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環境省 戦略的研究開発領域課題 (S-16)
PECoP-Asia
Policy Design and Evaluation to Ensure Sustainable Consumption and Production Patterns in Asian Region

Scenario Design Approach to Envisioning Sustainable Consumption and Production in Asian Context

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Introduction

- **There are opportunities and enablers to achieve SCP**
  - **E.g., Digitalization, 3D printing, lifestyle/workstyle changes due to Covid-19, …**

Car sharing service in Bangkok, Thailand [HaupCar]

- **"*SCP is about promoting resource and energy efficiency, … and a better quality of life for all*" [UNEP]**

- **It is indeed challenging to identify & validate SCP patterns to achieve 'goals' in, e.g., 2050**
  - **Concept of SCP is rather vague and of normative nature**
  - **Diversity of Southeast Asian countries**

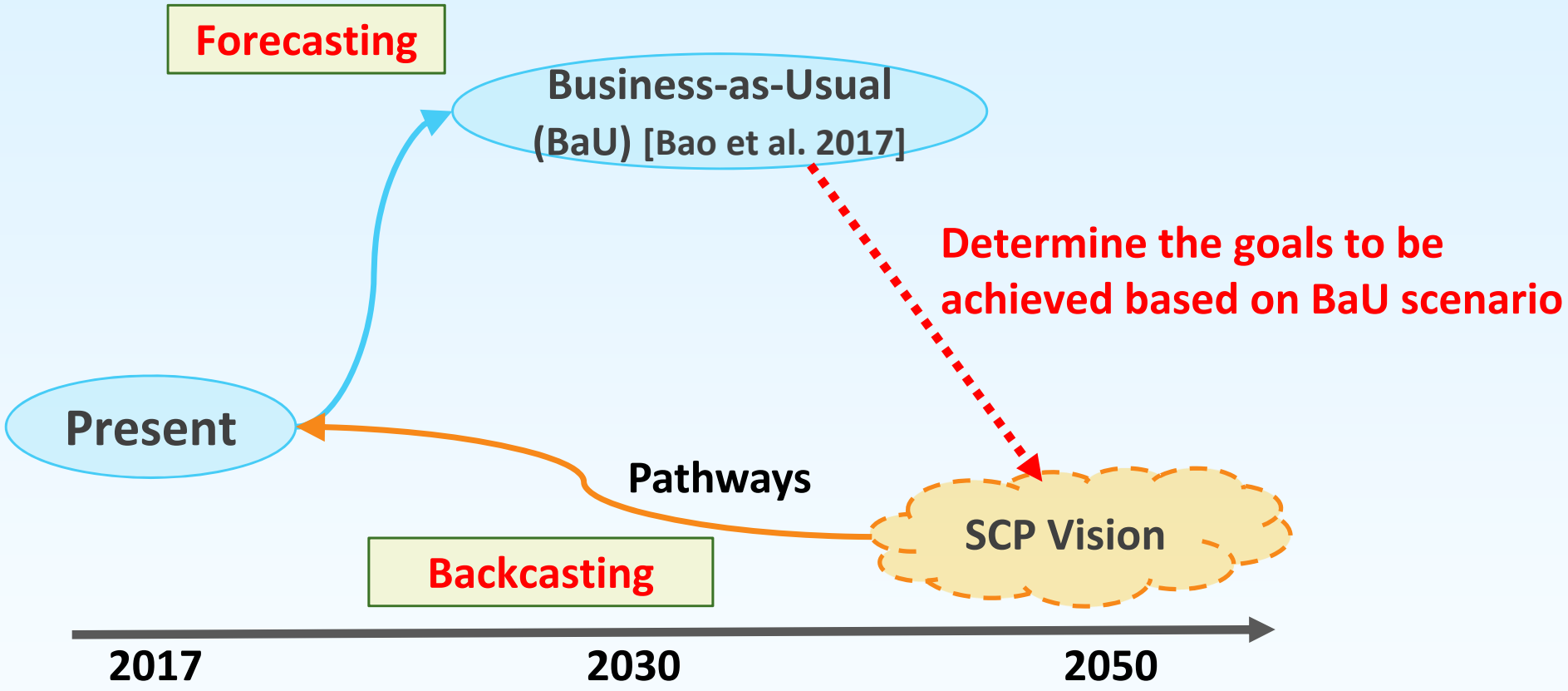
[https://www.traveldailynews.asia/impact-partners-with-haupcar-to-provide-private-car-rental]

Literature Review on SCP

- Tasaki et al. (2019) proposed a co-design method to generate SCP patterns using 'idea generation cards'
- Belmont Forum (2019) emphasized the need to address consumption and production as a socio-technical system
  - Rather than individual improvements in production efficiency, consumer behaviors, etc.
- Schroeder et al. (2019) proposed participatory backcasting as a framework for visioning exercises
- Vita et al. (2019) quantified SCP visions using regional Input-Output analysis

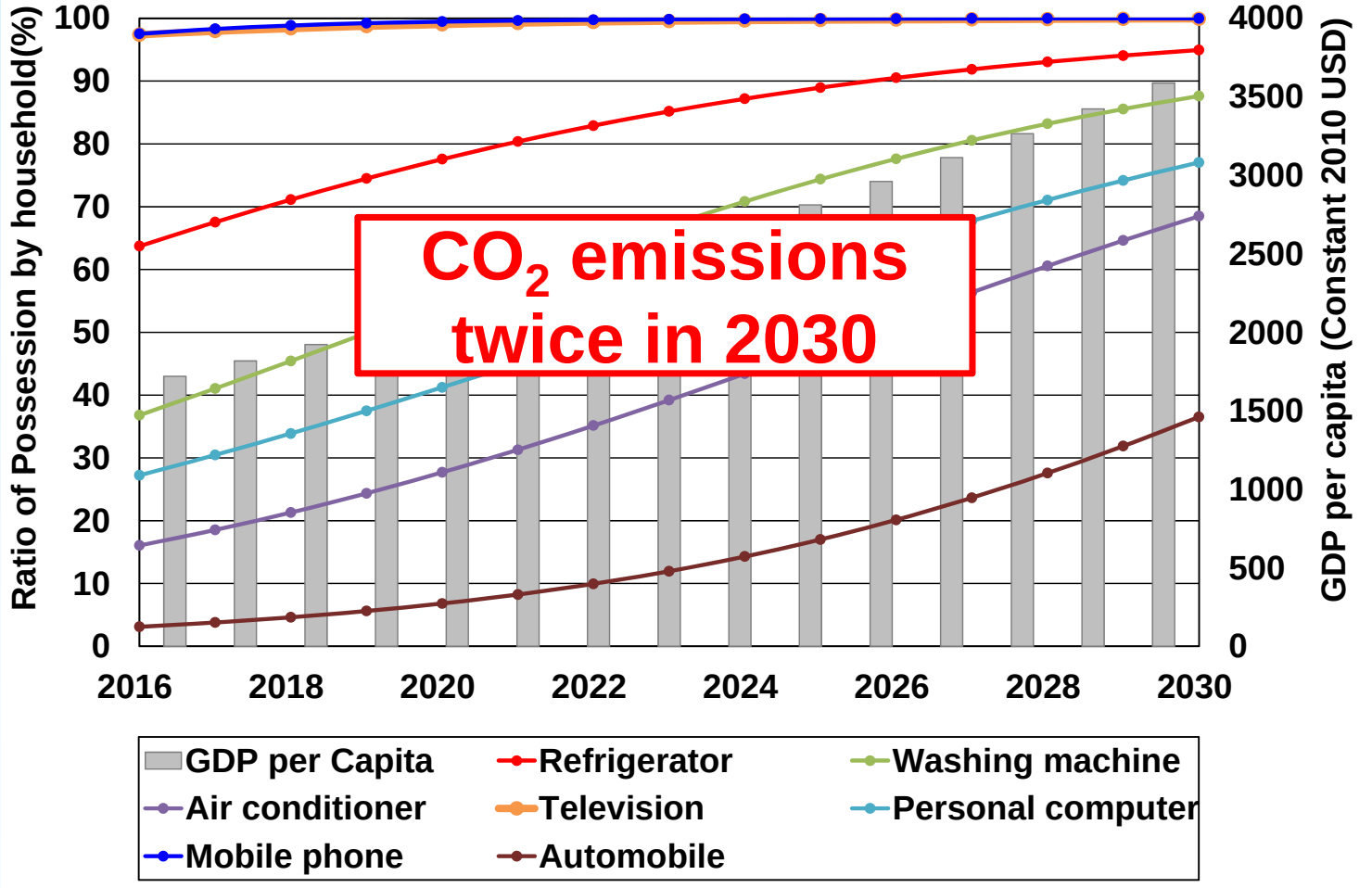
Question: How can we help experts and stakeholders develop and evaluate SCP visions to be achieved?

Scenario Design Approach to Envisioning SCP



[Bao, C. et al. (2017), Demand Estimation of Consumer Durables in Southeast Asia in 2030: A Business-As-Usual Scenario, CIRP LCE 2017, Kamakura, Japan, A32-1]

BaU Scenario for Vietnam: Possession Rate of Consumer Durables [Bao et al. 2017]



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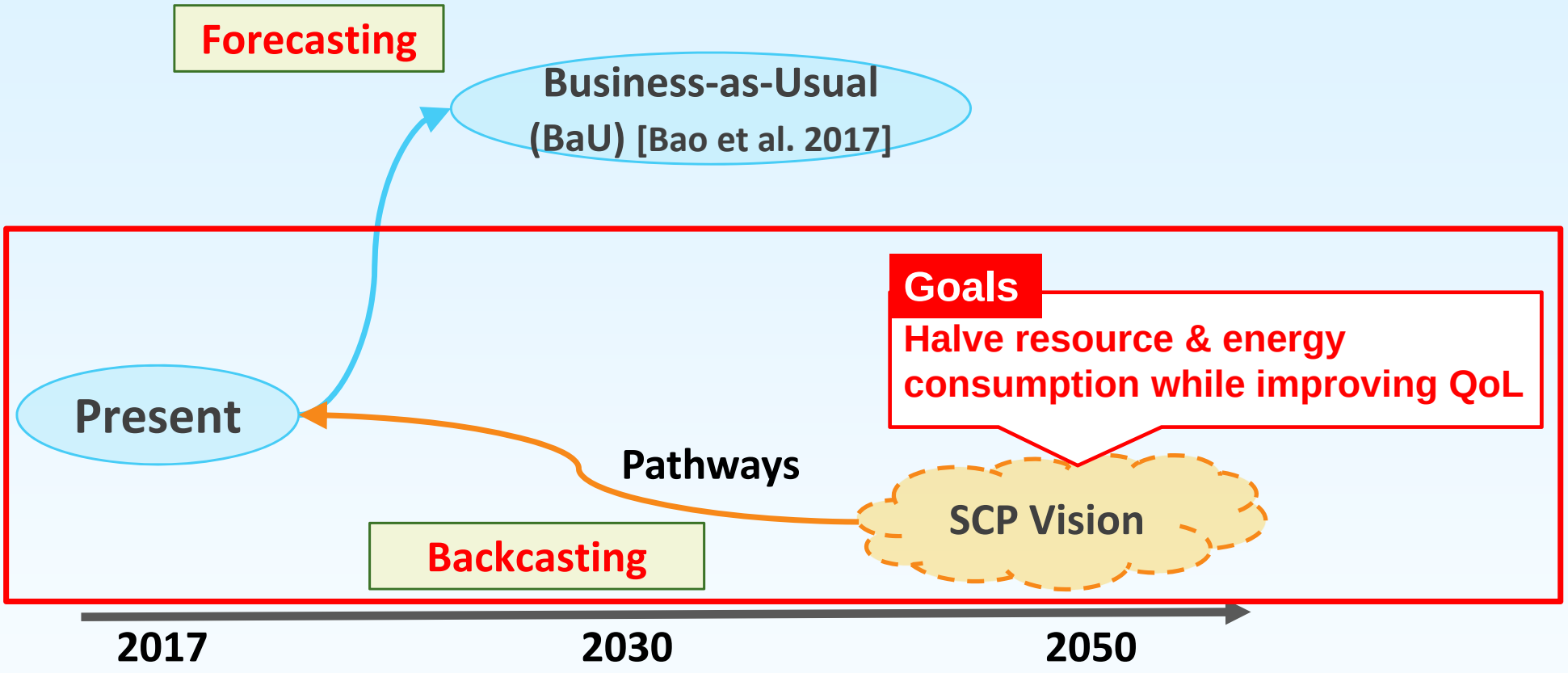
Scenario Design Approach to Envisioning SCP



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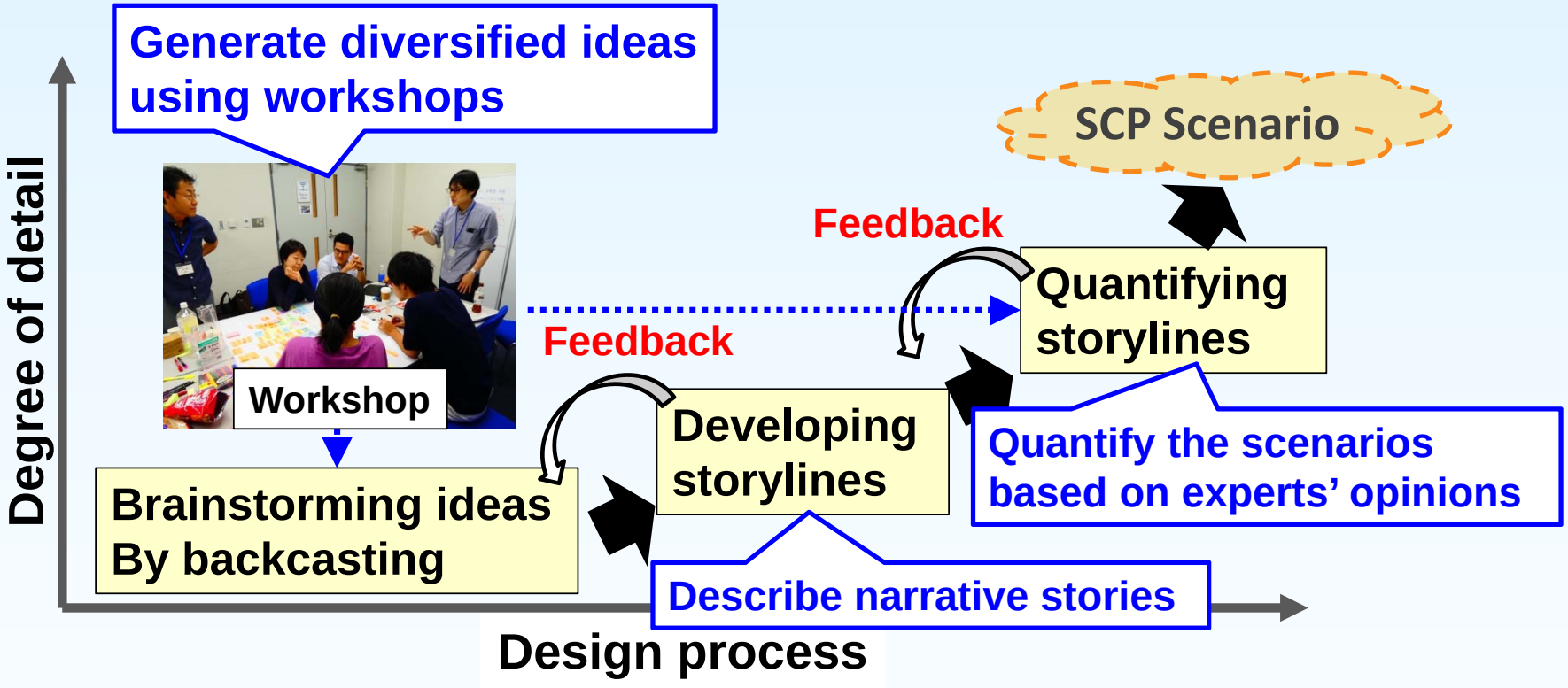
Process to Design SCP Scenarios Using Participatory Backcasting

- Design SCP scenarios through iterative processes
- SCP scenario = SCP vision + Pathway



Co-evolving Process of Methodological Development and Workshops

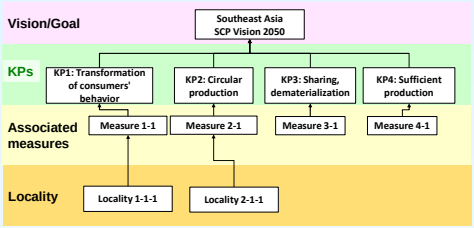
Idea generation & Storyline → **Quantification**

Methods

Four key phrases (KPs)

1. Consumer behavior
2. Sharing
3. Circular production
4. Sufficiency production

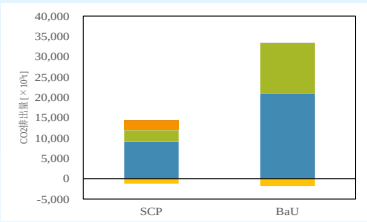
Structuring ideas generated in workshops



Scenario storylines

Group & Title	Storyline (locality in blue)
A: BICS Society (BICS: Business-Individual-Customer-Sharing)	✓ Because sharing services are already popular, B2B (leasing) and B2C sharing are widely used ✓ Some people become prosumers to satisfy their individual needs
B: Beauty is only skin deep	✓ Products are designed by coupling generalized part and customized part ✓ Because Vietnamese people like new products, customization is enabled by AR/VR
C: Infrastructure innovation 2.0	✓ Sharing and replacement is accelerated by visualizing information for consumers ✓ Certification system is introduced to advance repair skills in local industry

Quantifying scenarios (environmental)



Scenario workshops

Kyoto

Kobe & Kuala Lumpur

Kyoto & Kuala Lumpur

Kuala Lumpur

Online

2016 — 2017 — 2018 — 2019 — 2020

Four “Key Phrases” for SCP [Kishita et al. 2018]

- **Key phrase (KP)** as a typical pattern to change the conventional pattern for achieving SCP

KP1: Transformation of consumers' behavior
E.g., digitalization, information visualization, eco-labeling

KP2: Sharing/dematerialization
E.g., Leasing, PSS, servicizing

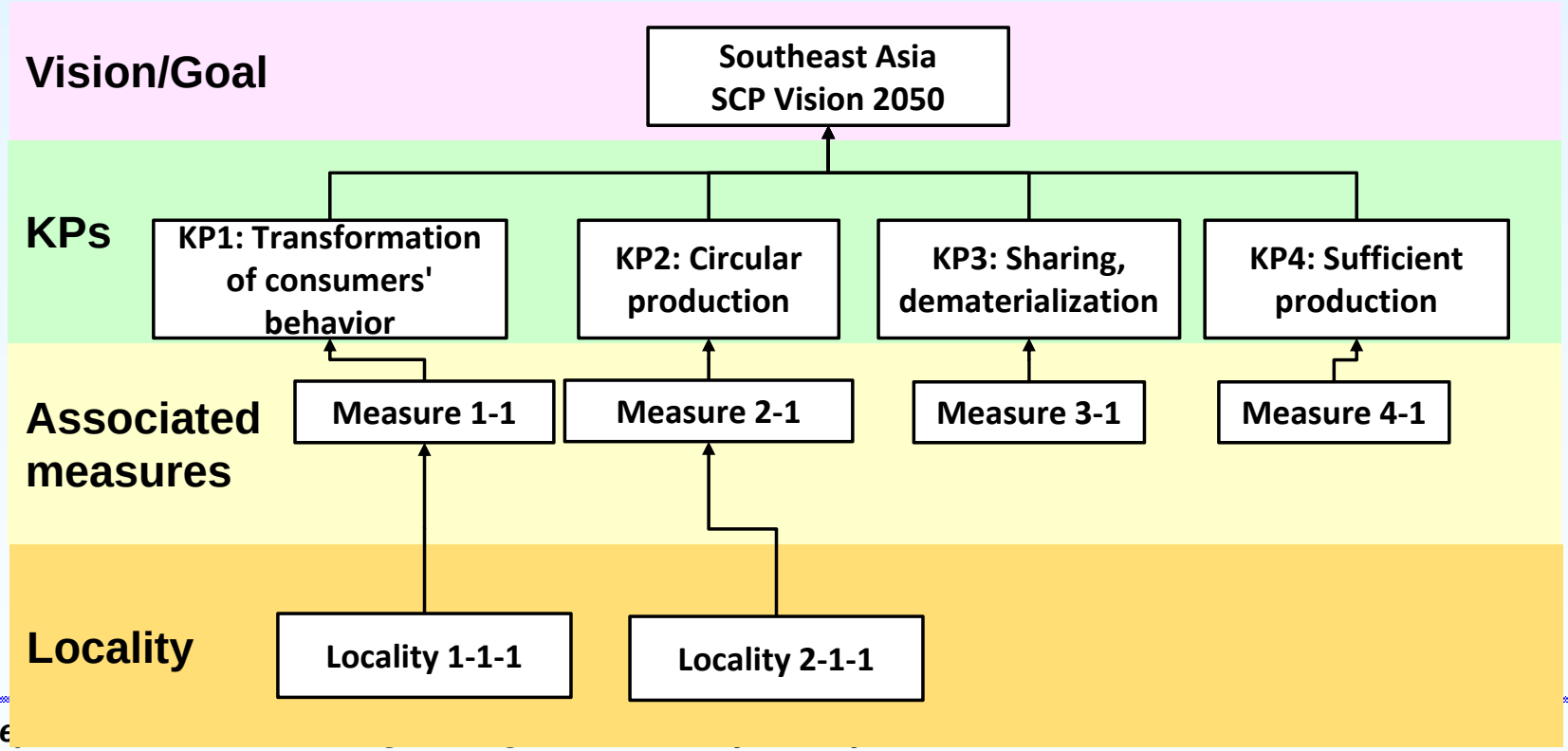
KP3: Circular production
E.g., Remanufacturing, long-use, extension of lifetime

KP4: Sufficient production
E.g., on-demand production, demand estimation

Kishita Y. et al. Designing Future Visions of Sustainable Consumption and Production in Southeast Asia," Procedia CIRP, Vol. 69, (2018), pp. 66-71.

Structuring Generated Ideas by Developing Logic Trees

- **Constructed a logic tree to assist backcasting thinking based on discussions in workshops**
  - **Add "Locality" (local characteristics) on the bottom layer**



Categories of “Locality“ [Tamura et al. 2017]

1. Demographics
2. Economy/Industry
3. Culture/Tradition
4. Infrastructure
5. Climate
6. Legislation
7. Geopolitics

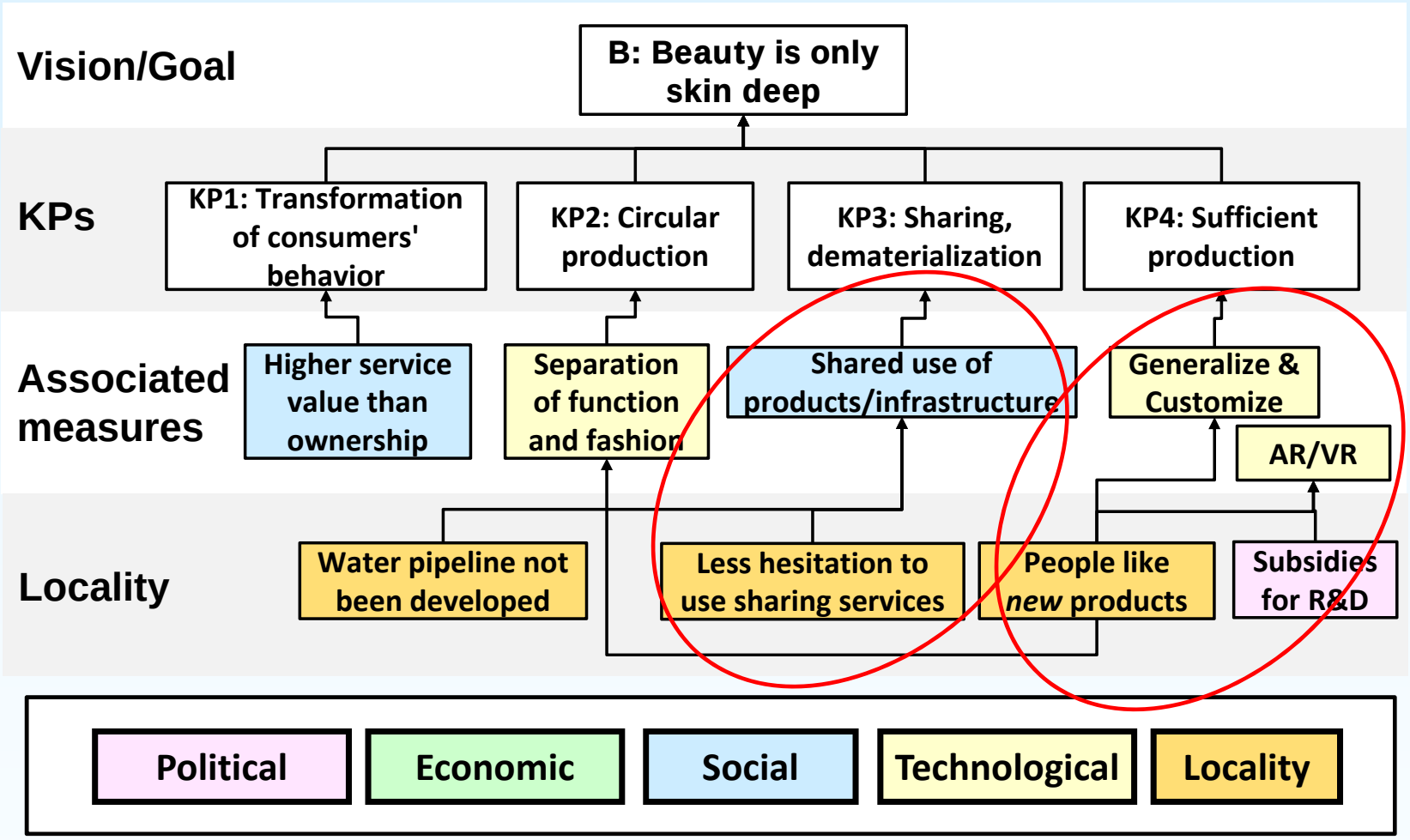
Tamura, T., Kishita, Y., Umeda, Y., “Proposal of a methodology for representing relationship between locality and daily tasks,” Proceedings of 2017 JSME Autumn Meeting, C03, (2017), pp. 161-162.

Scenario Workshop in 2018 (Kyoto): Idea generation & Storyline [Kishita et al. 2019]

- To describe SCP scenarios for Vietnam (urban area) in 2050
  - Gathered local data (e.g., economy, lifestyle, climate) through visiting and a literature review
- 20 experts participated (project members), divided into three groups (Groups A-C)

Kishita Y. et al. Framework of Participatory Scenario Design for Sustainable Consumption and Production, Proc. of EcoDesign 2019: The 11th International Symposium on Environmentally Conscious Design and Inverse Manufacturing, (2019), pp. 525-526.

Part of Workshop Result for Group B



Title and Storyline of SCP Scenarios (Group A-C)

Group & Title	Storyline (locality in blue)
A: BICS Society (BICS: Business-Individual-Customer-Sharing)	✓ Because sharing services are already popular, B2B (leasing) and B2C sharing are widely used ✓ Some people become prosumers to satisfy their individual needs
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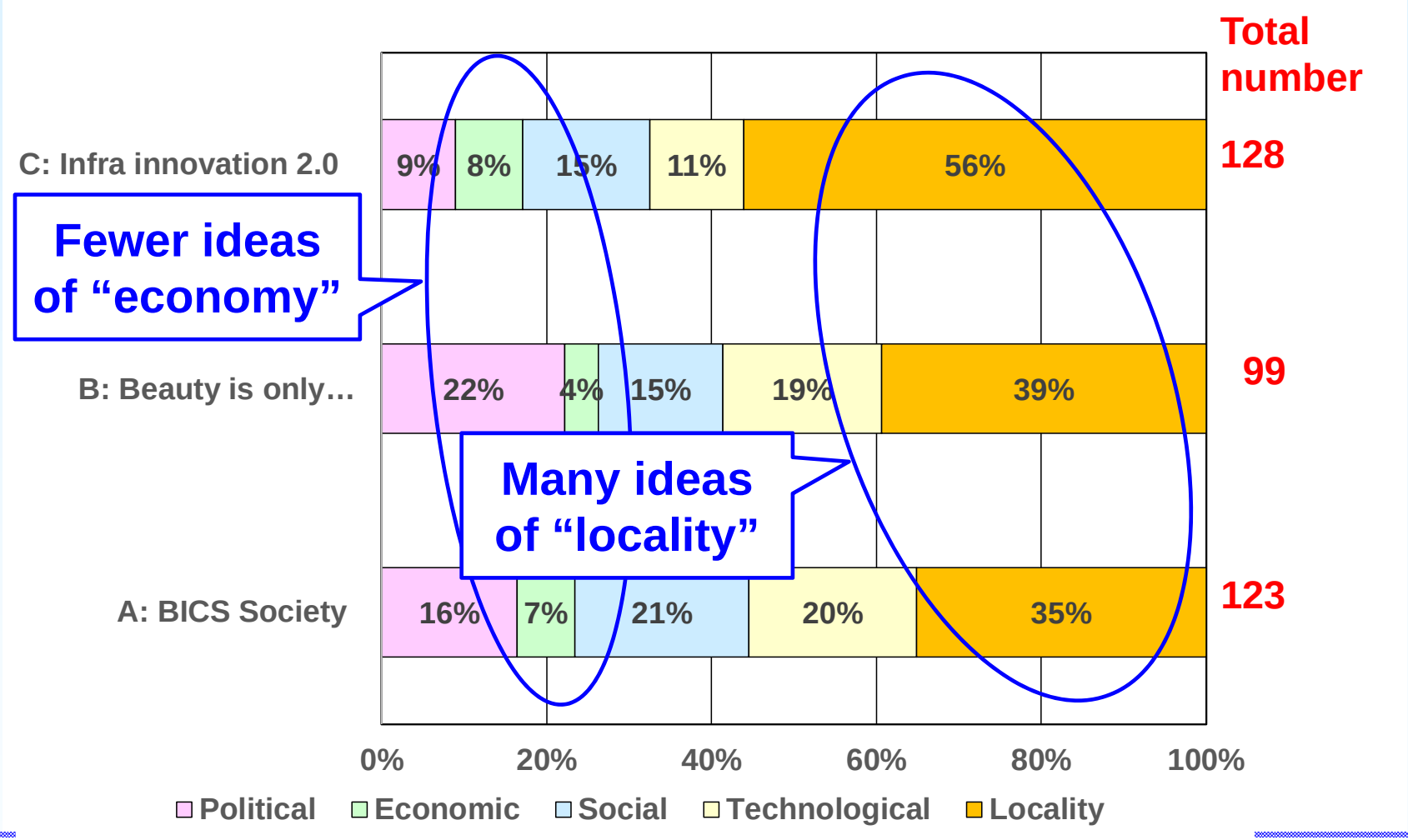
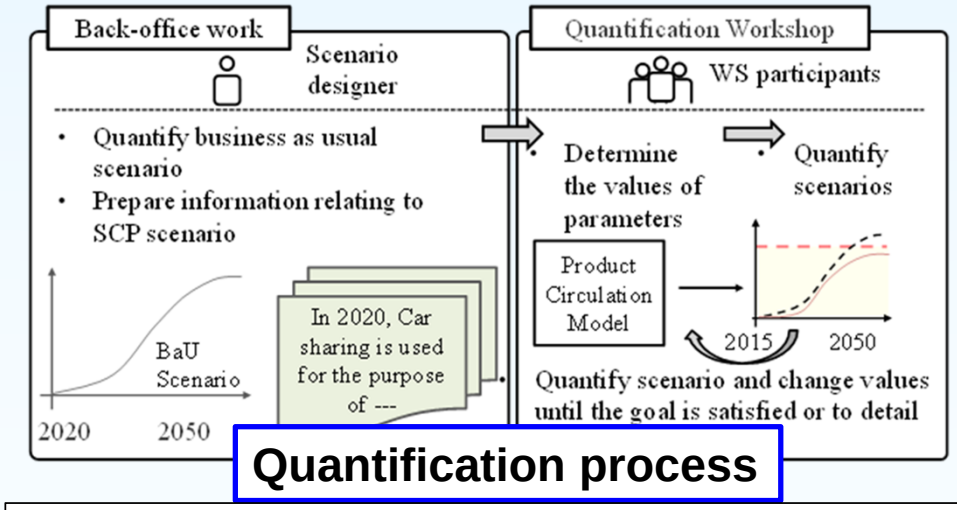
Number of Ideas Generated



Scenario Workshop in 2020 (Online): Quantification [Onozuka et al. 2021]

- To quantify the described SCP scenarios for Vietnam in 2050
  - Explored the condition for the goals (halving resource & energy consumption) focusing on automobiles
- Developed the quantification process by assuming participatory backcasting
  - Three experts + two facilitators participated



Quantification process

Online workshop

Onozuka S. et al. (2021) Quantitative Assessment Method for Supporting Scenario Workshops toward Sustainable Consumption and Production, CIRP Conference on Life Cycle Engineering 2021. (accepted)

Quantification Results (not exhaustive)

Scenario storyline

B: Beauty is only skin deep	✓ **Products are designed by coupling generalized part and customized part** ✓ **Because Vietnamese people like new products, customization is enabled by AR/VR**

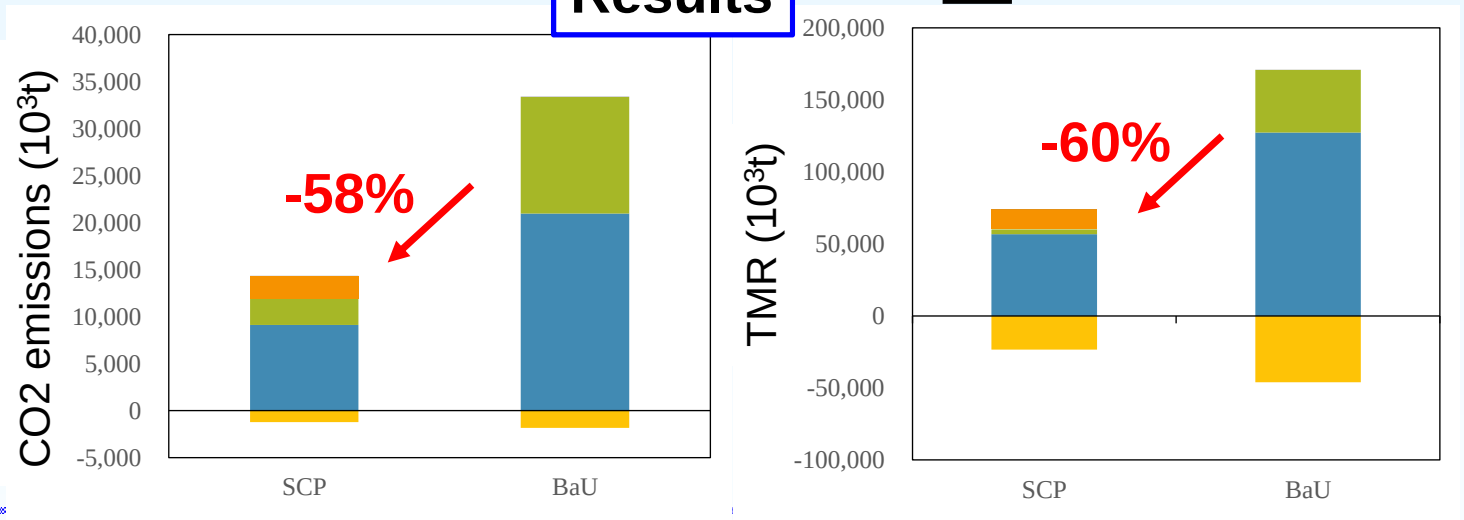
Input parameters

Parameter	BaU (2050)	SCP (2050)
CO2 emission factor for electricity generation (gCO2/kWh)	560	180
Diffusion rate of shared car customers	0%	50%
Annual driving distance (km)	10,000	10,000

Goals: Halve resource & energy consumptions

Possible to achieve by car sharing, renewable energy, and demand decrease

Results



Advantages & Limitations

- **Advantages**
  - Diversified useful keywords for SCP patterns were obtained
  - The quantification process enables to analyze which measures are effective at achieving predetermined goals
  - The proposed scenario design process is available for other regions (e.g., Japan)

- **Limitations**
  - It is very time-consuming to collect data and conduct workshops
    - Needs to further quantify the scenarios to cover more domains (household chores, working, etc.)

Conclusion

- **Presented a scenario design approach to envisioning SCP focusing on participatory backcasting**
- **The proposed scenario design process is transferable to other regions, but time-consuming…**
  - **Need to collect as much reliable data as possible**
- **It should be meaningful to undertake comparative analysis between regions for a better understanding of SCP patterns**
  - **Japan, Southeast Asia, Europe, …**