



**Transdisciplinary Sport and Physical Activity Development
in Urban Real-World Labs**

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Transdisciplinary Sport and Physical Activity Development in Urban Real-World Labs

Abstract

Purpose: The aim of this paper is to present a research approach that can contribute to a sustainable development of urban spaces for sports and physical activity, comprising theoretical reflections and directions for applied research.

Approach: This research builds on an urban real-world lab in a city district. It is based on principles of transdisciplinary research and intense processes of participation.

Findings: Five projects with regard to sport and physical activity development were implemented. The projects resulted in exchange and learning of citizens and other stakeholders as well as transformations of the social and built environment.

Research implications: Instead of top-down research and planning this approach enables bottom-up processes in which affected citizens and stakeholders can contribute to sport and physical activity development.

Practical implications: The approach can help to integrate sport and physical activity development and transformative processes of sustainable development in urban areas.

Social implications: Through participation and involvement, citizens can be empowered and social capital can be generated.

Originality/value: Urban real-world labs are a new approach for sport and physical activity development. This approach opens up the possibility to include sport and physical activity development in processes of city development. Hence, urban real-world labs are able to address an integrated urban and sport development process and can be used for city marketing purposes.

Key words: sport participation, sustainability, city, urbanization, urban planning, transdisciplinarity, transition lab, living lab, network, social capital, empowerment

Transdisciplinary Sport and Physical Activity Development in Urban Real-World Labs

Introduction

In modern civilization, cities represent spaces of paramount importance for sport and physical activity. Humans are physically active and do sports in their everyday living environment. While the human living environment used to be rural, today most people on earth live in urban environments. More than half of mankind lives in cities, and the number is growing. The United Nations expects over two thirds of the world population to live in cities by 2050 (United Nations, Department of Economic and Social Affairs, Population Division, 2019). The global process of urbanization inevitably poses the question of how we organize life in cities to ensure a high level of quality of life for as many people as possible living there.

Urban spaces for sport and physical activity play a crucial role in this context. Next to standardized sport facilities, which meet the demands of formal sports, it is necessary to consider the present and future importance of public spaces in cities. The reason for this is the dominance of public spaces – green spaces, parks, places and networks of walking and biking routes – as the most important locations for sports and physical activities. Various studies on sports participation in cities showed that the majority of the population practice sports and physical activities outside of standardized sports facilities and organized by themselves (i.e., informal sports). An overview of several analyses conducted in several German cities showed, for example, that around 45 % of all sporting and physical activities take place in natural environments and on streets (Bundesministerium für Verkehr, Bau und Stadtentwicklung, 2011). A recent review on locations of physical activity also emphasized the importance of the neighborhood environment including streets, roads and pavements, especially for adults (Kelso *et al.*, 2020). Due to ageing societies (UN Habitat, 2016) the relevance of public spaces will likely increase, and the importance of informal, non-competitive and health-oriented sports is expected to become more prevalent in future sport development (Wetterich, 2014a). These trends in sport participation develop simultaneously to the growing urbanization.

Considering these developments, a stronger focus on urban public and green spaces as places for sports, play, physical activities and health is necessary. The future quality of life in our cities will largely rely on the sustainable development of urban public spaces that foster

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4 active and healthy lifestyles (Edwards & Tsouros, 2008; Gehl, 2010; Sport England, 2015;
5 Kostrzewska, 2017).¹ From a marketing perspective, the provision of various opportunities for
6 citizens to participate in sports and live an active life is the prerequisite not only for an
7 effective promotion of physical activity, but also to satisfy the need of citizens for sport and
8 physical activities (Zhou et al., 2019). Moreover, urban spaces are fundamentally social.
9 Going beyond the conceived or geographical space, people perceive spaces in certain ways
10 and 'live' spaces (Lefebvre, 1991). Such lived, actively created spaces, characterized by
11 social interaction and exchange are critical for the creation of communities and human cities.
12 In this context, public spaces that enable social interactions, for example, through sport and
13 play, are essential for social cohesion and participation. For a sustainable development inter-
14 and intragenerational equity is required that considers social, economic and ecological
15 dimensions. Following this premise, urban spaces for sporting and physical activities have to
16 be considered resources that should be available for all members of society. Since decisions in
17 urban planning usually have long-ranging consequences, this is relevant for today's and future
18 generations. Besides access to social resources, participation in designing these resources is a
19 basic principle of sustainable development, where participation is both a means and an end
20 (Kopfmüller *et al.*, 2001).

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33 In sport development planning, the idea of participatory processes of planning has
34 been widely established (e.g., Sport England, 2015; Kostrzewska, 2017). The participation of
35 those affected is a central element of recent concepts of cooperative or integrative sport
36 development planning (Eckl, 2015; Wetterich, 2014b). However, in practice there is often a
37 dominance of particular interests, notably of actors from the municipal administration and
38 sports administered by the city or sports clubs. People organizing sports by themselves and
39 commercial providers of sports and physical activity are often neglected in these processes
40 (Bundesministerium für Verkehr, Bau und Stadtentwicklung, 2011). Moreover, sport
41 development projects are often centered in municipal departments responsible for sport which
42 act independently from other areas and sectors relevant for urban planning (Wopp, 2012). A
43 sectoral top-down planning, guided by particular interests, facilitates the design of urban
44 spaces following established forms of sport and standardized sports facilities and places
45 (Kähler, 2015). Hence, many sport development projects leave no room for innovative
46 processes and creative problem-solving (Wopp, 2003). In the light of sustainable urban
47 development, an enhanced process of participation seems promising. To make use of it, a
48 broader integration of actors from science and society next to experts of sport development
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4 planning is mandatory. Next to researchers this includes citizens as well as public, non-profit
5 and private providers of opportunities for sports and physical activities. Without a
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7 transdisciplinary integration of scientific and non-scientific actors there is a danger of a
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9 deficient problem identification and disciplinary reductionism. Next to a limited perspective
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11 on problems and possible solutions, it impedes a necessary theoretical and methodological
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13 reflection on the processes of sport development planning.

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15 In this case, the borders of sport development as a scientific discipline represent
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17 disciplinary limits of knowledge. This applies not only to sport development. Because of an
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19 increasing particularization of our scientific system, thinking across perspectives and
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21 disciplines is becoming more difficult (Mittelstraß, 2003). As a consequence, the development
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23 of sports facilities guided by individual interests and disciplines is facilitated, at the expense
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25 of a sustainable development of urban living environments that foster an active life.

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27 The aim of this paper is to present a research approach that can contribute to a
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29 sustainable urban development of urban spaces for sports and physical activity, comprising
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31 theoretical reflections and directions for applied research. While the approach takes into
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33 account facilities for competitive and elite sports, the focus lies on the development of spaces
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35 for sport and physical activity, which meets the needs for sport and physical activity of an
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37 urban population and fosters health, social integration and cohesion. The growing importance
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39 of public, open spaces in cities represents the starting point for an integrated process of urban
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41 and sport development for the benefit of a large share of the urban population.

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43 In the following, we first introduce the approach of urban transformations research in
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45 the context of sport and physical activity. Second, the real-world lab 131, its context, and the
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47 role of sport and physical activity development in the lab is described. We do this by reporting
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49 the research design and process of the transdisciplinary core project and provide details on
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51 five subprojects that focused on sport and physical activity development. Finally, the
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53 approach is discussed.

54 55 **Urban Transformation Research and the Development of Spaces for Sport and Physical 56 57 Activity**

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59 The development of urban spaces, including spaces for sport and physical activity, is a
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61 socio-technical process of transformation, comprising various dimensions of complexity.
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63 Social and organizational transformations are characterized by the three levels of complexity:
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65 dynamic, social and emergent complexity (Scharmer, 2009). Dynamic complexity represents

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3 the relation between temporally and spatially separated causes and effects. While simple
4 causalities are of minor complexity, dynamic complexity increases with the number of
5 unidirectionally or reciprocally influential components of a connected system. Social
6 complexity comprises different perspectives and interests of actors involved in social
7 situations, that is, the multidimensional interrelationships generated in a more or less
8 heterogeneous network of stakeholders. Emergent complexity describes non-linear processes.
9 This applies to social situations in which neither the identification nor the solution of the
10 problem is clear, and in which the most important actors and stakeholders are not known.
11 Transformative processes are complex insofar that they are often characterized by non-
12 predictable and sudden changes.
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Next to these three levels of complexity, technological, economic, institutional and cultural factors have an effect resulting in a multifaceted interdependency of social change (Schneidewind, 2014). The complexity of a transformation of public spaces usually goes beyond the capabilities of one discipline to identify and define a problem and its solution. Existing methods of observation and prediction are often limited in these contexts. To support complex processes of transformation it is useful to apply a transdisciplinary approach such as real-world laboratories (labs).

Urban Real-world Labs as a new approach of transdisciplinary research

Transdisciplinarity describes a form of research and practice which transcends disciplinary boundaries on a higher methodological level (Mittelstraß, 2003, Wiek & Lang, 2016) without ignoring their qualities. It is based on scientific disciplines and their specific knowledge and competencies, but it focusses on addressing real-world problems (Jaeger & Scheringer, 1998; Hirsch Hadorn *et al.*, 2008), which cannot always be fully grasped by bounded disciplines. Transdisciplinary research is therefore, in most cases, interdisciplinary as well, integrating various scientific perspectives. However, transdisciplinarity goes one step further by systematically including various non-scientific perspectives (Pohl, van Kerckhoff, Hirsch Hadorn & Bammer, 2008). Dependent on the specific project context, the methodology of transdisciplinarity serves several objectives:

- To find an appropriate definition of the problem that takes into account the perspectives of all stakeholder groups, both their needs and their perception of the problem.

- To gather, explicate and systemize non-scientific knowledge, which typically includes implicit knowledge of specific groups, local knowledge on the conditions of a specific case or ideas about goals, values or quality criteria.
- An early assessment of potential pathways or strategies for a solution, to combine an evaluation of direct effectiveness with a multi-perspective assessment of a broad range of side-effects.
- To create ownership through a strong involvement of stakeholders in the test or implementation of promising solutions which they have contributed to.
- To cultivate a mode of science that is part of society and societal transitions, and that is open for interactions with other parts of society, in contrast to purely empirical modes or expertocratic traditions.

With a strong focus on participation and problem orientation, transdisciplinarity should be considered not just as a theoretical principle, but as a research principle to combine practical and (disciplinary) scientific approaches in a specific life-world problem context (Bergmann *et al.*, 2010). For this new scientific mode that goes beyond traditional borders of scientific thinking and acting, new terms such as „mode-2 science“ (Gibbons *et al.*, 1994) or „co-evolution“ (Rip, 2002) have been introduced.

In its early years, the discourse on transdisciplinarity transported high expectations regarding the transformation of the system of science itself (Jantsch, 1972; Mittelstraß, 2003). However, these expectations have been lowered (e.g. Schmidt & Grunwald, 2005). Transdisciplinarity is but one approach in a wide family of non-traditional research formats, such as science of team science, mode-2 science, post-normal science, transformative science, transition management, and others. Within these field of related approaches, transdisciplinarity stands out as a strategy with quite some analytical and methodological rigor within a participatory setting. **The ontological foundation of transdisciplinary science are typically case studies with a high degree of inner complexity, both regarding the problems at stake and the actors involved (Stauffacher et al. 2012). The epistemological strategy to derive conclusions beyond the single case is typically to model the case as a system of different elements and mechanisms of interaction, e.g. interlocked market mechanisms, cultural practices, and ecological functions, linking human, technical and natural elements. These can be represented in various integrative forms, such as maps, networks or dynamic system models, to allow for comparisons across cases and as boundary objects to facilitate**

discussions across disciplinary boundaries and life-world perspectives. Nevertheless, the complexity of real-world problems and potential solution strategies makes transdisciplinary cases much richer than their model representation, and most learnings will stay qualitative and not easily comparable. In many cases, hermeneutical strategies are applied for a reflection of the researchers own position within the studied case and evaluation of the process (e.g. reflexive monitoring, van Mierlo et al 2010).

Recently, forms of transformative science have evolved with a strong link to the approach of transdisciplinarity, namely the real-world lab approach, emphasizing the impetus of facilitating transformation in transdisciplinary research. Based on such a transformative understanding of transdisciplinarity, the urban space poses several challenges. However, taking into account the limited capability for prognosis in traditional methodologies, real-world labs (and similar approaches, such as urban transition labs and urban living labs) can be used as research environments ideally adapted to transformation in complex settings.

To do so successfully, several prerequisites need to be considered. Following Schneidewind (2014), transformative research in real-world labs brings along a dissolution of the distinction between observer and observed system. The scientist becomes part of the transformation process he is analyzing. In this way, transdisciplinary research in a real-world lab context can be understood in the tradition of field research, intervention research and action research. It follows a principle attributed to one of the fathers of action research, Kurt Lewin: “If you want to truly understand something, try to change it” (Schein, 1996). The methodological strategy is based on an understanding of transformation in which innovation is not achieved through an analysis of causes and effects alone, but also through questioning old patterns of thought and through the systematic search for alternative routes of action (Johnson, 2013).

Real-world lab research aims at gaining transformation knowledge in a problem-oriented, transdisciplinary process. This knowledge can in turn be applied to initiate and support transformation processes towards sustainability (Lang *et al.* 2012). In this line, Schneidewind (2014) defines a real-world lab as a societal context, in which researchers carry out real-world experiments to understand social dynamics and processes. A real-world lab helps to understand complex transformation processes in modern societies. Cities have been identified as socio-technical systems of high complexity, as described previously, and therefore are considered as promising settings for real-world lab research (Nevens *et al.* 2013). Three levels can be addressed in the urban context: a) the city as a whole, b) districts

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4 that represent the citizens' everyday environment (Parodi *et al.* 2020), or c) single buildings
5 and households, the latter being the typical domain of so-called living labs.
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7 While urban real-world labs have been used in various scientific contexts (Parodi *et al.*
8 2018, Schneidewind, 2014), they are a new approach in the field of sport development. In the
9 following, we will show that the approach of transdisciplinary real-world labs is compatible
10 with recent ideas and concepts discussed with regard to sport development planning and
11 provides the potential for new developments in this field.
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18 *Urban Transformation and Sport Development*

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20 In the discussion on sport and community development various authors and
21 institutions called for a closer collaboration and integration of sport and city development
22 (Bundesministerium für Verkehr, Bau und Stadtentwicklung, 2011; Deutsche Vereinigung für
23 Sportwissenschaft, 2010; Kähler, 2014; Klaus, 2012; Rowe *et al.*, 2013, Sport England, 2015;
24 Wopp, 2012). A reason for this is that sport and opportunities for physical activity can
25 contribute significantly to active, healthy and socially cohesive communities (Edwards &
26 Tsouros, 2008; Rowe *et al.*, 2013; Sport England, 2015). However, most sports and physical
27 activities are practiced in self-organized, informal ways. Most of these self-organized
28 activities take place in places such as paths, streets, squares, green spaces und natural
29 environments. This makes public spaces, that were not built for the purpose of sport, an
30 essential element for sport, play and physical activity in cities. To meet the demands of
31 citizens, this situation requires forms of planning and development that cannot be handled
32 with traditional methods of sport development research and planning.
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43 Contemporary approaches of sport development planning call for an integration of
44 experts, municipal decision makers and affected citizens in the process of planning. However,
45 there is the risk of an imbalanced planning group (Wetterich, 2014b), consisting mainly of
46 representatives of institutionalized, formal sport, such as sport clubs, which pursue their own
47 interests and work closely with the municipal department administering community sport.
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51 For this reason, various scholars and institutions called for a paradigm shift (e.g.
52 Bundesministerium für Verkehr, Bau und Stadtentwicklung, 2011; Hylton & Totten, 2013;
53 Kähler, 2014; Klaus, 2012). Instead of being in the responsibility of the sport sector and sport
54 development officers, urban sport development should be considered an issue of an integrated
55 urban development. This different perspective goes along with a different question for
56 research. It is no longer about what a city has to do to support sport development. The
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relevant question then is how sport can contribute to reaching the aims or the future vision of a city (Kähler, 2014).

Participation is increasingly becoming a central element of planning in community sport development, similar to processes of urban development that are often based on substantial participation (Dempwolf & Lyles, 2012; Bock & Reimann, 2014). However, the right time for the integration of non-scientific actors in the planning process and intensity of participation is critical. If, for example, affected citizens are integrated only at a late point of the process, they are excluded from the identification of problems and the development of basic questions. Instead of cooperation, collaboration or empowerment of affected citizens, processes of participation are then reduced to mere information or consultation (see Fig. 1). An analysis of the situation and development of recommendations, done by experts and scientists without early and intense participation, will influence any subsequent discussions of the situation. While Hübner and Wulf (2014) noted that the integration of various stakeholders in the process of sport development after an initial analysis can qualify such recommendations, it should be noted, however, that an analysis and recommendations prepared in advance leaves little room for new perspectives or innovative problem-solving.

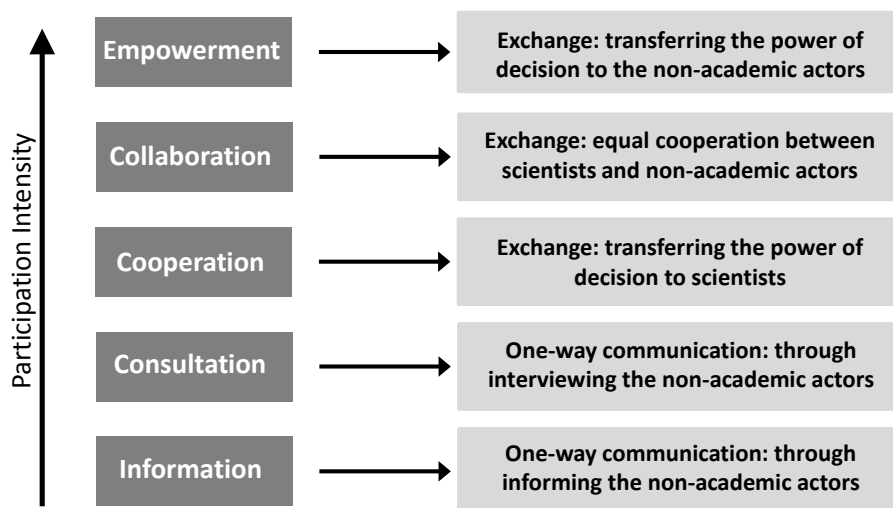


Figure 1: Five-step model of participation, following Brinkmann et al. (2015) and Stauffacher et al. (2008), (Parodi et al., 2017)

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Dependent on type, intensity and time of participation, different perspectives on problems and the development of solutions can develop. In this context, the approach of problem-solving and dialogue-oriented sport development planning (Wopp, 2012) should be noted. This approach stands out, because it is built on intense participation. Based on the premise that sport development is complex, problem-oriented procedures are central to this approach. The affected population takes part in the process of problem identification and the analysis of the situation is not made only by scientists of one discipline or the municipal sport department. This ensures participation right from the beginning. Instead of an orientation towards projected demands, planning is based on the development of scenarios and potentials through an integration of members of the affected population and stakeholders. An important feature is that the process is dialogue-oriented, that is, an active design of scenarios that might comprise conflicts and controversial issues. This planning approach is characterized by bottom-up procedures, in which the inhabitants of a city define the aims of transformation. Utilizable methods are future workshops or town hall meetings (Wopp, 2012), similar to their use in real-world labs. Last but not least, sport development planning should consider specific characteristics of cities. Different socio-economic environments, social milieus (Bundesministerium für Verkehr, Bau und Stadtentwicklung, 2011), and the ‘inherent logic of cities’ (Bockrath, 2014; Kähler, 2014) are critical elements that indicate specific lifestyles and activities of residents and should be considered in urban sport and physical activity development.

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The integration of urban and sport development, types, time, and intensity of participation, and the consideration of socio-economic aspects as discussed in sport development planning are compatible with the approach of real-world labs. Taking up these aspects, an integration of sport and physical activity development into a comprehensive process of urban transformation, based on transdisciplinarity and sustainable design, is feasible.

51 **Urban Sport and Physical Activity Development in the Real-world Lab “District Future** 52 **– Urban Lab”**

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In the following we show how processes of integrated urban and sport development, as outlined beforehand, have been implemented in the real-world lab “District Future – Urban Lab”.

The Real-World Lab “District Future – Urban Lab”

The real-world lab has been established in 2012 in the Karlsruhe, a city in southwestern Germany with about 310.000 inhabitants and comprises a number of projects that have been built around it. Within Karlsruhe, the real-world focusses on Oststadt, a district of Karlsruhe with about 21.000 inhabitants. The overarching goal is to contribute to a transition of a typical European urban district towards a culture of sustainability. The real-world lab is not limited to a single aspect or dimension of sustainability, but aims to address all aspects of sustainability in a comprehensive way, in order to learn about synergies, conflicts and other mutual dependencies between various aspects of sustainability. The underlying idea of sustainability is based on the Integrative Concept of Sustainable Development (ICoS) (Kopfmüller, 2001; Grunwald, 2012), initially designed for a scientific assessment of sustainability effects. The basic methodology of the real-world lab is transdisciplinary, building on participatory, transformation-oriented research integrating numerous partners from civil society, city administration and also (disciplinary) sciences.

One of the core projects is the “Real-world Lab 131”² (Parodi *et al.* 2016), which included the development of sport and physical activity in the urban district. The “Real-world Lab 131” was part of the research program “Science for Sustainability” of the German federal state Baden-Württemberg. The aim of the government was to establish sustainability as a principle of science to strengthen sustainable development (Ministerium für Wissenschaft, Forschung und Kunst Baden-Württemberg, 2013). The starting point of the project was an open process of participatory agenda setting. Milestones in this iterative exchange between citizens, local actors, scientists, students and city officials were a *Citizen Conference* (i.e. a town hall meeting) to identify core fields for the sustainable development of the district based on ICoS, and a *Citizen Forum* (“BürgerForum”) (Bertelsmann-Stiftung, 2015) to decide on project proposals that were developed by various scientists the university at the Karlsruhe Institute of Technology (KIT) within the fields defined by the citizens (Figure 2). More than 300 persons were involved in this process. To coordinate this process, a combination of meetings, workshops and online discussions were utilized. The ideas identified and initiatives generated in this process formed the core of the project. The integration of citizens and stakeholders at an early stage was paramount to ensure a problem- and transition-oriented approach, and helped to keep numerous stakeholders involved throughout the project (Meyer-Soylu *et al.* 2016).

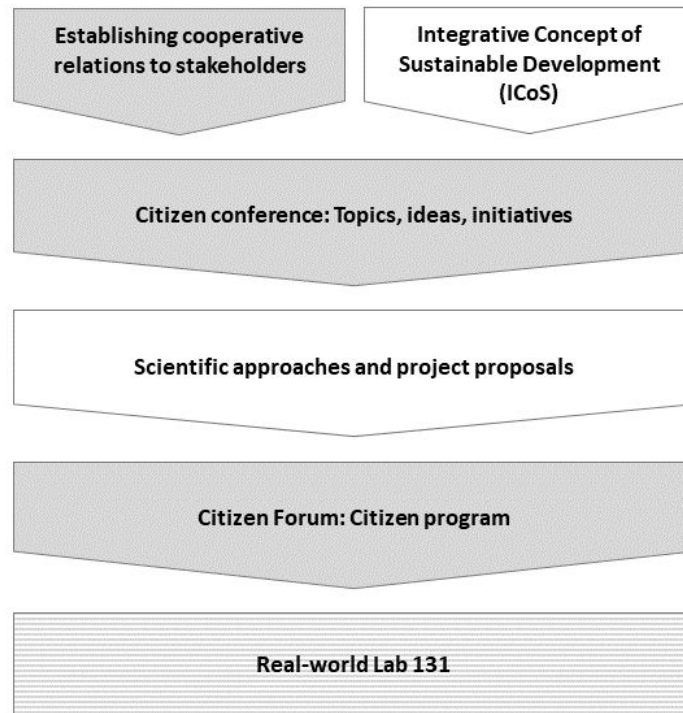


Figure 2. Interplay of participatory (grey) and scientific (white) work steps leading to Real-World Lab 131

In this process four overarching thematic fields were developed: 1) the city as a social space, 2) climate and energy, 3) mobility and quality of life, and 4) circular and sustainable economy. The thematic fields developed in this process were taken up quickly by the city officials of Karlsruhe and included to its integrated development plan, which can be considered a first result of the participatory process. Within the scope of the fields there are numerous aspects that relate to sports and physical activities. Examples that were uttered by citizens as a result of the participatory process are the development of public and green spaces, an attractive bicycle infrastructure, or the development of spaces and networks for shared activities.

In the next step, project concepts for the four thematic fields were developed and designed in a co-productive process between citizens and involved scientists. In this process, scientists from 13 departments of the KIT were involved, including the department of sports and sports science. Next to the projects, a real-world lab infrastructure was developed that provided administrative support, facilities in the district, support in data aggregation of different projects, an embedding of university classes in real-lab research, a process of formative evaluation, and consulting. Such an infrastructure is very helpful for

transdisciplinary research for various reasons: It enables an integration of results, it supports the exchange of experiences among participants, and the systematization of generated knowledge. Moreover, it enables quality assurance and a consistent presentation of activities to (potential) partners and interested citizens (Parodi *et al.*, 2018). All of these aspects represent typical difficulties in transdisciplinary research (Scholz *et al.*, 2006).

Sport and Physical Activity Development in the Real-world Lab 131

Considering the thematic structure of the Real-world Lab 131, it is apparent that the development of sport and physical activity cannot be assigned to a single field. There are various connections to the thematic fields, especially with regard to mobility and the city as a social space. While aspects of bikeability were dealt with in the project on mobility, the project on the city as a social space comprised most subprojects with regard to sports and physical activities. Various researchers from the fields of architecture, urban planning and sports science conducted five subprojects in co-production with citizens and other stakeholders. The basic premise of the project was that a high quality of public spaces and accessible private spaces is essential for a sustainable development of an urban district. They represent attractive places to meet others and spend time in the public. In this way, they support social interaction and the building of relations and trust. Moreover, these public spaces are used for sports and physical activities and foster residents' health. The aim of the project was to identify, analyze and develop spaces of social interaction and physical activity in the district, based on the proposals made in the citizen program. In the following, an overview and insights to the projects will be given.

The first project subproject with regard to spaces was called *Mapping Space*. This project focused on the design of urban spaces. The project was based on various seminars of the Faculty of Architecture and aimed to foster learning and exchange among students, citizens of the district and policy makers. The students visited central places of the district and developed various designs for these places that inspire social interaction and activities in public space. The plans and models were presented in various workshops and exhibitions and were discussed with citizens and city officials. Finally, the designs were published in a book (Lezuo, Abromeit & Lehel, 2018). In this way the Real-world Lab 131 became a learning environment not only for the students but also for citizens and city officials.

The second subproject was *Linear Square* and dealt with "linear places" such as streets and pathways in the district and their quality with regard to aspects of social interaction

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4 and physical activity. Field research and participant observation conducted by students of
5 architecture resulted in a map displaying various thematic walks in the district that can be
6 used by citizens and visitors.
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9 A third project dealt with active transport in the district by analyzing its *Walkability*.
10 Again, this was a student-based project which aimed at learning, but also to provide an
11 impetus for processes of transformation. Students of two seminars at the Institute of Sports
12 and Sports Science with a study focus on physical activity and health assessed the walkability
13 of the district and developed a walkability checklist for urban residents (Wäsche *et al.*, 2019).
14 The checklist can be used to assess whether a neighborhood is a friendly place to walk. By
15 taking the checklist and walking along everyday routes, residents can assess walking
16 friendliness, security, comfort and connectedness by rating various aspects and taking notes of
17 problems along the route. This helps not only to raise resident's awareness for the walking in
18 the neighborhood. The checklist includes various suggestions on how to take action, e.g. by
19 getting in touch with city officials and addressing specific problems of walking in the
20 neighborhood. The checklist was given to residents at various meetings and disseminated via
21 a website and social media.
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31 A fourth project was about the development of a *Circuit for Exercise in a Public Park*.
32 This project was initiated by a group of senior citizens and developed and implemented by
33 researchers of the KIT in cooperation with city officials responsible for public parks. The
34 circuit comprises 8 stations with various exercises for warming-up and motor fitness
35 (strength, coordination, agility) and a looping footpath for walking or jogging (endurance)
36 (see Fig 3). Furthermore, regular sessions for the elderly were provided by a qualified
37 instructor.
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Figure 3: Circuit for exercise in public park

The fifth project was called *Network for Physical Activity*. It was the largest of the five projects and focused on the provision of opportunities for sport, play and physical activity in the district. Through document analysis and interviews all providers of sport and physical activity in the district were identified. Next to sport clubs, commercial sport providers, schools, kindergartens, church communities, homes for the elderly, social welfare, youth clubs and other organizations from the public, private and non-profit sector, which play a role in the provision of sport and physical activities, were invited to take part in a survey (N = 63). Based on the collected data, it was analyzed which opportunities for formal and informal sport, play and physical activities sport facilities are available in the district, and which of them are accessible and open for the public. Moreover, public or accessible private spaces such as parks, lawns, squares, streets, backyards that are used for sport and physical activities were identified. The data were visualized using a map, to analyze the spatial provision of opportunities for sport and physical activities. Moreover, the organizational structure of sport and physical activity provision was analyzed by means of network analysis. To find out about interorganizational cooperation with regard to information exchange, exchange of human resources, cooperation with regard to sport facilities and partnership through joint projects and offerings, 72 organizations were asked to report about their relationships to other organizations. Next to the organizations mentioned before, organizations responsible for administration, coordination or consultation, e.g. municipal administration, sports associations, health insurances, and universities were included in the survey. The analysis

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revealed structures of cooperation characterized by a low density and high centralization. Moreover, central actors, brokers and peripheral actors with regard to the provision of diverse opportunities for sport, play and physical activities in the district could be identified (Fig. 4). This enables not only an analysis of the situation, but the opportunity to systematically develop organizational structures of cooperation. Detailed results and statistical analyses of the subproject including recommendations for sustainable network development can be found elsewhere (Wäsche *et al.*, 2019; Wäsche & Wolbring, forthcoming).

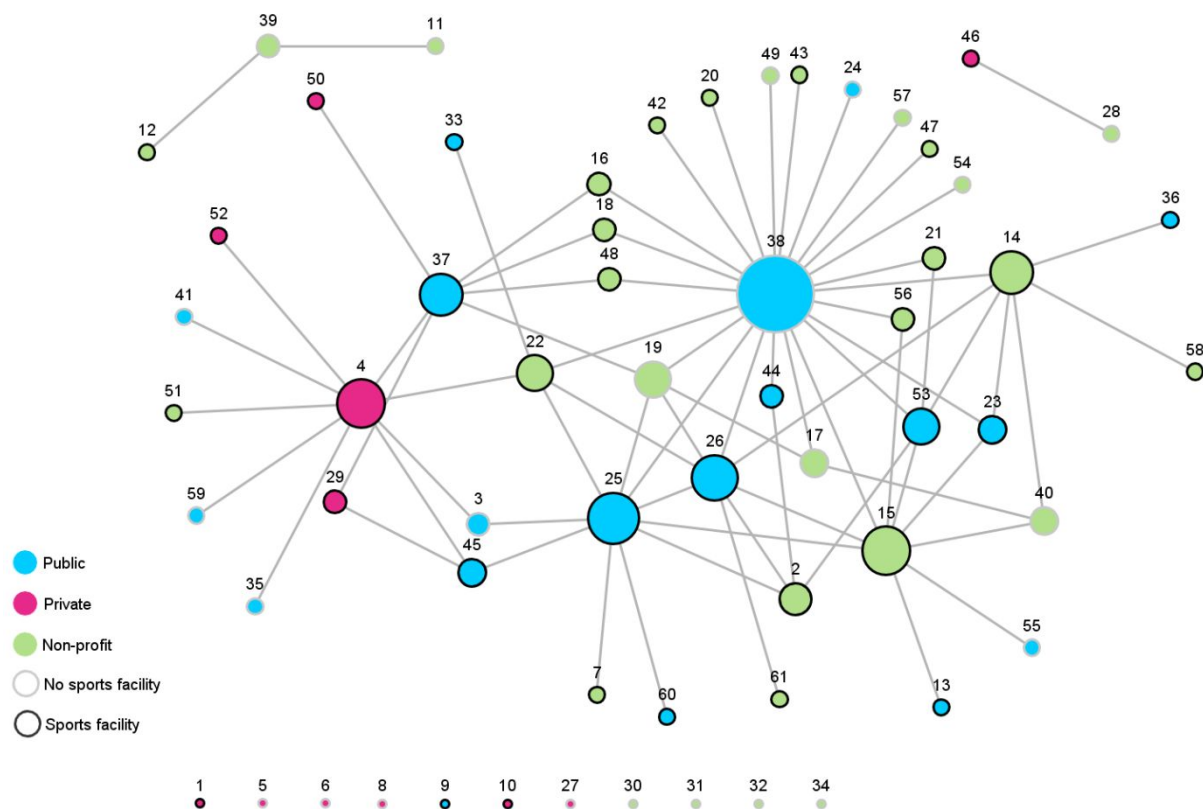


Figure 4: Network of cooperation among actors providing opportunities for sport and physical activity

While all five projects contributed to sport and physical activity development in the district and are of participatory nature, they followed different ideas. The projects *Mapping Space* and *Walkability* aimed primarily at learning and exchange among various actors. However, both projects comprised also processes of design: spatial plans and a walkability list. The projects *Linear Square* and the development of a *Circuit for Exercise in a Public*

Park focused on the design of various walks and a circuit that can be used by citizens and visitors of the district. The project *Network for Physical Activity* used a ‘traditional’ scientific approach in that quantitative data was collected through a survey and was analyzed statistically. Albeit the approaches of the five real-world experiments differ, they all followed the principle that problem-oriented action was taken to initiate and support processes of transformation with regard to sport and physical activity of the district’s population.

In this way, various results of the projects were generated. Besides publications, presentations, workshops and exhibitions, various transformations of the built and social environment took place. The central square of the district was redesigned during the course of the project and will be newly built with the explicit aims of fostering social interaction and physical activities. Additionally, new bike lanes were established in the district. The circuit for exercise was established in a public park and serves not only the purpose of health promotion but also for social interaction. Moreover, several meetings with the actors of the network for physical activity took place to initiate and foster exchange and cooperation. Finally, through participatory processes citizens and stakeholders became involved with issues of sport and physical activity development in the district and did not only learn about these issues, but started to care about developments and take part in developmental processes concerning sport and physical activity in their environment.

Discussion

The presented projects show that sport and physical activity development can be an element of transformative research in urban real-world labs. It was shown that processes of sustainable development and transformation require research and learning based on questions that are specific of the context – the district. Through an interplay of theory and practice, knowledge about the district is generated and shared with citizens and stakeholders. This knowledge supports the empowerment of civil society. Comprehensive processes of participation in a real-world lab add value to processes of urban development. Citizens and stakeholders are ‘nudged’ and raise awareness about the development of their living environments. Through an involvement in different projects and methods, the group of stakeholders comprised students, city officials, providers of sport and physical activity, researchers of the KIT, and citizens of the district. In contrast to most sport development projects, a wide group of stakeholders are involved including often neglected representatives of self-organized, informal sports and commercial sports providers who can also benefit from

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4 sport development, for example, through an increased demand of their services. The
5 involvement of all of these actors is critical with regard to development of a lively and
6 sustainable district. By interaction and cooperation of these actors, future processes of a
7 targeted development of sport and physical activity in the district will be supported. From the
8 perspective of sports marketing, such a development can contribute to community sports
9 provision to satisfy the needs of the citizens and to promote physical activity and health.

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14 An essential element of real-world labs is that they are open to participation of all
15 residents. Hence, real-world labs strengthen democratic processes and civil society.
16 Moreover, participation and transdisciplinarity support the sustainable development of various
17 forms of networks (Wäsche, 2014; Wäsche *et al.*, 2017). On the one hand, a transformative
18 network of scientific and non-scientific actors is built. On the other hand, a network of social
19 relations, i.e. social capital, among residents and stakeholders develops through processes of
20 participation. Cooperative capacity and social cohesion are important social factors of city and
21 neighborhood development.

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28 It was shown that urban real-world labs address various of the aspects discussed with
29 regard to sport development planning. In this way, intense participation, the identification of
30 specific problems and issues, and an integration of urban development and sport and physical
31 development is feasible. Transdisciplinary research in real-world labs has the potential to
32 foster processes of sport development that contribute to problem-oriented and sustainable
33 urban development.

34 35 36 37 38 39 *Limitations and directions for future research*

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Despite its benefits, an urban real-world lab also has limitations and poses challenges. Its implementation requires high efforts and participatory processes can evoke expectations of citizens and stakeholders that cannot be met. For this reason, close collaboration with experts and city officials is necessary to come to realistic expectations of possible changes. Moreover, it should be made clear that ideas and proposals may fail. It has also to be mentioned that participatory processes require high efforts to involve also disadvantaged groups of the population and it might not be accomplished.

Moreover, urban real word-labs are prone to conflict of aims (Parodi *et al.*, 2017). Real world-labs pursue simultaneously aims of research, education and learning, and transformation. Various actors may have different interests. Additionally, conflicts can arise from the multidimensionality of sustainable development processes. Different goals and their

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3 realization can exclude each other. In real world-labs such both kind of conflicts are likely to
4 appear.
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7 In case of conflict it has shown to be useful to deal with it in an open and transparent manner.
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9 Communication about existing conflicts among the actors involved is helpful and might lead
10 to case-specific solution. However, conflicts in urban real world-labs might not be solved, and
11 a resolution of conflicts of aims cannot be expected.
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14 It should also be noted that urban real-world labs do not replace the planning of urban
15 sports facilities necessary for institutions such as schools or sports clubs relying on formal
16 sports. Urban real-world labs should rather be considered an addition and enhancement of
17 traditional approaches of sport development planning. They provide new possibilities and
18 give rise to new perspectives. It would be interesting, for example, to include living labs
19 considering households in research on urban spaces for sport and physical activity
20 development.
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26 Last but not least, by focusing on the future organization and quality of life in cities,
27 urban real-world labs can be thought of in combination with other future concepts such as
28 “Healthy Cities” (World Health Organization, 2020) or “Smart Cities” (UN Habitat, 2016).
29 Similarly, urban real-world labs could be used to foster processes of cooperation and co-
30 creation with regard to place and brand marketing for cities (Book & Svanborg Edén, 2020).
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36 *Theoretical and Practical Implications*

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38 The transdisciplinary research approach presented uses urban real-world labs for sport
39 and physical activity development in an urban district. Besides theoretical and methodological
40 concepts that are different to traditional approaches in sport development planning, this
41 approach demands a new ‘thinking’ of researchers. Instead of top-down research and planning
42 this approach requires bottom-up processes in which affected citizens and stakeholders
43 contribute not only to the problem identification but also to processes of knowledge
44 generation and action with regard to sport and physical activity development.
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50 For practitioners, for example, city planners, officials and members of sport clubs,
51 managers and instructors of commercial sport providers, and teachers, this approach provides
52 an opportunity to participate in transformation processes and both contribute to and benefit
53 from sustainable development. Citizens are also encouraged to participate. Through
54 involvement they will be empowered and social capital can be generated fostering social
55 cohesion and integration in an urban district.
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Conclusion

Urban real-world labs are a new approach for sport and physical activity development. This approach is based on transdisciplinary research and rigorous participation to accomplish a process of sustainable development. Instead of top-down research and planning it enables bottom-up processes in which affected citizens and stakeholders can contribute to urban transformation. Moreover, this approach opens up the possibility to include sport and physical activity development in processes of city development and city marketing. Hence, urban real-world labs are able to address an integrated process of urban and sport development based on the needs and wants of residents and other stakeholders.

In the light of the multifaceted and complex challenges for our cities, innovative approaches and new methods can be helpful. Transdisciplinary research in urban real-world labs represents a new way that can contribute to future cities that support sport and physical activities, that are lively and healthy and ensure high quality of live for residents.

Notes

[1] In urban environments, “linear places” are of critical importance. They ensure connectivity and accessibility and prevent the spatial separation of places for sporting and physical activities. Examples are jogging paths, cycling routes to workplaces, or pedestrian-friendly ways to shops, kindergartens and schools. “Streets” showed to be the second-most important place for sporting and physical activities in cities. For example, 19 % of sports and physical activities in the city of Berlin take place on streets (Bundesministerium für Verkehr, Bau und Stadtentwicklung, 2011).

[2] The Real-world Lab 131 was supported by the Ministry of Science, Research and Arts of Baden-Württemberg, a federal state of Germany, within a research program to increase the contribution of science to sustainable development that started in 2015 (Ministerium für Wissenschaft, Forschung und Kunst Baden-Württemberg, 2015).

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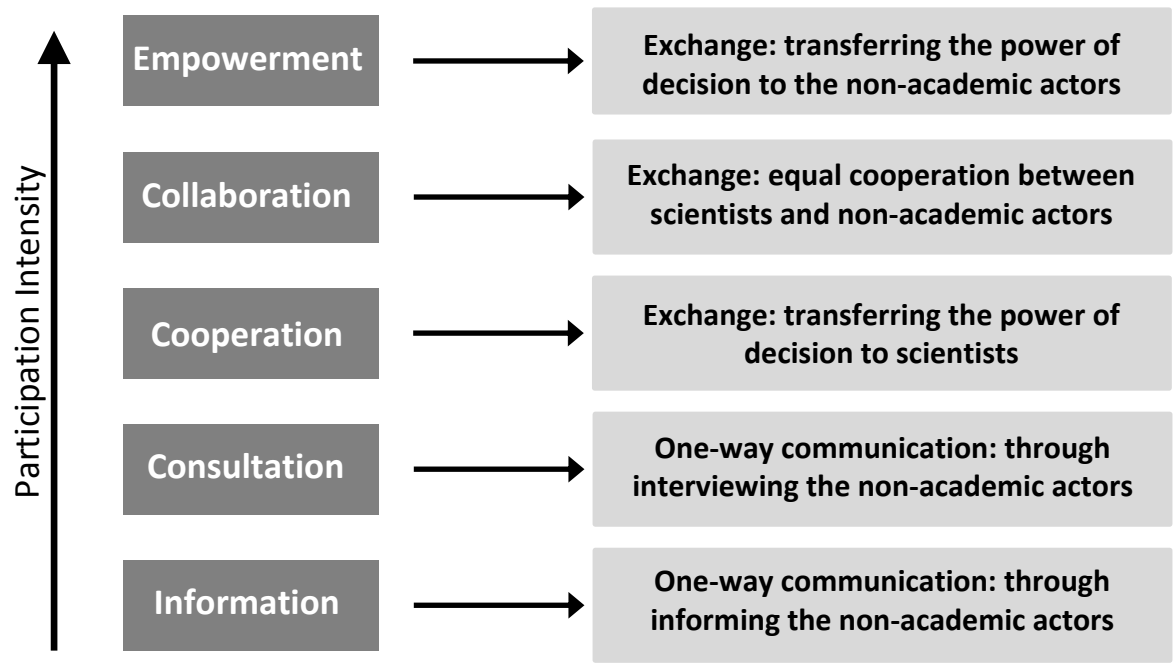
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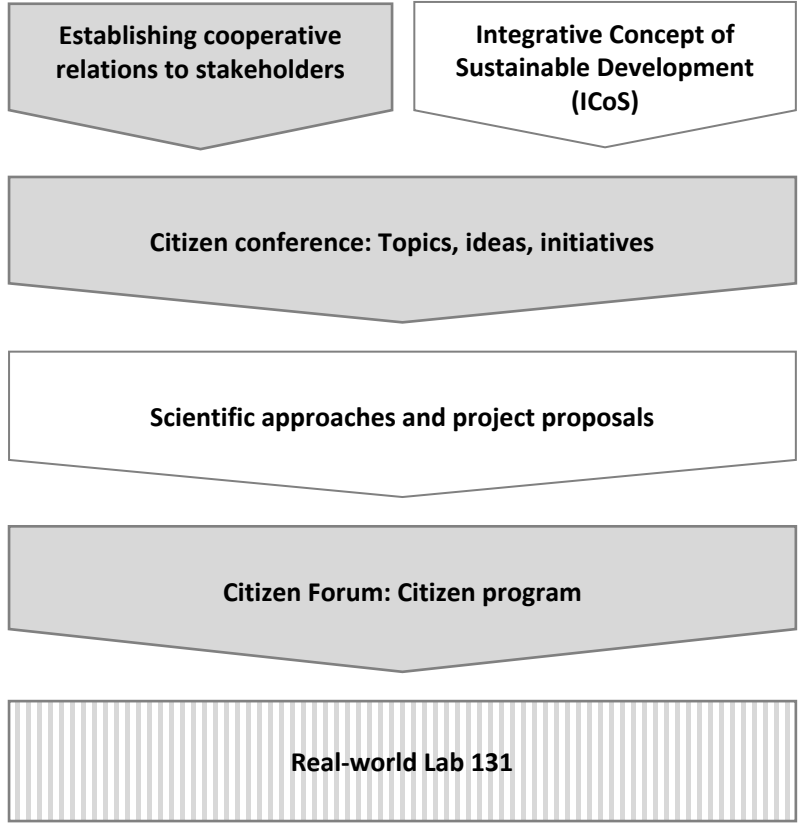
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Figure 3: Circuit for exercise in public park

220x130mm (96 x 96 DPI)

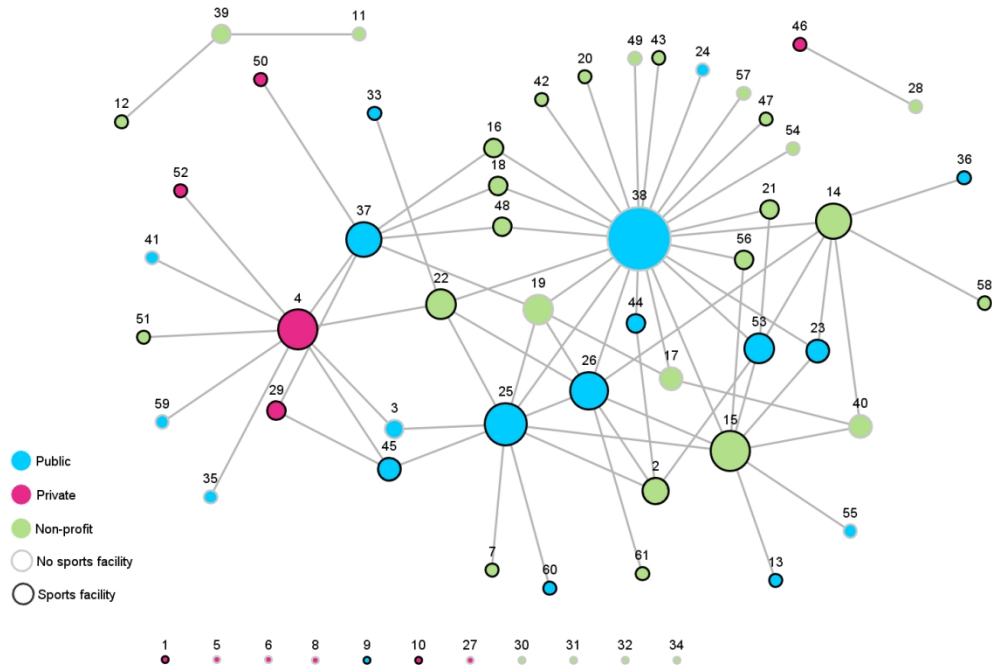


Figure 4: Network of cooperation among actors providing opportunities for sport and physical activity