



Research Paper

Institutional efficiency of urban soil sealing management – From raising awareness to better implementation of sustainable development in Germany

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HIGHLIGHTS

- Informal planning responses have the highest institutional efficiency.
- Legal-planning responses are objectively efficient but lack subjective efficiency.
- There is a demand to implement new economic-fiscal responses.
- High flexibility of responses might threaten ecological sustainable development.
- Institutional aspects need greater attention in science and planning practice.

ARTICLE INFO

Article history:

Received 31 March 2014
 Received in revised form 24 July 2014
 Accepted 25 July 2014
 Available online 28 August 2014

Keywords:

Soil sealing
 Urban management
 Policy efficiency
 Urban sustainable development
 Wicked problems

ABSTRACT

Despite a shrinking population, soil sealing and land consumption is still increasing in Europe. In an increasingly urbanized world, scarcity of space is rising. Under the umbrella of sustainable urban land use, conflicts between residential, commercial, industrial, transport and green areas need to be solved balancing social, economic and environmental objectives. However, managing urban environments and steering soil sealing is a challenge for policymakers and planners dealing with land use conflicts due to their complex constraints and driving forces. This paper investigates which strategies can be characterized as being institutionally efficient and contributing to a reduction in urban soil sealing. The analyses are conducted in Munich and Leipzig, Germany. For the evaluation, the method of Response-Efficiency-Assessment (REA) is applied using subjective and objective indicators, which are evaluated by a content analysis and Internet survey. Strategies of the following types are assessed: legal-planning, informal planning, economic-fiscal, co-operative and informational. Results show that informal planning strategies are institutionally the most efficient due to high flexibility, high acceptance and limited reduction in local authority, which legal-planning responses lack. Current economic-fiscal responses are assessed as being the most inefficient, and there is a need for implementing new taxes, which among other things can promote the protection of fertile soils. It is concluded that local authorities need to be more aware of their authority and responsibility to limit soil sealing and to guarantee a high urban living quality. Hence, more stringent rules should be justified with proof of their effectiveness before implementation.

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1. Introduction

Cities are confronted with increasing vulnerability and insecurity, and there is an urgent need for achieving urban sustainable development (Elmqvist et al., 2013). But balancing environmental, economic and social objectives in line with an urban sustainable development is challenging since space is limited and thus

trade-offs between sustainability dimensions occur. These trade-offs are interlinked with conflicts between land uses. For instance, agricultural areas for food production are under pressure to be developed for residential (social dimension) or commercial purposes (economic dimension) or into forest areas (environmental dimension) as a compensatory measure for built-up areas (Artmann, 2013a). Conflicts between different land uses also influence the shaping of land cover in general and in particular, the amount of impervious surfaces. For instance, residential areas like block development are more highly sealed than parks but less than commercially built-up land (Haase & Nuissl, 2007).

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Hence, approaching sustainable development is currently challenged by land use and land cover change (LULC). Local LULC has global, regional and local impacts such as on the global climate change or the local water quality (Chhabra et al., 2006). In particular, soil sealing jeopardizes the sustainable use of soil by its permanent covering of an area through impermeable and semi-impermeable artificial material (European Commission, 2012; European Environmental Agency, 2010, 2012). Soil sealing is closely related to land take or land consumption which is understood as the transformation of open areas such as forest or agricultural areas into areas for settlement or transport. Interventions to reduce soil sealing are needed as soil sealing has become most intense form of land take (Prokop, Jobstmann, & Schönbauer, 2011). In Europe, although the population is decreasing, the amount of sealed land still rises (European Commission, 2012). Controlling urban soil sealing is also crucial due to an increase in water surface runoff (Haase & Nuissl, 2007; Pauleit & Duhme, 2000), loss of agricultural areas for food production (Alberti, 2005), high concealed costs of sealing in suburban areas (Nuissl & Schroeter-Schlaack, 2009) or loss of urban green areas that provide recreational spaces (Lafortezza, Carrus, Sanesi, & Davies, 2009). Highly sealed urban districts can be characterized by a lack of close supply of green areas (e.g. parks, lawns, urban forests) because of higher demand per capita and because these green areas are on average relatively small in size (Artmann, 2013a; Breuste, Haase, & Elmqvist, 2013). Such an undersupply of urban green in the neighborhood in highly sealed districts might reduce living quality since urban green in the resident's living environment positively influences the perceived health of urban dwellers (Maas, Verheij, Groenewegen, de Vries, & Spessuwenberg, 2006) and because urban green areas are in general a crucial provider for urban ecosystem services (Bolund & Hunhammar, 1999; Larondelle, Haase, & Kabisch, 2014). All in all, management of soil sealing includes ecological, economic and social dimensions which need to be considered in line with sustainable urban management.

To achieve a sustainable use of soil and land, planning and policy would try to approach a balance between these three dimensions. Balancing the different sustainability dimensions amongst themselves is a crucial challenge in sustainable development (Fischer, 2003). In reality, decision makers and planners are confronted by a range of barriers to implement sustainable development such as fiscal constraints (Campbell, 1996; Nuissl & Schroeter-Schlaack, 2009) or lack of information, know-how and attention (Banuri, 2009; Hopwood, Mellor, & O'Brien, 2005). In addition, sustainable land use by an efficient steering of soil sealing is hindered by constraints like misleading fiscal incentives which promote further sealing, lack of obligation, missing detailed information on sealing development, and lack of awareness about ecological and economic impacts of soil sealing (Artmann, 2013b).

Taking these different sustainability objectives and the according conflicts into account, managing urban environments is a "wicked problem" (see also Rittel & Webber, 1973; Xiang, 2013), and because of its complexity, there is no universal solution of how to tackle it (Gaston, 2010). Steering urban soil sealing seems also to be challenging due to its complex constraints and driving forces and therefore can be regarded as a "wicked sub-problem" within the field of urban environmental management (Artmann, 2013c). According to the definition of "wicked problems," solutions cannot be regarded as being right or wrong but as more or less efficient (Rittel & Webber, 1973). Therefore, to achieve sustainable development and to steer soil sealing as a wicked sub-problem, there is a need to assess the efficiency of soil sealing management instruments.

The European Commission (EC) published a report which presents best practice examples in Europe on how to prevent, mitigate and compensate for soil sealing and land take and its ecological

impacts (European Commission, 2012). This evaluation is weak as it does not use pre-defined indicators for assessing efficiency nor does it discuss in depth advantages and disadvantages of the best practice examples. For instance, the 30-ha target set in Germany aiming to reduce daily land take from today's 80 ha/day to 30 ha/day by 2020 was stated in the report by the EC to be best practice. Although the report states that such targets are only efficient if they are mandatory, it fails to mention that the 30-ha target lacks political commitment as shown in interviews with experts and decision makers in Germany (Jörissen & Coenen, 2004). In particular, the soil sealing guidelines by the EC lack a discussion of institutional efficiency although this dimension forms the basis for an efficient implementation of sealing strategies and instruments (Artmann, 2013c). For instance, the guidelines name brownfield management or sealing monitoring as best practice examples for sealing management (European Commission, 2012) but does not mention that the implementation can be hampered by lacking legal obligation of brownfield management or manpower for sealing monitoring (Artmann, 2013b).

Ecologically sustainable management of urban soil sealing steering has a solid basis in Germany, which has been shown by Artmann (2014). However, experts see a lack of implementation of soil sealing strategies by German local authorities (Artmann, 2013b). Because of these findings, this paper hypothesizes that there is a shortage of institutional acceptance by urban planners and decision makers, hampering efficient soil sealing management and which needs to be considered in assessing the efficiency of strategies toward sustainable development.

Because of these scientific and practical shortcomings and following the hypotheses mentioned above, this paper aims to assess the institutional efficiency of soil-sealing management responses, strategies and sub-targets developed or implemented by urban decision makers and departments to demonstrate how sustainable land management can be achieved. The study is conducted in Germany, one of the most highly sealed countries in Europe (Prokop et al., 2011). The overall aim of the paper is to test the method of "Response-Efficiency-Assessment" which was developed to assess the efficiency of policies toward sustainable development on the example of soil sealing management (Artmann, 2013c). In Appendix 1, a glossary is provided to define some key terms.

2. Study area

Two case study cities were selected under specific selection criteria. One city represents a shrinking city or city in transition; the other case study represents a growing city. By doing so, various challenges of urban soil sealing management should be considered. Leipzig stands for a city in transition and was selected because census data showed that Leipzig had the highest increase in settlement and transport areas between 1998 and 2008 although the city was shrinking in regard to population, workplace development, unemployment rate, taxable capacity and purchasing power between 2003 and 2008, according to a study by the Federal Institute for Building, Urban Affairs and Spatial Research (2008). The statistics between the same observations period on land use development indicated that Munich had as a strongly growing city a high increase in recreational areas at the same time.

Leipzig is located in Saxony in East Germany and is home to 520,838 residents (2012) (Leipzig-Information System, 2014). Today in Leipzig, processes of both shrinkage at the urban fringes and re-urbanization in the urban centers can be observed (Haase & Nuissl, 2007). However, in the 1960s Leipzig could be characterized by a high decline in population accompanied by processes of shrinkage, suburbanization and urban sprawl, reaching their peak

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