

# Spatial Agglomeration and Interrelation between KIS and Tourism: The Case of Poland

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The aim of this research is twofold: (1) to identify clusters of tourism and of Knowledge Intensive Services (KIS) providers as inter-regional agglomerations, including the scope and strength of spillovers between Polish districts, and (2) to investigate the spatial relations between regional tourist development and KIS providers' localization. To measure inter-regional agglomeration phenomena, we apply spatial statistics of autocorrelation (local Moran's  $I_i$  statistic): Local Indicators of Spatial Association (LISA). We also use contingency tables to study the relationship between tourism development and the localization of KIS providers in Polish districts. We use data collected by the Polish Central Statistical Office for 2009 and 2015 in 380 Polish districts (firms registered in sections I and J of NACE classification and the number of tourists staying overnight). We observe statistically significant spillover effects in tourism supply in both urbanization- and localization-type clusters as well as the convergence processes of agglomeration in urbanized regions in relation to tourism and KIS clusters. Moreover, we find that mature tourism destinations are characterized by both low and high intensity of KIS, depending on the type of clusters (urbanized or localized). The highest percentage of districts with high growth in tourist development refers to the medium and high share of KIS providers. The results indicate a positive correlation between the share of KIS providers in districts' economies and dynamic growing tourism destinations. They also emphasize the need for research on the role of KIS (including ICTs) at different stages of tourism development and enhancing regional innovativeness.

*Keywords:* Knowledge Intensive Services, tourism destinations, agglomeration, clusters, spillover effects, Polish districts

## **Introduction**

Innovation is argued to benefit from interactions, and thereby cooperation, between firms in spatial proximity (Brodzicki & Kuczevska, 2012; Balland, Boschma, & Frenken, 2014). It seems to be especially impor-

tant with respect to tourism destinations as they concentrate interlinked companies and institutions of the broadly-defined tourism industry and are characterized by the occurrence of a decisive, intersectoral knowledge, crucial for innovation (Bieger & Weinert,

2006). Additionally, in the contemporary economy, the context of a growing need for the creative use of various forms of knowledge (Alves, 2007) as well as the rapid development of creative industries, which are merging with other sectors, such as tourism industry (European Cluster Observatory, 2013), should be taken into consideration.

The tourist sector attracts Knowledge-Intensive Services (KIS) providers (by generating demand for their services) who deliver knowledge essential for undertaking innovation-based activities in tourism. Thus, the intensification of KIS occurrence in a given area may enhance the innovativeness of both enterprises and the entire tourism destination since those services are used in innovative regional processes. It is of particular significance for (1) emerging tourism destinations, (2) destinations characterized by the dynamic growth of tourism, and (3) destinations which need to introduce rejuvenation strategies in order to enhance their development and avoid stagnation. Therefore, the processes of clustering are necessary, i.e. spatial concentration of knowledge-intensive and tourism-related business activities and the occurrence of agglomeration economies: both specialization (localization) and diversity (urbanization) externalities (Beaudry & Schiffauerova, 2009; Prager & Thisse, 2012).

It is, therefore, essential from the research perspective to examine, on the one hand, the occurrence, strength, and scope of the phenomenon of spatial agglomeration (concentration of economic activity in the spatial proximity) with regards to KIS and tourism. On the other hand, the interrelation between the occurrence of KIS and tourism providers in the local economy should be further investigated, considering different types of tourism destinations (urbanized vs. localized) and different stages of their life cycle. Thus, the aim of the research is: (1) to identify clusters of tourism and of Knowledge-Intensive Services (KIS) providers as the inter-regional agglomeration, including the scope and strength of spillovers between Polish districts, and (2) to investigate spatial relations between regional tourist development and KIS providers' localization.

We employ the explorative spatial data analysis

(ESDA), applying spatial statistics of autocorrelation (local Moran's  $I_i$  statistic) under the so-called Local Indicators of Spatial Association (Anselin, 1995, 2010) to measure the inter-regional agglomeration of economic activity in Polish regions (at NUTS-4 level, districts). We check for the statistical significance of spatial autocorrelation measures in order to identify the clusters of tourism and KIS, as well as the scope and strength of spillovers effects with regards to the analysed variables. We also use contingency tables to study the relationship between tourism development and the localization of KIS providers in Polish districts.

We use the data collected by Polish Central Statistical Offices at the district level for 2009 and 2015, i.e. the number of enterprises registered in sections I and J of the NACE classification (the Statistical Classification of Economic Activities in the European Community), reflecting, respectively, tourism supply (accommodation and food service activities) and KIS providers (information and communication services) as well as the number of tourists staying overnight in Polish districts. Additionally, we use the geostatistical information (GPS coordinates) of the enterprises (derived by geocoding their location on the basis of firms' addresses) in order to obtain the accuracy of the results in measuring the neighbourhood and determining the 'real' centres of tourism agglomeration in each district.

The rest of the paper is organized as follows. Section 2 provides an overview of the literature on the spatial agglomeration of economic activity concerning the process of spatial concentration (clustering), results of agglomeration economies, and measures of the agglomeration phenomenon. It is followed by Section 3 that shows the impact of Knowledge-Intensive Services on regional innovation processes in the context of tourism destinations. In particular, we discuss how the spatial concentration of economic activity, spatial proximity, and spatial interdependence affect the regional innovativeness of territorial units. Section 4 describes the research procedure, methods, and data sources, both for measuring inter-regional agglomeration and spatial interrelation between KIS and tourism. Sections 5 and 6 present the research and results of both stages of the research procedure. The

final section concludes and shows further research directions.

### **Spatial Agglomeration of Business Activity: Process, Regional Effects, and Measures**

Spatial agglomeration phenomenon refers to the concentration of businesses activities and the demand for services they provide in geographic space. Tourism is a spatial phenomenon that is particularly susceptible to concentration processes (Carreras, 1995; Yang, 2012; Sölvell, Ketels, & Lindqvist, 2008) as it is inseparable from tourism services, which means that customers mostly travel to places where the services are delivered (Vanhove, 2011, p. 12), although tourism often spreads beyond the borders of territorial units to neighboring regions (Majewska, 2015). This is a result of the spatial and functional interdependence of regions, as well as the external effects of agglomeration. In the literature, this is referred to as a geographic spillover effect (Yang & Wong, 2013; Yang & Fik, 2014), with reference to the phenomenon of knowledge diffusion, that can be defined as unintentional spatial interaction when the developmental processes, knowledge, productivity, innovations, etc. spread between neighboring regions. The existence and strength of spillovers are the evidence of the occurrence of functional ties between tourism firms located in neighbouring regions. Spillovers have a substantial impact on tourist agglomeration processes as positive spillover effects imply that the region can benefit from the tourism growth in the neighbouring regions. In fact, according to Marshall (1920), Hoover (1936), and Jacobs (1969), the basic premise of the spatial proximity and concentration of economic activity is that it can be beneficial due to agglomeration externalities to the overall economy as well as to sectors and firms clustered in a particular location (Prager & Thisse, 2012). This includes agglomeration externalities associated with the flow of knowledge or human resources (Ács, 2002, 2005), which is considered to stimulate regional innovation processes.

The positive agglomeration effects resulting from the concentration of economic activities are transmitted both within and between industries. In the literature two different main types of agglomeration

economies are distinguished: specialization (localization) and diversity (urbanization) externalities (Ács, 2005; Beaudry & Schiffauerova, 2009; Knoblen, 2009). The localization economies usually take the form of Marshall-Arrow-Romer (MAR) externalities, which operate mainly within a specific industry. The localization economies are the advantages that firms in a single industry (or a set of closely related industries) gain from being placed in the same location. These promote positive externalities and thus economic growth within industries. The second type, the so-called Jacobs' externalities, work across sectors and stem from a local variety of producers (Jacobs, 1969); they refer to the so-called co-agglomeration, i.e. the tendency of different industries to be located near each other (Ellison, Glaeser, & Kerr, 2007; Kolko 2010). In Jacobs' (1969) view, it is the industrial diversity (heterogeneity) rather than specialization that is seen as the most significant regional growth factor (Ács, 2002). Thus, the urbanization economies are advantageous to firms, regardless of the sector, from being located together.

As the consequence of localized sources and the advantages of agglomeration, regional clusters, defined as the concentration of economic activity, emerge. They differ in regard to the scope and the scale of the spatial concentration of economic activity as well as spatial interdependencies with the neighbourhood. Additionally, according to recent literature, clustering and co-location tendencies differ per subsector (European Cluster Observatory, 2013).

The spatial concentration of economic agents itself does not necessarily involve strong linkages and interactions among them. Nonetheless, the probability of such ties increases with the growing number of agents and the decrease in the distance between them (Brodzicki & Kuczevska, 2012, p. 62).

There is evidence in the literature and different studies of the importance of spatial concentration of firms and spatial proximity in enhancing innovation (including regional innovation systems), productivity, diffusion of knowledge, formation of social and business networks and other positive agglomeration effects (Ács, 2002; Duranton & Puga, 2004; Asheim, & Gertler, 2004; Sørensen, 2007; Weidenfeld, Williams, & Butler, 2010; Prager & Thisse, 2012). The innova-

tion process is by its nature knowledge-intensive and, therefore (as knowledge transfer in spatially concentrated areas is vital to innovation), innovations rely to a large extent on the presence of knowledge-intensive services (KIS), including ICTS (CEET, n. d., p. 26).

It is often argued that innovation is created and sustained through a highly localized process as it clusters in areas where specialized inputs, services and resources (including competition, interactive learning or institutional conditions) necessary for the innovation process are concentrated (Asheim & Gertler, 2004; Wolfe, 2009). Additionally, inter-organizational interaction and related external knowledge are believed to support innovativeness (Cohen & Levinthal, 1990; Muller & Zenker, 2001).

Spatial agglomeration in a traditional approach refers to the concentration of businesses in the area enclosed within the administrative borders of territorial units for which statistics are collected. There are two main groups of measures of spatial agglomeration: cluster-based methods (e.g. the Gini index, Location Quotient, etc.) and distance-based methods. The number of the latter methods is still emerging in the literature (see e.g. Kopczevska, Churski, Ochojski, & Polko, 2015). While spatial agglomeration as well as its externalities spread beyond the boundaries of territorial units and spillover between neighbouring regions (districts or other administrative units), the studies on the phenomenon of spatial agglomeration in tourism and methods of its measuring must take into account its inter-regional dimension.

Such research has been recently undertaken by, among others, Yang and Wong (2012, 2013), Yang and Fik (2014), and Yang, Fik, and Zhang (2016), as well as Majewska (2015). All these authors have taken into account the spatial interdependence (spillover effects) in tourism. In particular, Yang, and Wong (2013) investigate the spatial distribution of foreign and domestic tourist inflows to cities in China and their growth rates using exploratory spatial data analysis (ESDA). Yang and Fik (2014) emphasize that spatial effects have largely been overlooked in the literature. Thus, in their research, they provide a tourism development analysis that considers spatial effects (*spillovers* and heterogeneity). Majewska (2015), in contrast, identifies ge-

ographic spillover effects in both localization-driven and urbanization-driven clusters in Poland and proposes to employ them to modify a cluster-mapping procedure with a spatially weighted location quotient (SWLQ). With the help of Local Indicators of Spatial Association (LISA), applying the local Moran's  $I_i$  statistic that belongs to the most common (within LISA) measures of spatial interdependence (autocorrelation) of spatial variables in neighboring regions (Anselin, 1995; Schabenberger & Gotway, 2005), she identifies and empirically measures interregional effects of spatial agglomeration in tourism considering the occurrence and strength of geographic spillover effects in Poland.

### **Regional Innovation Processes as Agglomeration Effect: The Role of KIS Providers in Tourism Destinations**

The knowledge-based and rapidly changing economy redefines the ability of regions, including tourism destinations, and enterprises to prosper in the contemporary world. While the production of goods and services is becoming more knowledge intensive in response to market demand and also rapid development of so-called 'creative industries,' which are merging with other industries such as tourism (European Cluster Observatory, 2013), innovation process is based on the creative use of various forms of knowledge (Alves, 2007). In this way, regional innovations are largely dependent on the occurrence of knowledge-intensive services (KIS) in a given area.

KIS are defined as services that involve economic activities which are intended to result in the creation, accumulation, or dissemination of knowledge. Thus, the existence of a spatial association between regions (inter-regional agglomeration) with regards to the share of KIS providers in total economic activity can be perceived as reflecting knowledge spillovers in the regions. Based on the Statistical Classification of Economic Activities in the European Community (NACE), the service sector is divided into knowledge-intensive services and less knowledge-intensive services according to the approach relying on classifying production and services based on their R&D intensity (expenditure on R&D to value added ratio). The follow-

ing sectors of NACE are included into KIS: Post and Telecommunications, Computer Science, Research and Development, Water Transport, Aviation, Real Estate, Rental of machinery and equipment, Financial intermediation, Education, Healthcare and Social Assistance, as well as Other business activities, including Cultural Activities, Recreation and Sport. The latter sub-group is a part of tourism business services which are mainly classified as less knowledge-intensive. However, in urban tourism destinations, providers of tourism business services often co-exist with KIS providers (Majewska & Truskolaski, 2011, 2012). A significant subgroup of knowledge-intensive services is called high-tech KIS, which group includes Post and Telecommunications, Computer Science, Research and Development. Computer Science (division 62 of section J within NACE, i.e. computer programming, and consultancy) can be identified as ICT services.

KIS providers play a special role in innovation systems, and therefore in enhancing regional innovativeness. They serve as sources of innovations (initiating and developing innovation activities in client organizations), facilitators of innovations (supporting the innovation process of an organization) and as carriers of innovations (aiding in transferring existing knowledge so that it can be applied in a new context) (Miles et al., 1995). Thus, using KIS enables firms to conduct their own innovative activities.

A strong preference for locally provided services with regards to the location of KIS-related providers, observed in previous studies (OECD, 2006), supports the importance of geographical proximity and the development of clusters and networks in strengthening the innovative system in which the firms operate (Ács, 2002). It is noteworthy that tourism generates demand for KIS including ICT services (e.g. online ticket booking platforms for museums) as well as constituting a source of KIS itself (Kahle, 2002).

A tourism destination can be perceived as a set of competences and knowledge of key importance to the development of products and services (Hjalager, 2010). Some studies indicate that tourism areas are characterized by the occurrence of a crucial, intersectoral knowledge, essential for innovation (Bieger &

Weinert, 2006). It should be noted that tourism destinations concentrate interlinked companies and institutions of the broadly-defined tourism industry within their areas. In this way, they create favourable conditions for the emergence of product and process innovations. Geographical neighbourhood, mutual relations between economic entities and organizations, as well as network links are in this case necessary means of diffusion of knowledge and information within tourism destinations (Nordin, 2003; Porter, 2000).

Innovative entrepreneurship in tourism can also be analysed in the context of the concept of tourism area lifecycle (TALC) (Butler, 1980). Mature tourism destinations are under constant pressure to introduce strategies of rejuvenation and re-orientation, employing various categories of innovation. However, the pressure towards implementation of re-orientation strategy also concerns some 'new' emerging tourism destinations (Weber & Tomljenović, 2004; Mueller, Peters, & Blanco, 2010). Such a strategy usually calls for new forms of partnership in the tourism destination both within and outside the tourism sector; tourism businesses must operate more efficiently. This may lead to the intensification of KIS in a given area, as they are used in innovative processes in tourism.

#### **Research Procedure, Methods, and Data Sources: Measuring Inter-Regional Agglomeration and spatial interrelation between KIS and Tourism**

The research procedure is based on two main stages. First, we measure the occurrence of inter-regional spatial concentration, i.e. the agglomeration phenomenon, including spillover effects, using spatial statistics of autocorrelation (Anselin, 1995, 2010; Kopczewska, 2011; Páez & Scott, 2004; Schabenberger & Gotway, 2005) within exploratory spatial data analysis (ESDA). In particular, we apply local Moran's  $I_i$  statistic, as one of the most common used measures of spatial interdependence (autocorrelation) within Local Indicators of Spatial Association (LISA).

Within the second stage of the research procedure, we assess the relations between two properties of Polish districts: (1) the occurrence of KIS providers, (2) the intensity and dynamics (i.e. development stage) of the tourism development in a given area with the

use of variables based on data collected by the Polish Central Statistical Office. The occurrence of  $\kappa$ IS is measured as the share of business activities registered in section J within NACE classification ('information and communication services') in the general structure of total business activities in a given district in 2015. Tourism development is described by a number of tourists staying overnight in each district in 2015.

Local Moran's  $I_i$  statistic is a weighted correlation coefficient used for the detection of deviations with spatial characteristics in the random distribution of the variable  $X$ . It enables the determination of whether neighbouring areas are more similar to each other (in terms of variable  $X$ ), than would result from the stochastic nature of the phenomenon (Mora & Moreno, 2010). Moran's  $I_i$  statistic is expressed by the following formula (Anselin, 1995; Schabenberger & Gotway, 2005, p. 24):

$$I_i = \frac{(x_i - \bar{x}) \sum_{j=1}^n w_{ij}(x_j - \bar{x})}{\sum_{j=1}^n (x_i - \bar{x})^2/n}, \quad (1)$$

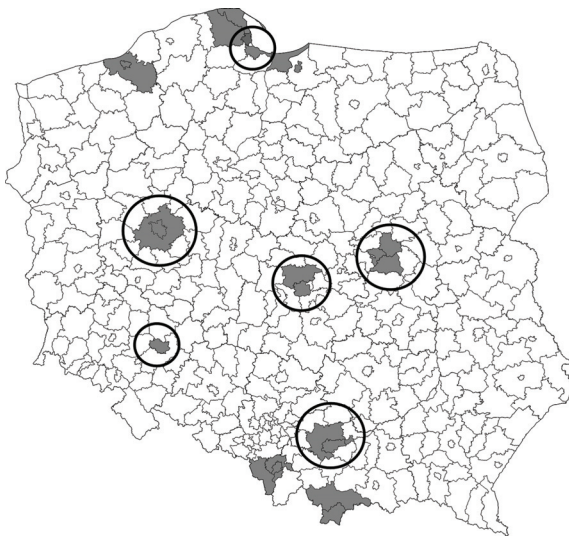
where  $x_i(x_j)$  is the value of the variable  $X$  in the region  $i(j)$ ,  $n$  is the number of regions,  $\bar{x}$  is the arithmetic mean of the variable  $X$ , and  $w_{ij}$  are the elements of the spatial weights matrix  $W$  between units  $i$  and  $j$ .

Local Moran's  $I_i$  statistic is based on a neighbourhood matrix (spatial lag operators  $W$ ). The spatial weights matrix  $W$  is simply a matrix ( $n \times n$ ) containing weights  $w_{ij}$  that describe the degree of spatial relatedness (i.e. contiguity, proximity and/or connectivity) between units of analysis  $i$  and  $j$  (Páez & Scott, 2004). There are different ways of defining the neighbourhood and building spatial weights matrices (Griffith, 1996; Páez & Scott, 2004), but there is no consensus about the operationalization of the neighbourhood construct (Grady & Enander, 2009; Riva, Apparicio, Gauvin, & Brodeur, 2008). These methods depend, inter alia, on the purpose of the study, the degree of knowledge of the area studied and its geographic conditions, and weighting function used (Haining, 2010; Chen, 2012; Timmins, Hunter, Cattet, & Stenhouse, 2013). One basic definition is based on physical contiguity with binary weights that assign a weight of 1 to pairs of territorial units sharing a border and 0 otherwise. Alternatively, connectivity can be given in terms

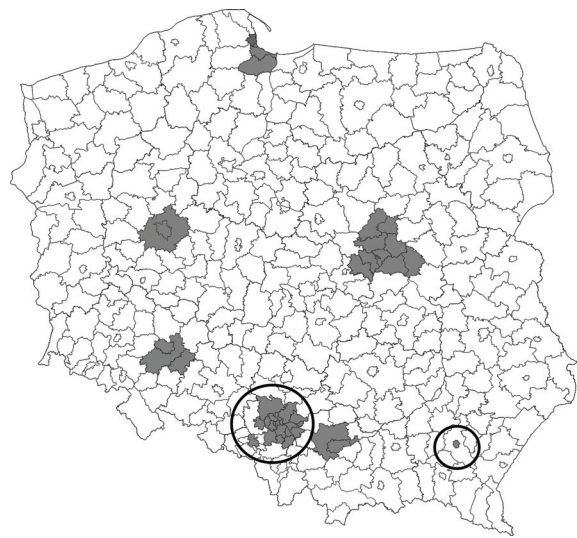
of travel time between pairs of origins and destinations as well as proximity that can be defined in terms of distance or other generalized costs (Páez & Scott, 2004, p. 55).

The rules of the neighbourhood used in the local Moran statistics (and other indicators of spatial association) often operate on the distance between the centroids of adjacent territorial units (Anselin, 1995; Schabenberger & Gotway, 2005; Lloyd, 2010). Then the neighbours are regions where the distance between the centroids of districts, that is, their geometric centres, regional capitals, centres designated on the basis of location data of economic activity (GPS coordinates of spatially localized firms), etc. does not exceed a specified number  $d$  of km. In this study, for measuring the neighbourhood and spatial autocorrelation, we use central tendencies of the localization of enterprises (mean GPS coordinates for each Polish district) as centres of tourism agglomerations, as proposed in the previous study of Majewska (2015), as well as centroids of districts (for  $\kappa$ IS providers). We use the GPS coordinates of enterprises set in the CSO database on individual firms registered in section I of NACE classification within 'accommodation and food service activities' ( $N = 131338$ ) located in 380 Polish districts in 2015.

Assuming that the intensity and dynamic of tourism development in a given area can be seen as indicators of stages within the Tourism Area Life Cycle (Butler 1980), we can verify whether the occurrence of  $\kappa$ IS providers and tourist activity in a given area is linked to the phase of this area's tourism development. Thereby, we apply a contingency table of two categorical variables according to the character of the tourism destination's development ('stages') and the share of  $\kappa$ IS in total business activity in the districts and check if there is a statistically significant relationship, i.e. if and how districts differentiate with respect to both characteristics. Tested is the zero-hypothesis, which states that both variables are independent (categories of one variable are distributed uniformly across the categories of the second variable) (Veal, 2006). A Chi-square test is produced, and the contingency coefficient  $C$  is determined in order to test whether there is any relationship between the two variables involved



*Figure 1* Significant Local Moran's  $I_i$  Statistics in Relation to the Share of Section I (Accommodation and Food Service Activities) in the Total Number of Firms in Polish Districts in 2015 ( $p < 0.01$ ) (based on Central Statistical Office data with the use of PQstat software)



*Figure 2* Significant Local Moran's  $I_i$  Statistics in Relation to the Share of Section J (Information and Communication) in the Total Number of Firms in Polish Districts in 2015 ( $p < 0.01$ ) (based on Central Statistical Office data with the use of PQstat software)

and whether the overall differences are statistically significant.

First, we define a district classification map (a typology matrix based on a character of districts' development as tourism destinations) placing the data on the intensity of tourism development (the number of tourists staying overnight) and the rate of its change in the 2-dimensional matrix (see Gołembski, 2011). Doing so, we can distinguish mature tourism destinations (characterized by high and stable numbers of tourists staying overnight as well as destinations with different dynamics reflecting stagnation, decline, and rejuvenation) or new, emerging tourism destinations (low or medium level of tourist function intensity and high dynamics).

### Inter-Regional Agglomeration of Tourism Supply and KIS Providers in Polish Regions

Within the first stage of the research procedure, we identify statistically significant clusters of neighboring districts in Poland similar to each other by the high values of the variables: (1) the share of section I in total number of firms registered in districts (inter-

regional tourism supply agglomerations) – Figure 1 and Figure 2) the share of section J in the total number of firms registered in districts (inter-regional KIS providers agglomerations) (Figure 2).

Figure 1 and Figure 2 present the results of spatial autocorrelation statistics, Moran's local  $I_i$ , obtained using PQstat software. The neighbourhood matrices were defined by the radius of the distance  $d$  between the centres of districts ( $d = 25$  km). They were set as central tendencies, i.e. the average value of GPS coordinates of enterprises of section I located in each district in Poland (Figure 1) and as geometric means (centroids) of districts (Figure 2).

We observe statistically significant spillover effects in tourism supply in both urbanization- and localization-type clusters (identified on the coast in the northern part of Poland and mountain region in the south). Urbanization-type agglomerations are marked with circles on the map (Figure 1) and those are agglomerations of Warsaw (in central-east part of Poland), Łódź (in the central part), Poznań (central-west), Wrocław (southwest), Krakow (south), and Tricity (north). Almost all of them (5 of 6 – excluding

Łódź agglomeration) are also identified as clusters of  $\kappa$ IS providers (Figure 2). Therefore, we can observe, at least to a certain degree, agglomeration convergence processes in urbanized Polish regions in relation to tourism and clusters of  $\kappa$ IS providers.

With regard to  $\kappa$ IS providers, we can identify two additional agglomerations (marked by circles on Figure 2) comparing tourism clusters, namely: the Silesian conurbation, which is a large industrial region in the south of Poland and Rzeszów agglomeration (south-east), a so-called 'aviation valley' with a strong and well developed  $\kappa$ IS-intensive aviation industry. Moreover, the spillover effects are generally stronger with regards to section J (average value of local Moran's  $I_i$  statistic for all districts equals 0.76 compared to 0.59 in the case of section I). In particular this can be seen the case of the Warsaw, Wrocław, and Gdańsk agglomerations.

Taking into consideration the spatial interrelatedness of tourism and  $\kappa$ IS providers, we can further investigate the observed relationship in different types of tourism destinations (apart from distinguishing between urbanization- and localization-type regions) identified by tourism intensity and its dynamics (stages of the tourist areas' development).

### Relations between Regional Tourist Development and $\kappa$ IS Providers' Localization in Polish Districts

Within the second stage of the research procedure, we analyse the relationship between regional tourism development (the phase of tourism development reflected by the level of tourism development intensity and its dynamics) and  $\kappa$ IS providers' localization. The former was measured by the logarithmized number of tourists staying overnight, while the latter by the share of firms registered in section J in total business activity in districts. For this purpose, a cross-tabulation was produced; the results are shown in Table 1 and Table 2.

Statistically, significant relations between the stage of tourism area lifecycle and the fraction of  $\kappa$ IS in total business activity in districts in 2015 can be confirmed (the value of Pearson chi-square distribution was 44.935 at the significance level of  $p = 0.000$ ).

It can be concluded that the high and medium-high percentages of  $\kappa$ IS in total services is most of-

ten found in districts with the highest growth rate of tourism (29.17% and 30.56% of districts at the 'dynamic growth' stage of tourism development), as opposed to units with low rates of growth or decreased of tourism (only 12.73% and 5.42% of tourism destination with, respectively, medium-low and low level of tourism development are, at the same time, characterized by the high percentage of  $\kappa$ IS). Within the group of districts share of  $\kappa$ IS providers in the local economy is the highest, the largest group (42%) are districts at dynamic growth and a medium-high level of tourism intensity.

Over 40 per cent of districts with the highest intensity of tourist development (mature tourism destinations) is characterized by the low share of  $\kappa$ IS in their economic activities. However, it should be noted that another group of such districts (25%) is characterized by a medium-high share of  $\kappa$ IS or even a high share of  $\kappa$ IS (18.75% of mature tourism destinations). This is a result of different types of tourist agglomerations in mature tourism destinations: the urbanized and the localized type; the latter type is mostly connected with monoculture development of tourism based on natural attractiveness and low levels of  $\kappa$ IS. Districts at the beginning of tourism development or in the decrease stage in terms of tourism development are much less likely to be characterized by a high percentage of  $\kappa$ IS than might be expected from the equal distribution.

### Conclusions and Discussion, Further Research

The study aimed to investigate spatial agglomeration processes and interrelations between  $\kappa$ IS and tourism in Polish regions (at NUTS-4 level, districts). We applied a two-stage research procedure. First, we tested the spatial autocorrelation of neighbouring Polish districts with regards to variables on tourism and  $\kappa$ IS providers' measures. The methodology, based on local statistics of spatial association and GPS coordinates of firms' localization, allowed us to model agglomeration processes and assess their strength and scope. As the main implication of the study, we identified a number of inter-regional agglomerations considering tourism supply and  $\kappa$ IS providers. We observe statistically significant spatial spillover effects of agglomeration in both urbanization- and localization-type



**Table 1** The Relationships between Intensity of  $\kappa$ IS Providers in a District and Its Phase of Tourism Development in 2015: Percentage of Rows

Category	Share of $\kappa$ IS (section J – information and communication)*			
	High	Medium-high	Medium-low	Low
Mature tourist destinations (high level, stability)	18.75	25.00	15.63	40.63
Dynamic growth (medium-high level)	29.17	30.56	29.17	11.11
Decrease or stability (medium level)	12.73	24.55	30.91	31.82
Decrease or stability (low level)	5.42	17.47	35.54	41.57

*Notes* \* In total business activity in districts. Based on Central Statistical Office data with the use of PQstat software.

**Table 2** The Relationships between Intensity of  $\kappa$ IS Providers in a District and Its Phase of Tourism Development in 2015: Percentage of Columns

Category	Share of $\kappa$ IS (section J – information and communication)*			
	High	Medium-high	Medium-low	Low
Mature tourist destinations (high level, stability)	12	9.30	4.20	10.40
Dynamic growth (medium-high level)	42.00	25.58	17.65	6.40
Decrease or stability (medium level)	28.00	31.40	28.57	28.00
Decrease or stability (low level)	18.00	33.72	49.58	55.20

*Notes* \* In total business activity in districts. Based on Central Statistical Office data with the use of PQstat software.

clusters as well as convergence processes of tourism and  $\kappa$ IS clusters in urbanized regions.

Within the second part of the research, we conclude that there is a positive correlation between the share of  $\kappa$ IS providers in districts' economies and tourist destinations at the dynamic stage of tourism development. Moreover, we find that mature tourism destinations are characterized by both low and high intensity of  $\kappa$ IS, depending on the type of clusters (urbanized vs. localized). However, the highest percentage of districts with high dynamics of tourist development refers to the medium and high share of  $\kappa$ IS providers.

The results indicate the need for an in-depth investigation of the role of  $\kappa$ IS providers in the regional development processes in tourism, in the case of new tourism destinations or of mature tourism destinations that are under the pressure of looking for new development impulses (rejuvenation strategies). It seems to be of particular importance to take into consideration the growing need for the creative use of various forms of knowledge in regional innovation processes as well as the rapid development of creative industries which are merging with the tourism in-

dustry. Thus, further research should also concentrate on verifying the collaboration on innovations between  $\kappa$ IS providers and other local firms in regions at different stages of tourism development. A question arises of whether such collaboration enhances regional innovativeness. What role in the emergence of new tourism destinations and innovation-based re-orientation of traditional tourism areas is played by knowledge-based services? In particular, what role in these processes can be attributed to collaboration between firms on introducing product and process innovations? This is a subject for further studies of the relations between  $\kappa$ IS (ICT) and tourism from a business perspective.

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