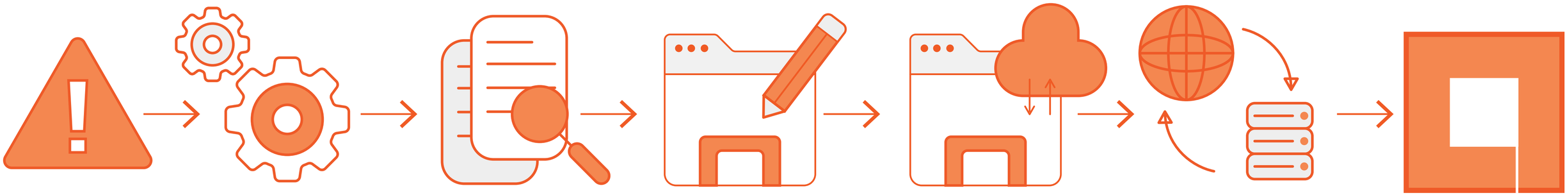
PRODUCT-SERVICE-SYSTEM, A STRATEGY FOR CREM TO MINIMIZE MATERIAL LEAKAGE IN OFFICE (TRANSFORMATION)

Minimizing material leakage within CRE by using PSS

Presentation, By Thanon Sommitr

Agenda



Research problem

Research questions

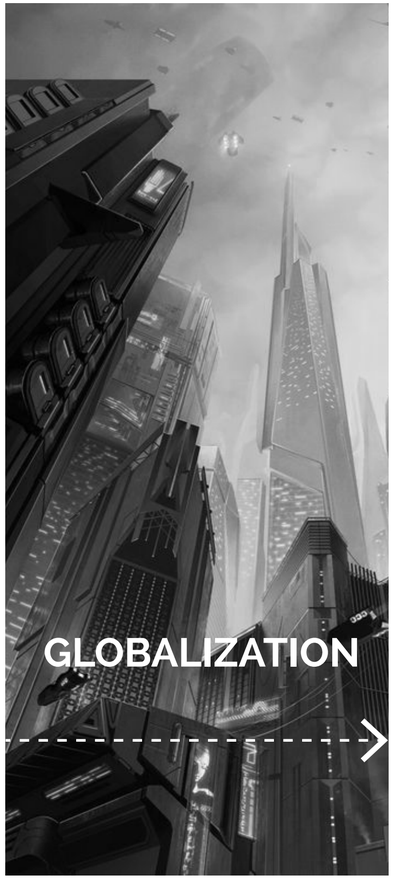
Theoretical research

Empirical research design

Empirical research result

Analysis/ conclusion

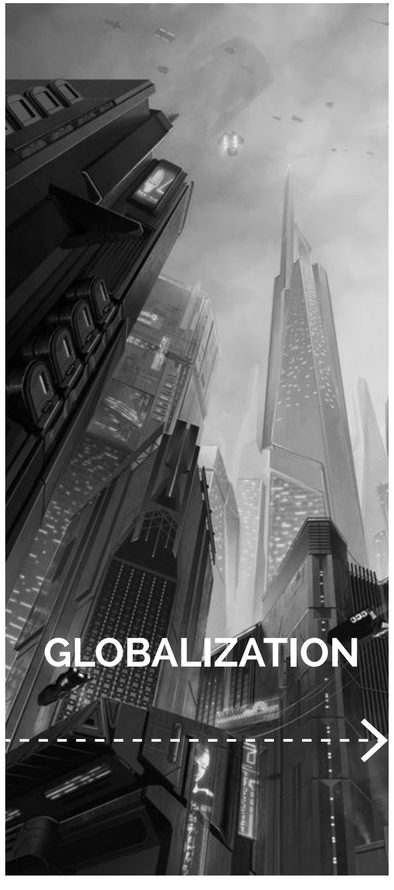
Other Subjects



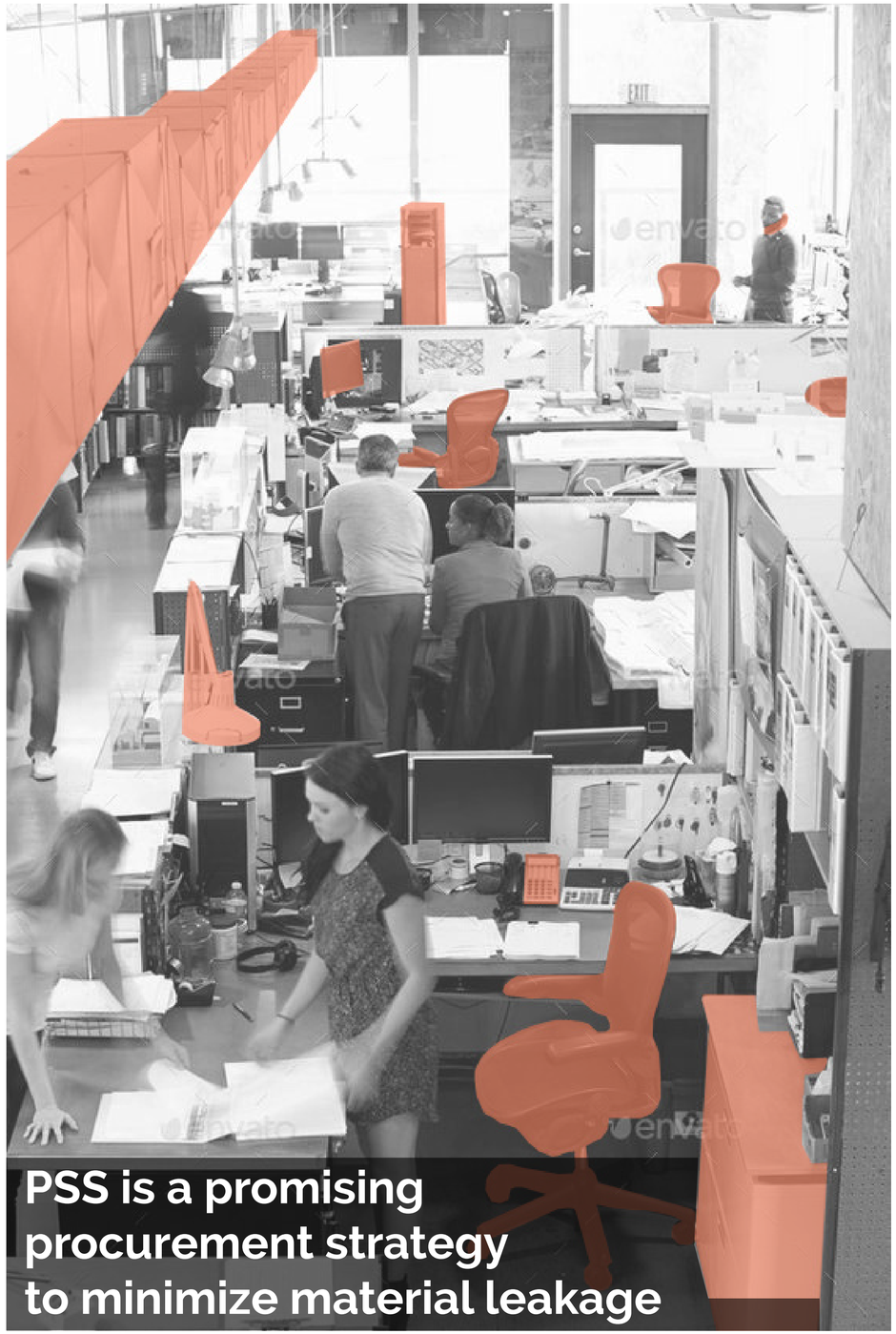
MATERIAL LEAKAGE

RESEARCH OBJECTIVE

FIND A SOLUTION TO MINIMIZE



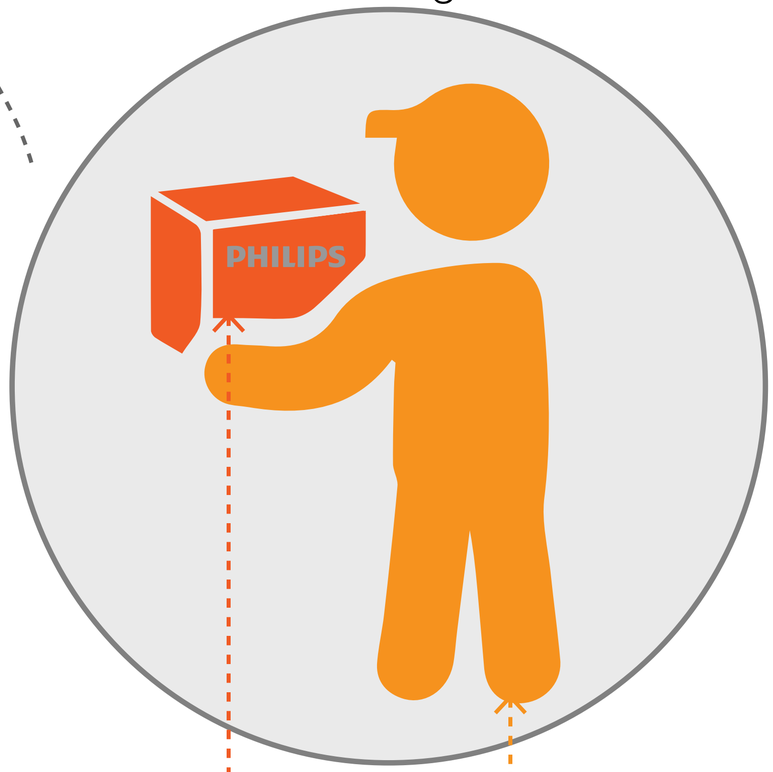
MATERIAL LEAKAGE



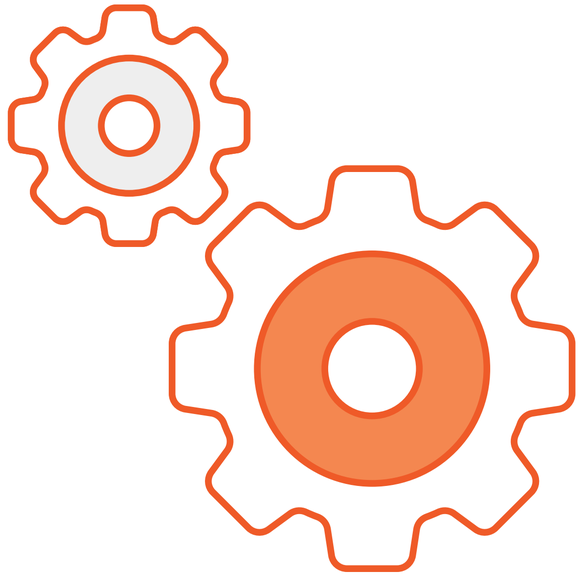
PRODUCT-SERVICE SYSTEM

Is it a possible solution to cope with the material leakage issue?

Provide product and service to consumer



Tangible product + Intangible service



Research questions

Research questions

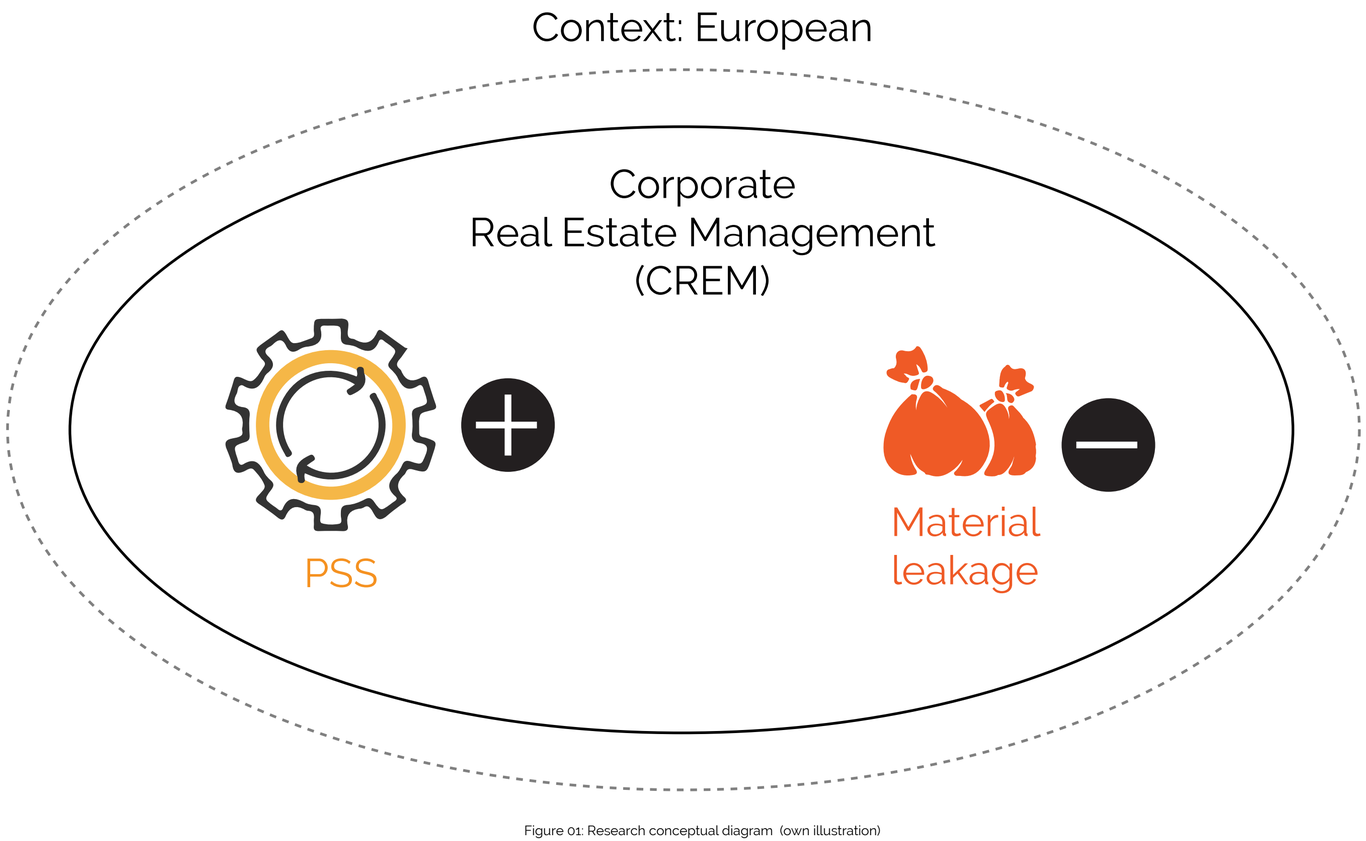


Figure 01: Research conceptual diagram (own illustration)

Main research question:

"To what extent does the Product-Service system (PSS) help corporate real estate (CRE) in minimizing material leakage?"

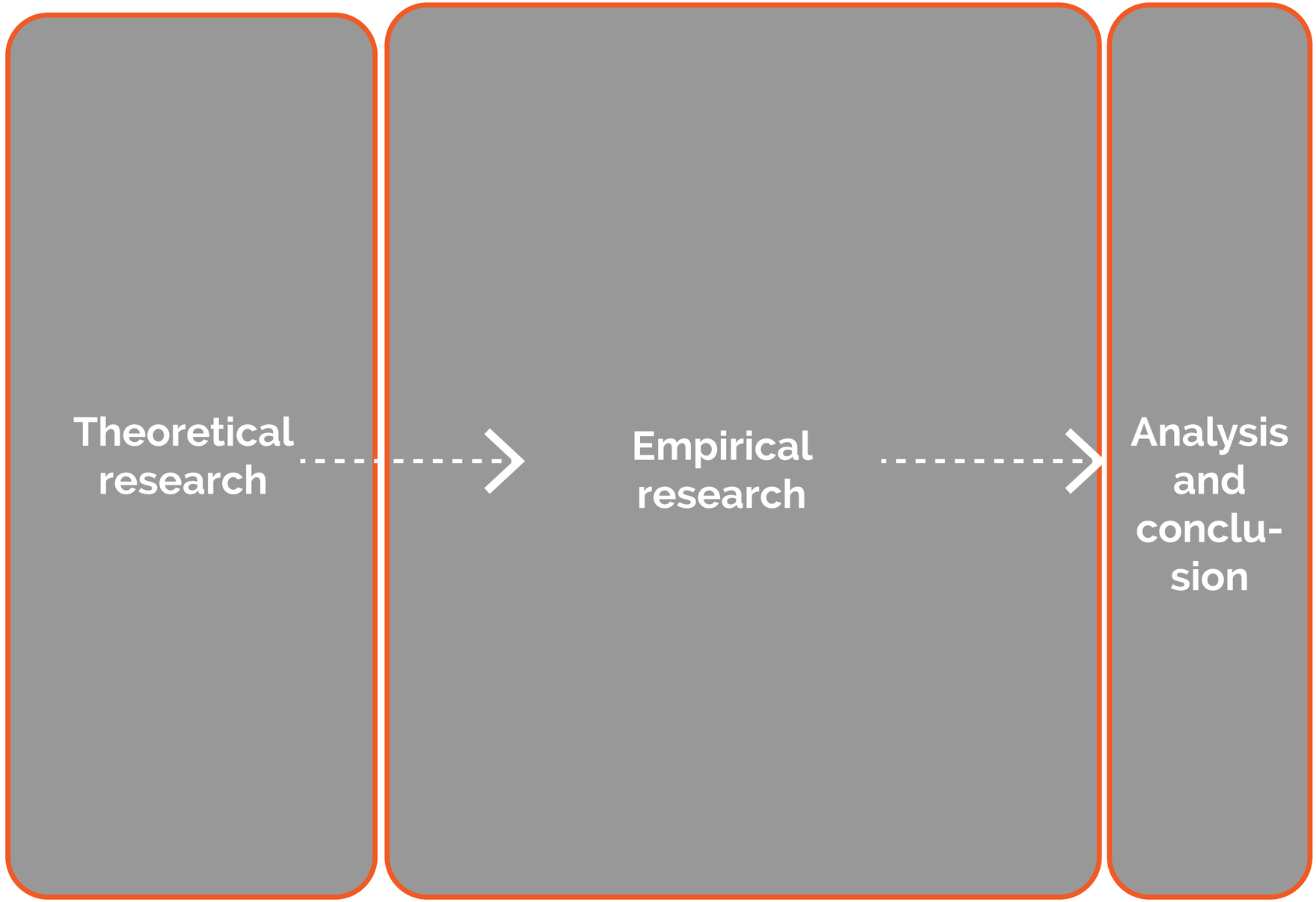
Sub research questions

1. What is the PSS? And what is the potential of PSS to minimize material leakage in office refurbishment?

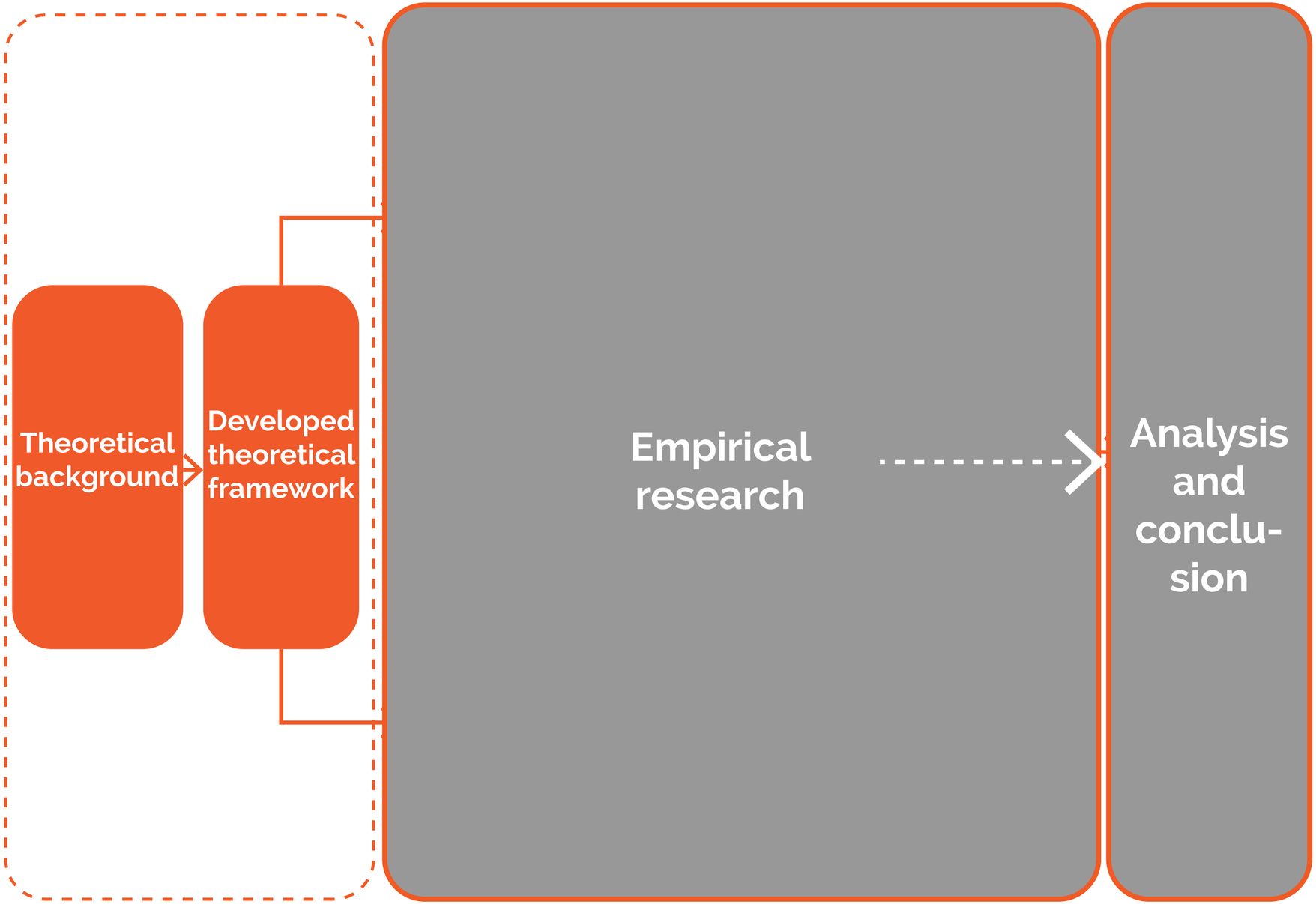
2.In real practice, to what extent is material leakage minimized by the product-service system?

3. What are the benefits of a PSS implementation to the consumers and PSS providers?

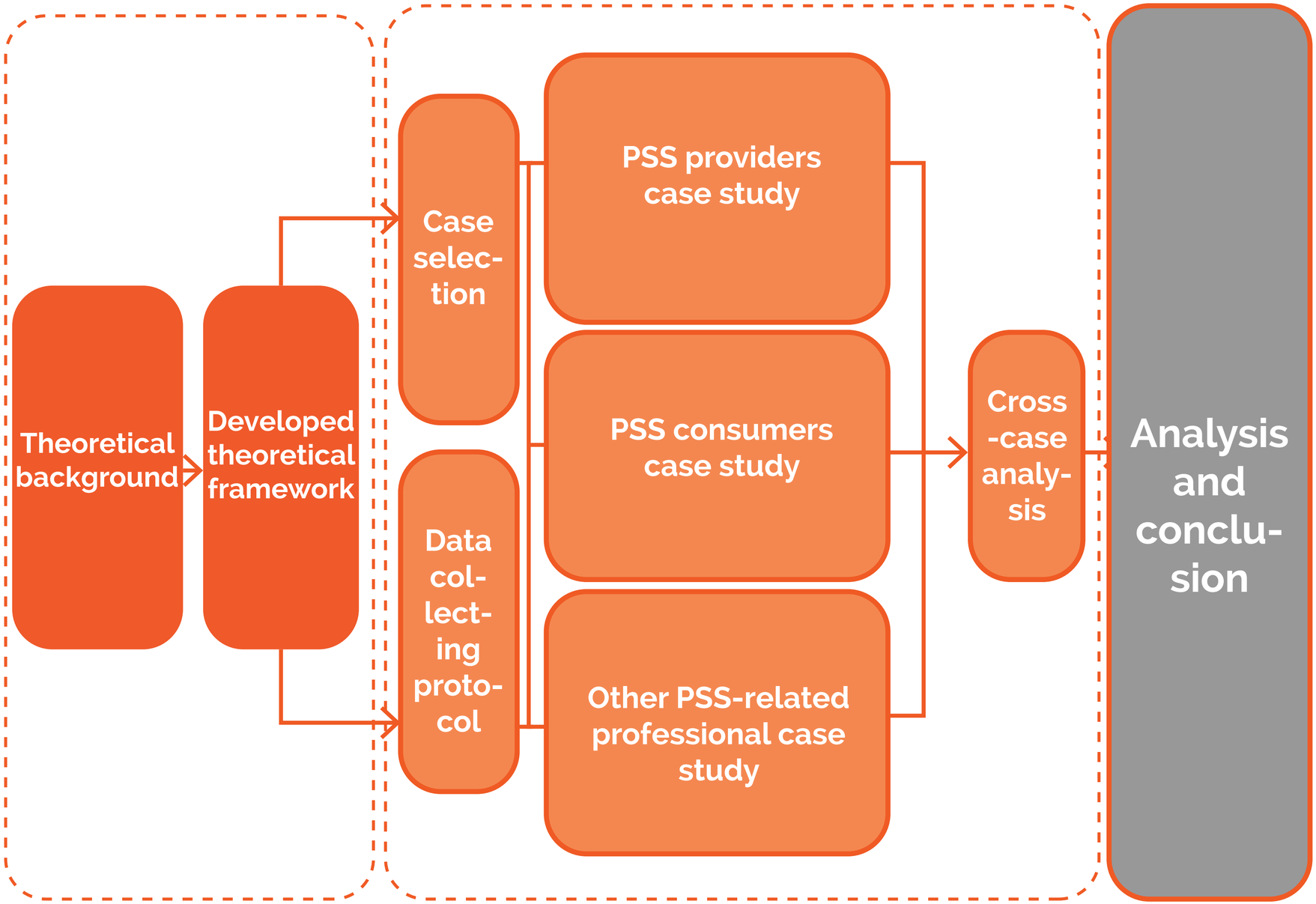
Research procedure/ overview



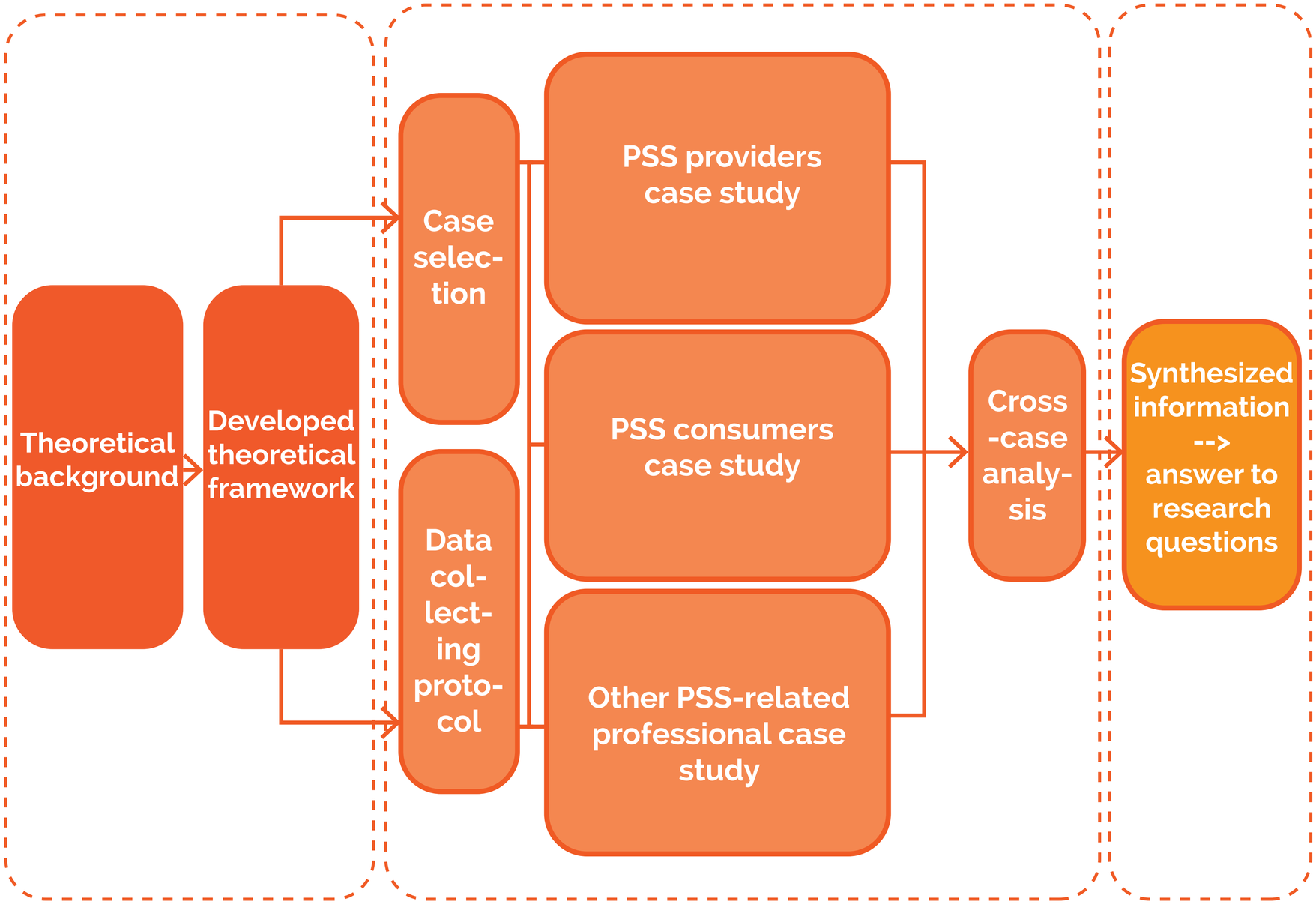
Research procedure/ overview



Research procedure/ overview



Research procedure/ overview



Theoretical research

Research-related concepts

Corporate Real Estate (CRE)

The real estate is occupied by the corporate. It is a physical entity to facilitate and contributes the corporate goals (Kooymans, 2000 and Widarta, 2021).

Corporate Real Estate Management (CREM)

is a strategic management discipline to enhance the corporation's performance through aligning CRE strategy (Haynes, 2017b)

Office

is considered as one of important CRE element which should be aligned with other

Material leakage

Material loss within its' product life cycle; waste, scrap, and defectives.

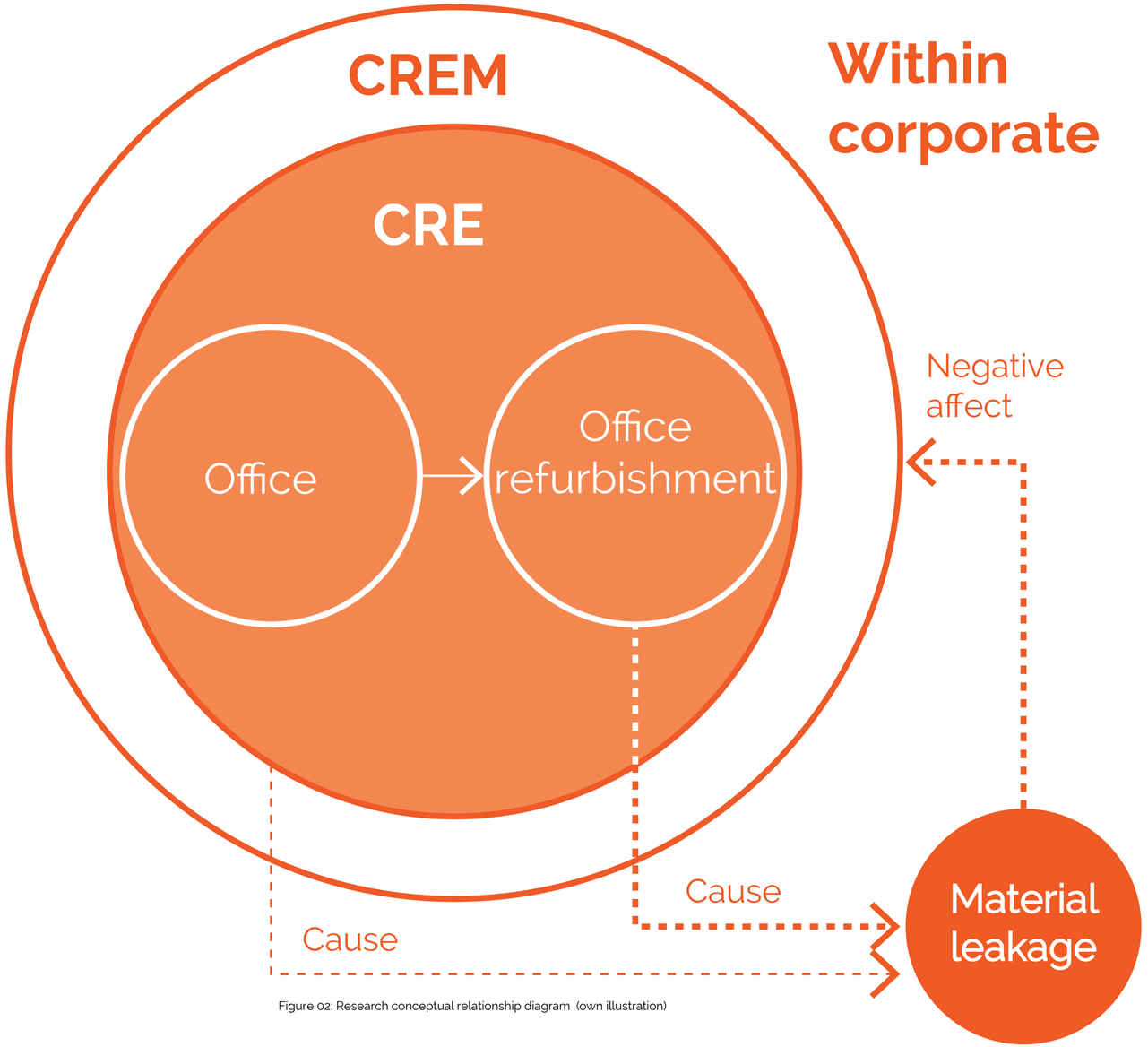


Figure 02: Research conceptual relationship diagram (own illustration)

Material leakage within CRE

Causes

(Office refurbishment is a material leakage contibutors)

Office construction is booming

Office refurbishment occurs more frequently

Generate higer average of construction waste

Material leakage

Consequences

(Negative effect of material leakage)

Environmental pressure

More construction/ disposal cost for the corporation

Other negative effect to the organization
(e.g. organization image)

Material leakage on each building layers

BUILDING LAYERS
(Longer life-span layers)

- **Building site**; eternal
- **Structure**: apprx 50yrs
- **Skin**: apprx 25yrs

SERVICE LAYERS
(Shorter life-span layers)

- **Services:** apprx 15yrs
- **Space plan:** apprx 10yrs
- **Stuff:** apprx 1-5yrs

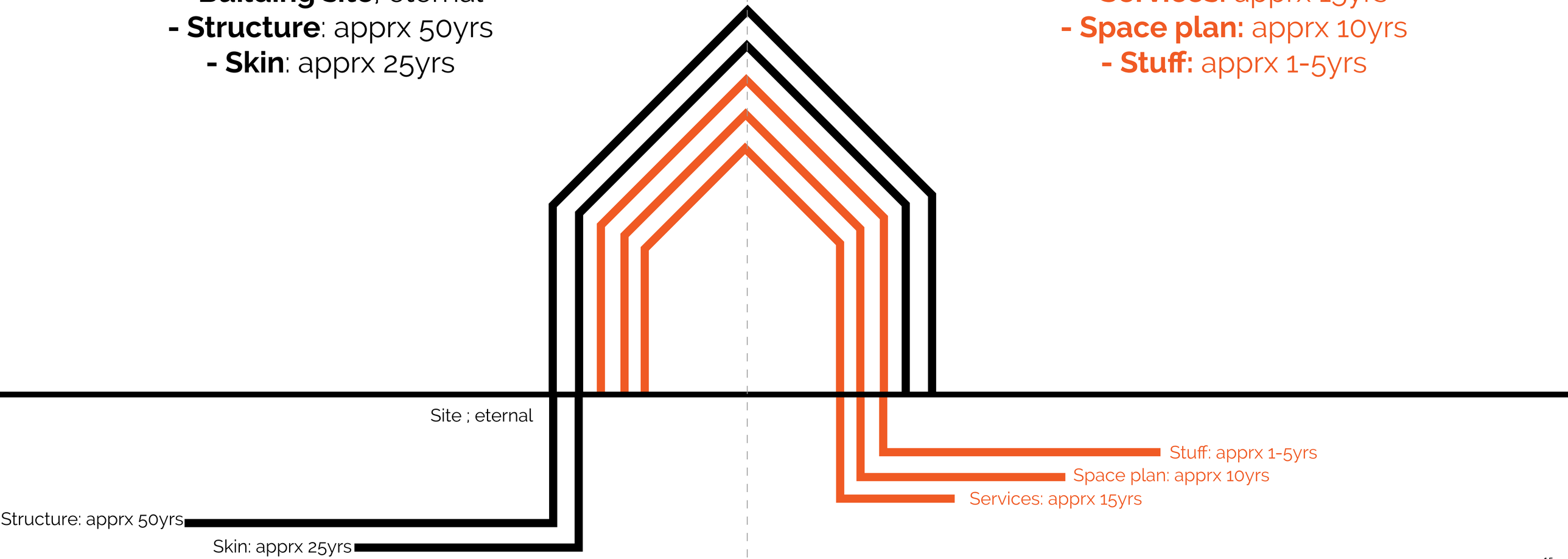


Figure 03: Six building shearing layer, source; Brand (1994) (own illustration)

Material leakage on each building layers

BUILDING LAYERS?
(Longer life-span layers)

SERVICE LAYERS?
(Shorter life-span layers)

In which layer is material leakage more generated?

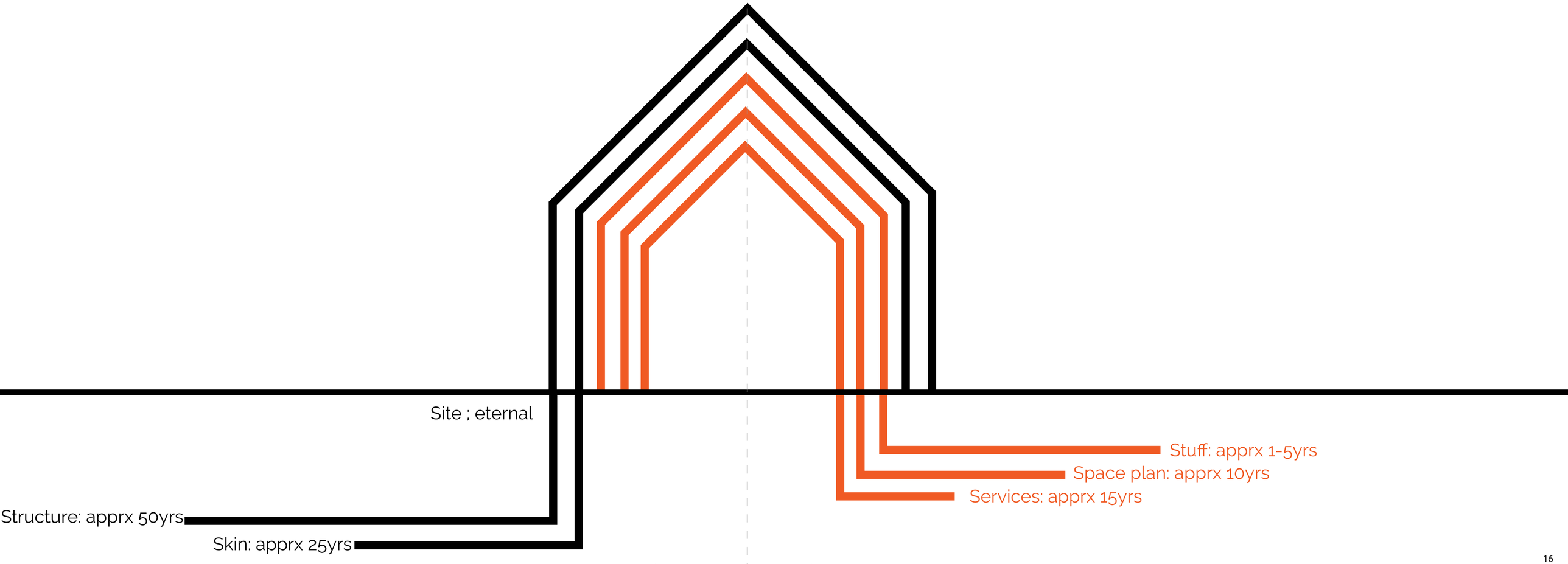


Figure 03: Six building shearing layer, source; Brand (1994) (own illustration)

Material leakage on each building layers

BUILDING LAYERS GENERATE MORE MATERIAL LEAKAGE

Because ...

1. Building layer requires more material in building construction compared to the service layer
(Pushkar, 2015)

2. Building layer generate more environmental damage (by using EI99 for period of 50 years)
(Pushkar, 2015)

3. The shorter life span component (service layer) have more opportunity to replaced by more environmental sustainability components
(Pushkar, 2015)

SERVICE LAYERS GENERATE MORE MATERIAL LEAKAGE

So far..... Haven't had a manifest conclusion on this aspect yet

Because ... Refurbishment - are mostly service layer works

1. The majority of R&R waste, 83%, is ended in landfills (Yu et al., 2021)

2. Fit-out projects generate more than double the construction waste compared to typical commercial construction projects.
(Hardie et al , 2011; Freymann et al, 2018 ; BPP, n.d.)

3. Fit-out projects usually take place more frequently than other construction projects
(Fard Fini and Forsythe, 2020; and Casas-Arredondo, 2021)

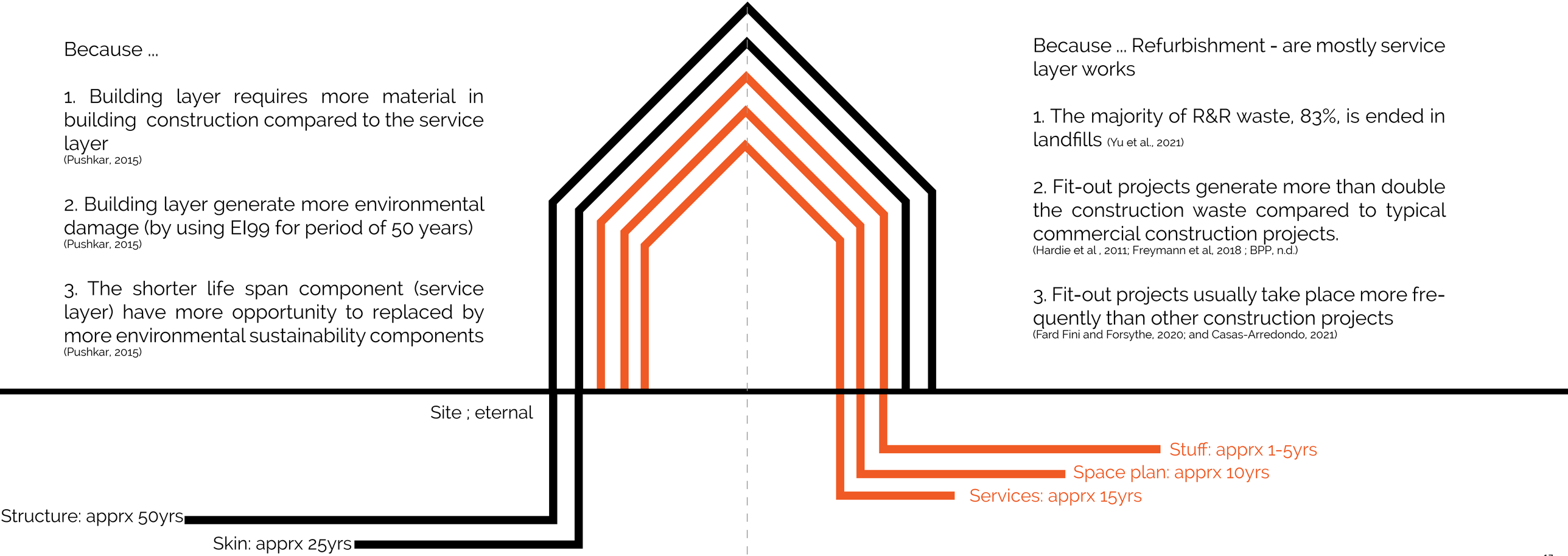


Figure 03: Six building shearing layer, source; Brand (1994) (own illustration)

Material leakage on each building layers

Providing building layer PSS is difficult

Building layer PSS implementation barriers

- **Building regulation** (e.g. Dutch building ownership regulation)

- **Financial aspect** (loan or mortgage - not easy)

- **Construction management** (increase transaction)

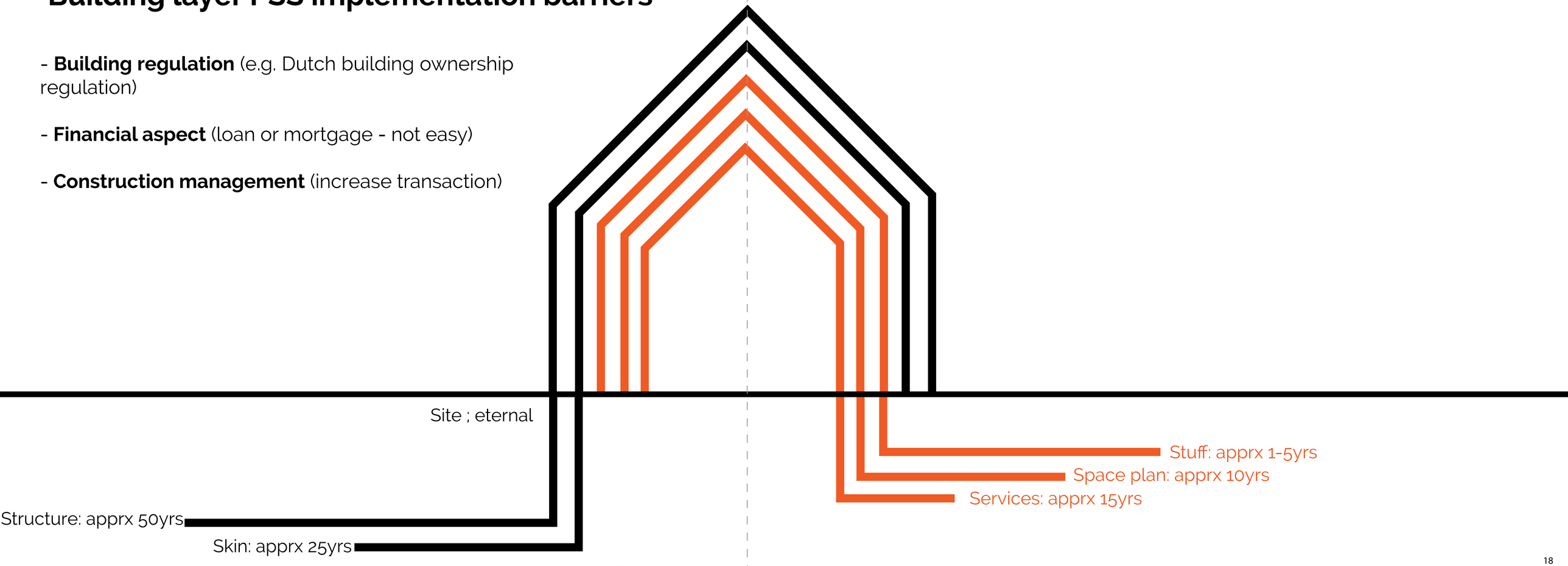


Figure 03: Six building shearing layer, source; Brand (1994) (own illustration)

Product-service-systems (PSS)

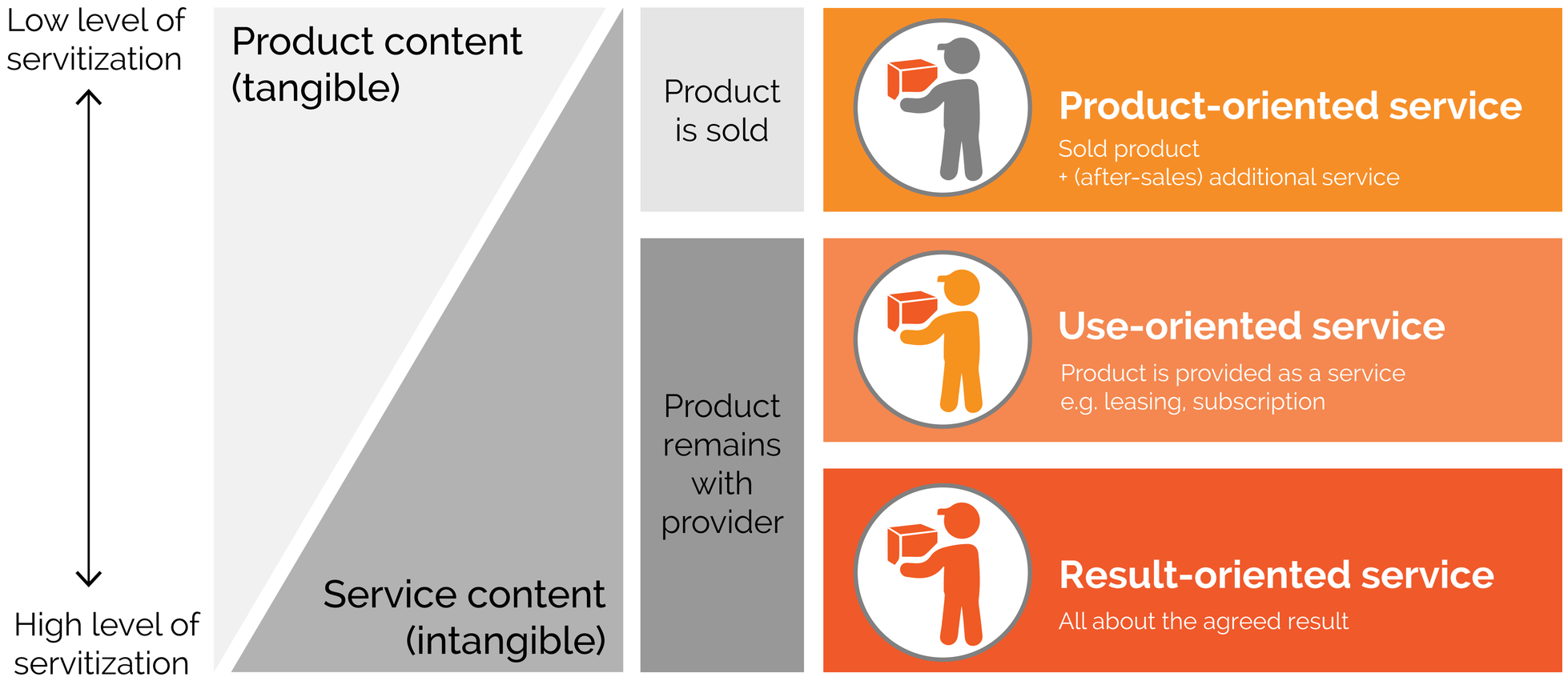


Figure 04: PSS categories, source; Tukker (2004) (own illustration)

PSS is a material leakage minimization contributor

PSS — **have**

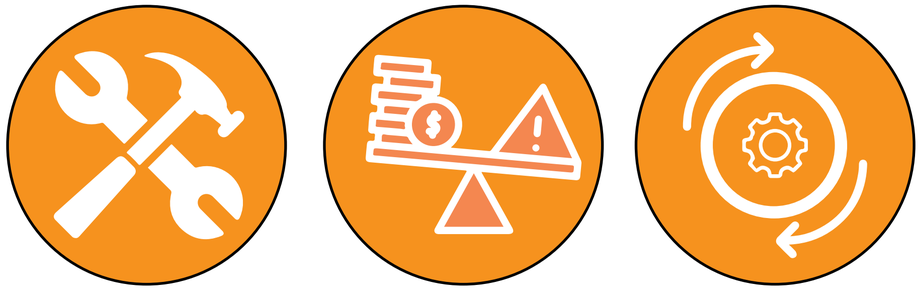
- Product-oriented service
- Use-oriented service
- Result-oriented service

PSS characteristics that could induce material leakage contributors

1. A proper product treatment
2. Most cost and re-source-effective way in product delivery
3. Support by specialized facilities and knowledge of PSS providers

PSS is a material leakage minimization contributor

PSS characteristics



Induce

Material leakage minimization contributions

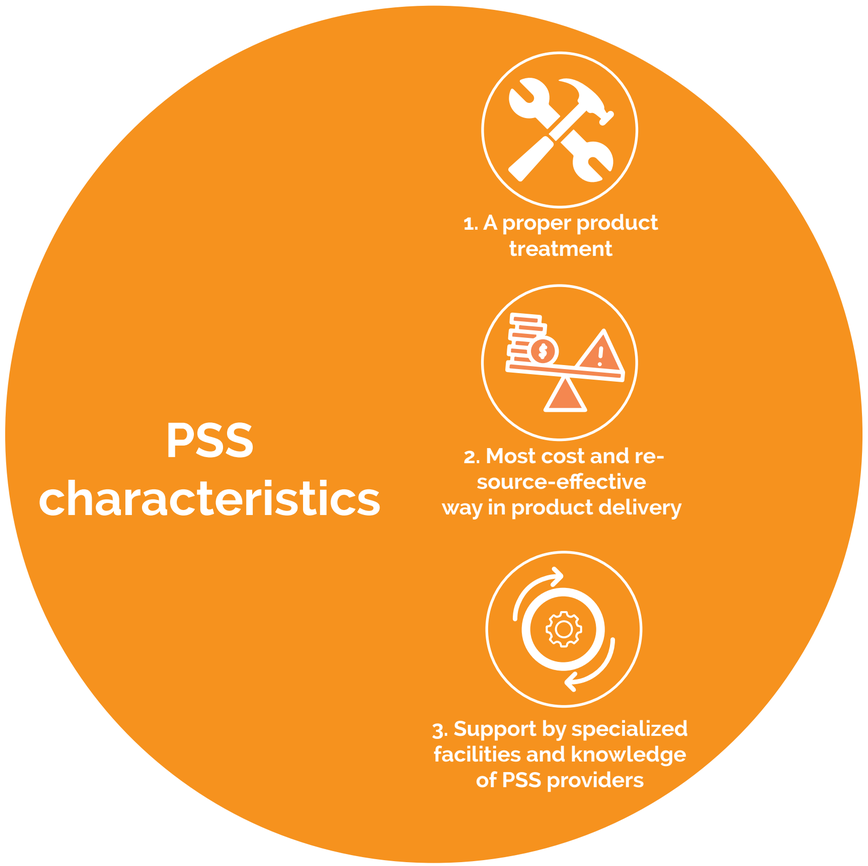
1. The efficiency of resource utilization improvement

2. Product life cycle extension

3. Product circularity improvemt

4. Optimizing waste recovery rate

PSS is a material leakage minimization contributor



Induce

Contribute to

Material leakage minimization

Material leakage minimization contributors

1. The efficiency of resource utilization im-provement

2. Product life cycle extension

3. Product circularity improvemt

4. Optimizing waste recovery rate

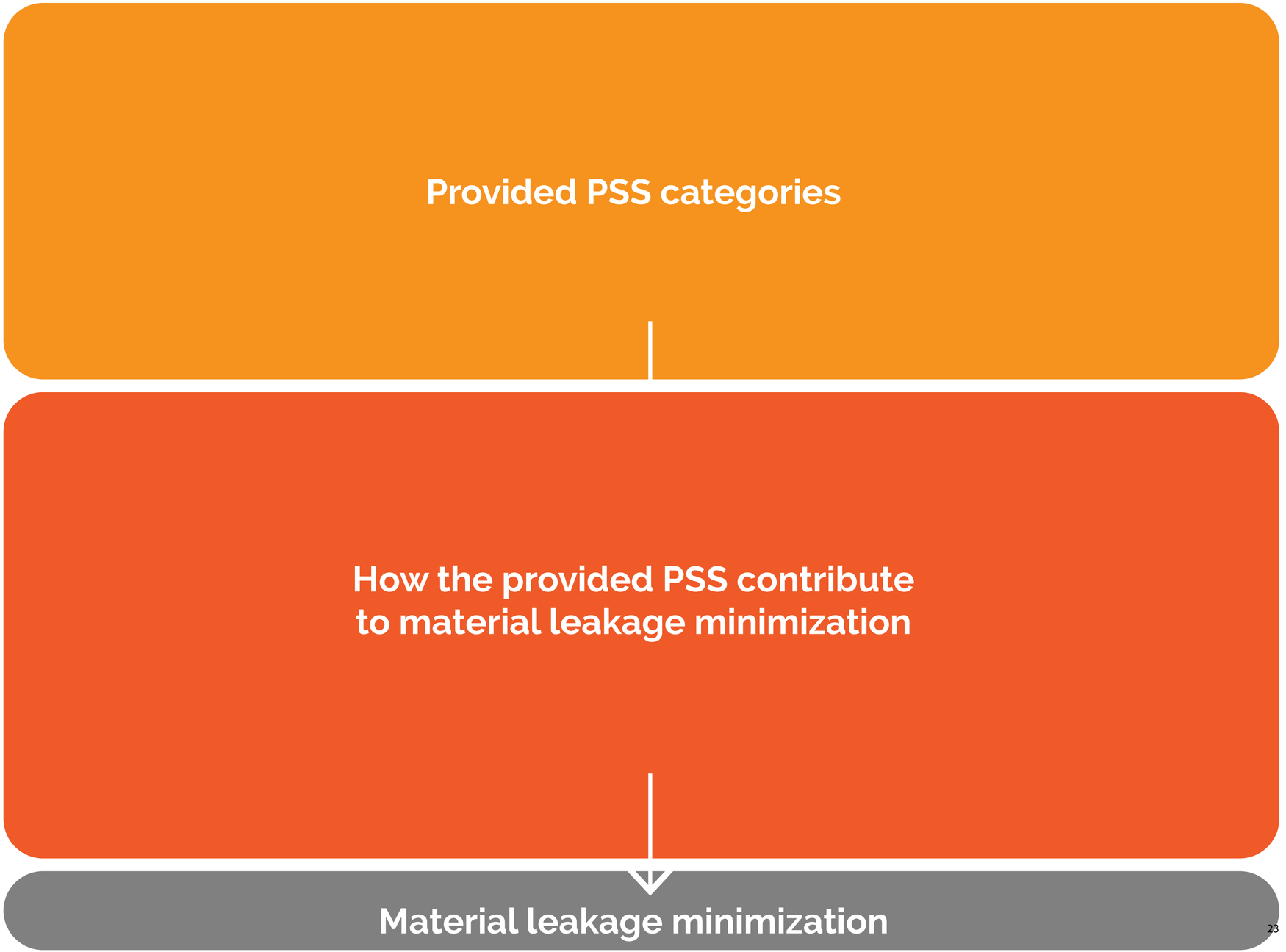
Product life-cycle

End-of-life management

Less material leakage

An analysis tool on how PSS could contribute to material leakage minimization

What aspect should an analysis tool consist of?

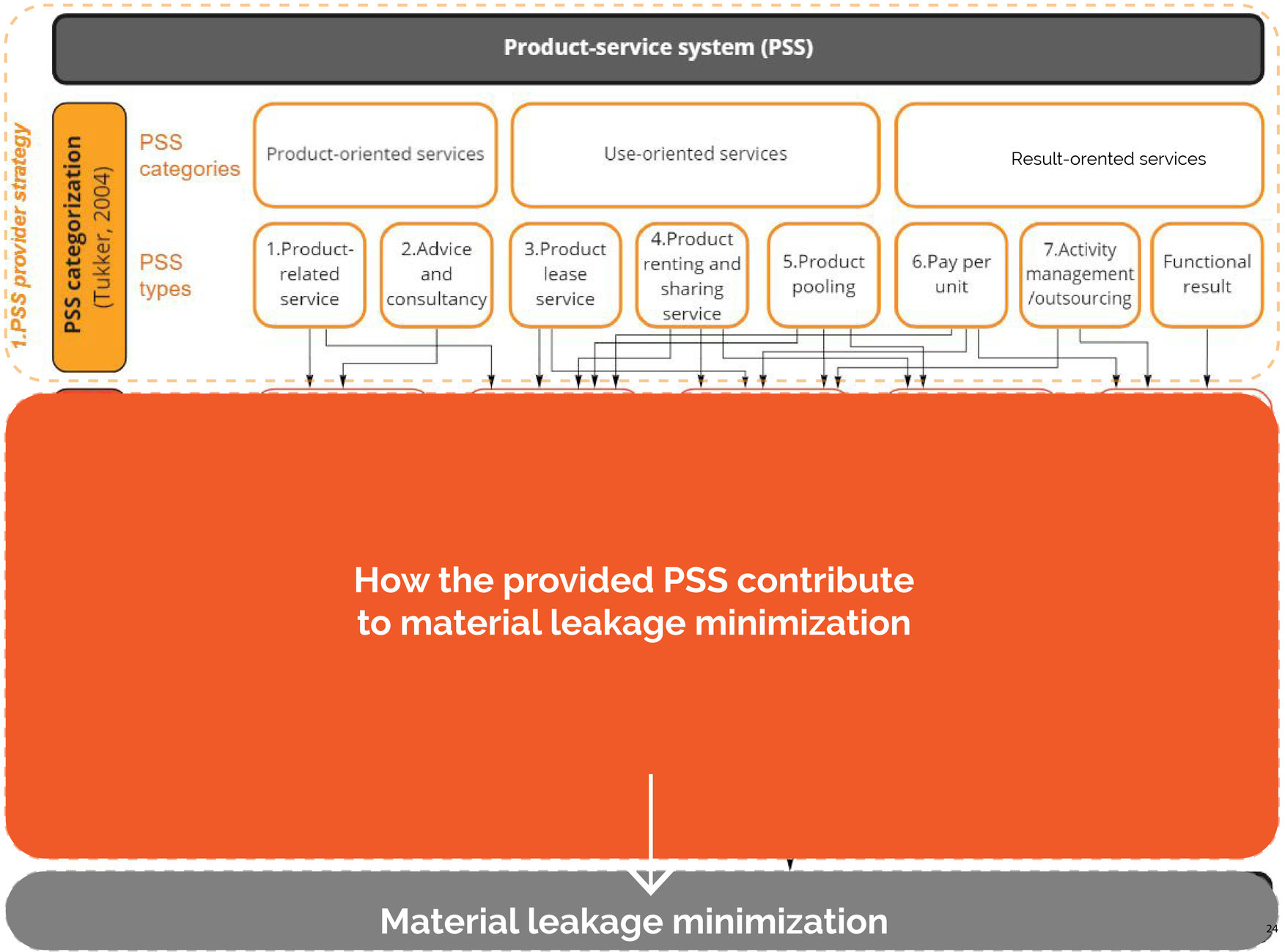


An analysis tool on how PSS could contribute to material leakage minimization

Framework set up
(combination of two theory)

8 PSS type/
3 PSS categories

PSS categories model
(Tukker, 2004)



An analysis tool on how PSS could contribute to material leakage minimization

Framework set up
(combination of two theory)

8 PSS type/
3 PSS categories

PSS categories model
(Tukker, 2004)

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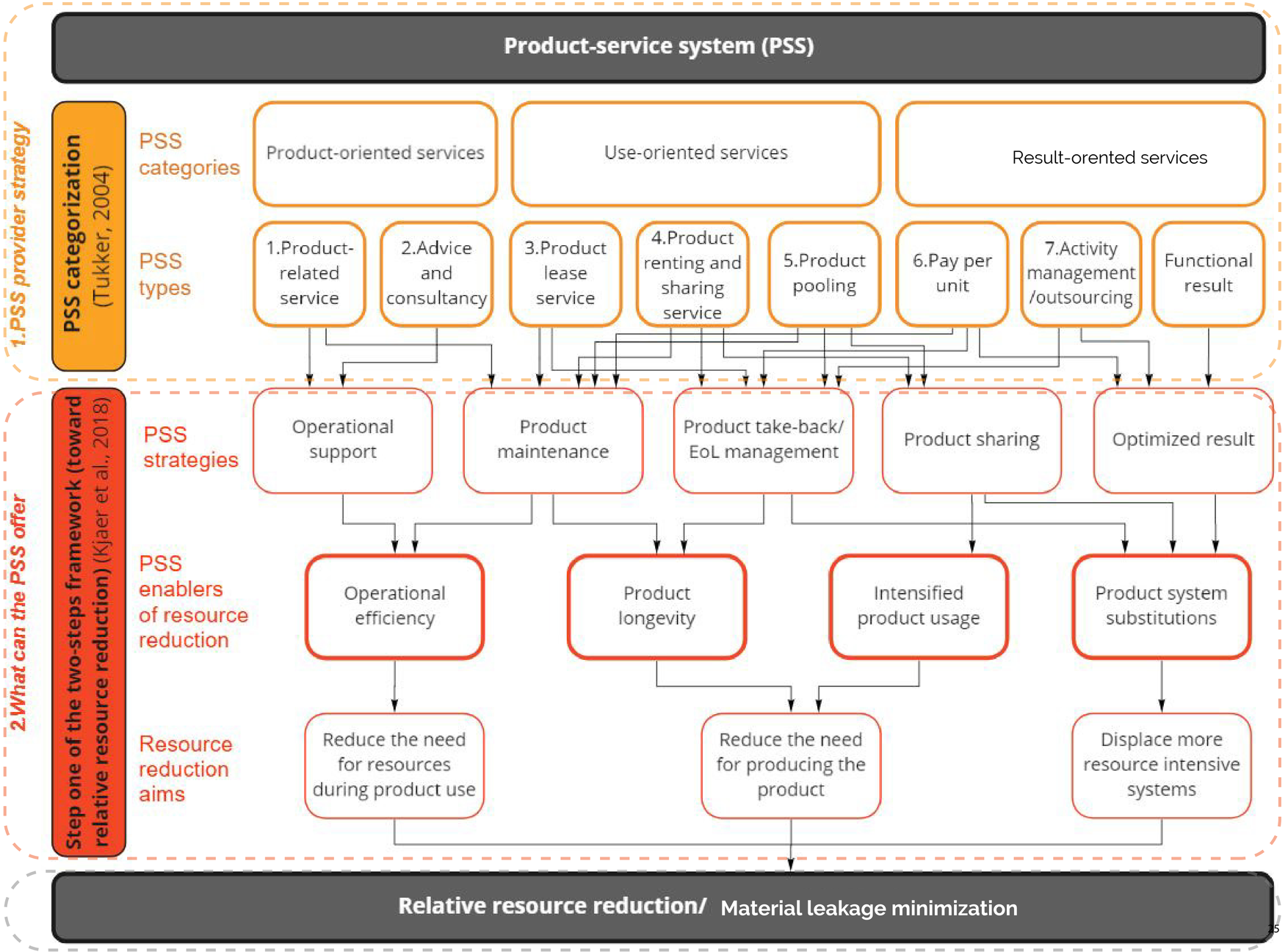
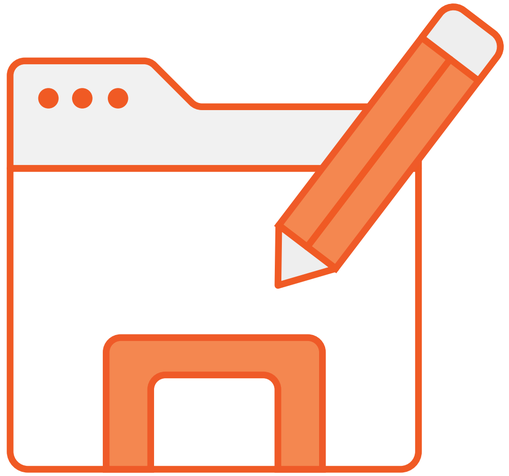
Step 1 — PSS to relative resource reduction

Only the first step is applied

Step 2 — Resource reduction to absolute resource decoupling

2-steps framework
(Kjaer et al, 2018)

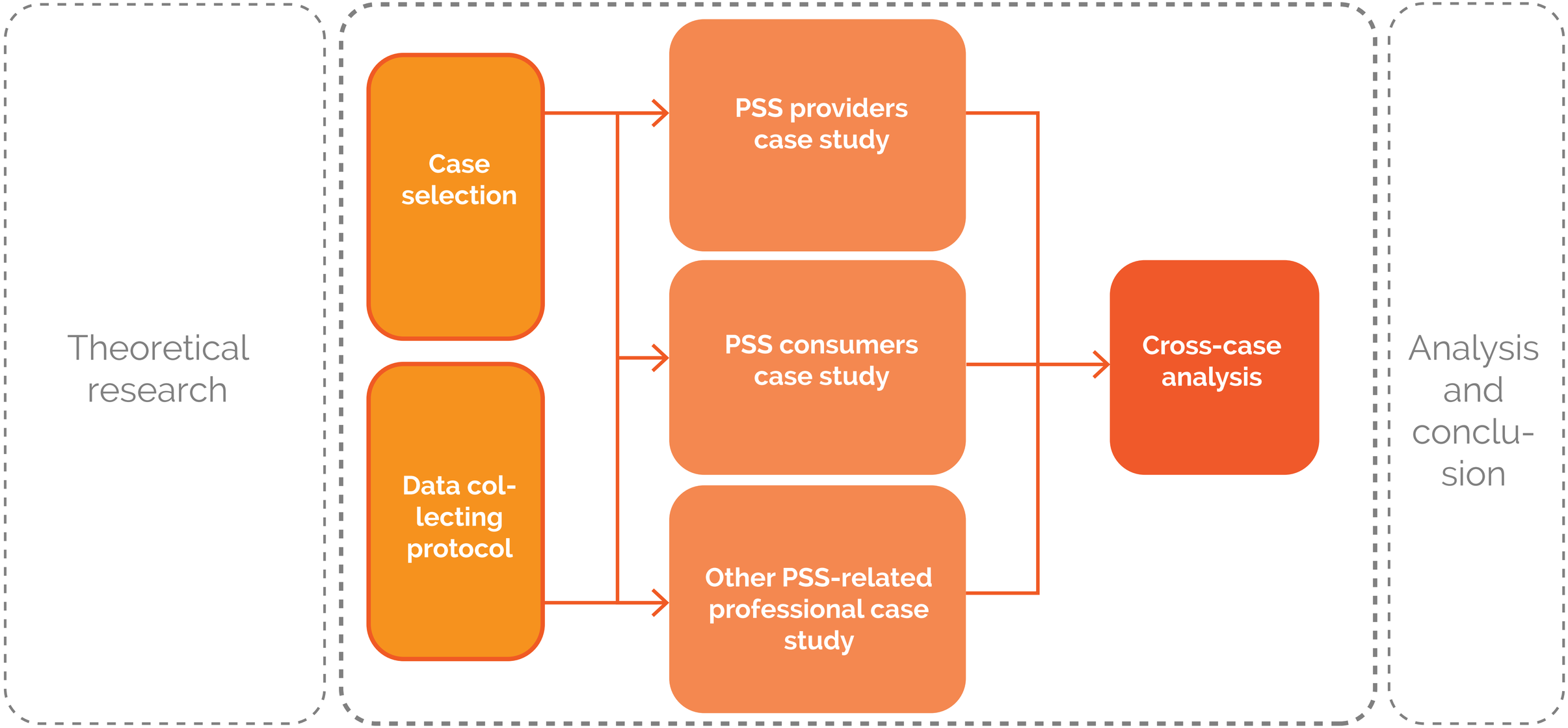




Empirical research design

(Case selection/ Data collecting protocol)

Three phases of empirical research



Phase1: Cases investigation objective

PSS providers

1. Provided PSS strategy

2. PSS to material leakage minimization contribution.

PSS consumers

1. A vision toward material leakage

2. Drivers to choose and barriers to not choosing PSS

Other PSS-related professionals

1. Situation of PSS nowadays

2. External factors that influence implementing PSS

Phase1: Cases selection criteria

	PSS providers	PSS consumers	Other PSS-related professionals
Required criteria	1. Available for interview 2. Provides PSS to the office 3. offers at least one of the PSS categories	1. Available for interview 2. Medium+ sized corporation	1. Available for interview 2. can provide an overview of the current situation of PSS
Preferred criteria	1. Providing PSS and other CE strategy	1. Experienced various office refurbishment	1. Has insight knowledge of the entire PSS life cycle

Phase1: All the selected cases

PSS providers

Company M
(Elevator as a service)

Company A
(Furniture as a service)

Company I
(Circular carpet)

PSS consumers

Company P
(Fast-fashion shopping store)

Company V
(Hi-technology manufacturer)

University E
(University in the Netherlands)

Other PSS-related professionals

Company L
(Leasing professionals and a representative)

Company T
(Furniture design company in Thailand)

Phase2: Case study investigation

Stakeholders address in the cases study

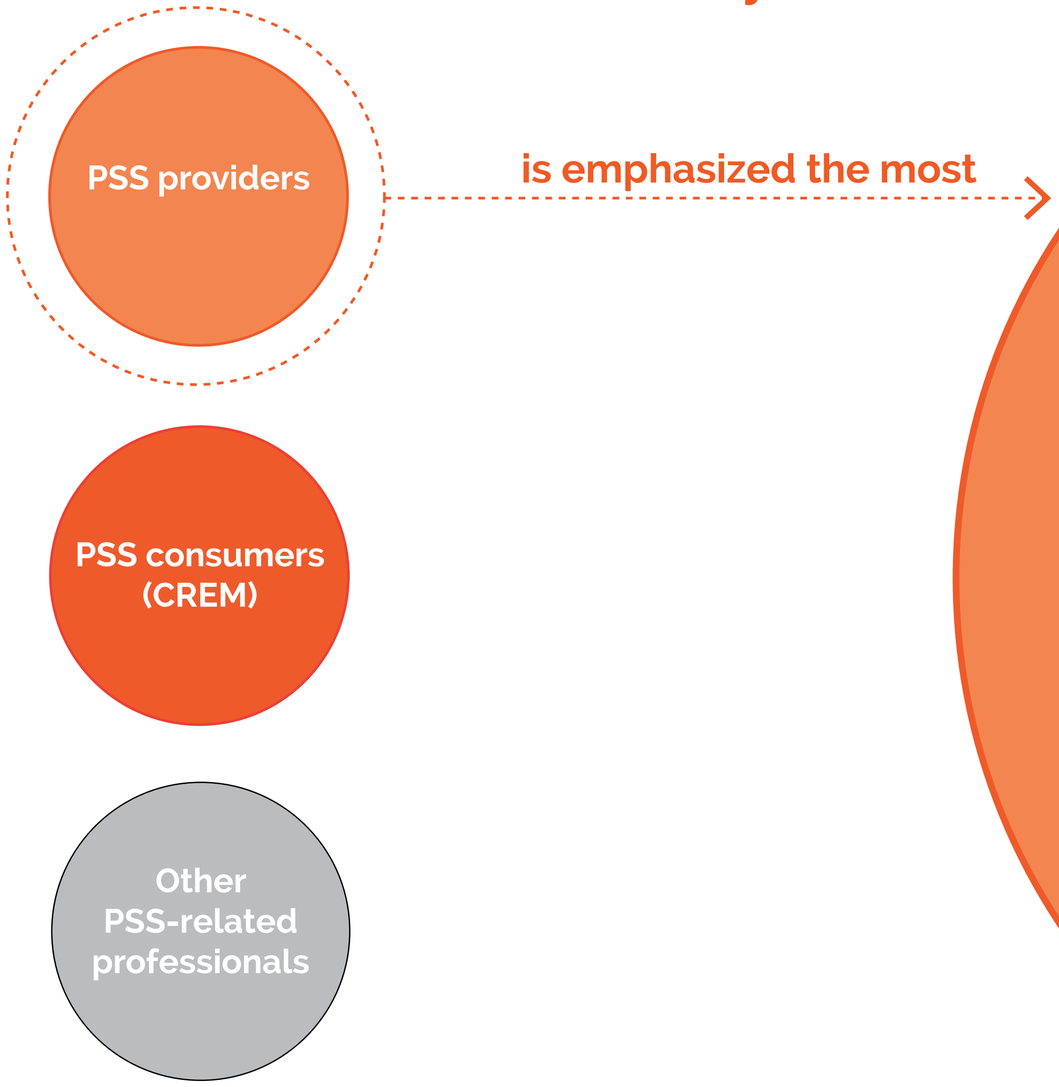


Figure 06: Empirical research stakeholders address (own illustration)

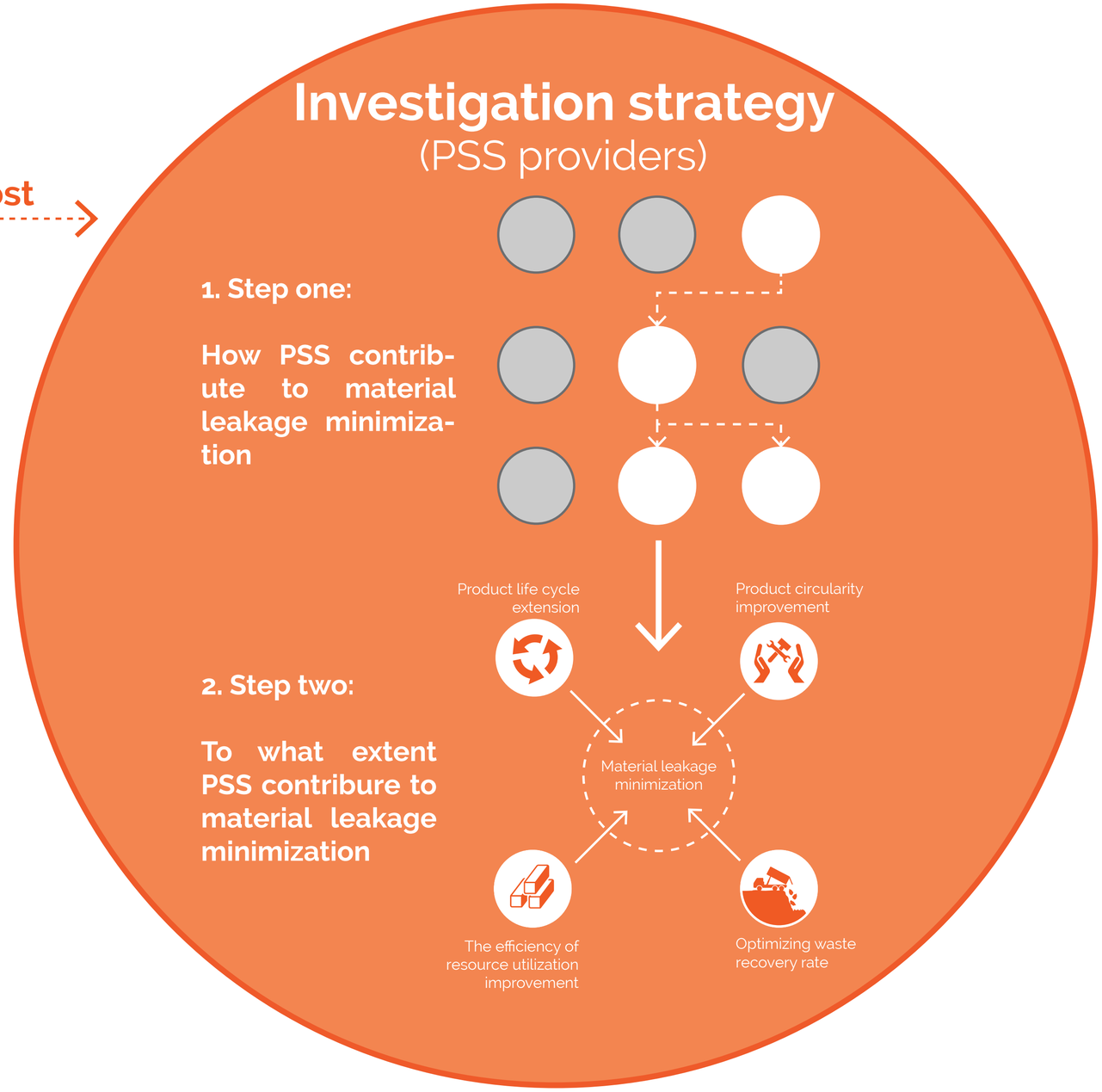
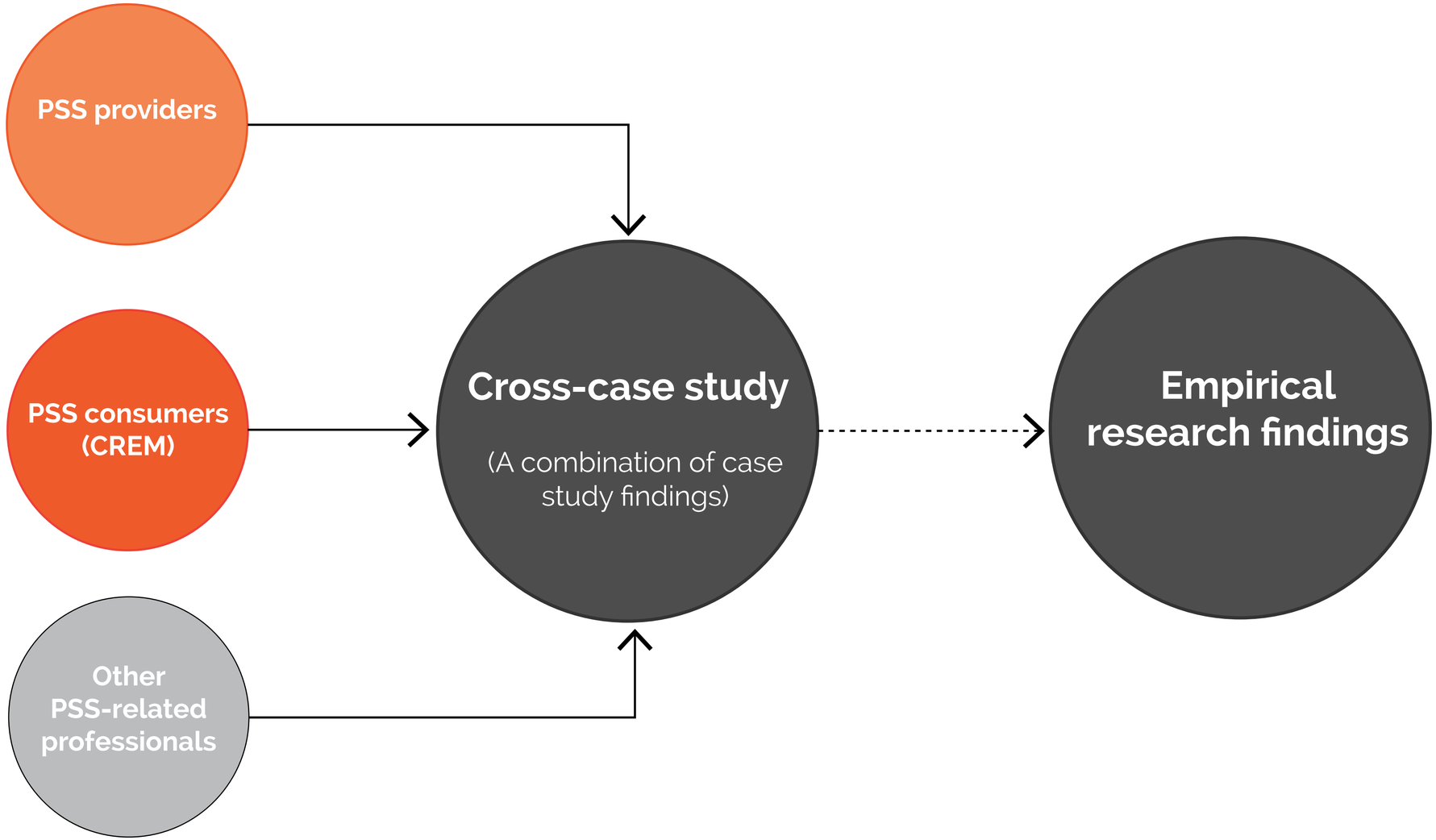


Figure 07: PSS provider case study investigation strategy (own illustration)

Phase3: Evaluation and analysis



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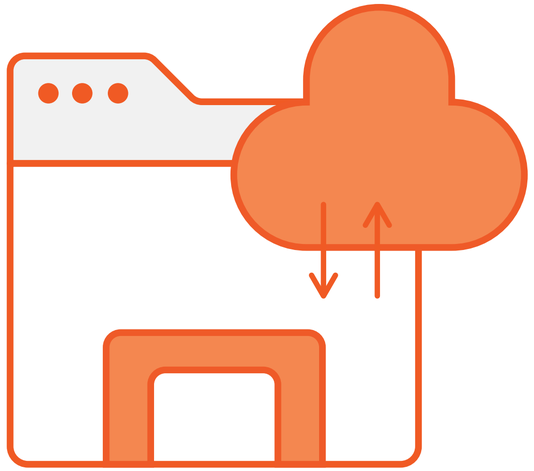


Empirical research result

(Case study results/ cross-case analysis)

PSS providers investigation phase one; How/ what strategies each PSS applies to contribute to material leakage minimization

Company M
(Elevator as a service)

Offer

1. Smart sensors and intelligent systems
3. Performance contract (pay-per-use)
2. On site maintenance, repair
4. Material passport

Company A
(Furniture as a service)

Offer

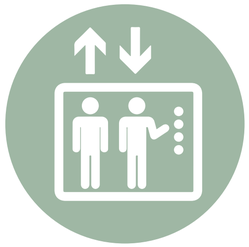
1. FAAS online platform
3. Furniture subscription (operational lease)
2. On site maintenance, repair
4. Circular hub (facilities)

Company I
(Circular carpet)

Offer

1. Using fully recycled
3. Buyback guarantee
2. Modular carpet
4. Customer training

PSS providers investigation phase one; How/ what strategies each PSS applies to contribute to material leakage minimization



Company M
(Elevator as a service)

Company A
(Furniture as a service)

Company I
(Circular carpet)

1. Smart sensors and intelligent systems

2. On site maintenance, repair

Product-oriented services features:

3. Performance contract (pay-per-use)

4. Material passport

Result-oriented services features:

1. FAAS online platform

2. On site maintenance, repair

Product-oriented services features:

3. Furniture subscription (operational lease)

4. Circular hub (facilities)

Use-oriented services features:

1. Using fully recycled

3. Buyback guarantee

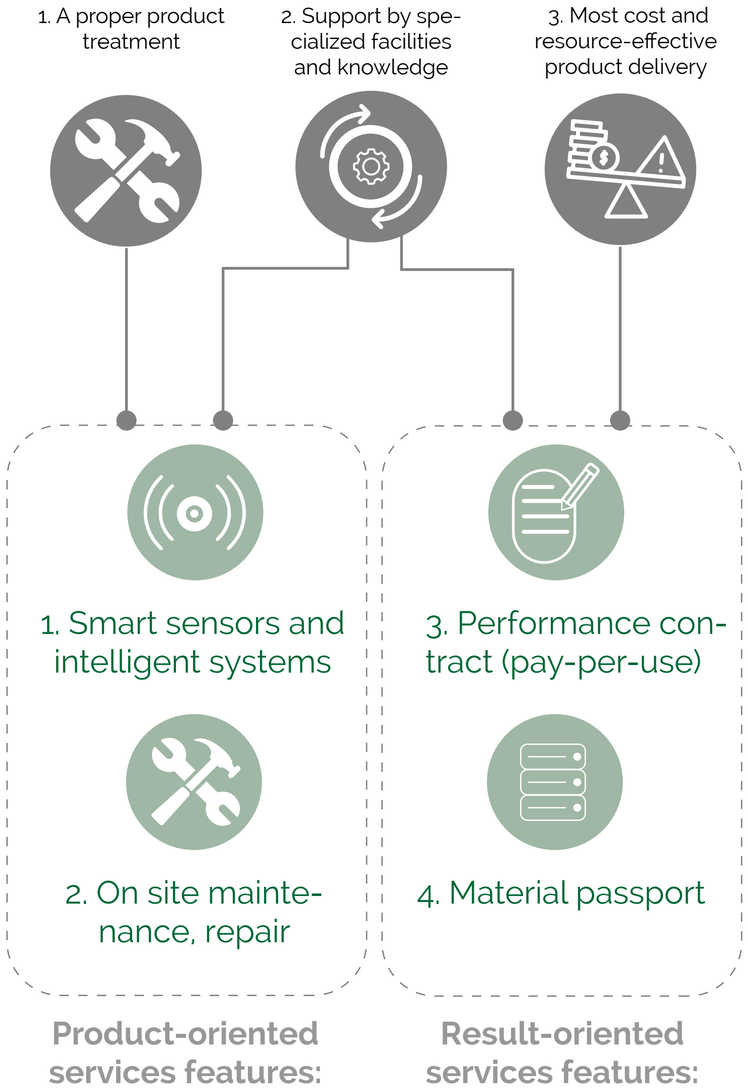
2. Modular carpet

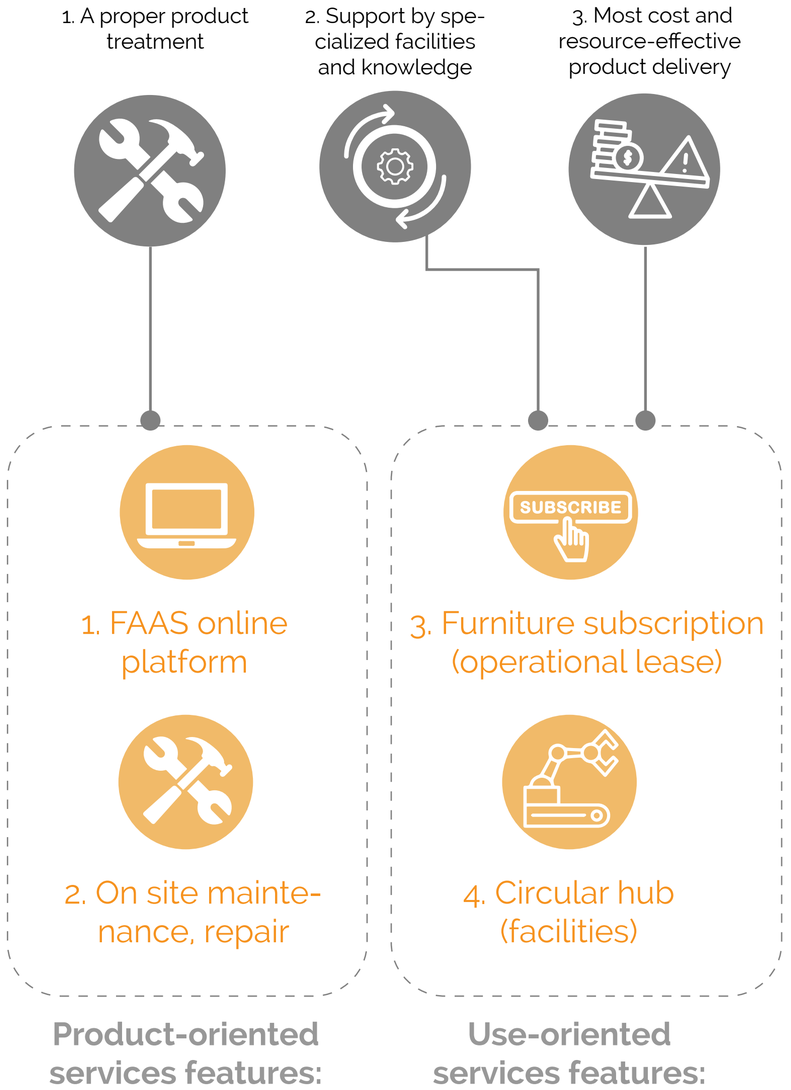
4. Customer training

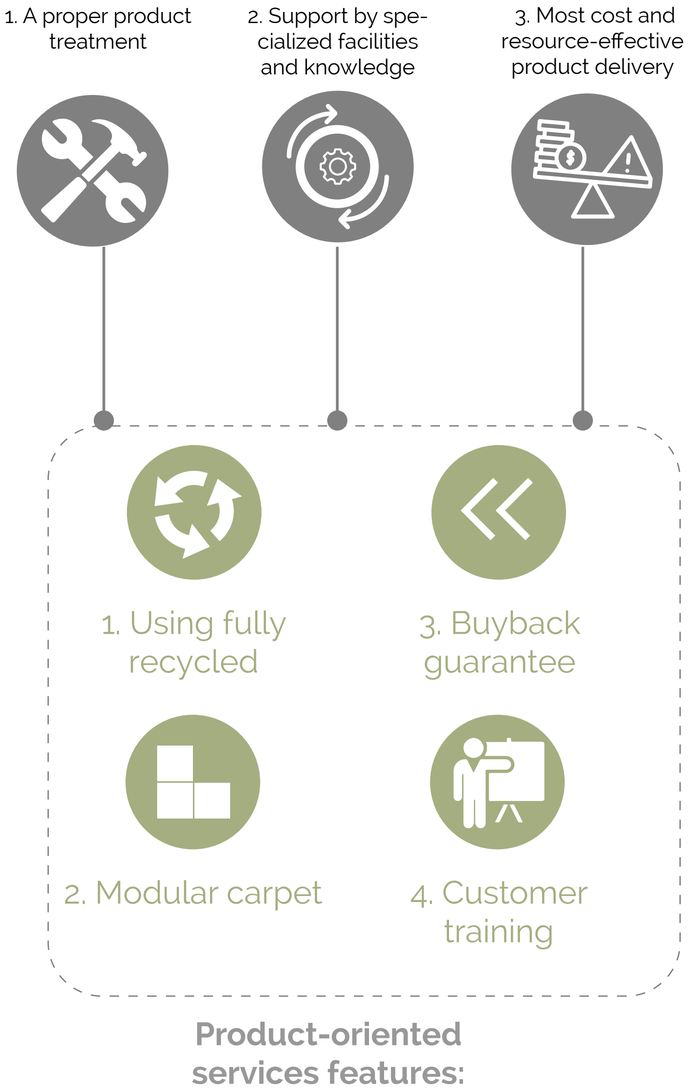
Product-oriented services features:

PSS providers investigation phase one; How/ what strategies each PSS applies to contribute to material leakage minimization

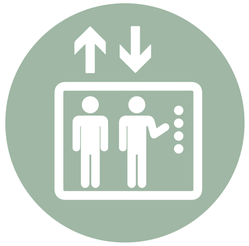
The presence of the PSS characteristics







PSS providers investigation phase one; How/ what strategies each PSS applies to contribute to material leakage minimization



Company M
(Elevator as a service)

Company A
(Furniture as a service)

Company I
(Circular carpet)

How they contribute to material leakage minimization

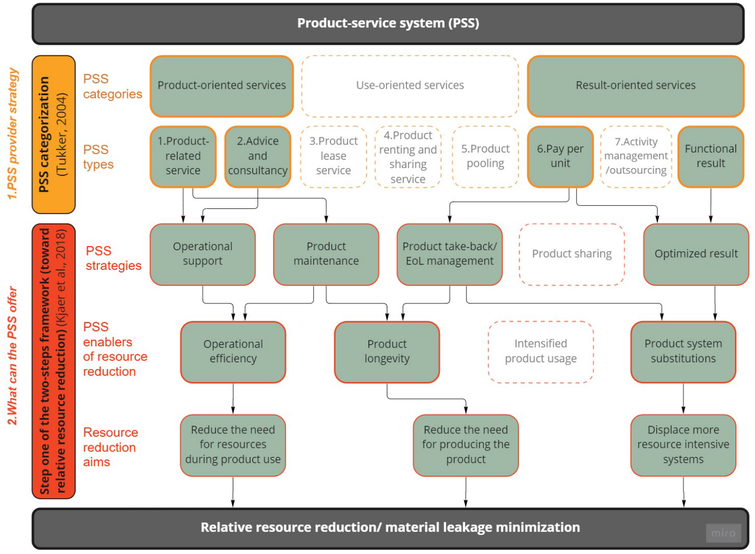


Figure 10: How could elevator as a service contribute to office material leakage minimization. Analyzed by using PSS categories+two-step framework, Source: Company M publication (n.d.), (Own illustration)

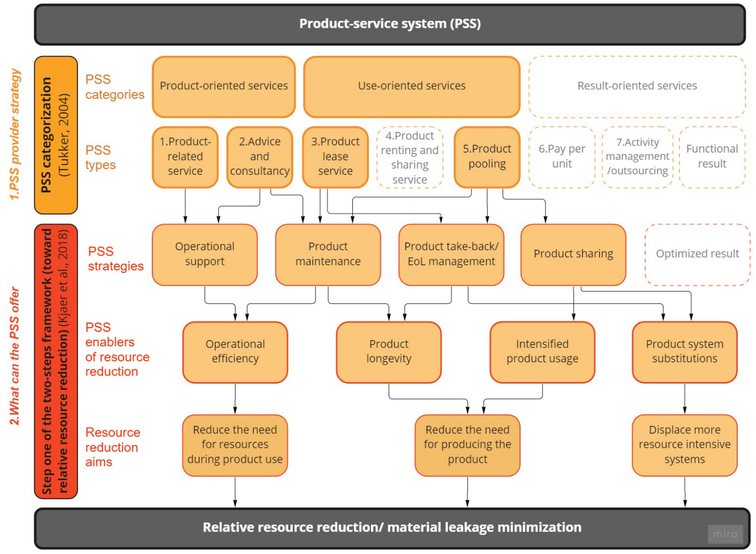


Figure 11: How could FAAS contribute to office material leakage minimization. Analyzed by using PSS categories+two-step framework, Source: Ahrend web page (n.d.); S.P., personal communication, 2022 (Own illustration)

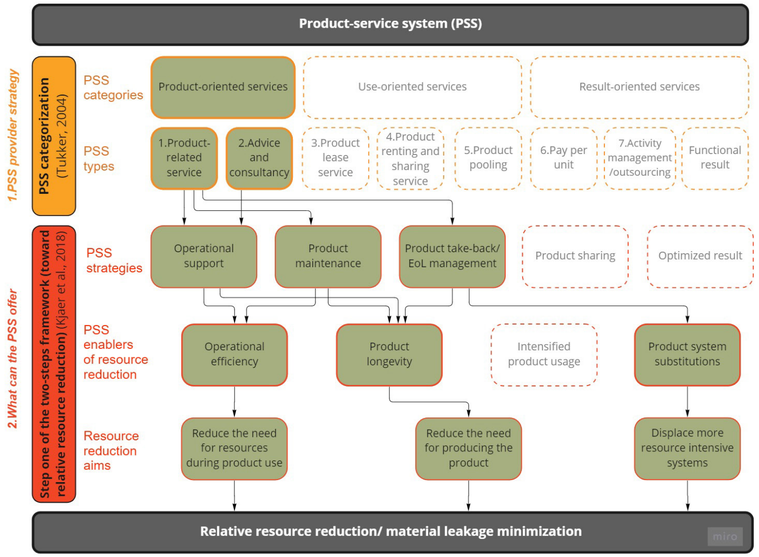


Figure 12: How could Interface carpet contributes to office material leakage minimization,
Source: Company I-related literature 1 (2021); Company I-related literature 2 (2021); J.L., personal communication (2022), (Own illustration)

PSS providers investigation phase two; The level of material leakage contributions improvement of each PSS provider case study

Company M
(Elevator as a service)

Company A
(Furniture as a service)

Company I
(Circular carpet)

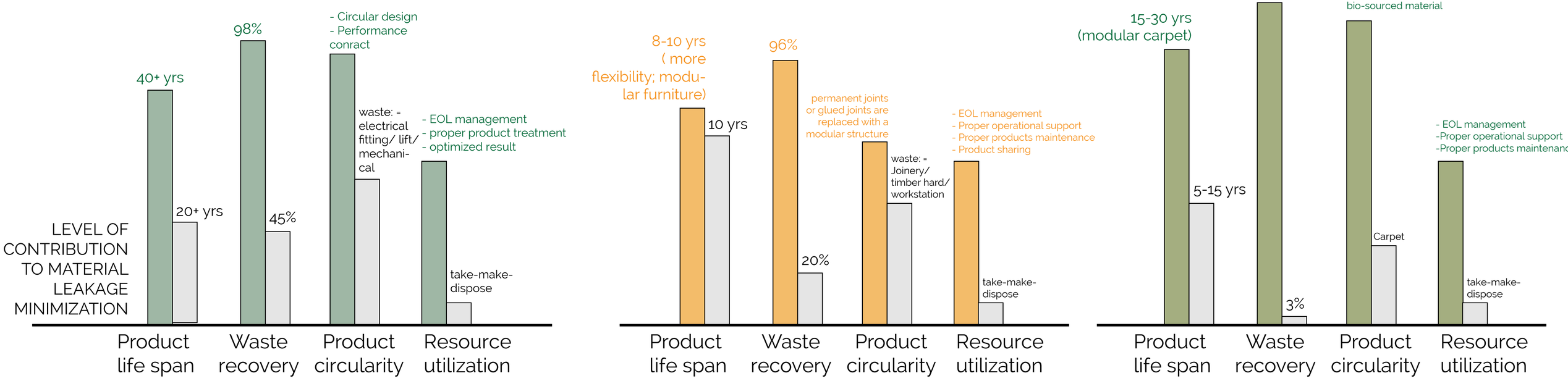


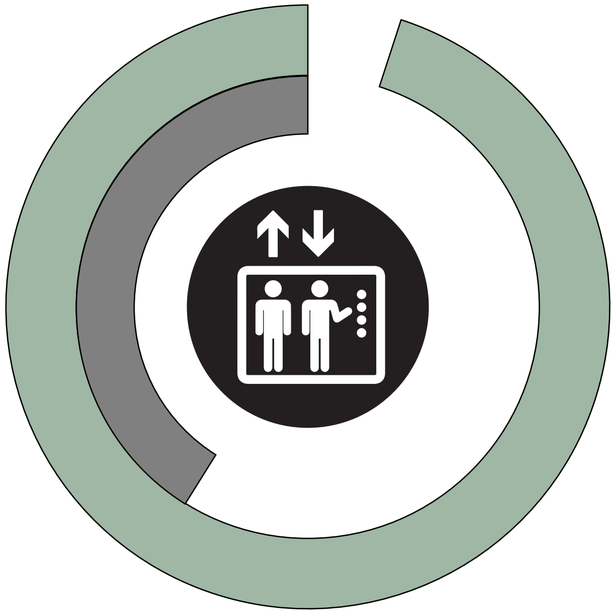
Figure 13: Material leakage minimization contribution and circularity improvement of each case study (own illustration)

= value of material leakage contributors of the avereage linear product

= value of material leakage contributors of the PSS product

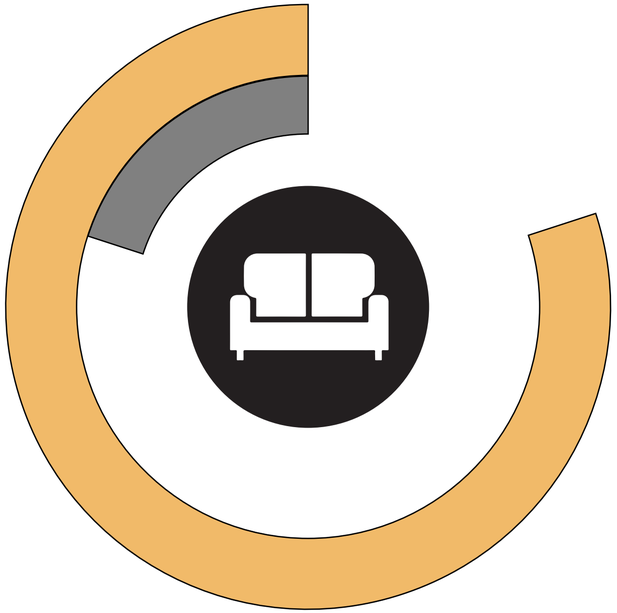
PSS providers investigation phase two; The level of material leakage contributions improvement of each PSS provider case study

Company M
(Elevator as a service)



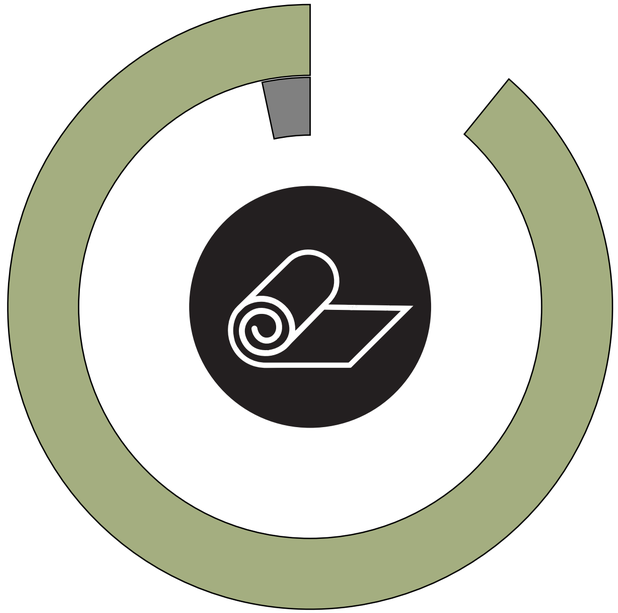
Circularity of
PSS porfolio = apprx 95%+

Company A
(Furniture as a service)



Circularity of
PSS porfolio = apprx 80%+

Company I
(Circular carpet)



Circularity of
PSS porfolio = apprx 90%+

= value of material leakage contributors of the avereage linear product

= value of material leakage contributors of the PSS product

Figure 14: Material leakage minimization contribution and circularity improvement of each case study (own illustration)

Cross-case analysis

Cross-case analysis (PSS providers)

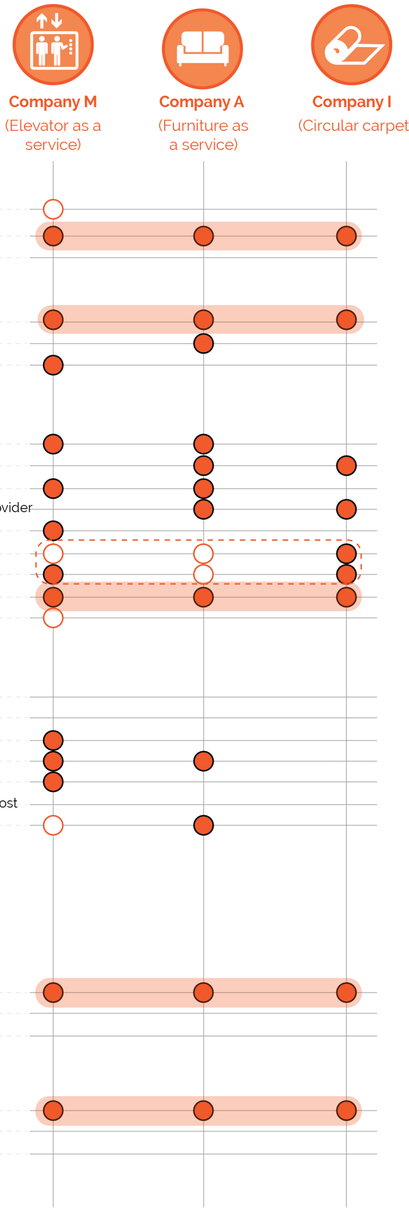


Figure 14: Cross-case study analysis results; PSS providers (own illustration)

Cross-case analysis (PSS consumers)

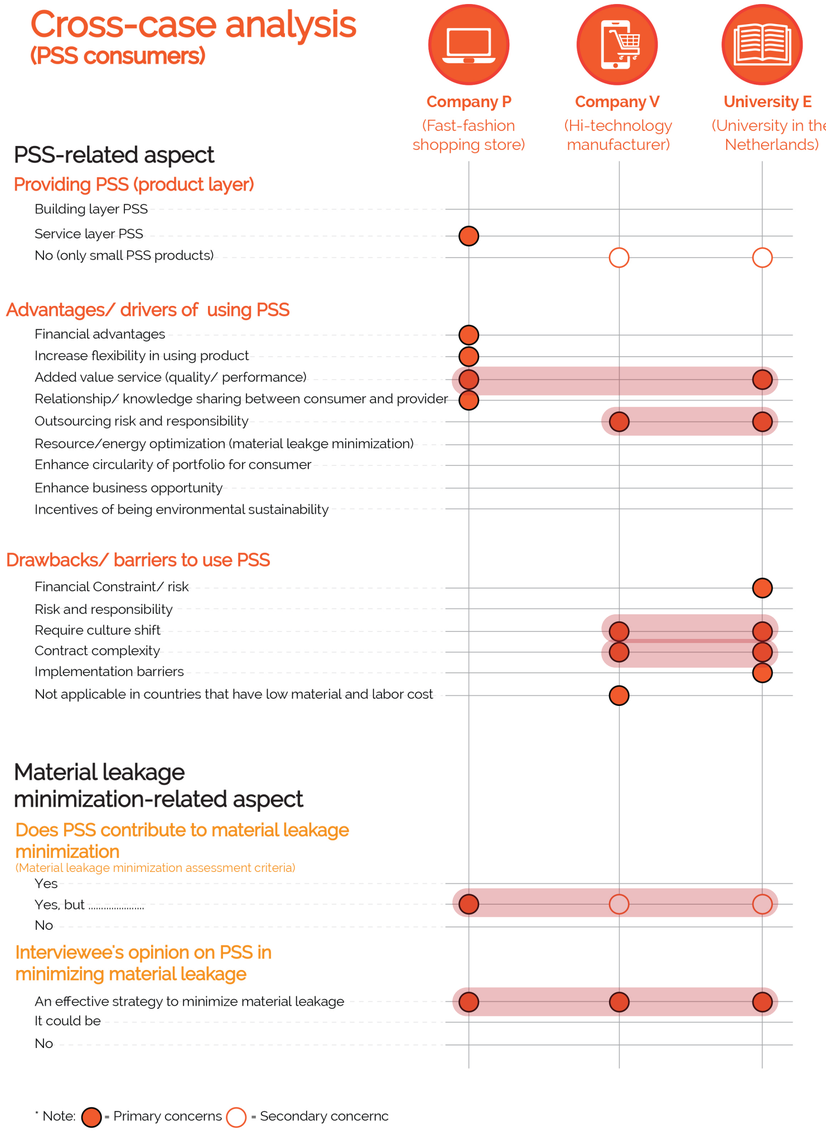


Figure 15: Cross-case study analysis results; PSS consumers (own illustration)

Cross-case analysis (other PSS-related professionals)

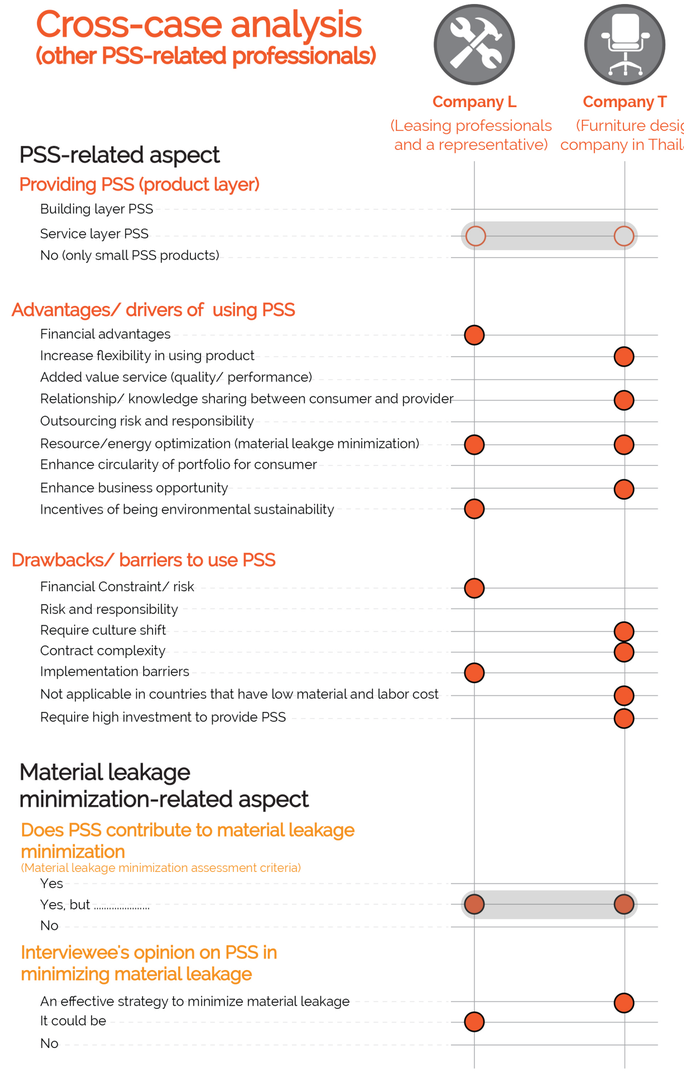
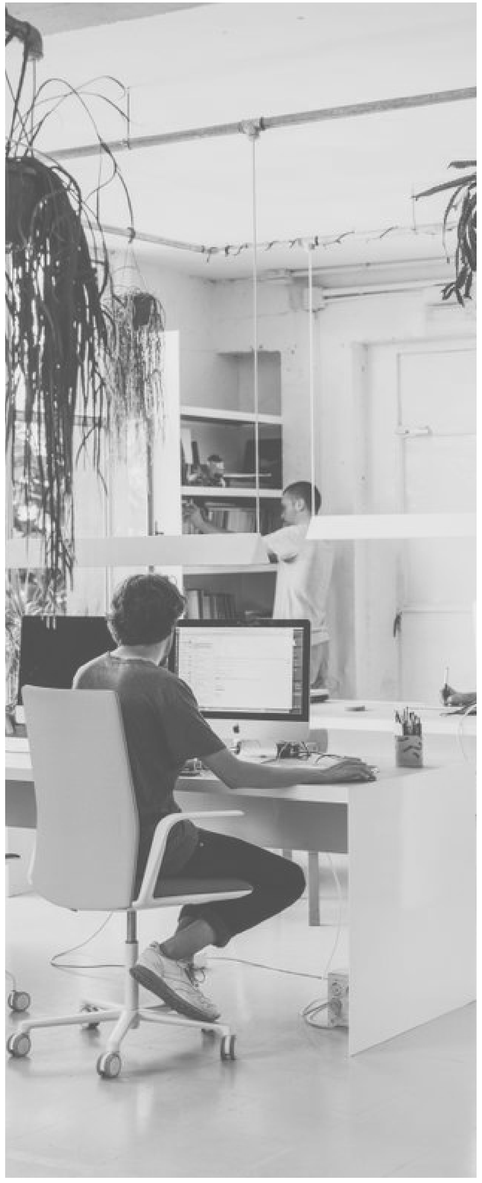


Figure 16: Cross-case study analysis results; ther PSS-related professionals (own illustration)

Cross-case analysis

PSS providers (3 cases)



PSS-related aspect

- Most of provided PSS is service layer

- Main Provider objective = enhance their business opportunities/ gain more company profit

- Challenges: Culture shift and contract complexity

Material leakage-related aspect

- All the PSS characteristic that could induce material leakage is present

- All material leakage contributors in PSS is greater than linear economy product

- Greater product circularity

Cross-case analysis

PSS consumers (3 cases)

PSS-related aspect

- No one has experience using building layer PSS

- Outsourcing risk and responsibility/ financial benefit are the main drivers/ added functional value

- Culture shift in using PSS and contract complexity are major barriers

Material leakage-related aspect

- All of the interviewees are aware that PSS could lead to material leakage minimization

Cross-case analysis

Other PSS-related professional (2 cases)

PSS-related aspect

- Two of them have differnt view on the benefits and drawbacks of PSS

- But Both of them agree that resource optimization is an advantage of PSS implementation

Material leakage-related aspect

- Both of them aware that material leakage reduction is a consequence of PSS implementation

- But material leakage minimization of PSS is often disregarded (from what they have experienced)

Inclusive cross-case study analysis - (case study findings)

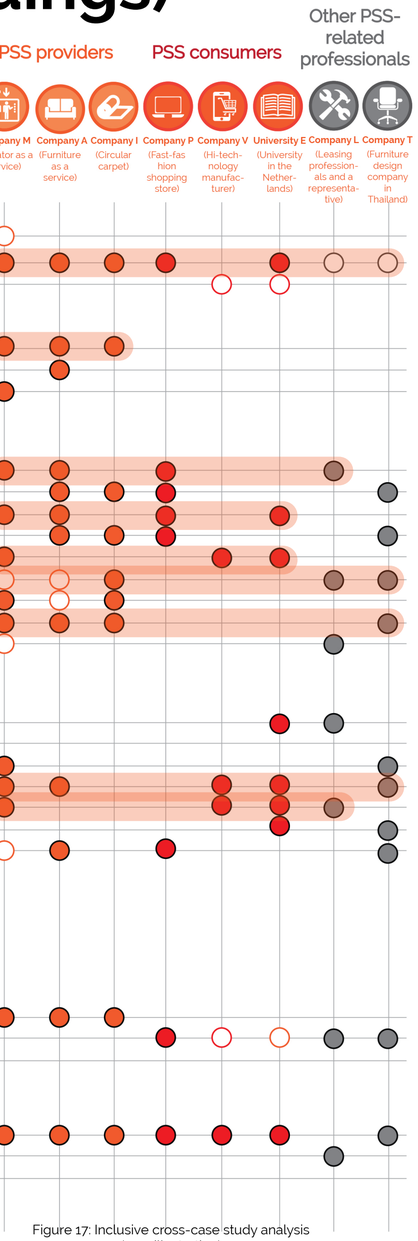


Figure 17: Inclusive cross-case study analysis (own illustration)

PSS-related aspect

1. Building layer PSS is hardly implemented.

2. Product-oriented service are provided/ used the most.

3. PSS providers --> **enhance the business opportunity for earning more profit**.
- resource optimization is one strategy to earn more profit

4. Consumer ---> **best facilitate their business** (financial advantage/ flexibility/ outsourcing risk).

5. Material leakage is not yet a primary driver.

6. Complexity of PSS contract and implementation = barriers

Inclusive cross-case study analysis - (case study findings)

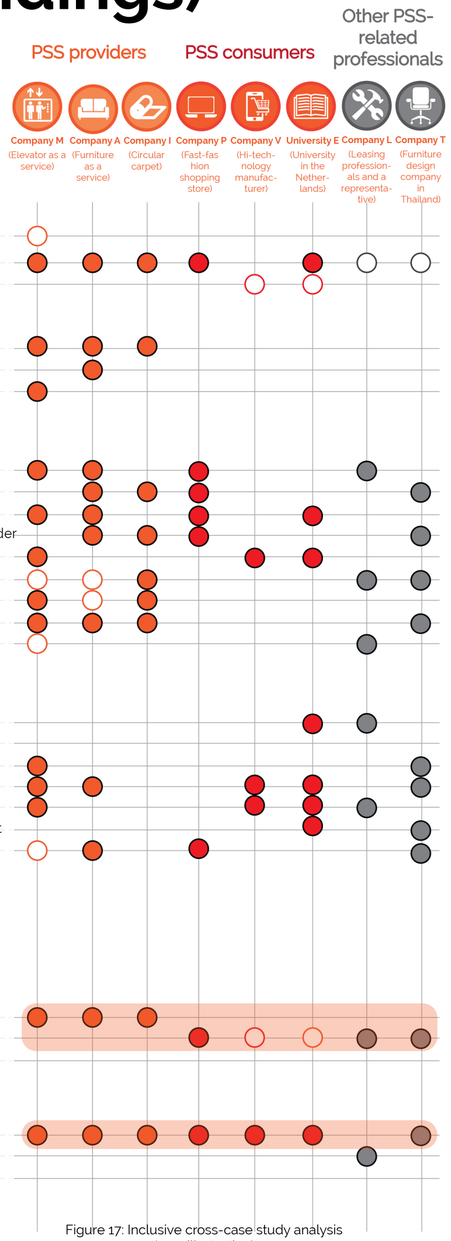
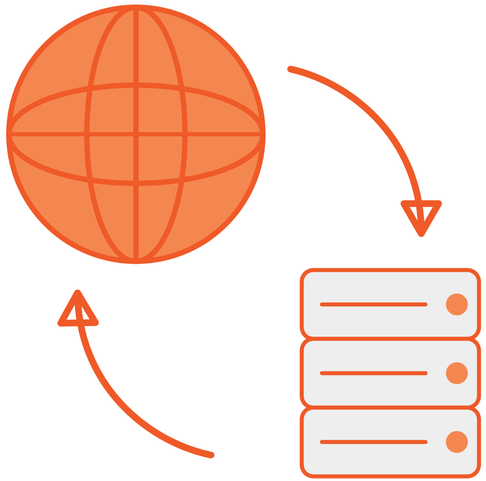


Figure 17: Inclusive cross-case study analysis (own illustration)

Material leakage minimization-related aspect

1. All of the interviewees are aware that material leakage minimization is a consequence of PSS implementation

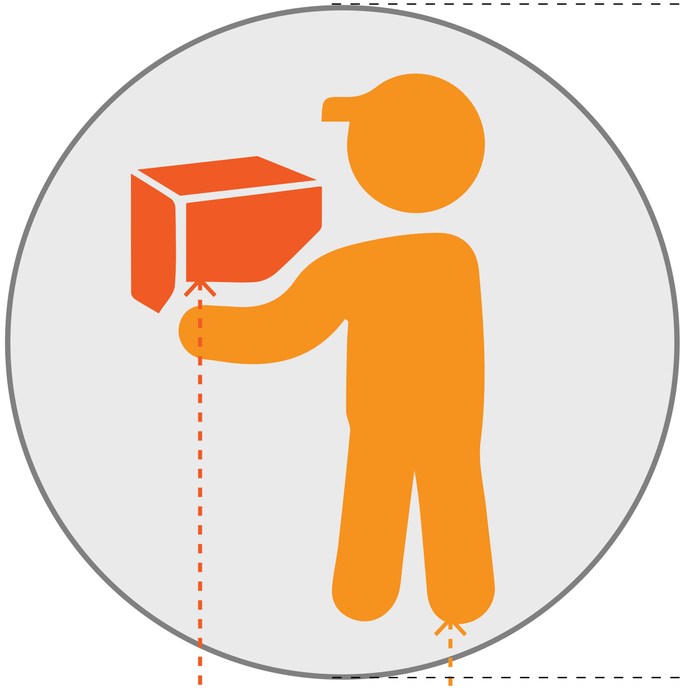
2. From the interviewees' perspective, PSS could be an effective solution for material leakage issue



Analysis/
conclusion

1. What is the Product-service system (PSS)? And what is the potential of PSS to minimize material leakage in office refurbishment?

PRODUCT-SERVICE SYSTEM IS



Tangible product + Intangible service

PRODUCT-SERVICE SYSTEM IS CATEGORIZED AS

- Product-oriented service
- Use-oriented service
- Result-oriented service

Product is sold

Product remains with provider

Low level of servitization

High level of servitization

TO

Meet consumers' demand

1. What is the Product-service system (PSS)? And what is the potential of PSS to minimize material leakage in office refurbishment?

PSS CHARACTERISTIC

1. A proper product treatment
2. Most cost and re-source-effective way in product delivery
3. Support by specialized facilities and knowledge of PSS providers

MATERIAL LEAKAGE MINIMIZATION CON-TRIBUTORS

1. The efficiency of resource utilization improvement
2. Product life cycle extension
3. Product circularity improvemt
4. Optimizing waste recovery rate

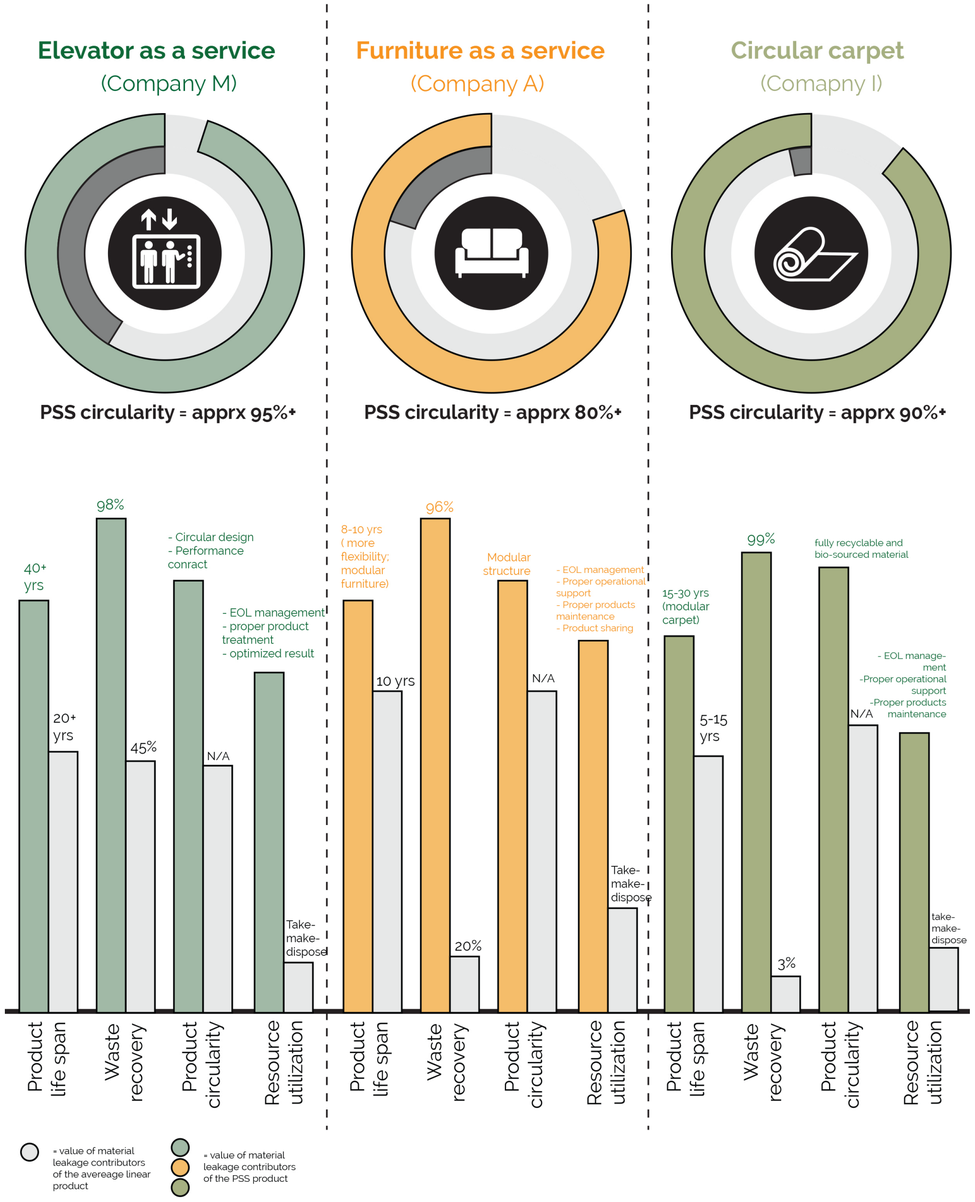
Material leakage minimization

2. In real practice, to what extent is material leakage minimized by the product-service system?

CASE STUDY

PRODUCT CIRCULARITY

LEVEL OF CONTRIBUTION TO MATERIAL LEAKAGE MINIMIZATION



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CASE STUDY

PRODUCT CIRCULARITY

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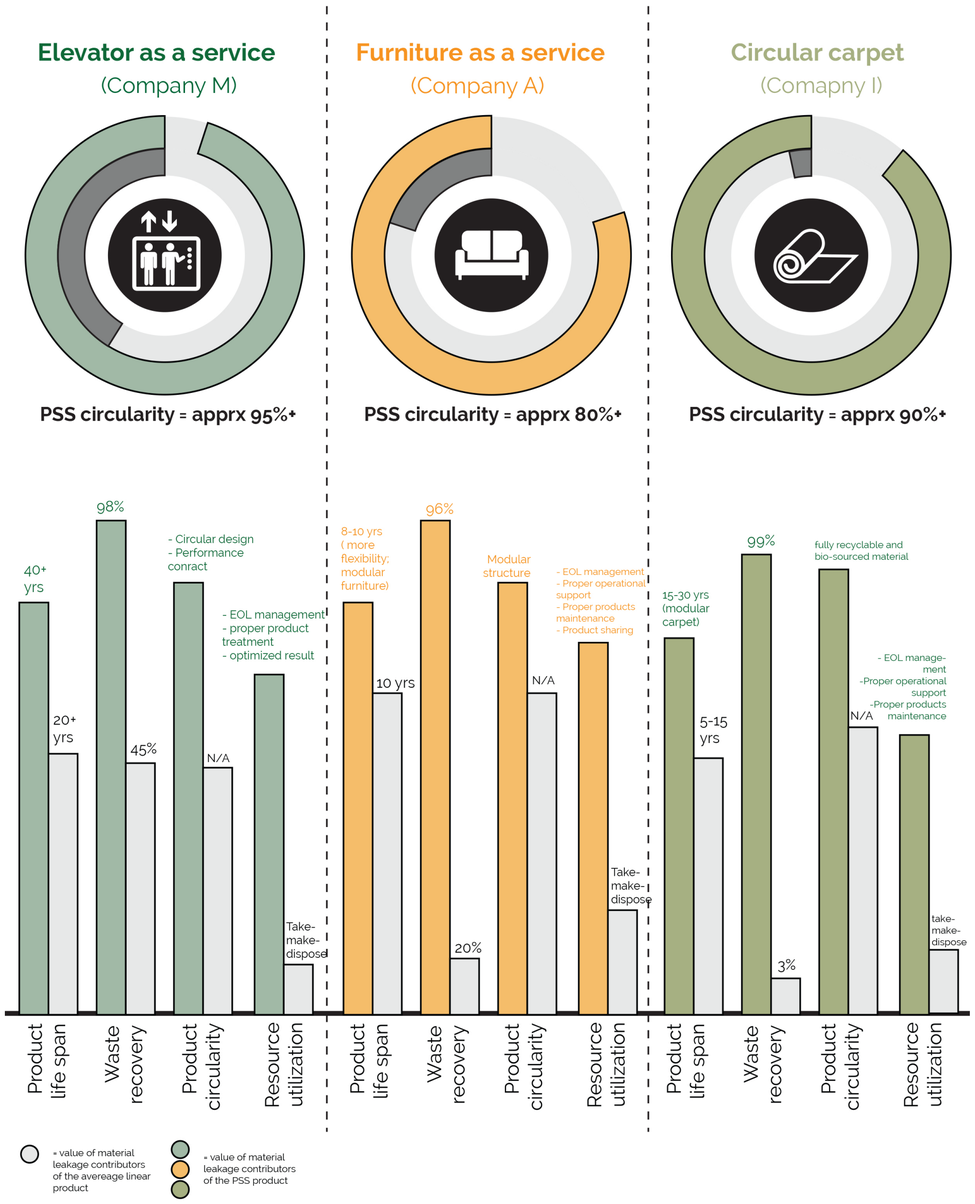


Linear-economy
(Take-make-dispose)

<

Product-service systems

2. In real practice, to what extent is material leakage minimized by the product-service system?

CASE STUDY

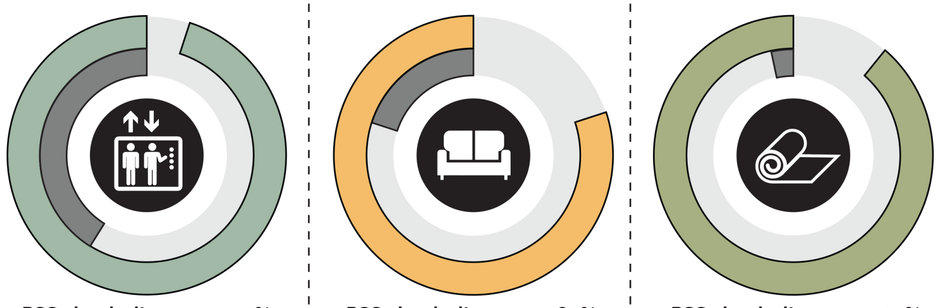
PRODUCT CIRCULARITY

LEVEL OF CONTRIBUTION TO MATERIAL LEAKAGE MINIMIZATION

Elevator as a service
(Company M)

Furniture as a service
(Company A)

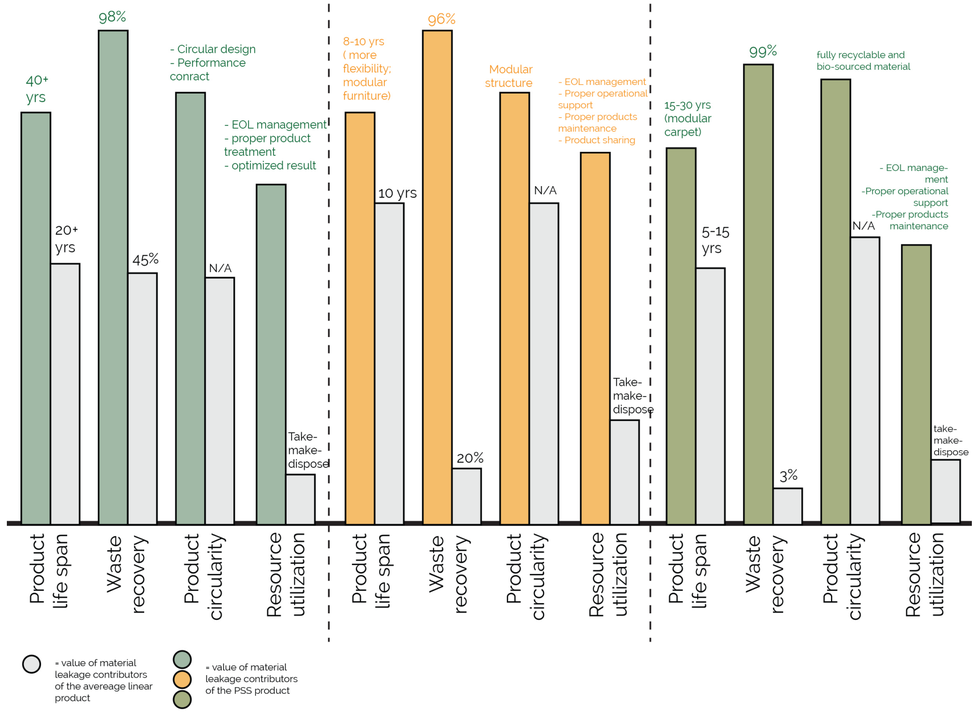
Circular carpet
(Comapny I)



PSS circularity = apprx 95%+

PSS circularity = apprx 80%+

PSS circularity = apprx 90%+



Theoretical findings

Aligned!

Empirical findings

3. What are the benefits of a Product-service system (PSS) to the consumers and PSS providers?

Benefits of providing PSS (PSS providers)

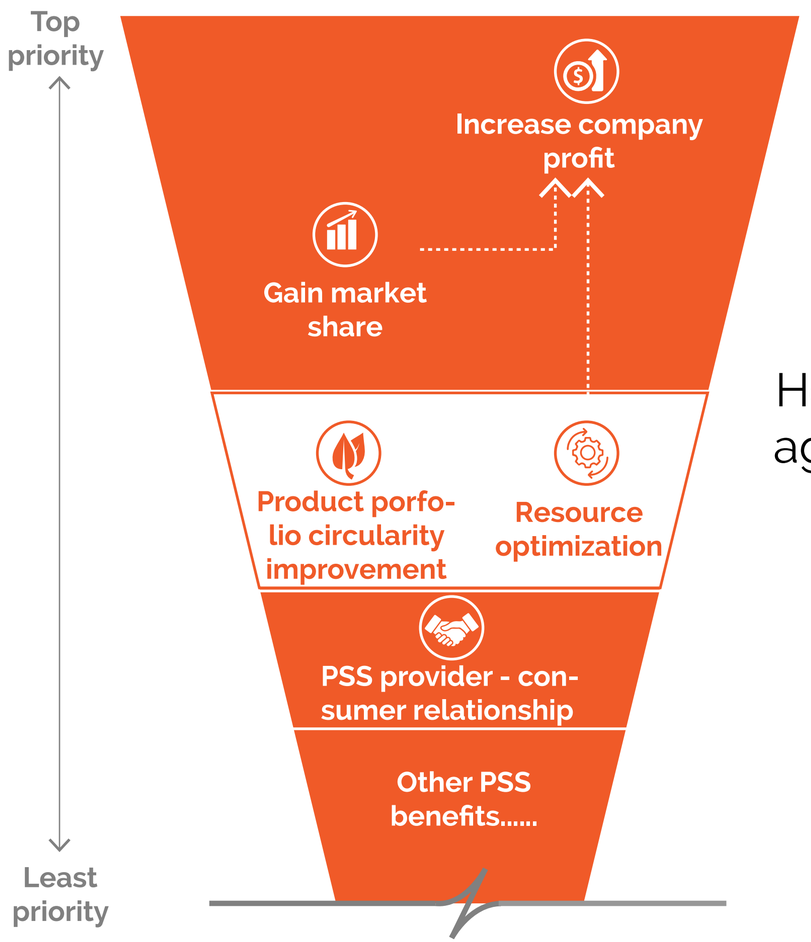
- Gain market share → Increase company profit
- Resource optimization → Increase company profit
- Product porfolio circularity improvement
- PSS provider - consumer relationship enhancement

Benefits of using PSS (PSS consumers)

- Product porfolio circularity improvement → Increase asset value
- Access the guaranteed high quality product with cost-effective fees
- Increase flexibility and adaptability in product use
- Outsource risk and uncertianty during using product
- Financial benefit (accomplish work scope without capital)
- Best aligning with consumers' demand

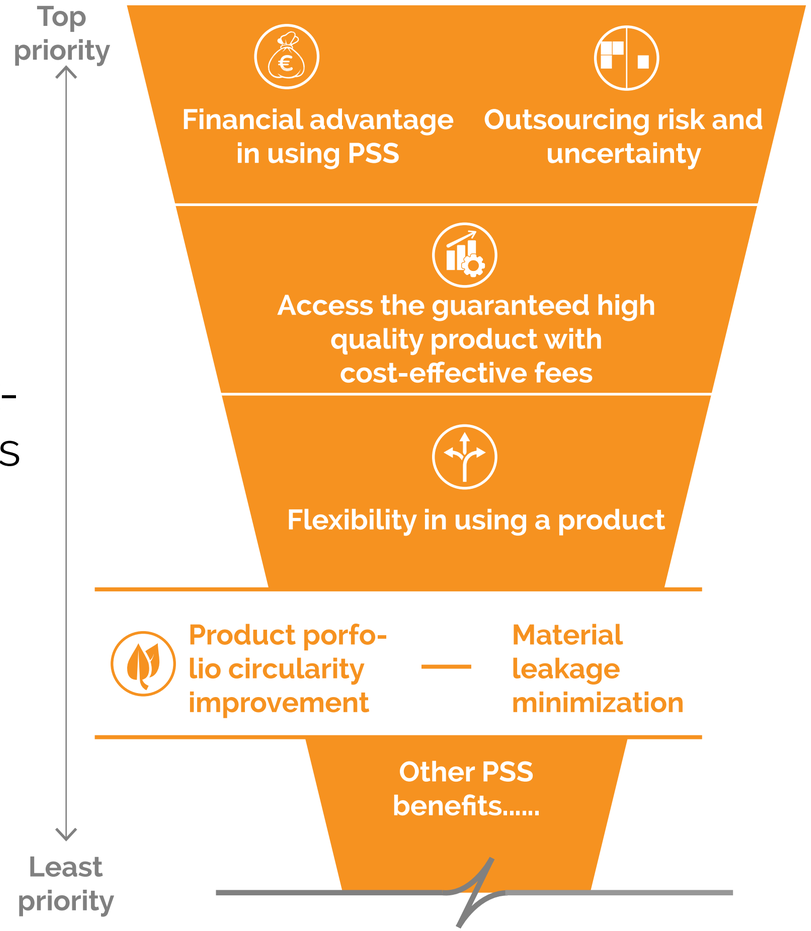
3. What are the benefits of a Product-service system (PSS) to the consumers and PSS providers?

Prioritized benefits of providing PSS
(According to 3 PSS providers cases study)



How material leak-age minimization is positioned?

Prioritized benefits of using PSS
(According to 8 cases study)



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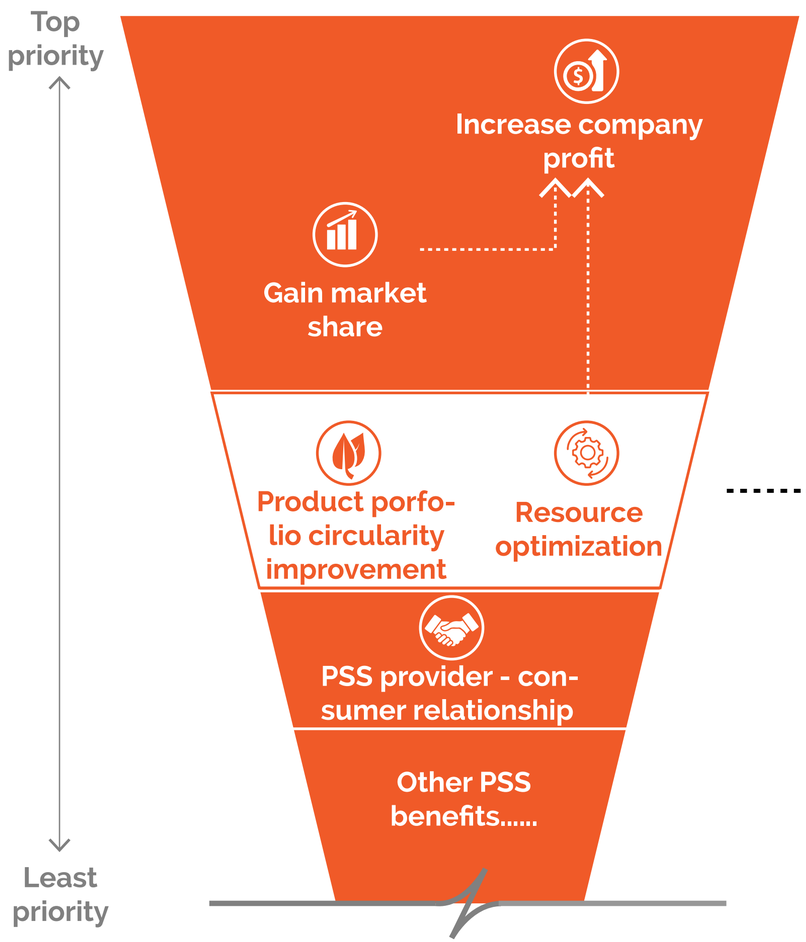
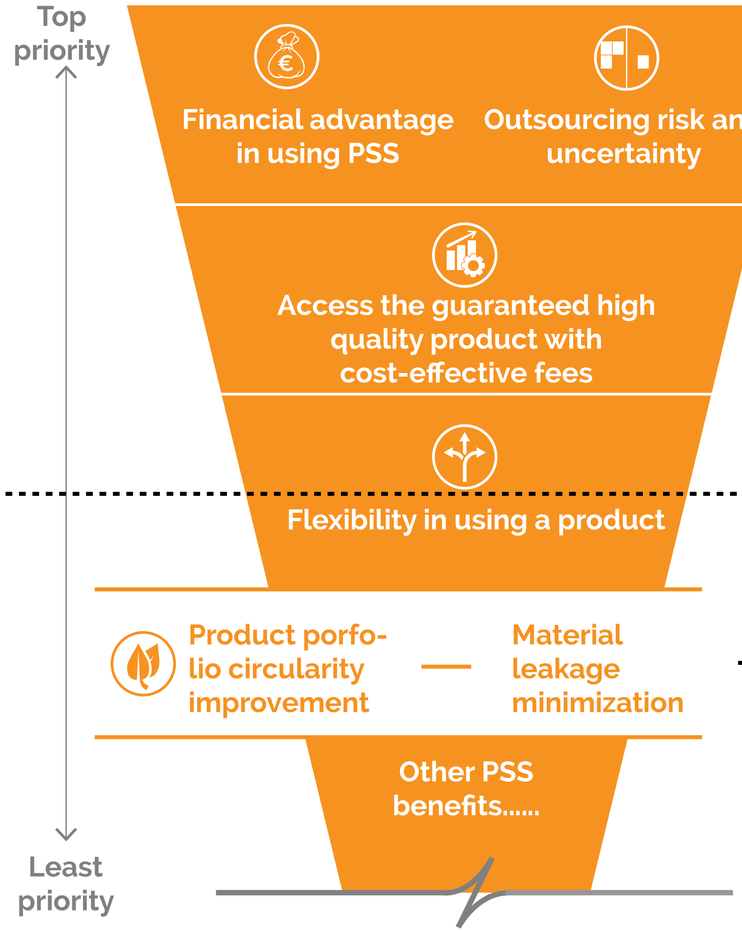


Prioritized benefits of using PSS
(According to 8 cases study)



Material leakage minimization feature has not yet been the primary driver for consumers and providers in PSS implementation

Main research question: To what extent does the Product-Service system (PSS) help corporate real estate (CRE) in minimizing material leakage?

PSS CONSUMERS (CREM)

PRODUCT-SERVICE SYSTEM IMPLEMENTATION

Material leakage reduction (within product life cycle)

PSS charac-teristic

Material leakage minimiztion contributors

Material leakage reduc-tion (for con-sumer)

Product responsibility allocation (to PSS providers)

MATERIAL LEAKAGE MINIMIZATION OF CONSUMERS

Improve product circularity

Less/ or non product responsibility

Discussion

PSS

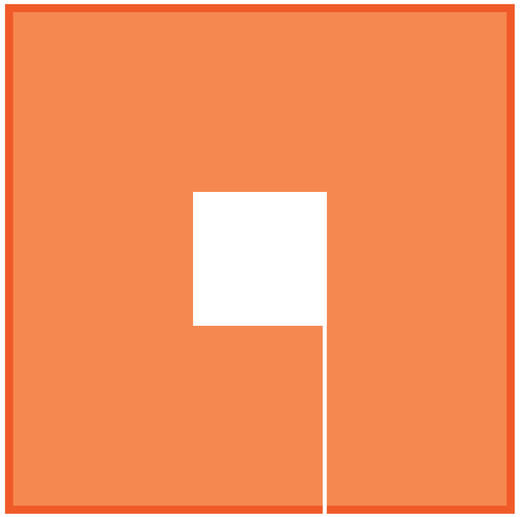
Has potential in contributing to....

Circular economy in CRE

1. Most of the PSS which are provided in the market are small components (service layer components)

2. The building layer component is almost not provided as PSS

3. There might be a better procurement strategy for minimizing material leakage than PSS



OTHER SUBJECTS

Research relevances

Scientific relevance

PSS is a promising strategy that has the potential to cope with material leakage issue.

However, the specific scientific literature on minimizing material leakage by applying PSS is still limited.

Practical relevance

Demonstrate the potential of PSS implementation for the material leakage minimization.

Besides material leakage minimization, other advantages of using PSS for CRE are also investigated

Societal relevance

PSS has already been a success in many other sectors (e.g. Netflix, Spotify= entertainment, or gym and fitness subscription)

PSS could evolve how corporate real estate portfolios access the product functionality in many ways.

Research limitation

- The information source regarding using PSS in CRE is limited

- The in-depth information regarding material leakage minimization by using PSS in CRE is limited.

- A small number of cases

Further research recommendations

- The amount of minimized material leakage by using PSS

- A deep investigation of material leakage minimization benefits by using PSS in the CRE

- A strategy development that could overcome the implementation barrier of building layer PSS implementation

- How to promote the material leakage minimization feature to be the main driver for consumers to use PSS.


THANK YOU/
QUESTION?