Report on Comparative Study of the Environmental Impact and Positive Effect of Hand Wash

June 2019

Shiseido Company, Limited

1 General

1.1 Assessment implementors

Affiliated institution:

Name: Kenji Ohashi

Contact: kenji.ohashi@shiseido.com

1.2 Report creation date

May 09, 2019

2 Goal of the study

2.1 Reasons for carrying out the study

To conduct a quantitative assessment and comparison of the environmental impact of adoption of handwashing using hand wash in developing nations versus the environmental benefits of the effects of preventing diarrhea achieved by handwashing.

2.2 Intended applications

To develop a methods of positive effect assessment of cosmetics and to conduct scenario analysis regarding the environmental impact level by country of sale in order to provide information towards improving future life cycle assessments.

3 Scope of the study

3.1 Study subjects and specifications

Luquid hand wash produced in Japan (volume content: 250mL)

3.2 Functions and functional units

Handwashing 500 times (volume used per handwashing: 0.5mL) via a single hand wash product for lathering, cleaning, and rinsing dirt from hands.

3.3 Scenarios

In this assessment, of the raw materials comprising hand wash, we assumed fatty acid materials are produced in Malaysia and other raw materials are manufactured in Japan. We also assumed manufacturing was conducted at a Japanese factory with the product used and disposed of in Japan set as Scenario 1 and with the product shipped to, used, and disposed of in a developing country (Indonesia) set as Scenario 2. For both scenarios, we compared the environmental impact and positive effect (prevention of diarrhea via handwashing).

3.4 System boundaries

The calculation was conducted targeting stages from raw material procurement to manufacturing, distribution, use (handwashing), and disposal.

Furthermore, Scenario 2, which is based on sales, use, and disposal in a developing nation, assumes that water used during handwashing will not be treated and will be discharged into a river, and that waste treatment following product use will be incineration followed by landfilling for all volume without recycling.

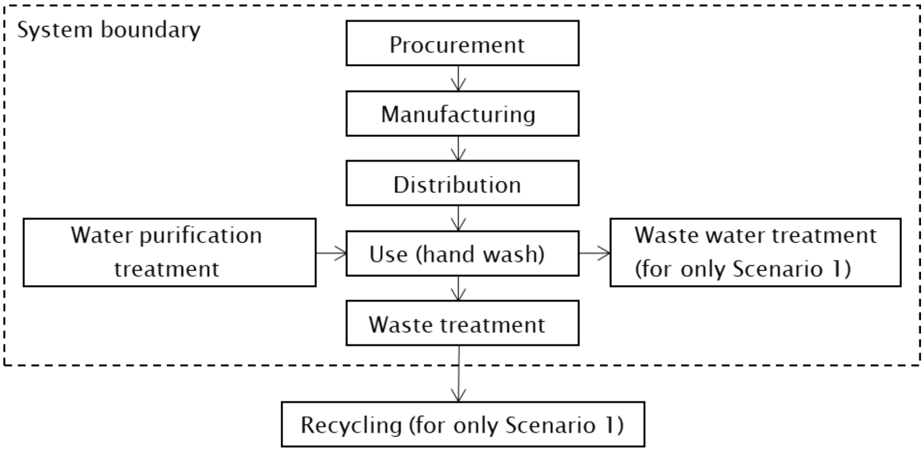

Fig. 3.4-1 Hand wash product systems and system boundaries

3.5 Special notes (excluded processes, matters, etc.)

The waste (container) from product sold, used, and disposed of in Japan is partially recycled but the recycling processes were excluded from the scope of this assessment. Furthermore, water facilities required for handwashing are not included in the assessment.

4 Inventory analysis

4.1 Primary data

We used internal data for data such as the composition of hand wash contents and containers as well as energy consumption which are related to processes during each manufacturing stage.

4.2 Secondary data

We used IDEA ver.2[1)] developed by National Institute of Advanced Industrial Science and Technology (AIST). For each waste disposal phase for products sold in Japan, we used the scenario indicated in Carbon Footprint Communication Program Plastic Container Packaging

PCR (PA-BC-02)[2].

4.3 Items in the inventory analysis and the results

The results of inventory analysis for Scenario 1 and 2 are indicated in appended materials as supporting information.

5 Impact assessment

6 Assessment steps and impact categories

For the impact assessment, we used the Japanese version of the LIME3, Life-cycle Impact Assessment (LCIA) Method based on Endpoint modeling to conduct a damage assessment and weighting. Impact categories for assessment in each step are shown in Table 5.1-1.

Table 5.1-1. Environmental impact categories for assessment

Impact categories	Damage assessment
Climate change	○
Air pollution	○
Photochemical oxidants	○
Water resource consumption	○
Land use	○
Resource consumption (fossil fuels, mineral resources)	○
Forest resource consumption	○
Waste products	○

6.1 Impact assessment results

The damage assessment results in Scenario 1 and 2 for each protection area. Fig. 5.2-1 to 5.2-4 indicate the five items with the largest impact in each scenario for each protection area. The biggest difference between Scenario 1 and 2 was the impact on human health, with a difference nearly 9 times greater. The human health impact in Scenario 1 was large because the size of the damage evaluation coefficient for water consumption during handwashing differed significantly with each country.

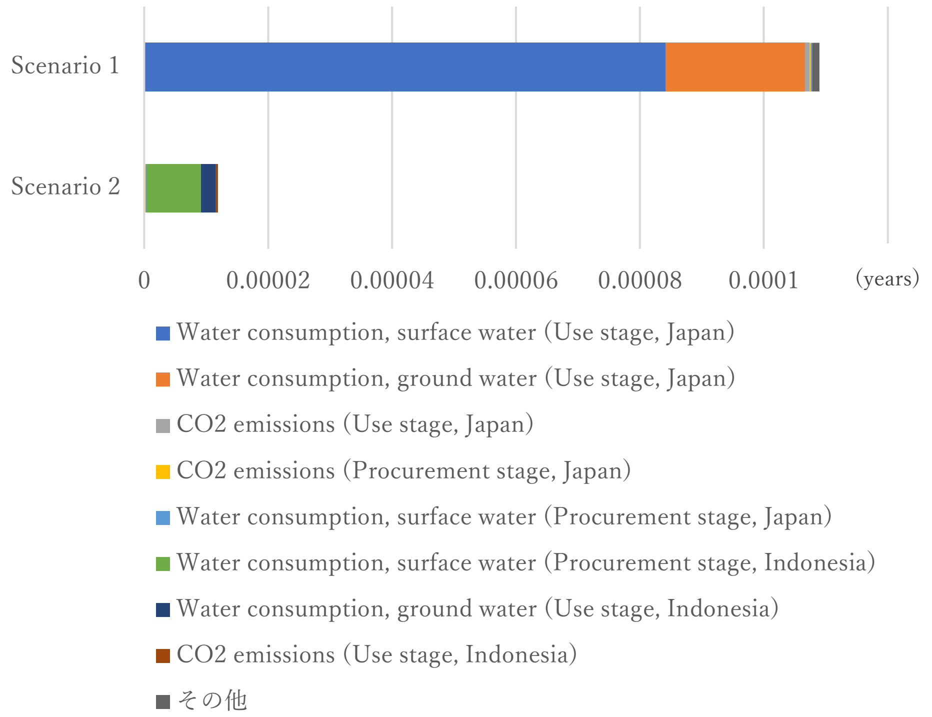

Fig. 5.2-1 Impact on human health

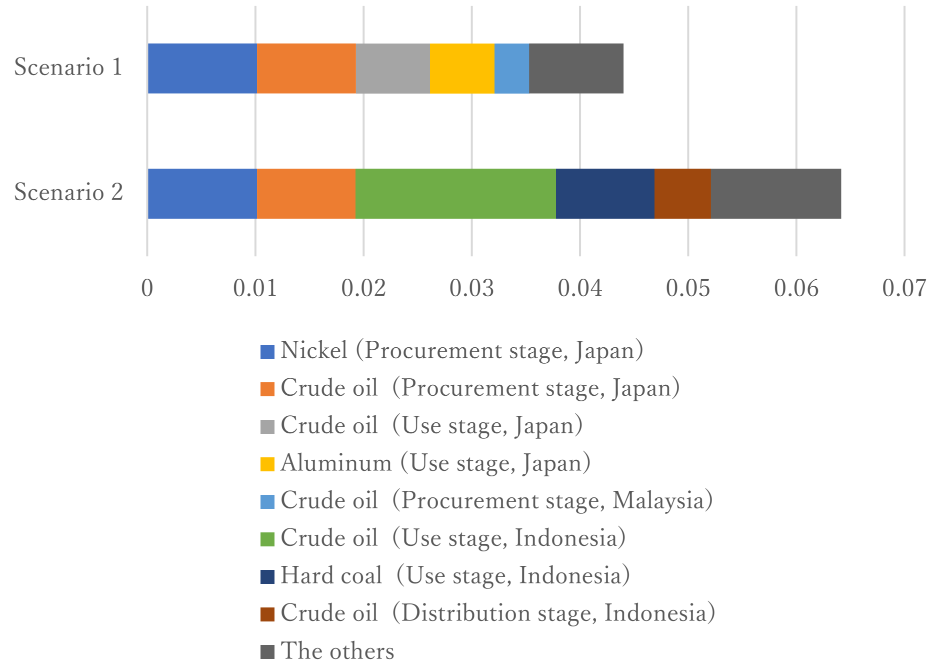

Fig. 5.2-2 Impact on social assets

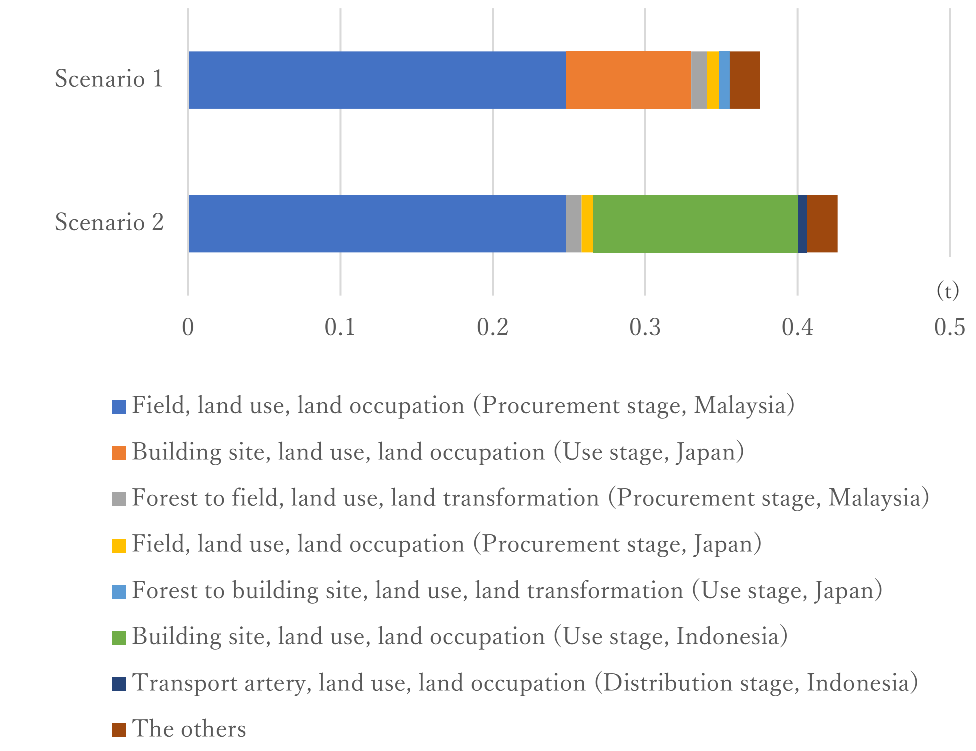

Fig. 5.2-3 Impact on primary production

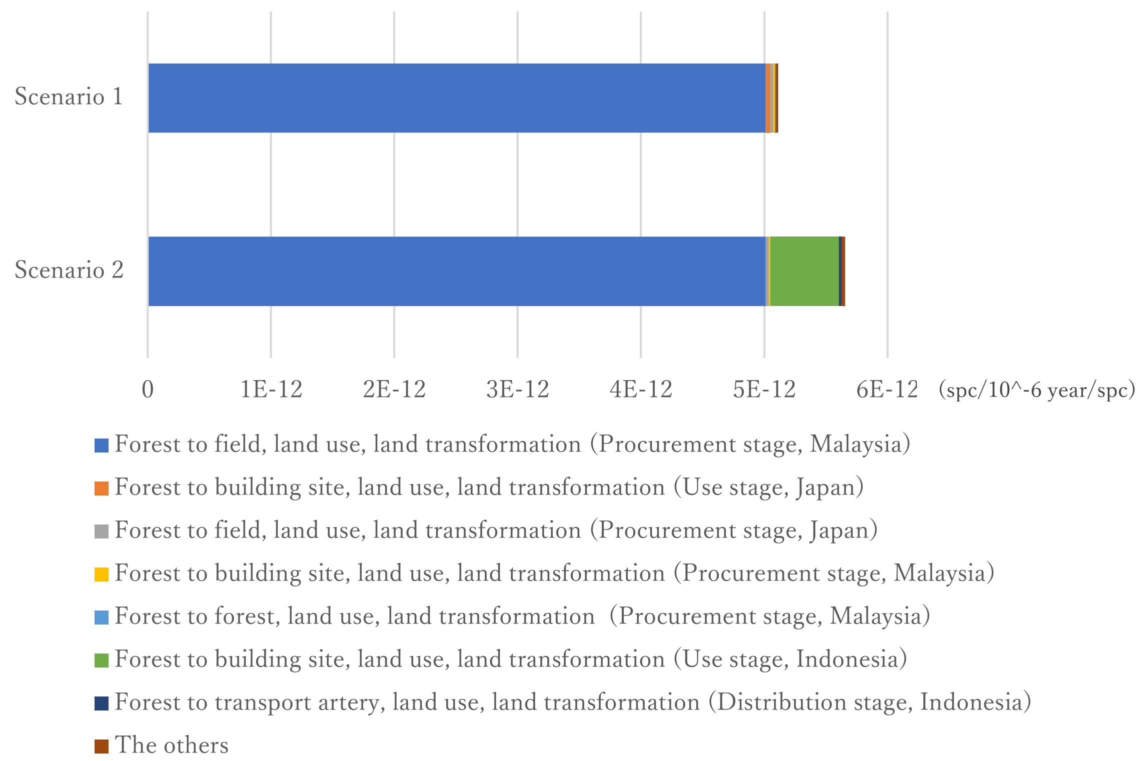

Fig. 5.2-4 Impact on biodiversity

6.1.1 Weighting

Weighting results by protection area, by life cycle stage, and by country based on the economic value index based on G20 population weighted average are shown in Fig. 5.2.5-1 to Fig. 5.2.5-3. weighting results showed that Scenario 1, which assumes use in Japan, were larger. This was due to tap water use (surface water and ground water) for rinsing during the product use stage.

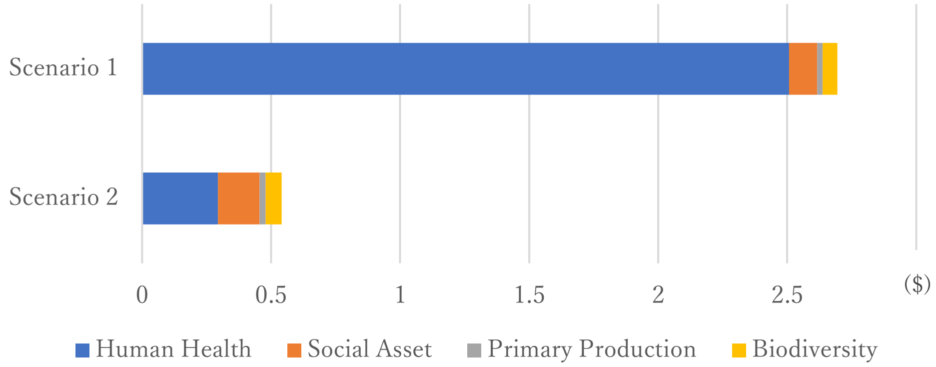

Fig. 5.2.5-1 Weighting results by protection area

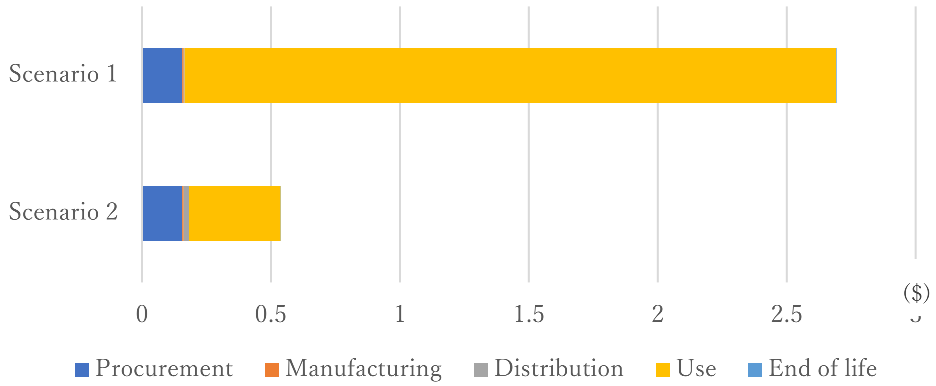

Fig. 5.2.5-2 Weighting results by life cycle stage

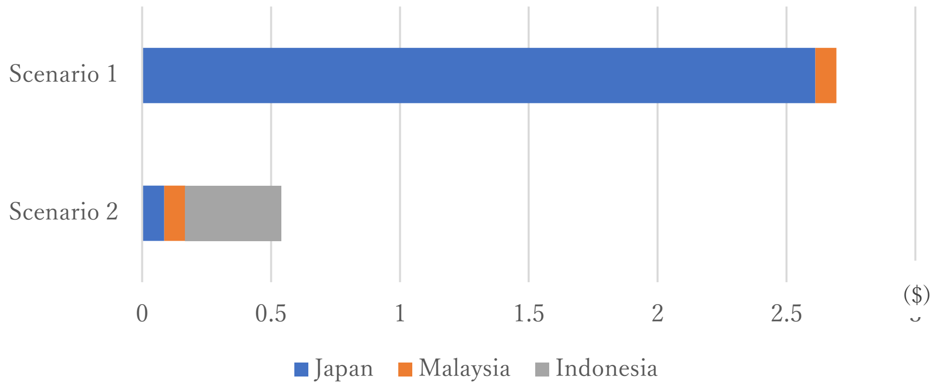

Fig. 5.2.5-3 Weighting results by country

7 Positive effect assessment

7.1 Assessment method

The WHO reports that the adoption of handwashing before meals can reduce the incidence of diarrhea by approximately 1/3 among middle- and low-income groups in developing countries[3]. As such, in Scenario 2, which assumes use of hand wash in developing nations, we set the assumption of being able to reduce DALY due to diarrhea by 33%. Conversely, for Scenario 1, which assumes use in Japan, we adjusted for the fact that a hygienic living environment has already been established by setting the effect to 1/10 that of middle- and low-income groups in developing countries. For DALY due to diarrhea, we used the figures indicated in the WHO report[4]. This report did not include data for Japan so for the Japanese scenario we apply the estimated DALY for EU affluent groups, which have a nearly equivalent hygiene environment. Handwashing frequency was set to 5 times per day and the volume of hand wash used was set to 0.5mL, then calculated the DALY reduction effect during the period of use of a single product unit (=100 days) as the per-product positive effect.

7.2 Assessment results

The positive effect due to daily use of product in Japan was a DALY reduction effect of 1.50E-06 years. For Indonesia, this was 1.10E-03 years. (Table 6.2-1) This difference is believed largely since advanced nations have established hygienic living environments and handwashing is already customary, so the baseline for DALY due to diarrhea is extremely low.

Table 6.2-1 Years of life lost due to diarrhea and reduction effect of product

Item	Region	Effect
Years of life lost due to diarrhea	Global average	9.97E-03 year/year/person
	Southeast Asia (middle- to low-income groups)	1.20E-02 year/year/person
	Advanced nations (EU affluent groups)	1.64E-04 year/year/person
Reduction via handwashing	Global average	3.32E-03 year/year/person
	Southeast Asia (middle- to low-income groups)	4.01E-03 year/year/person
	Advanced nations (EU affluent groups)	5.46E-06 year/year/person
Per-product effect	Global average	9.10E-04 year/product
	Southeast Asia (middle- to low-income groups)	1.10E-03 year/product
	Advanced nations (EU affluent groups)	1.50E-06 year/product

7.3 Comparative Evaluation of the Environmental Impact and Positive Effect

The results of Comparative Evaluation between Environmental impact weighting results for hand wash gained through LIME 3 and DALY reduction effect due to handwashing habits indicated in 6.2 are shown in Fig. 6.3-1. We saw significant improvements in Indonesia and other developing nations where handwashing is not sufficiently customary. It was indicated that hand wash potentially has significant positive effect far exceeding environmental impact through the product life cycle.

On the other hand, in developed nations that already have sufficient hygienic environments, the environmental load is shown to be larger than additional benefits of hand wash. This is believed to be attributable to the fact that WHO health damage estimates are calculated based on current onset rates and do not assess health damage for scenarios where current measures (handwashing) are not conducted. As such, the current assessment baseline in developed countries comprises a larger ratio of hand wash use compared to developing countries and does not look at health damage being avoided because of those customs.

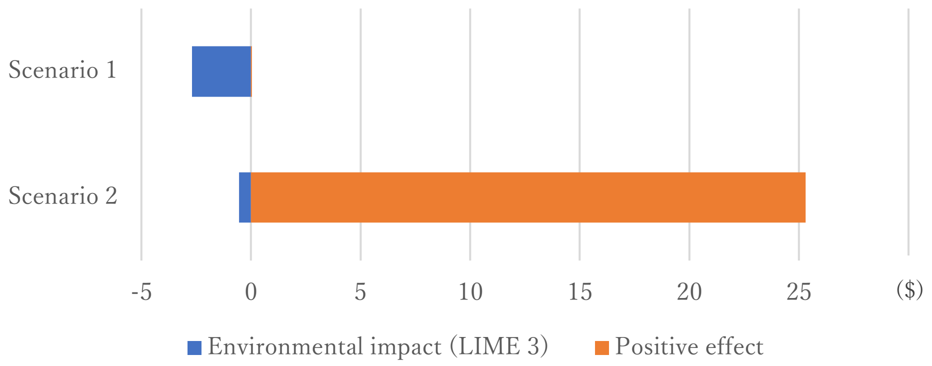

Fig. 6.3-1 Comparative Evaluation of the Environmental Impact and Positive Effect

8 Conclusion

It became clear by using the LIME 3 analysis that, due to the difference between countries and regions, the same product could produce varying environmental impact developing on each phase of the product life cycle including raw material procurement, production, distribution, use, and disposal. With Scenario 1, which assumes use in Japan, the size of the impact of water use during handwashing was significantly larger than other factors. Compared to Scenario 2, which assumes use in developing countries, the weighting result was four-fold. It is believed necessary to reassess the appropriateness of the volume of water use in developed nations based on the results of future assessment case study reports once a sufficient number of reports have been established.

The results of the comparison between environmental impact and positive effects indicate that the positive effect of the habit of handwashing using hand wash in developing countries significantly exceeds the environmental load. One of the superior points of LIME is the ability to monetize various environmental impacts, including human health, social assets, primary production, biodiversity, etc., to establish a single benchmark. However, with products that can improve human health and QOL like hand wash, the LIME methods can be used to assess the positive aspects of products. In addition to examining the negative impact of a product on environment, comparing it with the positive effect on the environment and society on the same axis based on scientific and social science perspectives can enable the provision of new information that can be applied to decision-making for economic activities. We expect the use of LIME 3 will enable us to transcend conventional life cycle assessments and make contributions towards a sustainable society.

Reference literature

1) IDEA ver.2
2) Carbon Footprint Communication Program Plastic Container Packaging PCR (PA-BC-02)
<Source: https://www.cfp-japan.jp/common/pdf_authorize/000058/PA-BC-02.pdf>
3) WHO, Hand washing promotion for preventing diarrhea
<Source: https://www.who.int/elena/titles/review_summaries/handwashing/en/>
4) WHO, Burden of disease (in DALYs) attributable to water, sanitation and hygiene ('000), by disease and region, 2004
<Source: https://www.who.int/gho/phe/water_sanitation/burden_text/en/>