



Analysing Capacity Factors for Urban Sustainability Transformations - The 'Eco-capital Suwon' in South Korea -

Hanna Kang*

* Ph. D., Chair of Spatial Development, Technische Universität Dresden, Germany (strongme.him@gmail.com)

ABSTRACT

Purpose: A growing body of literature has sought for a new urban approach that can dismantle problematic path-dependencies rooted in intertwined urban systems. In particular, scholars have paid attention to the role of societal agency in bringing about such systemic transformations towards sustainability. Against this background, this research analyses capacity factors associated with societal agency in transformation processes. **Method:** To do this, the research adopts a qualitative case study of a pioneering sustainability-oriented model, *Eco-capital Suwon*, by using methods of document analysis and in-depth interviews. **Result:** The results indicate that inclusive governance based on collaborative actor networks, and intermediaries working across different geographical scales, are essential. In addition, the research draws out theoretical reflections on how embedded assets of spaces and wider political contexts strengthen or weaken the emergence of capacity factors. Consequently, this study suggests to establish institutional and organisational frameworks that embrace transformative experiments across national-urban-neighbourhood territories, and to devise financial mechanisms for autonomous community activities.

KEYWORD

도시 지속가능성 전환
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1. Introduction

South Korea's economic growth can be characterised as an energy-intensive model, primarily dependent on fossil fuel-based industries [1]. Such growth has remarkably occurred in urban areas where labour forces and capital have been concentrated in the process of heavy industrialisation, especially in large cities [2]. The industry-driven urbanisation has induced a carbon-intensive 'urban system' that has produced sustainability challenges of continuous increase in energy consumption and greenhouse gas (GHG) emissions [3-4]. Accordingly, in 2017, the Moon Administration declared that Korea would achieve transitions from coal-fired/nuclear power to a renewable energy system, with the goal of 37% reduction of GHG emissions by 2030 compared with the business-as-usual scenario [5-6].

Achieving such transition, however, requires a new approach to deal with sustainability challenges that are 'coupled with and aggravated by the strong path-dependencies and lock-ins' of existing unsustainable systems [7]. In this sense, urban intervention should address the fundamental, co-evolutionary changes of socio-cultural, ecological, economic, and political structures [8-9]. Given this concern, a growing body of literature

has sought to identify urban approaches that can tackle such intertwined sustainability challenges; in the early 2000s, a research area called '(sustainability) transformation' emerged [10-14]. Building on 'systems thinking' (see [15-18]), numerous perspectives have appeared in terms of how to understand specific patterns and dynamics of change.

While transformation studies have been shaped by diverse schools of thought, there is one shared assumption whereby systemic change co-evolves with societal 'agency' [19-22]. The agency of diverse sectors—not only traditional governmental actors, but also civil society, communities, and intermediaries—collectively creates formal and informal networks 'within which decisions and strategies are developed, negotiated and implemented that lead to changes in societal structures' [21]. Having recognised that sustainability challenges are rooted in—and intertwined—across systems, as well as the role of agency influencing these systemic changes, it is necessary to identify the factors that are required to bring about transformations in the process of (urban) development.

Against this backdrop, this research aims to analyse agency-related factors that critically influence the emergence of urban transformation processes, inspired by the study of transformative capacity by Wolfram [23]. In order to investigate how these factors play a role in reshaping urban development in

Korea, a pioneering sustainability-oriented model, Eco-capital Suwon will be examined as a case study. To do this, a qualitative approach is adopted, comprising document analysis and semi-structured, in-depth interviews. The rest of the paper is organized as follows. Chapter 2 covers conceptual discussions, the concept of urban sustainability transformation and capacity factors related to societal agency. Chapter 3 describes research design and methods adopted to conduct the empirical analysis. A detailed justification for case selection and precise methodology are provided. Chapter 4 provides the results of case analysis on a set of agency-related capacity factors that are dominantly employed in the development processes of Eco-capital Suwon. Lastly, this research reflects on policy implications as well as theoretical considerations regarding the critical role of governance characteristics in facilitating transformation processes.

2. Capacity factors for urban sustainability transformations

2.1. Urban sustainability transformations

Responding to the recognition that urban challenges are intensively rooted in—and induced by—problematic urban systems, this Section traces a rising body of discourse on systemic change, which has collectively established the research field of ‘(sustainability) transformations’. It primarily focuses on societal systems, as Joss [24] describes, dominantly ‘from current fossil-fuel dependent socio-economic activity to future resource-efficient development based on drastically reduced carbon footprints’. Transformations can be explained with their basic characteristics: first, a temporal dimension of a medium- to long-term period (25–30 years); second, a thematic focus on GHG reductions and energy efficiency; and third, a conceptual relation to various infrastructure systems, including energy, transport, water, waste and agriculture [24].

Fundamentally built on systems thinking or complex systems theory, transformation studies have recognised the systemic character of societal sustainability reconfigurations [25]: society is composed of two or more components, and these components interact with each other [26–28]. The critical point here is that such interactions are established based on a high degree of interrelatedness between different elements and different scale levels [29]. By this attribute, changes in one element and/or level directly induce changes in others, and therefore there are emergent properties that cannot be analysed solely by referring to a part of the societal system, and that can only be understood by interactions in which society functions [28]. In this sense,

transformation is understood as a ‘co-evolutionary’ process of a societal system that involves diverse agency in interrelated, multiple dimensions and scale levels.

Transformation studies, over the recent decades, have been applied to urban dimensions, based on the understanding of cities as critical sites where components such as actors, their knowledge and value, and institutions interact across spatial scales. Urban studies have begun to adopt systemic perspectives, with the purpose of exploring how to frame urban approaches to govern such urban transformations. As a result, cities have increasingly received attention, in that the urbanisation force has provided cities with potentially advantageous environments where major societal transformations are initiated and developed, in terms of urban agglomerations [15, 30–31]. Scholars have started to explore particular dynamics and patterns of urban transformations. The advantage of the systemic approach lies in its distinction from sector-specific, domain-oriented approaches: it involves ‘multiple’ system changes across action domains and sectors that together bring about urban transformations [32].

The next Section mainly investigates factors of change dynamics that are associated with societal agency. The discussions consider the aspect of ability that is required to initiate and perform changes, inspired by the concept of transformative capacity [23].

2.2. Capacity factors associated with societal agency

This Section investigates agency-related factors involved in transformation processes. The discussions on governance place emphasis on the process (such as how decisions are made), rather than what is actually done [33]. In particular, the broad, inclusive participation of stakeholders has primarily formed the discourse on governance. Echoing this, a growing body of literature has sought to define the notion of inclusive governance and, by extension, how it conditions the processes involved in systemic change. Fukuyama [34] understands governance as ‘the ability of actors to perform towards objectives and ambitions that derive from the dynamic interaction and power struggles [...]’. However, inclusive governance can be defined as ‘a normative sensibility that stands in favour of inclusion’ [35]. The extent to which governance is more or less inclusive is related to the degree to which diverse stakeholders—including previously marginalised groups—participate in and exert influence on decision-making processes [36–37].

In addition, the remarkable roles of intermediaries—including those who are positioned between societal stakeholders—are highlighted, helping to create a shared discourse. Especially in the industry study, intermediaries are considered to be entities that

create the ecosystem needed for social organisations to work. They provide consultation and guidance, technical assistance, and build a network of supportive funders [38]. Recently, intermediaries have gained attention in the literature on sustainability transitions. Kivimaa, Boon, Hyysalo and Klerkx [39] define transition intermediaries as actors and platforms that influence transition processes by linking actors, activities, skills, and resources, and which generate collaborations to bring about new configurations. Furthermore, intermediaries articulate expectations and visions, exchange knowledge and build capacity, and provide institutional support [40].

Scholars, by extension, emphasise the interaction amongst diverse actors who can jointly solve problems in light of collaborative planning and action [36]. The involvement and empowerment of communities of practice (CoPs)—groups of individuals who attempt to produce social innovation—is stressed as a vital factor in this process. The notion of CoPs contains critical characteristics that should be distinguished from a community such as a neighbourhood [41]. Beyond a network of people, a CoP's identity is defined by a shared domain of interest (e.g. environmental activities, neighbourhood redevelopment, etc.). Members have a shared competence and mutually learn from one another. Likewise, members build relationships based on discussions and joint activities. Lastly, a CoP is a community of practitioners, and thus implements shared practices and experiments.

Drawing on these characteristics, three crucial conditions are required to enable CoPs to facilitate transformation processes: leadership, empowerment, and experiments. First, a CoP's leadership is distinguished from the general recognition of 'leaders' and 'followers', but is less hierarchical [42]. Onyx and Leonard [43] identify common elements of successful leadership empirically based on different cases: leaders have integrity in pursuing the public's interests; leaders make shared decisions and share skills with members; leaders fill identified gaps in knowledge, skills, and material resources for the public's benefit; leaders articulate a broad vision for the community and find a way to attain it; and leaders have practical skills in coordination and good communication with (and between) members.

The elements for successful leadership are closely tied to the empowerment of CoPs. The concept of empowerment refers to the process by which individuals and communities gain control and act effectively on their environment, thereby addressing social needs and provoking change [44]. From the capacity angle, empowerment factors include the active and purposeful participation of community members, competence in problem assessment and solving, access to resources (skills, information, social networks and organisations, funding), a shared vision, and

a sense of community [45].

The empowerment process should constitute diverse activities that, in first place, motivate and support the participation of community members in initiating and delivering community practices, in addition to those that create a supportive environment for such practices to bring about change. Furthermore, community-based experiments are required in and across various action domains such as energy, food, and transportation. At the same time, these experiments should aim to simultaneously address innovations in the urban environment, cultures, institutions, governance, markets, and technology. In initiating and performing experiments, it is essential to establish enabling environments with access to human, financial, technical, and organisational resources.

In addition, transformative knowledge forms a significant part of the systemic configuration process. In the sustainability context, transformative knowledge refers to 'knowledge on how to shape and implement the transition from the existing to the target situation' [46]. For instance, transitioning from a fossil to a bio-based economy requires revision of existing values and norms such as the belief in cheap fossil energy [47]. Transformative knowledge thus involves skills to change personal norms and assumptions, thereby leading to the transition of ideas, theories, and practices. Such knowledge includes the systemic analysis of the interrelations between perspectives, cultures, infrastructure, institutions, and practices, as well as recognition of the rigidity of such elements [23, 48].

In this sense, one vital condition to (co-)produce transformative knowledge is learning and reflexivity processes [49]. Learning is generally defined as changes in thought and behaviour [50]. In contrast, non-learning processes are self-sealing, repetitive, and non-changeable [51]. In transition studies, learning processes are recognised as the centre of societal change [20–21]. It is agreed that social learning involves changes in attitude, norms, and behaviour, which consequently contribute to system innovation. Pesch [52] describes social learning as an interactive process in which knowledge is exchanged. In recent transition studies, social learning is perceived as:

'a process of acquiring and generating new knowledge and insights, and of meaning-making of experiences in communicative interaction, [...] and] in which ideas and possibilities for collaborative action are being developed, experimented with and pursued in a diversity of networks' [53].

Lastly, many scholars have increasingly discussed the multi-scalar perspective on sustainability transitions [54–55]. As reflected on an increasing number of studies that has put an emphasis on the geography of sustainability transitions [56], the emergence of transformation processes is considerably conditioned

by geographical scalar interactions (inter-national, local scales etc.). The geography of sustainability transitions acknowledges diverse change pathways emerging across geographical and political-administrative scale levels. This geographical approach helps to explain different forms of institutional embedding in different territorial spaces (socio-spatial configurations). In addition, this approach focuses on 'embedded' strengths and weaknesses of spaces (socio-cultural, political, and ecological conditions such as institutional thickness, established social networks, leadership style, and external political relationships). It is useful for analysing specific sustainability challenges and environments in order to find a more fertile foundation for transformative innovations and activities.

Recently, the above-mentioned capacity factors have been empirically reviewed based on an exploration of diverse spatial and sectoral contexts [57]. The analyses have identified directions and strategies required to enhance capacity factors. These include increased connectivity amongst local sustainability initiatives [58], city-university partnerships [59], children's participation in planning [60], and the inclusion of the urban poor in planning [61]. While these studies strive to find strategies to enhance capacity factors, they give less consideration to the systemic property embedded amongst factors. Castán Broto et al. [62] claimed that there may be factors with the most relevance or importance as a pre-condition for the emergence of others. This research, therefore, intends to investigate the interrelations between the factors discussed above, and more specifically, to examine decisive capacity factors that can help to foster others, and consequently influence transformation processes.

3. Methodology

3.1. Analytical framework

Drawing on discussions above, this Section presents an analytical framework comprising 4 agency-related capacity factors, as shown in Table 1. The first factor is inclusive governance which refers to a wide range of stakeholder participation in deliberation of transformative actions, and also inclusion of previously excluded actors (such as local communities). It puts emphasis on intermediaries who provide consultation and guidance, and create networks among actors. The second factor is formation and empowerment of communities of practice (CoPs), and also enabling environments (e.g. regulations, resources) to support their activities. Next is transformative knowledge, which is required to recognise rigidity in current systems and to envision idealistic future. Here, social learning is considered as a tool for exchange of such knowledge.

Table 1. Capacity Factors for Urban Sustainability Transformations

Capacity factor	Description
Inclusiveness and intermediation	<ul style="list-style-type: none"> Broad participation and inclusion of marginalised actors Providing consultation and guidance Creating networks and collaborations
Community-driven innovation	<ul style="list-style-type: none"> Formation of communities of practice (CoPs) CoPs leadership, empowerment and experiments
Transformative knowledge	<ul style="list-style-type: none"> Recognition of path-dependencies (Re)shaping transitional norms and ideas Social learning
Multi-scalarity	<ul style="list-style-type: none"> System dynamics across geographical scales

Note: Capacity factors adopted here are inspired by the conceptual framework developed by Wolfram [23].

The last factor is interactions across multiple geographical scales.

3.2. Research design

For this research, a single case study for in-depth, exploratory analysis was chosen [63], in order to produce practical, context-dependent knowledge to understand a phenomenon within its real-life context (compared to theoretical, context-independent knowledge) [64]. The case chosen for this research is the *Eco-capital Suwon* in Korea. It not only represents urban transformation policy, but also a vital case of the governance approach regarding sustainability transformation [65]. Moreover, it encompasses multiple transformation experiments in various systems (e.g. energy, water). Particularly, it fits into a multi-stakeholder, participatory model of sustainability-oriented urban development and governance. At the same time, it is well-placed to demonstrate how transformation processes interact with the wider context where a more state government-led, centralised practice is dominant.

The *Eco-capital Suwon* can be interpreted as a set of transformative experiments across action domains, which collectively attempt to challenge current unsustainable systems and behaviours. This study adopts a single-case design with 3 sub-cases (3 projects included in the Eco-capital Plan; more details in Chapter 4), in order to show different systems (i.e. water, transport, energy).

3.3. Research methods

A qualitative approach was adopted to examine the capacity factors that are employed in the case. This approach includes two key methods: document analysis and in-depth, semi-structured interviews. These methods are applied to analyse capacity factors and their interrelations in respective sub-cases with the comparative perspective. The rationale of adopting these methods attributes to the characteristics of the framework that is

developed as qualitative measure for an emergent property that reflects attributes of urban stakeholders. Particularly, informal documents (e.g. social media) and in-depth interviews were essential to help analyse subjective and abstract factors such as the degree of feelings and awareness and recognition.

Firstly, numerous documents and materials were analysed to acquire information. They are broadly classified into four categories. First, diverse policy documents are used as the primary source for gaining detailed information. Second, policy research reports are included, regarding the overall urban development and sustainability policies/projects. Third, mass/social media documents are taken not only to understand various views on policies/projects (especially of the non-public sector), but also to gain access to the—then current opinions. Fourth, statistical reports are included to explore the status and trends of sustainability challenges.

Secondly, in-depth, semi-structured interviews (36 in total) were conducted from May 25–July 24, 2017. All interviews were conducted by the author, mostly face-to-face, and in some cases by phone. Interviews were audio-recorded with each respondent's written consent; these recordings were manually transcribed into written form by the author for analytical purposes. Interviews were conducted with 45 informants from 14 organisations and 2 neighbourhoods: the national ministry officials, Suwon Government officials, urban-level intermediaries and research institutes, local community organisations, neighbourhood-level public officials and resident group leaders. Interviews were held based on the interview topics, which include general information as well as specific capacity factors employed in the *Eco-capital Suwon* and the 3 projects.

4. Analysing capacity factors in the *Eco-capital Suwon*

4.1. The *Eco-capital Suwon* as a urban intervention for transformation

Suwon is located in the north-western part of Korea, approximately 40 kilometres south of the capital. The city has gradually become divided into the east and west of Paldal-gu (Fig. 1.). Responding to this, the concept of urban regeneration has been taken as an essential mechanism of developing and managing urban areas [66]. Regeneration was understood as the process of building sustainable urban space by the integration of physical, socio-economic and cultural improvement, and by the mechanism of participatory governance. Such approach was in fact motivated by the recognition of the previous construction-based urban practices [65]. This paradigm shift has

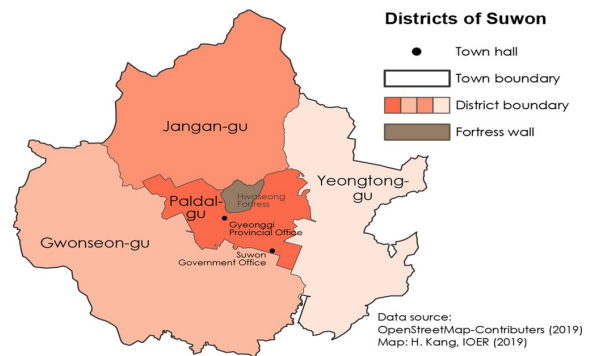


Fig. 1. Districts in Suwon [71]

begun to occur along with the city's political transition in 2010 when the Mayor Yeom declared the city's vision to become the 'Eco-capital'. [67–68]. Accordingly, an ambitious target was set to slash the city's GHG emissions by 40 percent by 2030 compared with 2005 levels [69].

'Today, we call upon the fundamental transformation of urban planning and policy as well as lifestyle, therefore declare to become Korea's Eco-capital. We put efforts to transform Suwon from grey city to green city [···]' [70].

Against this background, this research selects 3 projects included in the 3rd Eco-capital Plan, based on the differences in terms of action domains. The 3 selected projects cover domains of (rain)water management, green transport, and renewable energy. First, the Rain-city is a set of experiments using rainwater facilities in public buildings and spaces, and in houses (rooftop, garden). Second, the *EcoMobility* refers to both a month-long experiment on 'no car in one neighbourhood' (*Festival*) and follow-up community-led 'car-free day' in the neighbourhoods. Third, the *Citizens Solar Energy (CSE)* is activities of solar energy generation by a citizen-led organisation.

4.2. Dynamics of Capacity factors in the *Eco-capital Suwon*

1) Inclusiveness and intermediation: Multi-Stakeholder collaboration and partnership

In 2017, the Sustainability Division of the Suwon Government was founded according to the establishment of the city's sustainability-oriented organisation, the Suwon Sustainable City Foundation (SSCF). The SSCF was assigned to develop a 'cooperative platform' where diverse stakeholders are brought together for seeking solutions[72]. The city's another intermediary organisation, the Suwon Council for Sustainable Development (SCSD) has also worked on building a multi-stakeholder governance structure [73].

Selected 3 projects are mainly distinguished by their

governance characteristics (Table 2). The *Rain-city* represents Korea’s hierarchical governance model that is led by the public sector and experts. It was designed through the agreement between the Suwon Government (Water Circulation Team) and the Rainwater Research Centre in 2009. Based on related legislation and regulations, the national officials have played a role of developing project guidelines and providing financial support, and the urban officials have developed concrete work plans in collaboration with engineers.

On the other hand, the *EcoMobility* was planned with an aim to experiment on multi-stakeholder and participatory governance [74]. For more voices to be included, a survey was conducted by the Suwon Research Institute (SRI) on how far residents understood about the project and its objective, and used the

survey result as a basis to develop the master plan. At the neighbourhood scale, the Resident Working Group (RWG) was established to take a partnering role with the Suwon Government (EcoMobility task force). In addition, the EcoMobility Neighbourhood Centre (ENC) whose members were composed of Haenggung-dong residents, was in charge of intermediation between the public sector and the residents, and also mobilising resident participation by taking the advantage of established community fellowship. The formation of a broad range of resident groups were encouraged, in which previously excluded actor groups played an active role. At the urban level, the SCSD played a significant role as a motivator and supporter who collaborated with the ecomobility-oriented community network (named as the ‘Citizens Playing on Streets’). At the international level, the ICLEI EcoMobility Secretariat, as a project proposer, worked to promote the interaction with ecomobility-related international networks and businesses.

The *Citizens Solar Energy (CSE)* was launched by a citizen-led organisation, the Suwon Citizens Solar Energy Social Cooperative (SCSE-SC). Influenced by the national discourse on citizen-led energy generation, the formation of the SCSE-SC was agreed by 10 founding members, in cooperation with the Suwon Government (Renewable Energy Team) and the intermediation of the SCSD. By taking the organisational form of ‘social cooperative’, the SCSE-SC has become eligible to be supported by the Social Economy Centre (SEC). Particularly, the national-level energy exchange system has essentially played the role, in which electric power that is produced from the solar plants is purchased

Table 2. Governance Characteristics of 3 Selected Projects

Project	Main feature	Participating actors	Actor interaction
Rain-city	Infrastructural large-scale project Urban territory	<ul style="list-style-type: none"> Mainly the public sector and engineers/technicians 	Top-down and hierarchical
Eco Mobility	Participatory policy experiment Neighbourhood territory	<ul style="list-style-type: none"> Neighbourhood resident groups and the public sector International/urban/neighbourhood-level intermediaries 	Participatory and collaborative
Citizens Solar Energy (CSE)	Citizen-led activities Urban territory	<ul style="list-style-type: none"> Citizen organisation and the public sector Urban-level intermediaries 	Citizen-centred network

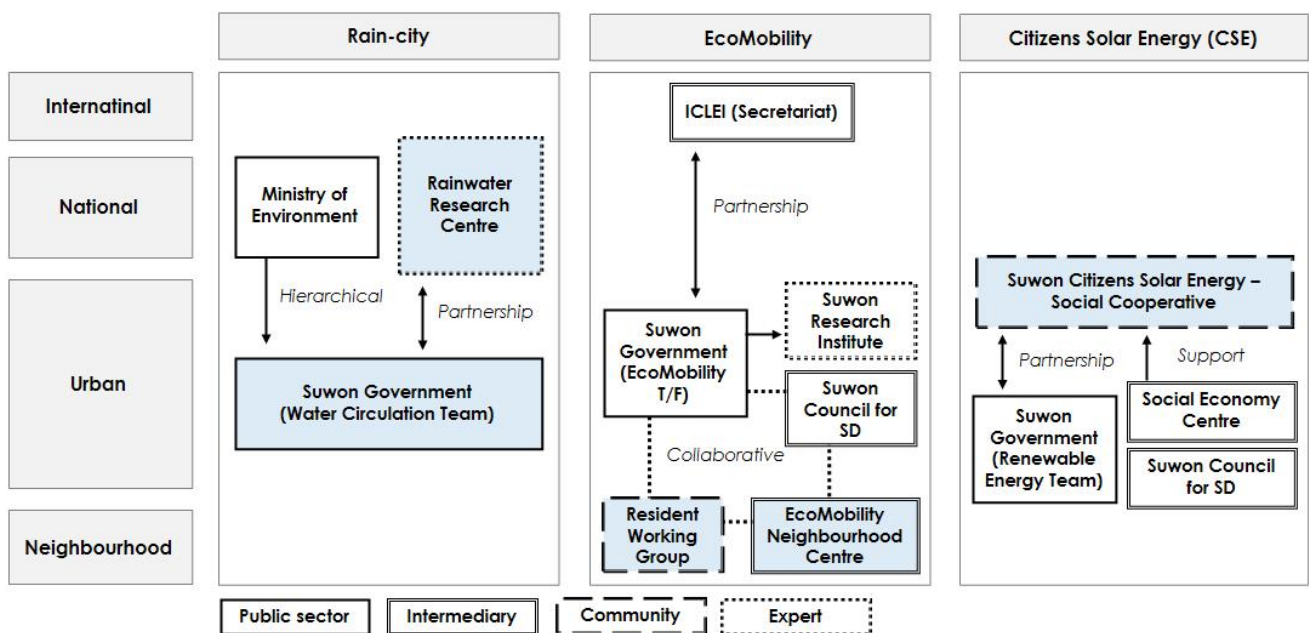


Fig. 2. Governance Structure of 3 Selected Projects
Note: Coloured boxes refer to dominant actor(s) of each project

by the Korea Electric Power Corporation, and additionally the Renewable Energy Certificate (REC) is issued by the Korea Energy Agency, and also purchased by power generation corporates who are obligated to provide certain amount of renewable energy to the Korea Power Exchange.

As depicted in Fig. 2., the *Rain-city* applies a more formal and centralised governance mode in which the national and urban government officials and technical/scientific experts had active relations. In contrast, the *EcoMobility Festival* employed more inclusive governance in promoting multi-stakeholder participation and their interaction. The *CSE* can be characterised as a citizen-led network of participating members of the SCSE-SC.

2) Community-driven innovation: Empowering communities of 'practice'

Under the policy motto of the Yeom Administration to establish the government of citizens, a range of governance models have been established which primarily aimed to empower citizens in decision-making related to policy design and practice [75]. Accordingly, for the first time in Korea, a 'citizen participatory urban planning' was exercised that planning experts (master planners, public officials, researchers) and 130 citizens (Citizens Planning Group) discussed on the overarching directions the city should follow for the next 15 years. In promoting citizen autonomy, the Citizen Autonomy School was launched with an aim to develop citizens' autonomous role in decision-/policy-making process, including community leadership, discussion skills, conflict coordination, budget compilation, as well as knowledge on Suwon and urban sustainability [76-77].

These programs have been actively implemented at the neighbourhood level, through the Neighbourhood Community Renaissance (NCR), in which the public sector empowers residents by providing resources required to meet the needs of their neighbourhood. The institutional structure of NCR has laid down foundations for community experiments. As a part of *Rain-city*, a community gardening program was initiated in Haenggung-dong, combined with the NCR activities. The Resident Solar Energy is another example delivered in Hwaseo 1-dong which has been known as a 'low-carbon green neighbourhood'. Making use of the neighbourhood's housing style that has a yard and rooftop, the resident leaders launched a subsidy program composed of the installation of household-scale solar panels and rainwater facilities. In addition, they installed a size of 18 kW solar panel on the rooftop of the public building in the neighbourhood, with the technical and operational support of SCSE-SC. Its operation has produced a profit of 7 million KRW per year, which has been accumulated as the neighbourhood fund

for green activities and social services. Despite these efforts to the contrary, they have failed to encourage the formation of communities of practice (CoPs), beyond merely providing subsidies for activities.

By contrast, in the case of the *EcoMobility Festival*, the government actors focused more on empowering diverse resident groups to the extent that they play as a main actor in the overall process of designing and delivering the project [74]. In particular, there were special considerations to encourage the empowerment of previously excluded stakeholders. The Suwon Rehabilitation Centre for the Disabled organised a tour program ('Heart Tour') during which participants cover their eyes or use wheelchairs, with an aim to deliver the message about 'inclusive transportation' [78]. With regard to establishing an ecological lifestyle, a series of 'car-free days' were delivered voluntarily by the citizens network: for example, a hundred of Haenggung-dong residents rode a bike along one of the congested car roads (Jeongjo-ro) and exclaimed 'independence from cars' on the country's Independence Day [78]. After the *Festival* ended, the residents decided to continue the ecomobile practices by holding a monthly car-free day. During the course of time, this car-free activity has been expanded to 20 neighbourhoods (as of 2018). One remarkable case is the 'Dreaming Bicycle' in Geumgok-dong that has employed creative ideas, such as movie screening using the electricity produced from bike riding and oven cooking using solar energy [79-80].

3) Transformative knowledge: Redirecting the urban system

The *Eco-capital Suwon* was an ambitious attempt to initiate political decision on drastic shift from the growth-oriented planning to human-centred, environmentally-sustainable development. It includes the restructuring of energy systems (increasing the proportion of renewable energy to fossil fuels), urban space and infrastructure (securing green spaces against urban infrastructures such as car roads and buildings), and urban ecology (altering the focus from waste disposal to resource circulation) [81].

In this sense, the *Rain-city* was designed to change the overall water supply system which has heavily depended on a centralised, piped-water network since the 1970s. Significantly, considering that more than 30% of water used in cities are for cleaning, flushing and gardening, it is inefficient to supply high quality water for these uses [82]. In particular, Suwon has suffered from water scarcity fundamentally caused by its geological character, which has led to large dependence on centralised water supply (89%), compared to the average rate of other cities' (28%) [83]. Responding to this challenge, the Suwon Government has started to embrace rainwater as a water resource, especially for the purpose of cleaning, flushing and gardening (all of which take up

30% of water consumption in urban areas) [84].

Similarly, the *EcoMobility Festival* has faced the ambitious task of changing the car-dependent transportation system, which not only has received considerable investment in infrastructure, but also serves as an artery through which one fifth of Suwon's residents commute to Seoul by car on a daily basis [85] (OECD 2017). As a matter of fact, Suwon's car dominance reached 46% as of 2010, even higher than the one of Seoul (27.6%) [86]. The *Festival* employed a scheme of mise-en-scène through which one neighbourhood was transformed into a real-world stage where only zero/low carbon vehicles were used. This month-long event served as a stepping stone to bring about changes in the overall transport system, including both improved services and increased use of public transportation.

The *CSE* has employed an alternative governance structure of 'social cooperative (SC)' which is operated based on networks of participating members. Their ultimate goal was to break down the current energy system that has been tremendously dependent on imported fossil fuel and nuclear energy [4]. Challenges remained regarding possibilities of generating alternative energy enough to substitute current energy supply [87]. Under the circumstance that renewable energy currently takes up only 2.8% of overall energy supply in Korea [88], and is to be expanded to 20% by 2030 [89], household-based, small-scale (renewable) energy generation has been increasingly recognised as an alternative mechanism to successfully achieve a shift towards more environmental and safe energy supply.

4) Multi-scalarity: Interaction across national-urban territories

The agency interaction between urban and national territories in Korea has been considerably affected by the country's political system which imposes top-down, centralised relationship between the national and local governments. With regard to financing, the gap between the tax collection and use of the local governments is covered by the national government's tax revenue and subsidies (and adjusted and compensatory grants) [90]. Similarly, the local legislation can be enacted when founded on its superordinate national frameworks [91]. The *Rain-city* is the case delivered as the national urban project, dominantly enabled by the interaction with the national government actors for the arrangement of related legislation/regulation and required finance. Similarly, the *CSE* has been accelerated by changed landscape at the national level, since the national government reshaped the country's energy policy direction to environment-friendly energy system (the 8th Master Plan on Electricity Demand and Supply, 2017–31), and accordingly declared to incrementally increase the proportion of renewable

energy by 20% by 2030 (the 3020 Renewable Energy Implementation Plan).

In the domain of green transportation, Suwon has led the national discussion to solve legislative obstacles to introducing urban railways (or trams) [92]. Herein lies the critical role of national actors in arranging legislative foundation¹⁾, particularly of the National Assembly in cooperation with the Ministry of Land, Infrastructure and Transport (MOLIT) and National Police Agency. By extension, the MOLIT has initiated the national project on 'wireless low-floor tram' in which the Korea Railroad Research Institute took charge of R&D in partnership with related private businesses.

5. Conclusions

This research started with a recognition of sustainability challenges that Korean cities have faced, largely induced by carbon-intensive urban development pathways. Then, it focused on the role of societal agency in transforming such pathways towards sustainability. Founded on conceptual understanding, this research sought to draw implications in terms of how capacity factors help to trigger systemic change, especially with regard to the extent to which governance characteristics influence the urban transformation processes. For this purpose, a real-world urban study approach was adopted with the case of the *Eco-capital Suwon* (and its 3 selected projects), which started as an ambitious policy decision to shift the direction of urban development from industry-driven growth to an environmentally-sustainable system in multiple domains. This case study aimed to examine capacity factors that have the potential to influence transformation dynamics in the urban context by exploring the interrelations that emerge between the factors. The research question was precisely answered by analysing capacity factors employed in the case and their respective roles in initiating and performing transformative actions. Consequently, the primary finding was obtained: 1) 'Inclusive governance' based on collaborative actor networks; and 2) Intermediaries working across different domains and scale levels condition the emergence and characteristics of agency-related factors for urban transformations.

The overall process of study made a set of contributions, not only to research on urban transformation, but also to the policies and practices of urban governance and planning. First, the research generated theoretical contributions, gained by exploring a real-world case characterised as a multi-stakeholder, participatory governance model of pursuing sustainability-oriented urban development [65]. Scrutinising such a case helps to examine 'a wide range of forms of interplay' amongst diverse stakeholders from

different sectors (especially from the public sector, and civil society, and local communities) and across political-administrative levels (not only in the neighbourhood and urban areas, but also in national territories). Additionally, the analytical design of the three different sub-cases—which were selected based on different agency roles—displayed diverse (and divergent) dynamics of transformation.

Second, the findings of this study bolster the argument that place and scale play a vital role in transformation, which has received growing attention by different scholars [54–55]. The case analysis fully confirms how embedded contexts—where urban transformation occurs—determine interventions to tackle sustainability challenges by utilising embedded assets (e.g. cultures, governance practices, the built environment, etc.). However, place-specific assets do not automatically generate contributions unless there are policy-level measures to nurture them. For example, Suwon has an established civil society and strong public interest as inherent assets, but the absence of policy measures aimed at the formation and empowerment of communities of practice (CoPs) can result in low citizen participation, as shown in the case of the household-scale rainwater project. Third, the research explains the considerations given to cross-scale relations, particularly when located in a centralised political system (which increases their importance), as well as diverse forms of interaction with national-level entities. The examples from the case analysis display how the national government's changed policy on renewable energy has accelerated CoP experiments regarding solar energy generation and business by (social) cooperatives, while, conversely, national existing legislation has delayed the operation of urban trams.

The findings described above converge on the comprehensive conclusion that inclusiveness—employed in governance modes and actor networks—plays a decisive role in facilitating urban transformation processes. The public sector (the Suwon government, intermediary organisations, and research institutes) plays a crucial role in enhancing this inclusive aspect of transformation, with particular attention on CoPs at the urban and neighbourhood levels by providing institutional and organisational support. This endeavour aimed to empower CoPs to the extent that they independently and autonomously initiate and perform activities—even outside of the government programme sphere. They are enabled not only by gaining knowledge, experiences, and building networks (with the public sector and amongst CoPs), but are also motivated by feelings of pride and ownership towards their activities. However, as identified during an interview with a citizen leader, who has initiated diverse urban-/neighbourhood-level community activities since 2012, community-driven experiments that are

expanded beyond the sphere of government programmes are often discouraged due to financial barriers to carrying out the experiments.

In this vein, one very pivotal policy recommendation is drawn out that the public sector empowers CoPs and their autonomous activities, accompanied by policy measures to help establish a sound financial tool of CoPs'. These are to be produced based on the CoPs' own independent activities, rather than programme-bound, subsidy-type government support. Good examples include (social) cooperatives/enterprises, which are entitled to independently earn profits from their own activities in diverse areas, and then (entirely or partly) reinvest such profits to continue and expand follow-up activities. One case is the Suwon Citizens' Solar Energy Social Cooperative, whose profits from solar plant generation have been reinvested for additional solar plant construction, and used for related activities such as educational awareness programmes for renewable energy. Here, considering the centralised national political system—which authorises the national-level policy framework as a prerequisite to any policy measures—the national government (and related ministries) plays a critical role in arranging for the necessary enabling conditions to nurture diverse types of financial tools for independent community activities. The empirical evidence for this argument refers to a series of processes regarding how the passage of the national-level Cooperatives Act has triggered and accelerated the nation-wide emergence of solar energy-oriented (social) cooperatives in Korea. Such independent and autonomous CoP activities are less influenced by potential changes in government policies, which revert to the old, unsustainable system, and whose priority is less oriented towards promoting community practices. On that account, ensuring that CoPs have sound financial tools carries a significant implication for transformative government leaders, who seek solutions to continue transformative policies beyond their term in office. Recommendations on urban policy and governance in South Korea (and beyond) can be summarised into three aspects:

- ♦ *Building collaborative partnerships with stakeholders from diverse sectors and scale levels, and establishing intermediaries to bridge possible gaps that could hinder joint action;*
- ♦ *Paying attention to neighbourhoods as vital spatial units for community formation and activities in multiple domains, as well as utilising established social relationships/networks amongst residents to create collective (but transformative) values and visions; and*
- ♦ *Devising/adopting community-operated financial mechanisms for community-led experiments, e.g. (social) cooperatives, and moving from programme-bound community formation/activities (operated through*

government support/subsidies) to autonomous, long-term community-led innovations.

Drawing on two distinct characteristics of the case city, Suwon, which includes its location within a centralised national system and its long history as an established city, two comparative studies would be worth conducting, with the purpose of analysing how ‘place’ conditions transformation dynamics. First, a comparative study on a city located in a decentralised (e.g. federal) system could reveal the different dynamics of agency interactions across political-administrative scales (notably amongst national ministries/assemblies) and amongst regional and local governments/councils in delivering transformative activities. Hence, this could help us to understand the different roles played by the national/regional/local governments in transformation processes. Second, a comparative study on a newly built city could offer insight into the role of established networks amongst citizens/residents in creating willingness and self-motivation to organise CoPs, and to take part in community activities.

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Reference

- [1] J. Mathews, Green growth strategies-Korean initiatives, *Futures*, 44(8), 2012, pp.761–769.
- [2] Q. Zhang, X. Deng, *Urban development in Asia: pathways, opportunities and challenges*, Berlin: Springer, 2017.
- [3] 온실가스종합정보센터, 2017년 국가 온실가스 인벤토리 보고서, 세종: 온실가스종합정보센터, 2017. // (GIR, 2017 National greenhouse gas inventory report of Korea, Sejong: Greenhouse Gas Inventory and Research Center, 2017.)
- [4] 에너지경제연구원, 2017 에너지 통계연보, 울산: 에너지경제연구원, 2017. // (KEEI, 2017 Yearbook of energy statistics, Ulsan: Korea Energy Economics Institute, 2017.)
- [5] 국무조정실, 제1차 기후변화대응 기본계획, 2016. // (Office for Government Policy Coordination, The 1st master plan on climate change, 2016.)
- [6] 산업통상자원부, 재생에너지 3020 이행계획(안), 2017. // (Ministry of Trade, Industry and Energy, Implementation plan on 3020 renewable energy, 2017.)
- [7] J. Markard, Sustainability transitions: an emerging field of research and its prospects, *Journal of Infrastructure Systems*, 17(3), 2011, pp.107–117.
- [8] A. Rip, R. Kemp, Technological change. In *Human choice and climate change: an international assessment*, Columbus: Batelle Press, 1998.
- [9] B. Elzen, F. W. Geels, K. Green, eds., *System innovation and the transition to sustainability: theory, evidence and policy*, Cheltenham: Edward Elgar Publishing Limited, 2004.
- [10] M. p.Hekkert, S. O. Negro, Functions of innovation systems as a framework to understand sustainable technological change, *Technological Forecasting and Social Change*, 76(4), 2009, pp.584–594.
- [11] X. Bai, B. Roberts, J. Chen, Urban sustainability experiments in Asia: patterns and pathways, *Environmental Science and Policy*, 13(4), 2010, pp.312–325.
- [12] Geels, Frank. eds. 2011. *The role of cities in technological transitions - analytical clarifications and historical examples*. In *Cities and low carbon transitions*. New York: Routledge.
- [13] Y. Jabareen, Planning the resilient city: concepts and strategies for coping with climate change and environmental risk, *Cities*, 31, 2013, pp.220–229.
- [14] F. Nevens et al., Urban transition labs: co-creating transformative action for sustainable cities, *Journal of Cleaner Production*, 50, 2013, pp.111–122.
- [15] M. Gell-Man, Complex adaptive systems. In *Complexity: metaphors, models and reality*, eds, D. Pines, G. Cowan, D. Meltzer, MA: Avalon Publishing, 1994.
- [16] J. Holland, *Hidden order: how adaptation builds complexity*, Cambridge: Helix Books/Perseus Books, 1995.
- [17] S. Kauffman, *At home in the universe: the search for the laws of self-organization and complexity*, New York: Oxford University Press, 1995.
- [18] L. H. Gunderson, C. S. Holling, eds., *Panarchy: understanding transformations in human and natural systems*, Washington DC: Island Press, 2002.
- [19] F. Geels, From sectoral systems of innovation to socio-technical systems: insights about dynamics and change from sociology and institutional theory, *Research Policy*, 33(6–7), 2004, pp.897–920.
- [20] R. Kemp, D. Loorbach, J. Rotmans, Transition management as a model for managing processes of co-evolution towards sustainable development, *International Journal of Sustainable Development and World Ecology*, 14(1), 2007, pp.78–91.
- [21] D. Loorbach, Transition management for sustainable development: a prescriptive, complexity-based governance framework, *Governance: An International Journal of Policy, Administration, and Institutions*, 23(1), 2010, pp.161–183.
- [22] U. Jorgensen, Mapping and navigating transitions - the multi-level perspective compared with arenas of development, *Research Policy*, 41(6), 2012, pp.996–1010.
- [23] M. Wolfram, Conceptualizing urban transformative capacity: a framework for research and policy, *Cities*, 51, 2016, pp.121–130.
- [24] S. Joss, Conceptualising urban sustainability: the process perspective, In *Sustainable cities: governing for urban innovation*, eds., S. Joss, London: Palgrave Macmillan, 2015.
- [25] M. Wolfram, N. Frantzeskaki, Cities and systemic change for sustainability: prevailing epistemologies and an emerging research agenda, *Sustainability*, 8(2), 2016, p.144.
- [26] A. M. H. Clayton, N. J. Radcliffe, *Sustainability: a systems approach*, London: Earthscan Publications Limited, 1997.
- [27] R. Dodder, R. Dare, Complex adaptive systems and complexity theory: inter-related knowledge domains, *Research Seminar in Engineering Systems*, Massachusetts Institute of Technology, 2000.
- [28] G. Gallopin, *A systems approach to sustainability and sustainable development*, Santiago: Economic Commission for Latin America and the Caribbean, 2003.
- [29] J. Rotmans, A complex systems approach for sustainable cities, In *Smart growth and climate change: regional development, infrastructure and adaptation*, ed., M. Ruth, Massachusetts: Edward Elgar Publishing Limited, 2006.
- [30] p.Hall, *Cities in civilisation: culture, technology and urban order*, London: Weidenfeld and Nicolson, 1998.
- [31] E. Glaeser, The new economics of urban and regional growth. In *The oxford handbook of economic geography*, eds., G. L. Clark, M. p.Feldman, M. S. Gertler, Oxford: Oxford University Press, 2000.
- [32] N. Frantzeskaki et al., Urban sustainability transitions: the dynamics and opportunities of sustainability transitions in cities, In *Urban sustainability transitions*, eds., N. Frantzeskaki et al., New York: Routledge, 2017.
- [33] OECD. What does ‘inclusive governance’ mean? Clarifying theory and practice, OECD development policy papers No. 27, Paris: OECD Publishing, 2020.
- [34] F. Fukuyama, What is governance? Working Paper No. 314, Centre for Global Development, 2013
- [35] S. Hickey, *Inclusive institutions*, GSDRC Professional Development Reading Pack No. 29, Birmingham: University of Birmingham, 2015.
- [36] J. Innes, D. Booher, *The impact of collaborative planning on governance capacity*, IURD Working Paper Series, Baltimore: Institute

- of Urban and Regional Development, 2003.
- [37] D. Joshi, B. Hughes, T. Sisk, Improving governance for the post-2015 Sustainable Development Goals: Scenario forecasting the next 50 years, *World Development*, 70, 2015, pp.286–302.
- [38] S. D. Cornell, How can intermediaries accelerate social change? *Social Innovation Forum*, 2018, <https://www.socialinnovationforum.org/blog/how-can-intermediaries-accelerate-social-change>, 2019.05.30.
- [39] p.Kivimaa et al., Towards a typology of intermediaries in sustainability transitions: a systemic review and a research agenda, *Research Policy*, 48(4), 2019, pp.1062–1075.
- [40] J. Howells, Intermediation and the role of intermediaries in innovation, *Research Policy*, 35, 2006, pp.715–728.
- [41] E. Wenger-Trayner, B. Wenger-Trayner, Introduction to communities of practice: A brief overview of the concept and its uses, Etienne and Beverly, 2015, <https://wenger-trayner.com/introduction-to-communities-of-practice/>, 2019.05.03.
- [42] H. Sullivan, Interpreting 'community leadership' in English local government, *Policy Polit.*, 35, 2007, pp.141–161.
- [43] J. Onyx, J. R. Leonard, Complex systems leadership in emergent community projects, *Community Development Journal*, 46, 2011, pp.493–510.
- [44] A. Kasmel, p.T. Andersen, Measurement of community empowerment in three community programs in Rapla (Estonia), *International Journal of Environmental Research and Public Health*, 8, 2011, pp.799–817.
- [45] N. Smith, L. B. Littlejohns, D. Roym, Measuring community capacity: state of the field review and recommendations for future research, Alberta: Health Canada, 2003.
- [46] ProClim, Research on sustainability and global change - visions in science policy by Swiss researchers, ProClim- Forum for Climate and Global Change, 1997.
- [47] S. Urmetzer et al., Learning to change: transformative knowledge for building a sustainable bioeconomy, *Ecological Economics*, 167, 2020, pp.1–11.
- [48] N. Frantzeskaki, Urban sustainability transitions: systems and agency dynamics, Copenhagen: Copenhagen University, 2015.10.21.
- [49] A. E. J. Wals, ed., *Social learning towards a sustainable world*, Wageningen: Wageningen Academic Publishers, 2007.
- [50] J. Sol et al., Reframing the future: the role of reflexivity in governance networks in sustainability transitions, *Environmental Education Research*, 24(9), 2018, pp.1383–1405.
- [51] C. Argyris, A life full of learning. *Organization Studies*, 24(7), 2003, pp.1178–1192.
- [52] U. Pesch, Tracing discursive space: agency and change in sustainability transitions, *Technological Forecasting and Social Change*, 90, 2015, pp.379–388.
- [53] B. van Mierlo, p.J. Beers, A. Hoes, Inclusion in responsible innovation: revisiting the desirability of opening up, *Journal of Responsible Innovation*, 7(3), 2020, pp.361–383.
- [54] L. Coenen, B. Truffer, Places and spaces of sustainability transitions: geographical contributions to an emerging research and policy field, *European Planning Studies*, 20(3), 2012, pp.367–374.
- [55] F. Caprotti, N. Harmer, Spatialising urban sustainability transitions: eco-cities, multilevel perspectives and the political ecology of scale in the Bohai Rim, China, In *Urban sustainability transitions*, eds., N. Frantzeskaki et al., New York: Routledge, 2017.
- [56] B. Truffer, J. T. Murphy, R. Raven, The geography of sustainability transitions: contours of an emerging theme, *Environmental Innovation and Societal Transitions*, 17, 2015, pp.63–72.
- [57] M. Wolfram, S. Borgstroem, M. Farrelly, Urban transformative capacity: from concept to practice, *Ambio*, 48(5), 2019, pp.437–448.
- [58] S. Borgstroem, Balancing diversity and connectivity in multi-level governance settings for urban transformative capacity, *Ambio*, 48(5), 2019, pp.463–477.
- [59] K. Withycombe et al., Building actor-centric transformative capacity through city-university partnerships, *Ambio*, 48(5), 2019, pp.529–538.
- [60] M. Nordstroem, M. Wales, Enhancing urban transformative capacity through children's participation in planning, *Ambio*, 48(5), 2019, pp.507–514.
- [61] G. Ziervogel, Building transformative capacity for adaptation planning and implementation that works for the urban poor: insights from South Africa, *Ambio*, 48(5), 2019, pp.494–506.
- [62] V. Castán Broto et al., Transformative capacity and local action for urban sustainability, *Ambio*, 48(5), 2019, pp.449–462.
- [63] A. Bhattacharjee, *Social Science Research: Principles, Methods, and Practices*, Createspace Independent Pub, 2012.
- [64] B. Flyvbjerg, *Making social science matter: why social inquiry fails and how it can succeed again*, Cambridge: Cambridge University Press, 2001.
- [65] 허태욱, 수원시 환경수도(저탄소녹색도시)로의 전환과 환경 거버넌스, *아시아연구*, 55(1), 2012, pp.67–98. // (T. W. Huh, Towards environmental capital (low-carbon green city) through environmental governance in Suwon, Korea, *Journal of Asiatic Studies*, 55(1), 2012, pp.67–98.)
- [66] 수원시, 수원행 도시르네상스 사업, 2014. // (Suwon Government, Suwon urban renaissance programme, 2014.)
- [67] 수원시, 환경수도 추진방안, 2010. // (Suwon Government, Strategies on establishing Eco-capital, 2010.)
- [68] S. H. Bak, Suwon seeks to become Korea's 'eco-capital', *The Korea Herald*, 2018.02.01., <http://www01.koreaherald.com/view.php?ud=20180131000765>, 2018.04.12.
- [69] 수원시, 환경수도 추진계획, 2011. // (Suwon Government, A plan on establishing Eco-capital, 2011.)
- [70] 수원시, 환경수도 수원 선언, 2011. // (Suwon Government, Declaration on Eco-capital Suwon, 2011.)
- [71] H. Kang, Capacity Factors for Urban Sustainability Transformations – The Eco-capital Suwon in South Korea, Ph.D. diss., Technische Universität Dresden, 2019.
- [72] 수원지속가능도시재단, 수원지속가능도시재단 소개, <http://www.sscf2016.or.kr/?p=46>, 2018.07.30. // (Suwon Sustainable City Foundation, Introduction of Suwon Sustainable City Foundation, <http://www.sscf2016.or.kr/?p=46>, 2018.07.30.)
- [73] 수원지속가능발전협의회, 수원지속가능발전협의회 소개, http://suwonagenda21.or.kr/bbs/content.php?co_id=sub1_7, 2018.09.09. // (Suwon Council for Sustainable Development, Introduction of Suwon Council for Sustainable Development, http://suwonagenda21.or.kr/bbs/content.php?co_id=sub1_7, 2018.09.09.)
- [74] 은정아, 최화정, 생태교통수원 2013 시민백서, 수원: 이클레이 한국사무소, 수원시, 2014. // (J. A. Eun, H. J. Choi, White paper on EcoMobility Suwon 2013, Suwon: ICLEI Korea office and Suwon city, 2014.)
- [75] 이재준, 김도영, 시민참여형 도시계획모델 개발에 관한 연구, *환경논총*, 51, 2012, pp.131–143. // (J. J. Lee, D. Y. Kim, A study on the development of citizens participatory urban planning, *Journal of Environmental Studies*, 51, 2012, pp.131–143.)
- [76] 유재규, '생태교통 수원 2013 5주년 리마인드 축제' 개최, *News1*, 2018.09.08., <https://news.v.daum.net/v/20180908210634050?fbclid=IwAR3kZqwsZDKFluURBp-FXSMZbApS8ai57QIT9khVZzzgzAefaYlifrR4j0>, 2018.05.23. // (J. K. Ryu, A remind festival of the EcoMobility Suwon 2013, *News1*, 2018.09.08., <https://news.v.daum.net/v/20180908210634050?fbclid=IwAR3kZqwsZDKFluURBp-FXSMZbApS8ai57QIT9khVZzzgzAefaYlifrR4j0>, 2018.05.23.)
- [77] 수원시정연구원, 수원시민자치대학 소개, <http://www.suniversity.or.kr/>, 2018.07.14. // (Suwon Research Institute, Introduction of Suwon Citizen Autonomy School, <http://www.suniversity.or.kr/>, 2018.07.14.)
- [78] 김종민, 광복절, '자동차로부터 독립만세', *중앙일보*, 2013.08.15., <https://news.joins.com/article/12351670>, 2018.05.06. // (J. M. Kim, On Independence Day, 'independence from cars', *JoongAng Ilbo*, 2013.08.15., <https://news.joins.com/article/12351670>, 2018.05.06.)
- [79] 마을르네상스센터, 2016 마을르네상스 공모사업 최종결과보고서, 수원: 마을르네상스센터, 2017. // (CNCR, 2016 Neighbourhood Community Renaissance report, Suwon: Centre for Neighbourhood Community Renaissance, 2017.)
- [80] 한성미, 2018 수원시민자치대학 운영현황 및 향후 비전, 수원: 수원시정연구원, 2018. // (S. M. Han, Operational status and future vision of Suwon Citizen Autonomy School in 2018, Suwon: Suwon Research Institute, 2018.)
- [81] 수원시, 환경수도 수원 추진상황 보고서, 2017. // (Suwon Government, A briefing on Eco-capital Suwon, 2017.)
- [82] 한무영, 김상래, 최지용, 도시물자급윤의 정의와 빗물이용을 통한 향상

- 방안, 대한상하수도계획 추계학술발표회 논문집, 광주: 대한상하수도학회, 2005, pp.11-18. // (M. Y. Han, S. R. Kim, J. Y. Choi, Definition of local water independency ration (LWIR) in cities and its improvement by rainwater harvesting, in Proceedings of 2005 Fall Joint Conference, Gwangju: Korean Society of Water and Wastewater and Korean Society of Water Environment, 2005, pp.11-18.)
- [83] 수원시, 레인시티 수원 추진사업, 2017. // (Suwon Government, Progress on Rain-city Suwon, 2017.)
- [84] J. Y. Won, M. K. Kim, M. Y. Han, Rain city initiative proposed by Suwon city, Korea, In Proceedings of 14th International Rainwater Catchment Systems Conference, Kuala Lumpur: Warwick University, 2009.
- [85] OECD, Urban transport governance and inclusive development in Korea, Paris: OECD Publishing, 2017.
- [86] 경기도교통정보센터, 통계자료: 2010년 교통수단 분담률, http://gits.gg.go.kr/gtdb/web/trafficDb/newzone/HB004/2/ASSPER/11_ASSPER_MODE.do, 2018.09.20. // (GTIC, Statistical database: modal share of 2010, http://gits.gg.go.kr/gtdb/web/trafficDb/newzone/HB004/2/ASSPER/11_ASSPER_MODE.do, 2018.09.20.)
- [87] 남형권, 8차 전력수급계획 폐기하라...취소 소송 제기, 에너지타임뉴스, 2018.01.16., <http://www.enertopianews.co.kr/news/articleView.html?idxno=3409>, 2019.12.12.) // (H. G. Nam, Abolish the 8th Basic Plan of Long-term Electricity Supply and Demand...filing of a lawsuit. Energy Time News, 2018.01.16., <http://www.enertopianews.co.kr/news/articleView.html?idxno=3409>, 2019.12.12.)
- [88] 이승관, 한국, 원전/석탄발전 비중 72%...OECD 평균 대비 쓸림 심각, 연합뉴스, 2018.09.04., <https://www.yna.co.kr/view/AKR20180903135600003>, 2018.10.06. // (S. K. Lee, Coal-fired/nuclear power generation takes up 72% in Korea...unbalanced energy structure comparing to OECD average, Yonhap News, 2018.09.04., <https://www.yna.co.kr/view/AKR20180903135600003>, 2018.10.06.)
- [89] 산업통상자원부, 제8차 전력수급기본계획(2017-31) 확정 공고, 2017. // (Ministry of Trade, Industry and Energy, A final announcement of the 8th Basic Plan of Long-term Electricity Supply and Demand, 2017.)
- [90] 고영선, 중앙정부와 지방정부의 기능분담: 현황과 개선방향, 예산정책연구, 1(2), 2012, pp.1-27. // (Y. S. Koh, The role of the national and local government: the status and areas of improvement, Journal of Budget and Policy, 1(2), 2012, pp.1-27.)
- [91] 문병호, 지방의회의 자치입법제도 운영현황 및 문제점, 강원법학, 8(1), 2013, pp.383-416. // (B. H. Moon, The status and problem of autonomous legislative system of local assembly, Gangwon Legal Studies, 38(1), 2013, pp.383-416.)
- [92] 김승희, 수원시, 트램 조기 도입 위한 토론회 개최, 이뉴스투데이, 2015.03.17., <https://www.enewstoday.co.kr/news/articleView.html?idxno=375748>, 2018.07.21. // (S. H. Kim, Suwon held an open forum for operation of trams, Enews Today, 2015.03.17., <https://www.enewstoday.co.kr/news/articleView.html?idxno=375748>, 2018.07.21.)

1) The revisions that enabled the tram operation include: the Urban Railroad Act (Article 18.2); Railroad Safety Act (Article 45); and Road Traffic Act (Article 2.17).