culture (Gratton 2020).

The aim of this paper is to analyse the distribution of development and of accessibility to written culture in the U-RI, to see if there is a correlation between them and if this was widened by the current pandemic crisis. Cultural accessibility was not used before as a possible indicator of territorial development in the areas surrounding cities, this being the reason why those services are almost always among the last to come to the attention of local authorities in the areas affected by urban sprawl when territorial actions are taken (Stoica et al. 2010). There is a need to view access to written culture from a new perspective, correlated with the economic and social development of the U-RI, to understand its importance in reducing the gaps between the richest and the most vulnerable groups and in eliminating the problem of territorial segregation at the peripheries of the urban environment. This perspective has already generated positive changes inside cities (Cercleux and Merciu 2013, Merciu et al. 2019), but those were limited mostly to inner city areas (Vesalon and Creţan 2019), rural areas, or post-industrial sites (Voiculescu and Jucu 2016), with a focus mainly on tangible heritage and/or customs and traditions. The newly populated U-RI areas and the written culture were mostly ignored by scientific analyses, even though they are the most affected by cultural replacement and by the loss of local identity due to urbanisation (Manea 2021). Therefore, our main research question is whether the distribution of written culture accessibility in the U-RI is positively correlated with the local level of development in the wider urban system area.

Methodology

Study Area

The case study method was used to analyse the accessibility to written culture and its consumption in the U-RI. It's important to highlight the influence of the local context over the development of U-RI, in contrast with the national and global backgrounds. In this case, due to the diversity of local factors, it is a futile attempt to evaluate the accessibility and consumption of culture in the U-RI at a national or further global scale (Mortoja et al. 2020). The study area, thus, is represented by Bucharest and the first ring of localities around it (Figure 1). The city was chosen because of its size and its diversity

of peri-urban typologies and dynamics. As of 2021, the National Institute of Statistics (NIS) mentioned that Bucharest has a population of 2,158,169 people, where we also add the population of 287,213 inhabitants of the selected localities around the capital city for this study, thus having into analysis a total of 2,445,382 people. It is important to mention that this data excludes the undeclared residents (without Bucharest or related localities domicile), workers, renters or students who opted not to get a floating visa, thus living informally in the study area. However, we highlight that their number might impact the actual reading or book buying practices.

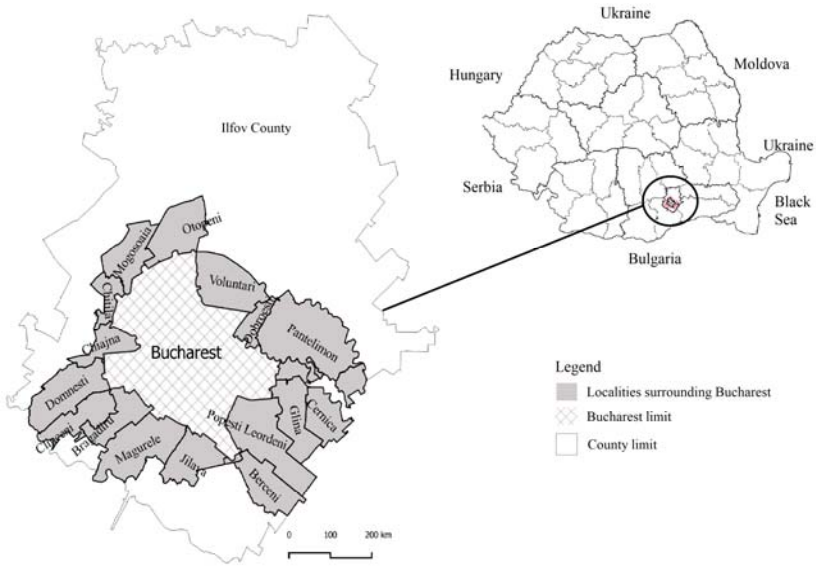


Figure 1. Study area and component localities. Source: ANCPI administrative limits

The evolution of urbanisation and urban sprawl in Romania has a long history that can be divided into different phases, each phase having a dominant direction of expansion and a certain category of population involved and creating a different U-RI typology (Ianoș 2004, Grigorescu et al. 2012, Suditu et al. 2014). In the communist period, population movements were strictly controlled, as well as any local investment. After 1990, with the transition to democracy and a consumerism approach, people got the right to move freely across the country, they recovered their lost properties, and they got the new right of having more than one residence (Ianoș 2004). As Rusu et al. (2020) observed, the free market was the main driving force of urban sprawl after the '90s, leading to open spaces loss, traffic congestion, higher pollution, and other environmental and social issues, such as the loss of place identity (Pătroescu et al. 2011).

Since 1995, the first phase of expansion in the U-RI of Bucharest began through a process of speculation by the acquisition of agricultural fields in the northern side of the capital by its richest residents (Ianoș et al. 2016). In 2000, those fields were

significantly transformed when the new owners began building holiday homes on them, transforming the landscape according to their urban ideal; the new residential areas were concentrated mainly in the northern side of the capital, in Băneasa, Otopeni, Voluntari, Pipera and Balotești (Suditu 2009, Iojă et al. 2014). In 2005, the new urbanism law helped to regulate the new developments (Suditu 2009); investments started to be directed towards multi-family buildings, following the main transport infrastructure and due to the financial accessibility, especially for the middle class (e.g., commune of Chiajna and town of Pantelimon, located near the west and the east main entrances to the capital city) (Stoica et al. 2010, Preda et al. 2022). At the same time, the economic crisis of 2008 brought back to Romania many workers that decided to stay as close to the capital as possible to have more employment opportunities – for them, new collective residential areas at a very low price were developed in localities with a poor environmental quality and/or lacking many basic services (e.g., Glina, Jilava) (Ianoș et al. 2010, Ianoș et al. 2012). After 2015, the urban sprawl continued in the northern direction for the high-income class, but a new direction appeared in the southern part, previously ignored by large developments, where the middle-income population is increasingly attracted (e.g., Popești Leordeni, Bragadiru and Berceni) (Ianoș et al. 2016).

These urbanisation phases of the U-RI comprised analyses focused on landscape and satellite images (Mihai et al. 2015, Ianoș et al. 2016, Stoica et al. 2021), but also indicators such as the purchasing power of the residents, the population increase rate and the living surface per person (Suditu 2009, Suditu et al. 2014), or the economic capital circuits in other cases (Lois González et al. 2016).

The difference in development in the U-RI can be also statistically analysed, using data from the NIS. The recent data show large discrepancies in: the living surface/person – with the northern part characterised by individual large villas, while the southern part has mainly collective buildings (Figure 2a); the population increase rate – the fastest growth being along the highways of Bucharest-Pitești in the east, Bucharest-Ploiești in the north, and Bucharest-Constanța in south-west (Figure 2b); and the average income/month – the richest population moves in the northern part, which is more developed and it has more natural space and amenities, compared with the southern part, where services are underdeveloped and it locates the waste of the capital city which is collected in landfills that affect the quality of the environment (Figure 2c) (Pătroescu et al. 2008).

Methods and Materials

The present study was conducted using approaches and materials of both quantitative and qualitative nature. Statistical data was collected from the public databases provided by the Romanian NIS, and it reflected the population dynamic of the U-RI, the access to public libraries and written culture consumption, the internet and

computer access and the construction sector in the area. The above-mentioned statistical data was complemented by information from Open Street Maps, Google Maps, the National Library of Romania, and Bucharest's Metropolitan Library, regarding the location of public and private libraries and bookstores. This quantitative data was statistically analysed and processed to determine the correlation between the local development, the population increase rate, the education accessibility and the use and consumption of written data. The analysis was rendered graphically using the Excel program and the Analyse-It extension.

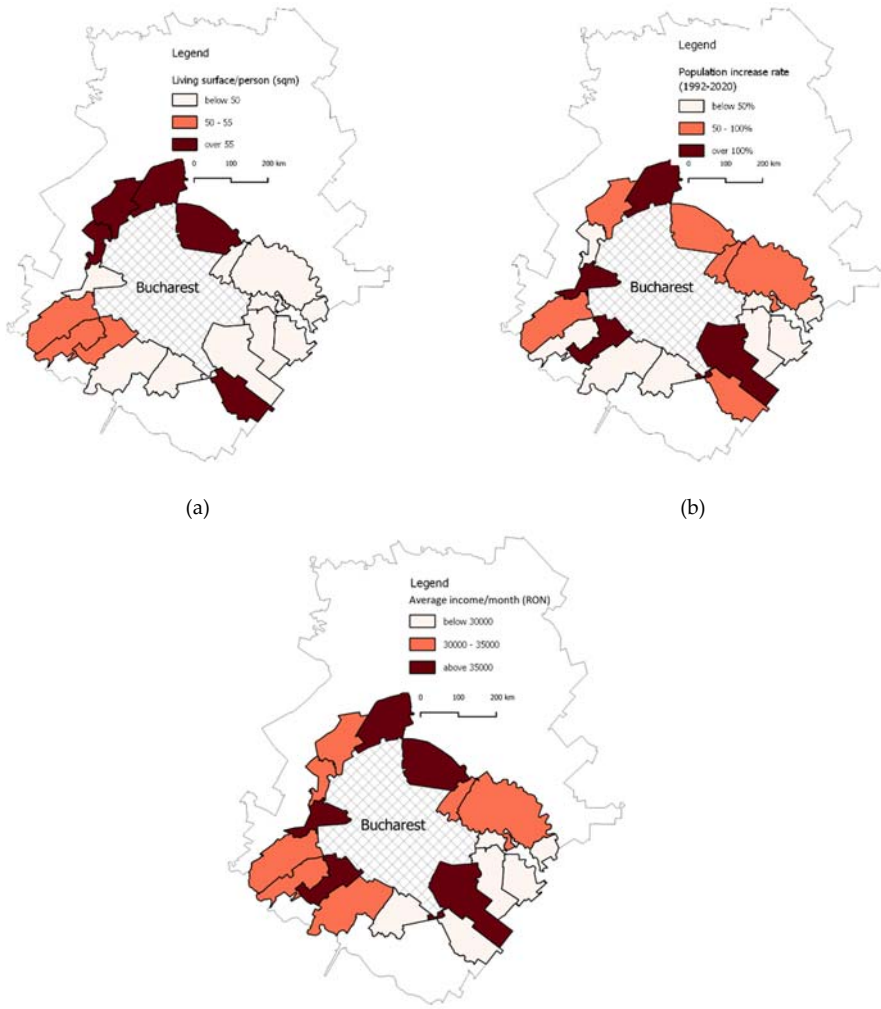


Figure 2. Classification of Bucharest's U-RI localities based on (a) living surface/person in 2020; (b) population increase in the 1992-2020 period; (c) average income/month in 2020. Source: NIS

One limitation of this data is that, during 2020 and 2021, there are no statistics collected regarding libraries, readers, and access to books and written culture, because most institutions were closed during the Covid-19 pandemic. Therefore, for this period, to assess the written culture consumption in the U-RI, a questionnaire was developed. This questionnaire was applied online, on a sample of 203 people, using the Google Forms application (due to its accessibility), and multiplied using Facebook local groups in the timeline of 1-15 August 2021. The questionnaire was structured in three parts, aiming to assess the access to written culture before, during and after the pandemic. So, the current results for bookshops are generated from the data of the Romanian National Institute of Statistics, while the results for literature consumption and the population's perception on the accessibility of written culture are from the applied questionnaires.

Some limitations of the questionnaire are the low response rate in some localities around Bucharest, where the statistical data also shows a higher rate of poverty and underdevelopment (e.g., Glina, Jilava, Clinceni). Also, there are more women than men that answered (Table 1), as they are more open to this kind of social media interaction (in February 2021, 78% of women used social media in the US, compared with 66% of men) (Pew Research Center 2021), while people aged over 65 years old were not represented mostly due to their lack of digital skills (in 2019, across EU, people between 65-74 years old used the internet three times less than the entire group between 16-74 years old) (Eurostat 2021).

Table 1. Profile of resăpondents to questionnaire

Gender			**Age (years)**			
Female	Male	No answer	Under 25	25 to 44	45 to 65	No answer
76.35%	23.16%	0.49%	10.34%	68.47%	20.69%	0.49%
155	47	1	30	139	42	1
Studies						
Gymnasium	High school	Professional school	University	Post-university	No answer	
1.97%	16.26%	3.45%	44.84%	33.00%	0.49%	
4	33	7	91	67	1	
Living time in the same locality						
Less than 1 year	1 to 5 years	5 to 15 years	More than 15 years	No answer		
7.39%	24.14%	37.44%	29.56%	1.47%		
15	49	76	60	3		

It is also true that, quantitatively, women read more than men (as they buy around 80% of the novels, except science-fiction, fantasy, and horror books, where men are more avid readers), a figure that made a reputable British newspaper state: "without women the novel would die" (Thomas-Corr 2019). Qualitatively, the reading practice of women is to take time to focus on the understanding of the text, when compared with

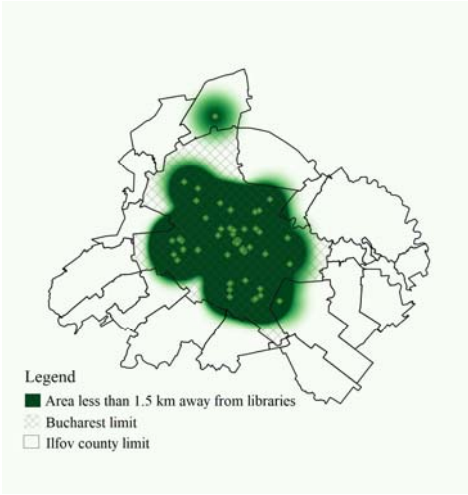
men who read hastily (Eman and Youssef 2012). Moreover, there is a strong bias regarding the respondents, as those people who use libraries and bookstores on a regular basis are more probable to respond, than those that had never opened a book in the last few years. Despite these study limitations, the applied questionnaire qualifies as a good method of comparing the accessibility and consumption trends of written culture before and during the pandemic, as well as the main demand trends for the future.

Results

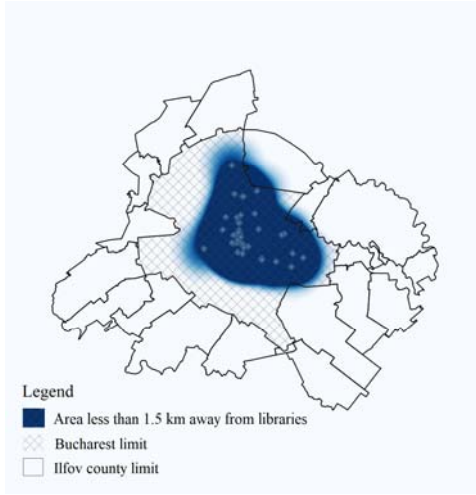
Cultural accessibility in the urban-rural interface of Bucharest

When analysing the location of public and private places who provide books (Figure 3), it is clearly observed that the epicentre of accessibility to written culture is represented by the centre of Bucharest (as a note, every library/bookshop is coloured at a radius of 2 km). Although the accessibility to libraries (Figure 3a) is aligned uniformly in all central areas of the capital city, except for peripheral areas, in the interface only in the northern side (Otopeni) we encounter public libraries. On the other side, related to actual bookstores (Figure 3b), we see the area decreasing in size, and the periphery actually taking almost half of the actual map in its lack of access to book shops. The most crowded area is in the west and north part of the capital, with the centre again being the place with the presence of most bookstores. However, hypermarkets and malls provide an alternative to book buying for the residents all over the city. The shopping centres and malls offering books in Bucharest and its U-RI represent selling points that are encountered in all its six sectors, and, acting opposite to bookshops and libraries, they do not share the same location (Figure 3c). On the contrary, in the centre of the capital there are more galleries, museums and art shops, with an exception in Mogosoaia. Based on the three maps, we can see clearly that the center area is the most important point of access to written culture for the capital city and its surrounding localities.

From 1995 to 2019, according to the Romanian NIS (Figure 4), the number of libraries in the U-RI of Bucharest has fluctuated, with a general decreasing trend. Most libraries are found in Voluntari, which has grown from one library in 1995 (like all the rest of the localities studied here), to 14 libraries in 2018 (in 2019 this number decreased with two), because of the large public investment in cultural facilities from the authorities. Also, there are many private educational units located in Voluntari and which have their own libraries. In 2019, there is only one library in Dobroești, Măgurele, Domnești, Chaijna, Chitila and Mogoșoaia; two libraries in Pantelimon and Clinceni; three libraries in Otopeni, Glina, Popești Leordeni and Berceni; and four libraries in Cernica and Jilava. By comparison, Bucharest, which grew from 387 libraries in 1995 to 441 in 2002, still had a total of 355 libraries in 2019.



(a)



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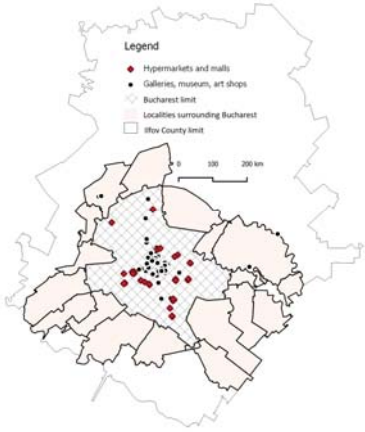


(c)

Figure 3. Accessibility to (a) libraries, (b) bookstores and (c) shopping centres and malls offering books in Bucharest and its U-RI. Source: Open Street Maps, edited in QGIS

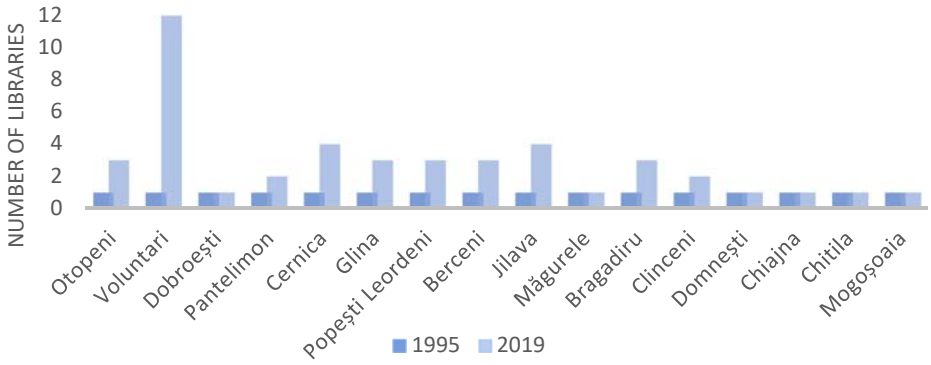


Figure 4. Number of libraries in the U-RI of Bucharest in 1995 and 2019. Source: NIS

Although Voluntari has the highest increase in the number of libraries, when referring to the change in the number of books in the libraries from Bucharest and its U-RI in the 2011-2019 period, Cernica has the largest increase, of 220%, followed by Jilava with 145.6% and Domnești with 76.8%. Bragadiru and Berceni are coming next, with a 48.6% and 40.4% increase, followed by Popești Leordeni (22.1%), Voluntari, at a slight difference of 20.5%, and Dobroești (18.5%). The positive change list is closed by Măgurele, with a 11.3% increase, and Pantelimon with 10.1%. On the opposite side, there is a dramatic decrease for Chitila (-70.2%), Glina (-65.8%) and Chiajna (-58.2%, despite its population increase of almost double), with lesser losses for Clinceni (-12.8%) and Otopeni (-6.9%). Surprisingly, Bucharest is on the negative change too, with a decrease of -3.4%.

These differences between localities regarding the number of books reflect the administrative investments, the education levels of the population, as well as the skills and the lifestyle of the new residents of the area. One exception to this is Jilava, where a possible explanation for the increase in the number of books is the existence of the penitentiary, where prisoners can get their sentence reduced if they write one or more books (an activity for which they also require some other book sources).

The positive increases in the total number of books over the years are also seen in the rising number of readers (Figure 5) in localities such as Jilava (600% more readers on a 145.6% increase in the number of books, as seen above), Cernica (195.1%) and Bragadiru (146.5%). Growing numbers of readers have appeared also in Voluntari (56.3%), Măgurele (44.3%), Otopeni (37.9%) and Berceni (35.4%). The smallest increase is found in Popești Leordeni (18.8%). There are more localities on the negative trend regarding the readers than the actual number of books, as seen in Mogosoaia (-72%), Glina (-60%), Chiajna (-54%), Dobroești (-48.6%), Clinceni (-47.2%), Domnești (-41.2%), Chitila (-22.2%) and Pantelimon (-13%). Bucharest is at a decrease of -23%, with an average for the total interface of a still positive 25% trend, but not as high as the first localities. This might be an indication of a less place-dependent consumption of written culture in those localities, with the transition to the use of virtual bookstores and new book formats instead of physical libraries, which are scarce and usually not updated with the newest books required by the population.

In terms of books borrowed per reader (Figure 6) in Bucharest and its U-RI in the 2011-2019 period, Dobroești has the record with 20.4 in 2011 and 16.2 in 2014, but it has a decrease to only 5.5 books in 2019. This trend is generally available to all localities. It is a decreasing trend generally, although in some localities (e.g., Popești Leordeni) it is more constant than in others (e.g., Bragadiru, Chitila, Mogoșoaia), where the decrease is considerable.

Regarding the accessibility or the desire to have access to a library in the Bucharest's U-RI (Table 2), the questionnaires showed that there is a general trend of decrease

between 2019 and 2020, with the highest gaps being in Pantelimon (29.6 in 2019 versus just 3.7% in 2020), Otopeni (50% versus 10%), Berceni (25% versus 8%), Chiajna (46.7% versus 13.3%) and Mogoșoaia (33.3% versus 13.3%). There are stable examples, like Domnești (33.3% in both years), Popești Leordeni (12.5%), Cernica (25%) and Bragadiru (14%), and exceptions where we see an increase (e.g., Jilava which doubled from 20% to 40%, and Clinceni with a small increase from 20% to 25%).

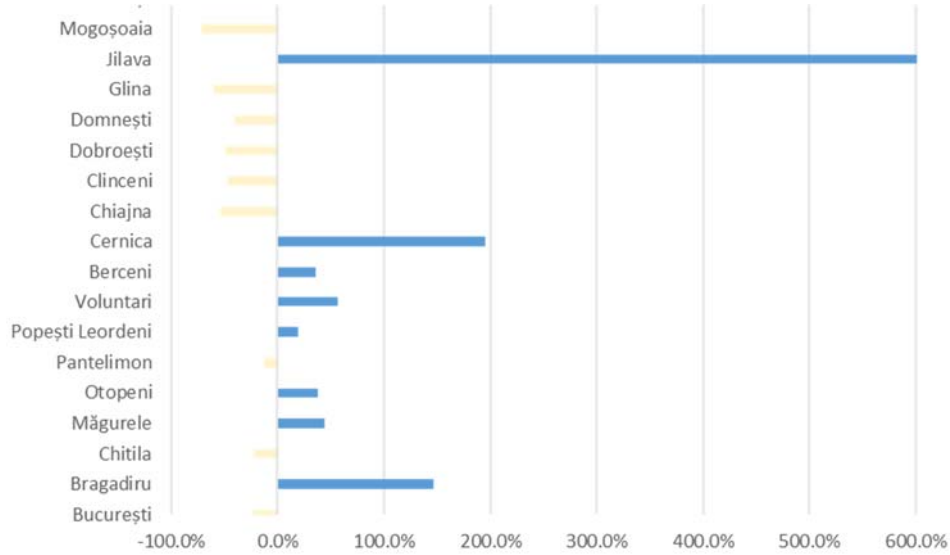


Figure 5. Dynamics of the number of active readers in Bucharest and its U-RI in the 2011-2019 period. Source: NIS

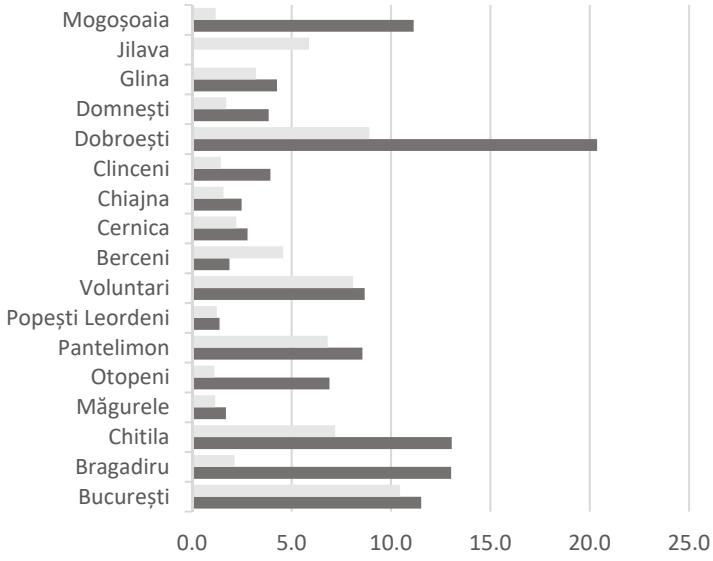


Figure 6. Books borrowed per reader in Bucharest and its U-RI in 2011 and 2019. Source: NIS

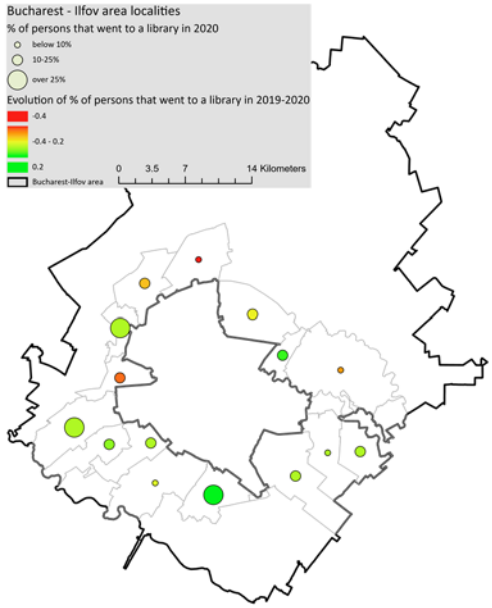
Table 2. Percentage of respondents that had access to a library or wished to have access, in 2019 and 2020, and that ordered at least one book online before the pandemic in Bucharest's U-RI

	People that went to a library		People that wished that they had access to a library		Books ordered online before the pandemic
	2019	**2020**	**2019**	**2020**	
Berceni	25%	8%	47%	43%	94%
Bragadiru	14.0%	14.0%	71.42%	42.85%	100%
Cernica	25.0%	25.0%	75.0%	50.0%	75.0%
Chiajna	46.7%	13.3%	46.7%	40.0%	66.7%
Chitila	50.0%	50.0%	50.0%	50.0%	50.0%
Clinceni	20.0%	25.0%	80.0%	60.0%	80.0%
Dobroești	0.0%	12.5%	50.0%	25.0%	50.0%
Domnești	33.3%	33.3%	33.3%	33.3%	100.0%
Glina	0.0%	0.0%	50.0%	0.0%	50.0%
Jilava	20.0%	40.0%	80.0%	40.0%	60.0%
Măgurele	14.3%	7.1%	28.6%	21.4%	64.3%
Mogoșoaia	33.3%	13.3%	46.7%	33.3%	93.3%
Otopeni	50.0%	10.0%	20.0%	20.0%	50.0%
Pantelimon	29.6%	3.7%	37.0%	44.4%	70.4%
Popești Leordeni	12.5%	12.5%	43.8%	25.0%	81.3%
Voluntari	26.3%	15.8%	63.2%	68.4%	73.7%
Average	25%	18%	51%	37%	72%

Source: processed data from the questionnaires

Regarding the persons who wished that they had access to a library (Figure 7), the trend resembles the first iteration of the actual access in terms of decrease, however the percentages are higher in comparison. For example, in Bragadiru, 71.42% of the respondents wished that they had access to a library in 2019, versus 42.85% in 2020; in Cernica, the difference is between 75% and 50%, while in Clinceni, between 80% and 60%. Like in the first situation, there are cases of stagnation, such as Chitila (50% in both years), and Otopeni (20% in both years) and two cases of increase (e.g., Pantelimon from 37% to 44.4% and Voluntari, with a small increase from 63.2% to 68.4%).

On the opposite side, regarding the actual lack of physical access in getting books, there is a general trend of buying books online as a preferred method of getting access to written culture, with Bragadiru and Domnești having each a 100% rate, while just 14%, respectively 33% percent of their inhabitants were using the library system in 2019, even before the pandemic. The data from all localities show at least 50% of people choosing to order books online, with percentages scoring higher in some of them (Berceni 94%, Mogoșoaia 93.3%, Popești Leordeni 81.3% and Clinceni 80%). Overall, this is the highest average for getting access to books, 72% of the total respondents choosing this method, in contrast with the actual average access to libraries of 25% in 2019 versus the lower 18% in 2011.



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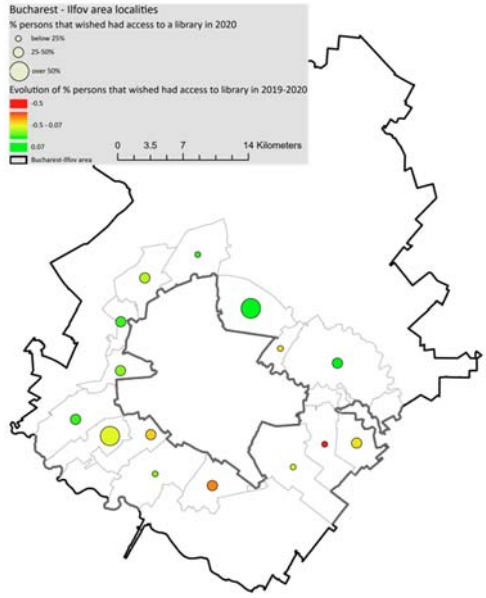

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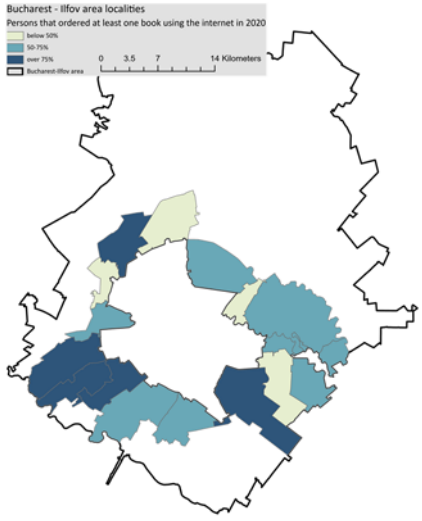


(c)

Figure 7. Population of Bucharest's surrounding localities, in 2020 and 2019-2020, based on: (a) access to a library; (b) wish of having access to a library; (c) number of books ordered online. Source: own data based on questionnaires

The data reflect the skills of the readers, as most showed abilities to use the internet and the online sources for acquiring books even before the pandemic. With the increase in the online sources and the movement of libraries and bookstores in the online environment after the closing of their physical locations, most previous readers did not feel the need for those facilities as they could get new books from the comfort of their homes.

In the Bucharest's U-RI, the questionnaires also showed a decreasing trend (Figure 8), with an average of 15.38 versus 12.23 books read in 2019 versus 2020, with the highest average in Bragadiru (20.14 in 2019 and 17.29 in 2020), followed by Mogoșoaia (20.6 versus 17.4) and Popești Leordeni (17.88 and 13.25).

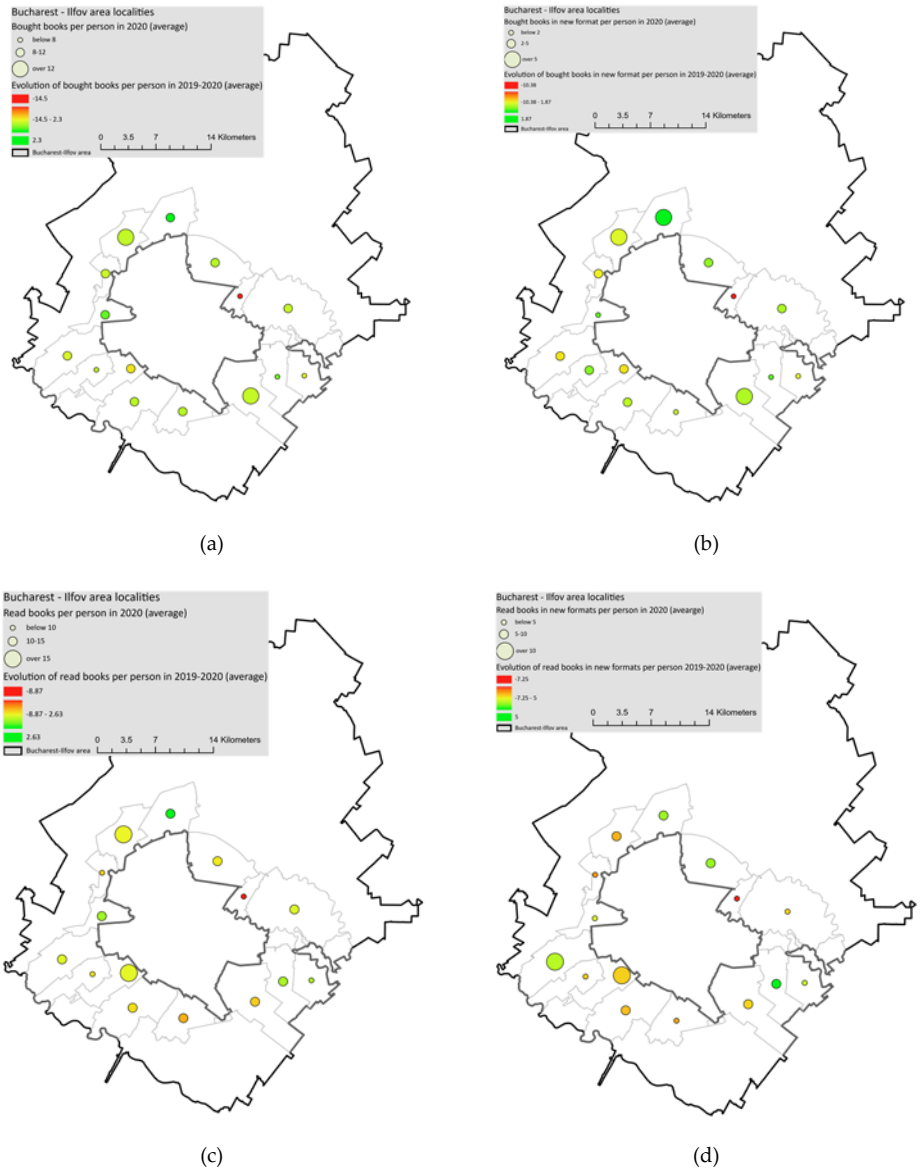


Figure 8. Average number of books: (a) bought, b) bought in new formats (e.g. e-book, audiobook), (c) read, (d) read in new formats, in Bucharest's surrounding localities, in 2020 and 2019-2020. Source: own data based on questionnaires

Regarding the books in a new format (e-book, audiobook or even books as podcasts), the highest number per person is still in Bragadiru, with 14.57 in 2019 and 12 in 2020, and the lowest number in Chiajna, with 5.2 in 2019 and 4.53 in 2020. Overall, the average is surprisingly decreasing, despite the limited access to bookshops and libraries, being 7.93 in 2019 and 6.03 in 2020. However, regarding the practice of buying books, the numbers are a little lower, the average being 14.14 in 2019 and decreasing to 9.89 in 2020, due to the lockdown and other unstable events in the book market that heavily affected the related industry in Romania. In 2020, the Romanian Association of Publishers announced a decrease of over 70% in the book trade value (Iancu 2020). Regarding the books bought in a new format, again, the numbers are low, with 6.38 in 2019 and just 3.50 in 2020, probably because of the increase in the platforms offering books in new formats for free (e.g., Humanitas library in Romania offered 45 free e-books in the first months of the pandemic).

Regarding the access to culture during the Covid-19 pandemic compared with the year before, in the perspective of the residents of Bucharest's U-RI (Figure 9), 45% had the

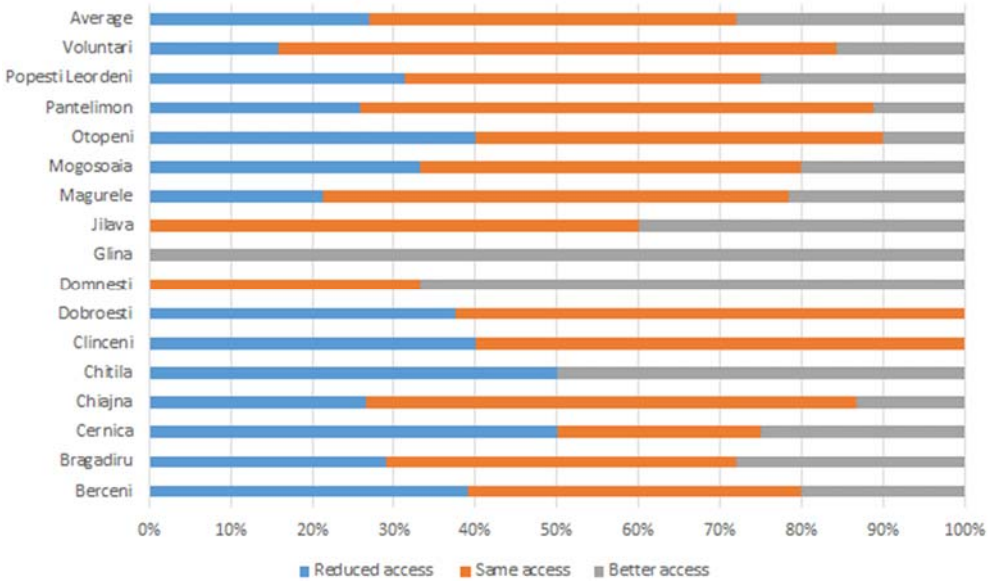


Figure 9. Access to culture during the Covid-19 pandemic compared with the year before, in the perspective of the residents of Bucharest's U-RI. Source: data from questionnaires

same access, while 28% had better access and 27% a reduced access. Cernica and Chitila had the highest reduced access of 50%, while Voluntari (68.4%) and Pantelimon (63%) had the same level, with better access for Glina (100% and Chitila (50%). This also reflects the development level of localities: (a) the ones that attracted a high-income population before the pandemic saw no difference because the residents relied on the online sources for access to written culture; (b) those with a middle-income population showed an increase of accessibility during the pandemic with the highest number of

book acquisition methods and the highly developed digital skills of the population; while (c) those localities with a low-income population showed a decrease in accessibility due to the movement of cultural services in the online environment and the general lack of digital skills of their residents.

Written culture accessibility as a possible indicator of urban sprawl and segregation

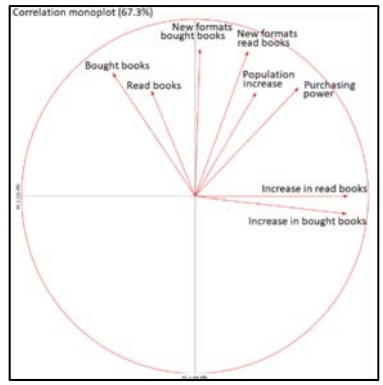
A Pearson correlation analysis of the quantitative (statistical) and qualitative (questionnaire gathered) data with the local purchasing power was attempted. The local purchasing power was chosen as the indicator of local development because it reflects not only the economic prosperity of the localities, but also the social structure of the U-RI. The analysis showed a high multiple R for all the three analyses (only quantitative, only qualitative and all data), with values higher than 75%, indicating that the variation in the purchasing power can be explained by the variation in the written cultural accessibility and usage. However, the p-values were greater than 0.05, which indicates that there is insufficient data to draw a conclusion, mostly due to the low sample of localities and their high local diversity.

The correlation analysis, although inconclusive due to the high p-values, shows that the purchasing power is positively correlated with almost all indicators that we extracted for measuring cultural accessibility and consumption (Table 3). This also shows that there is a strong positive correlation between the number of libraries, the number of available books and the number of readers, which is encouraging for those administrative units that want to invest in providing more such facilities (Figure 10a). Regarding the importance of bookstores, there is a strong correlation between the number of books bought and read, so again providing book purchasing facilities and places can lead to major improvements in this aspect (Figure 10b). The final correlation monoplot showing all indicators and the relationship between them (Figure 10c) displays that: (a) there is a positive correlation between the purchasing power and the use of new book formats (e-book, audiobook, etc.); (b) there is a negative correlation between the increase in population and the increase in the number of readers; and (c) there is a negative correlation between the number of books existent in the libraries and the number of books bought by the people from bookstores. This indicates that bookstores and libraries are to a great extent in competition, so it would not be advisable to do major investments in both, as the same result can be achieved only through the means of one. Also, the local administrations could not keep up with the increase in population regarding the provision of access to written culture, as the poor or uneducated population is the main source of demographic increase in the peripheries, and the high-income population no longer depends on the local authorities to provide access to literature, using the newly formats of publication which are no longer dependent on a physical location.

Table 3. Pearson's correlation r values between all indicators used in the analysis (quantitative and qualitative data)

Pearson's r	Purchasing power	Population increase	Increase in bought books	Increase in read books	New formats bought books	New formats read books	Bought books	Read books	Increase in readers rate	Books borrowed per reader	Readers	Books number	Libraries	Existing volumes	Borought volumes
Purchasing power	-	0.661	0.387	0.355	0.593	0.565	0.103	-0.009	-0.264	0.021	0.467	-0.387	0.071	0.084	0.185
Population increase	0.661	-	0.046	0.199	0.318	0.460	0.023	0.315	-0.156	-0.161	-0.136	-0.221	-0.136	-0.180	-0.170
Increase in bought books	0.387	0.046	-	0.828	-0.101	0.208	-0.290	-0.158	-0.084	-0.455	0.531	-0.352	0.074	-0.052	0.047
Increase in read books	0.355	0.199	0.828	-	0.015	0.288	-0.321	-0.047	-0.121	-0.560	0.489	-0.083	0.032	0.032	-0.097
New formats bought books	0.593	0.318	-0.101	0.015	-	0.688	0.600	0.167	-0.336	0.208	0.194	-0.071	-0.062	0.101	0.045
New formats read books	0.565	0.460	0.208	0.288	0.688	-	0.357	0.461	-0.450	-0.019	0.097	-0.440	-0.146	-0.180	-0.092
Bought books	0.103	0.023	-0.290	-0.321	0.600	0.357	-	0.554	-0.140	0.170	-0.284	0.099	-0.118	-0.156	-0.049
Read books	-0.009	0.315	-0.158	-0.047	0.167	0.461	0.554	-	-0.067	-0.287	-0.512	0.008	-0.120	-0.346	-0.251
Increase in readers rate	-0.264	-0.156	-0.084	-0.121	-0.336	-0.450	-0.140	-0.067	-	0.036	0.125	0.679	0.284	0.068	0.100
Books borrowed per reader	0.021	-0.161	-0.455	-0.560	0.208	-0.019	0.170	-0.287	0.036	-	0.094	-0.137	0.197	0.241	0.446
Readers	0.467	-0.136	0.531	0.489	0.194	0.097	-0.284	-0.512	0.125	0.094	-	0.002	0.583	0.644	0.624
Books number	-0.387	-0.221	-0.352	-0.083	-0.071	-0.440	0.099	0.008	0.679	-0.137	0.002	-	0.220	0.245	-0.010
Libraries	0.071	-0.136	0.074	0.032	-0.062	-0.146	-0.118	-0.120	0.284	0.197	0.583	0.220	-	0.848	0.894
Existing volumes	0.084	-0.180	-0.052	0.032	0.101	-0.180	-0.156	-0.346	0.068	0.241	0.644	0.245	0.848	-	0.857
Borought volumes	0.185	-0.170	0.047	-0.097	0.045	-0.092	-0.049	-0.251	0.100	0.446	0.624	-0.010	0.894	0.857	-

(a)



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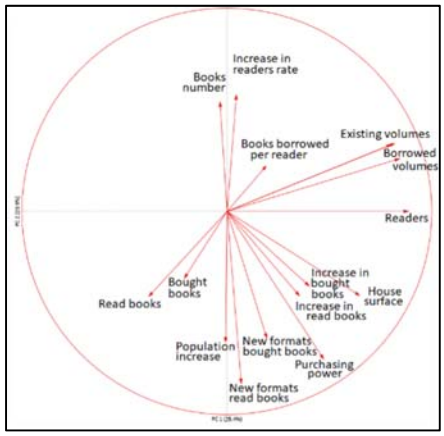

(c)

Figure 10. Correlation monopolots for: (a) the statistical data; (b) the questionnaire gathered data; (c) all data

By using the Principal components analysis (PCA), even though it is not statistically relevant to make predictions regarding the impact of written culture on local development, some clusters can be observed (Figure 11). This way, the similarities between different localities can be highlighted:

- Bragadiru and Chiajna are different from all other suburban communities, as they gained the most population and, at the same time, they fell behind with improving their accessibility to written culture. The new residents keep their customs and their urban lifestyles, so they continue reading on a constant basis, but they are partially dependent on the city for this service.
- Chitila, Clinceni, Măgurele, Pantelimon, Glina and Dobroești form another cluster. Those are the U-RI localities that do not meet their true potential regarding development. They lack not only access to culture, but also access to infrastructure and other basic services, so they are completely dependent on Bucharest from this point of view. However, the population

in this area is strongly connected to Bucharest from an infrastructural point of view, which alleviates the lack of local resources.

- Jilava and Cernica are the poorest of the analysed localities and the ones with the smallest population increase. Also, they are the latest in all development indicators, and the written cultural accessibility and usage.
- Berceni, Domnești, Popești Leordeni and Mogoșoaia are newly developed localities in the U-RI, with a very good accessibility towards the capital and a high use of cultural facilities. The middle-class population of the area is concentrated here, and they use literature on a constant basis.
- Otopeni and Voluntari are the outliers on all statistical data. They have a high-class population, as they developed as business clusters. They provide the inhabitants with a high number of libraries and bookstores, the population reads constantly, and they do not depend on Bucharest for providing written cultural services.

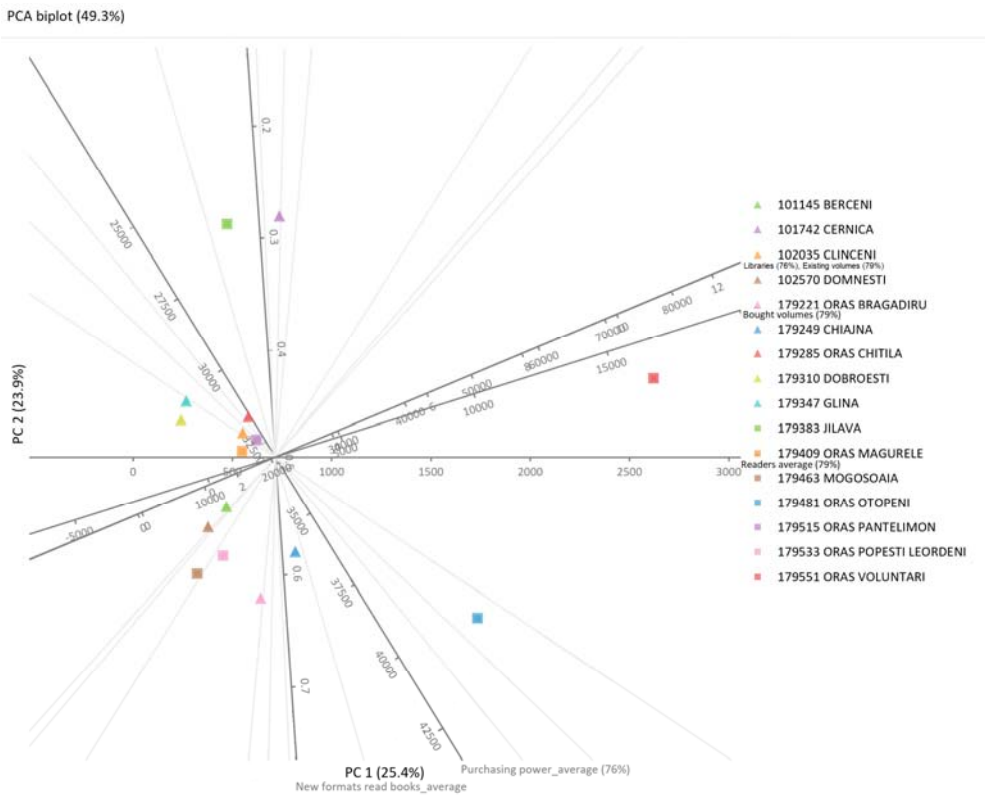

Figure 11. PCA analysis for the statistical data and the questionnaire gathered data

Discussion

In Bucharest's U-RI, the main findings of analysing the statistical data regarding the libraries, the readers and the existing volumes is that peri-urban localities had not considered written culture a priority and they are dependent on the capital city for providing this cultural service. The number of active readers of libraries is decreasing in both the city and its interface, which can be a possible indicator of a loss of interest in reading in physical form, influenced by other mediums like internet streaming, television, e-books, podcasts, etc. Also, the number of books available per reader in the U-RI interface decreased in the last decade, as well as the number of books borrowed/reader. There is a very large gap between the consumption of literature in Bucharest and in its surrounding area, with over 98% of the readers living in the area being from the capital, and only 2% from the U-RI. This can be explained not only by the differences in the total population and the accessibility to libraries, but also by the number of bookstores and the quantity and quality of educational services.

Another finding that can be observed from both the statistical data and the questionnaire answers is that bookstores and libraries are competitors and investing in providing services of both will not produce significant differences from investing only in one. Also, literature and written culture are no longer place-dependent services, with most people using the online environment for buying books even before the pandemic, a trend that accelerated after 2020. Moreover, the pandemic increased the consumption of books in new electronic formats (e-books, audiobooks, podcasts, etc.), which makes the need for a physical infrastructure less necessary for increasing the accessibility to culture (Nguyen et al. 2020). This increase was stronger in those localities with a high-income population, which further deepened the gap between the different areas of the U-RI.

However, the level of written culture consumption can partially explain the purchasing power of the population of a given area, those being directly correlated. As shown by the results of this analysis, the economic differences between the different localities of Bucharest's U-RI are also reflected in the number of readers, but there is a negative correlation between the increase in the number of readers and the increase of population. This suggests that it is important for the local authorities to attract a population with the habit of reading and that the reduced access to written culture services determines a decrease in the number of users.

Conclusions

The urban-rural interface is a place of strong and fast transitions, with a strong dynamic and powerful economic, demographic, cultural, etc. flows, caused by differential land rents, industrial location, and communication networks (Mohammadi

et al. 2012) However, it is also a space where segregation on different criteria can be observed, based on the level of development and the quality of services in each area. The access to written culture and its consumption are indicators of local development. The number of libraries, bookstores, books, and readers are all relevant in order not only to predict the standard of living, the purchasing power, and the educational level of a population, but also to explain the attractiveness/repulsiveness of certain places for some categories of population.

Cultural services, including the written format, are concentrated in the polarising city, creating a strong dependence for the surrounding neighbourhoods. This dependence is increasingly lower since the Covid-19 pandemic due to the increased use of online means for accessing culture (Yeo 2020). Audiobooks, e-books, and podcasts are only some of the new media formats that are replacing the written form of culture, especially in places with a low accessibility to libraries and bookstores.

Last but not least, the local authorities play a very important role in the level of written cultural accessibility and consumption through investments in education, activities supporting these investments, and other means of building the habit of reading among the community. The reason for investing in cultural services is because they are positively correlated with the level of education, the competencies and skills of the workforce, and the general development of the locality.

Although more case studies and data need to be considered for the correlation analysis, this study represents a first step forward in recognizing the role of written cultural access and consumption for the local development level in areas outside cities.

To conclude, the urban-rural environment and localisation impact the access to written culture, however with the current transformation in their distribution and publication format, books can become more accessible, irrelevant to the population's current location. Until then, the U-RI will maintain its dependence on the polarising city for accessing written cultural services, unless local investments are being made to promote these cultural services that are usually ignored by the local authorities.

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COMMUNITY RESPONSE TO DISASTER MITIGATION IN THE IMPACTED AREA OF MUDFLOW DISASTER

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Abstract: The impact of the mudflow disaster in Sidoarjo, Indonesia, which is still being felt by the community since 2006 until now, sets a background against which this review of disaster mitigation efforts that have been carried out so far is conducted. This study aims to find out the community response to disaster mitigation efforts that have been carried out in the hope that the programs remain evaluable, more targeted and more relevant to community needs. This research was conducted by a survey method using questionnaires and interviews and by quantitative-descriptive research data analysis. The results showed that the level of community understanding of disaster mitigation was very good, and the community participation was quite good, but the relevance of the mitigation activities conducted was felt to be still not meeting the community expectations and they have to achieve a desirable level of sustainability. Therefore, a greater level of community involvement in mitigation activities is required to create disaster preparedness and resilient villages.

Keywords:

disaster mitigation;
community response;
resilient villages;
sustainability

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Introduction

No human being certainly hopes to be hit by natural disasters, and neither do the people who used to live in the area impacted by the Lapindo mudflow disaster in Sidoarjo, East Java Province, Indonesia. The location of this study, Sidoarjo, is actually not a disaster-prone area. Even flood had never before stricken this region. However, ever since the mudflow disaster sprouted the first time in the region in 2006 with a considerable area of impact, Sidoarjo finally is now better known as a disaster area. Even the causes of the mudflow disaster, whether they be due to natural factors or due to human negligence, are still attracting debates around the world (Schiller et al. 2008, Tingay et al. 2015, Mohsin 2017). Neither the local government institutions nor the community itself were prepared to deal with the unexpected disaster, at that time.

To date, mud and gas are still gushing out from the centre of the blast, causing the affected area to continuously expand. The impacts felt by the surrounding community range from the mudflow itself – to as it happens, land subsidence, land movement, and even cracks and spewing gas with widespread pungent and widespread odour (Agustawijaya 2017). The groundwater in this area grows murky and it stinks strongly, making it an unsuitable source of clean water (Humaida et al. 2010). As a consequence of the disaster, people are now forced to lose their homes, agricultural land, jobs, and even the historical and cultural environments.

Fundamental debates about the causes of the disasters have led to protracted community land compensation (Novenanto 2016) while the efforts to help the people affected by the disaster to recover are still very limited (Iftita and Zurinani 2018). Moreover, at that time, the Indonesian government had yet to recognize the mudflow disaster as a national disaster (Schiller et al. 2008) so the handling of victims fell on the private exploration company PT. Lapindo Brantas. Although the disaster was triggered by human negligence on the company's part, the government should still be obliged to protect its citizens by providing security for them. The government has asked some victims whose houses were flooded or affected by other conditions to take part in the resettlement programs to several locations. However, some of those who have been asked to move are reluctant and remain in their homes for various reasons, while those whose houses are not included in the impacted map developed by the government, remain in their villages and try to adapt to the changing environment.

From the results of previous studies in the impacted areas in Porong, Jabon and Tanggulangin Districts, it is known that most villages in these three districts have a medium to high level of disaster risk, but some people choose to stay in their settlements (Ekawati et al. 2020), while according to the Sidoarjo Regency (2009), this location is an uninhabitable, a disaster-prone area. The problem raised in this research is that the various disaster mitigation efforts that have been carried out – both by NGOs

and by the government – have apparently yet to meet the needs of the community, and they especially need to improve the economic condition of the community. Disaster mitigation, a series of efforts to reduce disaster risk, through physical development, awareness raising and capacity building to face the threat of disaster (President of the Republic of Indonesia 2007), is an important activity that needs to be continued. The community must be encouraged to recover from the 'trauma' of the disaster in a shorter recovery period. This aims to reduce the impacts of the disaster felt by the community.

This study investigates the response of the community to disaster mitigation activities that have been carried out since the occurrence of the Lapindo mudflow disaster to date and to compile an evaluation of these activities based on the results of interviews conducted with local respondents. The novelty of this research is a review of the importance of community response as input in the review and evaluation process of several mitigation programs that have been implemented so far by accommodating the community needs to realise community-based disaster mitigation. If Dharoko (2006) used understanding, awareness and participation as indicators of community response, this research used understanding, participation and community needs in comparison to mitigation programs that have been implemented as a manifestation of the relevance between the two. Based on the data acquired in this study, it is hoped that the disaster mitigation programs that have been carried out so far can continue to be reviewed and evaluated, more on target and more in line with community needs. Research on community response is also useful so that the community can build a better settlement environment in their villages in the future.

Literature review

Research on disaster mitigation shows that such a topic is very important and relevant both today and in the future. Chadraabal et al. (2020) conclude that early action is an important factor in reducing the damage caused by the disaster. Hu et al. (2018) suggest that climate disasters in China only encourage innovation in the field of disaster mitigation, and Iwata et al. (2014) analyzes the difference between the public and private disaster mitigation. From the number and wide coverage of flash flood events in the Mediterranean region, Stavropoulos et al. (2020) suggest that the consequences have led to global efforts to mitigate impacts before, during and after the flood event. Andreastuti et al. (2019) conducted a comparative study of the character of the community response in two volcanic crises in Indonesia. Meanwhile, Goulding et al. (2018) found that, in times of crisis, the form of community response in Japan was to utilise social networks, cultural practices and collective intervention to build back better.

Indonesia is a disaster-prone country, and it is even referred to as a disaster supermarket because it has various types of disasters. Hence, we need disaster

mitigation programs that continue to be carried out on a massive scale throughout the region. The importance of people's life safety, the efforts to reduce property damage and the limited funds of disaster management will certainly require a higher national priority for efforts to mitigate hazards, prevention and preparedness activities (Bruce et al. 1999). Especially now the numbers of disasters in Indonesia and the world tend to increase as a result of climate change (Anderson et al. 2018, Winsemius et al. 2018, Benevolenza and Derigne 2019, Zandalinas et al. 2021).

Sarwidi (2013) mentions a three-step option that can be taken as a priority to reduce the impacts of disasters: (1) humans are kept away from the sources of disasters; and/or (2) the sources of disasters are kept away from humans; and/or (3) humans live in harmony with the threat of disaster by utilising and developing knowledge, science, technology and maintaining effective local wisdom, which is logically applicable.

Because many people chose to remain in the impacted area, disaster mitigation is absolutely necessary as an effort to reduce the impact of the disasters (Ianoș et al. 2019). The community also needs to adapt to the existing conditions of vulnerability. The vulnerability itself is a potential loss (Cutter et al. 2003), but some researchers claim that vulnerability is a function of exposure, sensitivity, and adaptive capacity (Gallopín 2006, Frazier et al. 2014, Sariffuddin et al. 2016). To reduce vulnerability, the adaptive capacity needs to be increased while mitigation activities that are in accordance with the needs of the community need to be continued to reduce the impacts of the disasters felt by the community.

Each region in Indonesia has different levels of vulnerability and types of disasters. For this reason, different ways of handling disaster preparedness and understanding are needed. Awareness of the potential and vulnerability of this disaster must be built in Indonesian society to reduce risk based on disaster mitigation education (Kastolani and Mainaki 2018). This proposal is reinforced by Preston et al. (2015) who revealed that, in education, community learning is an important feature for disaster response, especially in countries that have experienced natural disasters. Since an important element in preparing for a crisis event is community resilience and capacity (Preston et al. 2015), the community capacity needs to be improved with adequate disaster mitigation activities.

Disaster mitigation can be in the form of structural mitigation related to physical development and construction efforts as well as non-structural or non-physical mitigation (Wikantiyoso 2010, Saravanan 2016, Buchori et al. 2018), such as regional land use planning, community education/training, psychology, sociology, economics, law and so on. Disaster mitigation efforts through urban planning and design cover four aspects, namely: urban planning, architectural design, regulations in the field of urban and/or building planning & design, and the social preparation of the community. The potential use of local wisdom through understanding local

knowledge, local technology, local culture and local traditions that have been "tested" and present in people's daily lives turned out to be able to contribute to disaster mitigation (Wikantiyoso 2010). For example, through informal and traditional methods, the community is able to implement disaster management which is dominated by social mechanisms (Pratama and Sariffuddin 2018).

It is important to build and strengthen community preparedness for disasters with the application of community-based disaster risk reduction (Maarif et al. 2012). Key factors for the success of good practice in community-based disaster mitigation approaches involve the use of formal and informal community leaders and the development of related activities with the support of local disaster committees and volunteers (Victoria 2003). However, natural disaster mitigation must place an emphasis more on social rather than physical approaches, in which case these approaches are not only reactive, but they must be more proactive. In addition, the mitigation policies and programs that are made must be reviewed, evaluated and modified (Weichselgartner 2001).

Disaster preparedness will not be effective without the participation of vulnerable communities (Newport and Jawahar 2003). For this reason, it is necessary to know the community's opinions, responses to and desires for the disaster mitigation efforts that have been implemented. By definition, the response refers to the impression experienced when the incentive is removed, and in this case the response of the community can be seen through perception, attitude and participation (Gani 2014). According to Dharoko (2006), however, the community response has basic elements of understanding, awareness and participation. Setiawan and Bahri (2017) state that the response of the community takes the form of responses, reactions and answers. Meanwhile, Utami et al. (2014) and a comparative study from Preston et al. (2015) explored community learning and adaptation as a community response in disaster. This community response needs to be investigated to find out about the implementation of the disaster mitigation activities that have been designed, the level of community participation, the community's response to the activities that have been carried out, and the community's expectations of mitigation activities that are more in line with its current needs.

Methodology

This research investigating the community response to disaster mitigation in the areas impacted by the Lapindo mudflow disaster, Sidoarjo, used a survey method with primary data extracted through questionnaire (using Google Forms and paper) and in-depth interviews with the inhabitants of the study sites (Figure 1). Data analysis was carried out quantitative-explanatorily, with the results of the questionnaire in the form of scores in tables and charts being then described. Given some of respondents' low education levels, assistance was provided by the interviewers for them in filling out

the questionnaire by explaining the purpose of the questions they had to answer in the local language which was simpler and easier for the public to understand.

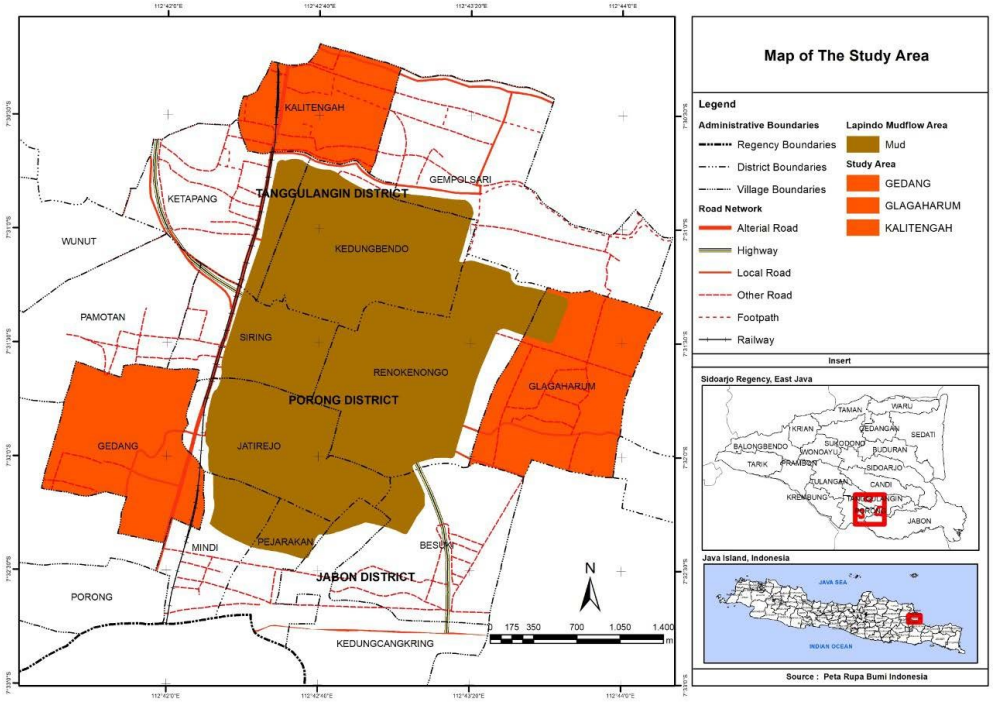


Figure 1. The study site in the area impacted by the Lapindo mudflow disaster, Sidoarjo, Indonesia
Source: processed from Peta Rupa Bumi Indonesia (2020)

The data collected consisted of primary data from the questionnaire answered by 146 respondents in three impacted villages – Gedang and Glagaharum Villages, in Porong District, and Kalitengah Village, in Tanggulangin District, Sidoarjo. The determination of the minimum number of respondents was based on the formula: $n = \frac{N}{Nd^2+1}$, where n = sample size, N = population size, and d = precision (10% of the population). Using this formula, the minimum number of respondents was found to be 100 (Kalitengah Village: 55 people, Glagaharum Village: 18 people, and Gedang Village: 27 people). In terms of population, Kalitengah Village of Tanggulangin District is the most populous village. Therefore, the highest number of respondents was taken from this village (Table 1). The selected respondents were those who were still living in the mentioned villages and who were of various ages, education levels and occupations, so as to obtain diverse input responses. The research questionnaire includes the community response to the assessment of the understanding of the importance of disaster mitigation, community participation, comparison of disaster mitigation programs that have been implemented and the most needed ones, and the variety of disaster mitigation activities that have been carried out after the 2006 mudflow disaster. The respondents' answers

were then tabulated and analysed. The next stage of the analysis was to compile and to explain the respondents' responses on the disaster mitigation activities.

Table 1. Population Size and the Number of the Respondents

Villages	Population Size in 2019	Numbers of Planned Respondents	∑Respondents
Kalitengah	12,978	55	61
Glagaharum	4,144	18	42
Gedang	6,325	27	36
Another impacted village	-	-	7
Total number	23,447	100	146

Source: data processed based on the Village Population Data (2020)

To strengthen the results of the study, in-depth interviews under certain topics were carried out with some of the respondents in order to figure out the rationales behind their responses. The respondents' answers were then classified in a table to make it easier to understand in relation to the topic. The results were then tabulated and analysed. The next stage was the scoring, which aimed to determine the community responses to the disaster mitigation efforts according to the respondents' perceptions.

Marfai et al. (2015) analysed the community response to flooding (in Jakarta) based on the chronology of events, perceptions on factors that heightened vulnerability and the importance of post-flood organisations/institutions. However, the indicators used to determine the response of the community to disaster mitigation in this study were adapted from the main elements of community response proposed by Dharoko (2006): (1) public understanding of disaster mitigation activities; (2) relevance of mitigation programs that have been carried out for the needs/expectations of the community; and (3) community participation in disaster mitigation activities.

Results

Reasons for the Community to stay in the Impacted Area

It is known that many non-displaced people choose to remain in the village even though the environmental conditions have changed and there is a high level of disaster risk. The results of the in-depth interviews with some community members as well as several local community leaders in the three affected sites revealed the reasons for the choice of the community to stay in their settlements as follows:

- Economically, the compensation money received by the community members is not enough to buy new houses within the same area as the houses they currently occupy.

- The already occupied houses are inherited from the parents. The compensation fund from the government is not enough to buy new homes for all heirs. The community members chose to remain in the houses that they inherited from their parents with all the risks of the impact of the mudflow disaster.
- From the socio-cultural point of view, people who have been born in the village find it difficult to adapt to new environments. Some people feel reluctant to move because they are bound by the mandate of their parents to look after the houses that they left behind. Many of the residents who have received government compensation for relocation chose to buy houses in the closest locations to their original settlement or houses in the neighbouring villages.
- In terms of transportation, some residents already feel comfortable living in their villages because of the proximity to work locations or the children's schools.

Land Use Change

Regarding the changes in land use in the three villages that became this study's sites (Figure 2), the 2005 situation shows the condition of land use before the disaster, the 2006 situation represents the condition of the land after the disaster (29 May 2006), and the 2017 situation is the most recent land use condition. It appears that in the post-disaster period 2006-2017, the area of the embankment holding mud increased very rapidly and submerged the paddy fields and the village community settlements such as those in Kedungbendo, Renokenongo, Siring, and Jatirejo Villages, and parts of Mindi and Pejarakan Villages.

Based on the data from the satellite imagery of land area changes in the area impacted by the Lapindo mudflow disaster, it was found that: the area of settlements and paddy fields decreased (Figure 3), while the area of water bodies, mud, vacant land and mud embankments increased significantly (Ekawati et al. 2020). This shows that the levels of disaster risk and vulnerability of the community settlements in the area affected by the Lapindo mudflow disaster are high and they require more attention (Ekawati and Sulistyowati 2021). Moreover, based on the 2017 situation, to the east of the mud embankment wall, there are still water bodies that have begun to inundate the locations around the community settlement in Glagaharum Village, so it is feared that the expansion of the mud embankment will be carried out again by the PPLS (the Sidoarjo Mudflow Management Center).

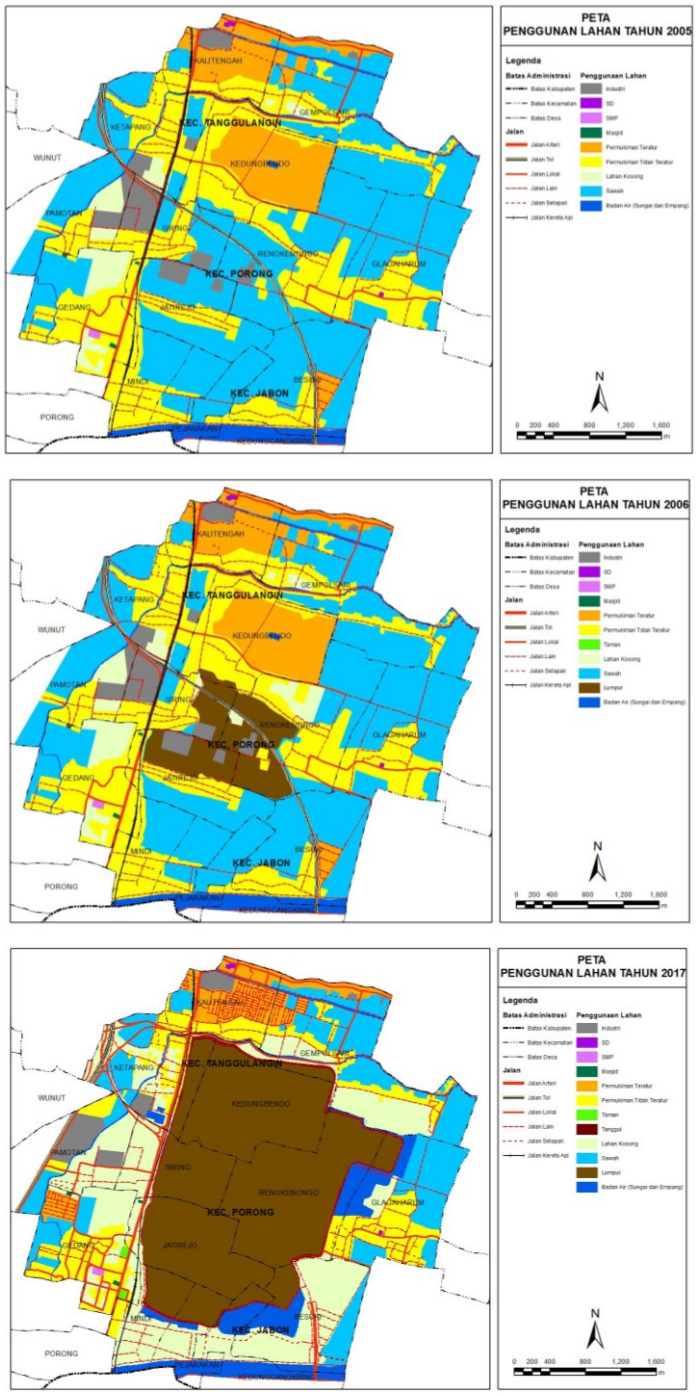


Figure 2. Land use change in the area impacted by the Lapindo mudflow disaster, Sidoarjo
Source: data processed and interpreted from Google Earth (2020)

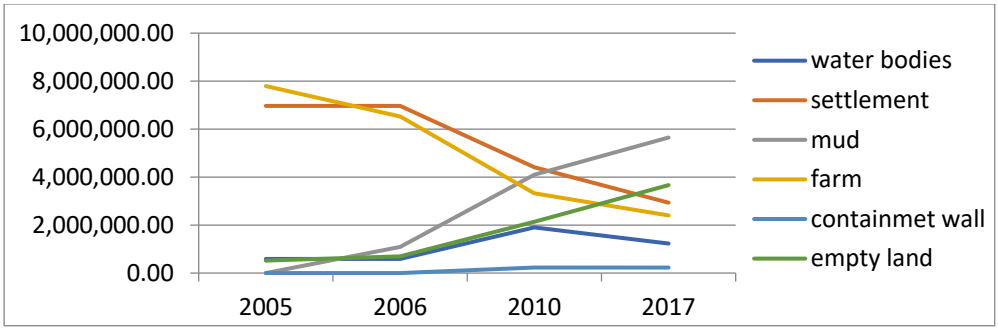


Figure 3. Changes in area of land impacted by the Lapindo mudflow disaster
Source: data processed based on the table of land use change by Ekawati et al. (2020)

Physical, Infrastructure, Environmental, Social, Economic and Cultural Changes

The most recent field survey clearly observed that, as a result of the disaster in the community settlement area, several ancestral graves of the residents are drowned, parts of the village roads are cracked, many community settlements are damaged, and cracks in the walls and damages on the houses roofs and floors are found, but this area is still inhabited today (Figure 4). Some of the residents even live in houses that are now unfit for habitation. In the rainy season, a lot of standing water around the community settlement sites cannot flow into the ditch due to land subsidence. Well water, which is a source of clean water, has also blackened in several locations so it cannot be used for daily needs. From the results of the interviews, it was revealed that the community members do not have enough funds to renovate their houses. Another impression that can be felt immediately in the affected area is the gas odour that is very strong and it disturbs breathing in almost all locations. Some residents even stated that their health is affected by this gas smell every day. Moreover, the air temperature is also felt to have increased after the disaster.

The economic changes as a result of the mudflow disaster are also concerning. Many residents are forced to lose their jobs because many factories and agricultural land in the location are submerged in the mud, and the regional economy in East Java Province was in shock (Schiller et al. 2008). Several respondents admitted that their income has decreased since the disaster. Meanwhile, it is difficult for people to switch to other jobs because of their limited education and skills.

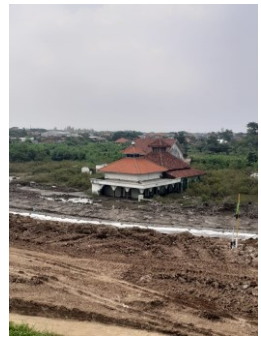
In the social sector, there was a social crisis at first because many people disagreed on the compensation for their properties which were impacted by the mudflow disaster (Farida 2014, Elika et al. 2017). However, based on the observation of the researchers at the analysed locations and the interviews with some respondents, the social relations of the community are currently very good as the family ties and communication between the residents have always been excellent.

(a)

(b)

Glagaharum , Porong - Sidoarjo

Glagaharum , Porong - Sidoarjo



(c)

(d)

Figure 4. The impact of the Lapindo mudflow disaster on community settlements
Note: (a), (b), (c) – some houses in a damaged condition are still in use as dwellings;
(d) – the mosque in Glagaharum Village affected by land subsidence.
Source: author's documentation (2020)

Meanwhile, in the field of culture and religion, people in the area affected by the mud disaster still maintain the cultural and religious events that were routinely carried out by their elders such as the rituals of nyekar (a tradition of putting flowers to somebody's grave), which is held every year at the beginning and the end of the month of Ramadhan, istighosah (praying together), kenduren, selametan and others (Ekawati 2018).

Community Understanding of the Importance of Disaster Mitigation

From the results of the questionnaire, it was figured out that only 48.6% of the 146 respondents feel the impacts of the existing disaster mitigation programs so far, while the other 51.4% either have not considered or do not consider that the disaster

mitigation programs have touched their needs. This shows that most people feel that the disaster mitigation activities have not been optimal or they have not approached their specific needs. Through the interviews, some respondents stated that mitigation activities were only carried out at the outset of the post-disaster period and after that disaster mitigation activities in their villages ceased from being conducted.

From the community's assessment of the importance of disaster mitigation, it was found that almost all the respondents consider disaster mitigation as very important: 73 people (50%) consider it as very important, and 67 people (45.9%) as important (Figure 5). Thus, it can be said that the community has a good understanding of the importance of disaster mitigation, with an average score of 4.42 of the maximum 5. The community is in grave need of a sustainable disaster mitigation program because, until now, the impact of the mudflow disaster is still felt.

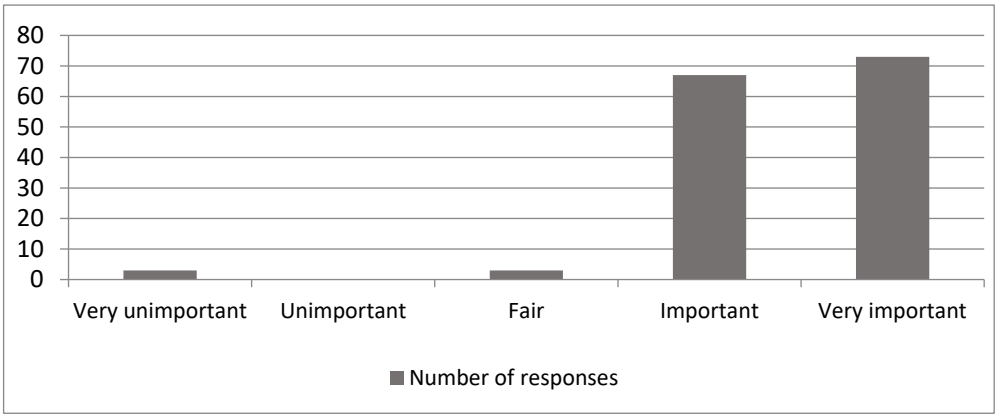


Figure 5. The importance of disaster mitigation from the community's perspectives in the impacted area of the Lapindo mudflow Disaster, Sidoarjo. Source: data processed from questionnaires

The Relevance of the Disaster Mitigation Program

An illustration of the community's response to the existing disaster mitigation programs and the community's most needed disaster mitigation programs (Figure 6) shows that the existing programs and the needed programs have almost the same distribution of answers. This shows that the existing mitigation activities are of relatively good relevance, but they still do not answer the community's needs. Many respondents hope that the mitigation programs improve in terms of quality and quantity and they better touch the needs of the community. Regarding the disaster mitigation activities, the respondents were given the freedom to choose more than one answer because one person may need more than one type of activities. Therefore, it is seen that the number of response items to the most needed mitigation activities per answer becomes higher.

Programs in the economic sector are the programs most needed by the community, with 109 respondents (74.7%) choosing them. Disasters are indeed very detrimental to society, due to both loss or damage to physical property, the environment and infrastructure, and damage to non-physical sectors such as the economic, social, and cultural-religious sectors. Many people have lost their rice field, which is a source of family income, making the economy difficult. However, their ability and opportunity to switch to other jobs are low.

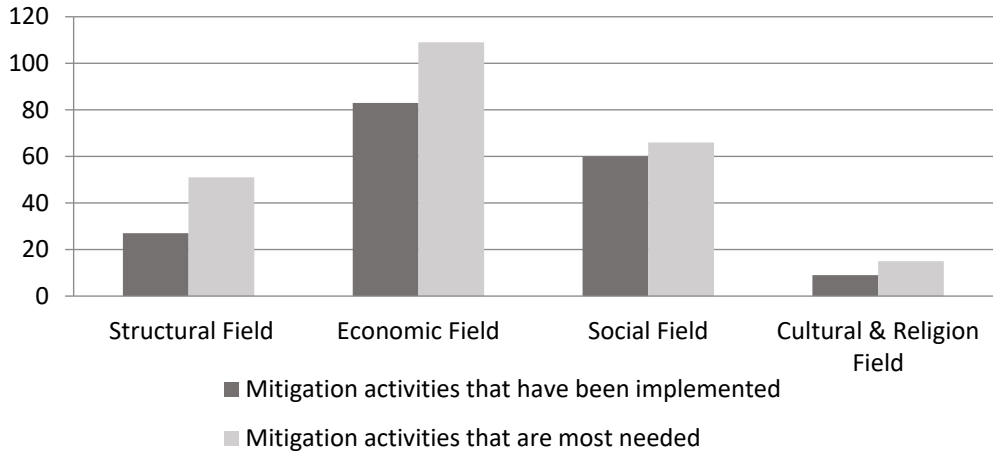


Figure 6. Community response to disaster mitigation activities in the impacted area of the Lapindo mudflow disaster, Sidoarjo. Source: data processed from questionnaires

The consequences of the post-disaster physical damage are often more important than the damage itself. Damage to the infrastructure of production facilities puts pressure on the economy (Coburn et al. 1994). Thus, mitigation also requires economic protection against disasters. Community economic empowerment needs to be prioritised with life skills training integrated with disaster mitigation programs (Sulistyowati and Ekawati 2021).

Programs in the social sector are also highly needed by the community, as shown by the response from 66 respondents (45.2%). Meanwhile, mitigation in the structural or technical fields is needed by 51 respondents (34.9%). The fulfilment of this need is possible because mitigation in the structural sector is considered to be the full responsibility of the government and so far, the structural and technical mitigation programs have been running quite well (Figure 7). Mitigation in the field of culture and religion is needed by as many as 15 respondents (10.3%). Although not many people consider the cultural-religious field as part of the disaster mitigation efforts, some feel that cultural and religious activities are still needed to strengthen their mentality in facing disasters.

(a) (b) (c)

Figure 7. Disaster mitigation in areas impacted by the Lapindo mudflow disaster
Note: (a) heavy equipment – alerted in mud embankment to dredge mud; (b) disposal of water to the Porong River; (c) elevation of mud embankment walls by means of heavy equipment.
Source: author's documentation (2020)

Participation and Evaluation of the Disaster Mitigation Program

Community participation in disaster mitigation activities plays a very important role (Table 2). It is one of the positive responses from the community in disaster mitigation programs, both initiated by the government, NGOs and community initiatives themselves.

Table 2. Community Participation and Evaluation of Disaster Mitigation Activities

Sector	Government	Community	Review & Evaluation
Physical, environment & infrastructure	• Construction of mud embankments, dredging of silt, disposal of mud into the Porong River, provision of pump houses • Repair of roads, bridges, channels and other infrastructure pieces • Provision of clean water and water distillation training	• Some community members reject the construction of mud embankments for fear of water seepage • Maintain environmental cleanliness by not littering • Making local rules: communities are prohibited from drilling new wells • Make a proposal to plant trembesi trees (Samanea saman) to reduce the impact of gas	• Community members and leaders should be involved and assisted in improving understanding of the benefits of each of the mitigation activities initiated by the government • The government should provide village funds and involve the community members for them to gain income • The implementation of the water distillation program is not well mastered, requiring more intensive training • The government should immediately respond to community proposals

Sector	Government	Community	Review & Evaluation
Economy	• Catfish farming training • Training in making bag crafts and products from waste recycling	• Participate and try to run a catfish pond business • Participate in training but with lacking skills and capital to start a business • Establish savings & loan cooperatives for emergency funds	• The training's intensiveness should be increased to enable people to work independently • The training should be increased in variety and be held continuously • There should be a venture capital assistance from the government to improve the community's economy
Social		• Community work together ("gotong royong") to clean the environments and the channels around the settlements • Establish social community organisations to handle disaster mitigation activities	• Gotong royong activities should be encouraged for cleaner environments • The community leaders (formal or informal) should be given greater empowerment to increase disaster mitigation popularity with the community
Culture-religion		• The community performs prayers and grave pilgrimages regularly	• This activity should be held more intensively to promote a culture of safety and resilience to disasters and to strengthen the mentality of those who face disasters

Source: analysis based on questionnaires and in-depth interviews

Discussion

Disaster management is largely incidental. The community and government agencies only provide assistance at the beginning of the disaster, but then they have left the victims who are trying to overcome their own socio-economic problems (Bahransyaf 2009). Funds and goods are only used to alleviate the suffering of victims for the moment although disaster mitigation needs to be done before, during and after a disaster (Stavropoulos et al. 2020). To help people deal with disasters, empowerment is also needed. Empowering communities by internalising disaster risk reduction tools and methods is a good way to deal with potential risks in the future (Asian Disaster Preparedness Center 2008). Therefore, community skills training as one of disaster mitigation activities needs to be carried out continuously.

Community-based disaster mitigation programs are the development of mitigation policies in consultation with local groups or communities, such as the formation of community organisations with outside technical assistance. This program is considered more likely to produce actions that are more responsive to the needs of the community, so that the community can also actively participate in building awareness of the dangers to be faced and to be able to protect itself in the future (Coburn et al. 1994). Goulding et al. (2018) found that, as a community response, Japanese people make better use of social networks, culture and interventions to build their territory – community-based disaster mitigation in Japan can be a lesson for people living in disaster-prone locations such as Sidoarjo to explore and develop local wisdom potentials such as informal and traditional methods as a new culture for the community in facing possible disasters in the future (Pratama and Sariffuddin 2018).

From the results of the research on community understanding of the importance of disaster mitigation, an average score of 4.42 was obtained. In other words, 95.9% of the respondents were found to consider disaster mitigation as important and very important. This shows that the level of community understanding of the importance of disaster mitigation is very good. The high understanding of the community is certainly very encouraging and it becomes a very useful capital to develop disaster-resilient villages (Maarif et al. 2012). Disaster mitigation is an indispensable effort to reduce the impacts of disasters such as damage to people's lives and properties, given that many people choose to remain in villages that now have high vulnerability to disasters. National priority should be taken for efforts to mitigate hazards, prevention and preparedness activities, given the limited costs of disaster management. As Chadraabal et al. (2020) remind, early action is an important factor in reducing the damage caused by a disaster.

The relevance of the existing mitigation activities with the needs of the community in general is quite good. However, the community feels that the activities were not sustainable and they were only carried out at the outset of the post-disaster period. The community still hopes that these activities continue to be carried out and they have a certain degree of sustainability so that they can really improve the economic situation of some people who lost their jobs after the disaster. However, the damage to infrastructure and property will also put some more pressure on the local economy (Coburn et al. 1994).

Utilising traditional organisational structures and mechanisms (such as formal and informal community figures) is one of the key factors of success in a community-based disaster mitigation approach (Victoria 2003). A fairly good level of community participation is the main capital for the success of disaster mitigation, but it requires all possible resources to make it sustainable (Newport and Jawahar 2003). The authors agree with Maarif et al. (2012) that the community should be a key actor who plans,

designs, acts, monitors, and evaluates mitigation activities as a disaster risk reduction effort, so that these mitigation activities will continue to be sustainable according to the community needs.

Specifically, for mitigation in the physical and infrastructure sectors, the community does not participate much because it had initially been handled by the BPLS (Sidoarjo Mud Control Agency) and now it is handled by the government-formed PPLS (Sidoarjo Mud Control Center). However, community involvement is still required to some degree to discuss the mitigation programs that are planned and will be carried out, regarding their objectives, impacts, benefits and so on. With intense communication between the government and the community, all obstacles in the efforts to reduce the impact of disasters can be prevented. In accordance with Hu et al. (2018) that disasters in China encourage community innovation in the field of disaster mitigation, community-based mitigation in the study area can trigger community innovation and form a new culture in the field of awareness of hazards that can lead to environmental disasters.

It is known that disaster mitigation encompasses structural and non-structural sectors (Wikantiyoso 2010, Saravanan 2016, Buchori et al. 2018). Therefore, the community response in the study area which reveals that mitigation efforts in the non-structural sector in their villages were only carried out at the beginning of the post-disaster phase needs to be followed up properly by the government. Non-structural disaster mitigation is equally important. Community members whose income has decreased, or who have even lost their livelihoods due to the disaster, of course, need additional income or new livelihoods. The data from the research results showed that, according to the community response, the most needed disaster mitigation activities today are those in the economic and social fields, whereas mitigation in the structural field is the third most needed.

An interesting finding in this research is people's recognition of the need for disaster mitigation in the cultural and religious activities as part of the most needed disaster mitigation activities. Although the percentage of those who respond this way was not significant, the implementation of disaster mitigation through education (Kastolani and Mainaki 2018) and the initiation of disaster resilient villages (Maarif et al. 2012) in the cultural and religious fields would certainly be more easily accepted by the community as it was the case of the Japanese people who use their social networks and cultural practice to build their region for the better (Goulding et al. 2018).

Indonesia is a multi-ethnic country with more than 1000 ethnics groups and 650 languages. Each region has its own culture, religions, beliefs, and local wisdom in responding to the disasters that occur there. It was revealed in research on the community response character at two volcanic disasters in Indonesia that two communities have different response characters because they have a different local

culture (Andreastuti et al. 2019). Religion, which is part of culture, also needs to be considered in disaster mitigation (Andreastuti et al. 2019). The authors of this study do not agree that religion is considered part of culture, however. Religious activities can be part of culture in society, but that does not mean that religion itself is part of culture. However, in relation to disaster mitigation, the authors agree that religious and cultural activities need to be considered as part of disaster mitigation because they can increase the adaptive capacity of the community to disasters that occur in its area.

If vulnerability is built by three things, namely a function of exposure level, sensitivity and adaptive capacity (Gallopín 2006, Frazier et al. 2014, Sariffuddin et al. 2016), then to reduce the level of vulnerability it is necessary to increase the adaptive capacity of the community and institutions in the village to the centre. It is realised that culture and religion are very useful in an effort to increase the adaptive capacity of the community and in directing the people's actions and the understanding of disasters. Therefore, the role of religious and community leaders is needed so that people are better able to think positively and to build themselves to increase their capacity in preparing for future disasters. Approaches to disaster mitigation should be carried out with more proactive measures. However, as stated by Weichselgartner (2001), the government needs to continue to review, evaluate and modify the mitigation policies and programs that are made to better suit the needs of the community.

Conclusions

From the above description it can be concluded that the community response related to the understanding of mitigation is very good so that the community can help to evaluate the disaster mitigation activities that have been carried out and to propose some of the activities most needed by the community. The response about the relevance of mitigation activities has been distributed quite well, but the respondents argued that mitigation activities still did not meet their expectations, especially in terms of community economic empowerment. Fairly good public participation in disaster mitigation activities should be appreciated, in which case it serves as excellent capital for the success of mitigation activities. The community expects that skills training activities for economic empowerment to not only be carried out in the initial period of a disaster, but also to be continued into the future.

Through a study conducted to understand the community's response to disaster mitigation that has been implemented in this study area, it is possible to understand the character, needs and expectations of the local community, which currently needs more economic improvement to survive in the disaster-affected residential areas. With this understanding, more intense communication, better coordination and collaboration between the community and the government together in reducing the impacts of disasters in the future can improve. Education on disaster mitigation for the

community through cultural and religious activities as well as the socialisation of disaster resilient villages can involve community leaders, both religious leaders and formal and informal figures who are more familiar with the characteristics and culture of the local community. This method can inspire disaster management in other areas that have their own unique characteristics and culture.

The recommendations from the disaster mitigation activities in the area impacted by the Lapindo mudflow disaster for structural mitigation activities are that the government needs to involve local community members and leaders (both formal and informal) and to be given an explanation in order to better understand the objectives and the benefits of each mitigation activity undertaken, and that more intense communication is needed between the government and the community to ensure that disaster mitigation activities are in accordance with the needs and expectations of the community.

Recommendations in the economic mitigation sector are that the community needs to be given an introduction to entrepreneurship (with various training and business assistance) and venture capital assistance so that people who lose their jobs can start earning income and without being dependent on outside financial assistance. Economic empowerment will increase the capacity and preparedness of the community in facing future disaster risks.

In other sectors, the government needs to quickly respond to relevant community proposals such as the proposal to plant trembesi trees (Samanea saman) around residential areas to improve the quality of the air which is polluted with gas bursts in the impacted area. The government also needs to support the mitigation activities in the social and cultural-religious fields initiated by the community to strengthen its mental preparedness and resilience in the face of disasters. In addition, the community needs to be encouraged to become a key actor who plans, designs, acts, monitors and evaluates the mitigation activities (community-based disaster mitigation) in a disaster risk reduction effort for developing a disaster resilient village.

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Aims & Scope

Urban and regional questions are crucial in understanding the present territorial conditions. From the World Bank's 'rediscovery' in its 2009 Report of the potential of cities in encouraging economic growth, to the multiple ways in which cities are being drawn into the processes of neoliberalism, to the dynamic growth of cities in the developing countries in Asia far out stripping the scale of cities in the older urbanized nations – everywhere there are signs of a rapidly changing urban condition. The same is true for the regions where 'old questions' of regional economic disparity and uneven development are being given a new twist as economic globalization impacts the national and local arenas.

JURA, the **Journal of Urban and Regional Analysis**, working as an **Open-access journal** (**with two issues/ year, in February and in August — starting with 2020;** previously annually publishing in June and in December, for the period 2009-2019), was launched as a response to the exciting world of urban and regional research emerging in reaction to these changes happening in the real world.

JURA represents the initiative of the Interdisciplinary Center for Advanced Research on Territorial Dynamics (CICADIT) at the University of Bucharest working in collaboration with Ronan Paddison at the University of Glasgow, for the period 2009-2020. Starting with 2021, JURA is also supported by the Professional Association of Romanian Geographers (APGR). While the intention is that articles published by JURA will draw on examples throughout the world, particular emphasis will be given to urban and regional change as it is being experienced in Eastern Europe.

Transitional economies, and urban and regional shifts in the region since the end of the socialist regimes have been profound. The socialist regime had its particular effects on the regional economy and the cities, linked with structures that, in many ways, were very different from the trends apparent in Western Europe in the post-World War II period. Since 1990, change has been swift, challenging our theoretical understanding of the processes; for example, it is plausible to transport theories of contemporary urban change under neoliberalism developed in the advanced economies to the transitional economy. The legacy of the socialist regime, its imprint on the city physically and socially, provides further reason to suppose that urban (and regional) development in transitional economies is distinctive. These differences re-emphasise a consistent axiom underpinning the study of cities and regions: that if it is possible to point to broad theories that apply across different regions of the world, they often need to be modified to take into account local conditions.

Though JURA is primarily concerned with looking at urban and regional change in the transitional East European economies, case studies exploring similar problems, but in other parts of the world are certainly parts of the journal's agenda. The remit of the journal is emphatically interdisciplinary. The analysis of the urban and regional conditions needs to be interdisciplinary. In reality, urban researchers usually tend to belong to a discipline reflecting their training whether as geographers, economists, sociologists, planners or any number of subjects concerned with the study of space and place. Our training very often endorses an appreciation of how other disciplines explore the city. For the journal, the acknowledgement of the many disciplines that are concerned with understanding cities and regions will be indicated by the different disciplinary backgrounds reflected in the published papers. Articles will be published by geographers, sociologists, planners, economists, political scientists, to mention just a few of the disciplines involved in the urban and regional study.

JURA plans to be a key outlet publishing topical articles dealing with cities and regions. In later issues, we plan to include sections devoted to notes and comments as well as a policy section outlining and discussing state and non-state initiatives aimed at improving cities and regions, together with the problems confronted by their implementation.

Edited by Prof. PhD. Ioan IANOȘ