

## APPLICABILITY OF TOOLS FOR BROWNFIELD REGENERATION IN THE CZECH REPUBLIC: A REGIONAL PERSPECTIVE

Jaroslav ŠKRABAL<sup>1</sup> , Petra CHMIELOVÁ<sup>1</sup> , Kamila TUREČKOVÁ<sup>1</sup> , Jan NEVIMA<sup>1</sup> 

DOI: 10.21163/GT\_2021.162.11

### ABSTRACT:

In the current period marked by the need to address a number of economic and social challenges in the context of the sustainable development of towns and municipalities, the issue of the regeneration and reuse of brownfields is a topic that can help find an effective solution on the local, national and international level. The aim of this article is to assess the use of tools in the process of the regeneration of brownfields on the territory of municipalities with extended competence in the Czech Republic. The information contained in this paper was compiled on the basis of a primary survey. It was found that the highest number of abandoned buildings and premises are located in regions which were focused on industrial and mining activities in the past. Furthermore, the authors found that brownfield sites have been regenerated and reused successfully in the territory of the Czech Republic. Based on the relevant survey, the most frequently used financial tools employed by municipalities with extended competence (MEC) for the regeneration of brownfield sites in the last 10 years included municipality budgets, European subsidy programmes and national subsidy programmes. According to the survey, non-financial tools used for the successful regeneration of brownfields included own activities and support from the CzechInvest agency. The motives of municipalities and towns located in the territory of individual MECs in the relevant country included mainly a new use of buildings (the rescue of historical buildings/premises and unused industrial parts of a village/town) in the territory of the MEC. The results of the article also highlights the regional differences of the studied area in the case of the existence and use of various financial and non-financial instruments in the process of brownfield regeneration in individual MECs in the Czech Republic.

**Key-words:** *municipality with extended powers, tools, brownfields, regeneration, spatial analysis, Czech Republic*

### 1. INTRODUCTION

Re-using and regenerating derelict and abandoned areas constitutes an important element in sustainable land use policy and planning (Klusacek, et al. 2021). According to Tureckova et al. (2018), soil degradation is one of the most important environmental challenges facing our society in recent times. In Eastern and Central Europe, these changes are significantly modified by the processes of privatisation and the profound changes in grant policies (Krejci et al., 2019). Abandoned buildings and sites are an integral part of cities in Central Europe (Tureckova et al., 2017). Brownfields that are in the inner city, near the inner city or near other municipal subcentres are generally well-connected with the current technical and social infrastructures (Koch et al. 2018. Skrabal, 2020). The proximity to an upper-level regional center is of crucial importance for decisions with respect to how (and if) brownfields will be reused (Navratil et al., 2019). Brownfield prioritization tools help identify the most useful investments in the possibility of regenerating abandoned buildings and sites for efficient land recycling. Some of the benefits they can bring include economic, environmental, but also social ones, for example reducing crime. The prioritization tools developed so far are targeted at decision-makers (urban planners, regional development agencies, national and regional authorities, grant agencies, etc.) who are responsible for broad territories (cities, regions or states) (Chrysochou et al., 2012, Pizzol et al., 2016). In the past, several tools were developed to help support brownfield regeneration. The most important tools that have been developed will be listed here. Pizzol and

---

<sup>1</sup> School of Business Administration in Karvina, Silesian University in Opava, 733 40 Karviná, Czech Republic, skrabal@opf.slu.cz; chmielova@opf.slu.cz; tureckova@opf.slu.cz; nevima@opf.slu.cz.

colleagues developed two decision-support systems called SYRIADE (Pizzol et al., 2011, Zabeo et al., 2011, Agostini et al., 2012) and the Timbre Brownfield Prioritization Tool (TBPT) (Pizzol et al., 2016, Bartke et al., 2016, Frantal et al., 2015, Alexandrescu et al., 2017). SYRIADE has been developed to support regional authorities in the ranking of potentially contaminated sites and brownfields for the priority of investigation, when information on site-specific investigation and risk is not available. SYRIADE considers environmental impacts, economic aspects, and shareholders' perspectives (Limasset et al., 2018). Another tool to strengthen brownfield regeneration which has been developed is the Timbre (Tailored Improvement of Brownfield Regeneration in Europe) Brownfield Prioritization Tool (TBPT), developed as a web-based solution to assist stakeholders with identifying which brownfield sites should preferably be considered for redevelopment or further investigation, taking into account a set of success factors properly identified through a systematic stakeholder engagement procedure (Pizzol et al., 2016). Among the factors that determine the successful regeneration of brownfields (so-called success factors) in different geographical and political contexts (i.e. in different European countries) is key to supporting investors and decision-makers in reducing uncertainties and thus increasing the likelihood of success of the regeneration process (Meyer and Lyons, 2000, Thornton et al., 2007, Frantal et al., 2013).

Within the TBPT, these success factors are integrated by means of a Multi Criteria Decision Analysis (MCDA) methodology which includes stakeholders' requalification objectives and perspectives related to the brownfield regeneration process and takes into account the three pillars of sustainability (i.e., economic, social and environmental dimensions). The tool will help to allocate available and limited resources, time and energy to those areas that are assessed as being the most critical, urgent or profitable to be regenerated. The targeted users of the tool are represented by state, regional and local authorities and other representatives of public administration, urban planners, regional development agencies, grant agencies, site owners (individuals or consortia of owners), investors, developers, consultants, and researchers. The Timbre Brownfield Prioritization Tool (TBPT) has been developed to assist stakeholders in ranking brownfield sites according to their redevelopment potential (Pizzol et al., 2016).

The development of the Timbre Brownfield Prioritization Tool took place between June 2011 and May 2014 as part of the EU-funded Timbre project. The TBPT was developed within the "prioritization" work package, headed by one member of the Timbre consortium (the Institute of Geonics, Czech Republic). Seven other partners, including two research institutes, two universities, one national environmental authority, one small enterprise and one brownfield portfolio holder were formally involved in this work package. This means that they took part in formal and informal meetings to discuss what worked (and what did not) in two respects: (1) developing the tool, that is, obtaining a final output to show to the project's funders and (2) tailoring the tool to its would-be users. These two goals overlapped but pursuing them both proved challenging while constructing the network (Alexandrescu et al., 2017).

Subsequently, we can mention another project to support the regeneration of brownfields such as the project RESCUE (Regeneration of European Sites in Cities and Urban Environments) studied several revitalization methods practised to encourage the sustainable use of brownfields and identified best practices for taking local sustainability into account in future revitalization projects (Bartke and Schwarze, 2015). There are many other tools that have been developed and contributed to enhancing brownfield regeneration. Within the general instruments, which will be analysed in this article, it is mainly the use of financial instruments in the form of grant programs, various budget support, etc. For non-financial instruments, support forms of various agencies such as the CzechInvest agency or other forms of support in the form of communication of other agencies and, last but not least, own activities in the process of brownfield regeneration are taken into account.

The aim of this article is to assess the use of tools in the process of the regeneration of brownfields on the territory of municipalities with extended competence in the Czech Republic. The article is designed as follows, where the Introduction is followed by a second chapter focused on the data and methodology of the paper. The third chapter contains the results based on the stated aim of the paper. This chapter is divided into individual subsections, which present individual results based on

geographical aspects. The next chapter (Chapter 4) pays attention to the discussion. At the end, a Conclusion is drafted, which summarizes the essential results that the authors of the paper have reached.

## 2. DATA AND METHODOLOGY

The given issue of the studied area mainly concerns the situation regarding brownfields in the regions of municipalities with extended powers (hereinafter referred to as "MECs") in the territory of the Czech Republic. The existence of abandoned buildings and areas is very evident in the Czech Republic, especially in various regions, such as structurally disadvantaged regions. The reason for the existence of these buildings and areas is mainly the transformation of the economy after 1989. Another reason for the occurrence of brownfields is the return of property to the original owners after 1989 and last but not least, the situation is affected by growing competition within the market economy in individual regions, with both capital and human resources moving to stronger regions with large agglomerations. There are many factors that are behind the emergence of abandoned buildings and areas. It is clear, however, that the occurrence of brownfields is more than obvious in a given republic. Among the ways to eliminate the occurrence of abandoned buildings and areas is to find and use individual tools that can help solve the problem, especially finding a new use for existing brownfields. The regeneration and reuse of abandoned buildings and areas is important especially for the development of individual regions. Based on these circumstances, the authors of the paper decided to address this issue, especially the usability of tools (financial/non-financial) in the process of the regeneration of brownfields in the MECs in the Czech Republic.

There are 205 municipalities with extended powers (MEC) in the territory of the given state. These are so-called municipalities of the 3rd degree and are an intermediate element of the transferred competence of self-government between regional authorities and other authorities (below that are authorized municipal authorities and the lowest is all other municipal authorities). Compared to other municipal authorities, municipal authorities of municipalities with extended powers thus have some additional areas of competence, not only for their own, basic administrative district, but usually also for other municipalities in the vicinity.

Based on the studied area and the selection of MEC regions within this area of the topic, the authors of the paper chose the method of questioning for their primary research. In terms of the choice of contacting the addressees, the method of questioning was chosen for Internet (electronic) questioning. It is a quick form of data collection and then examining and comparing the individual results between regions in the case of a given contribution between MEC regions.

As mentioned above, the authors of this paper focus mainly on the usability of tools (financial/non-financial) in the process of the regeneration of brownfields in the MEC in the Czech Republic. During the creation of the research, a questionnaire (electronic questionnaire) was created, which contained a total of 11 questions. Based on the creation of individual questions, the authors of the paper focused primarily on the situation regarding the existence of brownfields in the MECs. Furthermore, the questions focused on successfully regenerated abandoned buildings and areas in the regions. The third part of the questionnaire survey was focused on the use of financial and non-financial instruments in the process of brownfield regeneration. The last part of the research paid attention to the reasons that forced the MEC regions to regenerate abandoned buildings and grounds. The questions in the given research were closed, where the respondents had to choose the individual options offered and open, where the participants of the given research had the opportunity to comment on the given question without restriction.

The questions of the given research were processed and discussed between the individual authors of the paper on the basis of the detailed study area. In addition, the research questions were created in the electronic tool Google Forms, which helps to create, submit and process various research items. After the creation of the questionnaire survey, a cover letter was created, which contained basic information about the research. An essential part of the original letter was a link that directed the respondents to the research. The cover letter was then sent electronically to all MECs via data boxes.

Data boxes in the Czech Republic are a state-guaranteed electronic communication tool that replaces paper letters. It serves mainly for communication with public authorities.

Individual MECs or, as mentioned above, the so-called municipalities of the 3rd degree are mostly cities and their municipal authorities are therefore mostly municipal authorities. A cover letter referring to the research was sent to the authorities concerned. The given MECs then form smaller regions, which are shown in the figure below (**Fig. 1**). The description of individual MECs in a given figure is the designation of individual cities with municipal authorities under which the MEC regions fall.



**Fig. 1.** Geographical representation of MECs within the territory of the Czech Republic.  
(Source: CSO, 2021).

The primary research based on the chosen method of questioning, when the electronic questionnaire was created, took place from 11 January and the end of data collection was 16 May 2021. The authors of the research addressed the given respondents or the given MEC only once in one wave. It was stated above that 205 MECs of the research return were addressed at a relative frequency of 47.3%, with 97 MECs participating in the research in absolute terms. **Fig. 2** shows the designation of the MECs that participated in the research. It can be said that all regions at the NUTS 3 level, to which individual MECs belong, are thus represented. For better clarity, how many MECs participated in the research in each NUTS 3 region is shown in the table below (**Table 1**).

**Table 1.**

**Regional comparison of return on primary research.**

NUTS 3	Number of MECs [number]	Number of answers in absolute terms [number]	The total return in relative terms [%]
Central Bohemian Region	26	14	53.9
South Bohemian Region	17	10	58.8
Plzeň Region	15	10	66.7
Karlovy Vary Region	7	2	28.6
Ústí nad Labem Region	16	5	31.3
Liberec Region	10	1	10.0
Hradec Králové Region	15	7	46.7
Pardubice Region	15	6	40.0
Vysočina Region	15	6	40.0
South Moravian Region	21	10	47.6
Olomouc Region	13	5	38.5
Zlín Region	13	7	53.9
Moravian – Silesian Region	22	14	63.6
<b>Total</b>	<b>205</b>	<b>97</b>	<b>47.3</b>

Source: based on own survey, 2021.



**Fig. 2.** Highlighted MECs that participated in the research.  
(Source: based on own survey, 2021).

MECs are categorised in individual regions of the Czech Republic (NUTS 3), as can be seen in the figure. The authors then focused on the response rate of the survey at the regional level of NUTS 3. The information about the response rate in individual regions of NUTS 3 is recorded in the table below (**Table 1**). The table shows the name of NUTS 3 regions with the number of MECs in the relevant regions. The third column focuses on the absolute expression of the response rate of the addressed MECs. The last column of the table pays attention to the relative response rate of addressed respondents (MECs).

On the basis of the findings, it can be said that the overall response rate of the primary survey was 47.3%. Within the regional comparison, we can see in the table above that the highest response rate was in the Plzeň Region and the lowest response rate was in the Liberec Region in relation to the number of MEC regions in individual NUTS 3 regions in the Czech Republic.

Based on the research, the results of the questionnaire survey were examined in more depth on the basis of an overall comparison and subsequently according to individual geographical conditions. Among the geographical conditions, MECs within the border area were examined. This is an area located along or closer to state borders. Border regions often suffer from the historical consequences of their peripheral location, a lack of integration into predominant structures and the resulting isolation. The number of MECs located in the border area is 61 in absolute terms. 28 MECs located in a given geographical area participated in the survey in absolute terms. If we look at the relative frequency of respondents who participated in the research in the case of the border, then the value reaches 45.9%. **Fig. 3**, which is shown below, shows the regions that occur at the border.

Data on MEC regions in the border area were further examined by the authors from a geographical point of view of the northern and southern part within the country. The regions in the north are characterized by industrial activity and the southern part of the border is considered mainly as regions that are not so burdened by industrial activity. In the northern part of the country, there are three structurally affected regions, where the most abandoned buildings and areas within the country occur. The regions that can be classified as structured regions include: Karlovy Vary, Ústí nad Labem and Moravian-Silesian regions. For this consequence, the given comparisons between the northern and southern regions of the MEC were also documented. There were 14 MEC regions in both the northern and southern parts. The given distribution of regions is shown in the figure below (**Fig. 4**).



**Fig. 3.** MEC regions in the border area following participation in research.  
 (Source: based on own survey, 2021).



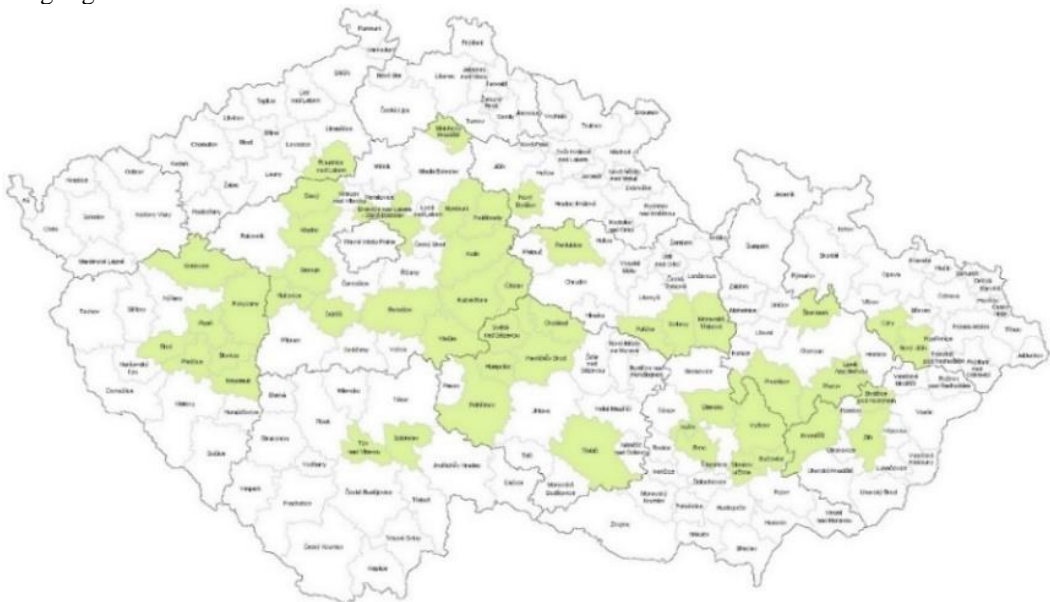
**Fig. 4.** Northern and southern regions of MECs on the border following the participation in research.  
 (Source: based on own survey, 2021).

Other comparisons of MEC regions on the basis of research were compared on the periphery. These are regions that are located in the interior of the country or on the border. For these regions, it was found that 17 MEC regions participated in the survey. The given regions are highlighted in the figure below (**Fig. 5**).



**Fig. 5.** MEC regions occurring in peripheral areas following primary research.  
 (Source: based on own survey, 2021).

The last regions examined are the regions that are located in the middle position (inner position of the grouped regions). These are regions that do not occur on the border or in the periphery of geographical areas. Furthermore, there are larger agglomerations in these regions, with a higher density of both inhabitants, etc. Based on the research, it was found that the research was attended in absolute terms by 52 MEC regions, which are, as mentioned above, concentrated in the internal position of the geographical group. **Fig. 6** shows the regions (MECs) that participated in the research in highlighted colour.



**Fig. 6.** MEC regions in an internal position following participation in the primary research.  
 (Source: based on own survey, 2021).

### 3. RESULTS

The third chapter is designed to interpret the results that the authors of the article arrived at on the basis of the selected primary research (questionnaire survey) and the method of selecting the method of comparing the results between the various regions of the MEC. When interpreting the results, the most significant results from the questionnaire survey based on all MEC regions will be presented first. The next part of this chapter will be used to compare individual MECs according to the information given in the previous chapter.

#### 3.1. Results of the Questionnaire Survey in Relation to all MEC Regions

The mentioned subchapter will focus on the results of the questionnaire survey within all MECs. As mentioned above, 97 respondents (MEC) participated in the absolute frequency and the relative expression was 47.3%. The most important results of the questionnaire survey will now be presented.

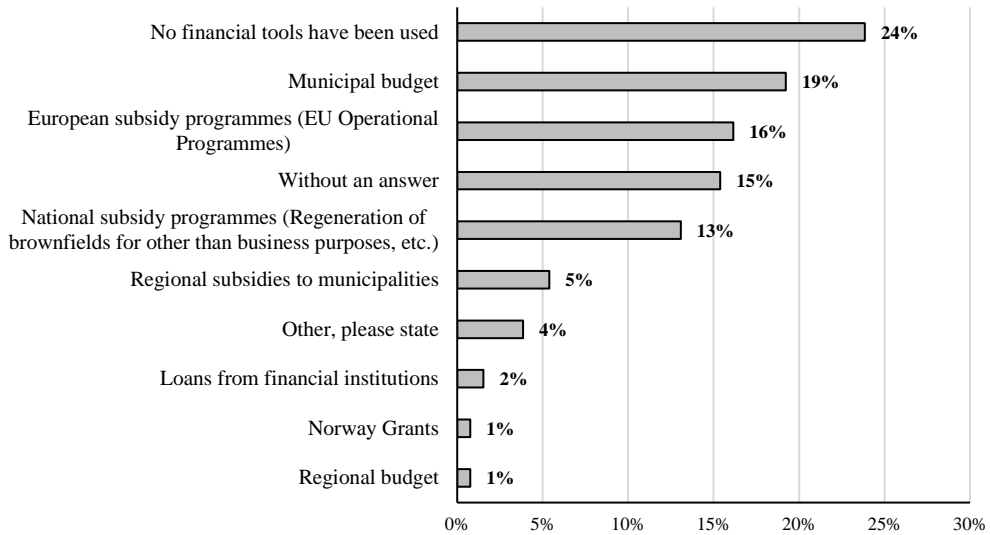
It was stated above that the first part of the primary research focused on the existence of brownfields from the perspective of MEC. The addressed respondents were asked to choose if there are any abandoned buildings or premises, so-called brownfield sites, in their territory (MEC). On the basis of the primary survey results, it can be said that, in relative terms, 85.6% (83 responses) of the addressed respondents chose "Yes", and the remaining 14.4% (14 responses) stated there were no brownfields in their territory.

Then, in the structured questionnaire survey, the authors asked whether any brownfields had been regenerated successfully in their territory (MEC) in the last 10 years. In relative terms, the authors of the primary survey recorded 61.9% (60 responses) of "Yes" answers, where the respondents answered that brownfield sites had been regenerated successfully on their territory in the last 10 years. The "No" option was selected by 37.1% (36 responses) of the survey respondents. One respondent did not comment on the question, while in relative frequency it was 1.0%.

The next question paid attention to whether the addressed MEC participated actively in the regeneration. Here, the addressed respondents could choose from two options, the first one being "Yes" and the other option was "No, the regeneration of brownfields was arranged by the private sector". In total, the question was answered by 88.7% of respondents (86 responses), where 37.1% (36 answers) selected the option that their MEC actively participated in the regeneration of brownfields. The remaining 51.6% (50 answers) of the addressed respondents stated that the regeneration of abandoned building or premises was arranged by the private sector. The last group consisted of respondents who did not participate in the survey, i.e. in the relative frequency of 11.3% (11 responses).

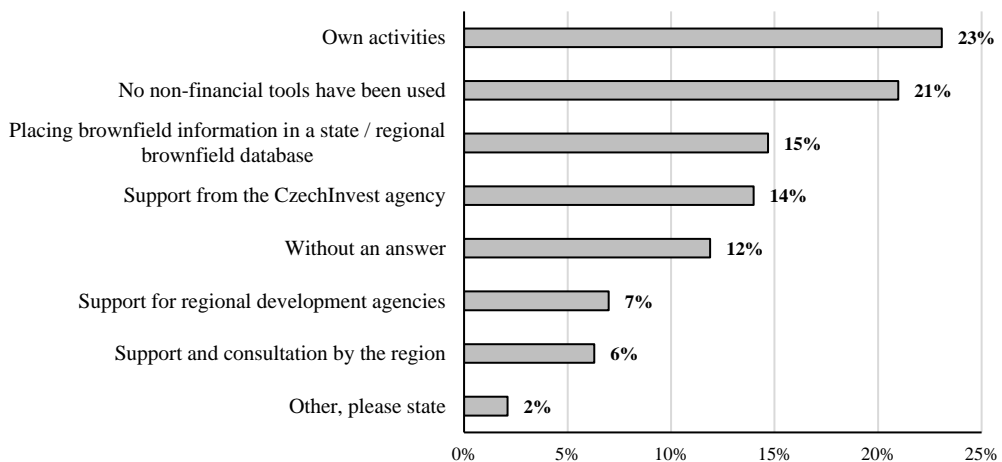
The essence of the whole survey is constituted by the following two questions, which focused on the use of financial and non-financial tools in the process of the regeneration of brownfields in the last 10 years in the territory of the MEC. First of all, the results focusing on financial tools will be commented on, where the relevant question was answered by 79.4% of respondents (77 responses); the remaining 20.6% (20 responses) of the addressed representatives of the MECs did not respond to the question. It is important to note that the respondents could choose from multiple options. The respondents who answered the question most frequently responded that no financial tools had been used. The second most frequent response was municipality budgets and then European subsidy programmes. The results are shown in the figure below (**Fig. 7**). The applicability of European subsidy programmes in the case of the regeneration of brownfields in the territory of the Czech Republic was studied by Tvrdon and Chmielova (2020), who proved that there is a certain time delay in the regeneration of abandoned buildings and premises in the Czech Republic compared to Western European countries. Other results of the study indicate that there are considerable differences between NUTS 3 and NUTS 2 regions within the country in the case of the number of existing brownfields, as well as their possible regeneration and reuse.





**Fig. 7.** Use of financial instruments in the process of brownfield regeneration in the last 10 years. (Source: based on own survey, 2021).

The following question asked the addressed respondents to choose non-financial tools used in the last 10 years in the brownfield regeneration process. As stated above, the addressed respondents of the MECs could choose from multiple options. The question was answered by 82.5% of the addressed respondents (80 answers); the remaining 17.5% of the interviewed MEC representatives did not respond to the question. The figure below (**Fig. 8**) shows the responses to the question. From the given research it was found that the MECs most often stated that they use their own activities, with a relative frequency of 23%. It was further stated that no financial instrument was used. Last but not least, the non-financial tools used by the MECs to regenerate brownfields on the basis of research included the placement of information on brownfields in the state/regional database of brownfields and the subsequent support of the CzechInvest agency. The agency manages and coordinates the activities connected, among other things, with the administration of the database of brownfields at the state and regional level (NUTS 3), where it has its regional branches.



**Fig. 8.** Use of non-financial instruments in the process of brownfield regeneration in the last 10 years. (Source: based on own survey, 2021).

The next question asked the addressed respondents to state the tool (financial/non-financial) that helped them most and/or which they consider to be most efficient/most suitable. Within this question, the respondents did not choose from options, but were asked to write their answer down. This question was answered by 49.48% of the respondents; the most frequent tools they stated included subsidy programmes (EU funds, national financial means intended for the regeneration of brownfields), the active cooperation of interested parties (owners, investors, agencies) and consultations with the CzechInvest agency on possible ways of obtaining funds and other supporting information. Within this question, 50.52% respondents (49 responses) did not answer.

The last question of the survey focused primarily on the identification of reasons that had made the MEC representative regenerate brownfield sites on their territory. The character of the question was intended to make the respondents write down a text answer, not to choose from options. The question was answered by 58.76% of respondents (57 responses); the most frequent reasons predominantly included: the new use of a building (premises), rescue of a historical building/premises, the non-used industrial part of a municipality/town in the territory of the MEC, and the problematic situation with the structural stability of a building in the relevant cadastral territory.

### **3. 2. Results of MEC Regions Occurring in Border Areas**

The next subchapter will focus on the results of a questionnaire survey within the MEC regions located at the border. Part of this subchapter will be the publication of the results of the MEC regions that participated in the research located on the border within the northern and southern part of the country. The number of respondents from the border area that participated in the questionnaire survey in absolute terms was 28, where in relative frequency it is 28.9% of all MECs that participated in the primary survey. Based on the results below, which will be based on the border regions, the number of MEC regions in absolute terms will be 28 registered in both parts of 14 MEC regions.

The first part of the questions, as mentioned above, focused on the existence of brownfields in the given MEC regions. Based on the results of the research, it was found that the existence of brownfields in the borderland in relative frequency is evident in 78.6% of MECs. The stated value is obtained on the basis of data where MEC regions from the border area stated that abandoned buildings and areas occur in their regions. In the northern part of the country, in the case of the MEC regions, it was found that the occurrence of abandoned buildings and areas in this area is higher than in the southern part. From the results, which compared the northern and southern regions on the basis of the border, the authors found that the occurrence of brownfields is evident in absolute frequency in 12 MEC regions in the northern border and in 10 MEC regions in the southern border.

Another question that will be examined in this paper on the basis of border data is whether the regeneration of brownfields in the given regions has taken place in the last 10 years. Based on the results obtained from the primary research, it can be said that 68% of respondents in relative frequency stated that brownfields were regenerated in the given regions. In absolute frequency, there are 19 MEC regions out of 28 (the number of MEC regions that participated in the research). In the case of a comparison between MEC regions in the northern and southern parts of the border, the research showed that in the northern regions, 9 MEC regions answered in absolute frequency, that they had regenerated brownfields in the last 12 years and, in absolute terms, 7 MEC regions have chosen this option. The remaining regions either stated that there was no regeneration of abandoned buildings and areas in the given MECs or did not comment on the issue.

Another question was whether the specific MEC was actively involved in the regeneration of brownfields. The results of the research within the border regions of the MEC showed the possibility "Yes" was stated by 13 regions of the MEC (in relative frequency 46%). The remaining regions mentioned the option "No, the regeneration of brownfields was provided by the private sector itself" in the case of absolute frequency, there are 12 regions (43%) and the remaining three MEC regions did not comment on the issue (11%). In the northern part of the regions, 9 MEC regions stated in absolute terms that they were actively involved in regeneration. In the regions in the southern part of

the border, 4 MEC regions expressed their opinion in absolute terms (29%). The remaining regions stated that they did not take an active part in the regeneration or did not answer the question.

An important question of the research was the indication of which financial and non-financial instrument has helped residents the most (MEC) in the case of brownfield regeneration in the last 10 years. As mentioned above in the comparison of all MEC regions for these questions, respondents (MEC) had the opportunity to choose more options. For financial instruments at the border, within the relative frequency of 24%, municipal budgets and subsequently European subsidy programs dominated (20%) and the possibility where the respondents stated that no financial instruments were used. The fourth option that the respondents chose were national subsidy programs, where in relative frequency it is 17% of responses from the research. Other options will not be commented on here due to the small relative values. If we look at the comparison of the results between the northern regions of the MEC and the southern ones, the results are approximately identical in both cases. The given regions are dominated by financial resources from national and European funds for the regeneration of brownfields. Furthermore, the authors of the paper were interested in what non-financial instruments they have used in the last 10 years in the process of brownfield regeneration. In the given regions, the option "Own activities" dominated, while in relative frequency it is 22%. Other options were the same, at 16%, where it was the support of the CzechInvest agency, the support of regional and development agencies and the placement of information on brownfields in the state/regional database of brownfields. A necessary research issue was the reason that led the MEC regions to regenerate brownfields. At the border, it is mainly a question of answering the question, especially the new use of buildings and premises and the removal of unsightly buildings, which can pose a threat to the health of the population. As mentioned above, this was a textual answer to the question.

### **3. 3. Results of MEC Regions Occurring in Peripheral Areas**

The next part of the mentioned chapter will focus on the interpretation of results within the MEC regions located in the periphery. The number of MEC regions that participated in the given border research was 17 MEC regions within the relative frequency. This is a relative value of 17.5% of all returned questionnaires.

In the case of the analysis of the questions, it was found that 15 regions of the MEC in absolute terms stated that there are abandoned buildings or areas in its territory. Furthermore, in the case of another question, it was found that in the regions that occur on the periphery, there were 12 regions in absolute terms, where the regeneration of brownfields has taken place in the last 10 years. An essential part of the survey was the question of whether the MEC specifically participated actively in the regeneration of brownfields. Here, it was found that in 8 cases of MEC regions, the respondents answered that they were actively involved in the given regeneration. The "No" option was chosen in absolute terms by 6 respondents and the three survey participants did not comment on the question. In the case of financial instruments in the given regions, most research participants addressed stated that they had used national funds for the regeneration of brownfields in the last 10 years, with a relative frequency of 30%. Furthermore, the same 15% of respondents chose options such as the use of European funds for the regeneration of brownfields and subsequently that the funds were not used for the regeneration of abandoned buildings and areas. Other options will not be commented on here due to the small relative values of the given options. In the case of non-financial instruments, the consultations and support of the CzechInvest agency dominated in the given regions. In relative frequency it is 25% and subsequently the option "Own activities" was on the same relative values. The third option mentioned by the respondents was to place the information in the state/regional brownfields database. This response option had a relative frequency of 22% in the study. Another question was directed to the respondents to indicate which tool helped the most in the case of the regeneration of an abandoned building or area. From the given analysed answers, it was found that most respondents wrote that it was funds in the form of subsidies. The last question of the research focused on the situation, which was to state the reasons that the respondents or MEC caused the

regeneration of brownfields. Of the MEC regions located on the periphery, the most frequent answer was that it was a new use of buildings, premises and the removal of unsightly buildings.

### **3. 4. Results of MEC Regions Occurring in the Middle Position Areas**

The last area analysed will be the regions that occur in the internal position. It was found that these are 52 MEC regions, which are located in this part of the geographical area. If we look at the relative frequency in the case of participation of MEC regions in research, which are located in the above-mentioned area, it is 53.6%. The issues in the given MEC regions will now be analysed.

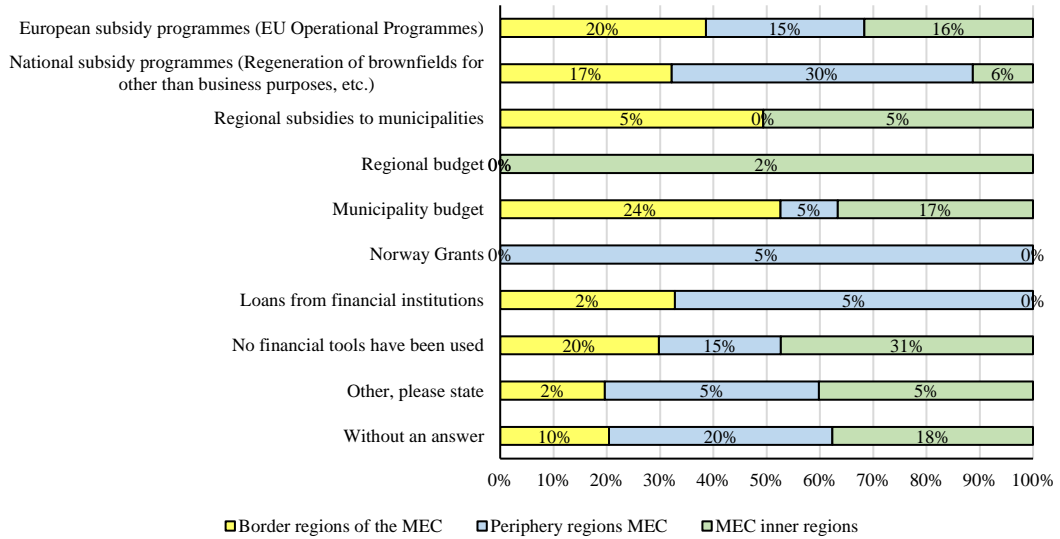
The number of respondents who stated that brownfields occur in their territory (MEC) was answered in absolute frequency by 46 respondents. In relative frequency, this is 88.5% of the surveyed participants based on answers solely from regions that are in an internal position. The remaining regions replied that there were no abandoned buildings or areas in its territory. Another question was focused on whether the MEC territory had successfully regenerated brownfields in the last 10 years. Here, 29 out of 52 respondents expressed an absolute frequency that there was a successful regeneration in its territory. In relative frequency, this is 71%. The remaining regions, or 23 MEC regions, replied that brownfields had not been regenerated in its territory. Following the question, the authors of the paper further addressed whether the MEC was actively involved in brownfield regeneration. It was found that only 15 MEC regions answered 'Yes' while the other 32 regions replied that regeneration was carried out by the private sector itself. In relative frequency, this is 62%.

The main research issues included questions focused on the financial and non-financial brownfield regeneration instruments that the MEC has used over the last 10 years. Among the financial instruments of the regions in the internal position, most respondents reported that they used municipal budgets at a relative frequency of 17%. Respondents reported in the greatest relative frequency the possibility that no funds were used at a relative frequency of 31%. Subsequently, 18% of respondents did not comment on the issue; the fourth option in relative frequency was that the MEC representatives contacted used European brownfield regeneration programmes. In the case of non-phony instruments for MEC regions located in the internal position, the most respondents in relative frequency were found to be 31% who reported that no non-financial instruments had been used. Another possibility from the surveyed participants was that they used their own activities, at a relative frequency of 23%. Subsequently, 16% of respondents did not comment on the question. The fourth option, at a relative frequency of 11%, was to state that the survey participants used the placement of information on brownfields in the state/regional database of brownfields. Other response options will not be commented on due to the low relative frequency.

The following question was aimed at respondents to indicate which tool helped the most in the case of brownfield regeneration. Most respondents stated that the most suitable tool for brownfield regeneration was the use of subsidy funds. Another option was to negotiate with the owners in the case of brownfield regeneration. The reasons that led the participants to address the regeneration of brownfields were mainly the new use of buildings and premises and the threat of the building collapsing. Another possibility that the respondents mentioned was the threat of environmental burdens associated with brownfields.

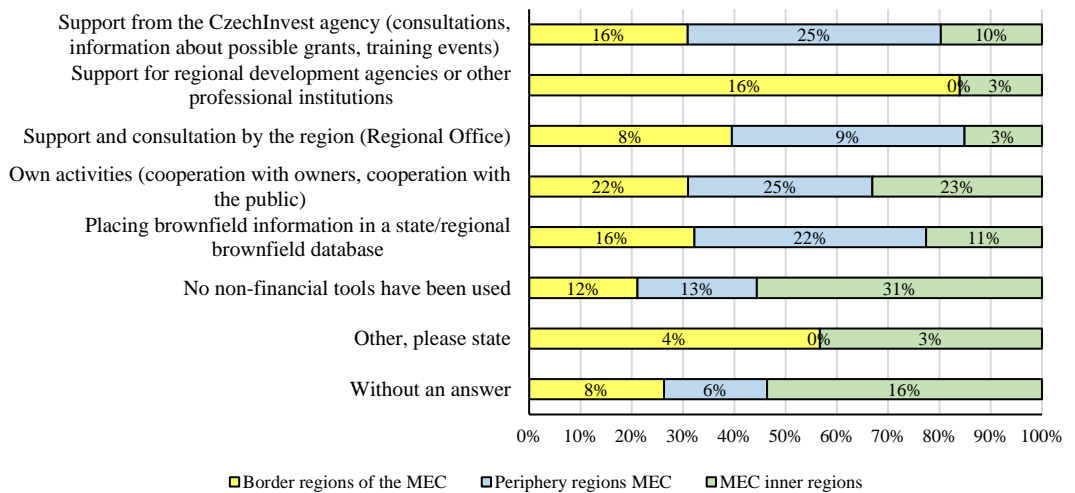
### **3. 5. Evaluation of Tools Between Individual Analysed MEC Regions**

**Fig. 9** below shows the complete results in relative terms for the use of financial instruments in the brownfield regeneration process between the individual MEC regions analysed, which were examined above. If we look at the more detailed results of the picture, we can observe that, in the case of MECs which are located on the border, the budgets of municipalities, European and national programs for the regeneration of brownfields are more preferred. MEC regions located in peripheral areas mainly use national budgets for brownfield regeneration. MEC regions in the internal position make the most of the possibilities offered, especially municipal budgets and European operational programs.



**Fig. 9.** Comparison of the use of financial instruments between MEC regions.  
 (Source: based on own survey, 2021).

The next figure (**Fig. 10**) focuses on the usability of non-financial instruments in the process of brownfield regeneration between individual MEC regions. If we analyse the table below, we can say that the MEC regions on the border mostly use their own activities, the support of the CzechInvest agency and the support of regional development agencies or other abominable institutions. In the last 10 years, the MEC regions in the area of peripheries have mostly used non-financial instruments such as their own activities, support from the CzechInvest agency and the placement of information on brownfields in the state/regional database of brownfields. Other regions examined were MEC regions in the internal position. If we do not analyse the results that the respondents did not use any non-financial instruments or did not answer the question, then the most used tool in this area is the use of their own activities and placing information about brownfields in the state/regional database of brownfields.



**Fig. 10.** Comparison of the use of non-financial instruments between MEC regions  
 (Source: based on own survey, 2021).

#### **4. DISCUSSION**

The research focused on brownfield regeneration tools in individual MEC regions in the Czech Republic. From the given results it is evident that individual MEC regions are aware of this problem with the existence of abandoned buildings and areas, which is mainly influenced by various policies both in the past and in the present (Krejci et al., 2021). This fact was also reflected in the results of the research, where 86% of the respondents stated that there are abandoned buildings and areas in its territory. Furthermore, in the presence of brownfields, it is important to take into account the geographical structure of regions (Frantal et al., 2013), whereas mentioned in the paper in the northern regions, especially in the border there is a greater proportion of abandoned buildings and areas than in the southern regions of the country (Martinat et al., 2016). Furthermore, it was found that most of the addressed MECs, which participated in the questionnaire survey in the last 10 years, performed the regeneration of brownfields. Here again we can compare the fact between the regions in the northern border and southern from the above results and it is clear that the regions that occur in the northern border, to a greater extent indicated that the regeneration of brownfields took place on its territory. This fact was also found in the comparison of MEC regions in the inner territory. Here, the respondents stated to a large extent that the given regeneration took place on its territory. The most significant problem that appears in the regeneration of brownfields is primarily the property rights that are associated with the buildings and areas. Most of the existing brownfields in the country are privately owned and this problem seems to be justified, as the given owners may not have any interest or sufficient funds for possible regeneration (Tureckova et al., 2018).

Based on the research, it was found that the regeneration of abandoned buildings and areas in the given MECs, which participated in the research, was provided by the private sector itself. In the case of a comparison between the individual analyzed regions, we can notice that the border regions primarily stated that the regeneration of abandoned buildings and areas was mainly provided by the public sector in the case of analysing results in internal regions.

It is also clear that the regions of the MEC are trying to use a variety of financial and non-financial instruments that are designed to support the regeneration of brownfields, which were identified from the research. As part of the analysis of all MEC regions that participated in the research, municipal budgets dominated among financial instruments, and non-financial instruments mostly reported their own activities. In the case of comparisons between regions on the basis of geographical point of view, border regions most often stated that they used municipal budgets in the case of financial instruments, national subsidies dominated in peripheral regions and subsequently most often mentioned municipal budgets as the most used financial instrument. In the case of the use of non-financial instruments, it can be noted that on the basis of the analysis of all regions, own activities were most often mentioned. In the comparison between regions in the case of geographical point of view, it can be said that own activities dominated in the border area. This fact was also found in the regions in the periphery and in the middle position. It was stated in the periphery that the regions used consultations with the CzechInvest agency in case of the possibility of brownfield regeneration.

Respondents also stated in the given analyzed regions that one of the most used tools that helped them was financial support in the form of subsidy titles for the regeneration of brownfields. The reason that mainly influenced them to the process of restoration and use of abandoned buildings and areas was mainly the new use of the buildings and facilities or the problematic situation with the statics of buildings.

The above results of the research helped us to look at the fact about the regeneration of brownfields between individual MEC regions in the Czech Republic and in relation to regional differences within the geographical location of the regions, which are, as mentioned above, very evident. The obtained results, which were presented in this paper, can contribute to new possibilities how to effectively adapt the regeneration of brownfields based on regions occurring in different geographical locations in the Czech Republic.

## 5. CONCLUSIONS

The paper focused on the application of tools in the process of the regeneration of brownfields in the territory of a municipality with extended competence (MEC) in the Czech Republic. In the paper, the authors analysed the primary survey which was conducted from 11 January to 16 May 2021. On the basis of the information contained in the paper, it can be said that 47.3% of the addressed respondents participated in the survey. It was found out that the highest number of abandoned buildings and premises can be found predominantly in regions with a problematic situation in the area of industrial and mining activities (Ústí nad Labem and Moravian-Silesian regions). Furthermore, the authors focused on the number of successfully regenerated brownfields in the last 10 years in the territory of the MEC; it was found here that the highest number of successfully regenerated abandoned buildings and premises was located in the South Moravian, Moravian-Silesian and South Bohemian regions. According to Tonin and Bonifaci (2020), the reconstruction of brownfields is decisive for the urban revitalisation of each town or village due to the fact that the soil is a valuable and non-renewable source and an important production factor for the whole economic system of each cadastral territory. Nowadays it is important to pay attention to the regeneration of brownfields in urban environments importance to the utilization of smart technology in the Czech Republic. Research according to Klusacek et al. 2020 identified that there are different factors which determine the successful implementation of smart city concept during the process of brownfields regeneration in the conditions of the post-socialistic urban environment. The concept of smart cities is strongly tied to technologies, and the project creating smart neighbourhoods requires substantial financial investments. The most essential issues of the whole survey included issues focusing on the application of financial and non-financial tools in the brownfield regeneration process. The most frequently used financial tools identified within the survey included primarily municipality budgets, European subsidy programmes and national subsidy programmes. The most frequent nonfinancial tools included own activities of MEC, support from the CzechInvest agency (the agency dealing with the support of business activities in the Czech Republic and managing the National Brownfield Database in the relevant country) and the placement of information about brownfields in the state/regional database of brownfields.

The research also focused on regional comparisons of MECs based on geographical location, where the authors examined the MEC regions in the border area, where the results were further analyzed in more detail based on MEC regions in the northern and southern parts of the country. The research was carried out on the basis of the fact that the northern part of the country has been heavily industrialized in the past and it is clear that there are a large number of abandoned buildings and grounds in these areas. Subsequently, the authors performed an analysis of MECs located in peripheral areas. These are MEC regions that do not occur in the border and internal position of the state. The last regions analyzed were MEC regions, which occur in the middle position of the above state. The results showed that there are some differences between the analyzed regions. In the northern regions of the MEC, abandoned buildings and areas were found to be more common than in the southern regions of the MEC. This fact is obvious, as mentioned above from the predominant industrialization of the regions concerned. Subsequently, the results pointed to the fact that the regions in the northern areas had a greater regeneration of brownfields in the past than the MEC regions in the southern areas. Furthermore, there are regional differences in the case of regeneration of abandoned areas provided by the public or private sector. There are differences mainly in the border regions and the middle regions. The MEC regions in the border area most often stated that the regeneration of brownfields was ensured by the public sector, and in the MEC regions in the internal position it was found that the reuse of abandoned buildings and areas was mostly provided by the private sector itself. An interesting finding was the comparison of results in the case of the use of financial and non-financial instruments within the regions examined. In the case of border regions and regions in the middle position, the budgets of municipalities dominated within the financial instruments for the reuse of brownfields. For the regions in the periphery, it was stated that national subsidy programs were most often used. If we look at the results in the case of non-financial instruments in the process of brownfield regeneration, we can notice that most regions, based on geographical scope, stated that they were most often used in the process of their own activities. The MEC regions, which are located

on the periphery, further stated that the consultations of the CzechInvest agency were used. Examining the results of the given primary research as a whole is not very effective, because the given results can distort the unexplored regional differences that obviously exist. It is necessary to examine the results also on the basis of the geographical scope of the regions, which can help us to obtain more information about the results and comparisons between regions.

It is important to point out that the research had some limitations when the number of respondents in the case of a regional comparison was not the same. Another limitation is the fact that when filling in the results, respondents stated in certain cases that they do not have information on brownfields in the MEC territory, because in case of using information on brownfields they use the National Brownfields Database managed by CzechInvest or regional databases of abandoned facilities and sites which are mostly analysed at the NUTS 3 level. The fact that the questionnaire survey was established as pilot research also seems important. It is obvious that when researching the issue focused on MEC regions in the field of brownfields and the use of tools for their regeneration, it is important in the future to use other procedures, methods and data that can contribute to new findings and interesting results in the case. On the basis of the findings, it is important to prioritise the use of existing abandoned buildings to building on the agricultural land. According to Squires and Hutchison (2021) the development of brownfield sites includes both private and public costs resulting from the soil contamination. In addition, brownfields create negative externalities concerning the viability of real estate, and are considered to be hazardous for their development. The application of tools (financial, non-financial) is a basic prerequisite for the successful regeneration and reuse of an abandoned building or premises, which could serve for new purposes in the following years, and contribute to the development of the area or territory.

## ACKNOWLEDGMENT

This paper was supported by the project SGF/7/2020 „The measures of the public sector for the strengthening of the regeneration potential of brownfields in the area of the Czech Republic. “

This paper was supported by the Ministry of Education, Youth and Sports Czech Republic within the Institutional Support for Long-term Development of a Research Organization in 2021.

## REFERENCES

- Agostini, P., Pizzol, L., Critto, A., D'Alessandro, M., Zabeo, A. & Marcomini, A. (2012) Regional risk assessment for contaminated sites Part 3: Spatial decision support system. *Environment International*, 48, 121 – 132.
- Alexandrescu, F., Klusacek, P., Bartke, S., Osman, R., Frantal, B., Martinat, S., Kunc, J., Pizzol L., Zabeo, A., Giubilato, E., Critto & Bleicher, A. (2017) Actor networks and the construction of applicable knowledge: the case of the Timbre Brownfield Prioritization Tool. *Clean Technologies and Environmental Policy*, 19, 1323 – 1334.
- Bartke, S., Martinat, S., Klusacek, P., Pizzol, L., Alexandrescu, F., Frantal, B., Critto, A. & Zabeo, A. (2016) Targeted selection of brownfields from portfolios for sustainable regeneration: User experiences from five cases testing the Timbre Brownfield Prioritization Tool. *Journal of Environmental Management*, 184, 94 – 107.
- Bartke, S. & Schwarze, R. (2015) No perfect tools: Trade-offs of sustainability principles and user requirements in designing support tools for land-use decisions between greenfields and brownfields. *Journal of Environmental Management*, 153, 11–24.
- CSO (2021). Czech Statistical Office. Available from: <http://www.un.org/sustainabledevelopment/> [Accessed May 2021].
- Frantal, B., Kunc, J., Klusacek, P. & Martinat, S. (2015) Assessing success factors of brownfields regeneration: international and inter-stakeholder perspective. *Transylvanian Review of Administrative Sciences*, 44, 91 – 107.
- Frantal, B., Kunc, J., Novakova, E., Klusacek, P., Martinat, S. & Osman, R. (2013) Location Matters! Exploring Brownfields Regeneration in a Spatial Context (A Case Study of the South Moravian Region, Czech Republic). *Moravian Geographical Reports*, 21 (2), 5-19.



- Frantal, B. & Martinat, S. (2013) Brownfields: A geographical perspective. *Moravian Geographical Reports*, 21 (2), 2-4.
- Chrysochou, M., Brown, K., Dahal, G., Grada-Carvajal, C., Segerson, K., Garrick, N & Batgtoglou, A. (2012) A GIS and indexing scheme to screen brownfields for area-wide redevelopment planning. *Landscape and Urban Planning*, 105 (3), pp. 187-198.
- Klusacek, P., Konecny, O., Zgodova, A. & Navratil, J. (2020) Application of the Smart City Concept in Process of Urban Recycling - Case Study of Špitálka in Brno, Czech Republic. *DEUROPE (The Central European Journal of Regional Development and Tourism)*, 12 (1), pp. 22-40.
- Klusacek, P., Navratil, J., Martinat, S., Krejci, T., Golubchikov, O., Picha, K., Skrabal, J. & Osman, R. (2021) Planning for the future of derelict farm premises: From abandonment to regeneration? *Land Use Policy*, 102, 105248.
- Koch, F., Bilke, L., Helbig, C. & Schlink, U. (2018) Compact or cool? The impact of brownfield redevelopment on inner-city micro climate. *Sustainable Cities and Society*, 38, 31–41.
- Krejci, T., Navratil, J., Martinat, S., Frazier, J. R., Klusacek, P., Picha, K., Skrabal, J. & Osman R. (2021) Spatial Unevenness of Formation, Remediation nad Persistence of Post-Agricultural Bornwfields. *Land*, 10 (3), 325.
- Krejci, T., Navratil, J., Martinat, S., Picha, K., Klusacek, P., Osman, R. & Skrabal, J. (2019) Current use of former communist agricultural properties in South Bohemia. In: *XXII. International Colloquium on Regional Sciences*. Brno: MU ESF Brno, 665-671.
- Limasset, E., Pizzol L., Merly, C., Gatchett, M. A., Le Guern, C., Martinat, S., Klusacek, P. & Bartke, S. (2018) Points of attention in designing tools for regional brownfield prioritization. *Science of The Total Environment*, 622 – 623, 997 – 1008. "
- Martinat, S., Dvorak P., Frantal B., Klusacek, P., Kunc J., Navratil J., Osman R., Tureckova K. & Matthew, R. (2016) Sustainable urban development in a city affected by heavy industry and mining? Case study of brownfields in Karvina, Czech Republic. *Journal of Cleaner Production*, 118, pp. 78-87.
- Meyer, P. B. & Lyons, T. S. (2000) Lessons from private sector Brownfield redevelopers -planning public support for urban regeneration. *Journal of the American Planning Association*, 66 (1), 46–57.
- Navratil, J., Martinat, S., Krejci, T., Picha, K., Klusacek, P., Skrabal, J. & Osman, R. (2020) The fate of socialist agricultural premises: To agricultural 'brownfields' and back again? *Moravian Geographical Reports*, 27 (4), 207 – 216.
- Pizzol, L., Critto, A., Agostini, P. & Marcomini, A. (2011) Regional risk assessment for contaminated sites Part 2: Ranking of potentially contaminated sites. *Environment International*, 37 (8), 1307-1320.
- Pizzol, L., Zabeo, A., Klusacek, P. Giubilato, E., Critto, A., Frantal, B., Martinat, S., Kunc, J., Osman, R. & Bartke, S. (2016) Timbre Brownfield Prioritization Tool to support effective brownfield regeneration. *Journal of Environmental Management*, 166, 178-192.
- Skrabal, J. (2020) What Can we Learn from Brownfield Databases? Exploring Specifics of The Location of Brownfields in The Czech Republic. *Geographia Technica*, 15 (2), 191-201.
- Squires, G. & Hutchison, N. (2021) Barriers to affordable housing on brownfield sites. *Land Use Policy*, 102, 105276.
- Tonin, S. & Bonifaci, P. (2020) Assessment of brownfield redevelopment opportunities using a multi-tiered approach: A case in Italy. *Socio-Economic Planning Sciences*, 71, 100812.
- Thornton, G., Franz, M., Edwards, D., Pahlen, G. & Nathanail, P. (2007) The challenge of sustainability: incentives for brownfield regeneration in Europe. *Environmental Science & Policy*, 10 (2), 116–134.
- Tureckova, K., Martinat, S., Skrabal, J., Chmielova, P. & Nevima, J. (2017) How local population perceive impact of brownfields on the residential property values: some remarks from postindustrial areas in the Czech Republic. *Geographia Technica*, 12 (2), 150–164.
- Tureckova, K., Nevima, J., Skrabal, J. & Martinat, S. (2018) Uncovering patterns of location of brownfields to facilitate their regeneration: Some remarks from the Czech Republic. *Sustainability*, 10 (6), 224–234.
- Tvrdoň, M. & Chmielova, P. (2020) Interlinkages Between Strategic, Financial and Regional Frameworks of Brownfield Regenerations: the Case of The Czech Republic. *Geographia Tehcnica*, 16 (1), 113-127.
- Zabeo, A., Pizzol, L., Agostini, P., Critto, A., Giove, S. & Marcomini, A. (2011) Regional risk assessment for contaminated sites Part 1: Vulnerability assessment by multicriteria decision analysis. *Environment International*, 37 (8), 1295 – 1306.