Forest Management Research Group
– *Introduction*

By means of silviculture we can establish productive, healthy and diverse forests to changing environment

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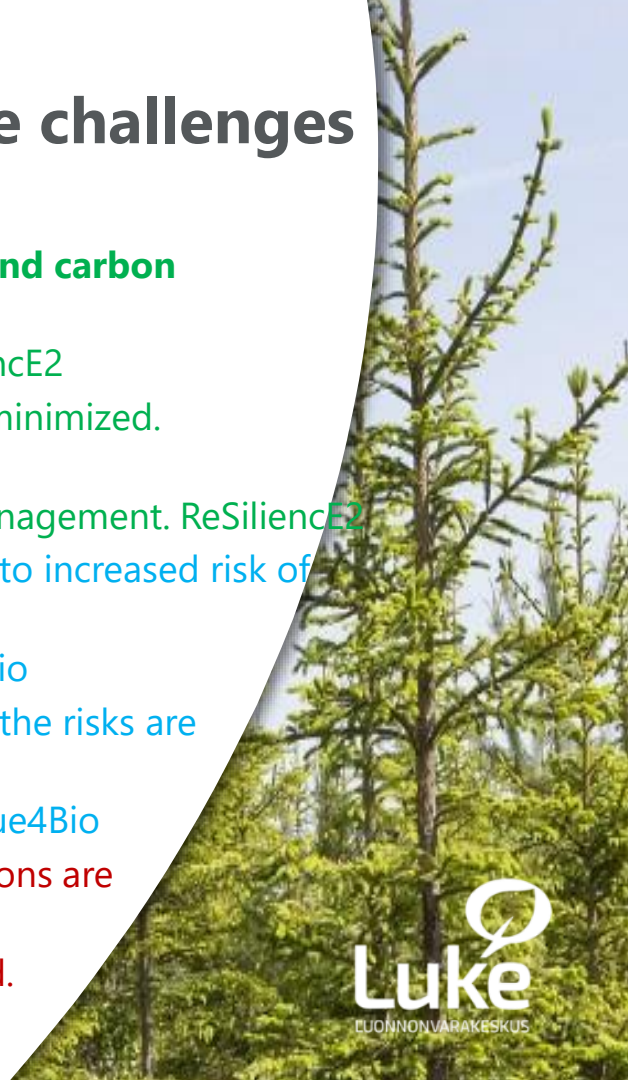
1. Luke's strategy

2. Main trends in silviculture

- Demand for **sustainable management of forests**
- Need for promoting the use of forests as **carbon sinks**
- Call for **better biodiversity**, water and soil protecion
- **Multiple use of forests** increases
- Climate changes and increases forest growth and damage, which **call for more timely forest management**
- Challenges caused by **delayed management operations** (delayed forest regeneration, lack of early tending of seedling stands and delayed first thinning)
- **Mixed-species stands** are prefered
- **Number of tree species** in forest regeneration increases
- **Continuous cover forestry** (CCF) becomes more popular
- **Cost and quality** awareness increases
- **Supply of services** increases
- Availability of **skilled workers diminishes**

3. Forest management – answers to future challenges

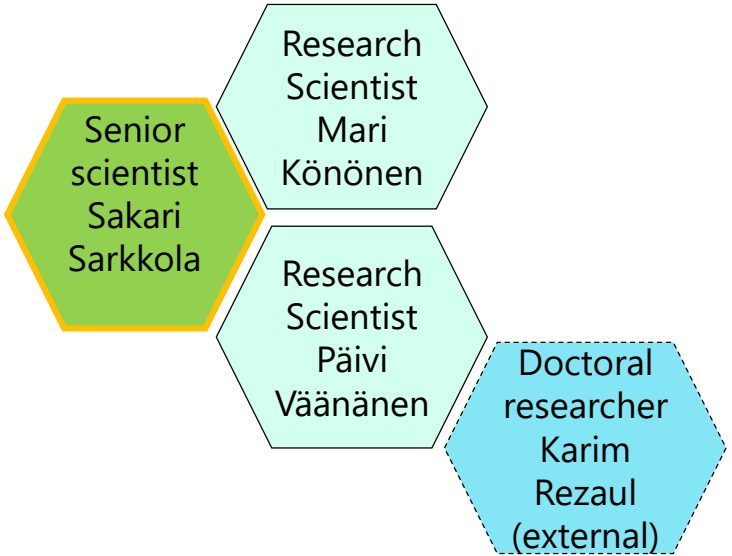
- **Sustainable use** of forests is promoted. (all programmes)
- Climate change challenges are met by **improving forest growth and carbon sequestration**. Land&Climate, Bio2Circular
- Forest **biodiversity is protected** and enhanced. Value4Bio, ReSiliencE2
- **Soils are protected and negative impacts on watercourses** are minimized. Land&Climate
- **Multiple use of forests is better taken into account** in forest management. ReSiliencE2
- **Preparedness** to warmer climate and extreme weather events and to increased risk of disasters is **improved**. ReSiliencE2
- **Rapid and successful forest regeneration** is guaranteed. Value4Bio
- The **benefits of coninuous cover forestry (CCF) are utilized** and the risks are overcome. Value4Bio, ReSiliencE2
- **Genetic improvement** potential is taken in more efficient use. Value4Bio
- Awareness of the costs and benefits of forest management operations are promoted and **cost-efficiency is improved**. Value4Bio
- **New technologies** and operation methodologies are implemented. Value4Bio



1. Forest and Water balance Management in Peatlands

Competencies:

- Peatland forests and their management
- Nutrient and Water balance
- Timber production
- Carbon balance
- Biodiversity
- Ecosystem services



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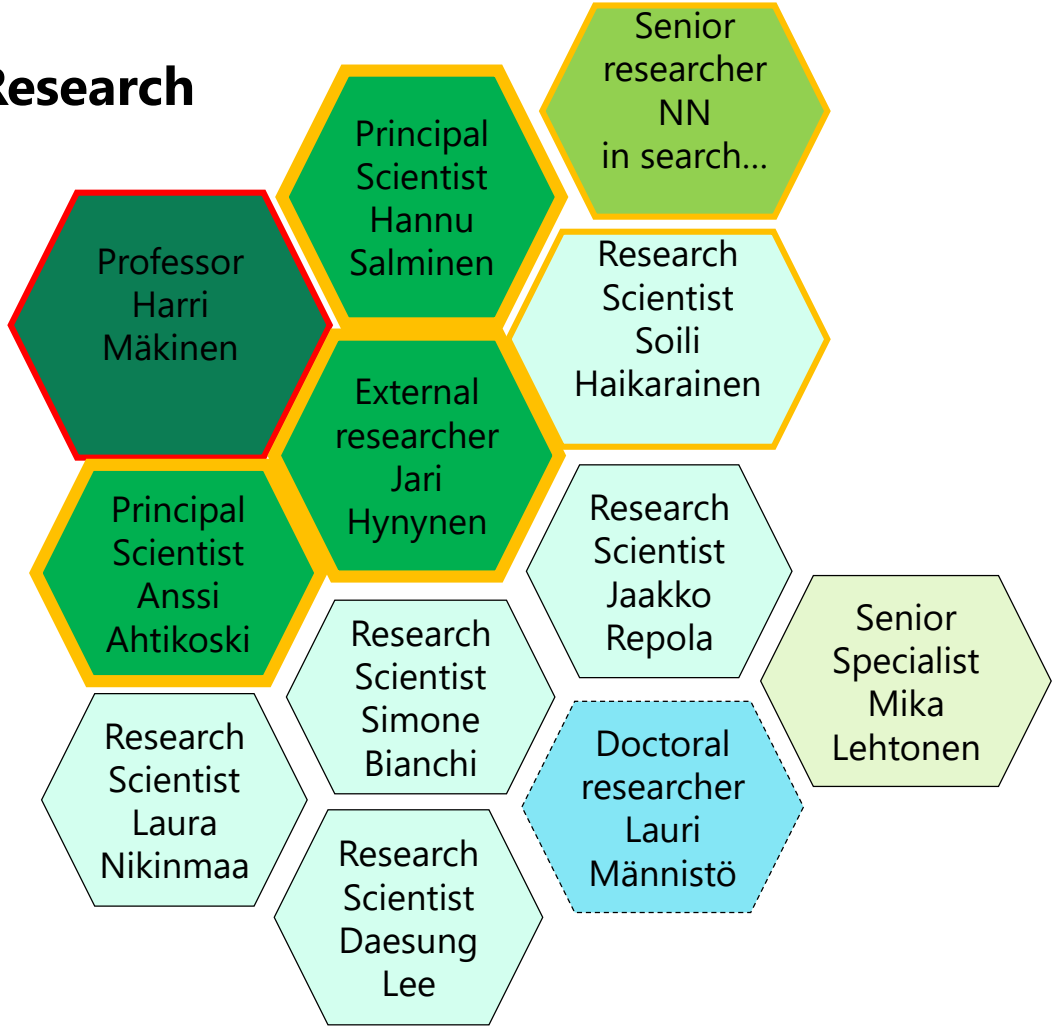
2. Forest Growth and Yield Research

Competencies:

- Growth dynamics of Forests: rotation and Continuous Cover Forestry
- Forest growth modelling and scenario calculations
- Enhancing forest growth and increase of mixed-species forests
- Motti-calculations and simulations, forest growth model kernel for calculations systems



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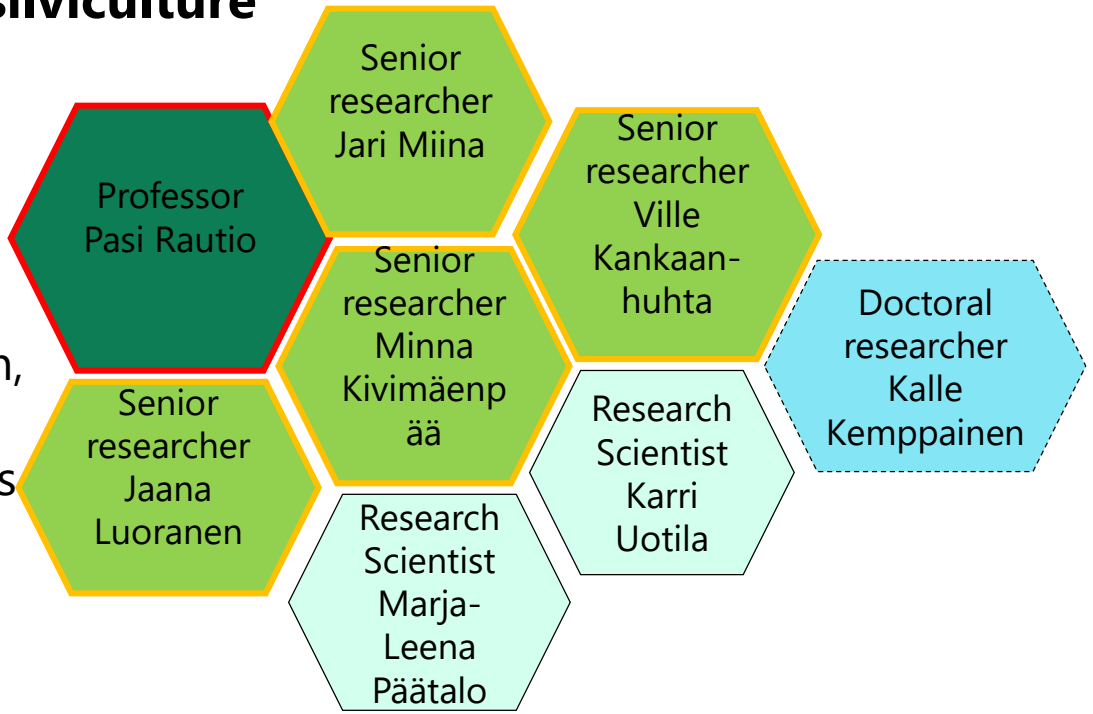
3. Forest Regeneration and silviculture

Competencies:

- Forest regeneration biology:
  flowering and seed yields of forest trees,
  management of seed production, direct seeding
  natural regeneration of seedlings
- Forest tree nursery production
- Forest regeneration and young stand management
- Damage risk management
- Technology for silviculture



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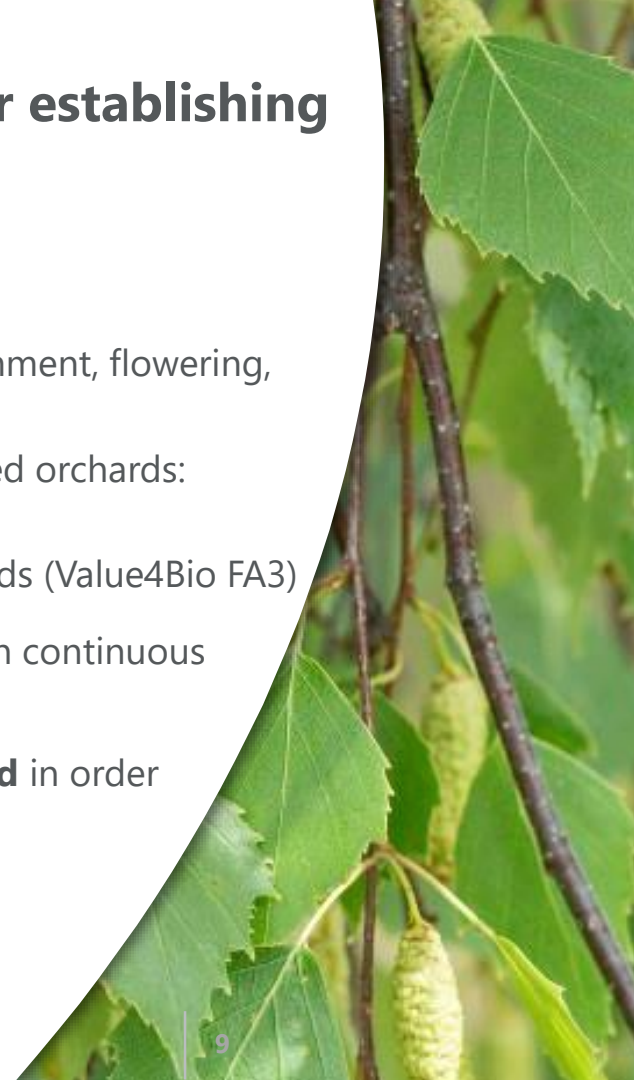
3.1. Enough high quality seeds are produced for establishing diverse forests in changing climate

- **Seed orchards** meet the future needs:
  - **Seed production is improved** at seed orchards (establishment, flowering, seed protection) (Value4Bio FA4)
  - **Genetic diversity is taken into account** in managing seed orchards: maintanence of clonal diversity (ReSiliencE2 FA4)
  - **Selection of tree species is more diverse** at seed orchards (Value4Bio FA3)
- **Seed availability and its genetic diversity are quaranteed** in continuous cover forestry (Value4Bio FA4)
- **Genetically improved seed material is more efficiently used** in order to improve seed availability (Value4Bio FA4)



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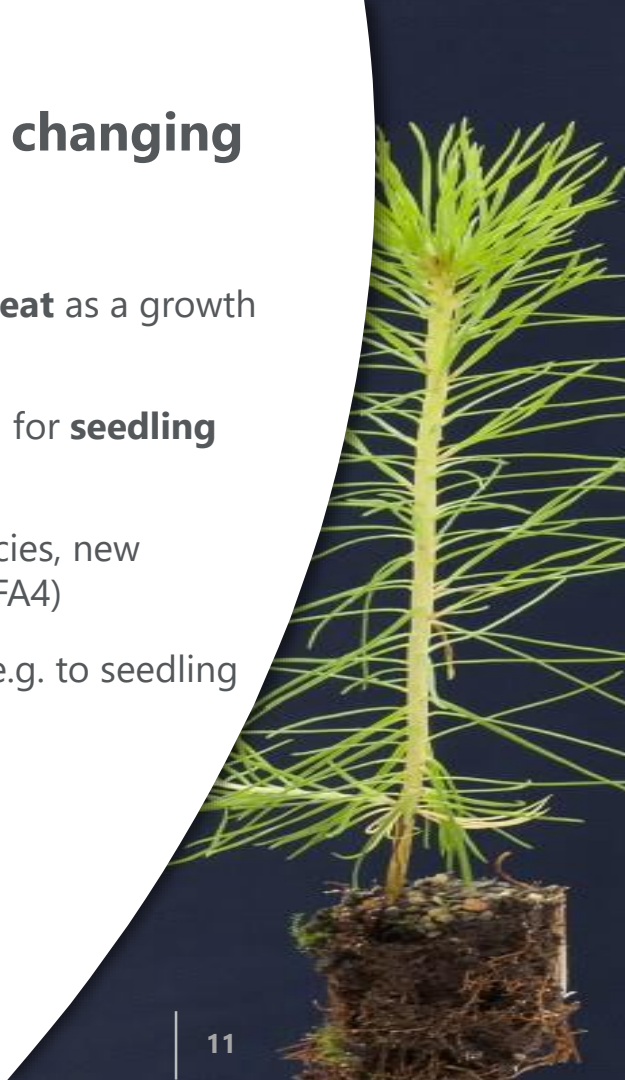
3.2. Acclimation and adaptation to changing climate conditions and extreme weather events

- **Resistance and resilience to abiotic stresses** and their interactions during annual cycle are considered more in silvicultural operations and tree breeding programmes (ReSiliencE2 FA1)
- The **role of increasing tree species diversity, mixed forests and continuous cover forestry** in the mitigation of negative impacts of climate change is known (ReSiliencE2 FA4)
- **Seedling production and forest regeneration is adapted to** changing climatic conditions in different seasons (ReSiliencE2 FA4)
- The impacts of climate change on pest damage are understood. Silvicultural **measures for mitigation of new pest damage are developed**. Methods for identification of pests and stopping the outbreaks are available (ReSiliencE2 FA4)

3.3. Seedling production and logistics adapts to changing operational environment

- Sustainagle growth **materials are developed for replacing peat** as a growth medium (recycling of materials) (Bio2Circular FA3)
- New **methods, technologies and automation** are developed for **seedling production** (Value4Bio FA2)
- The **future needs of plant protection are met**: new tree species, new solutions such as UVC and plant based products (ReSiliencE2 FA4)
- New **solutions are developed to support seedling supply** (e.g. to seedling storage and logistics) (Value4Bio FA2)



3.4. Cost-efficient management chain produces diverse climate-smart forests

- **Climate-smart, high quality forest management chain** for regeneration and young stand management (Value4Bio – FA4, ReSiliencE2 FA3, Land&Climate – FA2)
  - **Damage risk management** for regeneration chain is developed.
  - **Wood production and carbon sequestration** in forest regeneration are **optimized**.
  - **Precision forestry** – aims for good forest regeneration method, good **soil preparation** result, tree **species selection** and **good environmental performance** of forest management are harmonized. (Value4Bio FA2, Land&Climate FA2)
- **Information invenstive, digital operation models are developed** for forest regeneration and young stand management. (Value4Bio FA2)
- **New technologies** are developed and cost-efficiency is improved in **mechanized forest management**. (Value4Bio – FA2)

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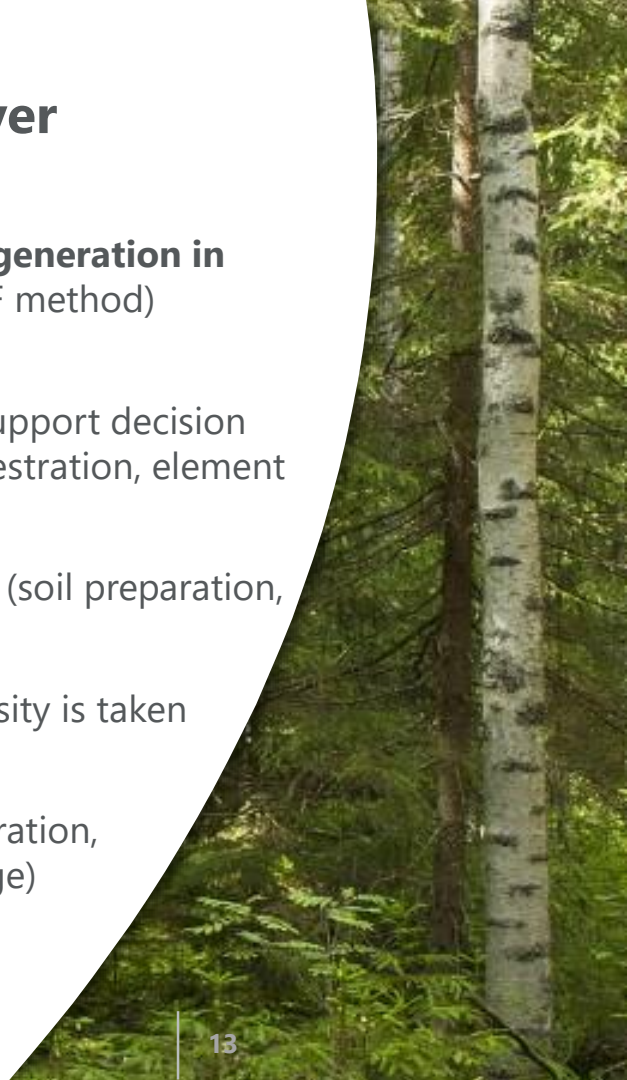
3.5 Regeneration is sucessful in continuous cover forestry (CCF)

- **Solutions are developed to meet the challenges in CCF regeneration in peatland forests** (groundwater level control, selection of CCF method) (Value4Bio FA2, Land&Climate FA2, FA3)
- Developed, **novel CCF simulation methods** are applied to support decision making in CCF – regeneration, growth, cuttings, carbon sequestration, element export to surface waters (Value4Bio FA2)
- **Methods for improving regeneration result** are developed (soil preparation, complementary planting) (Value4Bio FA2, Land&Climate FA2)
- **Maintanence of genetic biodiversity** and tree species diversity is taken into account in CCF (Value4Bio FA1, ReSiliencE2 FA1)
- **Risks are known and managed in CCF** (e.g failure in regeneration, management of undergrowth and small trees, root rot damage) (ReSiliencE2 FA4)



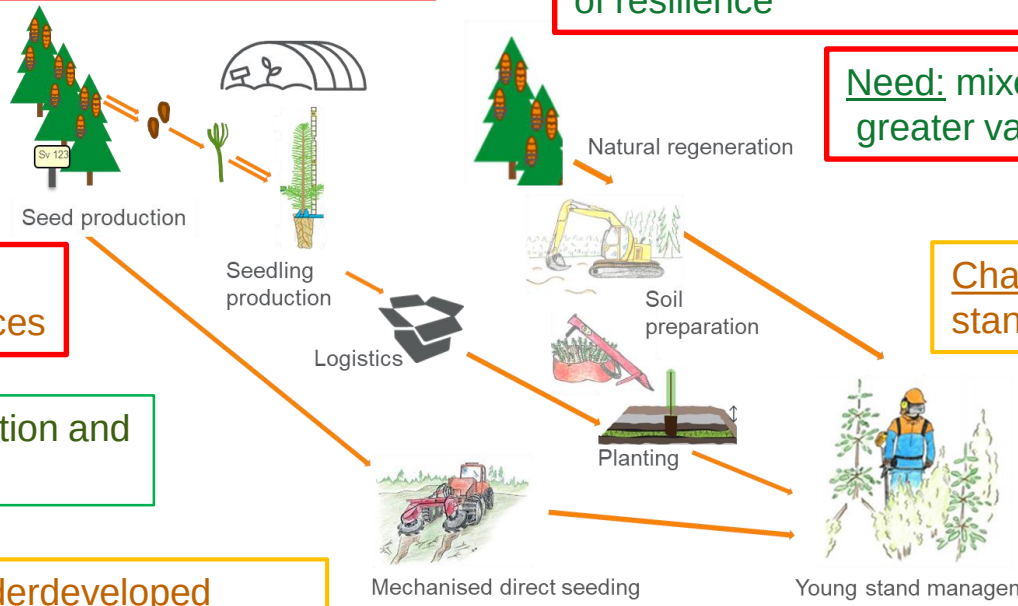
Co-innovation – *e.g. in Silviculture technology…?*

Need: agility in operations – precision forestry

Need: damage risk management and increase of resilience

Challenge: cost-efficiency

Need: mixed-species stands and greater variety of tree species



Challenge: lack of labour force & resources

Challenge: neglection of young stand management

Need: mechanization and digitalization

Need: carbon sequestration and products with long life cycle

Challenge: underdeveloped services in opened markets

Challenge: quality of regeneration

Thank You!

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