SCP Policy Design for Socio-technical System Change: Envisioning-based Policy Making (EnBPM)

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Abstract

The focus of SCP policy has shifted from management of environmental pollution to wider socio-technical change including infrastructure, lifestyles and business models that are sustainable over decades. This paper first examines the expansion of the SCP policy domain through changes in focus of the following two aspects; product lifecycle policy and policy for changes in provision systems. The authors call for limiting lifecycle-based policy approaches to those that address a socio-technical transition to sustainability. They argue that transition-oriented SCP policy design proposed as envisioning-based policymaking (EnBPM) requires a new approach based on envisioning, social experimentation, a new indicator system to monitor the progress of transition, and development of a new business model. In doing so, they further develop the case for EnPBM and the present direction of potential policy research for developing EnBPM as a policy design approach.

Key words: efficiency, envisioning-based policymaking (EnBPM), social experimentation, sustainable consumption and production (SCP), transition

1. Introduction

Sustainable consumption and production (SCP) is a policy concept aiming at sustainable development that focuses on consumption and production systems. The United Nations Environment Programme (UNEP) defines SCP as “a holistic approach to minimizing the negative environmental impacts of consumption and production systems while promoting quality of life for all” (UNEP, 2015). The focus of SCP policy, however, has shifted from simple management of environmental pollution to promotion of wider socio-technical change including infrastructure, lifestyles and business models that are sustainable over the decades.

Conventional environmental policy has aimed at environmentally-benign consumption and production such as pollution prevention, promotion of green products and services, and inclusion of environmental externalities into economic activities. Recently, especially since around 2015, SCP policies have also come to facilitate more fundamental changes in consumption and production in terms of technology, business models and infrastructure changes.

Hotta et al. 2021 emphasized that this shift could be described as the expansion of the SCP-related policy domain in three phases as shown in Table 1. The 1st phase of SCP (SCP1.0) mainly addressed pollution prevention and cleaner production. The 2nd phase of SCP (SCP 2.0) emphasized increasing efficiency throughout the lifecycle of materials, products and services. Then, in the late 2000s, policy discussions in the SCP-related domain expanded to include systematic transition of socio-technical systems, lifestyles and infrastructure driving consumption and production (SCP 3.0). They also determined that this expansion could be observed in recent international sustainability policy agendas such as the Paris Agreement, and agreements emerging from the G7 and G20 processes. They further argued that the

Table 1 SCP 1.0, 2.0 and 3.0.

Approaches	SCP 1.0	SCP 2.0	SCP 3.0
Major concepts	Pollution prevention, Cleaner production (as an intermediate between SCP 1.0 and 2.0)	Industrial ecology, Resource efficiency, Product lifecycles	One planet living, Sufficiency, Decarbonization, Transition
Key issues	Industrial pollution	Climate change, Waste, Environmental issues associated with consumption	Well-being, Lifestyle, Socio-technical system
Approaches	Installation of end of pipe technologies, Technology and management for cleaner production	Increasing material and energy efficiency	Consensus building, Changes in infrastructure, Changes in lifestyles, New business models
Attitude of policies	React and cure	Anticipate and prevent	Long-term goal setting, Investment, Creating business environments, Innovating and communicating

Source: modification of Table 1 of Hotta et al., 2021.

long-term and middle-term sustainability goals in SCP 3.0 require future-oriented policy design going beyond conventional evidence-based policymaking. Thus, in the era of SCP 3.0, the goals and strategies of SCP policy are not limited to environmental policy areas but expanding to socio-technical system design and transition. This change in the SCP domain poses the following four challenges for policy design: (1) envisioning concrete images of a society that has successfully met its mid-term and long-term goals, (2) policy support for learning from model cases, experimental projects and new businesses to achieve a long-term and mid-term vision, (3) facilitating creative processes among stakeholders and (4) examination of the social implications of innovation towards decarbonization, digitalization and transitioning to sustainable lifestyles and infrastructure. To address these challenges, the authors proposed envisioning-based policymaking (EnBPM). This new approach is defined as a policy approach for addressing "long-term policy concerns such as future visions of sustainable society, social experimentation with such societal visions before full policy implementation based on long-term goals as well as social sustainability." It will require "a more decentralized and collaborative approach for policy design based on working together to envision and realize future directions of society among stakeholders because it puts importance on the social appropriateness of sustainability," unlike Evidence-based Policy Making (EBPM) (Koide et al. 2020).

As the focus of SCP policy has changed and expanded in response to changes in the policy agenda, it is difficult to implement SCP policy effectively without understanding such changes and diversity. The way socio-economic development is understood has changed from referring only to economic development that can be measured by GDP to a form that emphasizes well-being, happiness and sufficiency (European Commission, 2009; Fleurbaey, 2009; Hák et al., 2012; Shrotryia & Singh, 2020; Stiglitz et al., 2018).

Thus, building on the work done in Hotta et al., 2021, this paper argues for further consideration of the direction in which SCP and EnBPM have been headed as a policy design approach for the SCP 3.0 era.

2. Expansion of Policy Domains for SCP

Illustrating the situation through Fig. 1, this section further develops characterizations of different phases of SCP from SCP 1.0 to 3.0 as discussed by Hotta et al., 2021. Figure 1 broadly categorizes the focus of different policy domains in the following two aspects: 1) product lifecycle policy and 2) policy on changes in provision systems. Product lifecycle policy is divided further into that which addresses the upstream part of product lifecycles, i.e., 1-1) production and distribution, and that which addresses the downstream part, i.e., 1-2) wastes and recycling. Policy on changes in provision systems is divided into that which focuses on actors on the demand side, i.e., 2-1) lifestyle, and that which focuses on facilities and such, i.e., 2-2) infrastructure.

SCP 1.0, shown in the first column, aims at preventing direct environmental pollution while continuing economic growth. The policy domain for SCP 1.0 includes 1-1) pollution prevention or cleaner production as an approach for production and distribution, 1-2) cleaning-up and sound management of wastes and recycling, 2-1) awareness-raising campaigns for behavioral changes in citizens' lifestyles, and 2-2) development of basic infrastructure for sanitary, healthy, and convenient lifestyles, including development of roads, cities, housing, public transport and so on.

SCP 2.0, shown in the second column, aims by increasing energy and material efficiency to decouple environmental impacts caused by economic globalization, such as greenhouse gas emissions, from waste generation and economic development. As will be discussed in Section 3, SCP 2.0 focuses on a lifecycle approach to products and services aiming to improve material and energy efficiency. Thus, the policy domain for SCP 2.0 includes 1-1) improvements in the energy and material efficiency of products, 1-2) promotion of recycling at the waste management and recycling stage, 2-1) promotion of green purchasing and information tools such as eco-labels to influence consumption patterns and lifestyles, and 2-2) further promotion of smart and compact cities including public transport infrastructure.

Meanwhile, SCP 3.0, shown in the two right-hand columns, emphasizes socio-technical change to achieve fundamental reductions in unsustainable consumption of materials and energy while maintaining or increasing the welfare and well-being of society as a whole. The "circular economy" concept emphasizes the transformation of consumption and production systems that depend on natural resources in addition to conventional recycling, and emphasizes technological innovation and the fostering of new businesses. The circular economy, along with decarbonization, has come to be seen as the gateway to conversion to SCP by economies dependent on non-renewable resources.

Therefore, the policy domain for SCP 3.0 as a circular economy may include 1-1) promotion of design for the environment, and repair and refurbishment for production and distribution, 1-2) promotion of reuse and waste reduction for waste management and recycling, 2-1) promotion of sharing and servisizing for lifestyle change, and 2-2) digitalization such as in utilization of social media, IoT, big data and other digital media and information as part of infrastructure development to minimize transaction costs in realizing a circular economy.

Furthermore, the policy domain for SCP 3.0 as "one-planet living" or socio-technical system change is an emerging area which needs envisioning and social experimentation for designing new lifestyles, infrastructure and business models. Potential key concepts for SCP3.0 may include reconsideration of product ownership, dematerialization, attention to local needs, service provision, sustainable resource use, decentralization and multi-functional online platforms.

To reflect economic and social conditions, SCP policy needs to be customized through multi-stakeholder collaboration to incorporate various SCP menus such as sound treatment, recycling, sharing and multi-functional AI-linked online platforms, which are shown in each circle in Fig. 1.

The combination of policy menus for achieving a specific policy goal does not have to be uniform, and the effect of SCP policy can be achieved by flexibly and strategically combining them according to each country's industrial, consumption, urban and other structures. Developed countries have generally responded to the gradual shift from pollution control to efficiency and sufficiency approaches, but in rapidly growing developing countries, simultaneous implementation of SCP1.0, 2.0 and 3.0 will be required.

3. Life-cycle Approach in the SCP 2.0 Era

As discussed in the introduction, since the 1990s, the most influential SCP policy approach can be said to be a life-cycle-based efficiency approach (SCP 2.0). Policy design for SCP 2.0 requires comprehending SCP from the perspective of a product's life cycle, focusing on material destiny from upstream to downstream.

Life-cycle thinking for policy intervention usually focuses on the different stages of the life cycle of products and materials in addition to preventing pollution caused by dumping, leakages and emissions from industrial production. Basically, it looks to divide the life cycle of products and materials into resource extraction, production/manufacturing, distribution, consumption, recycling and waste management.

Life-cycle thinking for policy intervention usually places policies regulating environmental impacts in each lifecycle stage, or incorporates environmental externalities in each lifecycle stage or in combinations of different lifecycle stages (Aoki-Suzuki, 2015; Institute for Global Environmental Strategies, 2010). For example, some well-discussed policy instruments at the resource extraction stage are the pricing of excessive material extraction, including material resource extraction charges, taxes on raw materials, and aggregate levies (Aoki-Suzuki, 2015). For the production stage, policy instruments

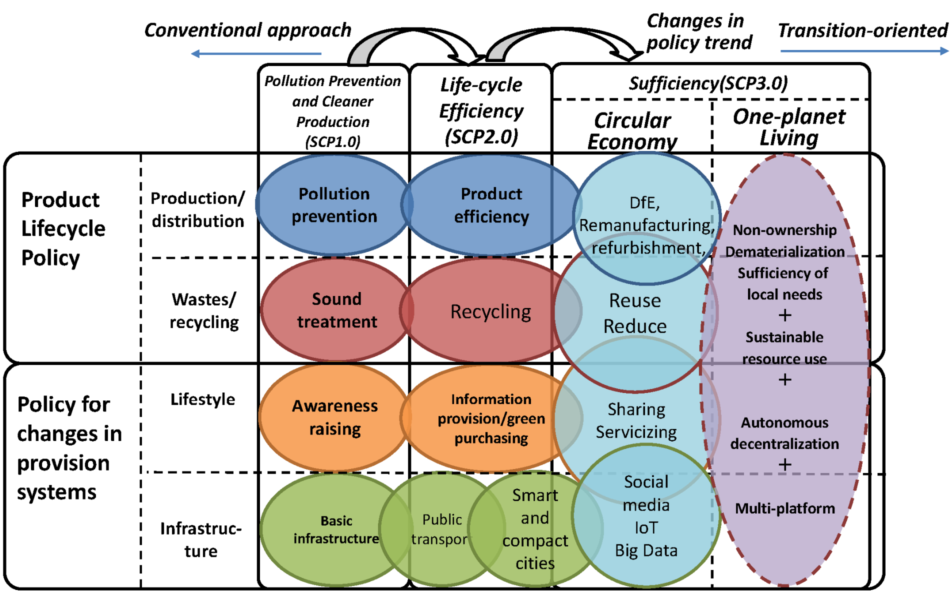

Fig. 1 Shift in policy tools and approaches for SCP.

include environmental management systems (EMS), and promotion of cleaner production and standards for resource efficient products, as well as criteria and standards for eco-design. For the consumption stage, they include eco-labels, awareness-raising campaigns, green procurement, incentive schemes such as deposits and refunds, differentiated VAT and charges for single-use items. The waste management and recycling stage includes instruments such as extended producer responsibility (EPR), pay-as-you-throw (PAYT), municipal waste charges, awareness campaigns, landfill taxes and incineration charges for companies. Although the policy instruments mentioned here do not constitute an exhaustive list, they make up a very common framework for comprehending resource efficiency and material circulation policy areas and perceiving any potential intervention points.

Figure 2 presents an image of the lifecycle-based SCP policy interventions described above.

The lifecycle approach, however, tends to be more effective in considering policy interventions for individual products, services or material streams such as packaging, automobiles, electric and electronic products, food and so on. In addition, since it focuses on product life cycles, it tends to play down the role of consumption as a driving force for product and service systems as opposed to consumption as representing one stage of a whole system.

In this context, the growing popularity of circular economy policies is both an advanced version and a close relative of concepts focusing on product and material life cycles, particularly those focusing on environmentally sound management and the 3Rs (reduce, reuse and recycle) of end-of-life products. This emerging policy concept puts more emphasis on less dependency on primary material consumption, wider use of secondary material cycles and development of new circular business models. In this concept, the specific instruments towards sustainability are not limited to increasing material efficiency of products. Rather, the concept focuses on the transition to much broader systems including business models and infrastructure. The utilization of information and communication technology (ICT), entrepreneurship and innovation to enable the transition is also part of this concept.

4. Envisioning-based Policymaking as a Policy Approach in the SCP3.0 Era

To achieve ambitious medium- to long-term goals such as the Paris Agreement (United Nations Framework Convention on Climate Change, 2015), SDGs (United Nations General Assembly, 2015), and Osaka Blue Ocean Vision (G20, 2019) related to SCP, fundamental changes in socio-economic structure, including business models and lifestyles, are required. In other words, the policy goal is to realize transitions in socio-technical systems, including technological innovation and lifestyle innovation. In this way, to achieve the medium- to long-term goals, it is important to share a vision of embodying the society we should aim for and to accumulate evidence.

The life-cycle approach of policy intervention does not explicitly involve policy design for socio-technical system changes, even those related to institutional reform, infrastructure transformation, innovation, new business models and lifestyle change. It also underplays the role of consumption as a driving force of consumption and production systems.

Thus, it is vital to consider ways 1) to envision future directions based on ambitious middle- and long-term goals for socio-technical change, 2) to conduct social experimentation on new SCP patterns to examine their pros and cons, 3) to monitor the progress of sustainability transition, including development of indicators, and 4) to provide incentives to new business and service models to sustain such socio-technical infrastructure. These are intervention points of an updated SCP approach in a SCP value-creation model.

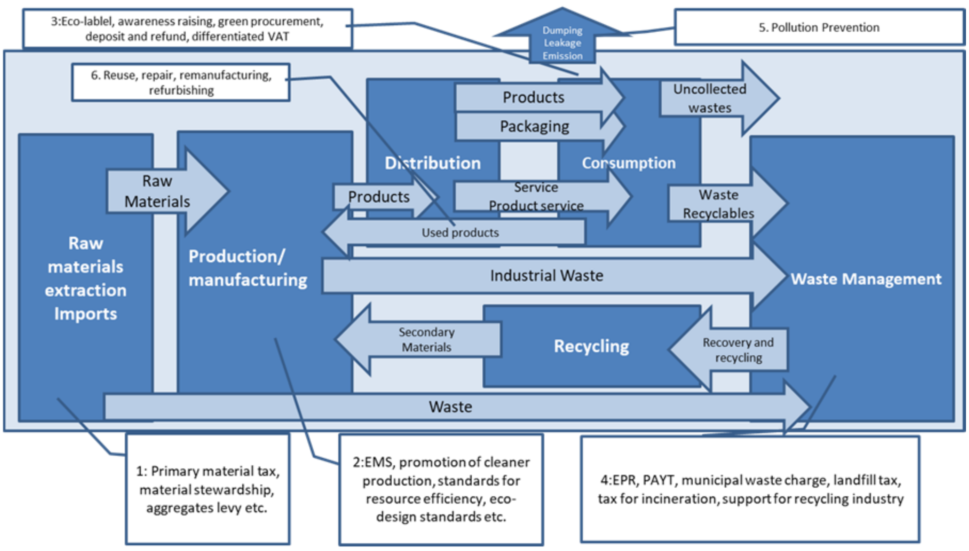

Fig. 2 SCP policy design based on a life-cycle perspective.

4.1 Envisioning and Developing Scenario-based Narratives

One of the most important pillars for EnBPM is "envisioning" as a creative process in social-technical system design for sustainability. For example, the direction of long-term changes in urban infrastructure and lifestyles is often difficult to imagine from the form of workshops among stakeholders alone. Thus, envisioning is crucial as a process for developing a concrete image and road-map, and for generating evidence of the social/economic and technological impacts of achieving these long-term goals in specific local/national contexts. This envisioning process can be supported and facilitated by multi-stakeholder dialogues involving science and policy interactions such as scenario development, modeling analysis and stakeholders' dialogues. It is vital to have a process for co-designing sustainable lifestyles through consensus on changes for infrastructure and business for maintaining or increasing the well-being of a society as a whole.

Application of "envisioning" can be seen in the attempt by Kamei et al. (2021a) to analyze the socio-economic impact of rapid urbanization and possible pathways of sustainable urban development for the long-term future of Bhutan. This approach was originally applied to envisioning future urban development scenarios for Tokyo (Kamei et al., 2021b). Kamei et al. applied a qualitative analysis based on shared socioeconomic pathways (SSPs) for climate change scenario analysis in urban settings. For that purpose, they tried to incorporate the urban context, such as urban planning, spatial analysis, historical/cultural background and detailed urban infrastructure engineering elements, including urban form, buildings and transportation modes. In addition, a stakeholder consultation process was implemented to gain a deeper understanding of the local context. The socio-economic scenario analysis in their study in Bhutan (SSPs Bhutan) proposes decentralized development, conservation of local resources and cultural assets in contrast to the business-as-usual case, where the population influx into the city continues. By utilizing the nine indicators of Bhutan's gross national happiness (GNH) as well as urban planning factors related to quality of life, such as differences in access to infrastructure, energy systems and services between urban and rural areas, the study compared different implications for future development patterns in the different scenarios.

The study showed that urbanization will drive the construction of new urban infrastructure by increasing demand due to the influence of social factors such as education and employment. The study suggests that recent trends in urbanization may exacerbate the social disparities between urban and rural areas. Future projections based on some empirical analyses using existing literature and local experiences can support local-specific strategies for sustainable transition, thereby also increasing the local quality of the living environment and mitigating the emerging social risks associated with ongoing rapid urbanization and socio-technical transition.

4.2 Social Experimentation

Another important pillar of EnBPM is social experimentation. It is not yet clear how society will look after achieving those goals. Thus, social experimentation can be instrumental in examining the effectiveness of different policy options in different social contexts. Social experimentation can also generate evidence of benefits and challenges to achieving these goals in a real setting. It can also generate a narrative for encouraging different stakeholders to contribute their actions and support for a sustainable transition as a way to transform socio-technical systems. Social experiments can motivate citizens and improve their implementation capacity. They open a window for discussing co-creation of a new lifestyle transcending the boundaries of citizens, companies and governments.

For example, the Institute for Global Environmental Strategies （IGES） conducted a study including social experimentation on how macro-level goal-setting for decarbonization (1.5 degree target) could be achieved at the urban and consumer levels by indexing lifecycle environmental impacts (IGES et al., 2019). The 1.5 degree lifestyle agenda has a systematic nature based on interdependence among consumer habits, markets, services, technologies and social rules. Bringing about changes in consumer behavior requires three elements: motivation/intention, ability and opportunity. For consumers to overcome obstacles and smoothly transition to a 1.5-degree lifestyle, it is essential that different stakeholders, such as national and local governments, producers and companies, citizens and civil society organizations (CSOs), play their respective roles and co-create societal visions and lifestyle changes. In particular, the government needs to review existing regulations, indicators for monitoring progress towards goals and transition management to avoid lock-ins. Governments also need to provide infrastructure for sustainable choices, motivate citizens and the business sector to take action, and provide feedback. The business sector must offer innovative products and services and related new business models. Citizens may make sustainable choices, work with governments and businesses to develop products and services and engage in grassroots efforts and dissemination activities in communities, workplaces and schools.

The study aimed at identifying challenges and opportunities for realizing macro policy goals at the micro level. Based on the current footprint of the city and consumer segment and the calculated effectiveness of reducing environmental impacts through lifestyle changes, the study tried to extract options at the living level toward the 1.5 degree target (Koide et al., 2021). It also engaged with individual households in social experimentation to try to identify options for 1.5 degree lifestyles.

4.3 Monitoring Progress towards Sustainability Transition

Another emerging important pillar involves long-term goal setting and planetary boundaries. This is related to measurement of progress towards long-term and middle-term goals, with more emphasis on social issues, well-being and lifestyles, as observed in the policy discourse on sustainability. The framework for planetary boundaries was introduced in research by Rockström (2009) to define the safe operating space for humanity with respect to the planet's biophysical subsystems or processes (Rockström, 2009). This framework was updated in 2015, concluding that climate change, genetic biodiversity, land-system change and biogeochemical flows are already beyond the boundaries of the earth's safe operating zone (Steffen et al., 2015). This concept, emerging from the research community, gradually surfaced into policy discourse in the 2010s. In this discourse, sustainability issues were framed as ways of living as well as systems which enabled and determined those ways of living. This emerging discourse calls for a transition of lifestyles, production systems and infrastructure based on long-term goals that take planetary boundaries including climate change into consideration. At the same time, a certain level of well-being and inclusion of social considerations are also important concerns in this discourse.

Beyond GDP is one such example in this emerging policy discourse (European Commission, 2009). More than 15 national governments and international organizations are conducting initiatives to design social progress, wellbeing and happiness indicators (Cabinet Office of Japan, 2011). The discourse on "beyond GDP" tends to include discussion on how to achieve ways of living that provide sufficiency. This cannot be measured by GDP as the sole indicator. The recent global sustainability goals encourage a fundamental shift in socio-technical systems for realizing high levels of well-being within planetary boundaries. These goals should not only aim to reduce consumption of non-renewable resources but also to change evaluation methods from those associated with monetary value to more comprehensive ways of measuring the well-being of society as a whole. Various types of "Beyond GDP" indicators have been proposed, including subjective well-being, quality of life, environmental indicators, sustainable development indicators, overall progress approaches or the combination of social and environmental aspects, adjusted-GDP approaches and community indicators (Hák et al., 2012).

One alternative approach for capturing various elements of progress in society is to calculate wealth as a stock, rather than capturing it as a flow. Different types of intangible capital, such as infrastructure, human resources and the natural environment are to be taken into account, with a view towards promoting intergenerational well-being. Managi and Kumar (2018) define this type of integrated indicator as inclusive wealth.

This reframing of issues inevitably leads us to reconsider our vision and goals as well as potentially the value system associated with consumption and production practices of the society. Setting new goals or a new vision also requires creation of new indicators to monitor the progress of socio-technical changes. For example, if the circular economy concept is something distinct from conventional waste management and the 3Rs (reduce, reuse, and recycle), it requires a new set of indicators to check the progress of policies promoting the circular economy. These could be progress on the expansion of new business models in line with the circular economy concept, contributing to dematerialization or ensuring less dependence on virgin materials, and assessing any positive social and environmental benefits.

4.4 New Business Model and Service Model Development

Social and technical infrastructure changes driven by long-term goal setting should be mainstreamed by market forces and by new business models and service provision models. As discussed above, if there are no supplies of services or products to satisfy trends towards such long-term goals, consumers will be locked into conventional practices.

The OECD Meeting of the Environment Policy Committee at Ministerial Level held in Paris, from 28 to 29 September 2016 discussed the circular economy concept, with policy makers emphasizing "the importance of new business models and the barriers to increasing their take-up in the circular economy (…) Circular business models, where firms generate economic value by undertaking business activities which close material loops, will become increasingly attractive" (OECD, 2016).

Bocken et al. (2014) also discusses the necessity of recognizing business model innovation as a key to delivering social and environmental sustainability. By reviewing innovative business model examples, Bocken et al. categorized sustainable new business models into the following eight archetypes, 1) maximizing material and energy efficiency, 2) creating value from 'waste', 3) substituting with renewables and natural processes, 4) delivering functionality, rather than ownership, 5) adopting a stewardship (in terms of long-term health and well-being), 6) encouraging sufficiency, 7) re-purposing business for society/environment, and 8) developing scale-up solutions (Bocken et al. 2014).

Since then, more recent discussions on circular economy business models have emphasized increasing expectations towards roles played by ICT in new business for sustainability by decreasing the costs of transactions and commutations (Lüdeke-Freund et al., 2018). Digitalization may be able to revitalize reuse or sharing by increasing connectivity among users, products and services.

With growing interest in the utilization of ICT, innovation and dematerialization expressed in the circular economy concept, the emerging attention on a sharing economy is also closely related to policy emphasis on innovation and new business models. A sharing economy or collaborative consumption, which entails "peer-to-peer based activity of obtaining, giving or sharing access to goods and services" enabled by information and communications technologies, has the potential to address social issues such as climate change, pollution, localness and community, and under- and over-consumption (Hamari et al., 2016). The sharing economy is framed in several ways, including as an opportunity for improving the economy, introducing sustainable ways of consumption and promoting decentralized and equitable economy, neoliberalism and deregulation (Martin, 2016).

The most important point is that there is a shift in the discourse represented in this concept and that "the term goes beyond the mechanics of production and consumption of goods and services in the areas that it seeks to redefine (examples include rebuilding capital, including social and natural, and shifting from consumer to user)" (Ellen MacArthur Foundation, 2013). It is essential to develop a social business model and promote private investment.

5. Conclusion

In this paper, we have discussed various policy domains and menus under different versions of SCP by focusing on 1) product lifecycle policy, and 2) policy for changes in provision systems. We have also compared how policy approaches may differ between those in the SCP 2.0 era, which focus on a lifecycle approach, and those under SCP 2.0, which require future envisioning for socio-technical system change. In doing so, we mentioned that SCP 3.0 requires a new policy-making approach suitable for a socio-technical system transition. We therefore have further promoted the concept of EnBPM. In particular, evidence for realization of the visions must be accumulated through social experiments. We have identified four important pillars for EnBPM: 1) formulation of a vision for a future society through scenario analysis and narratives leading up to it, 2) evidence from social experiments in which stakeholders participate, 3) an increased role for capital indicators to measure development of social wellbeing, and 4) social entrepreneurs to foster new business models for advancing SCP.

In particular, in future international cooperation on sustainability, the perspectives of investing in social experiments and social innovation will become increasingly important. It is also important to evaluate international collaborative projects in terms of whether they encourage social innovation towards transition to sustainability.

References

Aoki-Suzuki, C. (2015) *Examining Future Implementation of Waste Prevention and Resource Reduction Policies in Asia and the Pacifi c – Referring Practices in European Countries*. IGES, Hayama, Japan. Retrieved from https://www.iges.or.jp/jp/pub/examining-future-implementation-prevention-and/en (accssesed 6 September 2021)

Bocken, N. M. P., Short, S. W., Rana, P. and Evans, S. (2014) A literature and practice review to develop sustainable business model archetypes. *Journal of Cleaner Production*, 65: 42–56. https://doi.org/10.1016/j.jclepro.2013.11.039

Cabinet Office of Japan (2011) *Measuring National Well-Being-Proposed Well-being Indicators*. Cabinet Office of Japan, Tokyo. Retrieved from https://www5.cao.go.jp/keizai2/koufukudo/pdf/koufukudosian_english.pdf (accessed 6 September 2021)

Ellen MacArthur Foundation (2013) *Towards the Circular Economy Vol.1 Ecnomic and Business Rationale for an Accelarated Transition*. (Vol. 1). Ellen MacAurthur Foundation, Cowes, UK. https://doi.org/10.1162/108819806775545321

European Commission (2009) *GDP and Beyond-Measuring Progress in a Changing World*. European Commission, Brussels. Retrieved from https://ec.europa.eu/eurostat/cros/system/files/06_GDP%20and%20beyond.pdf (accessed 6 September 2021)

Fleurbaey, M. (2009) Beyond GDP: The quest for a measure of social welfare. *Journal of Economic Literature*, 47(4), 1029–1075. https://doi.org/10.1257/jel.47.4.1029

G20 (2019) *G20 Osaka Leaders' Declaration, G20 Osaka Summit 2019*. Retrieved from https://www.mofa.go.jp/policy/economy/g20_summit/osaka19/en/documents/final_g20_osaka_leaders_declaration.html (accessed 31 August 2021)

Hák, T., Janoušková, S., Abdallah, S., Seaford, C. and Mahony, C. (2012) *Review Report on Beyond GDP Indicators: Categorisation, Intensions and Impacts: Final Version of BRAINPOoL Deliverable 1.1, A Collaborative Project Funded by the European Commission under the FP7 Programme (Contract no. 283024).* CUEC, Prague. Retrieved from https://www.socioeco.org/bdf_fiche-document-2817_en.html (accessed 6 September 2021)

Hamari, J., Sjoklint, M. and Ukkonen, A. (2016) The sharing economy: Why people participate in collaborative consumption. *Journal of the Association for Information Science and Technology*, 67(9): 2047–2059. https://doi.org/10.1002/asi

Hotta, Y., Tasaki, T. and Koide, R. (2021) Expansion of policy domain of sustainable consumption and production (SCP): Challenges and opportunities for policy design. *Sustainability,* 13(12): 6763. https://doi.org/10.3390/ SU13126763

Institute for Global Environmental Strategies (2010) *Policy Tools for Sustainable Materials Management : Applications in Asia*,. IGES, Hayama, Japan. Retrieved from https://www.iges.or.jp/jp/pub/policy-tools-sustainable-materials-management/en (accessed 6 September 2021)

Institute for Global Environmental Strategies (IGES), Aalto University,and D-mat ltd. (2019). 1.5-Degree Lifestyles: Targets and Options for Reducing Lifestyle Carbon Footprints. Technical Report. Institute for Global Environmental Strategies, Hayama, Japan. Retrieved from https://www.iges.or.jp/jp/pub/15-degrees-lifestyles-2019/en (accessed 6 September 2021)

Kamei, M., Mastrucci, A., van Ruijven, B.J. (2021b) A Future Outlook of Narratives for the Built Environment in Japan. Sustainability 2021, 13, 1653. https://doi.org/10.3390/su13041653

Kamei, M., Wangmo, T., Leibowicz, B.D., Nishioka, S. (2021) Urbanization, carbon neutrality, and Gross National Happiness: Sustainable development pathways for Bhutan. Cities, Volume 111,102972. https://doi.org/10.1016/j.cities.2020.102972

Koide, R., Hotta, Y. and Watabe, A. (2020) EBPM towards lifestyle innovation. *Review of Environmental Economics and Policy*

Studies, 13(1): 70–73. https://doi.org/10.14927/reeps.13.1_70 (in Japanese)
Koide, R., Kojima, S., Nansai, K., Lettenmeier, M., Asakawa, K., Liu, C. and Murakami, S. (2021) Exploring carbon footprint reduction pathways through urban lifestyle changes: a practical approach applied to Japanese cities. *Environmental Research Letters*, 16(8): 084001. https://doi.org/10.1088/1748-9326/AC0E64
Lüdeke-Freund, F., Gold, S. and Bocken, N.M.P. (2018) A review and typology of circular economy business model patterns. *Journal of Industrial Ecology*, 23(1): 36–41. https://doi.org/10.1111/jiec.12763
Managi S, Kumar P, (eds.) (2018) *Inclusive Wealth Report 2018: Measuring Progress Towards Sustainability*, 1st Edition. Routledge.
Martin, C.J. (2016) The sharing economy: A pathway to sustainability or a nightmarish form of neoliberal capitalism? *Ecological Economics*, 121: 149–159. https://doi.org/10.1016/j.ecolecon.2015.11.027
OECD (2016) *Chair's Summary Meeting of the Environment Policy Committee (EPOC) at Ministerial Level, 28-29 September 2016*. OECD, Paris. Retrieved from http://www.oecd.org/environment/ministerial/2016-ENV-Ministerial-Chair-summary.pdf (accessed 6 September 2021)
Rockstrom, J. (2009) A safe operating space for humanity. *Nature*, 461: 472–475. https://doi.org/10.1038/461472a
Shrotryia, V.K., and Singh, S.V.P. (2020) Measuring progress beyond GDP: A theoretical perspective. *Emerging Economy Studies*, 6(2): 143–165. https://doi.org/10.1177/2394901520983784
Steffen, W., Richardson, K., Rockstrom, J., Cornell, S. E., Fetzer, I., Bennett, E. M. and Sorlin, S. (2015) Planetary boundaries: Guiding human development on a changing planet. *Science*, 347(6223): 1259855. https://doi.org/10.1126/science.1259855
Stiglitz, J.E., Fitoussi, J.-P. and Durand, M. (2018) *Beyond GDP Measuring What Counts for Economic and Social Performance*. OECD, Paris. Retrieved from https://www.oecd-ilibrary.org/docserver/9789264307292-en.pdf?expires=1543400987&id=id&accname=ocid195399&checksum=4214BC364A196D419AD9D7046833D166 (accsessed 6 September 2021)
UNEP (2015) *Sustainable Consumption and Production: A Handbook for Policy Makers* (Global Edi). United Nations Environment Programme. Nairobi. Retrieved from https://wedocs.unep.org/handle/20.500.11822/9660 (accessed 6 September 2021)
United Nations Framework Convention on Climate Change (2015) Paris Agreement. *21st Conference of the Parties*. https://doi.org/FCCC/CP/2015/L.9
United Nations General Assembly (2015) *Transforming our World: The 2030 Agenda for Sustainable Development*. Retrieved from https://sustainabledevelopment.un.org/content/documents/21252030%20Agenda%20for%20Sustainable%20Development%20web.pdf. (accessed 6 September 2021)

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Satoshi Kojima graduated from The University of Tokyo with a Master's in Engineering. After engaging in water- and environment-related official development assistance (ODA) projects in several countries including Indonesia and Hungary, he studied environmental economics at the University of York in the United Kingdom. After receiving his Ph.D. in Environmental Economics, he joined IGES in 2005 where he has engaged mainly in quantitative policy analysis of sustainable development policy in East Asia. He published a book *Sustainable Development in Water-stressed Developing Countries: A Quantitative Policy Analysis* through Edward Elgar Publishing in 2007.

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