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The regional policy

6. Sustainable city – flexible or durable? Socio-economics aspects of urban patterns

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Abstract

This paper's goal is to introduce an interdisciplinary assessment of urban patterns as a factor of socio-economic development, presenting selected examples of how different urban patterns (compactness, complexity, decentralisation and porosity) influence family economics, risk management for city dwellers and entrepreneurs, labour market and social inclusion or inequality. Urban patterns and socio-economic aspects of urban life are closely linked in a complex and manifold way. The main topic of the paper will be the assessment in what way durability or flexibility of a built environment influences urban sustainable development.

It is not possible to identify one spatial pattern that in the best way meets the need to adapt to new challenges and threats. However, case studies can point to certain features of cities, especially their diversity, as being the most important for their proper functioning.

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Introduction

The beginning of the XXI century has been shaped by a number of important phenomena. The first of them is globalisation with the ever-growing flow of the information, people and capital, but also the transfer of pollution, disease, and increasing conflicts between the regions. The second is the high level of urbanisation. In 2050 the share of the urban population is expected to reach 70% globally, while in European Union (EU) it is already higher (EEA, 2011). Cities also host concentration of economic activity. The share of big cities in the national GDPs excesses significantly the share of their residents in the population of the country. City clusters may represent even stronger influence on economy. The best example in EU is "pentagon area" demarcated by the urban agglomerations of London, Hamburg, Munich, Milan and Paris, which generates 46% of the whole GDP of EU (EEA, 2010a).

Another important phenomenon is the increasing instability of the environment and climate. The standard of living in developed countries has never been so high and yet we are facing an increasing number of hazards in almost all areas of human life: climate change, depletion of fossil resources, the emergence of new health problems, economic crises and political conflicts, including terrorism and armed conflict, some of them within the borders of Europe or in its immediate near.

Most of the challenges and problems of the modern world are concentrated in urban areas. Cities are the main consumers of energy and centres of creating new technologies for energy savings, the most endangered places epidemiologically-wise and yet those where the medical assistance is provided and new methods of disease prevention and treatment developed. Cities are centres of social and economic activity, places where ideas and innovations are emerging; last but not least – places where millions of people live in close proximity to each other. The idea that connects most of the answers to the contemporary challenges is that of sustainable or durable development.

Sustainable development refers to three interconnected resources: the socio-economic capital (human being and their communities), the natural environment (natural systems we whare and depend upon) and the built environment (Rodin, 2014). Durability of the city and its ability to adapt must include the relationship between these elements. The paper will present an analysis of the relations between the spatial patterns of the urban built environment and its resilience to socio-economic and envirenmental risks. The risk may represent not only a disaster or crisis, but every radical change which may destabilize the functioning of the city.

Resilience is the opposite to urban vulnerabilty and the interaction of these two properties reduce or enhance accumulative disaster impacts (Lankao and Qin, 2011). Spacial patterns are the most durable elements of the cities. At the same time, a city is a dynamic organism that must respond to changing demands of city dwellers, to new opportunities and risks; adapt to technical progress and climate change. Existing urban patterns may be the cities' assets or barriers to farther development, they can enhance or decrease their resilience. Exploring the possibility of urban adaptation is now one of the most pressing tasks of urban studies. While the level of coverage of costs and benefits of adaptation related to the environment (especially the coastal zones and agriculture) is already high, and these related to health, infrastructure, flood control and energy – medium, studies on water management, transport, tourism, and macroeconomic effects are yet in the initial stage (EEA, 2013). However, the current research and state of art provide some insight of what types of urban patterns may be the most resilient.

6.1. Typology of urban patterns and their elements

Urban space is a complex system of tangible and intangible elements. It consists of buildings, infrastructure, built-up areas and undeveloped/green areas, as well as the connections and interactions between them. Built environment patterns comprise transport systems; size and scale of districts, quarters and building plots; localisation of different functions (residential, industrial, commercial, administrative, recreational, cultural, educational and other); and the urban density. The intangible aspects of urban patterns inlude the character of the city (industrial, academic, touristic), its landscape (a system of panoramas and views) and the soundscape (sounds, their types and intensity) (Schafer, 1993; Dubois, Guastavino and Raimbault, 2006). A collection of these diverse elements defines the city as a whole.

Socio-economic development of the cities both depends on the urban patterns and shapes them. In the history of the urban development, we can follow the influence of urban ideas, but mostly this of political, social and economic ones. In the past these ideas affected the size and location of public buildings, residential structure and building quality differentiation. Today, urban patterns are consciously used as a tool to shape sustainable socio-economic development (Gospodini, 2006). 71.7% of the EU-28's population live in a densely-populated or an intermediate urbanised area; around 200 million persons are living in

densely-populated areas and almost 160 million in intermediate urbanised areas (Eurostat, 2012). Urban resilience and sustainability must be based on good use and proper reshaping of the existing patterns and new built environment should be created with care to be an asset and not a burden for the future.

The most common elements of urban typology comprises:

1) size of the city. Despite centuries-long efforts to determine the optimal size of city (e.g. Leonardo da Vinci ideal city, satelite city of E. Howard or B. Malisz theory of city thresholds) there is no dominant theory in this regard (Batty, 2008). City scale also depends on regional conditions;
2) boundaries that may be administrative, functional or morphological (EEA, 2009);
3) population density (number of inhabitants per unit area, usually 1 km^2). Generally higher density is correlated with bigger size of the city.

Analysis presented in the paper is based on the urban typology proposed by Huang, Lu and Sellers (2007). They proposed following characteristics of the urban patterns, based on the metric analysis of patches in the satellite images of metropolitan areas:

1) complexity (determined by the irregularity of patch shapes; the more different and the smaller the patches – the higher the complexity);
2) centrality (average distance of the dispersed parts to the city centre, which was defined as the centroid of the largest patch);
3) compactness (defined as the fragmentation of the overall urban landscape);
4) porosity (defined as the ratio of open space compared to the total urban area).

In this paper the following typology will be used:

1) complex city;
2) decentralized city;
3) compact city;
4) city of high porosity.

In complex city there is a variety of economic activities, comprising different form and size of enterprises. Most of the global and regional metropolis can be described as complex city – from Paris and London to Warsaw and Berlin. Also smaller cities may be complex if they provide various opportunities and activities, e.g. Salzburg, Nice or Lublin. The opposite is the industrial or mining city with one enterprise as a core of local business and highly dominant job-provider. In such city, commercial and public services are also addressed to the needs of the homogeneous group of people, and as a result – less numerous and less

varied (Rodin, 2014). In complex cities, variety of economic and social activities are mirrored by diverse urban and architectural forms. There is also a bigger variety of housing, associated with the diversity of social groups in terms of the financial situation and lifestyle. In a very complex city there is no large monofunctional districts or quarters (office, industrial or residential), and the activities of different city dwellers are not separated spatially.

In decentralized city there is more then one area where the concentration of different services, both commercial and public, can be observed. The more decentralized a city, the bigger number of the sub-centres. An important feature is also the dispersion of such sub-centres and their availability (measured by the distance between residence areas, workplaces and other functions).

Many towns and cities in recent years has changed the structure from monocentric to polycentric (Dieleman and Faludi, 1998; Hall, 1999; Helbich, 2010; Batty, 2008). It is the result of intruducing new functions to the housing districts, the emergence of new economic clusters, dispersal of jobs instead of their previous concentration in large industrial plants and office districts (Malmber and Maskell, 2002). The nature of this decentralisation may be very different, from the urban-style centres (squares with shops, cafes, local cultural centres, some local administration, parks and common gardens in Warsaw (Centra Lokalne, 2015)), through new jobs cetres in Edge Cities (as Schiphol in Amsterdam or Massy-Saclay near Paris (Bontje and Burdack, 2005)) to large malls on the outskirts of many European and American cities (Gospodini, 2004). All of them, however, mean that local residents have access to a variety of functions without having to travel to the city center. It is essential that these centres also provide them with jobs, thereby further enhancing the reduction of travel, cost of living and strengthening local identity (Malone-Lee, Sim and Chin, 2001).

Compact city is one of the most often discussed and generally recommended feature of the sustainable city (Burton, Jenk and Williams, 2003; Burgess, 2000). It reduces the costs of infrastructure, enables city dwellers to move around on foot, reduces the energy consumption and waste production, decreases the negative impact on natural environment and provides the social and economic benefits of proximity (Litman, 1997; Gehl, 2014; Owen, 2009; Sadowy, 2014b; Malone-Lee, Sim and Chin, 2001). Still, there are some doubts and reservations regarding the downside of the compactness, especially related to highrising building (Mega, 2000).

On the other hand, one of the most prominent problems of modern cities is urban sprawl (Brueckner, 2000; EEA, 2006). Suburbs represent

very low diversity, both in terms of urban patterns, architecture and socio-economic ascpects. They usually comprise single family houses, inhabited by the middle class, often homogeneous in terms of nationality, race, and/or religion; devoid of functions other than housing, with the exception of shopping malls, located beyond the pedestrian walk. Suburbs are also characterized by low and very low intensity of development, which results in more rapid increase consumption of the space then the increase of the number of inhabitants of urban areas (EEA, 2010).

Porosity of the city can be primary or secondary. If we treat the areas of the city that are not sealed as urban "pores", they can be natural, green areas (as parks, lawns, water, simply not yet built-up areas, lakes and rivers, etc.) or the brownfields, devastated by natural or human-related causes (hurricanes, bombing, devastation of former industrial areas). The first could be represented by Stockholm, the latter by New Orleans. The origin of the former can also be two-fold: they can be introduced according to urban planning or be a result of chaotic urbanisation. Therefore, the role they play in the city functions can differ significantly.

The relations between the urban types are not straightforward. Generally, high complexity should be related to high decentralisation, and very compact city could be expected to have smaller porosity. However, well-planned, compact city with higher buildings may have a higher lever of porosity then suburbs with almost completely sealed areas. Complex city may tend to be compact, but as well it can be sprawled across a large area. Therefore, the possible combination of the features (including also size of cities) are numerous.

6.2. Drivers of change and socio-economic risks

Cities are shaped in a centuries long process and are influenced by many factors. Some of these factors have a distinct character of threats, such as natural disasters or war. Others may be even positive – as the emerging new industries or migrations of creative class. However, they aways destabilize the current way in which the city operates. City dwellers and investors shape the lifestyles and patterns of the city, but they must also adapt to them. Different stakeholders' relations with a city vary, both in terms of impact strength and durability of the relations, as presented in table 6.1.

		LONGEVITY OF THE RELATION WITH THE CITY		
		LOW	MEDIUM	HIGH
IMPACT ON THE CITY	LOW	A participant of a business meeting at the airport conference centre	An employee temporarily assigned to a particular city or student from another city or country	A resident of the suburbs, occasionally visiting the city
	MEDIUM	A tourist	Public administration official working temporarily in the city	A common city dweller
	HIGH	A specialist invited to propose a program of revitalization or development strategy	International developer	A resident, property and entrepreneurship owner (family business)

Table 6.1. Examples of city stakeholders, depending on the strength and durability of their relations with a given urban space
Source: Sadowy, 2014a.

It is just an outline of the numerous and complex relations between the city and its stakeholders and is by no means a complete catalogue. However, we may state that the more diverse the group of stakeholders, the more their interest in sustainable and durable development vary. Developers may tend to ignore the negative long-term effects of construction. Tourists will visit specific locations and their impact on the non-touristic parts of the city will be limited. Both groups represent increasing number of stakeholders, whose links to the city are short-termed and aimed primarily at achieving short-term benefits.

Tourism may have very negative influence, not only in form of the damage to the environment and the local communities of less developed countries (Dielemans, 2011), but also to European cities (Russo, 2002). An example would be Venice, which is gradually being deserted by the residents as a result of rising prices and growing burden of everyday life. Globally, number of tourists is constantly growing, with 2 million leisure travelers in 1950 to approx. 800 million tourists in 2008. The forecast for 2020 stipulates a 1600 million leisure travelers (EEA, 2011). For cities, this means a lot of investing and functional pressure.

Globalization and increasing mobility encourage the migration flows. City dwellers move between the cities in search of work and more attractive living conditions, as well as for personal reasons. In the years 1995–2004, in Europe, the number of internal migration amounted to over 10 million (EEA, 2011). Cities compete for highly qualified residents and

creative class (Florida, 2004). The greater the difference between the quality of life in cities and their attractiveness, the greater the pressure for migrations (Turok and Mykhnenko, 2007). Migrants introduce new demands and expectations. They have differents habits and lifestyle, including cooking habits, size of living space and demands on it, different demands on public spaces and services (EEA, 2009). Therefore they may look for more complex cities, but even in formerly homogenous ones they may create important change (Rodin, 2014).

Another type of pressure comes from the changes of the lifestyles. The crisis in the US in 2008 was in part caused by the belief that every American family could afford a family house. Also in Europe the size of the average house or flat is constantly growing (EEA, 2009). Hence comes the pressure for cheaper land for new development in the outskirts of cities, formerly used as farmland. Such suburbanisation may be favored by inadequate planning policy. This is the case in Poland, where the local spatial development plans provided for residential areas would be enough for 65 million people, while today Poland has 38 million citizens (Kowalewski, Mordasewicz, Osiatyński, Regulski, Stępień and Śleszyński, 2014). Expanding cities cover the areas that has not been built-up before because of the high risk. An example would be building on floodplains in Poland or bushfires in the suburbs of Australian cities (Chen and McAneney, 2004).

Other important risks are the social polarization and exclusion of certain groups, as well as lack of spatial justice. Often they are associated with economic change, as the deindustrialization of Europe and the closing of large industrial plants in Central and Eastern Europe after 1989. The conversion or destrying of former industrial buildings may not only make thousands of people jobless, but also blur social memory and have very negative social impact. An example may be the case of the Gdansk Shipyard (Stocznia Gdańska), where the wall mural presenting stories of former workers was demolished for the investment of real estate development. It was perceived as as a strikeout of entire profession for a new social order dominated by the middle class (Chomicka, 2010; Sadowy, 2014a). There is also the very different case of Birmingham, where despite of the fact that the revitalization did not fulfil the city dwellers hope in terms of the economic recovery, the transformation of the image of the city minimized the social discontent (Hubbard, 1995).

Health is one of the most important factors of quality of life. Medicine has now reached a very high level, and the cities are hubs of medical knowledge, as well as that of medical care. However, there are also new health risks, resulting from urban lifestyles. Numerous trips; urban population growth and high number of everyday contacts; overuse of

antibiotics or waiver of vaccinations all pose new and serious epidemiological threats. In addition, there are negative effects of air pollution, the source of which is mainly cars, constant exposure to excessive noise (EEA, 2014c) or excessive lighting with artificial light, obesity resulting form the lack of exercise and daily walks. The spatial structure of cities has an impact on many of these kinds of behaviour, and the World Health Organisation (WHO) considers that urban planning is an important determinant of health (EEA, 2009). This interdisciplinary approach is also expressed in the content of local policy documents. Health equity issue appeared in approx. 60% of such documents concernig planning in 2012 and approx. 65% in 2013. In the case of housing these figures are approx. 58% and approx. 62% for the years 2012 and 2013 (WHO, 2014). Healthy urban planning depends greatly on the existing urban patterns.

One of the major challenges in contemporary urban policy is also adaptation to climate change (EEA, 2013 and 2014b; European Comission, 2009). It is a complex and manifold problem. In the paper two type of threats will be taken under consideration: disasters caused by hurricanes and heavy rains and the temperature rise, with special emphasis on heat waves.

6.3. The resilience of different type of urban patterns

Sustainable urban development must provide personal, economic, social and health safety. In the first Survey on Quality of Life in Europe in 2003 8 factors have been identified: economic situation; housing and the local environment; employment, eduaction and skills; household structures and family relations; work-life balance; health and health care; subjective well-being; perceived quality of society (Eurofound, 2003). It is very important to perceive also the variations between demographic and social groups. Social polarisation may be the result of spatial injustice: spatial concentration of people with low/high incomes in separate areas of the city, as well as the location of the less well-off households in the areas most exposed to nuisance and health hazards. An example would be a greater exposure to noise of people living in conditions of relative poverty. According to WHO research, the most vulnerable social group in the EU in this regard are single parents living in relative poverty (WHO, 2012).

Proposed analysis presents the impact of the urban patterns on city resilience. It is shown according to the typology of 4 urban patterns: complexity, decentralization, compactness and level of porosity. The analyzed risks/challenges are: migration flows (significant inflow or outflow of city

dwellers) and socio-economic polarization of city dwellers; the economic crisis, in particular related to the high levels of unemployment; increase in crime and the threat of a terrorism; health risks, especially related to heat waves and epidemic occurences; the last problem is related also to climate change causing not only tmperature increase but also hurricans and torrential rains.

Positive effects of urban pattern enhance the resilience and ability to adapt, facilitate quick and appropriate response or even reduce the likelihood of the risk. Negative effects are barriers to adjustment, make it difficult to react or increase the likelihood of risk.

6.4. Complex city

Facing the migration and social polarisation problem complex cities tend to ease the including the new residents into existing social structure. In a diverse spatial pattern it is easier to find a suitable place to live and work. Heterogeneous neighbourhoods have fewer social tensions, which makes easier for immigrants to be included in the local society. In the case of migration from the city, it is difficult to identify a very clear advantage or weakness of this kind of urban pattern. However, in homogenous, monofunctional residential areas emigration of a specific social group may leave whole parts of town deserted and degraded, and in a result, more difficult to be revitalized (e.g. large housing estates in former East Germany (Ott, 2001).

Urban complexity can take many forms. In case of a genuine diversity of urban pattern, where people of different social status are living in close proximity, social polarisation is unlikely. The city where poverty and wealth districts are clearly separated from each other loses its important social function, which is the opportunity to meet people different from ourselves (Sennet, 2007). According to the model proposed by Huang, Lu and Sellers, the more diverse the city (the smaller patches of different functions/groups of users), the greater resilience to the phenomenon of social polarisation.

Each economic diversification makes the city resilience grow. There are various opportunities to find employment or start one's own enterprise. In the complex structure of the city it is also easier to find spaces suitable for particular type of enterprise, as there are simply more choices. It is also possible, in case of the reduction of the household income, to remain in the same neighbourhood, but after moving to a smaller residence.

Complexity also favors maintaining some unique characteristic features of the city. In the global and regional competition between the cities it can

provide a significant advantage, since the identity of the place is important factor attracting the creative class and tourists. It also promotes a sense of roots and self-esteem in other groups of city dwellers (Gospodini, 2004; Hubbard, 1995). On the other hand, there is a drive for economic and cultural clusters, due to the benefits of proximity, and possibility to use the same infrastructure (Gospodini, 2004). Such actions, even as they seem to reduce the complexity of the city, can also enhance resilience to economic fluctuations.

Crime factors are similar to the mechanisms of social polarisation. In complex city different levels of social control and responsibility for immediate neighbourhood may occur. In the cities with "better" and "worse" districts, wealthier residents may have a tendency to cede all responsibility for law and order to appropriate services (in extreme cases – exclusively for the private security), and even police can avoid intervention in "ghettos" of poverty and high crime rates. Real complexity provides better understanding and cooperation between different groups of city dwellers, thus providing the higher level of social trust and cohesion, the best defence against crime and violence.

The diversity of the urban pattern in this case is beneficial especially if it provides the diversification of the infrastructure. Diverse modes of transport can complement each other, if a failure occurs in one of them (eg. flooded subway tunnels, damaged tram lines or blocked streets). The location of power plants in one place makes their eventual failure affect all consumers in a city. The dispersion of plants producing electricity and/or heat guarantees that at least part of the city should not be deprived of them. The same applies to the diversification of other important resources including services for crisis management.

Diverse urban patterns provide more diverse response to heat waves. They make it easier to find cooler places, in open public space or in commercial or public building, e.g. air-conditioned shops, public administration buliding or cultural institutions. The possibility of spending even short time in a lower temperature can make a big difference to health, especially for groups of high risk (elderly city dwellers, children and some disease sufferers). Mostly, however, the city resilience to temperature increase depend on the specific type of architecture, use of natural ventilation, shadowed public spaces, accessibility of green spaces and/or water (Changnon, Kunkel and Reinke, 1996).

The epidemiological effects of interactions between different city dwellers (e.g. children and elderly citizens), different patterns of moving around the city (cars versus public transport) and sustainable urban planning require more extensive research in which they will be taken into account. Undoubtedly, the uniformity of the spatial structure and building

facilitates both analysis of possible scenarios of the epidemic, as well as the development of standards of conduct. Spatially diverse city does not have to be at greater risk, but it is surely an environment in which there is a need to develop more varied methods of gathering information and implementing varied standards of conduct. Mostly, health of city dwellers depend on numerous factors, but social cohesion and support, more typical for the complex city, are also important to maintain individual resilience (McLaren, 1992).

6.5. The decentralized city

Similar to complex city, urban patterns with strong local sub-centres makes better environment for new city dwellers, who can root in local community, find different services and possibly even jobs close to their new homes. Sub-centres are also important places of connecting people from the same neighbourhood, building social relations and local identity. All that factors should enhance social cohesion, but in general, it is possible to find many sub-centres in significantly polarized city, as well as in a city with high level of social cohesion. In really diverse neighbourhood sub-local centres enhance positive trends, but in a "gettoized" city different city dwellers may also concentrate around their sub-centres, further secluding from other social groups.

Existence of many sub-centres coincides with more diverse economic activities – there simply must be more services, health, educational and cultural centres, local shops and small-scale employers to form sub-centres. Consequently, more sub-centres equals more complex city, benefiting from its economical resilience to crisis. As sub- centres also should result in stronger social relations, it would be easier for the unemployed to find help and support, very important for people in difficult situation, practically- and psychologically-wise. Proximity of the services provided by local sub-centres also reduces the commuting costs for city dwellers. In ideal cases it is possible to access all needed destination or even find a new job within walking distance. Long trips to location of workplaces can even exclude whole social groups from the labour market, e.g. women living in the suburbs, when the only car left in family is claimed by their husbands or partners (Hirt, 2008) or people too tired after the long commute to work effectively (Zenou, 2002).

Single, clearly defined city centres, gathering a large number of city dwellers and tourists make the important target for many types of crime – from pickpockets hunting for careless tourists and shoppers, to the terrorists who choose crowded places as goals of their attacks. It should be

not an argument against having attractive main centres in the cities, with historical monuments and many cultural and entertainment facilities. It is only important to remember that some dispersion of city functions may make a city not only more comfortable but also safer.

Heat waves result or not in heat islands depending on the density and porosity of urban patterns and the presence of sub-centers do not seem to have any serious influence. They may become an asset, if they provide the concentration of local services helping to soften the impact of the heat. It may be public space with some green area or water, public spaces within the air-conditioned buildings, easily accessible for the neighbourhood.

The presence of sub-centres makes the long and numerous trips across the city unnecessary, thus decreasing the contacts with other city dwellers in the public transport or in crowded city center. This can reduce the risk of accidents and epidemiological risks. It is also important that sub-centres should comprise health centres or at least some medical services. They should be included in a crisis management network, not only for epidemiological reasons but also for any biohazard risk.

Similarly to the high temperature risk, presence of the sub-centres does not reduce the risk itself form the torrential rains and/or hurricanes but may be helpful in managing the crisis, especially if they provide dispersion of the infrastructure and public services.

6.6. The compact city

Compact cities have lesser tendency for homogenous districts as it is more difficult to introduce social boundaries in highly populated areas. Compactness is in fact very often correlated with mixture of land uses and proximity of varied uses (Neuman, 2005). Segregation and polarisation along ethnic and/or socio-economic lines are typical for suburbs and areas of urban sprawl (EEA, 2009). However, the exact influence of compactness on social equity is not yet fully researched and some findings suggest that some effects may even be negative. However, cities with large proportion of high-density housing and large quantity of locally provided services and facilities are those that are best in promoting social equity (Burton, 2000).

Compactness and density of the city have direct influence on municipal costs of the public infrastructure, also in long term, which affects future generations. Low-density housing, typical especially for the suburbs, is more cost intensive than high-density housing (EEA, 2010a). Development of the green fields outside the city requires also new social

infrastructure, while some infrastructure existing within city boundaries or in central districts remains ineffectively used. Compact cities may also tend to provide more stable markets. Urban sprawl, land abandonment and competition with agriculture for farming land around the city may create unpredictable pressures and expectations on the market. They may result in prices which do not reflect the real value of the land, as well as jeopardise the sustainable land-use in long term (EEA, 2010a).

Compact cities often are characterised by smaller flats and more effective use of common services. They also have better developed public transportation system which is effective only if provided in reasonably high density. Therefore, city dwellers spend less on everyday necessities. Difference between the costs of private and public transport can be significant. In EU households spend about 12% of their income on private transport and less then 2% on the public one (EEA, 2005).

Compactness encourages walking, cycling and the use of public transport thus reducing the costs and risks related to PM and energy use – both important determinants of direct and indirect costs (EEA, 2009). Quality of the space for pedestrians and cyclists may strongly influence how frequent commuters chose this type of moving around the city. Disparity between EU countries are still very marked – from 8.9 km of cycling paths and lanes per 1 km^2 in Helsinki, 4 km/km^2 in Copenhagen, Hannover and Stockholm, to less then 0.5 km/km^2 in Madrid, Prague, Rome and Oslo (EEA, 2009).

Compact urban areas use much less resources then the low-density areas. It can be seen even on national level, where countries with very low density (Australia, Canada, Finland and USA) use 30–40 tons of the raw resources per capita, while more urbanized countries of higher density (Germany, Austria, UK, Japan or UE-27 as a whole) use below 20 tons per capita (Sadowy, 2014b).

It is statistically feasible that larger number of people may comprise larger number of offenders, and urban areas of high density are potential targets for different types of crime. High level of crime, along with congestion and pollution have been one of the most prominent drivers to move from the densely populated central areas to suburbs (Howley, 2009). However, low density provides less of social common control of the space and single houses are more prone to breaking and entering then multifamily housing.

Highly populated areas are more risk-prone for this type of terrorism where the goal of the attack is to reach as many victims as possible, as shown by the dramatic examples of 9/11 or attacks in European metro lines. Also, even if the attack is precisely targeted, in compact cities the collateral damages are more probable.

Compact cities increase the risks associated with heat waves because of the high percentage of the sealed soil and the longer time it takes for the bigger cubatures of buildings to cool during the night. Most of the premature deaths due to the heat during a heat wave in 2003 took place in urban areas (EEA, 2013). The cause of heat islands is the lack of green spaces, ponds, but also the use of air conditioning. Whereas it takes more effort to provide the natural methods to cool the buildings (proper insulation, natural ventilation, window shutters), the installation of air conditioning cool air inside, but give off extra heat outside. Such a phenomenon can further enhance the spatial injustice – when air-conditioned office and residential buildings of high standard make the risk even greater for other city dwellers.

Number of people is also an important factor. The higher density , the more people feel the effects of the flood, or hurricane rains that affect the area. For example, in 2002 in Dresden, when Elba poured in a similar area as it was in the XIX century losses were much higher. On the other hand, the intensity reduces the unit costs of building infrastructure, so it is easier to implemment appropriate investments in order to drain rainwater.

6.7. Cities of high porosity

Influence of the city porosity on migrants behaviour and on social equity depends mostly on the character of the "pores", as mentioned before. Well-planned cities with several green areas are much more flexible in case of significant change of their population. It is easier to introduce new buildings into existing urban structure, as well as the losses of some of the inhabitants are not so clearly concentrated in specific areas. Even chaotic planning, leaving some of the plots not built-up, gives the city potential to host new city dwellers. Green areas used as a common gardens may enhance social cohesion.

On the other hand, secondary porosity, caused by the war damages, hurricanes or foreclosing of some buildings can create very unfriendly and even dangerous urban pattern. Weaker social groups may be more exposed to risk and social injustice may increase.

Very high porosity means that city is sprawled and ineffective in terms of land-use. Some porosity is yet needed for the city to function properly and have both green areas and reserves for further development. There is also an interesting trend of local urban farming and gardening that may benefit from this urban pattern (Barthel, Parker and Ernstson, 2013). It generally corresponds to the trends to live, consume and work more locally in the face of the global crisis.

Similar to the problem of social spatial injustice, secondary porosity may be the source of several dangers and create habitats and operational grounds for criminal groups. Also chaotic planning, resulting in uncontrolled empty plots may reduce the public safety in the city.

Natural porosity of the city, that is the presence of numerous green areas in the urban pattern is one of the most important factors in creating the resilience to heat waves. It is especially beneficent if the areas create corridors and networks that help to naturally introduce cooler air from outside of the city (Kronenberg, 2012). Also the proximity to safe green areas has very positive influence of lifestyle and health.

City porosity reduces the risk associated with large amounts of water from heavy rains or flooding. Introduction of a "porosity" to the structure of the city can be simple and unexpensive addition to building storm sewers. In San Francisco, very rapid, short-lived downpours sometimes cause overflows of sewer. Therefore, in addition to the construction of new infrastructure, it was decided to introduce a water permeable pavements, squares and parking lots to increase natural retention (Rodin, 2014).

Conclusion

Sustainable city is a resilient city. However, the above analysis shows that there is no perfect model of the city, which arguably would provide a competitive advantage in the economy and high quality of life.

The diversity of the cities seems to be particularly important feature in terms of their sustainability. This confirms the hypothesis of J. Jacobs that cities diverse in terms of architecture, space and functions are more friendly, more dynamic places to live (Jacobs, 1992) as well as more recent theories (Leichenko, 2011). Diverse communities, with a range of demands, expectations and activities and are also more resistant to economic crises (Rodin, 2014).

Another important feature is the porosity of the city. Excessive porosity equals excessive growth of urban sprawl and suburbs, while within the city are vast undeveloped areas. However, the presence of undeveloped patches enhances the flexibility and adaptability of the city in many fields. If necessary, allows further development and introduction of new facilities and infrastructure. In the case of climate change, makes the city more flexible in responding to extreme temperatures (less risk of heat islands), and heavy rain or flooding (greater possibilities of natural retention). City diverse and reasonably porous is also more conducive to the welfare of the inhabitants and biodiversity. It applies only to the primary porosity, while

secondary porosity may become an asset only in case of well-planned revitalisation.

The level of compactness and decentralisation of cities is more ambiguous. Indisputably the compact city helsp to reduce the costs and increase the efficiency of the infrastructure, stabilizes the real estate market, strengthens social bonds, generates economic clusters. Compact city favors walking and cycling, important for the costs of living and health of residents. However, compact urban pattern is less flexible in adaptation to new trends. If the city is so compact that it is not sufficiently porous, its residents have limited access to green spaces and recreation. It is also more difficult to minimize the effects of heat waves and torrential rains. High concentration of population may increase the risk of crime and terrorism. However, all evidence indicates are that the radical alternative – urban sprawl and suburbanisation – is a source of even greater harm and risks.

The current decentralisation of cities shows that this trend corresponds to a very strong demand. It is certainly associated with the deindustrialisation and the need for the local identity. So it is already part of the process of adapting to the new expectations of urban residents. Generally, the city with many sub-centres is more resilient and flexible but it requires more coordinated management.

Overall, urban patterns of the cities seem to play a much more important role than their size. According to Eurostat forecasts, the share of urban population in the total population of the EU will remain stable in the horizon of 2030 and even 2050. The period of "new cities for new society" is long gone. In contrast, the volatility and uncertainty of the environment is likely to remain high or even increase. Therefore, it is important to know in what extent the existing cities are able to respond and adapt to new demands and risks. Diverse city, primarily porous, decentralized, fairly compact, with a good information system and coordinated management seems to be best suited to today's challenges. This city can be a healthy form advocated by the European Environment Agency Healthscape 2030 (EEA, 2013), as well as a favorable environment for socio-economic development. From the point of view of urban sustainable development the best guarantee of durability is flexibility.

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