



Product-Service-System (PSS) Design:

(I). *Concepts & Examples*

Dr. Yicha Zhang
Associate Professor (Maître de conférences, HDR)
UTBM, ICB-COMM
yicha.zhang@utbm.fr

12-2023, Shanghai

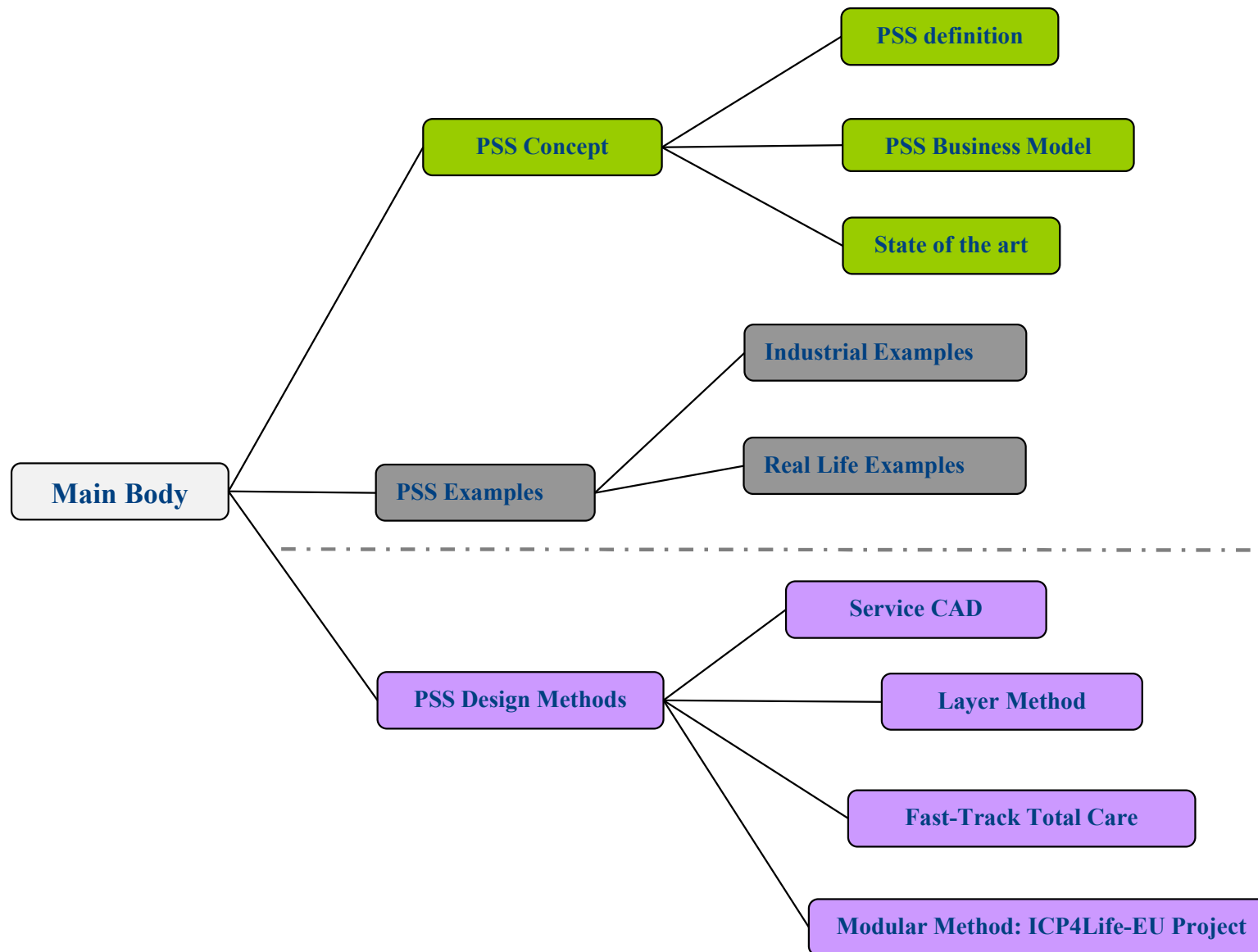


■ Agenda

- Course Structure
- References
- Introduction on PSS
- Examples in Industry & Real life
- Exploration & Discussion : course project extension



Course Structure



References & Resources

➤ Books

1. Lindahl, T. Sakao M., and T. Sakao. "*Introduction to Product/Service-System Design.*" (2009).

➤ Conference Proceedings & Journals

1. **CIRP IPS2** Conferences & Proceedings
2. CIRP Procedia
3. CIRP Annals
4. Journal of Cleaner Production



Product-Service-System: *Basic concepts & examples*



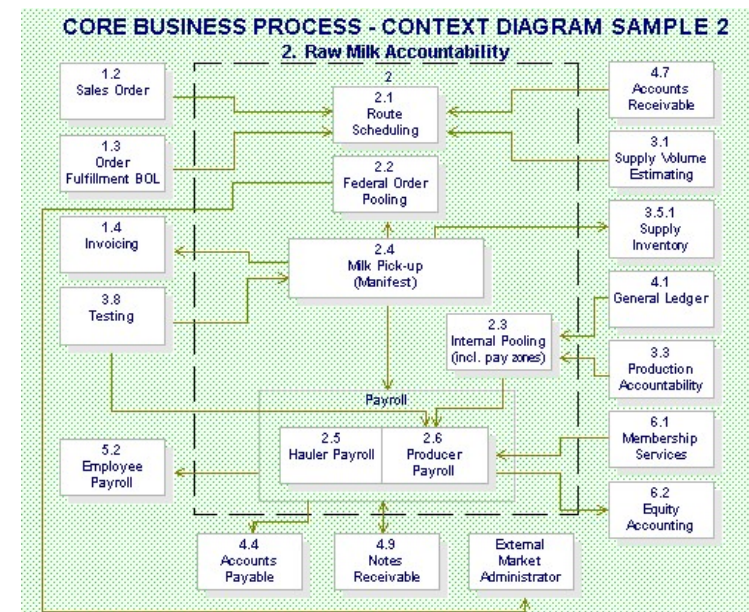
PSS Definition

➤ Key Word 1: Product?

*Product (business): an **item** that ideally **satisfies** a market's want or **need**



*Product (project management): a **deliverable** or set of deliverables that **contribute** to a **business solution**



PSS Definition

➤ Key Word 2: Service?

A service: *an **activity** which has some element of **intangibility** associated with it. It involves some interaction with customer or property in their possession, and does not result in a transfer of **ownership**. A change of condition may occur and provision of the service may or may not be closely associated with a physical product.*



Proposed definition: *a set of **organized activities** to **enhance** the associated product or solution (their function or performance) so as to **bring added value** for customers and other stakeholders.*

PSS Definition

- Key Word 2: Service?



PSS Definition

➤ **Key Word 3: System?**

A system: is a regularly interacting or interdependent group of items forming a unified whole.
Every system is delineated by its spatial and temporal boundaries, surrounded and influenced by its environment, described by its structure and purpose and expressed in its functioning.

Cultural system; political system; economic system; social system...

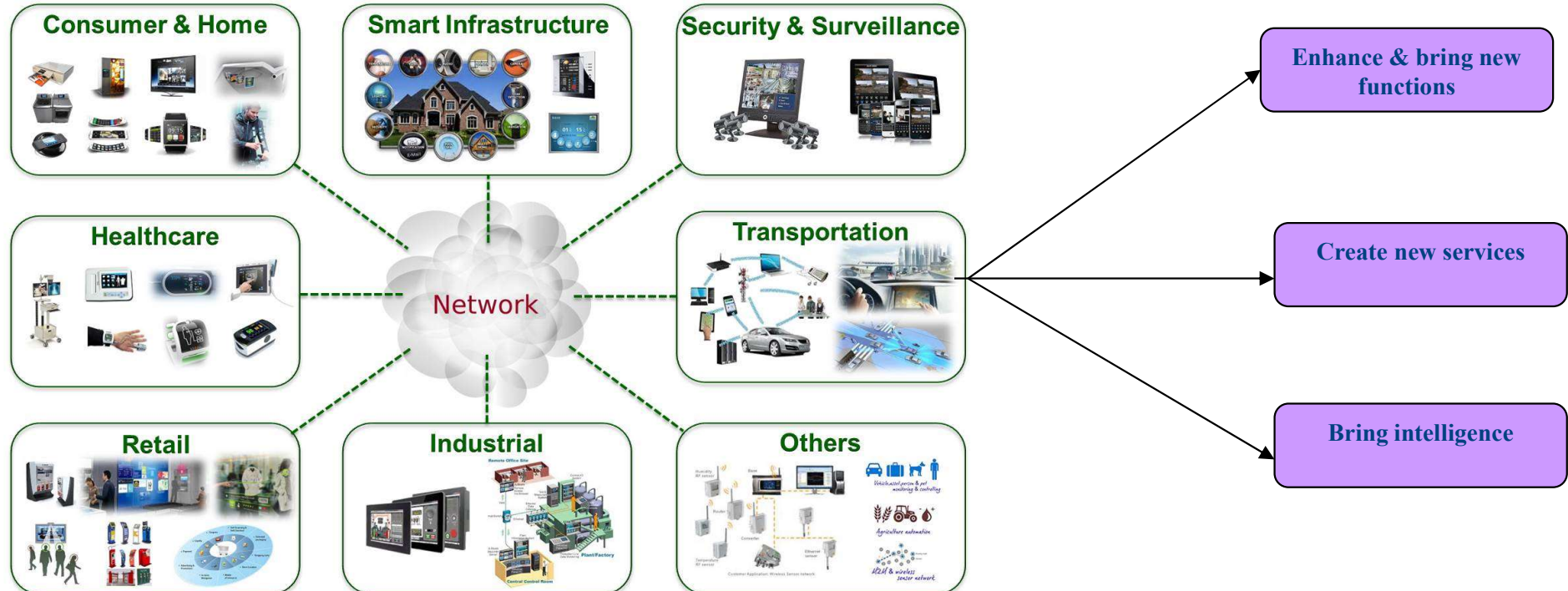
Human-made systems are made to **satisfy** an identified and stated **need** with purposes that are achieved by the delivery of wanted outputs. Their parts must be related; they must be "designed to **work as a coherent entity**" – otherwise they would be two or more distinct systems.



Internet of Things (IoT)

➤ What is a IoT?

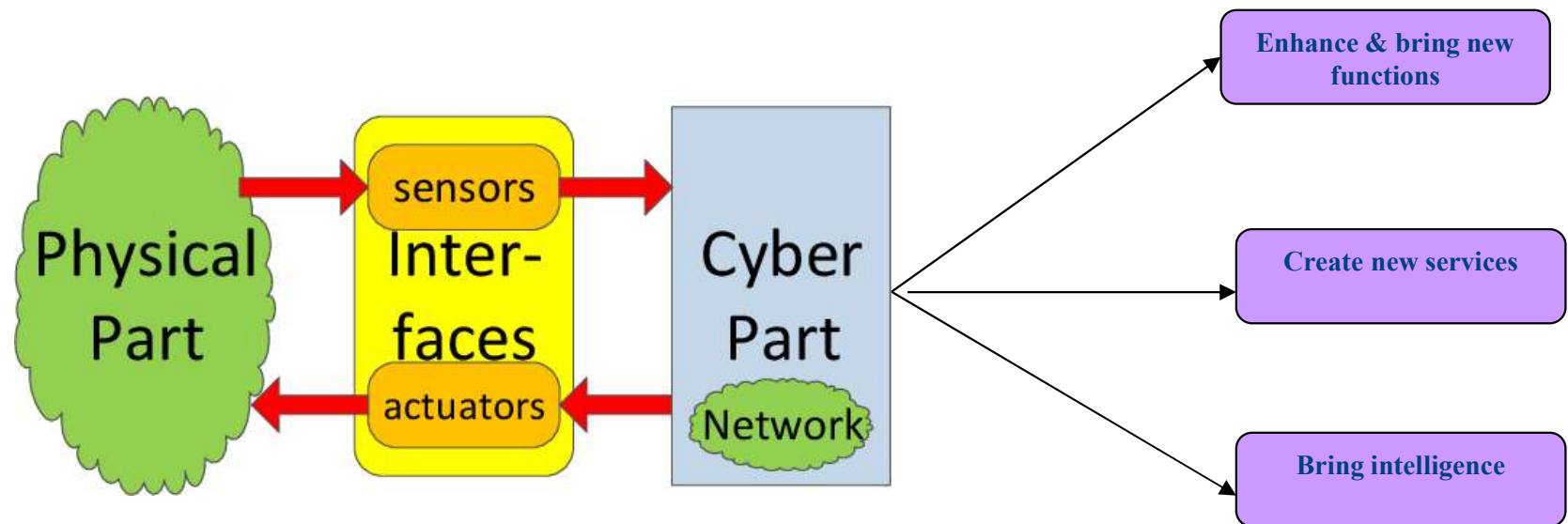
The Internet of things (IoT): is the **network of physical devices**, vehicles, and other items embedded with electronics, software, sensors, actuators, and network connectivity which enable these objects to **collect and exchange data**. Each thing is **uniquely identifiable** through its embedded computing system but is able to interoperate within the existing Internet infrastructure.



Cyber-physical-systems (CPS)

➤ What is a CPS?

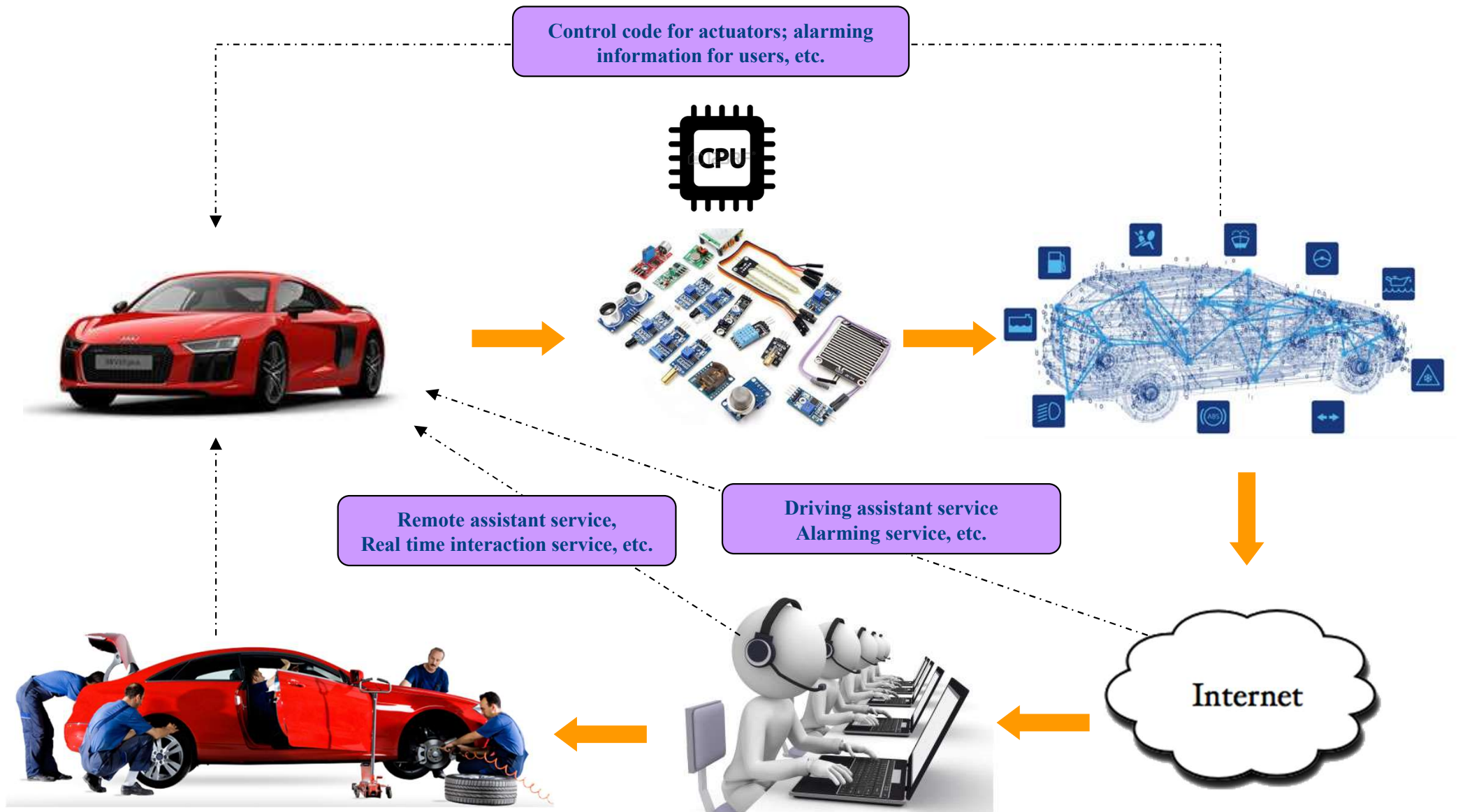
A cyber-physical system (CPS): is a *mechanism* that is *controlled or monitored* by computer-based algorithms, tightly integrated with the *Internet and its users*.



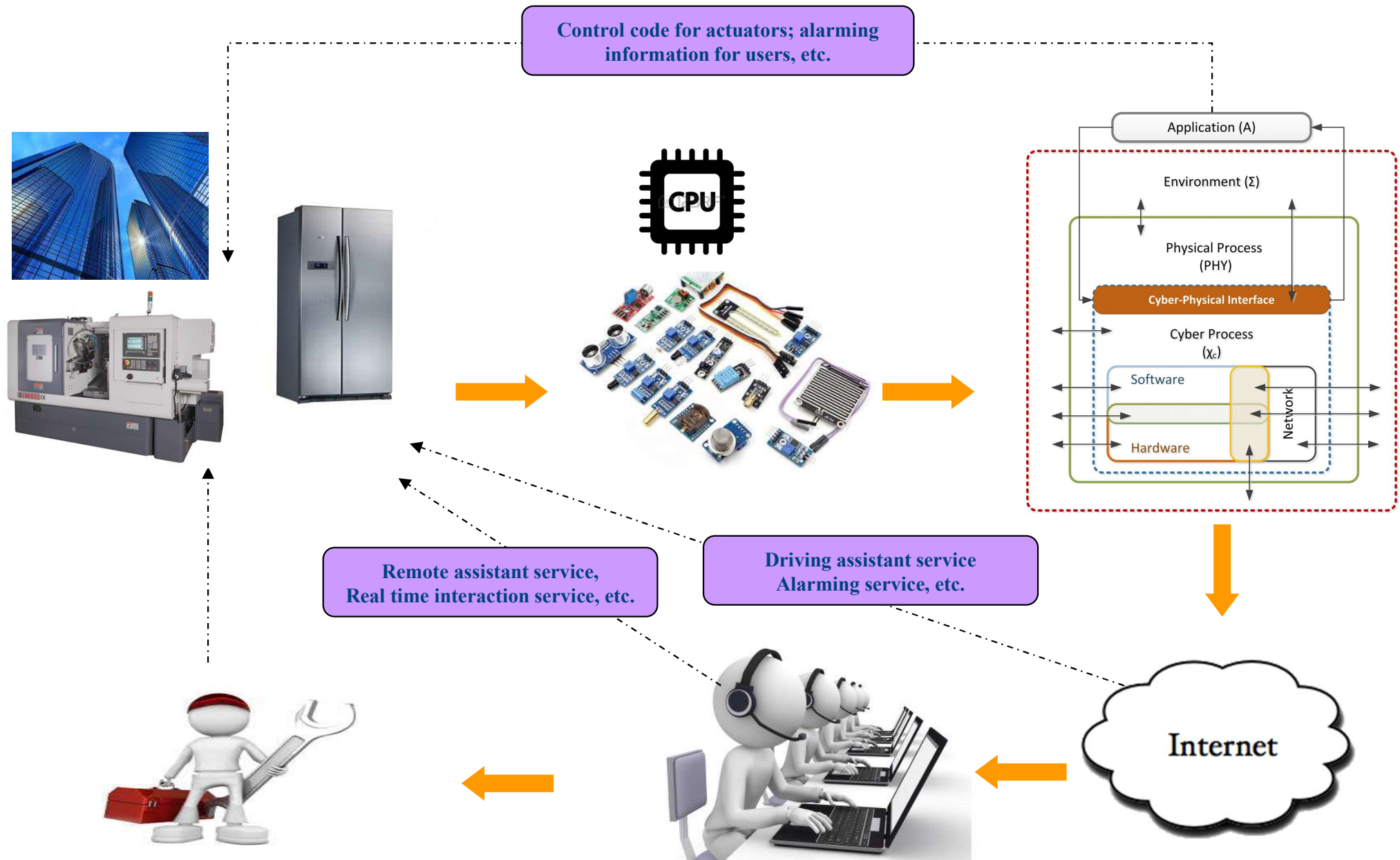
In cyber-physical systems, **physical** and **software** components are deeply intertwined, each operating on different spatial and temporal scales, exhibiting multiple and distinct behavioral modalities, and interacting with each other in a myriad of ways that change with context.

Turn Ordinary Product into IOT & CPS

Car + Service Example



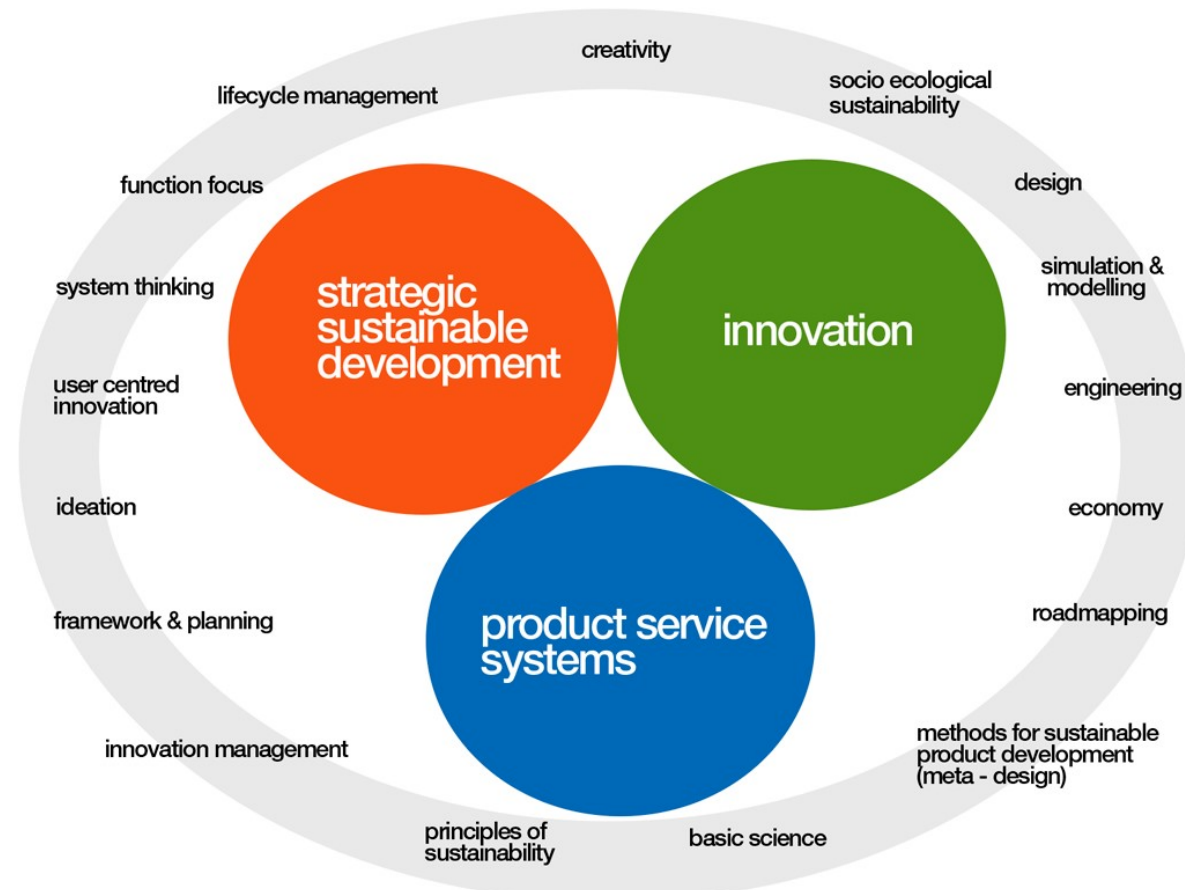
Turn Ordinary Product into IOT & CPS



Product-Service-System (PSS)

➤ What is a PSS?

An Industrial Product-Service System is characterized by the *integrated and mutually determined planning, development, provision and use of product and service shares including its immanent software components in Business-to-Business applications and represents a knowledge-intensive socio-technical system.*



Product-Service-System (PSS)

➤ PSS Features

PSS is an **integrated product and service** offering that **delivers values** in industrial/civil applications.

PSS is a **new product/service** understanding consisting of integrated **product and service** shares.

PSS comprises the **integrated and mutually** determined planning, development, provision and use.

PSS includes the **dynamic adoption of changing customer demands** and provider abilities.

The partial substitution of product and service shares over the **lifecycle** is possible.

This integrated understanding leads to new, **customer-adjusted solutions**.

PSS enable innovative function-, availability- or result-oriented **business models**.

Product-Service-System (PSS)

- A PSS Example: rental bicycle system in Belfort



Product-Service-System (PSS)

- A PSS Example: **decomposition** of the rental bicycle system in Belfort

Physical side

Bike

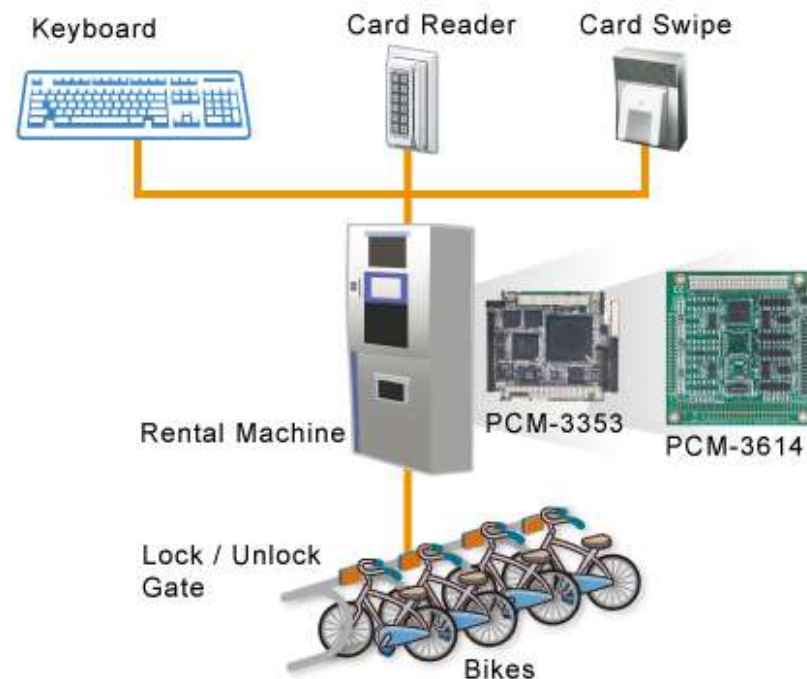
Parking Station

GPS/Sensor

Lock System

Payment Terminal

‘Balance’ transportation System



Non-physical side

Payment System

Allocation System

Maintenance System

Monitoring System

User Data Management System

.....

Product-Service-System (PSS)

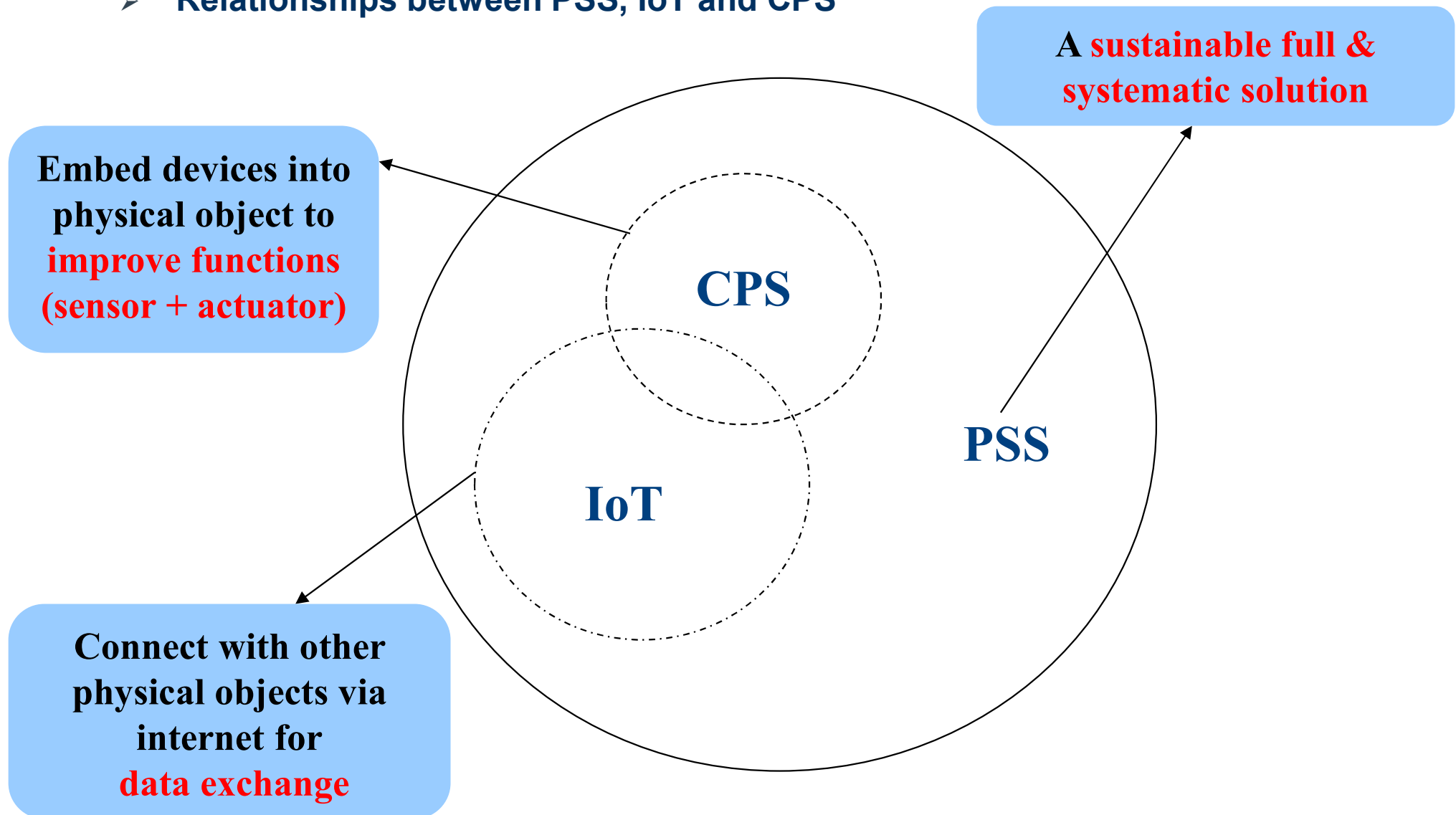
- A PSS Example: **Bad Design** of PSS with bad results for discussion



Why this happened?
What are the main problems in design?

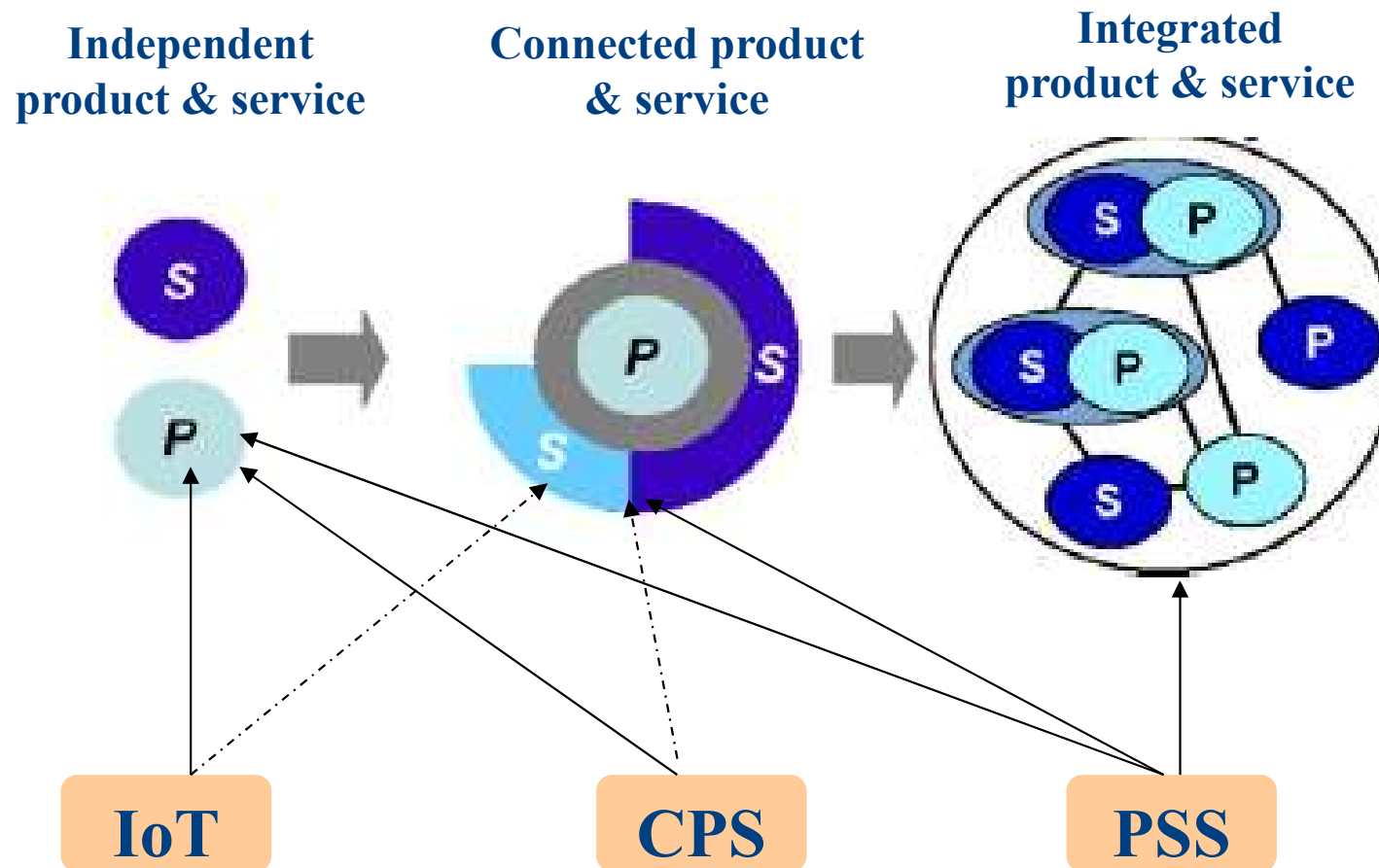
PSS vs IoT vs CPS

➤ Relationships between PSS, IoT and CPS



PSS vs IoT vs CPS

➤ Relationships between PSS, IoT and CPS



PSS vs IoT vs CPS

➤ Implications on Design of PSS

IoT

**Physical product
and
service/functions
are designed
independently**

No life-cycle view

Less stakeholders

**Less
change/adaptation
of product**

CPS

**Physical product
and
service/functions
are designed
independently**

No life-cycle view

Less stakeholders

**Less
change/adaptation
of product**

PSS

**Physical product
and service are
designed in
integration**

**With life-cycle
view**

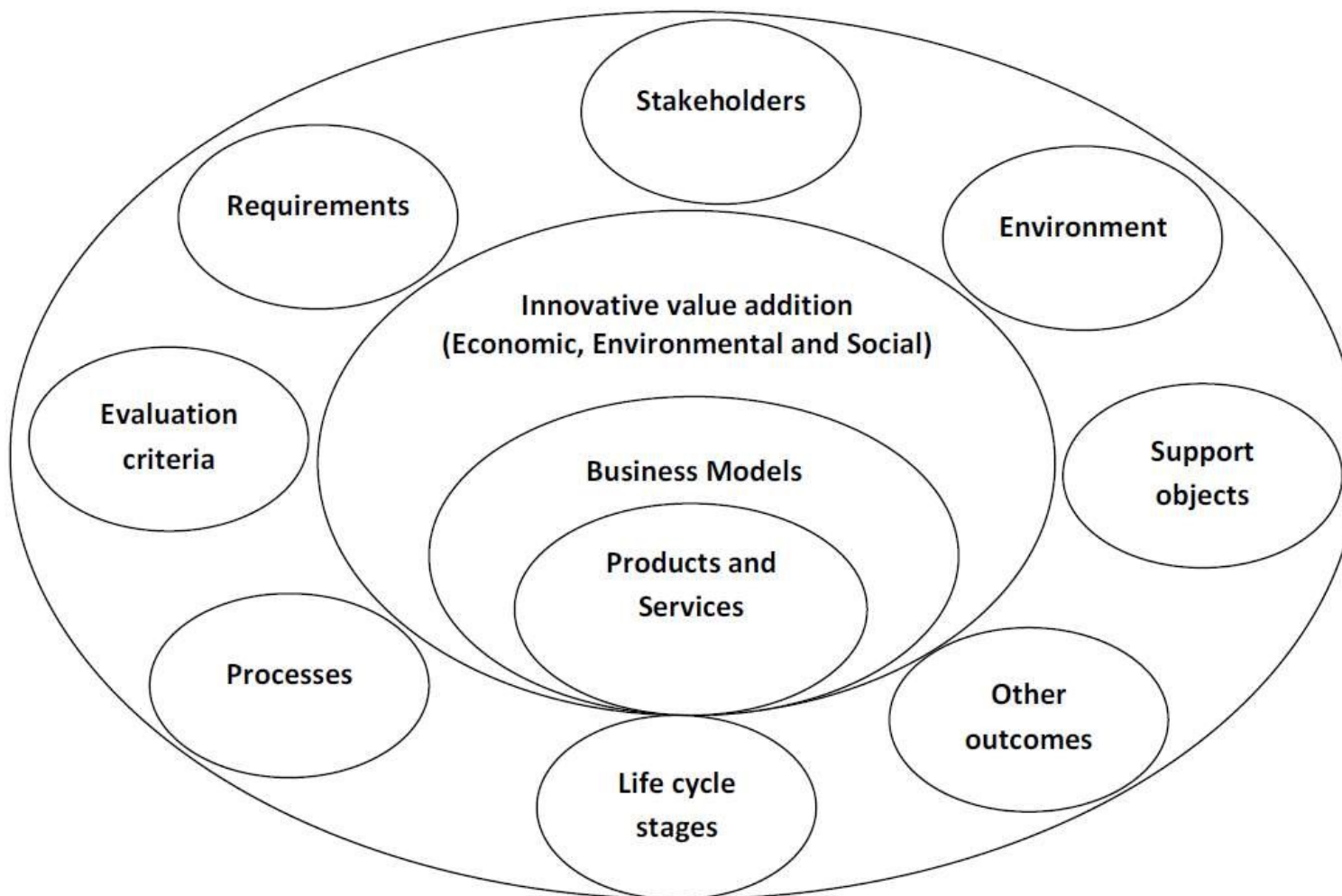
More stakeholders

**More
change/adaptation
of product**

+ considerations...

PSS Elements

➤ Main Elements to be Considered in PSS Design



Design of PSS is an interdisciplinary design!

To Consider:
Technical factors

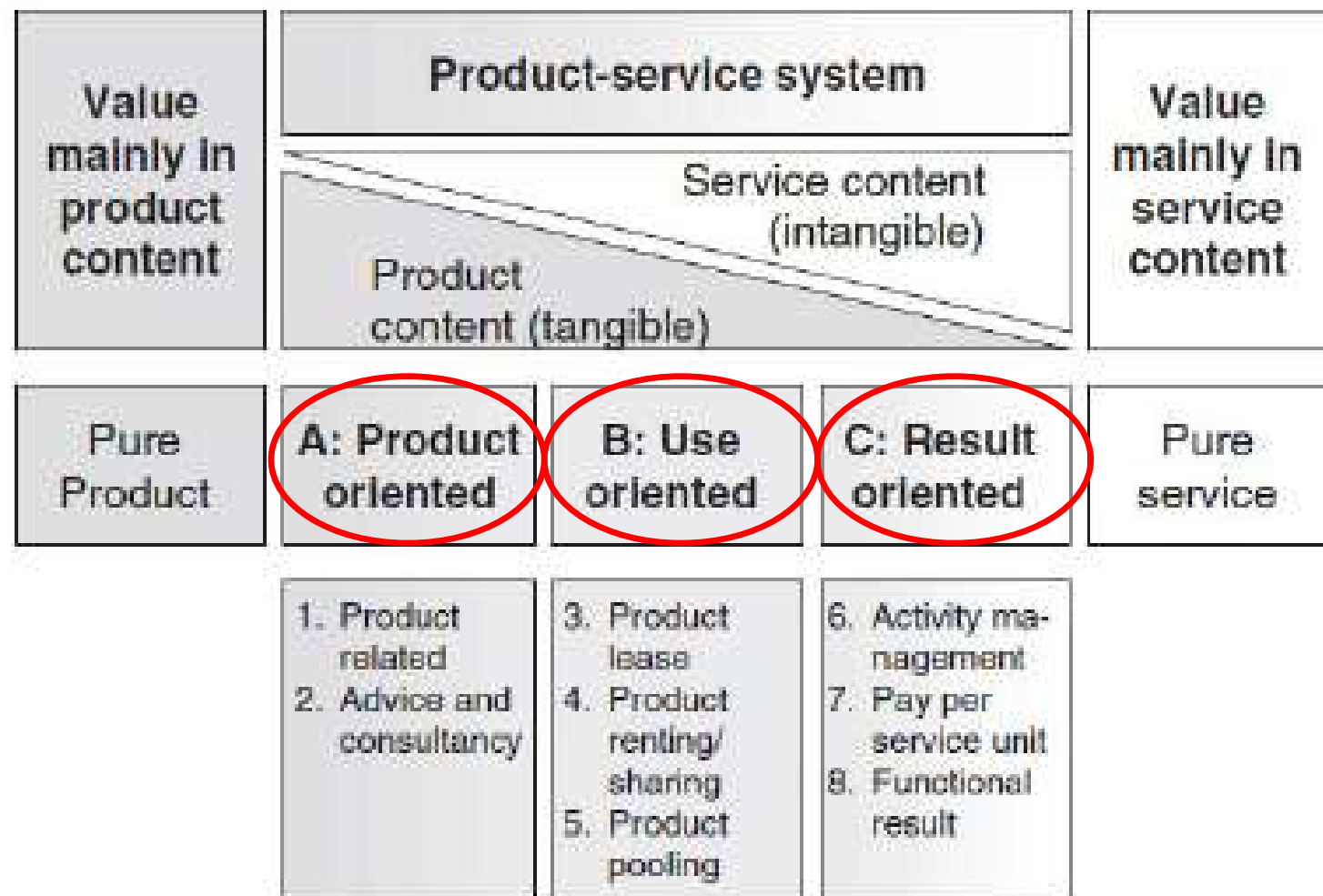
Social factors

Economic factors

Environmental factors

PSS Business Model

➤ Main Types of PSS



PSS Business Model

➤ Main Types of PSS: industrial examples



Standard Product

+

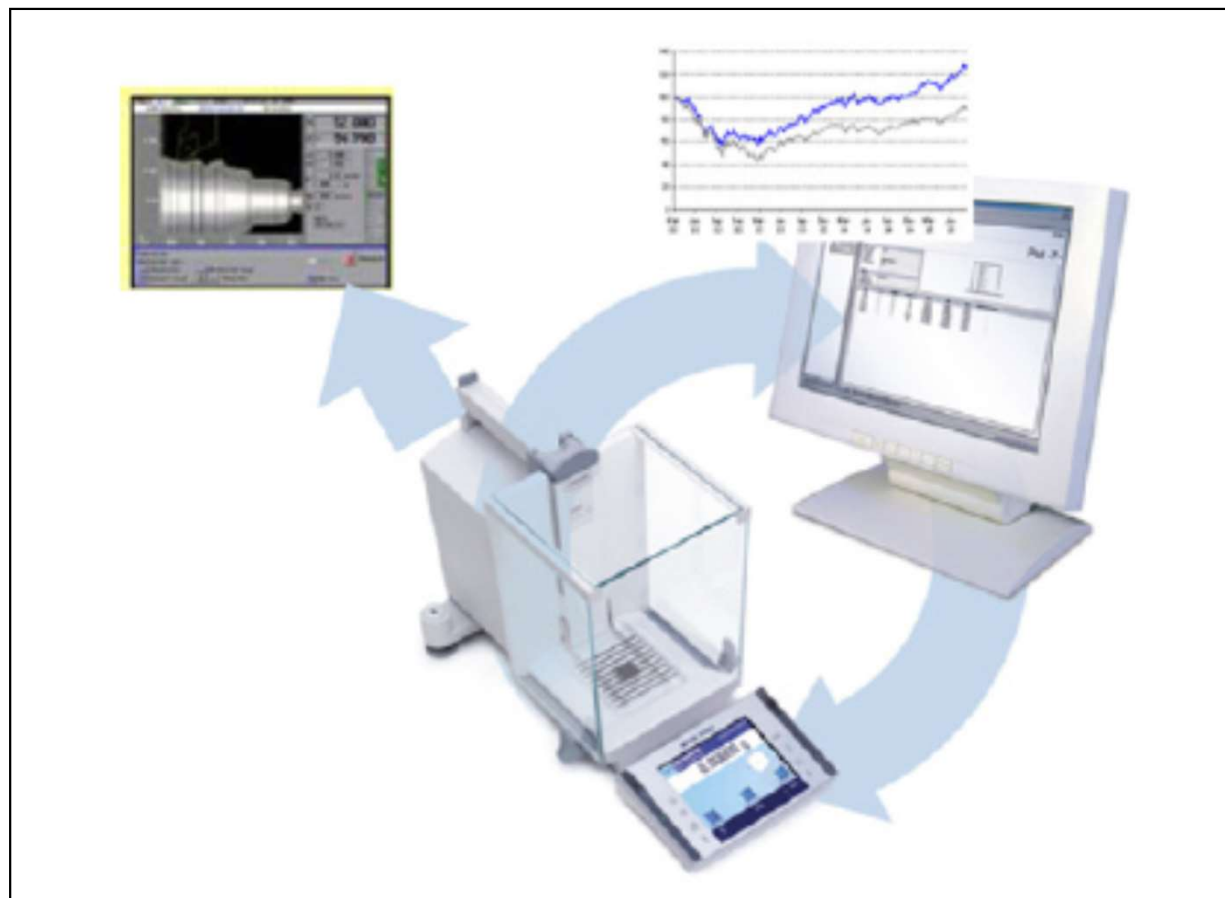
Standard Services

**User pay for
machine &
services**

**Connect
provider when
required**

PSS Business Model

➤ Main Types of PSS: industrial examples



Proactive maintenance based on equipment observation and wear-analyses

Standard Product

+

Embedded & connected devices

User pay for machine & services

Keep connecting with provider

PSS Business Model

➤ Main Types of PSS: industrial examples



Customized rental production line

**Non-Standard
Product**

+

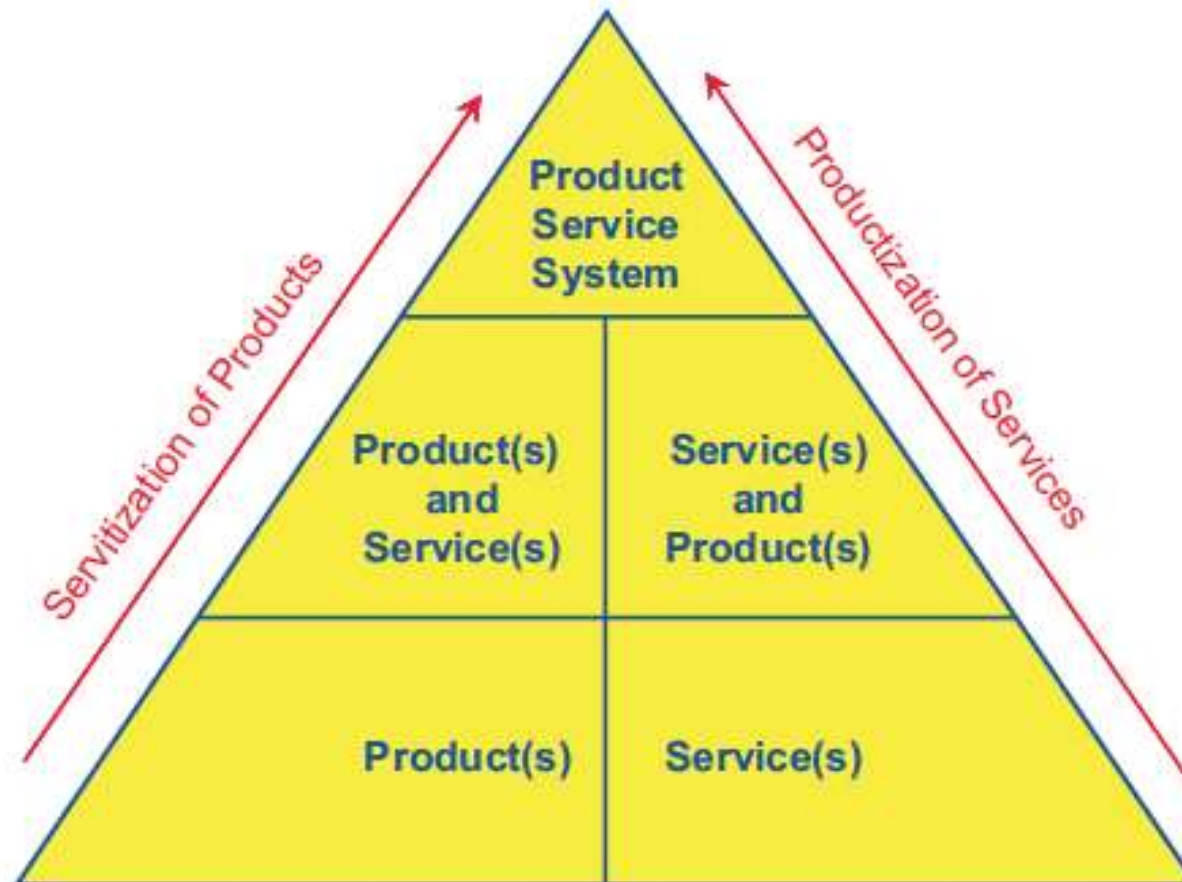
Rental contract

**User only pay
for use time**

**Keep
connecting with
provider**

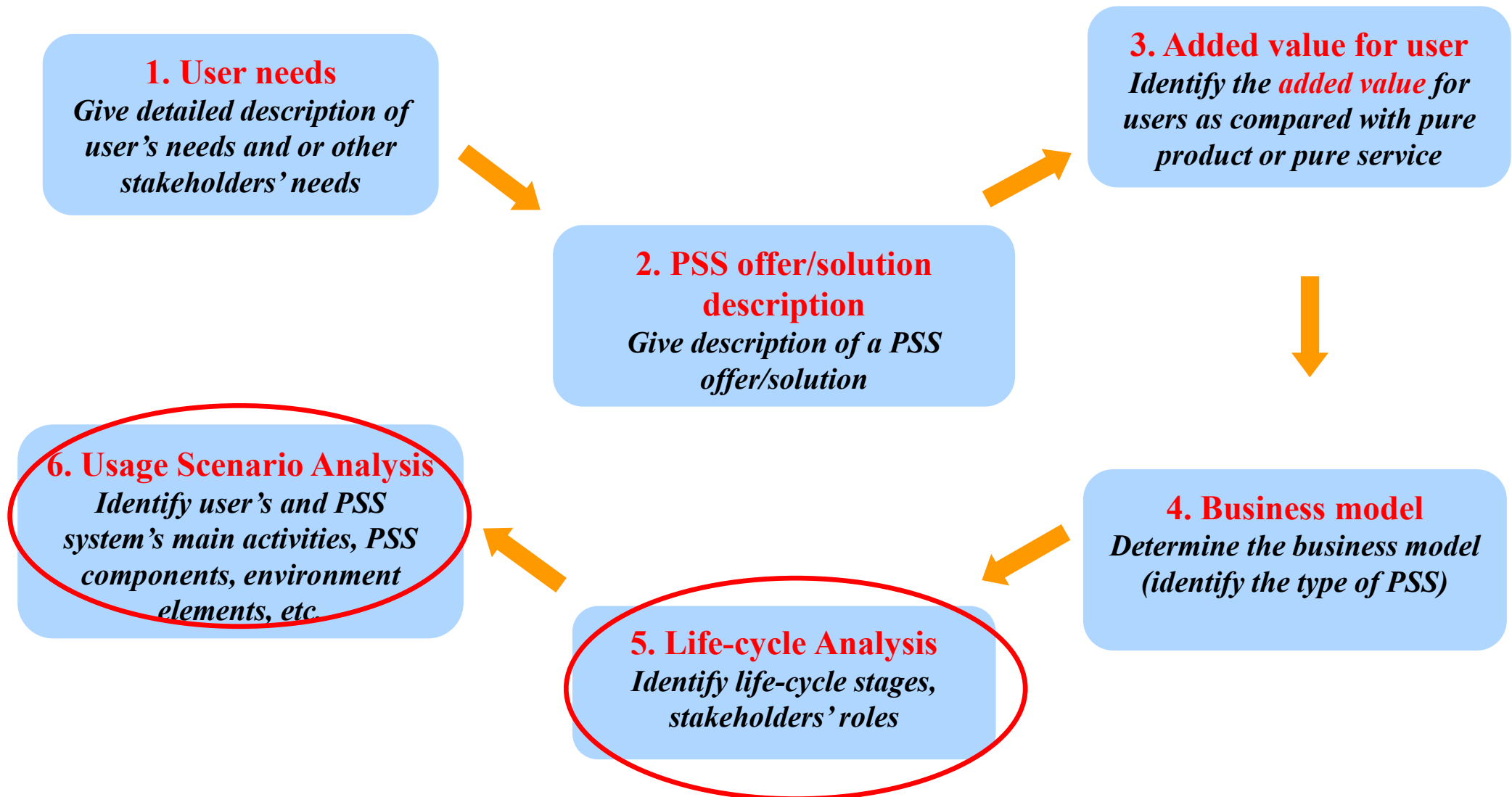
PSS Business Model

➤ Evolution of Product & Service



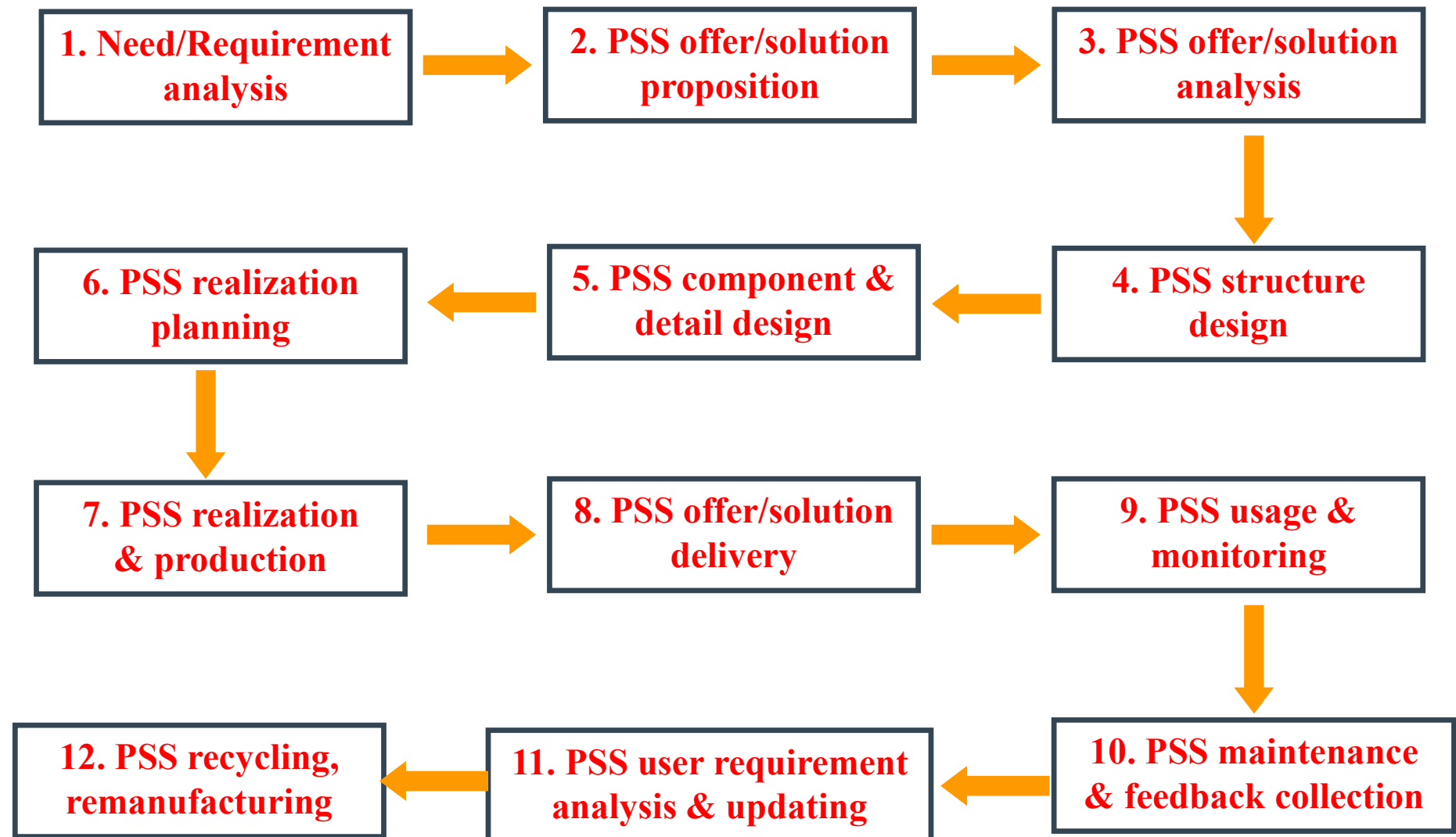
PSS Business Model Analysis

➤ Analysis Workflow (6-step)



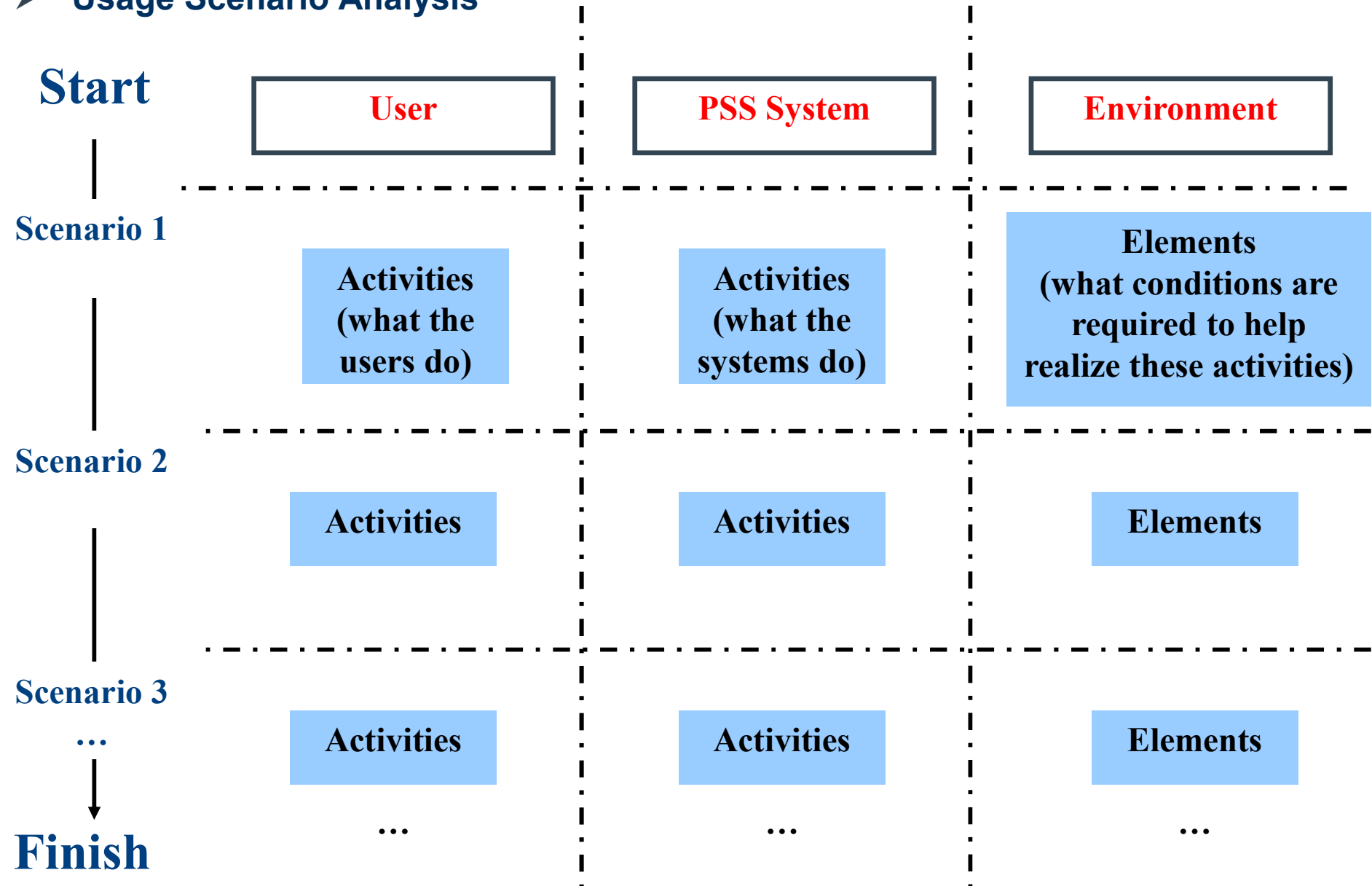
PSS Business Model Analysis

➤ Life-cycle Analysis



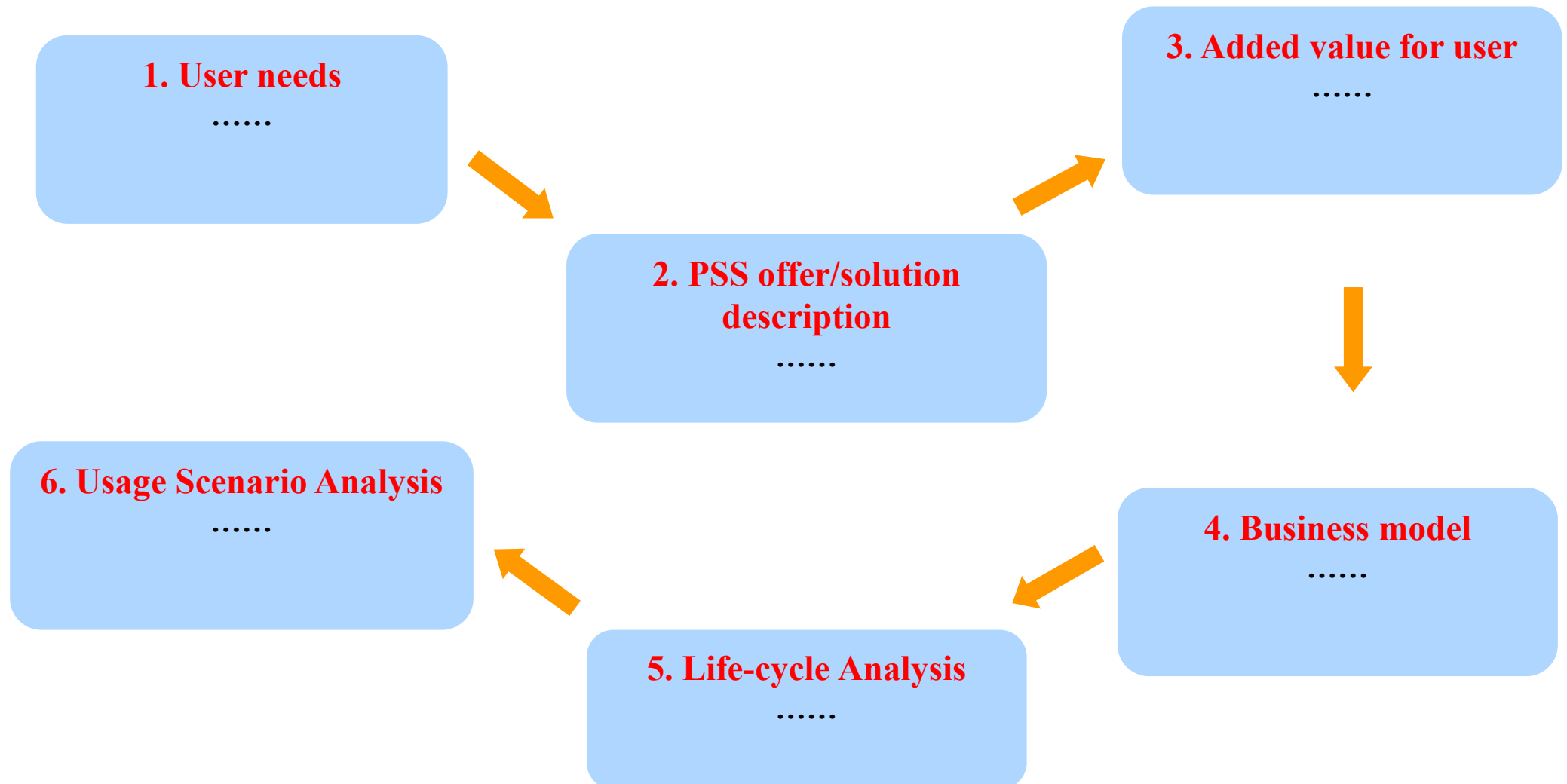
PSS Business Model Analysis

➤ Usage Scenario Analysis



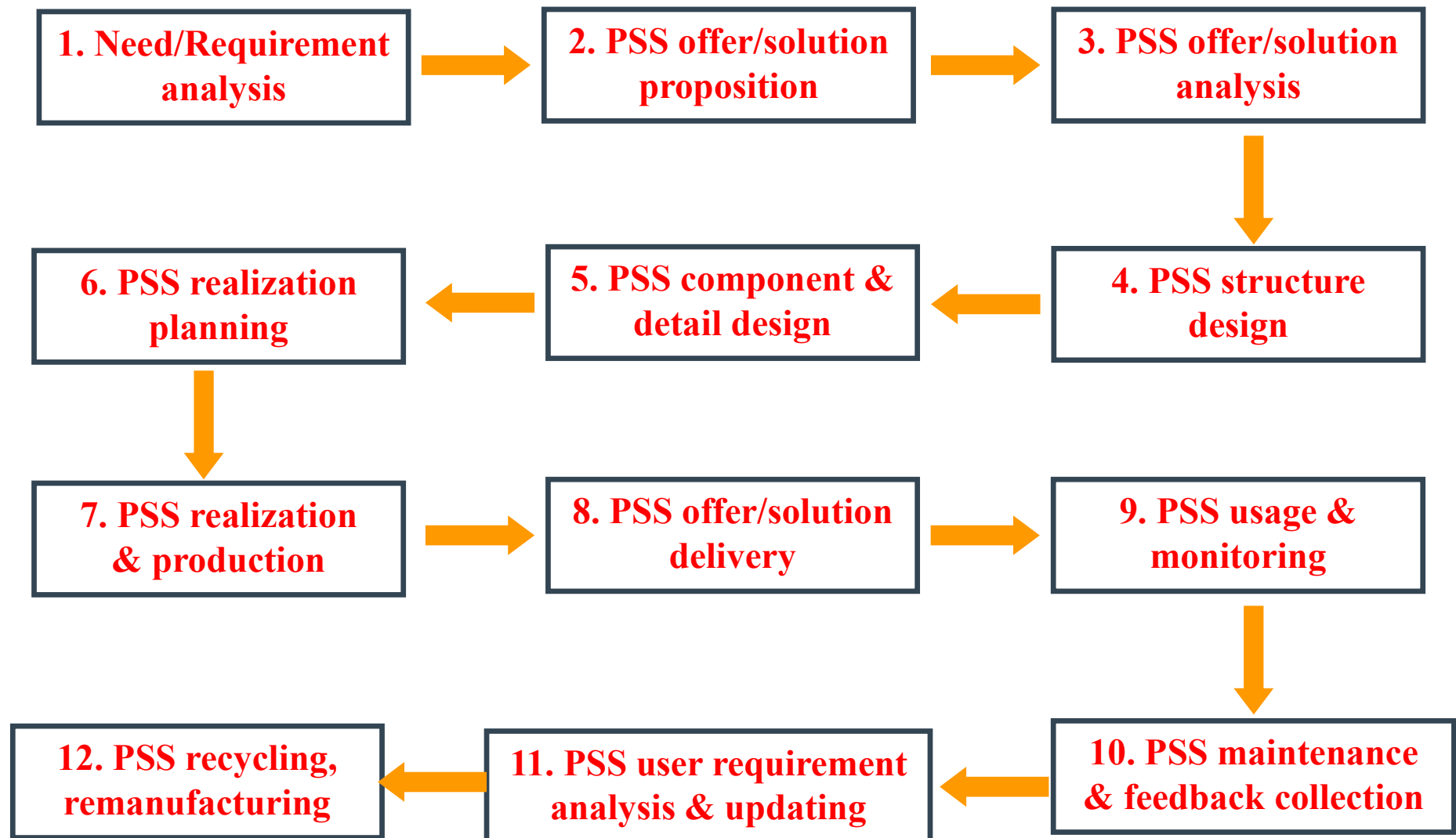
PSS Business Model Analysis

➤ 6-Step Method Demonstration: bike rental system in Belfort



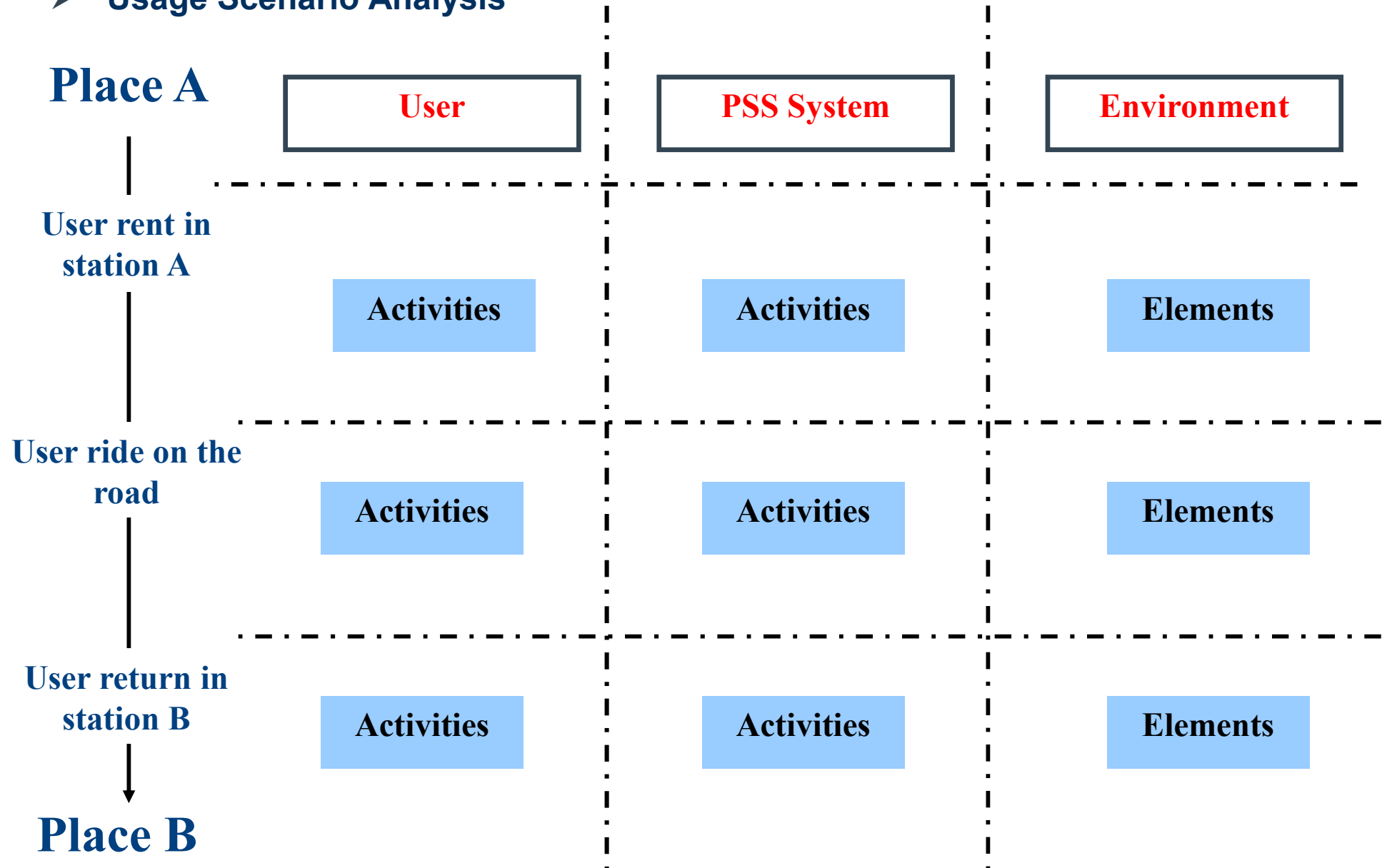
PSS Business Model Analysis

➤ Life-cycle Analysis



PSS Business Model Analysis

➤ Usage Scenario Analysis



PSS Business Model Analysis

➤ A PSS Example: rental mobile phone of Free



The advertisement illustrates a Pay-Per-Use (PSS) business model for mobile phone rental. It shows a Free SIM card and an Apple iPhone 7 Plus 32Go. The total monthly cost is 37.99€, which includes the rental of the phone and the Free forfait. The price is broken down as follows:

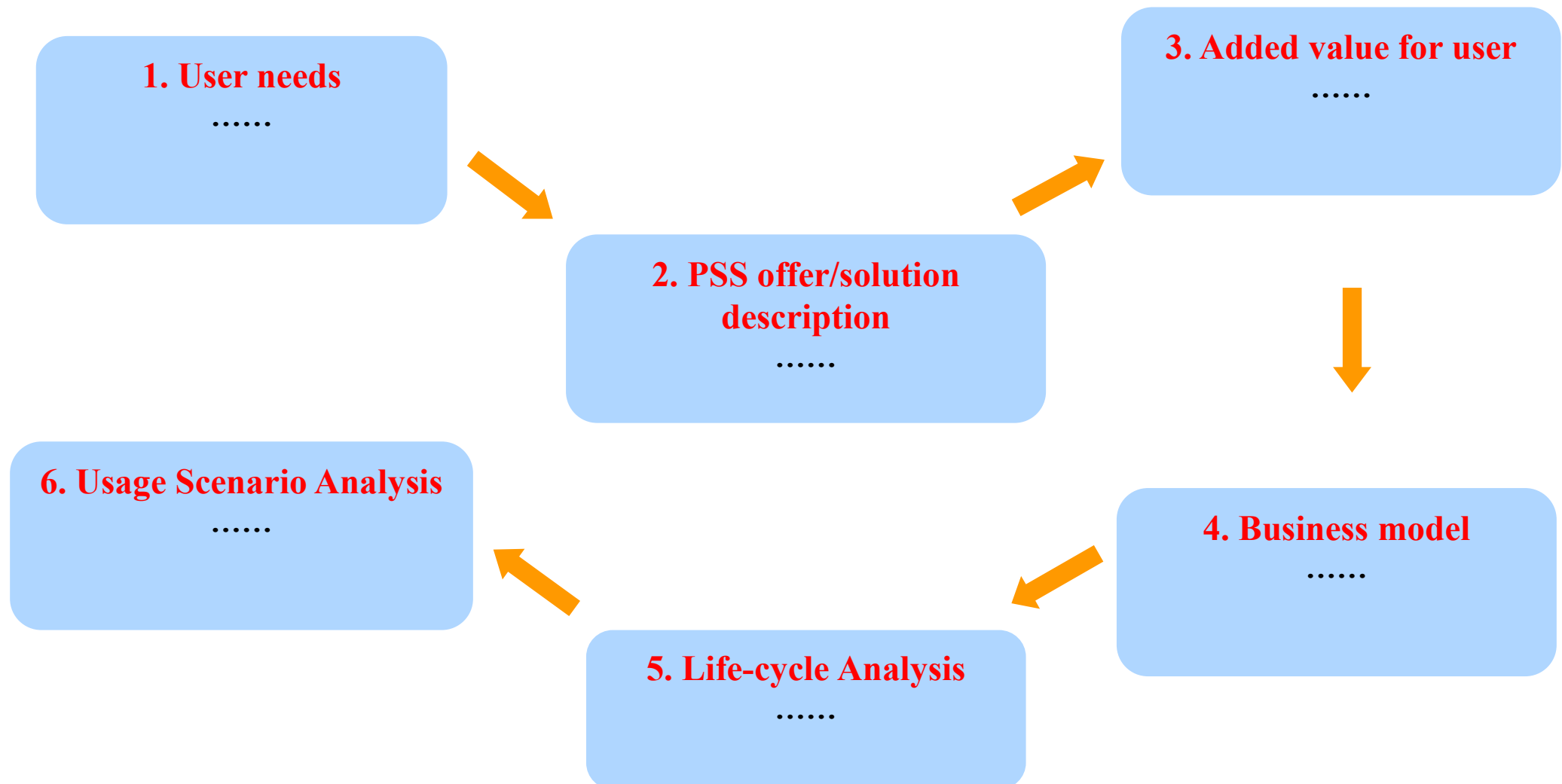
Service	Price	Notes
Forfait Free	15,99€/mois	19,99€/mois pour les non abonnés Freebox
Apple iPhone 7 Plus 32Go	22€/mois	sur 24 mois en location ⁽¹⁾ (+ paiement initial de 139€)
Total	37€⁹⁹/mois	(Non abonné Freebox 41,99€/mois)

[Voir la fiche](#)

VOIR LES OFFRES DE LOCATION ET M'INSCRIRE

PSS Business Model Analysis

➤ 6-Step Method Practice: Mobile phone rental PSS of Free company



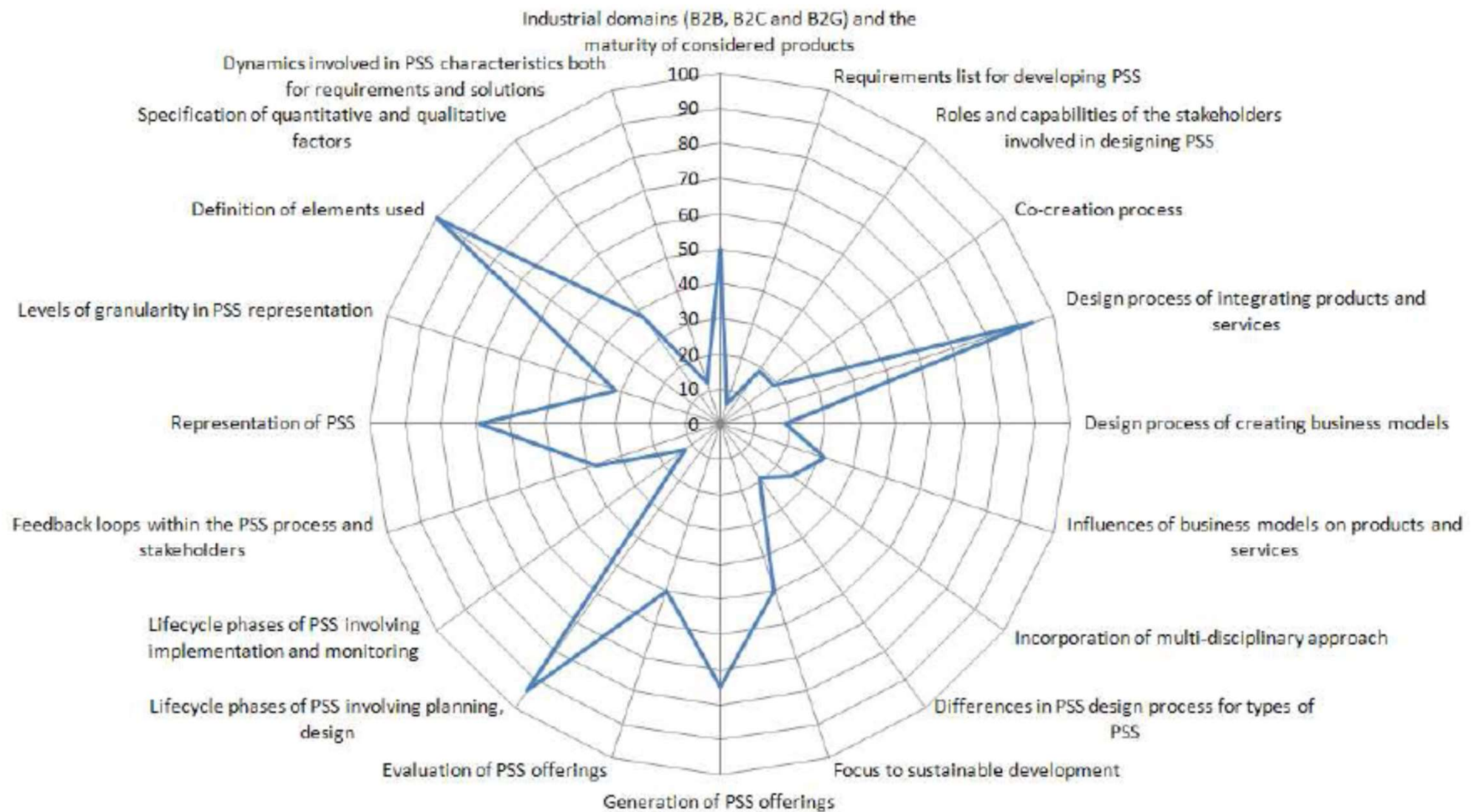


Why PSS?

- **Bring more 'added values' for user and other stakeholders**
- **High-customization**
- **Sustainable and eco-**
- **Systematic & full coverage of lifecycle**

PSS Status

➤ Maturity of PSS (in 20 dimensions)





Thanks for your attention !

