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Methodological and Ideological Options

Ecology-related resilience in urban planning – A complex approach for Pécs (Hungary)

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ABSTRACT

The aim of this paper is to introduce an urban planning methodology which enables planners to select projects, which fit the main goal of the city and develop a resilient strategy structure, based on the selected projects. The planning process is demonstrated by the development of a resilient city strategy – in this case, by the city of Pécs.

The main goal of a city (in the case of Pécs: to become a sustainable city) determines policy directives and the functional areas involved, whilst the strategic goals and sub-goals of the functional areas influence projects. These projects generate impact flows, which provide the basic data for Ecological Network Analysis to measure the basic resilience of the strategy structure.

It is known from ecological systems that neither totally redundant nor highly efficient systems are sufficiently resilient. ENA allows an optimisation procedure to be undertaken. As a result, a complex iterative model is devised, suitable to elaborate a resilient strategy structure.

This paper shows that efforts to achieve sustainability can be used to organize resilient structures. The study applies this locally – where city strategy pursues sustainable aims – and globally, where existing global knowledge will be organized into a resilient structure.

1. Introduction

Rockström et al. (2009) identified nine planetary boundaries, three of which man has already violated (climate change, the rate of biodiversity loss, and the level of interference with the nitrogen cycle). Their results intensified the sustainability debate: How can we ensure the safety of mankind's activity on our planet?

The fact that Ecological systems' main feature is resilience explains why sustainability and resilience are interconnected in published papers; to the point where the term 'resilience' is interchangeable with 'sustainability' (Saunders and Becker, 2015, Arora-Jonsson, 2016).

Resilience can be defined as "The ability to resist and respond to a shock (internal or external) and recover once it has occurred …" (Annarelli and Nonino, 2016, p.2). Folke et al. (2010) integrate the main elements of resilience thinking: resilience, adaptability and transformability as a systems behaviour and dynamics, which also indicate that the term "resilience" is not necessarily connected to ecological systems. Rochas et al. (2015, p. 359) conclude that there are universal features of resilience, namely that a system is resilient if it is diverse, redundant, efficient, autonomous and strong in its crucial components. These definitions suggest that resilience is a more general term, than sustainability.

The origin of the notion of resilience is ecology, where there is little doubt that well operating ecological systems work resiliently. However, ecological systems are sustainable in the long run; ecological systems and sub-systems are harmonised, since higher systems emerge if subsystems need this (Cf. 'ecological hierarchy' in Meadows (2008, pp. 82–85)). In socio-ecological systems this sustainable, harmonising element is not given, even, as it is seen e.g. from Rockström et al. researches, the opposite seems to be valid. We define this harmonisation element as a systems behaviour, which contributes to (or at least does not endanger) the safe operating place for the Planet's living systems, and name this behaviour as *sustainability element*.

A misfit of a sub-system is not obvious, as long as the carrying capacity of the main system is greater than the damage due to the misfit of subsystems. An agrarian production system could fit into its larger environment (and be resilient) if it can deliver products in large quantities and good quality, independently of the fact that they used chemicals and pesticides which are not in harmony with ecological systems. Therefore, in many cases a system can be resilient and at the same time not sustainable: a misfit within the planet's main system.

Ecological Network Analysis (ENA) measures the level of resilience in an ecological system by examining the physical flow of materials and energy. It examines and measures *structural resilience* which – if the

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system proves to be resilient – inherently means sustainability in ecology terms. In the case of socio-ecological systems, resilience is not equal to sustainability, because the *sustainability element* is not necessarily present.

This study focuses on *urban resilience planning*, the resilience of the structure of the city strategy, and provides a method for creating a *structurally resilient strategy*. ENA also provides the methodology for creating a resilient structure (an optimization procedure), which is appropriate to plan a resilient strategy. Additionally, this method is used to unify sustainability efforts (as the sustainability element) with resilience in a way that it organizes these efforts into a resilient structure. The sustainability element is provided in two ways:

1. First, locally, the main goal of city strategy and related policy directives pervades the project generations and experts select sustainable projects;
2. Second, globally, existing published sustainability efforts (research and cases) are the source of the sustainability element.

In both cases these efforts will be organized into a resilient structure.

1.1. Resilient Cities

The resilience of cities is a relatively new topic. In fact, the need for the conceptual term emerged in the aftermath of the attack - invariably referred to as '9/11' - on New York's World Trade Centre in 2001 (Mendonça and Wallace, 2015, Annarelli and Nonino, 2016), although, the actual origin is earlier, in the 1990s (Lu and Stead, 2013). Foster (2006) asserts that a region can achieve an *intentional resilience* if both the

- *preparation* (*assessment and readiness*) and
- *performance* (*response and recovery*) resilience are strong in the region.

Foster, in addition, suggests that resilience can, in fact, be developed - which also supports the use of ENA for urban planning (as in the *preparation phase* of a regional development project).

Recent developments clearly show that there are different forms of crisis which are likely to occur, such as an economic crisis or climate change, and one specific significant form is the wide-spread and serious increase in the urban population - which inevitably increases the demand for products and services, with increasing environmental and social impact on the hinterland. This is the case not only in China (Zhang, 2013), where the size of cities in itself indicates a significant impact, but also in Europe (see 'Five UK Cities' in Minx et al., 2011). According to Foster's categories, the first part of the *preparatory* phase (the *assessment*) should disclose all the changes expected, whilst the *readiness* of the region (the second part of the phase) should be elaborated for these changes. Rochas et al. (2015) produced resilience assessments for cities and detailed how to select the most effective recovery strategies related to energy supply reliability and to the sustainable use of resources. Liu et al. (2011) analysed the structure and functioning of an urban system and undertook considerable research into 'urban metabolism', which is one of the key terms in similar research (Zhang et al., 2015a). Both examples refer to the *assessment* phase, and the latter also indicates that the structure of the region is a critical element of resilience. In order to prepare a region or city for change, for adequate *readiness*, the structure should be planned carefully, and one well known means of this is *urban planning*.

The structure of a city can be influenced by the city's strategy, and this strategy should focus on *intentional* resilience, as a consequence of which future projects would create the necessary (physical and non-physical) infrastructure.

There are numerous alternative approaches to regional development. On a European political level a guideline for an Integrated Urban Development Strategy (IUDS) was announced in the European Union (Lisbon Strategy, Leipzig Charter). However, the environmental part of the IUDS is rather weak, and – in the case of Hungary – the country level applications were segmented and did not reach the expected results (Suvák, 2010). A recent study further analysed the most important features of cities which are regional centres in Hungary. They state that stakeholders hardly have a chance to form the processes; only a few of them can participate in the decision making (Bajmócy et al., 2016, p.97).

There are several research projects referring to the transformation of cities. Xue (2014) argues that existing solutions are not necessarily appropriate: e.g. the idea of eco-villages neglects the existing urban structures, therefore, does not represent proper solutions. A few of the other relevant researches are the following: Camagni et al. (1998) states that there are three main fields to intervene, namely: technology, territory and lifestyle. Ackerman (2004) sees the co-governance as a crucial point in the transformation. Pretty (2011) suggests ecoculture, where place-based connections with the environment would improve the city's resilience. Arora-Jonsson (2016) argues that resilience itself has its own culture, and as such, it contributes to the production of the necessary transformative knowledge. Alternative transformative approaches will be further addressed in Section 7.3.

1.2. Location

Pécs is a medium-sized city with approximately 150,000 inhabitants today, located in the southern part of Hungary. The structure of the city was strongly influenced by coal-mining (Hajnal et al., 2009). Between the 1950s and the 1980s, the city's population nearly doubled, mainly due to the mining industry. When the coal-mines were closed at the end of the century, the main driving force of the city was lost, but the huge infrastructure remained, waiting for re-purposing, refurbishment and/or a final replacement. Since Pécs has one of the largest universities in the country, the cultural element was dedicated to becoming such a driver. The culture in this case means those expressive forms of culture (e.g. theatre, music, arts), which are able to generate revenue for the city. This new orientation is further promoted by the fact that Pécs was always a multi-cultural city – a type of melting pot of different values. Hungarians, Croatians and Swabians, still live comfortably together here. A significant event occurred in 2010, when Pécs was selected to be a European Capital of Culture along with Essen and Istanbul, which further stimulated some renewal in the direction of culture: Renovated public spaces, streets, squares and neighbourhoods, new cultural centres, a concert hall, a new library and science centre and a 'Cultural Quarter' were planned and built.

The local authority of Pécs also voiced a request for a sustainable energy- and for a city strategy. Both have been produced in accordance with the requirements of the local government, based on sustainability principles.[1]

The model of the city's sustainable energy strategy is available now; a simulation, based on this strategy was developed, which integrates the proposals of the energy strategy, simulating the energy system at an hourly rate (Kiss, 2015).

1.2.1. The Structure of the Paper

Fig. 1 depicts the urban resilience planning process. After the *Introduction* (Section 1), *Methodology* (Section 2) is discussed. *Goal-hierarchy and the basic building blocks* (Section 3) describes the main goals of the city, policy directives and selected functional areas with their main

[1] Both are in Hungarian. The city strategy is available at http://gov.pecs.hu/download/tajekoztatok/fejlesztesi_koncepcio/pecs_telepules_fejl_strat.pdf (20/4/2017); the energy strategy is at: http://gov.pecs.hu/download/tajekoztatok/strategia/pmjves.pdf (20/4/2017).