Can Metropolitan Region Not Be Innovative?

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Abstract. One of the qualities of metropolises is their innovativeness. However, when we ask about the qualities of an innovative metropolitan region, the matter becomes somewhat complicated. The tasks of a metropolitan region concentrate around matters of supporting the functioning of its main centre. However, we should not assume that this support is only meant to take place in the form of simple economic functions like workforce accessibility, the providing of food, drinking water or fuel. Technological and industrial subcentres play an important role in a metropolitan region, their operation being directed at goals that the main centre works towards, which shows that if this support is to be efficient, then it has to be adapted to specific needs in a greater manner, in addition to meeting the criteria of innovativeness. In turn, if the subcentres are directed towards competitiveness, then they must tend to the development of their own creativity, which must result in increasing the degree of innovativeness of the activity that takes place inside them in all four types of innovation: product, process, marketing and organisational. From among the most commonly cited indicators of innovativeness, the number of patents is brought up the most frequently. Among Polish research institutions, the highest number of patents are being filed by universities and pharmaceutical companies, while territorially the most innovative region is that of the Warsaw metropolis. Innovation in urban planning and architecture is most often based on striving towards sustainable development, the minimisation of labour associated with transport and improving the quality of life of society, in addition to the adaptation of the latest technological solutions in building construction and the promoting of energy efficiency and the generation of renewable energy.

1. Introduction

Globalisation1 and its accompanying trend of the relocation of the residents of rural areas to cities is causing a landslide effect in the form of an increase in the number of the largest of the world's metropolises. According to GWaC2, 22 new metropolises with a population count greater than 10 million appeared between 1970 and 2014. According to popular sources3 there are currently as many as 42 such metropolises, which amounts to an increase by a rate of 10 per year, assuming its constancy. Geographically, the greatest development of large metropolises is being observed in Asia, particularly in China, India, Indonesia and Japan. These are countries which are experiencing rapid economic

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1 Dicken P. Global Shift Mapping the Changing Contours of the World Economy, Gulford Press, London 2015 : „globalisation is primarily a change in the reations between different geographic scales”.
2 In 1970 there were only three such metropolises, while in 2014 there were as many as 25 - according to Globalization and World Cities Research Network, source: www.lboro.ac.uk/gawc
3 https://en.wikipedia.org/wiki/List_of_metropolitan_areas_by_population
development as a result of the relocation of industrial production, mainly from Europe and the US, to their territories. China in particular stands out in terms of a very dynamic increase in the number of its urban population. There are five Chinese cities with a population count greater than 10 million, these cities being: Shanghai, Beijing, Shenzhen and Tianjin. However, according to various sources, there are cities with even more residents, like, for instance, Chongqing, which is reportedly inhabited by 32 million people, or the hyper-metropolis of the Pearl River, with a population reaching up to 57 million people. Such enormous groupings of people must lead to the emergence of phenomena in many areas and their impact is not always positive, particularly regarding the natural environment. Thus, the problem of sustainable development, as well as issues concerning the prevention of catastrophic natural phenomena, must be analysed very carefully and taken into account in spatial development strategies.

2. The metropolis and its surroundings

The city that becomes the seed of a metropolis is called the core city. Domański wrote about the role of core cities within metropolises - but also, somewhat in parallel, on the role of metropolitan areas, of which metropolitan regions are parts of - as follows: "The core cities of metropolises, without a metropolitan area, would not be what they are today, they would lose an essential part of their functions, and at the same time their rank within the hierarchy". The role that Domański sees in the metropolitan area, without which the core city loses its significance, is clearly accentuated here. This statement makes it possible to highlight the factor that is key to the functioning of metropolises - uniqueness, and to be more precise - the innovativeness of functions which are of decisive significance to a city called a metropolis, precisely due to the leading intellectual role of the residents of such a centre in the development of its region. However, seeing as it was underlined that this "feedback loop" between the elements of a metropolis is essential, then it is also not without significance whether - and if so, then to what degree - the subcentres of a metropolis, that are polycentrically distributed relative to the core city, are innovative as well. It is also important to properly order the terms that are being used in the discussion on metropolitan phenomena so as to not cause an impression in the reader that they are being used interchangeably or randomly. A certain version of the definitions of some terms can be found in a different publication by the author, which is why repeating them again does not appear necessary. Differentiating between a metropolitan region and a metropolitan area is essential from the point of view of statistical geography, so in order to simplify the matter it has been assumed that the discussion will revolve around the former. We could also refer to the metropolitan functional area, which is probably the most adequate research field, however, this, in a sense, limits the scope of the influence of metropolises, which is represented most fully in relation to the problem of innovativeness by the metropolitan region itself. Accepting the assumptions presented above, we can make an attempt at analysing this problem on the example of the Krakow metropolitan region.

3. Types of innovation in the Krakow metropolitan region

According to Kopaliński's dictionary, innovation is "the introduction of something new; a newly introduced element; a novelty; reform". If we accept this definition, then we can refer to a certain action

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4 A city that constitutes the densely populated centre of a metropolitan area — called also core city [source: https://www.merriam-webster.com/dictionary/core%20city]

5 Domański B. 2006 Metropolia jako biegun wzrostu gospodarki opartej na wiedzy. Spojrzenie na Kraków w perspektywie kapitału ludzkiego (Metropolis as a pole of economic growth based on knowledge. A look at Krakow from the perspective of human capital)

6 Podhalański, B. 2013, The integration of metropolitan spaces, Monograph 443, Krakow

7 Kryworutschko J. Aktuelle Probleme des Stadtebaus in der Ukraine // Urbane Metamorphosen fuer die Krim. (Current problems in terms of building cities in Ukraine. Urban metamorphoses for Crimea) LIT Verlag / Muenster-Berlin-Wien,2005

8 Kopaliński W. Słownik wyrazów obcych i zwrotów obcojęzycznych z almanachem (Dictionary of foreign words and expressions with an almanach), Oficyna Wydawnicza Rytm, Warszawa, 2007, p. 16.
or process, an item, a non-obviousness and a significant change, as a reference to the search for those relations that allow us to trace the possible influence of the subcentres of metropolises on the actions of its core. Available publications\(^9\) point out that Polish academic facilities were some of the most innovative entities, particularly the Jagiellonian University (12), in addition to pharmaceutical companies (Polpharma - 10), construction companies (Fakro - 6) and the EIT+ Wroclaw Research Centre (6). A year prior, in 2016, among the top ten in terms of the number of filed patent and utility model applications by universities in Poland there were 7 polytechnic schools, the AGH university and two other universities, including the Cracow University of Technology\(^10\). Unfortunately, there is an observable tendency for the decrease in the number of people who run private companies\(^11\).

The main reason, as can be concluded from the statistical data published by GUS (the General Statistics Office of Poland - transl. note) is the aging of society, including that of the owners of already active companies. Young entrepreneurs thus do not found new ones, instead taking over family companies that already exist on the market. Do already existing companies, often with a certain position and recognisability on the market, attempt to implement new, innovative products? A certain part of them do invest in research in their respective fields in order to find new solutions that would make it possible to significantly increase their profits. However, this is currently an insufficient amount for us to be able to speak of a permanent, pro-development trend. In the Lesser Poland Voivodship, in order for it to become possible to draw general conclusions, we would have to compare them to general European trends\(^12\), with the most innovative countries including Sweden (in the field of the quality of academic scientific research), Germany, Finland and Belgium. Ireland, in turn, is ahead of the remaining countries of the European Community in terms of innovation in small and medium-sized companies. When comparing these tendencies we can see that Lesser Poland is in line with this general European trend, insofar as we acknowledge that patents filed by universities are a result of scientific research performed at universities from Krakow and Lesser Poland. Taking into account the patents filed by companies that are located not within the metropolis itself, but rather within its zone of influence, in this case in Nowy Sącz (Fakro), we gain evidence in support of the confirmation of this thesis.

The aforementioned company cooperates with the Cracow University of Technology and the Faculty of Architecture, whose students regularly participate in jointly organised competitions, whose secondary goal is the growth of the innovative creativity of students. Speaking on the subject of students, their ability to think outside the box is widely known, which is why one of the types of activity that influences the development of innovativeness is the proposing of interesting ideas by students, which, after being appropriately developed, can be commercialised. In order for this to become possible, the universities of Lesser Poland strive to support efforts to use at least some ideas that are devised during the education process in practice, however, it is necessary to make it possible to develop prototypes by existing economic entities or the establishment of new ones - with young entrepreneurs, who are students, often striving to become the owners of said entities. This is not that simple as it sounds - as studies performed in 2017 on the activity in establishing so-called start-ups by students, and, more broadly - the eagerness to take on the role of an entrepreneur, have shown. The reason why this group is the subject of interest appears to be obvious - students constitute the most dynamic and innovation-oriented segment of society.

\(^9\) http://www.eitplus.pl/polska-z-rekordowa-liczba-patentow-przyznanych-przez-europejski-urzad-patentowy/
\(^10\) https://www.pk.edu.pl/index.php?option=com_content&view=article&id=1685:pk-w-top-20-raportu-urzedu-patentowego-rp-2016&catid=8&Itemid=405&lang=pl
\(^11\) https://mambiznes.pl/wlasny-biznes/spada-liczba-przedsiębiorcow-polsce-82819
\(^12\) http://ec.europa.eu/regional_policy/pl/newsroom/news/2016/07/14-07-2016-innovation-performance-compared-how-innovative-is-your-country
Not stopping at the published results of research, the author performed an experiment based on asking questions to students of the Faculty of Architecture and two engineering faculties, about motivation or demotivation to begin their own economic activity as an individual entrepreneur. The direct reason for this had been the statements included in a publication by the Office of the Marshall of the Lesser Poland Voivodship. "Student respondents most often pointed to public financing and expressed disappointment in the lack of accessibility to non-returnable funding within the current perspective. The balance of experiences from previous perspectives, however, pointed to a conclusion that this support had not brought the desired results. In the years 2006-2013 public funds spent on the development of start-ups consumed 12,3 billion PLN. Their effects are still to be observed. As far as we know, the granting of non-returnable subsidies for the development of privately owned companies has been abandoned after 2013, which might have been caused by the fiasco of these types of subsidies, something that is elaborated in a different publication, whose author stated that: "There is this interesting dependency, that most projects that had not been granted funding went better than those that had".

This conclusion, contained in the cited publication, is very hurtful from not only the students' point of view, but also of that of other young people who are striving to obtain support for their attempts at starting their own business - but it can also be very true! It is the overcoming of the initial barriers that can constitute the most effective way of proving oneself as a future entrepreneur under difficult market conditions, for as business practice has shown, it can be equally as or even more difficult to manage a company in a manner that can sustain its operation under conditions of intense competition. This can also be the reason for the phenomenon observed in studies that students of large universities that are headquartered in large metropolitan cities are reluctant to take on the risk of establishing their own companies, which means that they do not want to become individual entrepreneurs, instead searching for well-paid jobs at already existing companies. Students from smaller universities located in metropolitan regions, in turn, take on this challenge more often. This would constitute another piece of evidence in favour of the truthfulness of the thesis being discussed, in that a metropolis cannot function without support from its zone of influence, and because organisational innovation is one of the four types of innovation mentioned in the Oslo Manual - then in this case the founding of new companies is evidence of the most desirable organisational activity, as it bodes well for the future of a region's development.

4. Competition: does it build or does it destroy?
The majority of theories on the development of metropolises or their metropolitan regions is based on competitiveness as the main "driving force" behind innovation and progress in technical fields. This statement is probably mostly right, but it would be good to ask the following questions: is it really so? does it always have to be this way? We can find cases that contradict this view on the problem, seeing certain positive phenomena that are a result of cooperation. It does not appear true that any positive synergetic effect can be obtained under the conditions of intense competition, while it is easier to observe a greater probability of the occurrence of positive effects of synergetic efforts in a situation of cooperation or the achievement of common goals. When observing pro-environmental efforts, as well as actions

13 www.obserwatorium.malopolska.pl Przedsiębiorczość studentów w Małopolsce (Student entrepreneurship in Lesser Poland). Departament Rozwoju Regionalnego
14 Conclusions drawn from this observation will be the subject of a separate publication
15 https://www.malopolska.pl/rozwoj-regionalny/malopolskie-obserwatorium-rozwoju-regionalnego
16 Op. cit. p. 93
17 K. Bagiński, Na start-upy wydaliśmy już ponad 12 mld zł. W większości to zmarnowane pieniądze (We have spent over 12 billion PLN on start-ups. This money has mostly been wasted), available at: http://innpoland.pl/133413,na-start-up-y-wydalismy-juz-ponad-12-mld-zl-w-wiekszosci-to-zmarnowane-pieniadze [27.11.2017]
18 Op. Cit. 12
19 http://home.agh.edu.pl/~kkulak/lib/exe/fixe.php?media=user:konrad:var:oslo-manual.pdf
increasing energy efficiency in the construction sector, the cooperation of different sectors appears to be the only reasonable path that can be taken in light of the effects that can be obtained.

If every branch of engineering would act without concern for a common goal, which in construction is undoubtedly the achievement of an optimal economic, technical, aesthetic and functional effect in the form of a technologically advanced building, concentrating solely on the perfecting of their individual products, we would have a situation in which, despite having perfect parameters, they would not be possible to use to construct anything at all because of, for instance, their creator's lack of concern for dimensional coordination or material resistance parameters. What good would come from a super innovative solution whose durability is almost non-existent because this factor was not taken into account during its development at all, with other parameters being focused on instead? Referring to the relation: metropolitan area versus the metropolis, we can employ an analogous comparison. The sole development of the means of innovation within the metropolis would result in a "void effect" in relation to the metropolitan area, which would, as a result, lead to an excessive intellectual depletion of subcentres, leading, in the long term, to an economic one.

This phenomenon is, in a sense, visible on the example of German cities like Leipzig or Dresden, where a sizeable decrease in population count has led to a general lowering of the potential of these cities, in addition to causing not only physical changes in their structures distinct of "shrinking cities" but has also produced changes in the mentality of the residents who have remained there, the proof of which are numerous situations bordering on nationalism, which are, however, not widely publicised by the media. This situation has been, in part, caused by competition on the global employment market, as well as competition in the form of other cities in Germany which offer their residents better employment, social and financial conditions, in addition to a better offering in terms of spending free time.

The different spatial structure of these cities, partially resulting from the experiences of the Second World War, during which there were no large monofunctional housing estates composed of tall panel apartment blocks, was not without significance here. Elements of the traditional cityscape, composed estate greenery, cultural facilities or religious spaces, necessary in every urban layout, were also not commonly present in these housing estates, which has also probably facilitated their abandonment by residents. The conclusion from the observation of the condition of not only Dresden or Leipzig, but also of many other smaller cities of eastern Germany, whose situation had been similar (although not as dramatic) becomes obvious - competition between urban centres, and between metropolises in particular, does not appear to be the best method of improving the dynamics of their development.

5. Innovative elements in the development of the Krakow metropolis and its metropolitan region

In order to trace the problems of innovation within the Krakow metropolis, we should first define the fields in which it can be expected. This is not going to be about all the possible forms of innovation, but mainly those that are associated with the functioning of a metropolis as an urban organism, as well as some other ones which affect the part of society that inhabits said metropolis. The main areas of our search are housing (which is one of the main functions of a metropolis) contemporary forms of solving

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20 http://www.fronda.pl/a/matka-kurka-dla-frondy-nacjonalizm-niemiecki-nigdy-nie-umiera,100002.html
21 http://autonom.pl/?p=21256
22 Racoń-Leja K. 2013, Ślady II wojny światowej w miastach europejskich (Traces of World War II in European cities) Technical Transactions, iss. 3. Architecture, iss. 1-A, p. 101-118
23 Kozień-Woźniak M. 2008, Dzieło architektoniczne w przestrzeni ludycznej (Work of architecture within a ludic space). Technical Transactions b. 15 Architektura b. 6-A, p. 387.
24 Napiórkowski A. Dokąd prowadzi relatywizm. Pytanie o religijność niemiecką (Where relativism leads us. The question about German religiousness), „W drodze” 2(270) 1996, 36-43.
transport problems that appear inside metropolises and within metropolitan regions, in addition to energy efficiency in connection with ecology and sustainable development. In Europe the country with the greatest and longest lasting experiences in the aforementioned sphere is Germany. The first practical implementations of the idea of energy efficiency have taken place in this country, as well as in Switzerland, with said idea currently becoming probably the most important global issue. All larger metropolises, as well as global corporations which generate their own energy in various forms are investigating solutions that save energy, in addition to other numerous goods that are being consumed by the residents of said metropolises.

The greatest consumer of energy on the metropolitan scale is industry, followed by housing and transport. Depending on the climate zone, the demand for energy changes in a cyclical manner; in temperate climate zones the need for energy has two evident peaks - during winter and summer, when there is the need for either the heating or cooling of residential spaces. Attempts at globally lowering the amount of energy that is irretrievably lost are still ongoing, in the sphere of housing they are limited to increasing the insulation of buildings, lowering the degree of energy loss during its transfer and attempts at using renewable energy sources in the social sphere - in the promotion of pro-energy-efficient and pro-environmental behaviours among the societies that inhabit metropolises. Following this trail, we can conclude that this subject is at an early stage of development in the Krakow metropolis.

There is currently a lack of housing estates that have, like German housing estates, implemented and working systems of the use and saving of rainwater, whose heating systems utilise renewable energy, and which consume electric power obtained from such renewable sources like photovoltaic panels or wind turbines, as well as mechanic ventilation with heat reclamation. Of course in some currently built single-family buildings or small residential buildings the technologies distinct of passive houses and indeed buildings of this type themselves are being introduced, however the phenomenon is not present on a wider scale. The basic ecological problem is high air pollution, which has become so inconvenient and hurtful to the health of residents that the increasing use of individual means of protection in terms of anti-smog masks can be considered as a form of innovation within the metropolis. The effectively working metropolitan transport system, as well as attempts at expanding and propagating rail-based passenger transport across the entire metropolitan region are, without a doubt, a form of progress. The implementation of park and ride systems that have been known and tested abroad, as well as electric cars and bicycles on a larger scale, could be seen as a sign of innovatively transforming the forms of travel used by residents.

The system of renting vehicles (so far featuring fossil-fuel-powered and hybrid cars) to persons who do not own their own cars that is becoming increasingly popular can also be considered innovative. This trend, which is in line with preparations to introduce a so-called closed circular production economy, can turn out to be another innovation, affecting the manner of the functioning of metropolises. The widespread use of smartphones is altering the functions of city centres, which are being abandoned by banks, which have so far been responsible for maintaining this sensitive and capital-consuming historical building substance, causing its gradual degradation. Public spaces and religious buildings are changing their character, their current religious functions is disappearing, causing them to take on the character of a museum and becoming a sort of a tourist attraction. The negative behaviour of tourists which gather in front of the San Luigi dei Francesi in Rome, and who are visibly annoyed by the liturgy that takes place there because they have to wait to see Caravaggio's paintings thankfully does not take place in Krakow yet, despite the fact that the city is being visited by a very large number of tourists.

The rapid adaptation of the pro-tourism oriented service sector, which provides, for instance, electric vehicles which travel across predetermined routes, walking tour guides who support themselves with

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25 In Krakow this phenomenon is not as widespread as in other European countries.
electronics or systems for guided tours of buildings that utilise Internet transmissions, can be considered some form of innovation in terms of tourism. In the metropolitan region we can observe the phenomenon of preparing for the stage in which tourist traffic will shift from the metropolis to interesting sites located a further distance away from the core city. Of course one of the conditions for success will be the conducting of efforts to promote this direction, based on the use of at least the same innovations that have been proven to work in the metropolis. Furthermore, it is in the metropolitan region that interesting experimental forms of residential buildings that solve certain social problems - like it has, for instance, been done in Chile or Lebanon26 - can be built.

6. Conclusions
Metropolises can, of course, function without support in the form of their metropolitan region, however, they can do so under the condition that they can obtain goods and conduct export. However, the situation in which strong ties with its region do exist and, as a whole, that region is innovative at least to a degree that is close to the level of the innovation of the metropolis itself, is much better.

The Krakow metropolis, as well as its metropolitan region, show appropriate levels of innovativeness and are characterised by appropriate region - metropolis - region relations.

The degree of the practical application of innovative technologies in the residential architecture of the metropolis and the metropolitan region has, so far, been unsatisfactory.

The human capital which is at the disposal of metropolitan Krakow is one of its most precious qualities. Directing a greater share of potential towards innovatively solving the observed trends in the spatial development of the region and utilising its undoubted cultural and natural advantages can lead to further dynamic development of the entire settlement system.

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