

Business Design of Product Circulation Using Life Cycle Simulation

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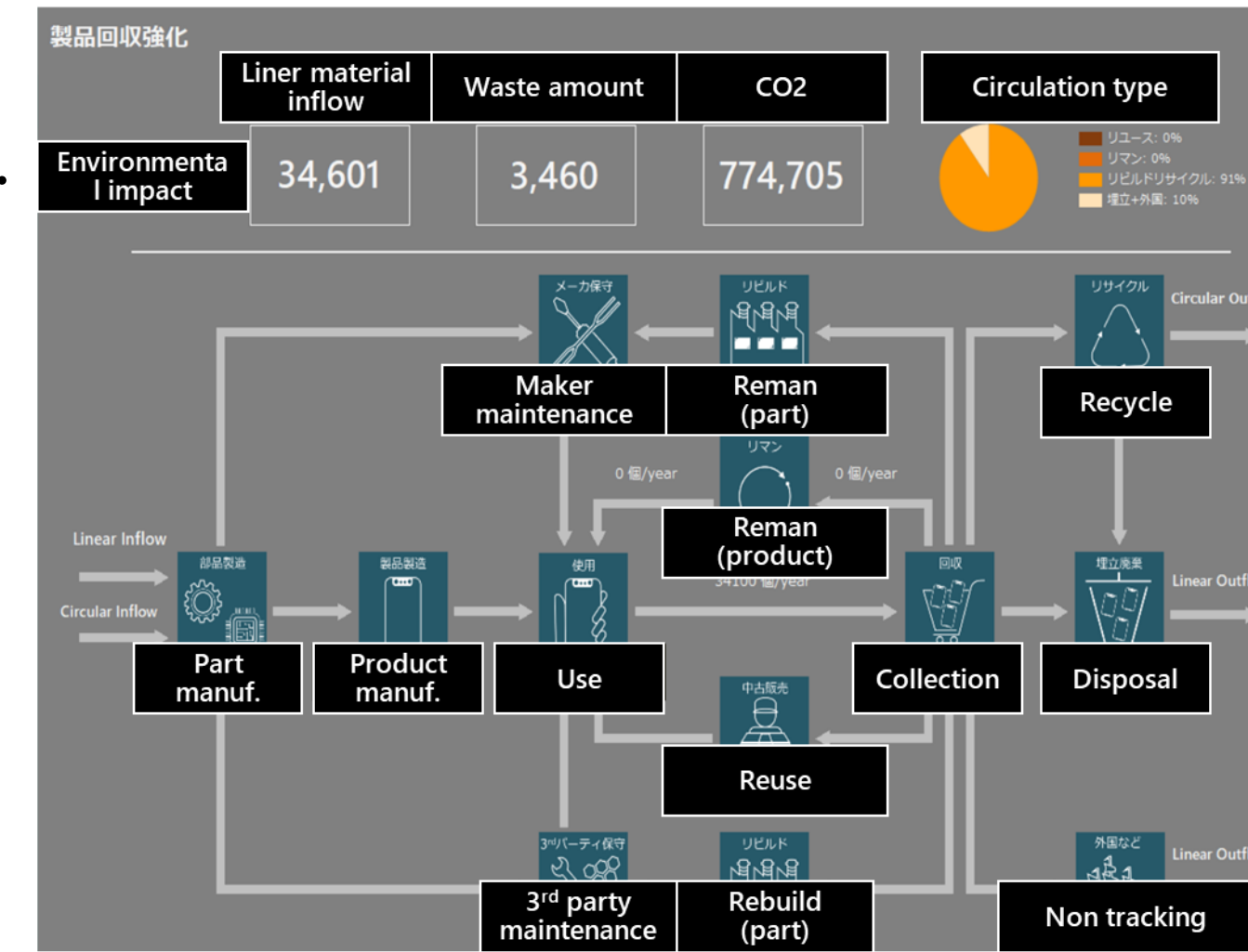
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Introduction

Issue to realize product circulation

- In order to realize resource decoupling, the product circulation which can maintain the value of used products is important [1].
- To realize the product circulation, there are several issues in building collection network as shown below.
 - Difficulty in collection due to product missing after shipping.
 - High transportation cost
 - Low operation rate in reproduction lines due to the small number of collections.



Schematic of life cycle simulation

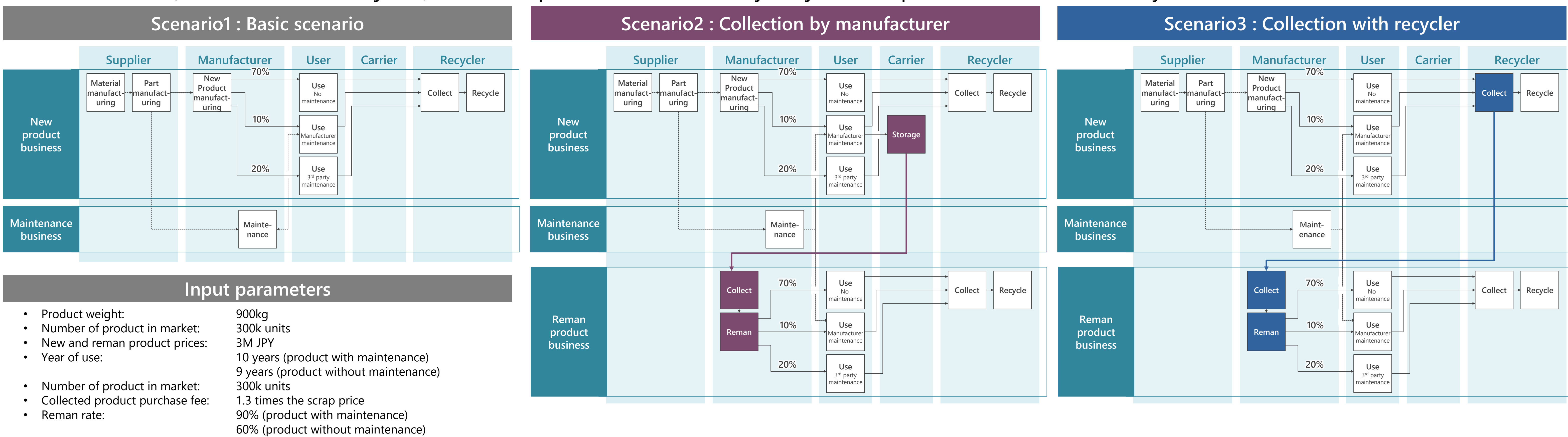
Basic strategy

- Establishing the product circulation business collaborating with recycler.
- Evaluating the feature of its business and clarify the establishment requirement using life cycle simulation [2].

Scenarios in life cycle simulation

Scenarios and parameters

- Scenario1 (Basic scenario)** : The product are disposed at the end of use.
- Scenario2 (Collection by manufacturer)** : The products with maintenance contract are collected and remanufactured (reman) by manufacturer.
- Scenario3 (Collection with recycler)** : The products collected by recycler are purchased and reman by manufacturer.



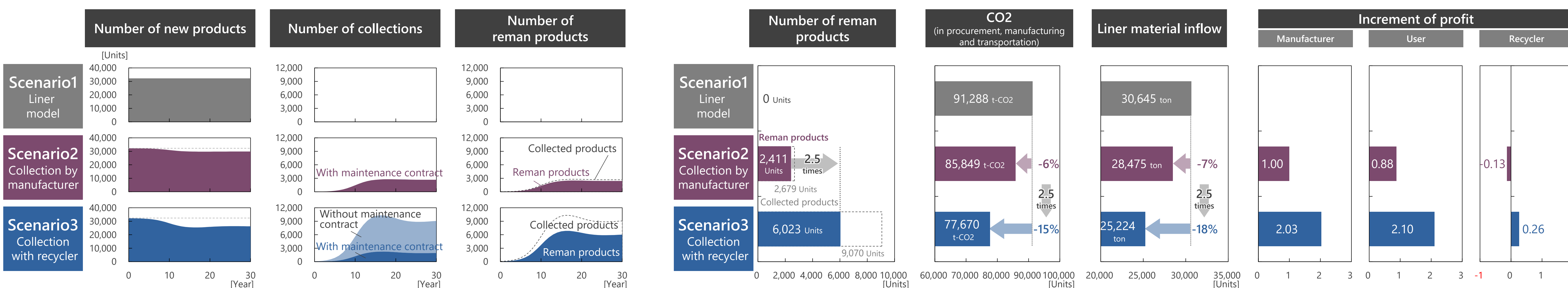
Results and discussion

Results

- In scenario2, the number of reman products is small since the reman rate is high but the number of collections is low.
- In scenario3, the number of reman products increase due to the large number of collections even though the reman rate is low.
- The number of reman products and environmental burden have a liner relationship. On the other hand, the increase in profit slows down as number of reman products increases.

Discussion

- The cost for product collection is the same, even though the reman products decreases as the reman rate decreases. It is important to reduce the product collection which cannot reman.
- By sorting and collecting the products which can reman in recycler, the cost of collections can be reduced, and the profit is improved.
- Active participations of recyclers may achieve a win-win situation for manufacturers, users, and recyclers while the advancement of product data traceability and reman technologies are crucial.



Conclusions

- In scenario of collection with recycler, it is possible to increase the product collection because manufacturer can collect the products which are missed after shipping.
- By sorting the product in recycler which can be remanufactured, the cost of collection can be reduced, and the profit are improved.
- Active participations of recyclers may achieve a win-win situation for manufacturers, users, and recyclers.

[REFERENCE]

- Ellen MacArthur Foundation: Circular economy system diagram, Drawing based on Braungart & McDonough Cradle to Cradle C2C, 2019.
- Umeda Y. et al., Study on life-cycle design for the post mass production paradigm, Artificial Intelligence for Engineering Design, Analysis and Manufacturing, 14, 2000, 149-61.