



TOWARDS A TRANSFORMATIVE *BATTERY* TERRITORY

A Spatial Exploration of Response-able Future Pathways for North-East Hungary

Fruzsina Kovács | 5675316

23. 06. 2025. - P5 presentation

first mentor: Alexander Wandl

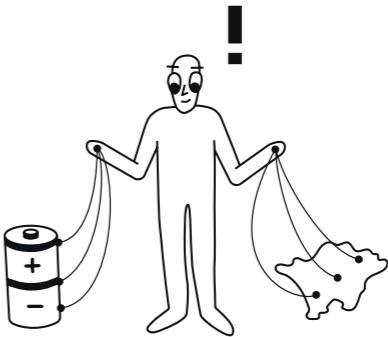
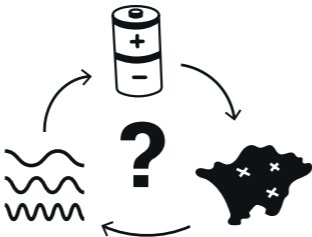
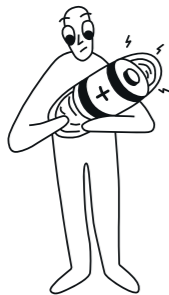
second mentor: Francesca Rizzetto

delegate: Angela Greco

Metropolitan Ecologies of Places Studio, 2024-25

Samsung SDI battery factory in Göd (source: János Bódey / Telex)

NARRATIVE
NARRATIVA



1

2

3

4

5

6

Problem Field

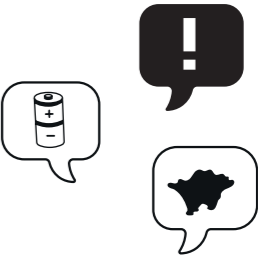
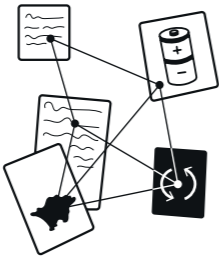
Transformability

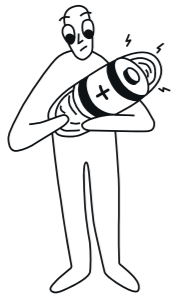
Understanding

Exploration

Operationalisation

Conclusions



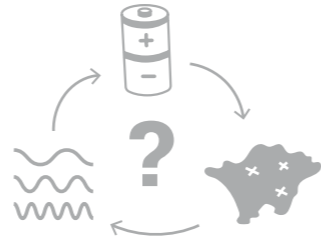


1

Problem Field

2

Transformability

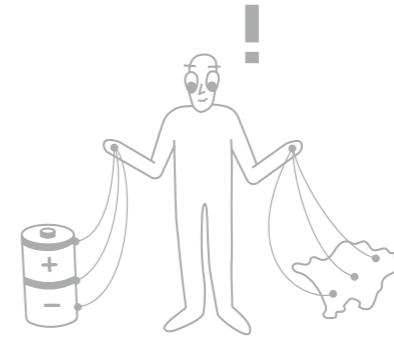


3

Understanding

4

Exploration

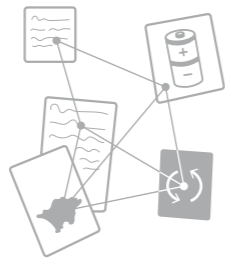


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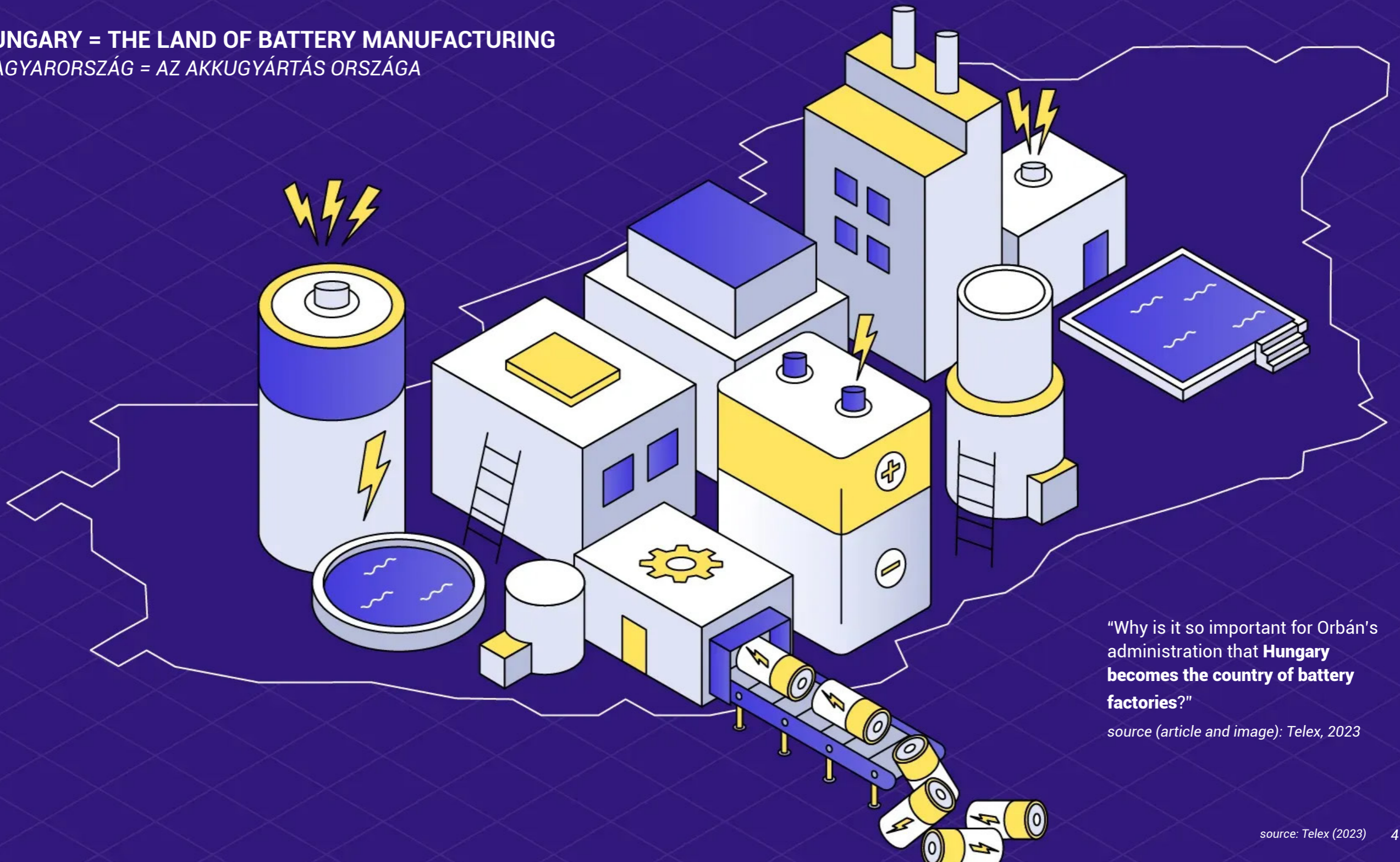
Operationalisation

6

Conclusions



HUNGARY = THE LAND OF BATTERY MANUFACTURING
MAGYARORSZÁG = AZ AKKUGYÁRTÁS ORSZÁGA



"Why is it so important for Orbán's administration that **Hungary becomes the country of battery factories?**"

source (article and image): Telex, 2023

ECONOMIC DEAD-END PRODUCTION DECLINE

GAZDASÁGI ZSÁKUTCA ÉS GYÁRTÁSI VISSZAESÉS



They let the external contractors go, then started firing colleagues over the smallest things. Now they've told us we're next.

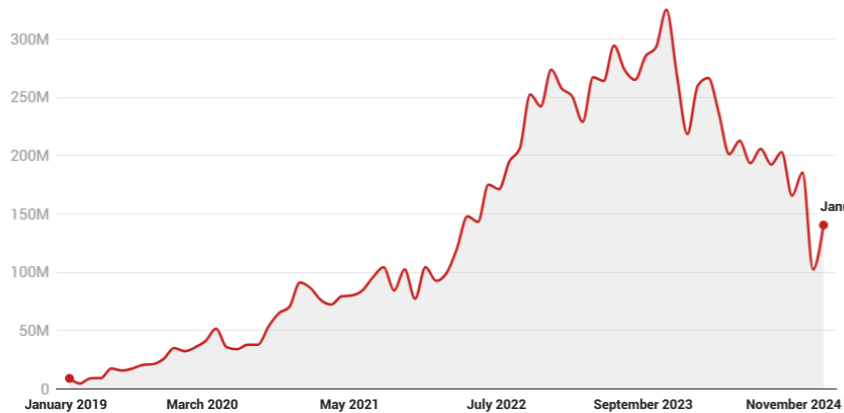
ECONOMY 19. February 2025. - 05:04



Battery production in Hungary dropped sharply by 32 percent in May.

ECONOMY 12. July 2024. - 10:52

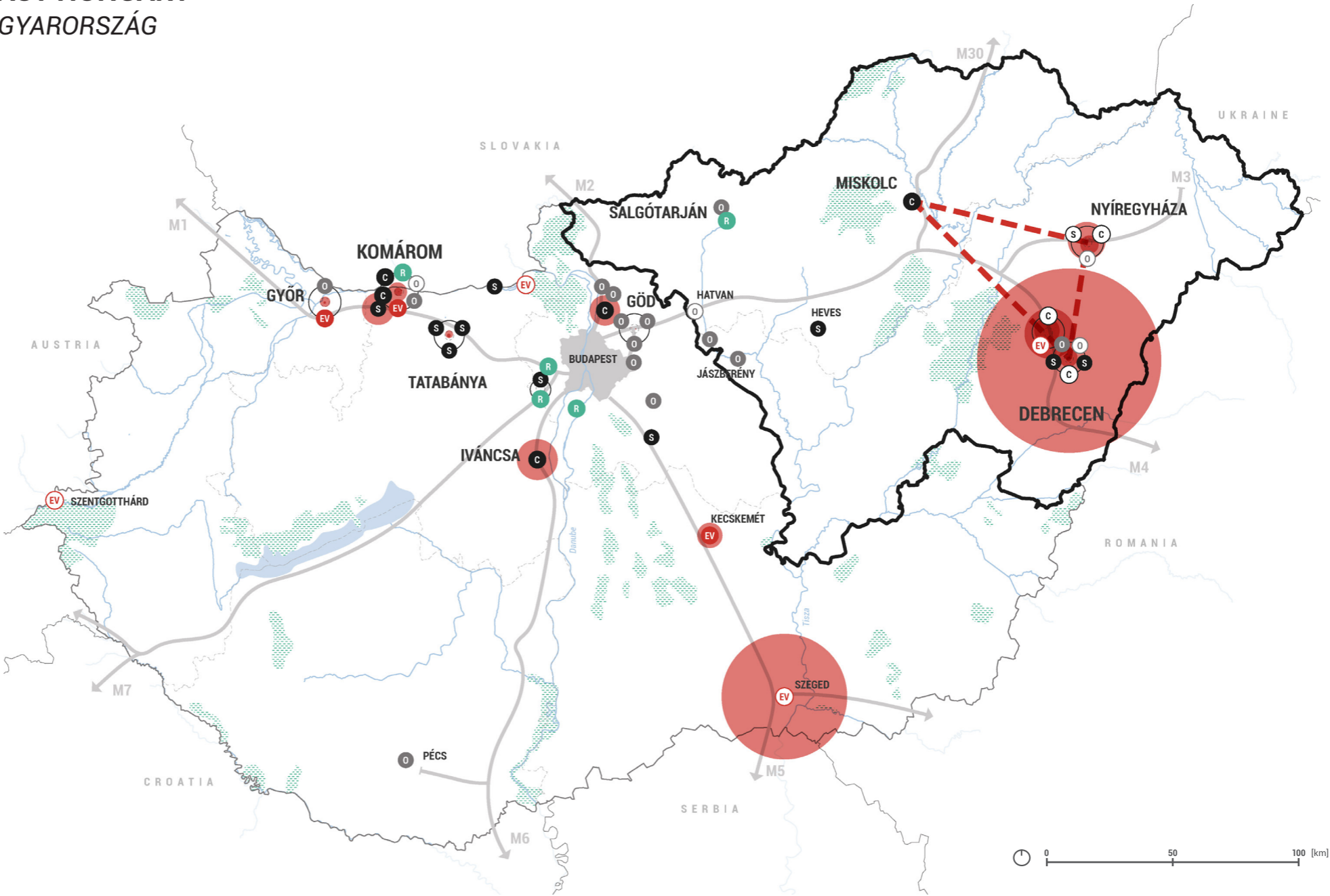
Production value of battery and dry cell manufacturing (thousand HUF)



REGION IN FOCUS: NORTH-EAST HUNGARY
FÓKUSZRÉGIÓ: ÉSZAK-KELET MAGYARORSZÁG



- active / ○ planned or being built
- EV Electric vehicles
- C Cell manufacturers
- S Sub-component manufacturers
- O Other components
- R Recycling companies
- Highways
- Waterways
- Waterbodies
- NUTS2 region borders
- National parks
- Value of investment (Billion HUF)



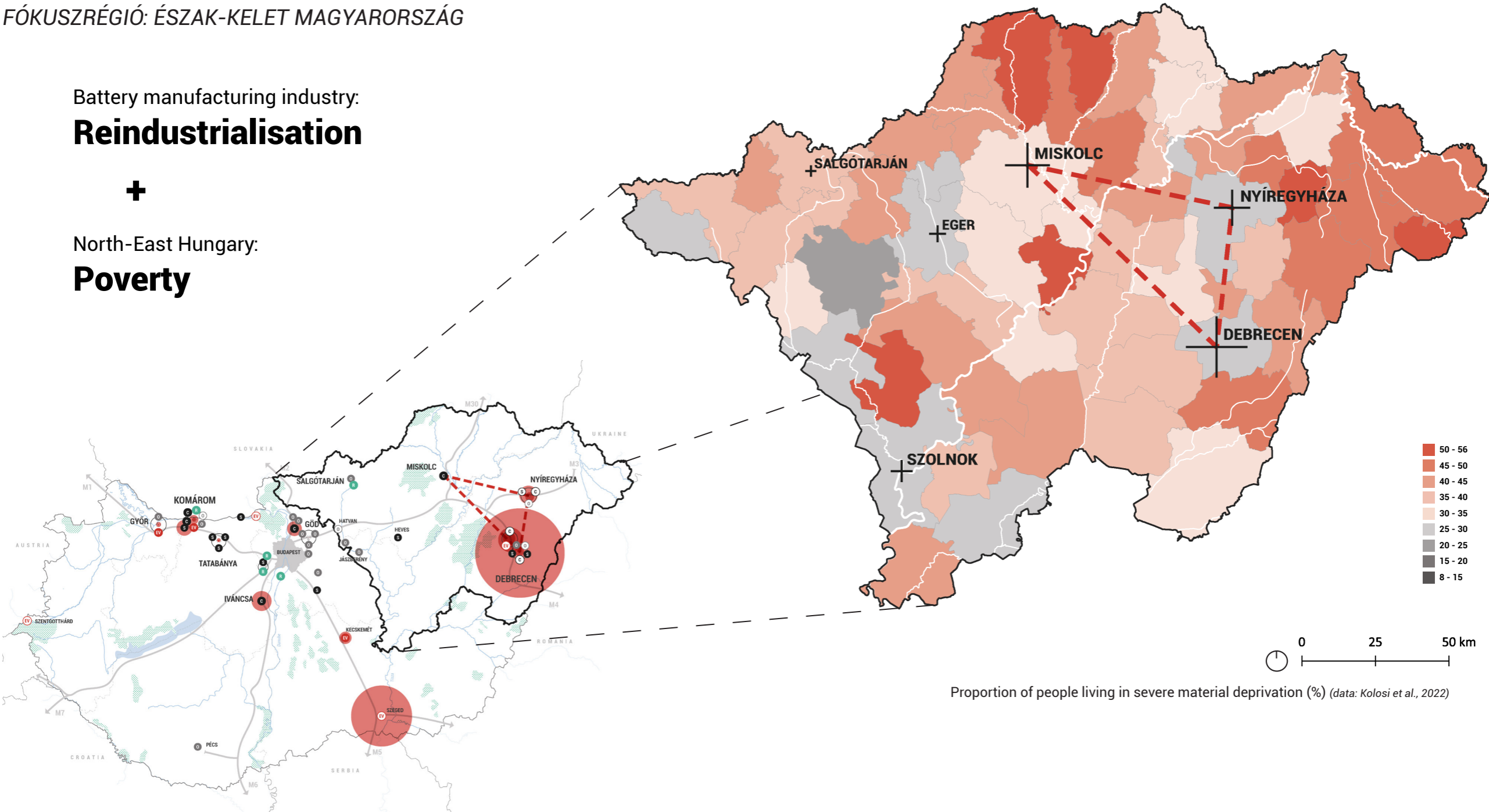
REGION IN FOCUS: NORTH-EAST HUNGARY
FÓKUSZRÉGIÓ: ÉSZAK-KELET MAGYARORSZÁG



Battery manufacturing industry:
Reindustrialisation



North-East Hungary:
Poverty



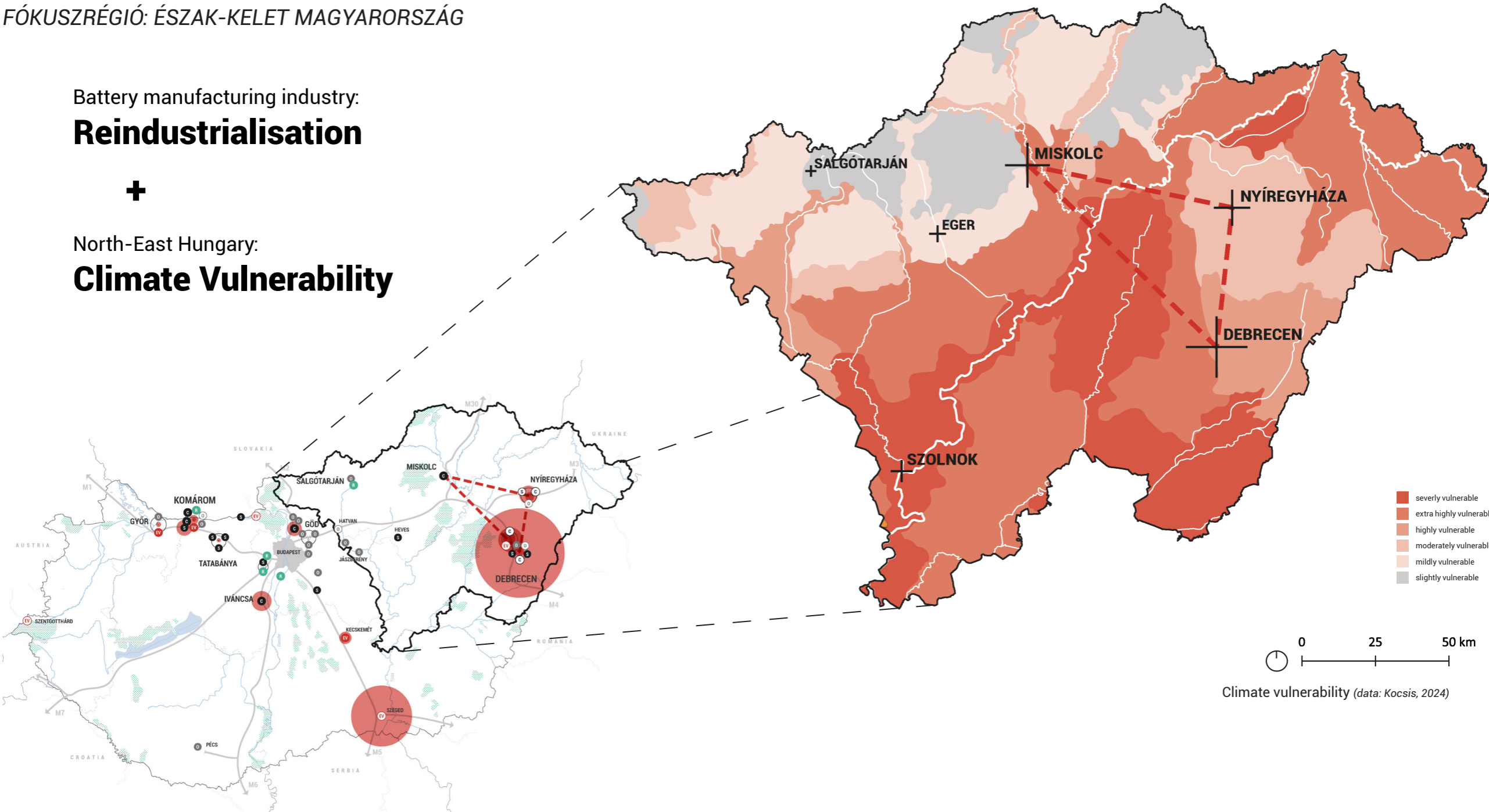
REGION IN FOCUS: NORTH-EAST HUNGARY
FÓKUSZRÉGIÓ: ÉSZAK-KELET MAGYARORSZÁG



Battery manufacturing industry:
Reindustrialisation



North-East Hungary:
Climate Vulnerability





... & UNCONTEXTUAL DEVELOPMENTS

... ÉS KONTEXTUS NÉLKÜLI FEJLESZTÉSEK



"[...] considerations related to **regional development or local characteristics do not appear to play a role in site selection** for these investments (with the exception of clustering within the value chain)." (Czirfusz, 2022)



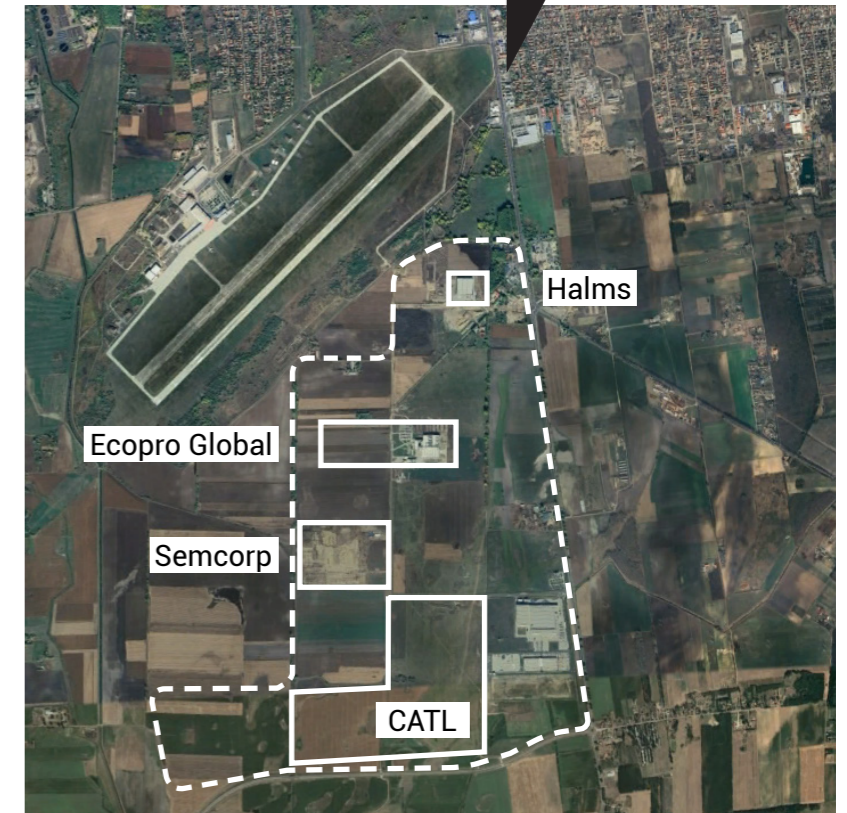
Megafactories next to villages

SK, Iváncsa - next to a village of 3000 inhabitants, without participatory planning, polluting the soil, water and air,



Greenfield developments

W-Scope, Nyíregyháza - it is being built at the moment on one of the best agricultural soils in the country



Away from resource availability

Southern Industrial Park, Debrecen - no water available nearby, they need to build a pipe system to provide for the factories (CATL, Halms, Semcorp, EcoPro Global)



Hungary is currently experiencing a rapid (re)industrialisation process under the banner of **sector electrification**, pushed by the economic vision of the government. Resulting in **uncontextual development patterns both spatially and socially**, the process can be described as an '**unsustainable sustainability transition**'.

BATTERY = CURRENT & FUTURE CRISIS

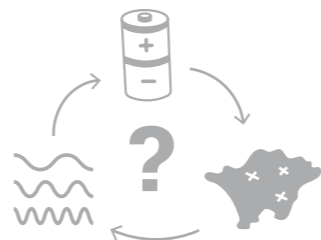
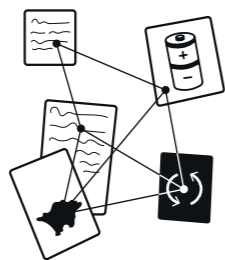


1

Problem Field

2

Transformability

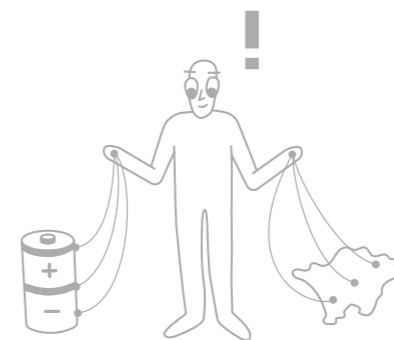


3

Understanding

4

Exploration



5

Operationalisation

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Conclusions





TRANSFORMABILITY

/ TRANSFORMATIVE RESILIENCE /



TRANSFORMABILITY

/ TRANSFORMATIVE RESILIENCE /



VALUES (following Folke, 2016)
ÉRTÉKEK (Folke (2016) után)



**DEVELOPMENT WITHIN THE
PLANETARY BOUNDARIES**



JUST SOCIETY



**RESILIENT BIOSPHERE FOR
HUMANITY AND ECOSYSTEMS**

THE ENABLERS OF TRANSFORMABILITY
AZ ÁTALAKÍTHATÓSÁGOT ELŐSEGÍTŐ TÉNYEZŐK





How could the **current battery crisis be leveraged** to enable **long-term spatial, transformative change** in **North-East Hungary**?

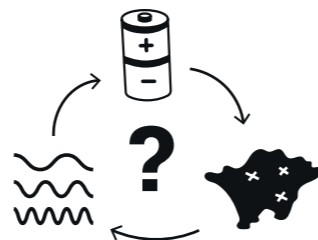


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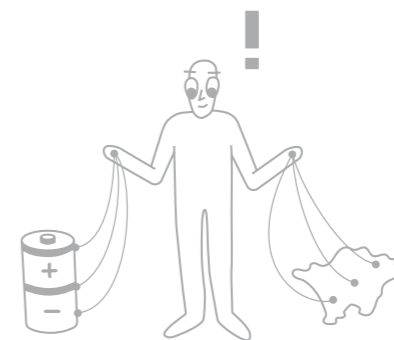


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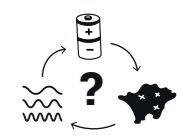
Operationalisation

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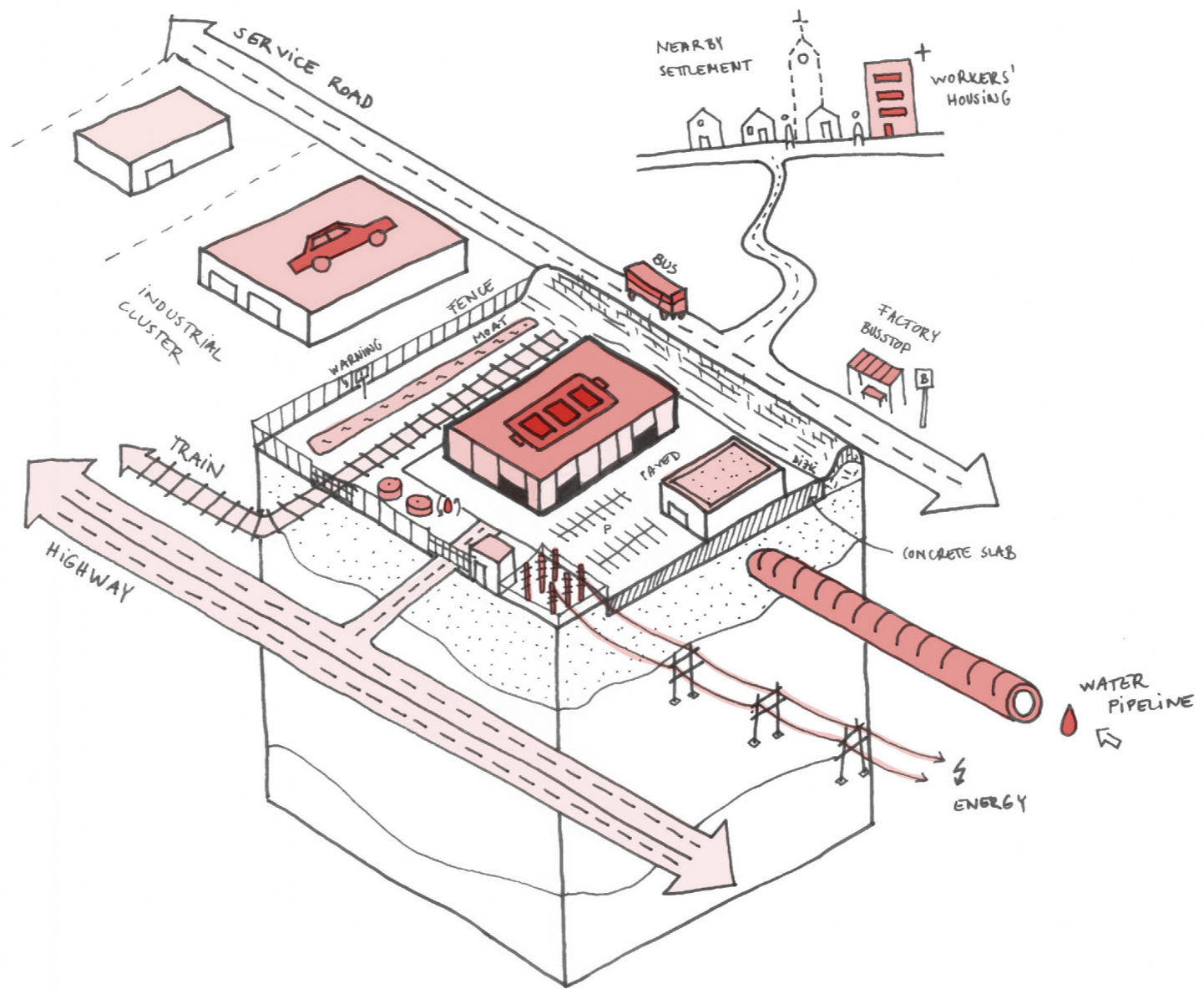
Conclusions

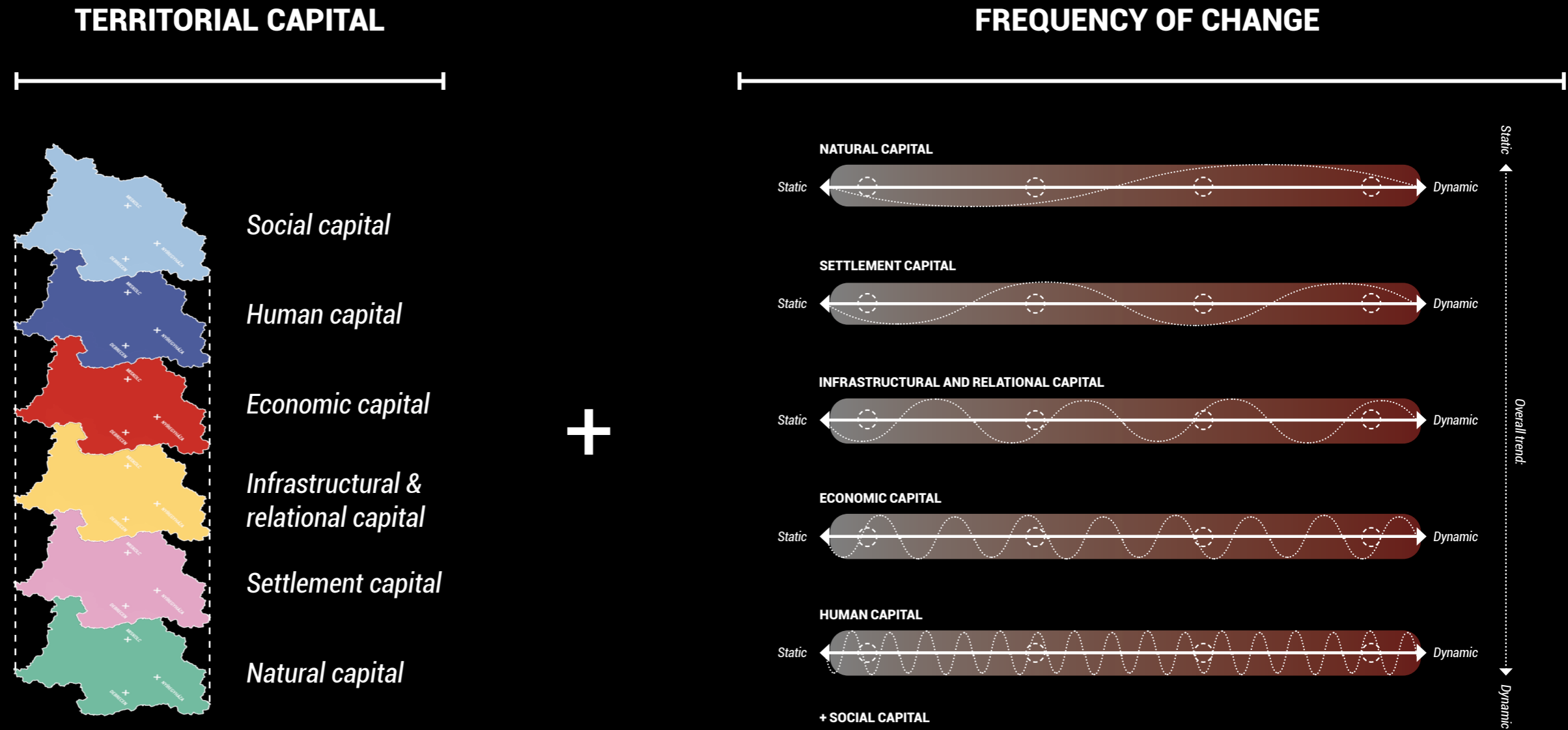


BATTER-POTENTIALS
AKKUMULÁTOR - LEHETŐSÉGEK



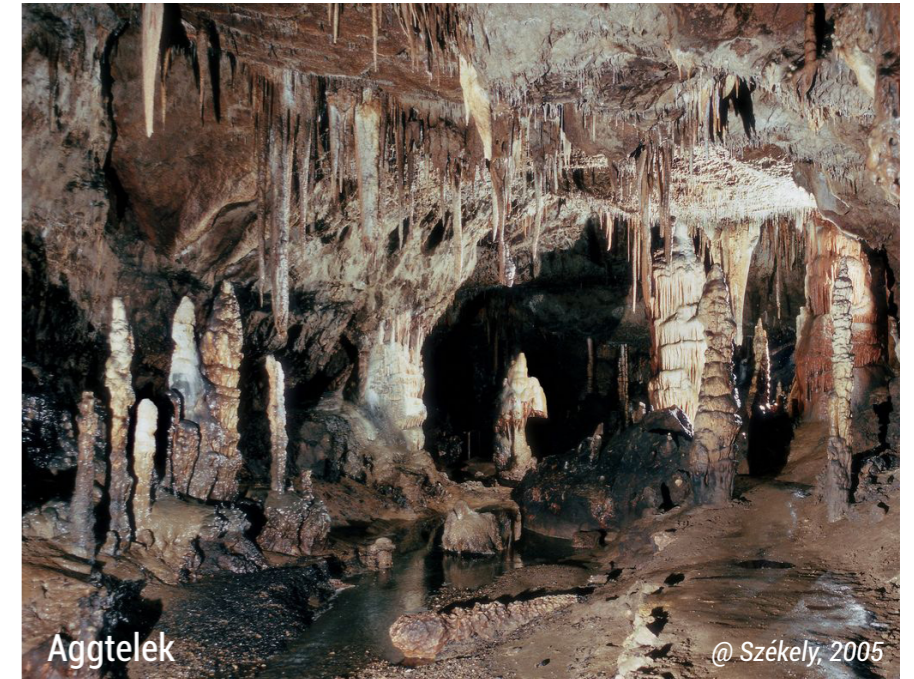
- ! Strict environmental regulations
- € Compulsary contribution
- Shared interest: improving efficient infrastructure
- Changing ownership
- Diversify production
- Localise production
- Batteries + other function
- Batteries + circular function
- Industrial symbiosis: with other industries, settlements, R+D





NATURAL CAPITAL

TERMÉSZETI TŐKE

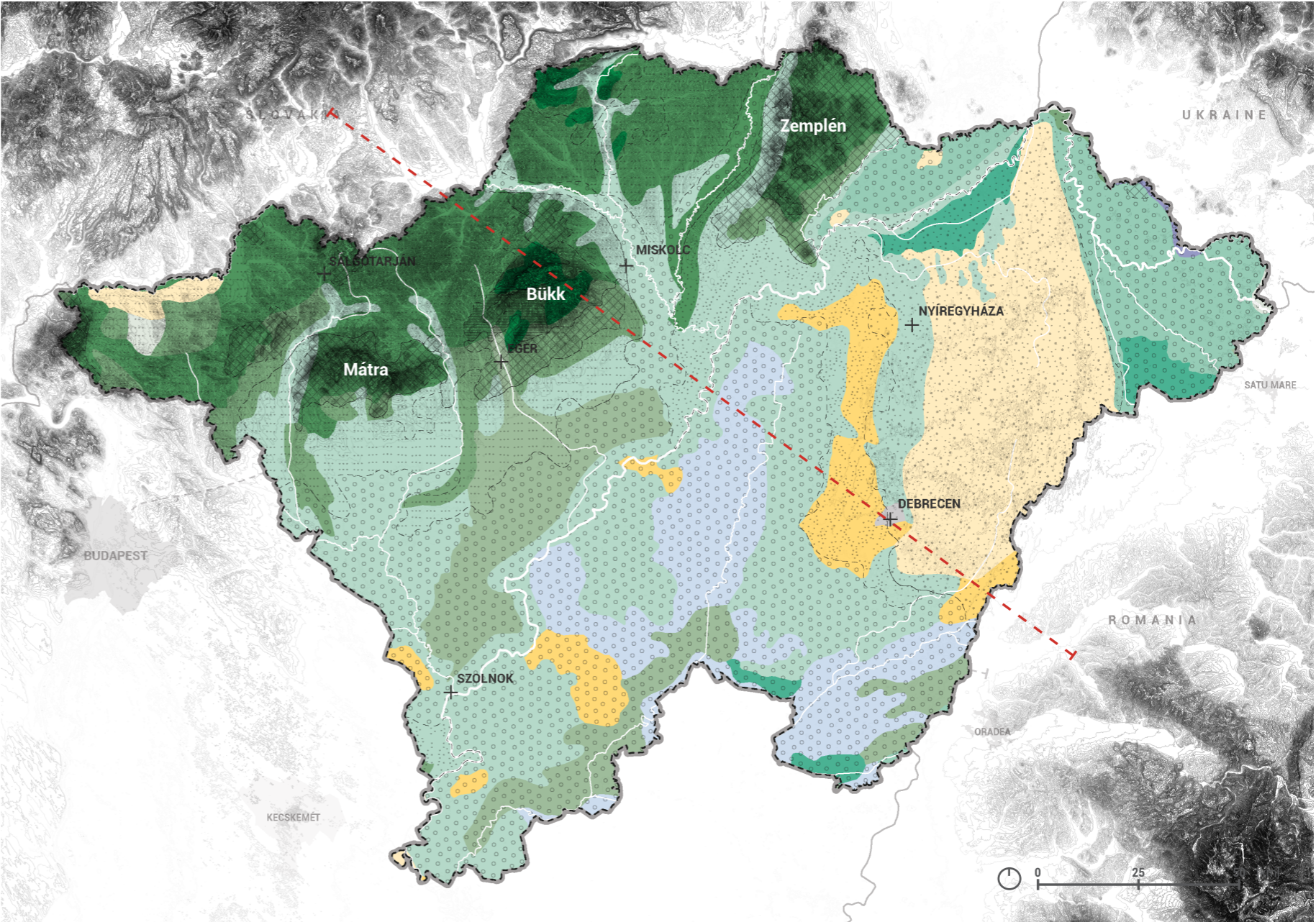
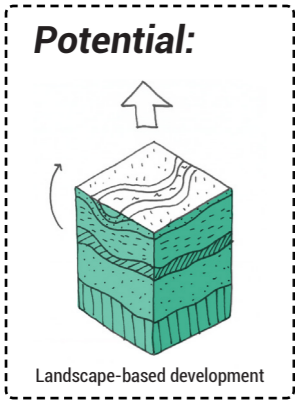


NATURAL CAPITAL: GEOMORPHOLOGY, TOPOGRAPHY, SOIL

TERMÉSZETI TŐKE: DOMBORZAT, TALAJ

- SOIL TYPES
- Sand (arenosol)
 - Black soil / humous (chernozem)
 - Leached black soil (phaeozem)
 - Young river sediment (fluvisol)
 - Swamp soil (histosol)
 - Salinated soil (solonetz)
 - High-swelling clay soil (vertisol)
 - Brown forest soil (cambisol)
 - Brown forest soil with clay (luvisol)
 - Rock-like soil (leptosol)
 - Waterlogged soil (gleysol)
 - Town

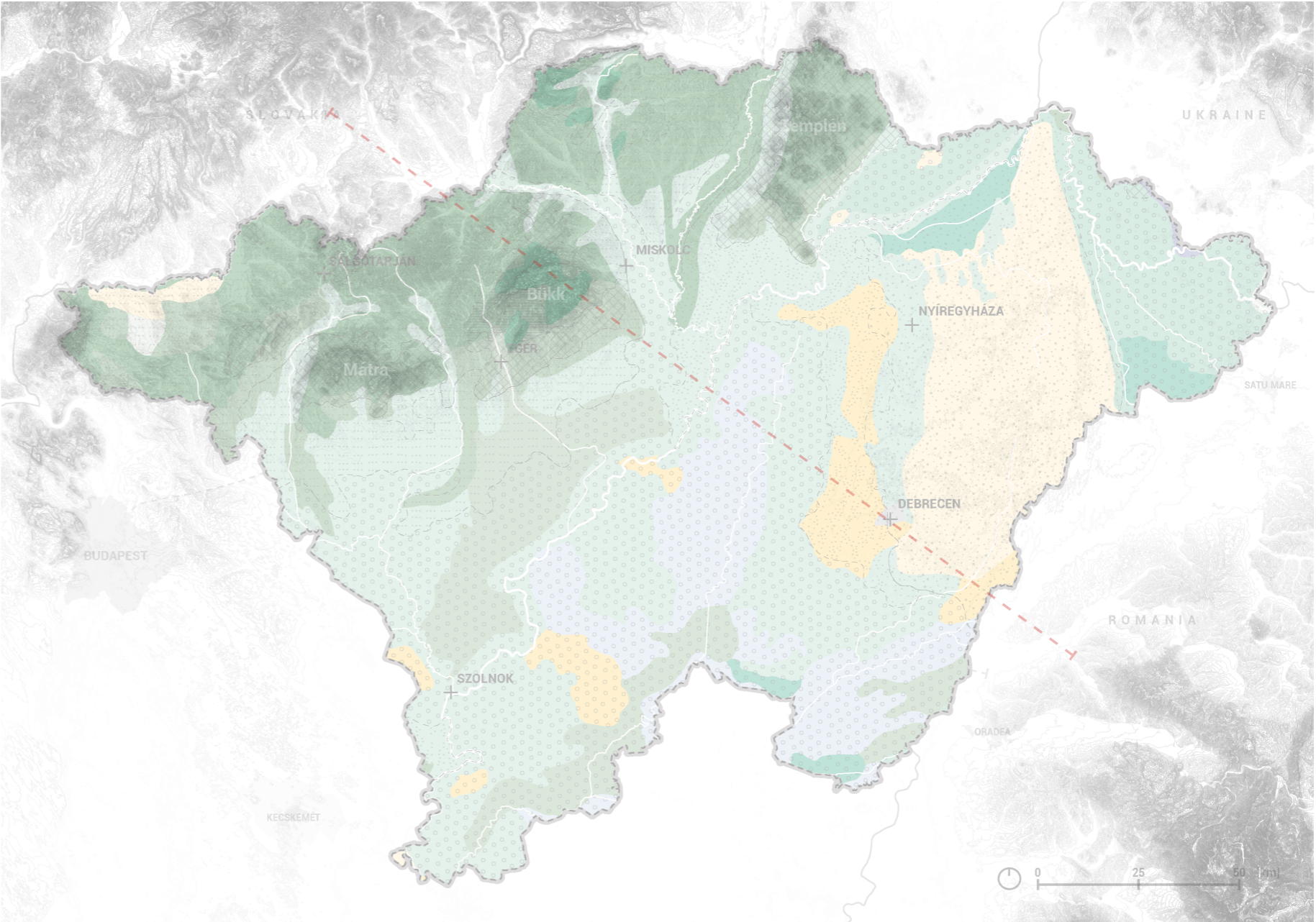
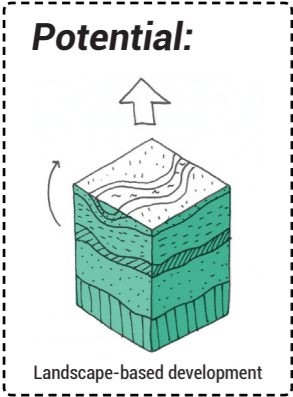
- GEOMORPHOLOGY
- Sand
 - Loess
 - Clay with sand
 - Sedimentary rock
 - Mezozoicum rock mix with basalt
 - Vulcanic rocks
 - Rivers
 - Topography



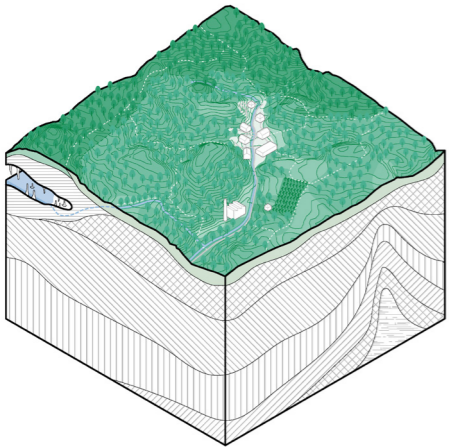
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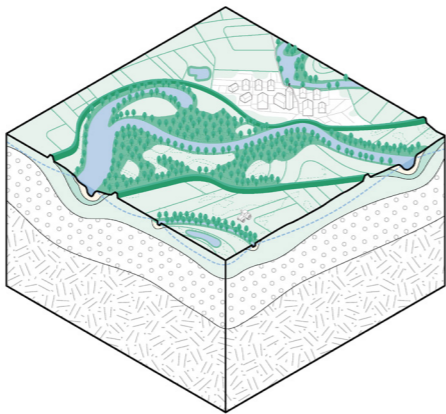
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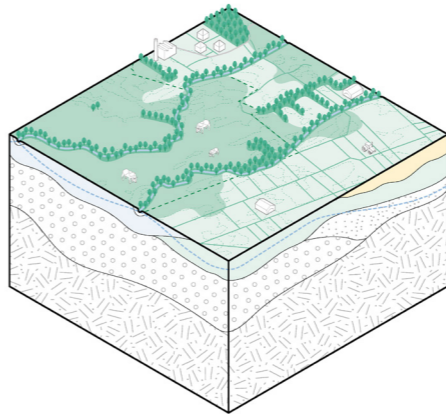
NATURAL CAPITAL: LANDSCAPE AS BASE
TERMÉSZETI TŐKE: A TÁJ, MINT KIINDULÁSI PONT



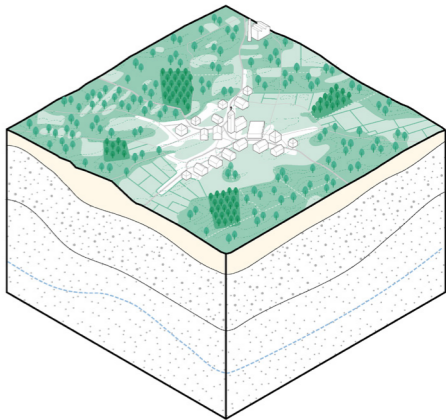
MOUNTAINS



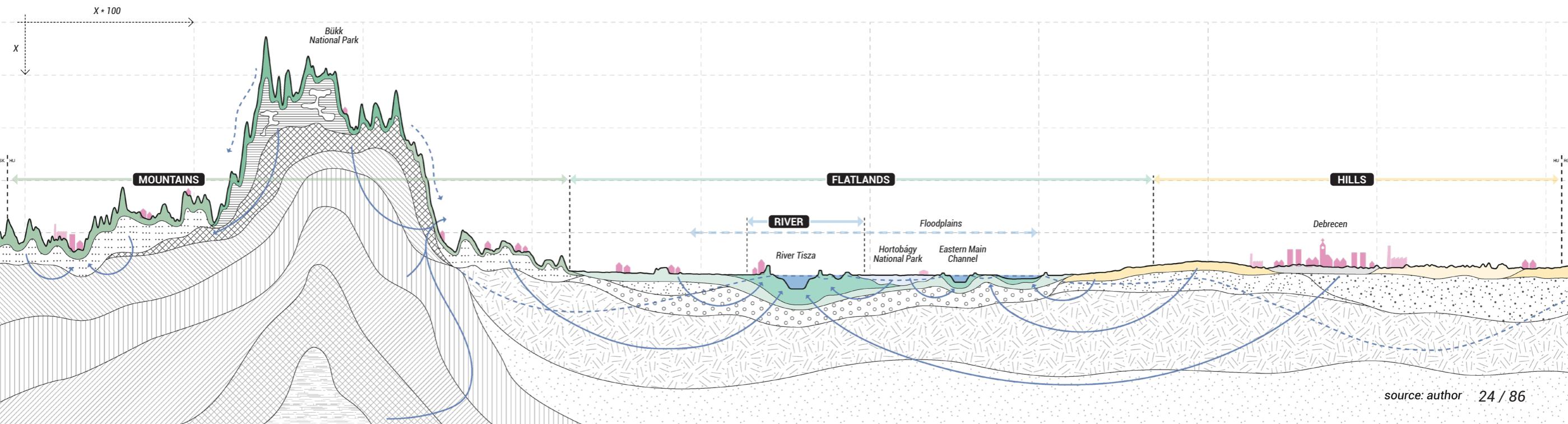
RIVERS



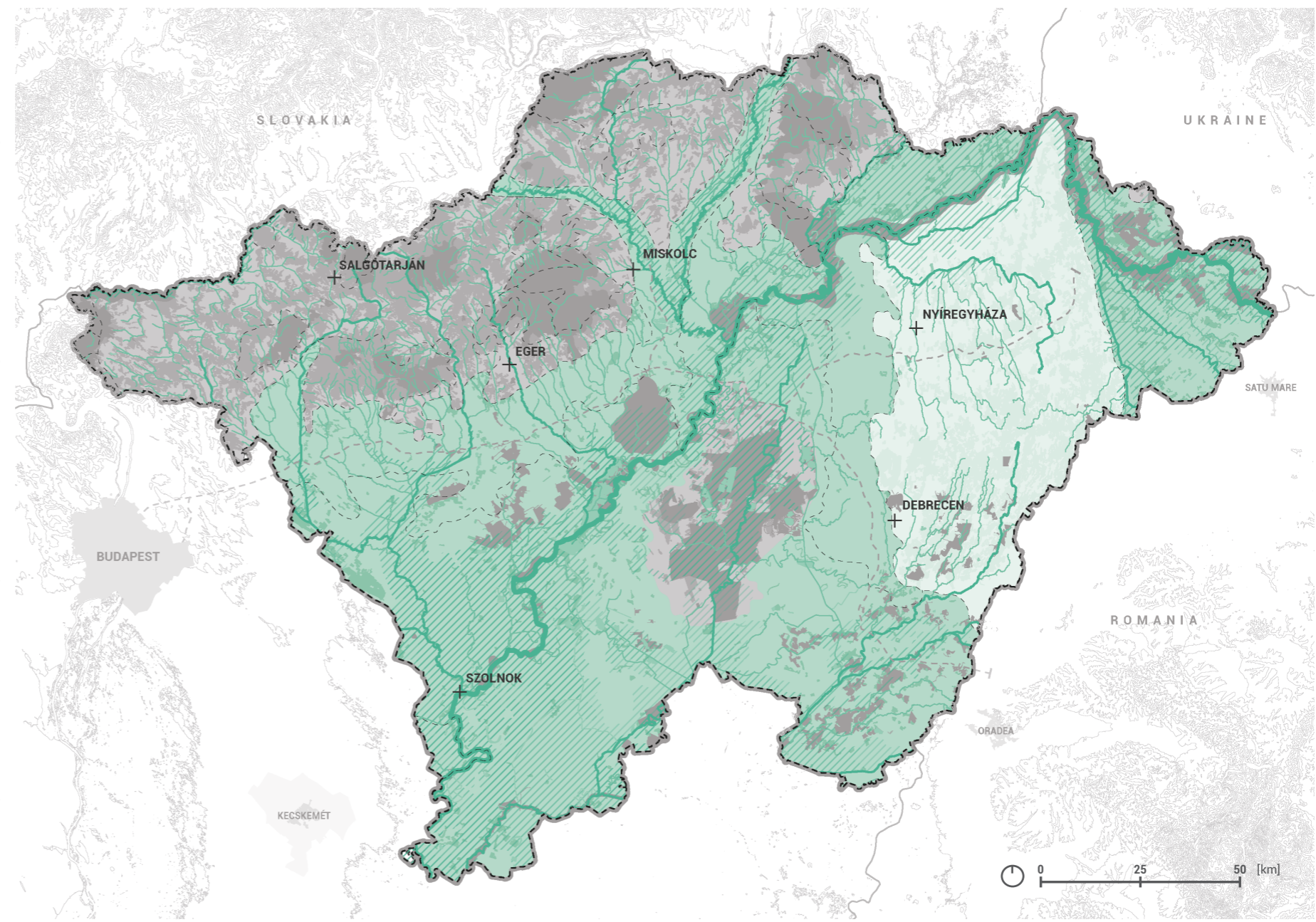
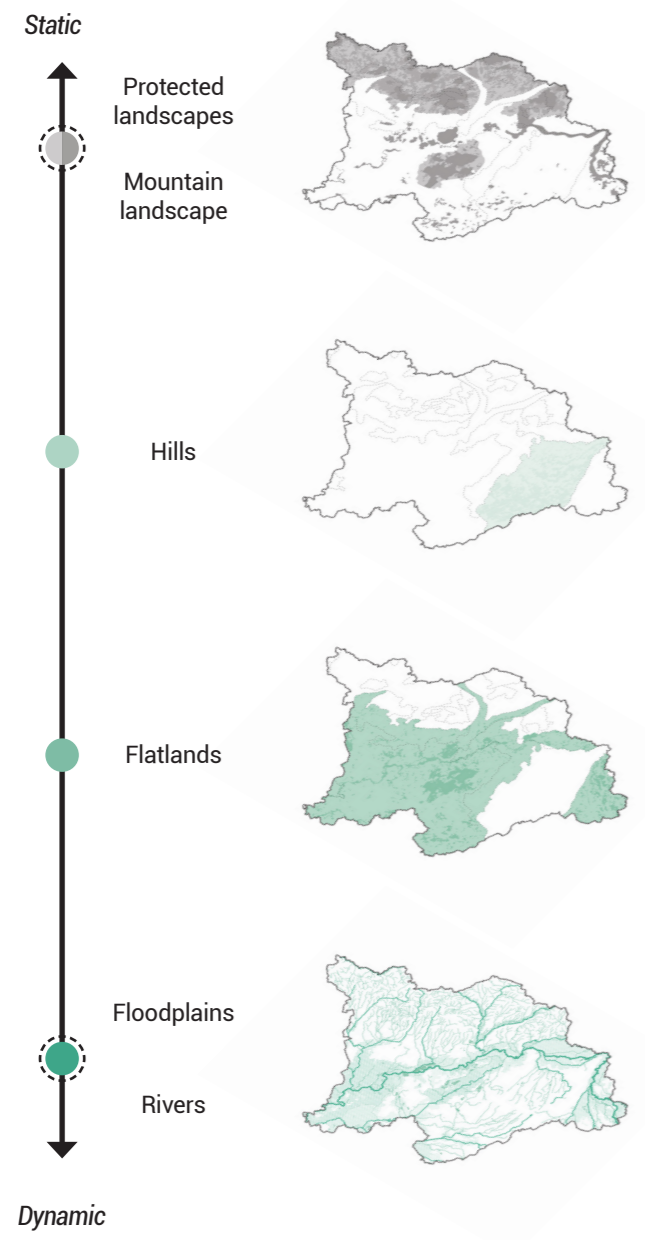
FLATLANDS



HILLS

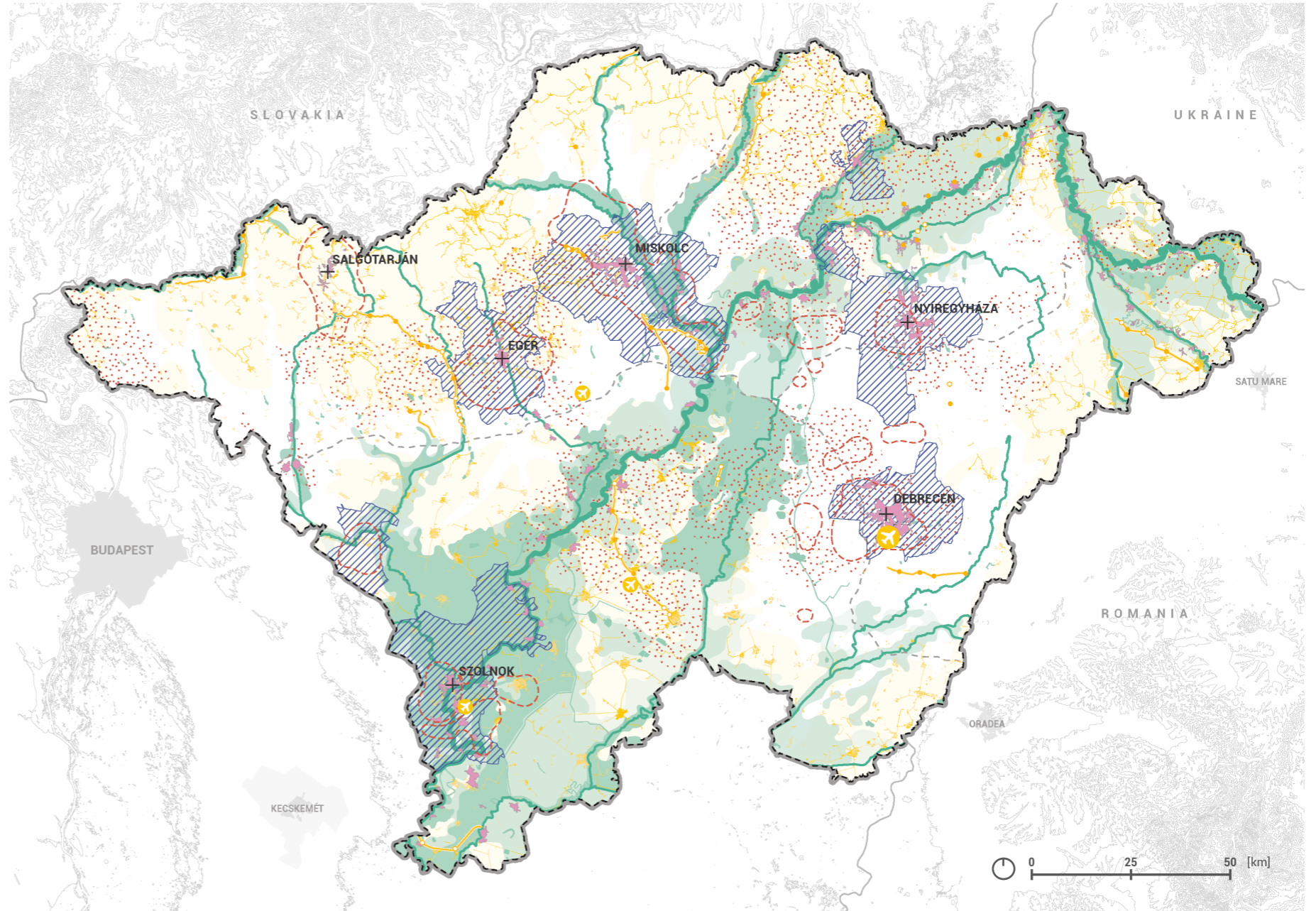


FREQUENCY OF CHANGE
A VÁLTOZÁS FREKVENCIÁJA



HIGH FREQUENCY OF CHANGE

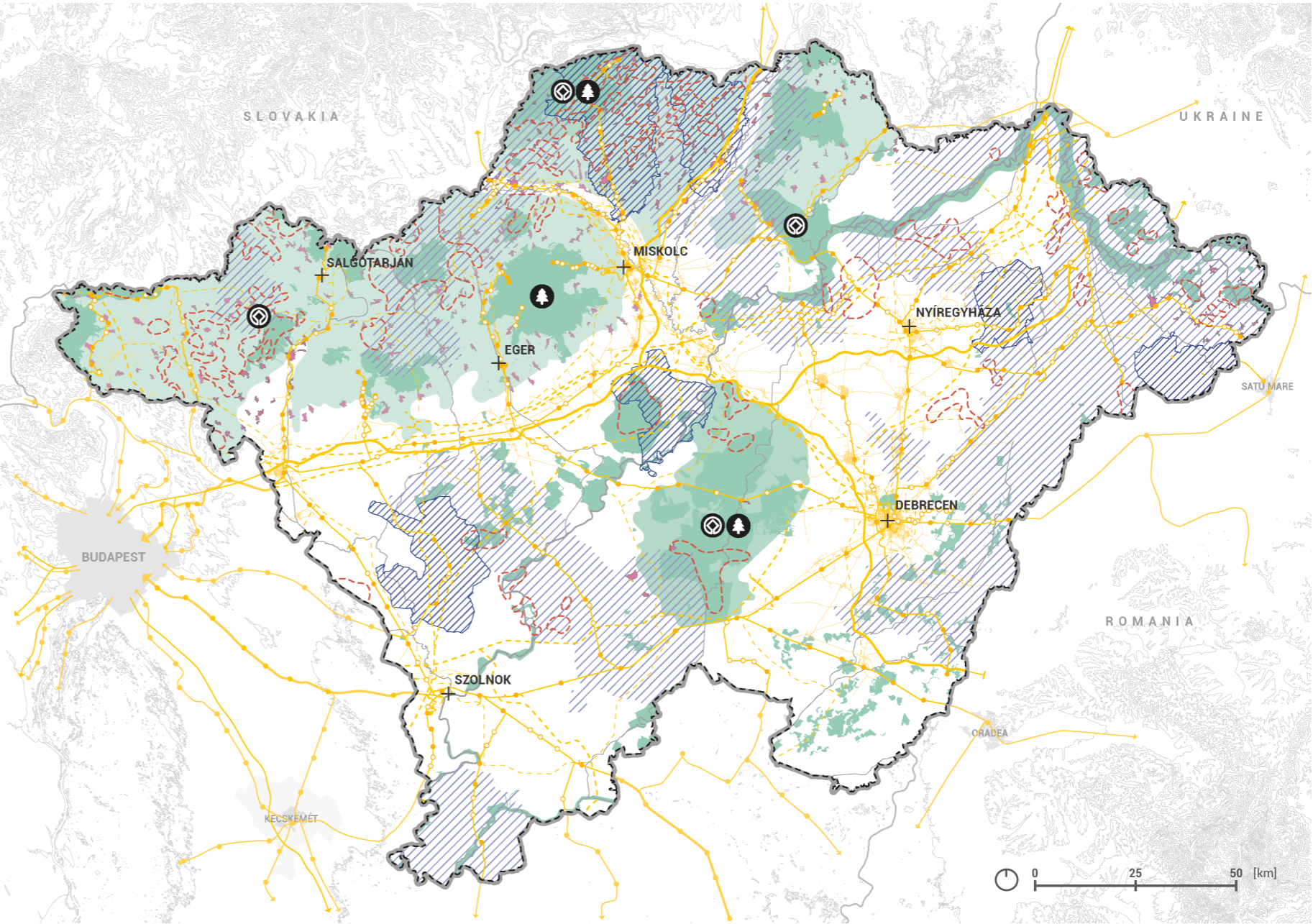
MAGAS VÁLTOZÁSI FREKVENCIÁK



LOW FREQUENCY OF CHANGE

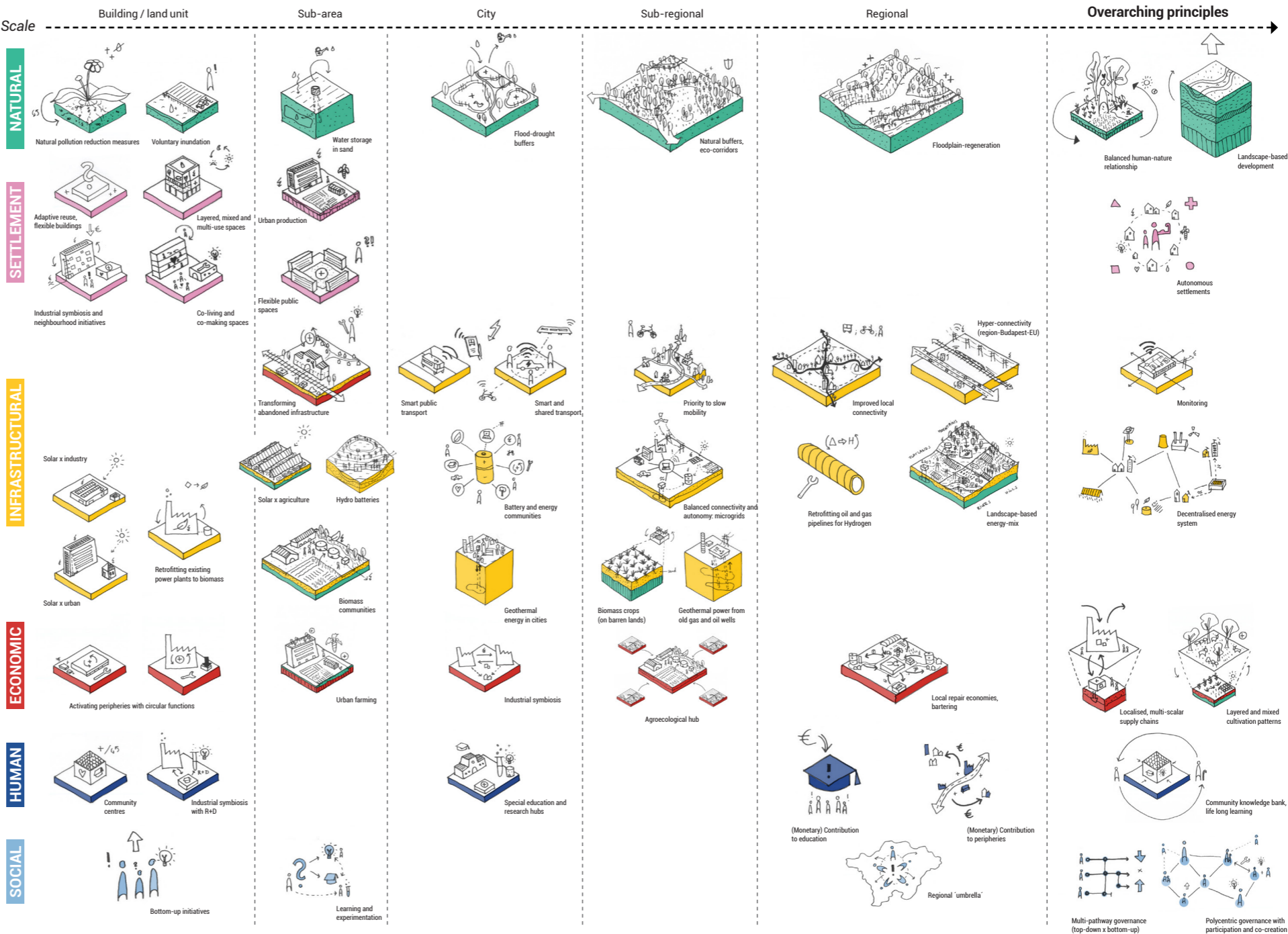
ALACSONY VÁLTOZÁSI FREKVENCIÁK

- NATURAL CAPITAL
- protected areas
 - biosphere reserves
 - mountain landscape
- SETTLEMENT CAPITAL
- small villages and settlements with cultural heritage
- INFRASTRUCTURAL CAPITAL
- 750; 400 kv power-line
 - 220 kv power-line
 - highways
 - train tracks: double track
 - train tracks: single track
 - well-connected roads
- ECONOMIC CAPITAL
- functional deserts
- HUMAN CAPITAL
- highly vulnerable, least knowledge



IDENTIFYING TRANSFORMATIVE POTENTIAL

AZ ÁTALAKÍTHATÓSÁGI POTENCIÁL MEGHATÁROZÁSA



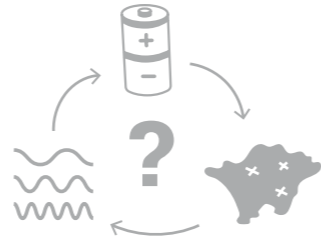


1

Problem Field

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Transformability

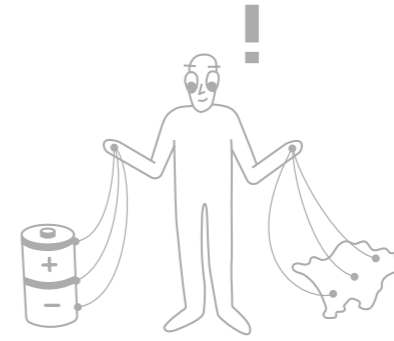


3

Understanding

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Exploration



5

Operationalisation

6

Conclusions



VISIONING

JÖVŐKÉPALKOTÁS

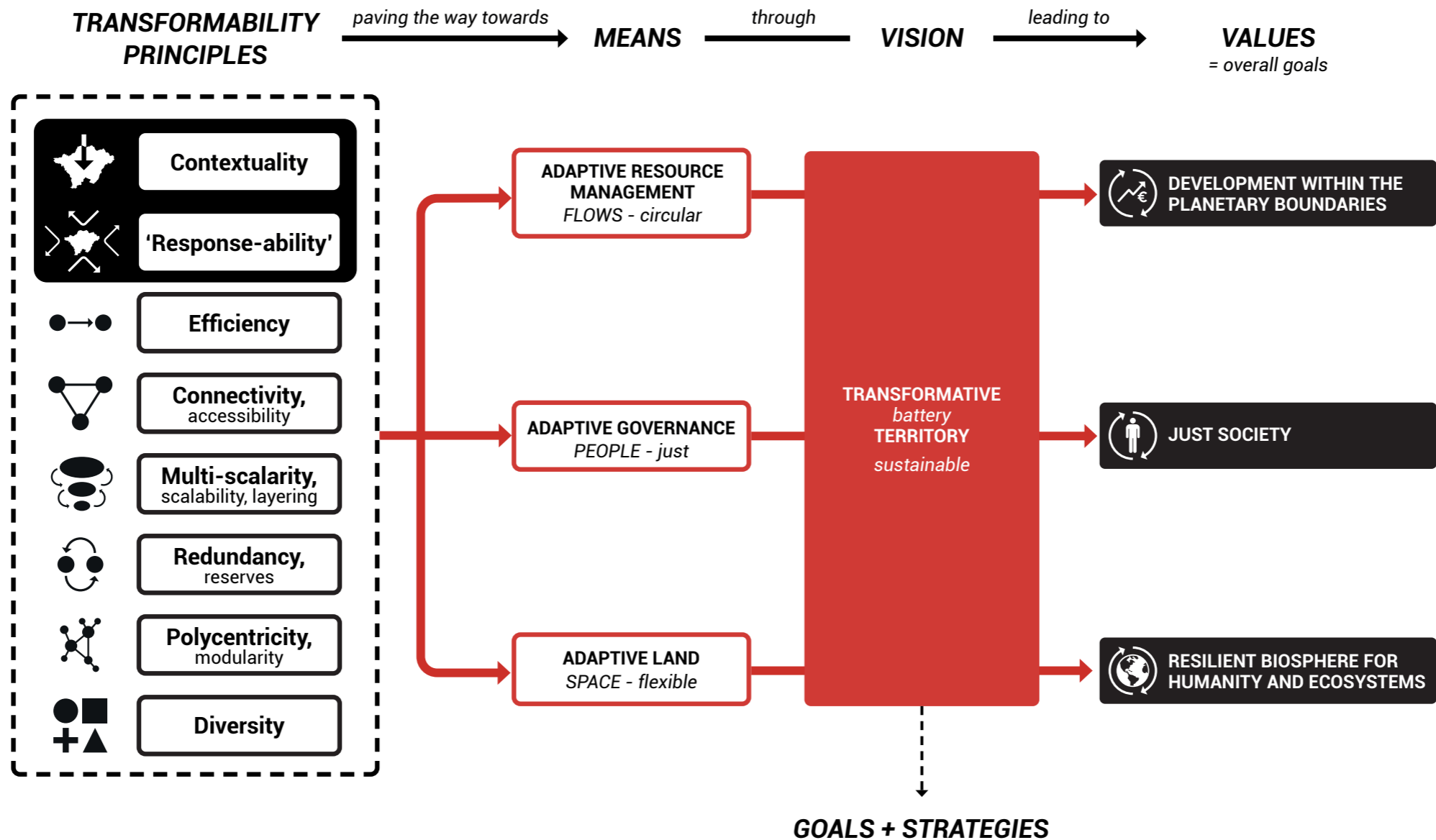
VISION

*values, goals,
principles*



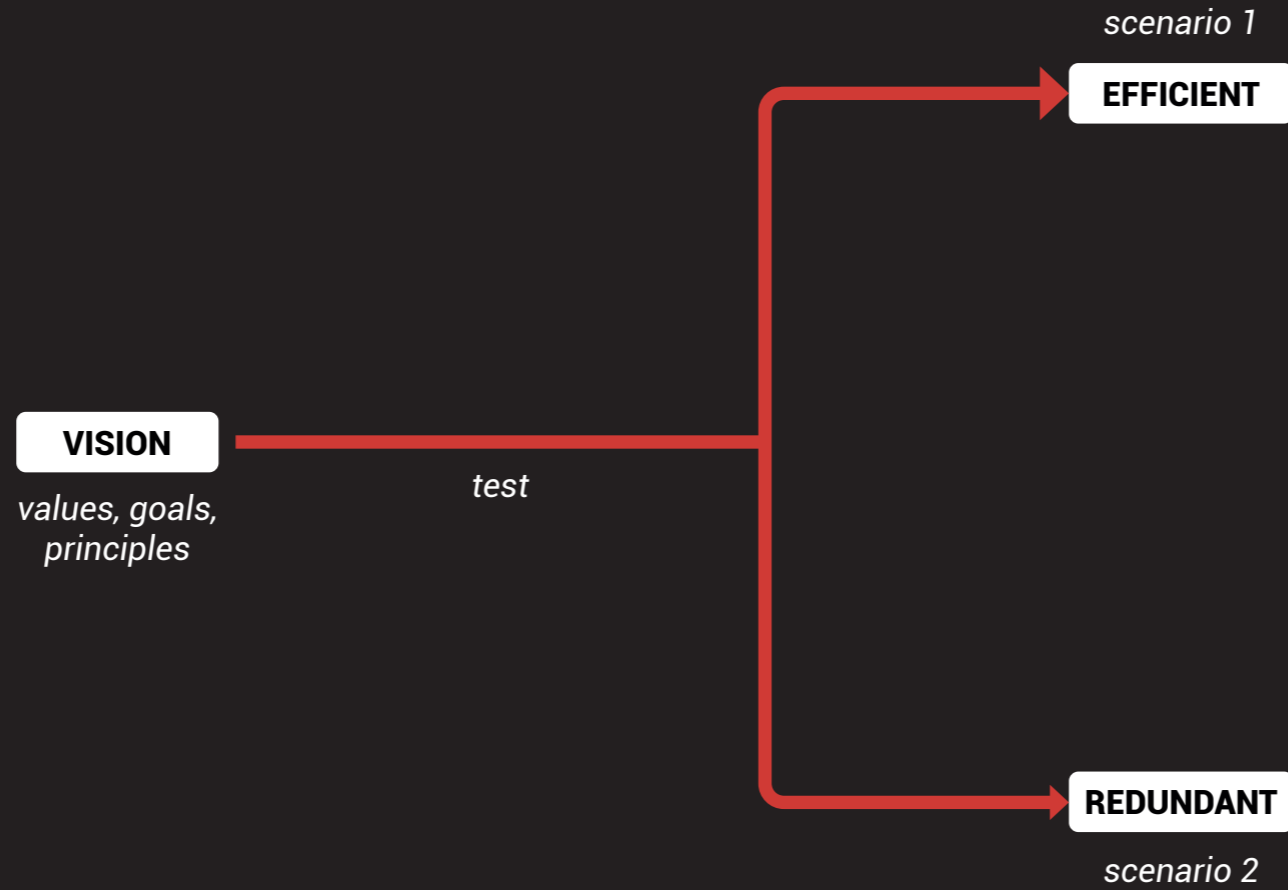
In the upcoming 50 years, the North-East Hungarian region turned the current battery-crisis into an opportunity by following a **just, circular and flexible** development path, and established a **contextual, sustainable and resilient spatial framework** **allowing for future transformation in case of need.**

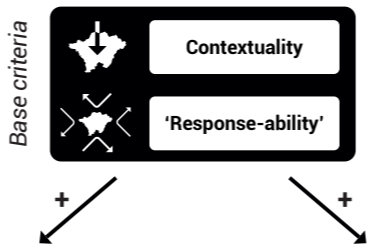
VISION OF A TRANSFORMATIVE BATTERY TERRITORY
AZ ÁTALAKÍTHATÓ AKKUMULÁTORIPARI TÉRSÉG JÖVŐKÉPE



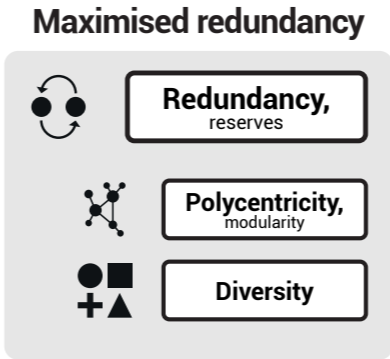
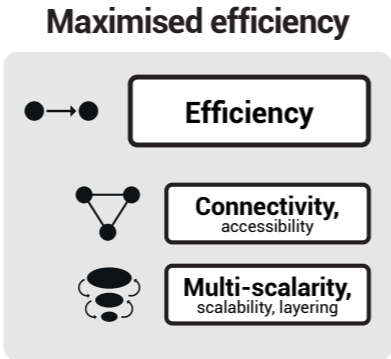
SCENARIO-MAKING

SZCENÁRIÓ-ALKOTÁS





S1: Efficient - Vertical
Hierarchical & optimised

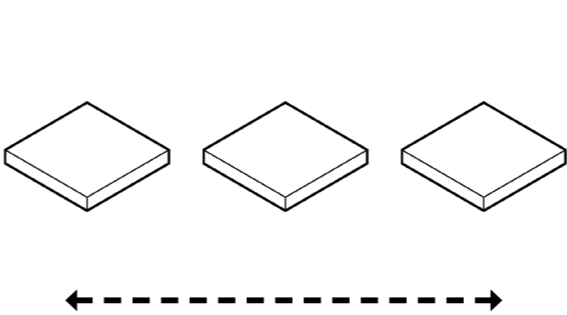
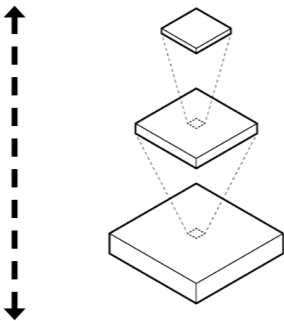


S2: Redundant - Horizontal
Decentralised & diverse

top-down

following current development patterns
+ keeping centrum-periphery relations

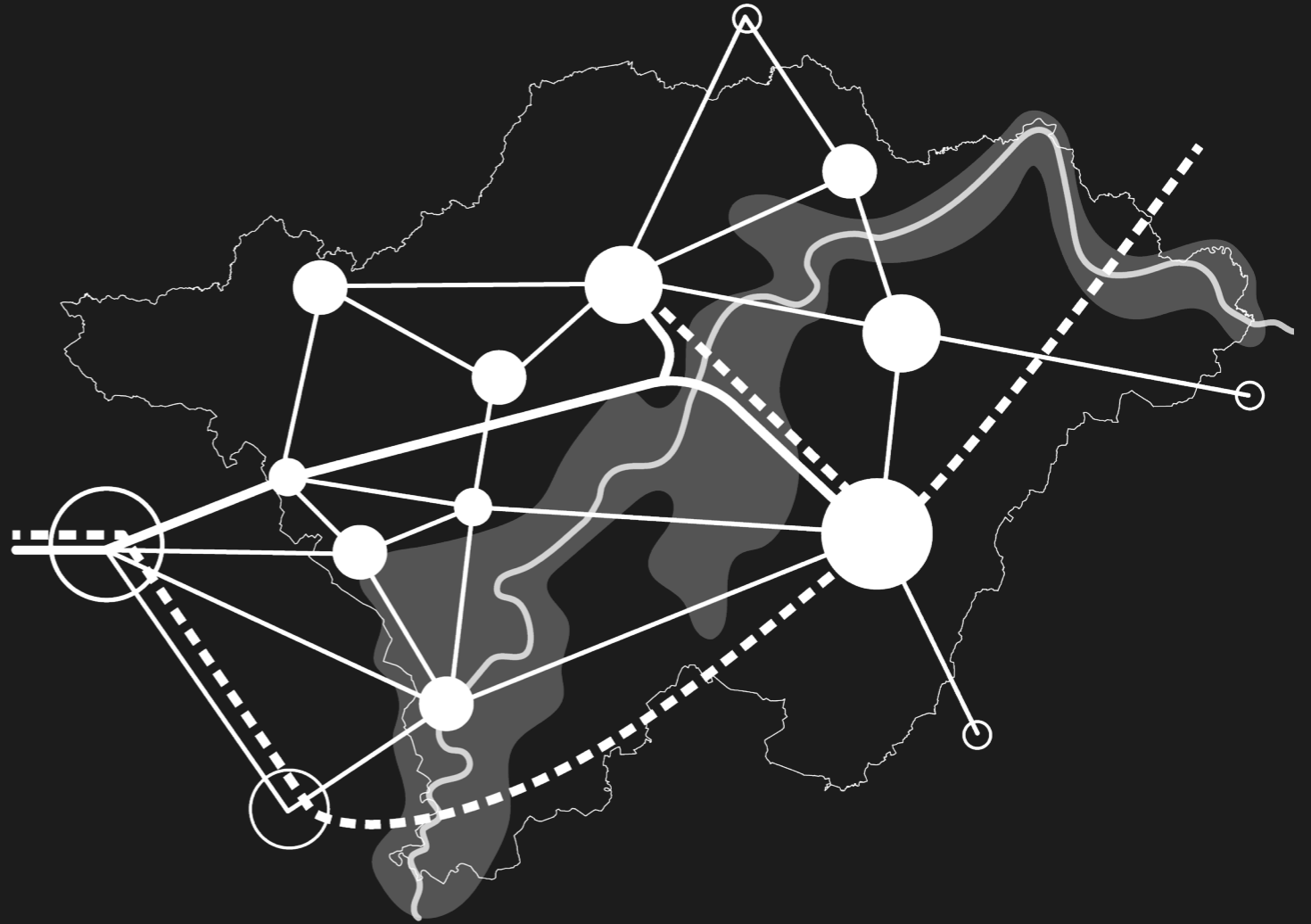
optimised, preventative crisis-response



bottom-up

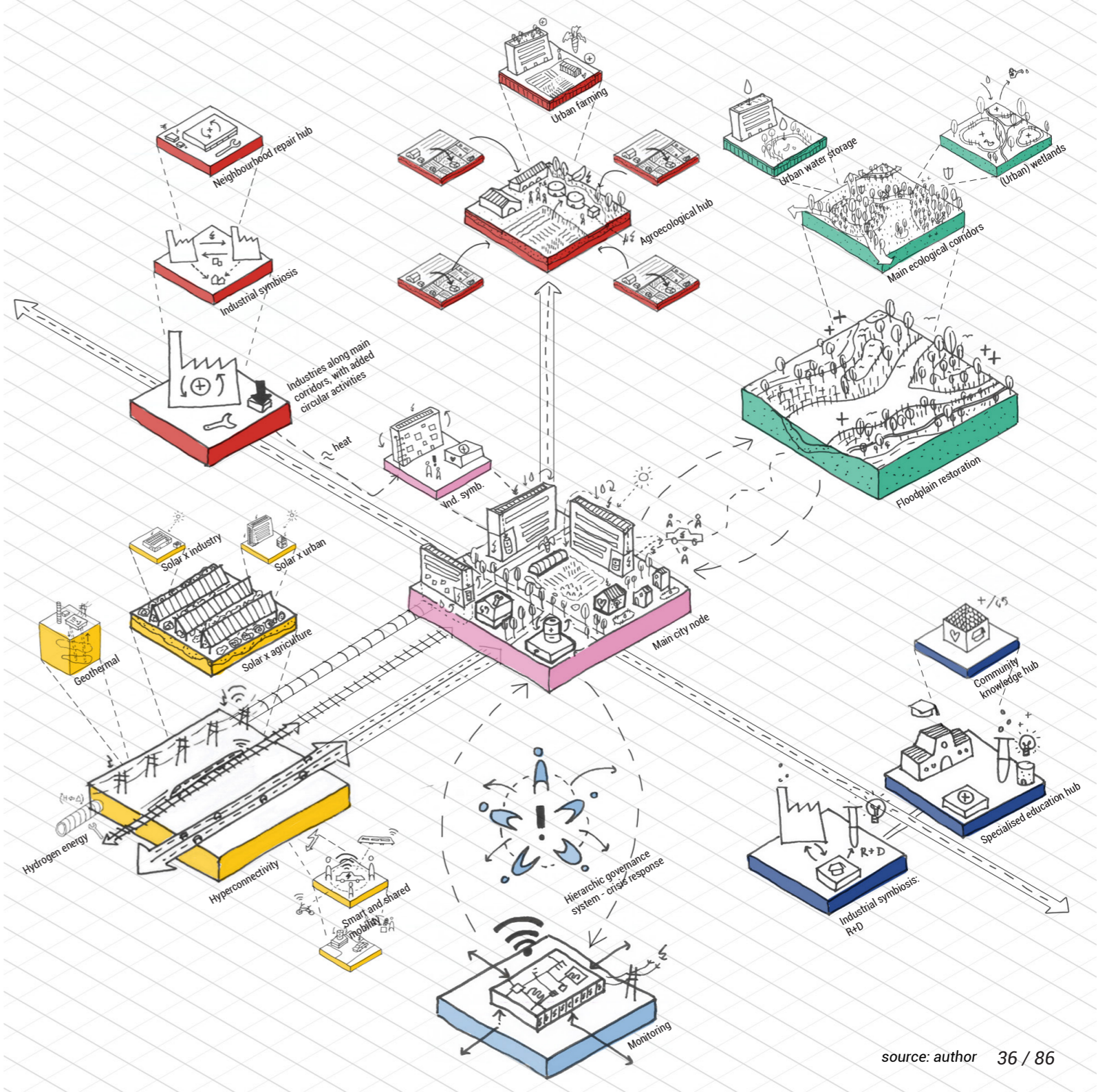
new way of spatial organisation based
on social values and community

reserves, redundant crisis-response



**Efficient:
Hierarchical & Optimised**

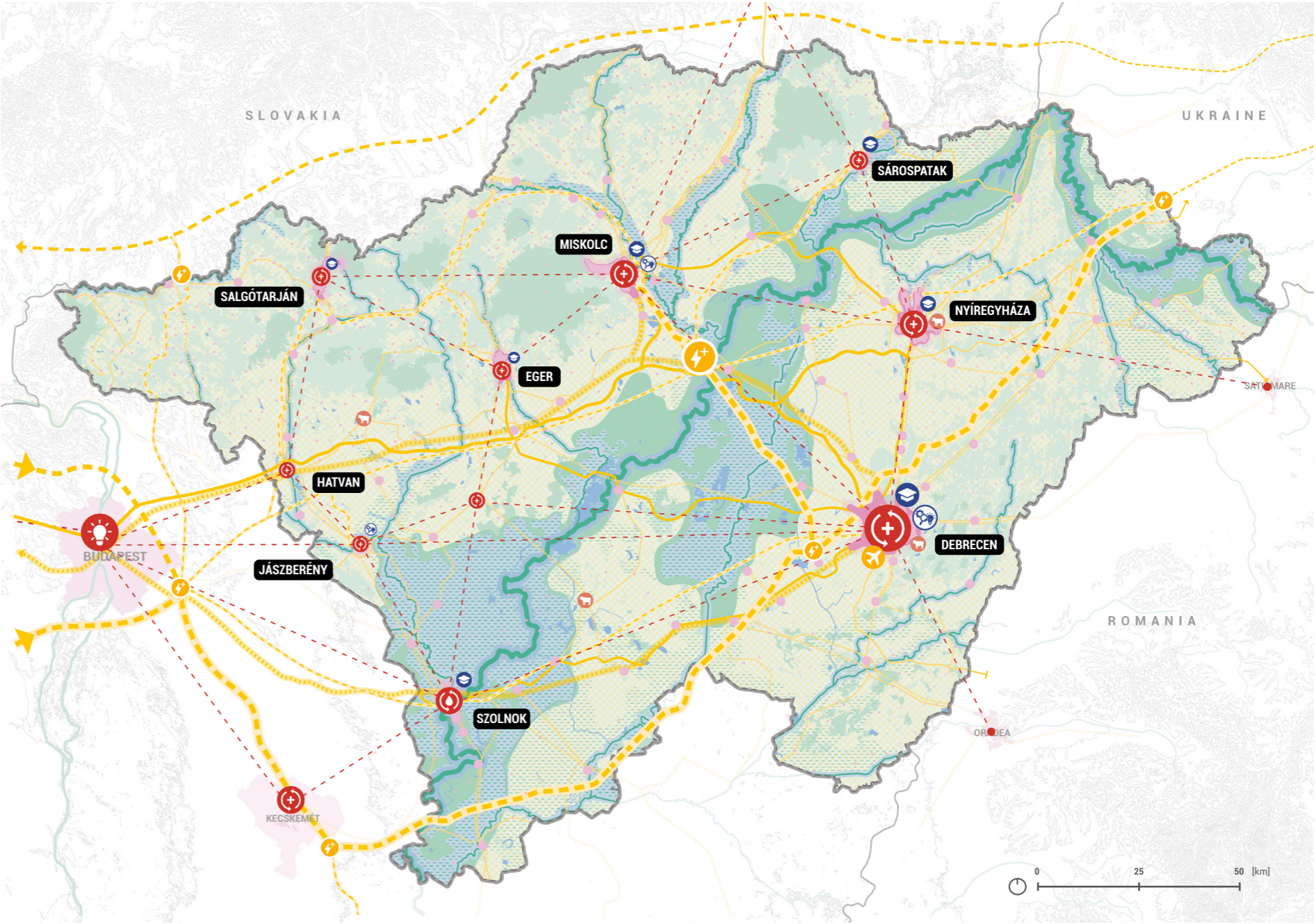
EFFICIENT - HIERARCHICAL AND OPTIMISED
HATÉKONY - HIERARCHIKUS ÉS OPTIMALIZÁLT



HUMAN CAPITAL

EMBERI TŐKE

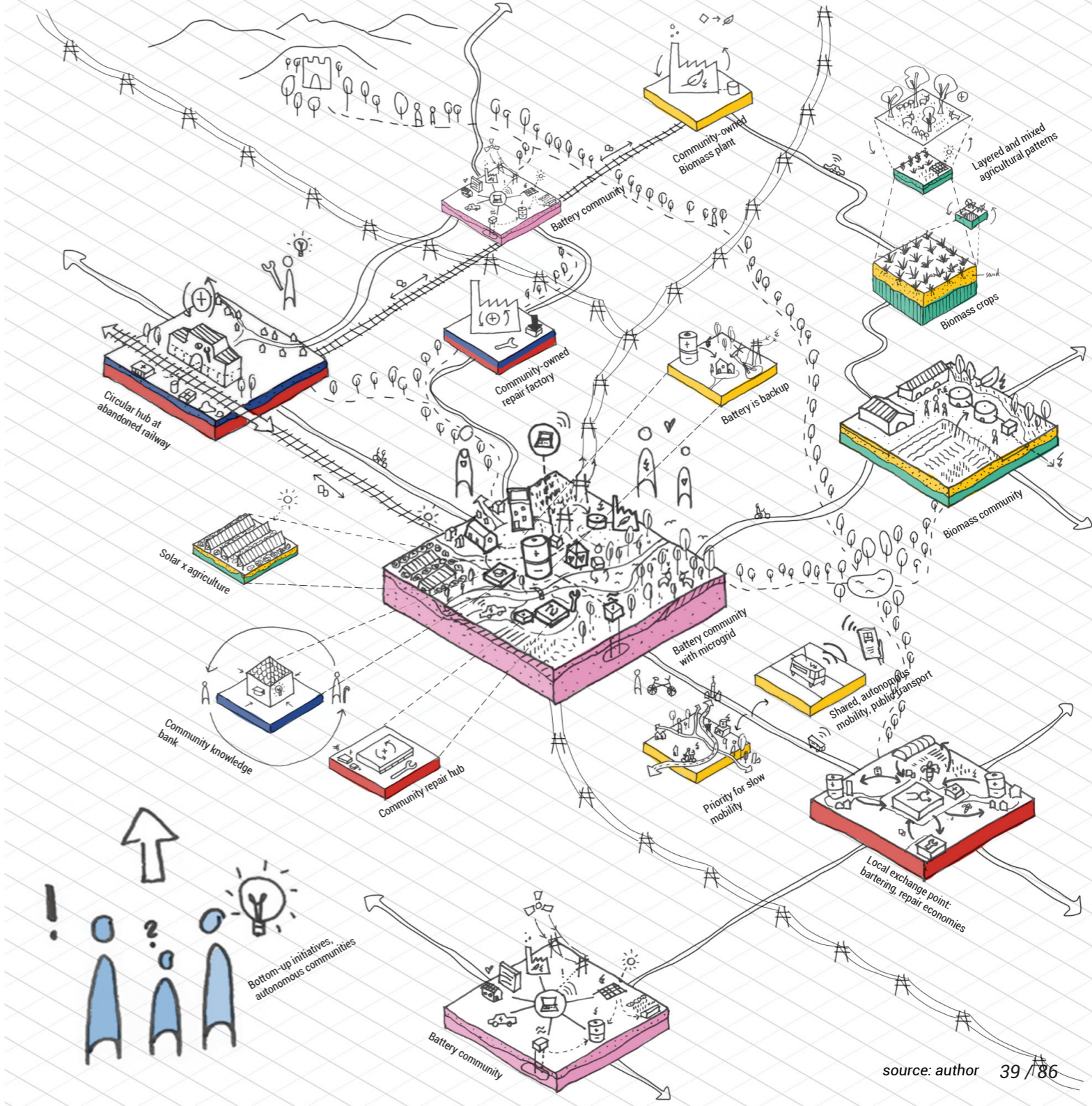
- river Tisza
- natural buffer
- floodplains
- waterbodies
- smaller river buffers
- protected areas
- low-hierarchy settlements
- mid-hierarchy settlements
- growing settlements
- highways
- primary roads
- high speed train
- train tracks
- hydrogen network (EHB)
- local hydrogen network
- regional energy hub
- airports
- local energy mix (solar, geot.)
- agroecological hubs
- Budapest: centre of knowledge
- Szolnok: water capital
- added (circular) function
- optimised circular and knowledge network
- R + D hubs
- special knowledge hubs



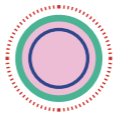


**Redundant:
Decentralised & Diverse**

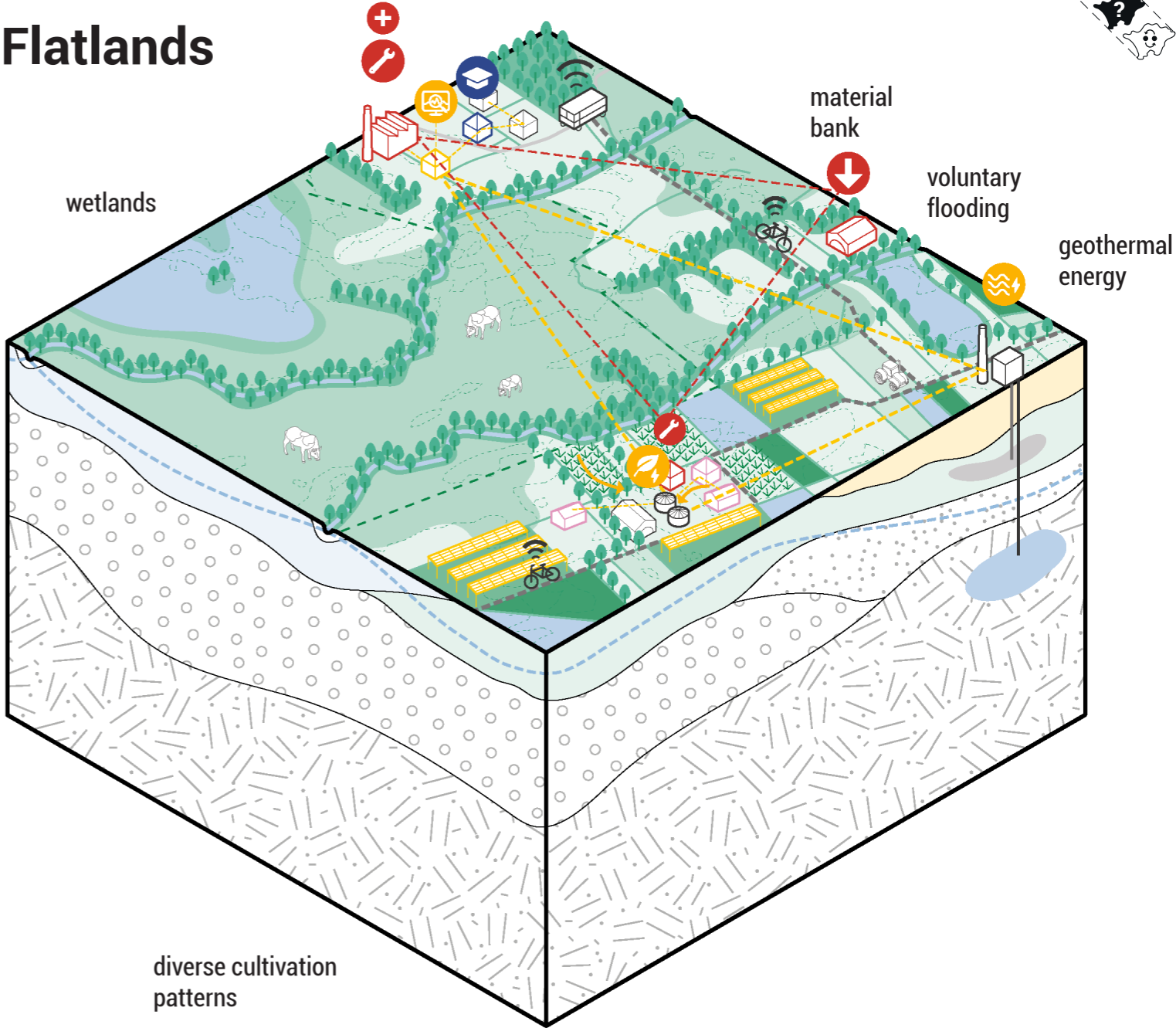
REDUNDANT - DECENTRALISED AND DIVERSE
REDUNDÁNS - DECENTRALIZÁLT ÉS SOKSZÍNŰ



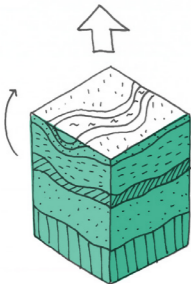
LANDSCAPE AS BASE
A TÁJ, MINT KIINDULÁSI PONT



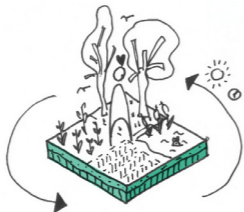
Flatlands



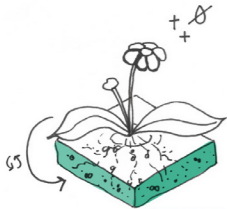
Steering principles



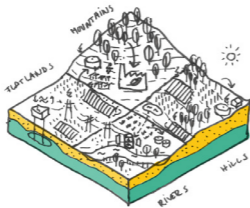
Landscape-based development



Balanced human-nature relationship



Natural pollution reduction

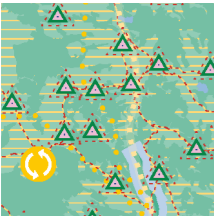


Landscape-based cultivation

diverse cultivation
patterns

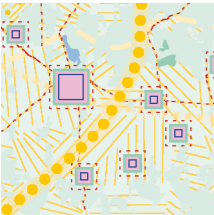
SPATIAL ORGANISATION

TÉRSZERVEZÉS



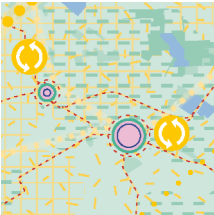
MOUNTAINS

- natural vegetation (forests)
- landscape-based energy mix
- mountain settlements



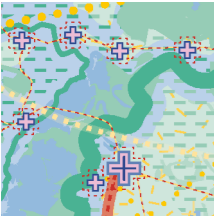
HILLS

- natural vegetation (forests)
- landscape-based energy mix
- mountain settlements



FLATLANDS

- natural vegetation (forests, grass)
- landscape-based energy mix
- mountain settlements

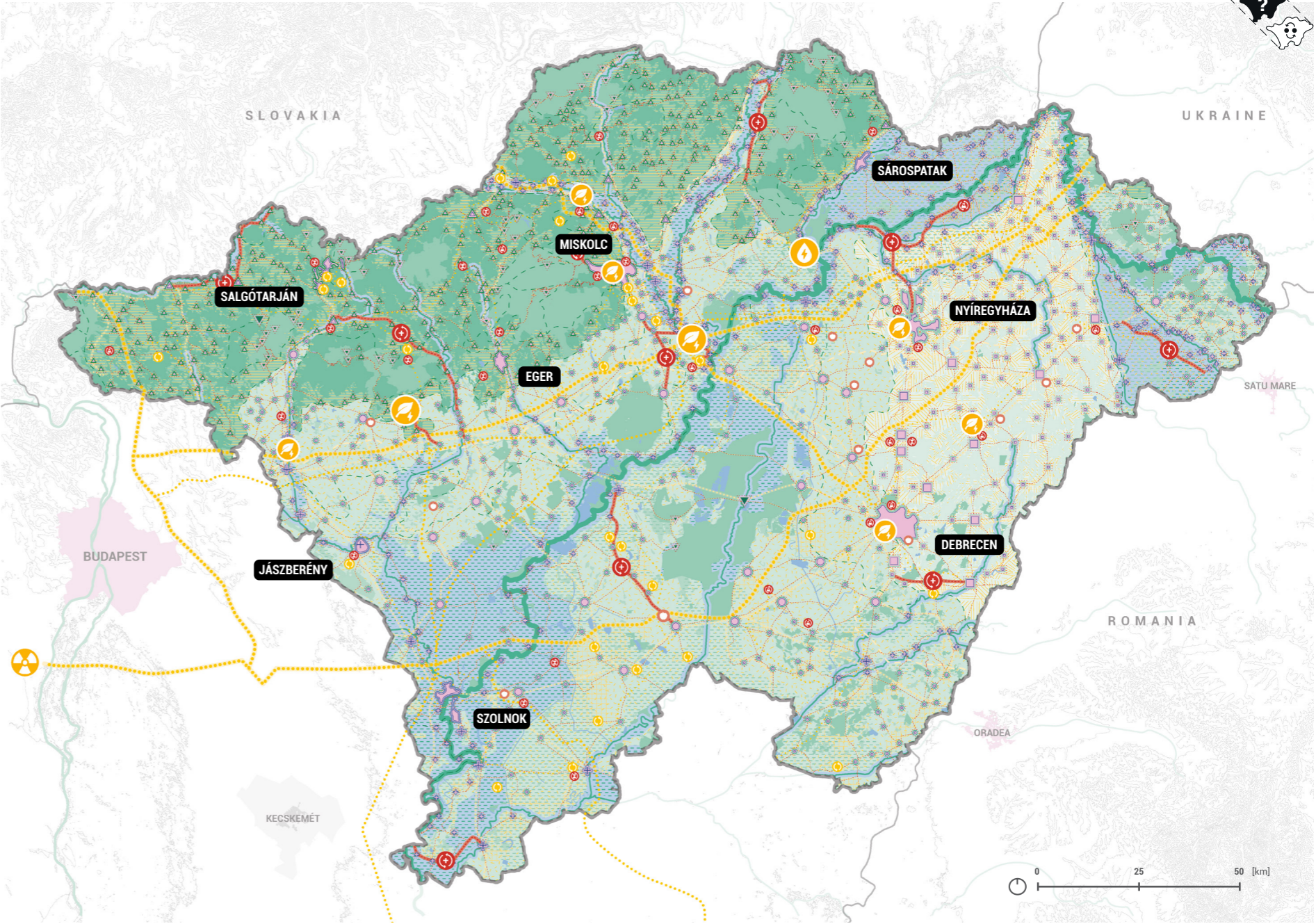


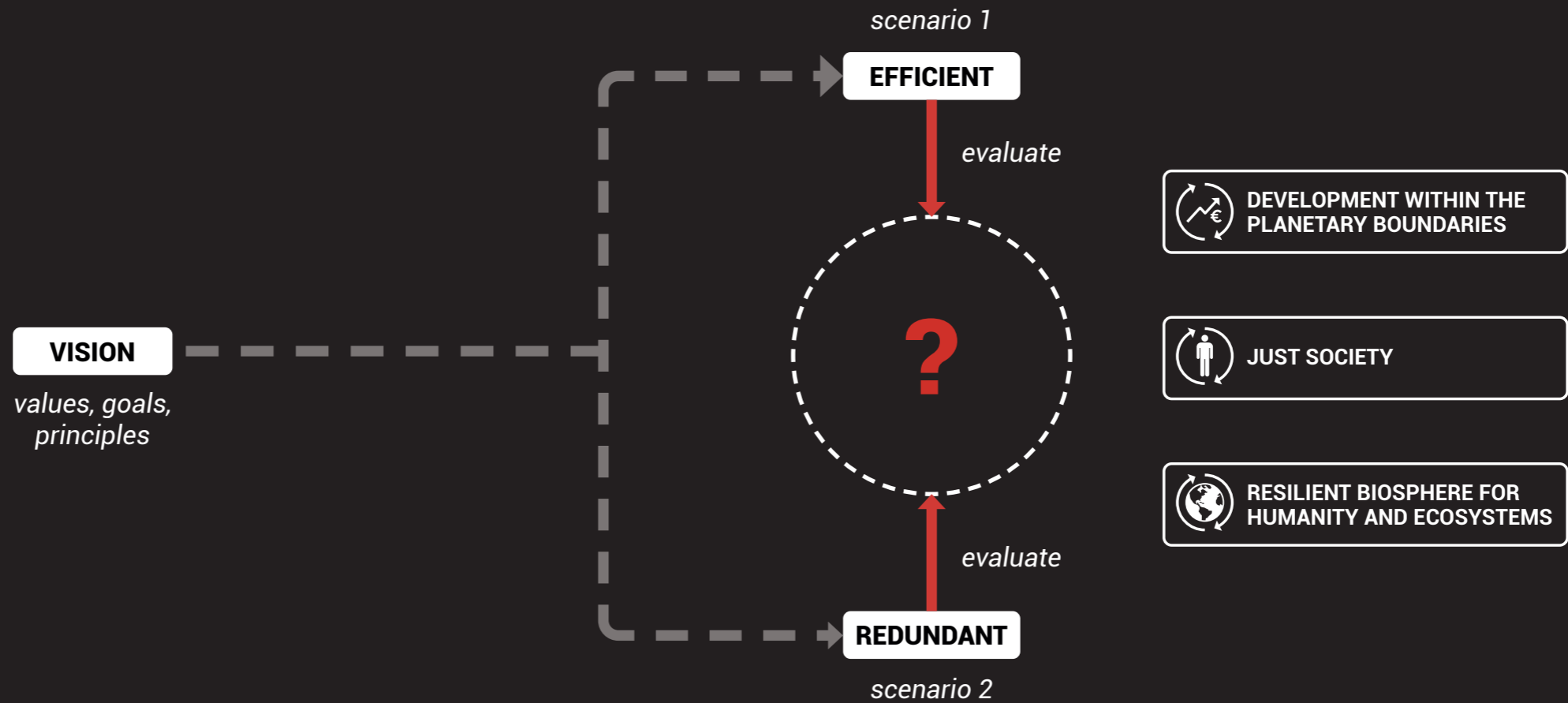
RIVER

- rivers
- floodplains: mostly underwater
- floodplains: vegetation, floodrisk
- river settlements

- protected areas
- cultural heritage settlements
- border of different geomorphological areas
- transformed food industry
- transformed chemicals industry
- transformed metal industry
- added (circular) function
- reuse of abandoned train tracks
- local roads: circular routes

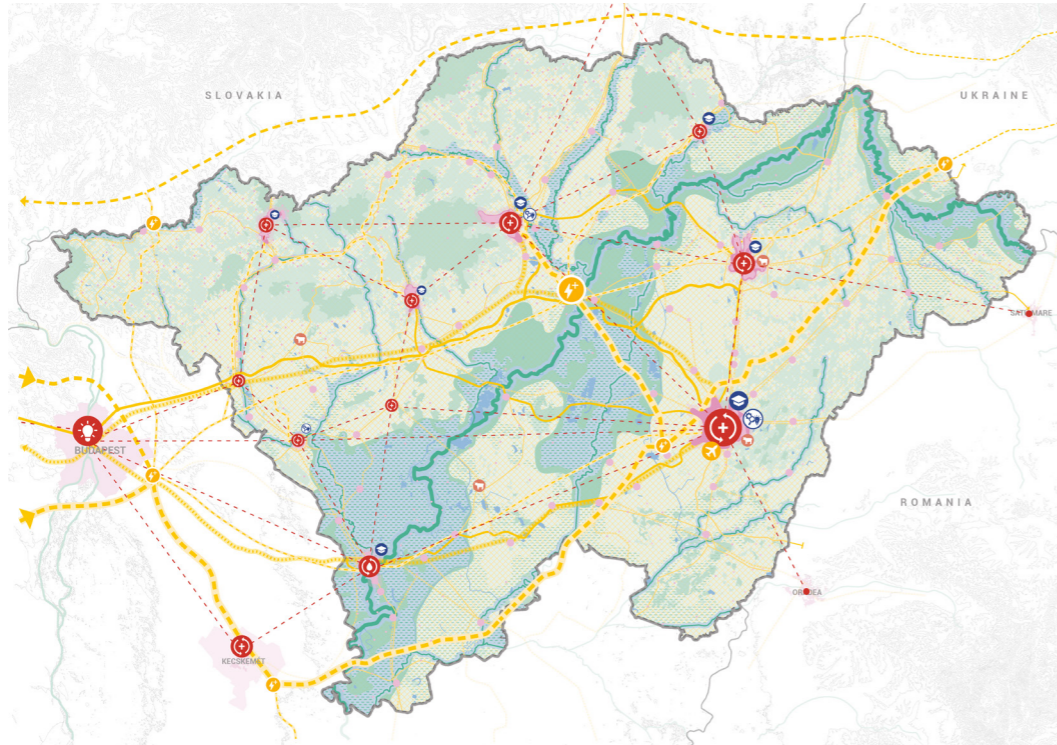
- connection to nuclear power plant
- transformed mineral industry: energy production
- transformed powerplants: biomass
- main powerlines: fallback system
- powerlines
- natural gas and oil fields: geothermal wells
- highways
- train tracks





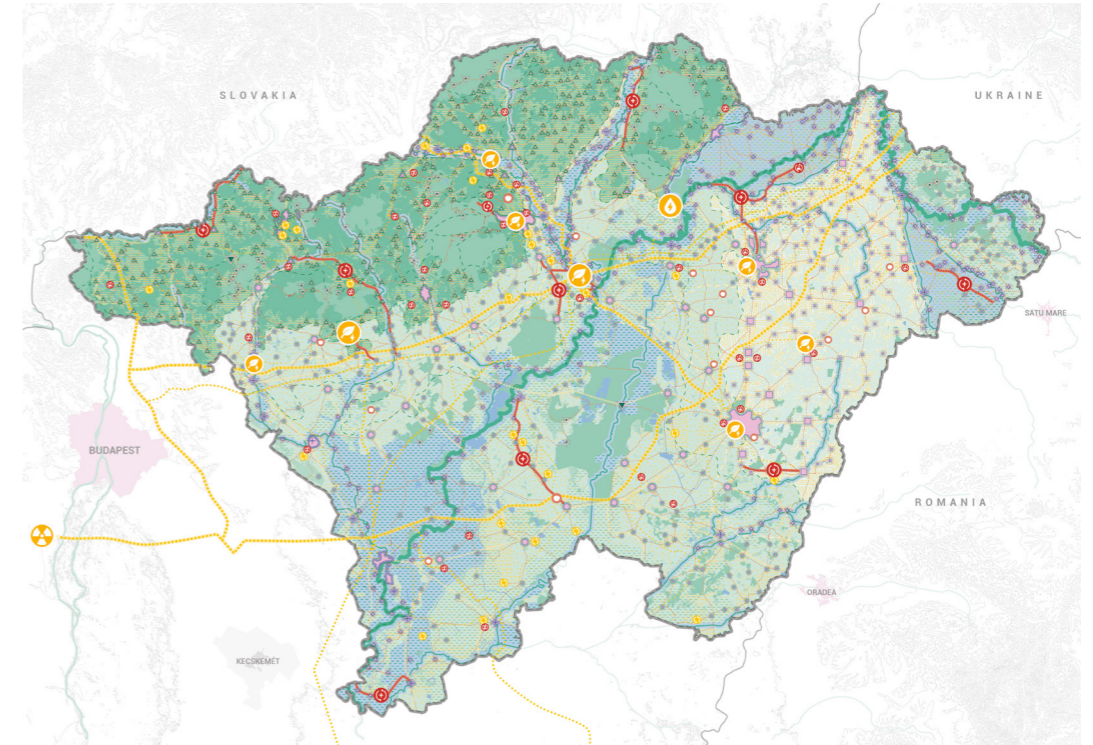


EFFICIENT - HIERARCHICAL AND OPTIMISED



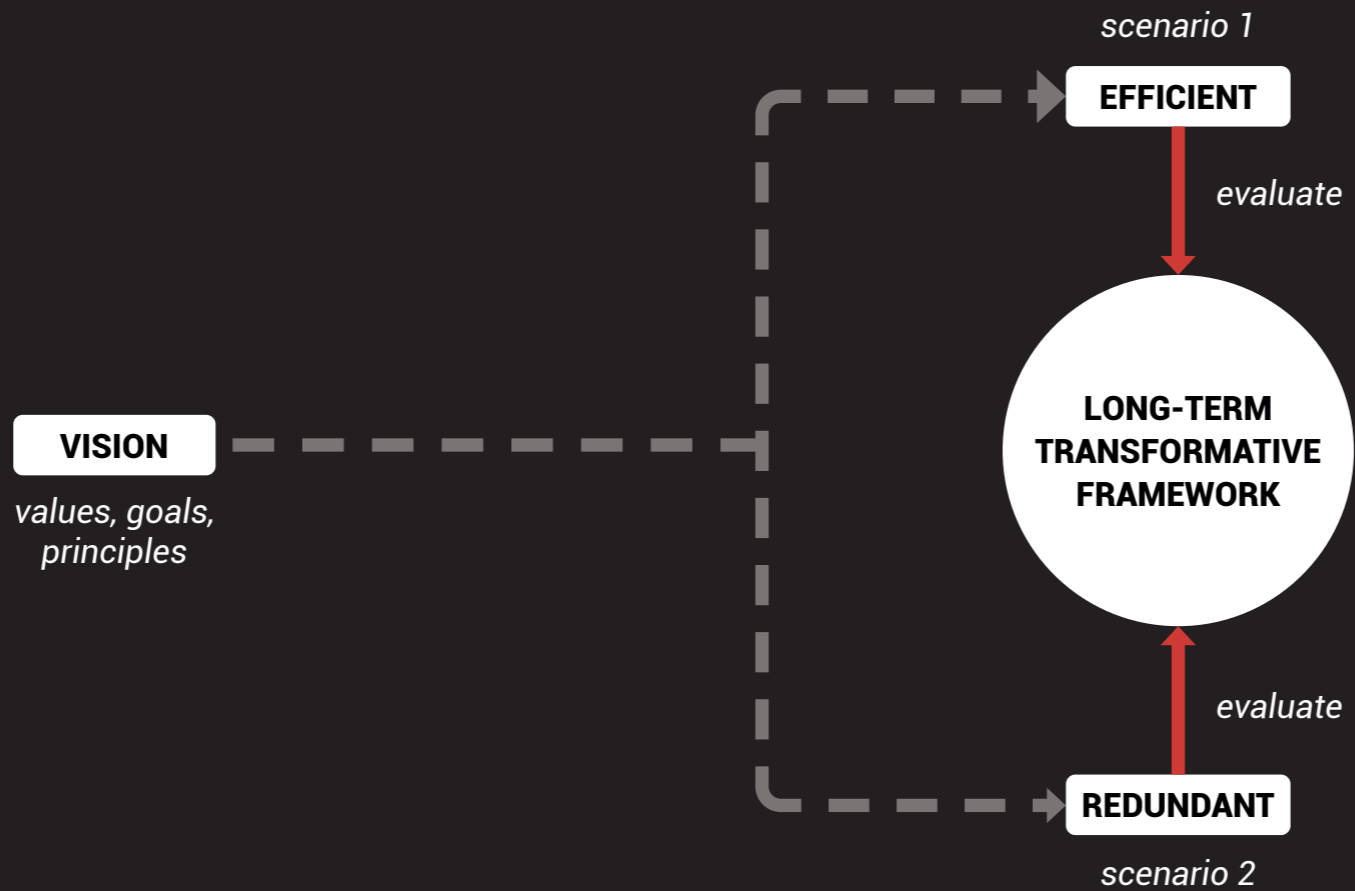
- + economically viable, optimised and crisis preventive
- + high social acceptability
- too profit-oriented and technology-based
 - cannot handle sociospatial disparities
 - dependent, does not reduce consumption

REDUNDANT - DECENTRALISED AND DIVERSE

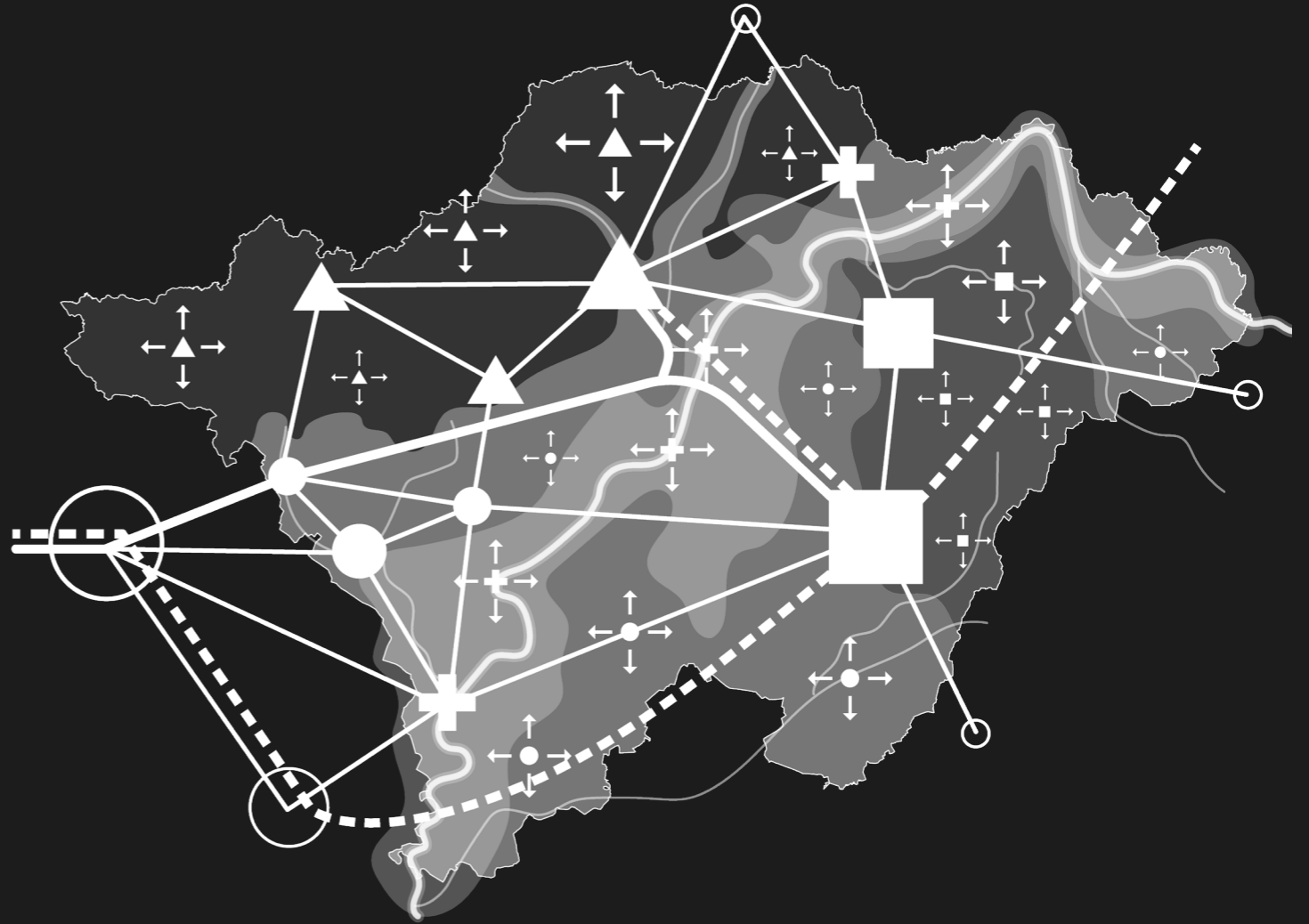


- + strong social values and care
- + sufficient reserves in case of crisis; autonomous
- + landscape-based cultivation
- requires a significant behaviour shift & community cooperation
 - might not be economically viable on the long-run

LONG-TERM SPATIAL FRAMEWORK
HOSSZÚTÁVÚ TÉRI KERET




Long-Term Transformative Framework

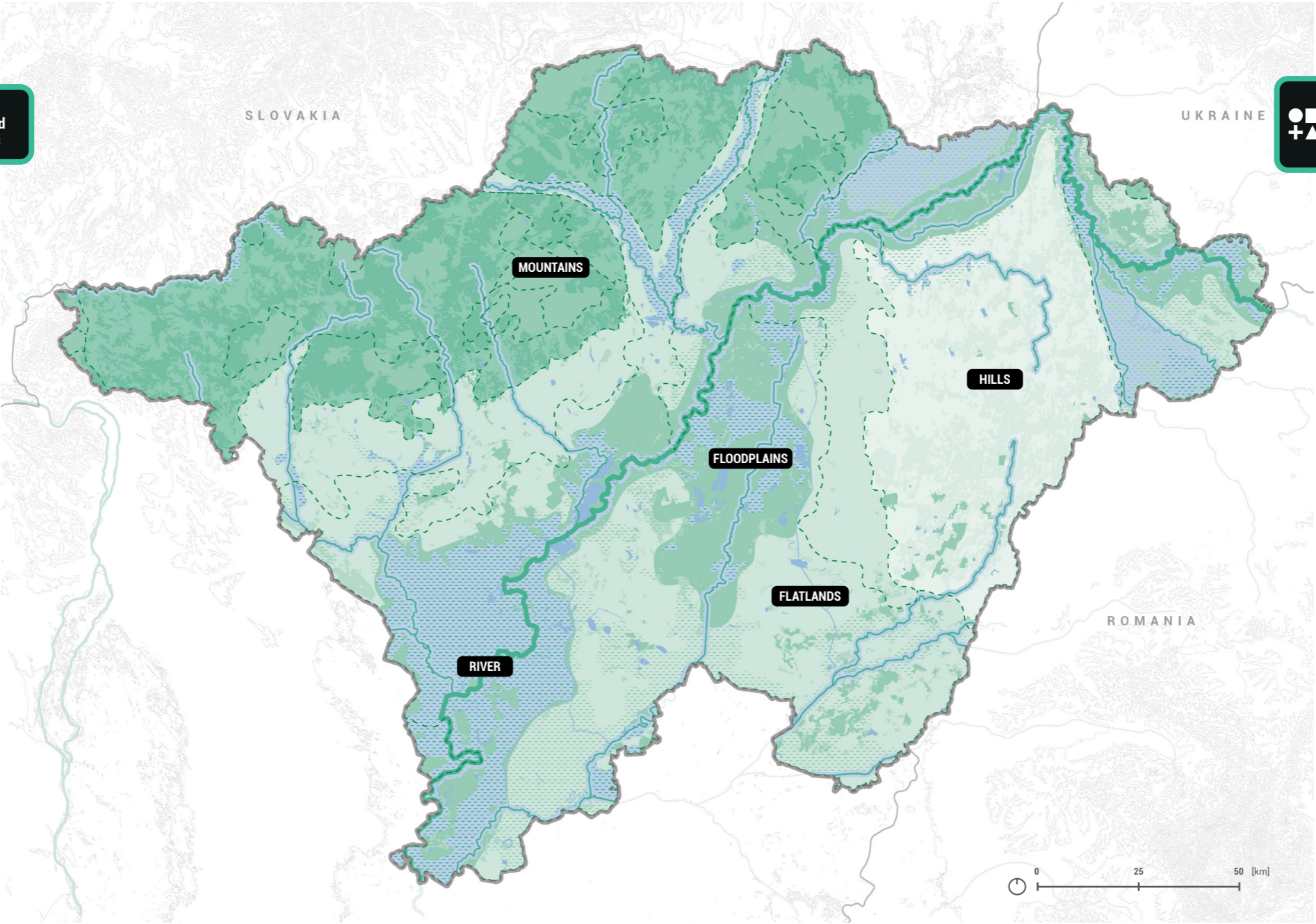


NATURE
TERMÉSZET

EFFICIENT



Regional floodplain
restoration: flexible and
multifunctional buffers





Landscape-mosaics: local
(community) cultivation,
landscape-based layered
functions

REDUNDANT



SETTLEMENT
TELEPÜLÉS

EFFICIENT

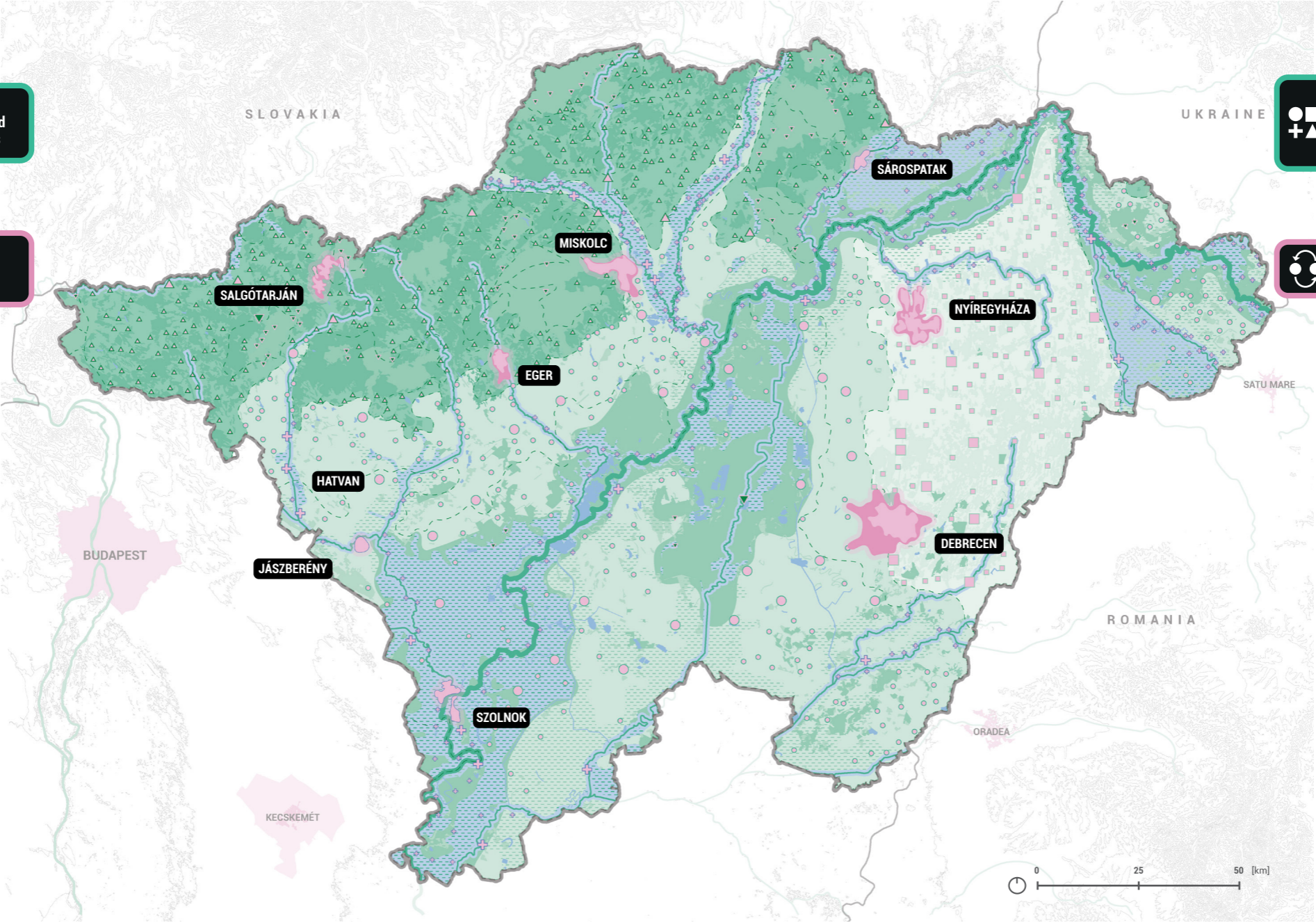
Regional floodplain restoration: flexible and multifunctional buffers

Main nodes are the innovation and service hubs of the region

REDUNDANT

Landscape-mosaics: local (community) cultivation, landscape-based layered functions

Autonomous settlements and communities



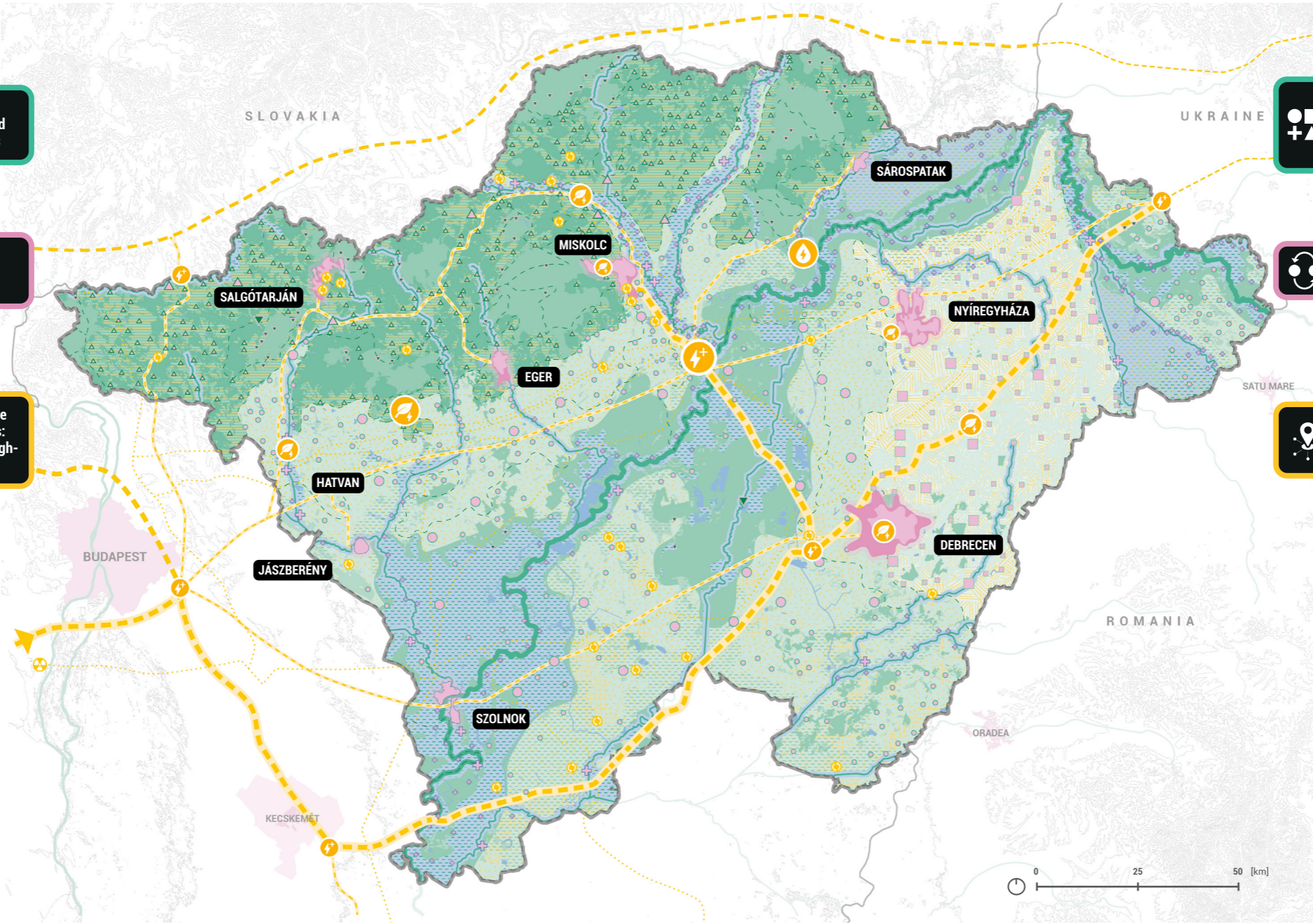
ENERGY
ENERGIA

EFFICIENT

Regional floodplain restoration: flexible and multifunctional buffers

Main nodes are the innovation and service hubs of the region

Advanced infrastructure connecting main nodes: hydrogen backbone, high-speed train, shared EV



Landscape-mosaics: local (community) cultivation, landscape-based layered functions

Autonomous settlements and communities

Connected peripheries: local, shared, autonomous networks and vehicles

REDUNDANT



TRANSPORTATION
KÖZLEKEDÉS

EFFICIENT

Regional floodplain restoration: flexible and multifunctional buffers

Main nodes are the innovation and service hubs of the region

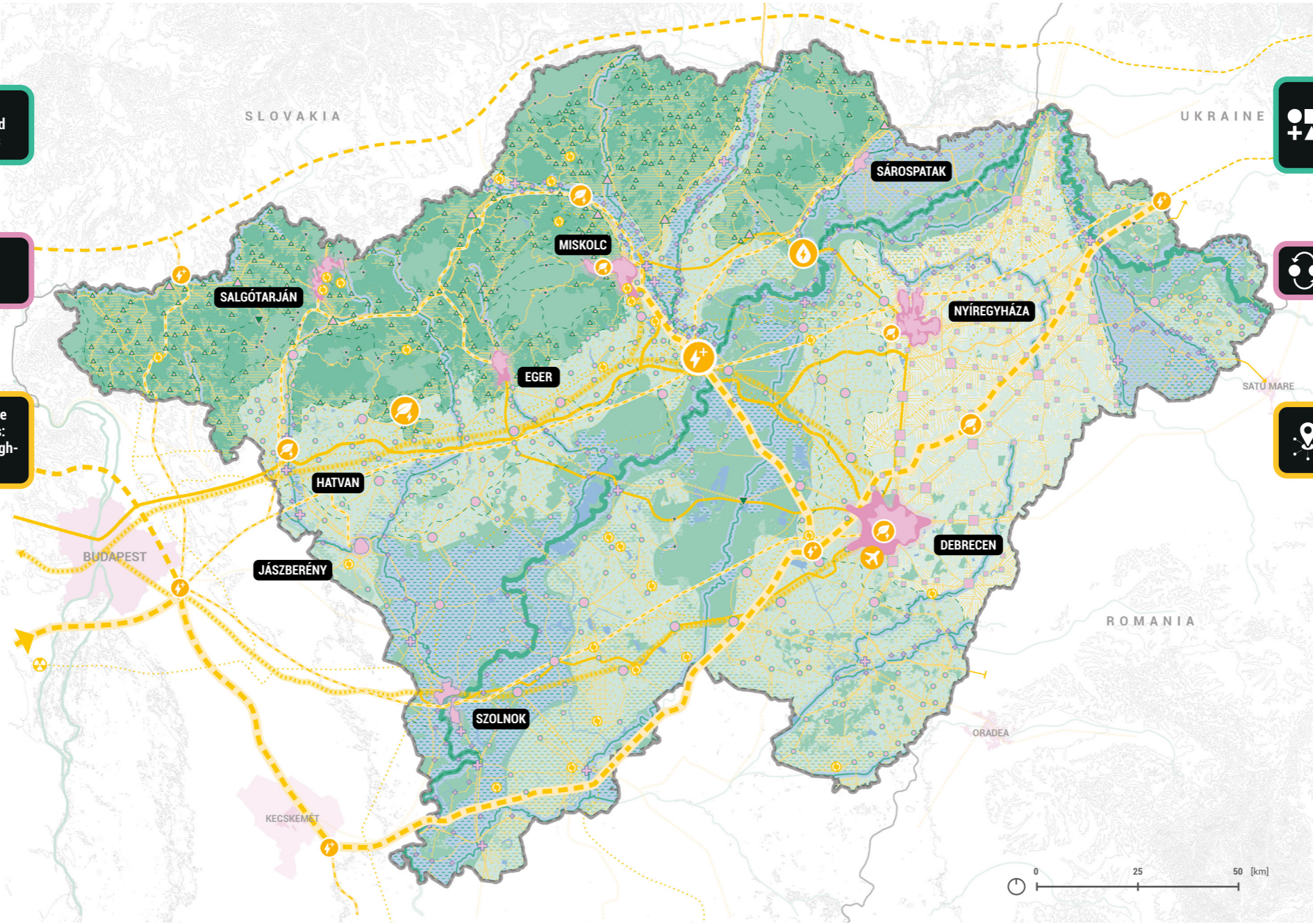
Advanced infrastructure connecting main nodes: hydrogen backbone, high-speed train, shared EV

Landscape-mosaics: local (community) cultivation, landscape-based layered functions

Autonomous settlements and communities

Connected peripheries: local, shared, autonomous networks and vehicles

REDUNDANT



ECONOMY
GAZDASÁG

EFFICIENT

Regional floodplain restoration: flexible and multifunctional buffers

Main nodes are the innovation and service hubs of the region

Advanced infrastructure connecting main nodes: hydrogen backbone, high-speed train, shared EV

Localised, multiscalar supply chains

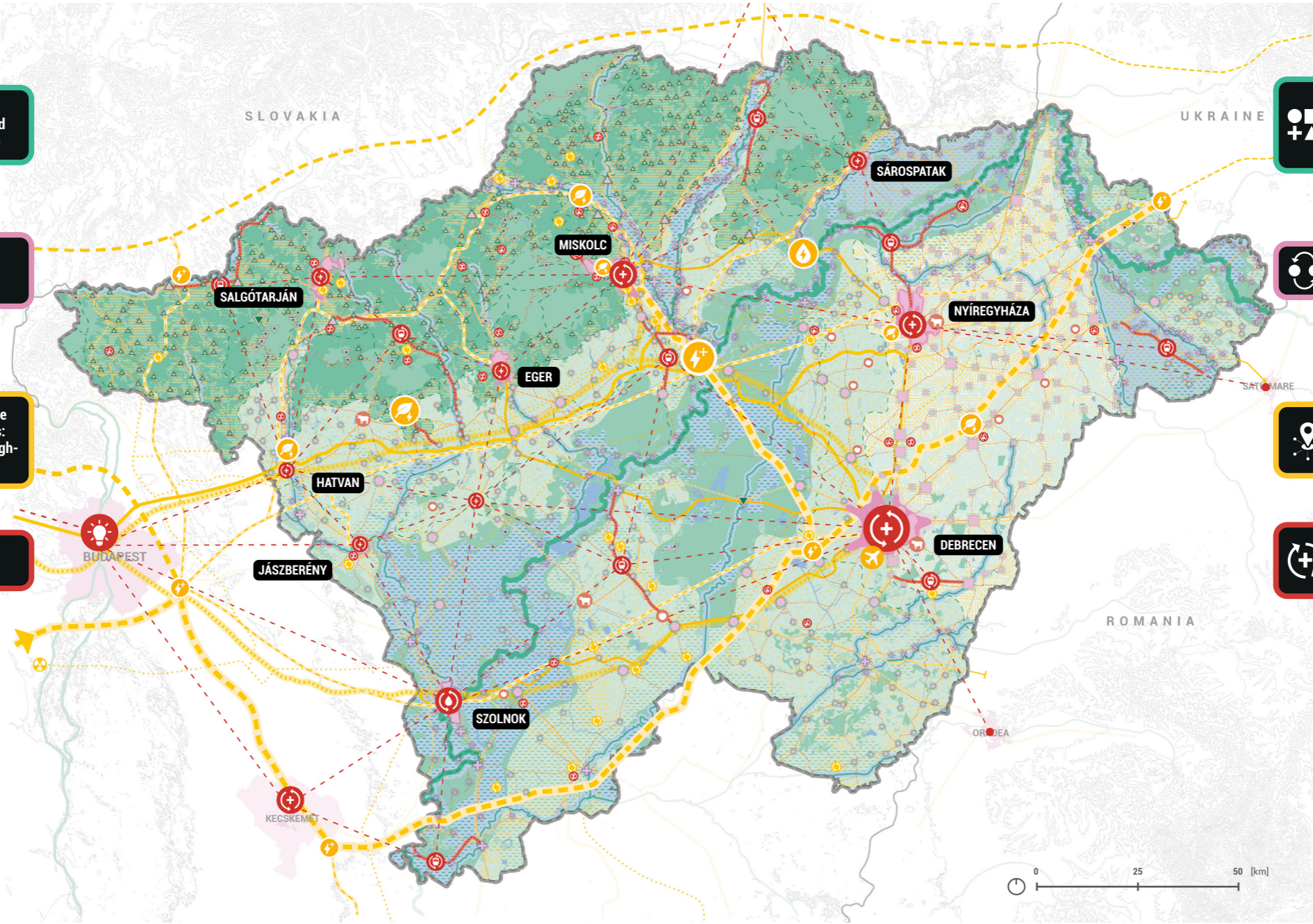
Landscape-mosaics: local (community) cultivation, landscape-based layered functions

Autonomous settlements and communities

Connected peripheries: local, shared, autonomous networks and vehicles

Local repair economies, barbers, markets landscape-based production

REDUNDANT



HUMAN CAPITAL
EMBERI TŐKE

EFFICIENT

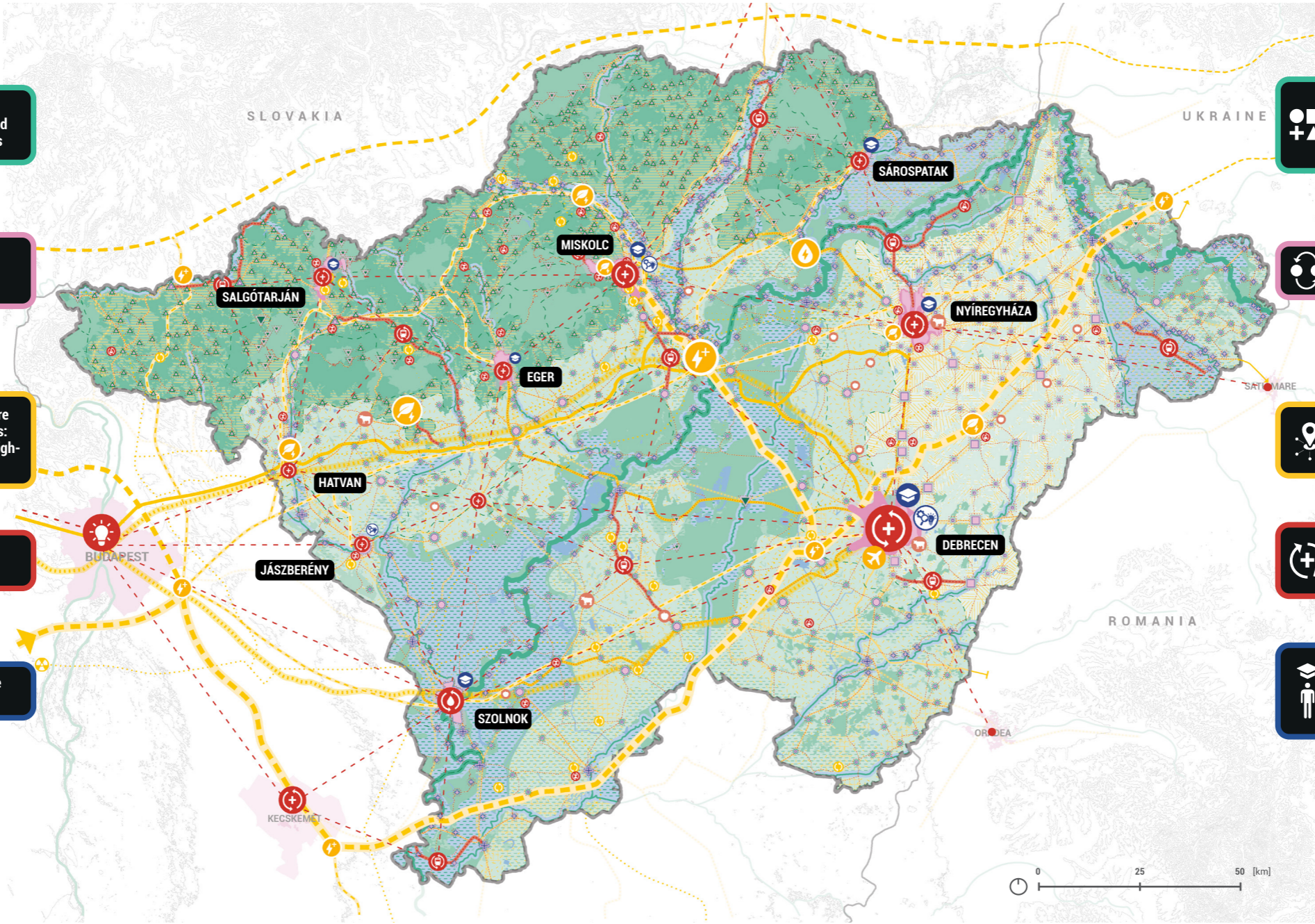
Regional floodplain restoration: flexible and multifunctional buffers

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Specialised knowledge and research hubs



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Autonomous settlements and communities

Connected peripheries: local, shared, autonomous networks and vehicles

Local repair economies, barbers, markets landscape-based production

Life long learning, community knowledge banks, mixed livelihood schemes

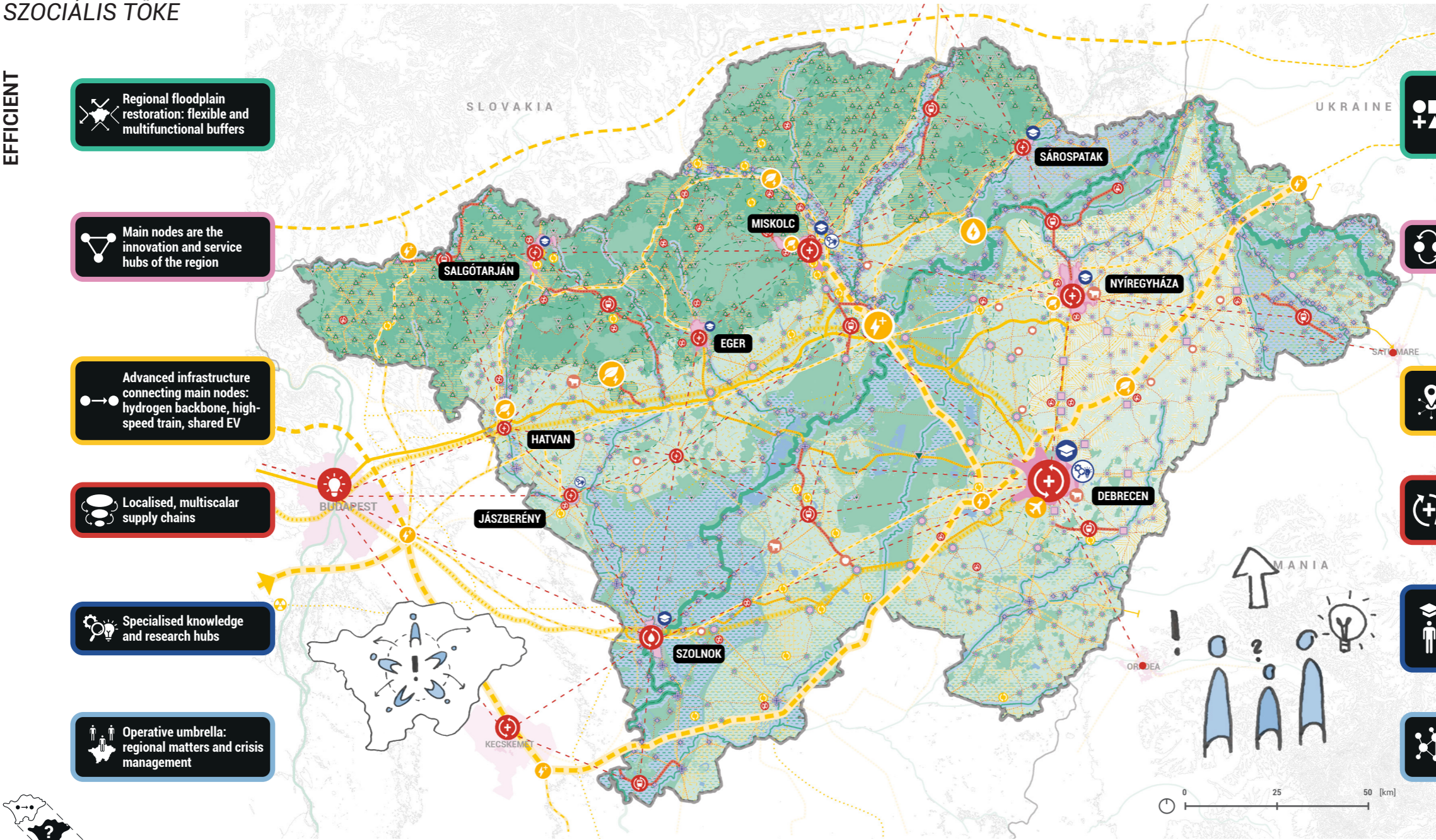
REDUNDANT



SOCIAL CAPITAL
SZOCIÁLIS TŐKE

EFFICIENT

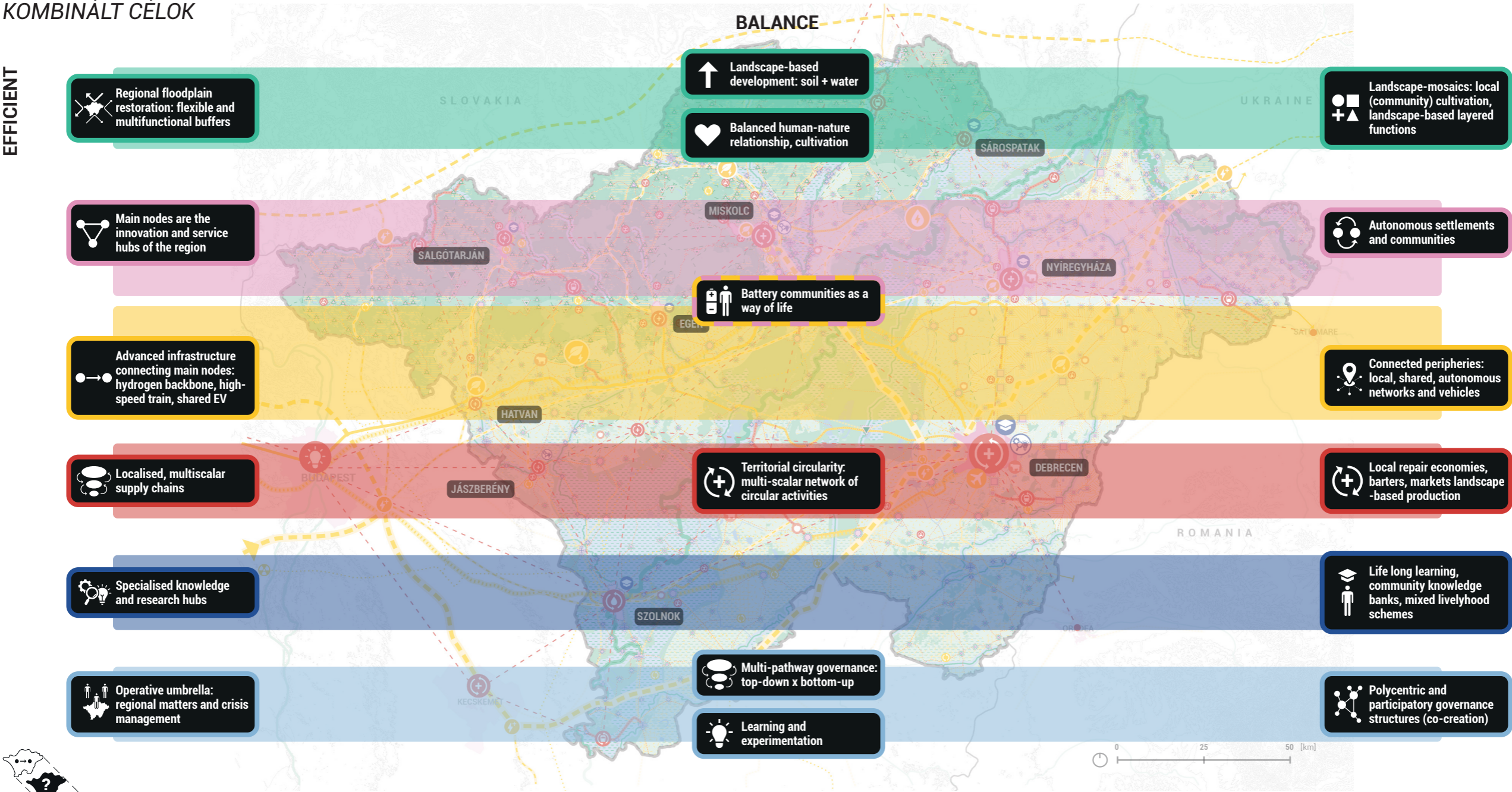
REDUNDANT



COMBINED GOALS
KOMBINÁLT CÉLOK

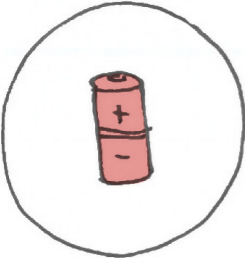
EFFICIENT

REDUNDANT

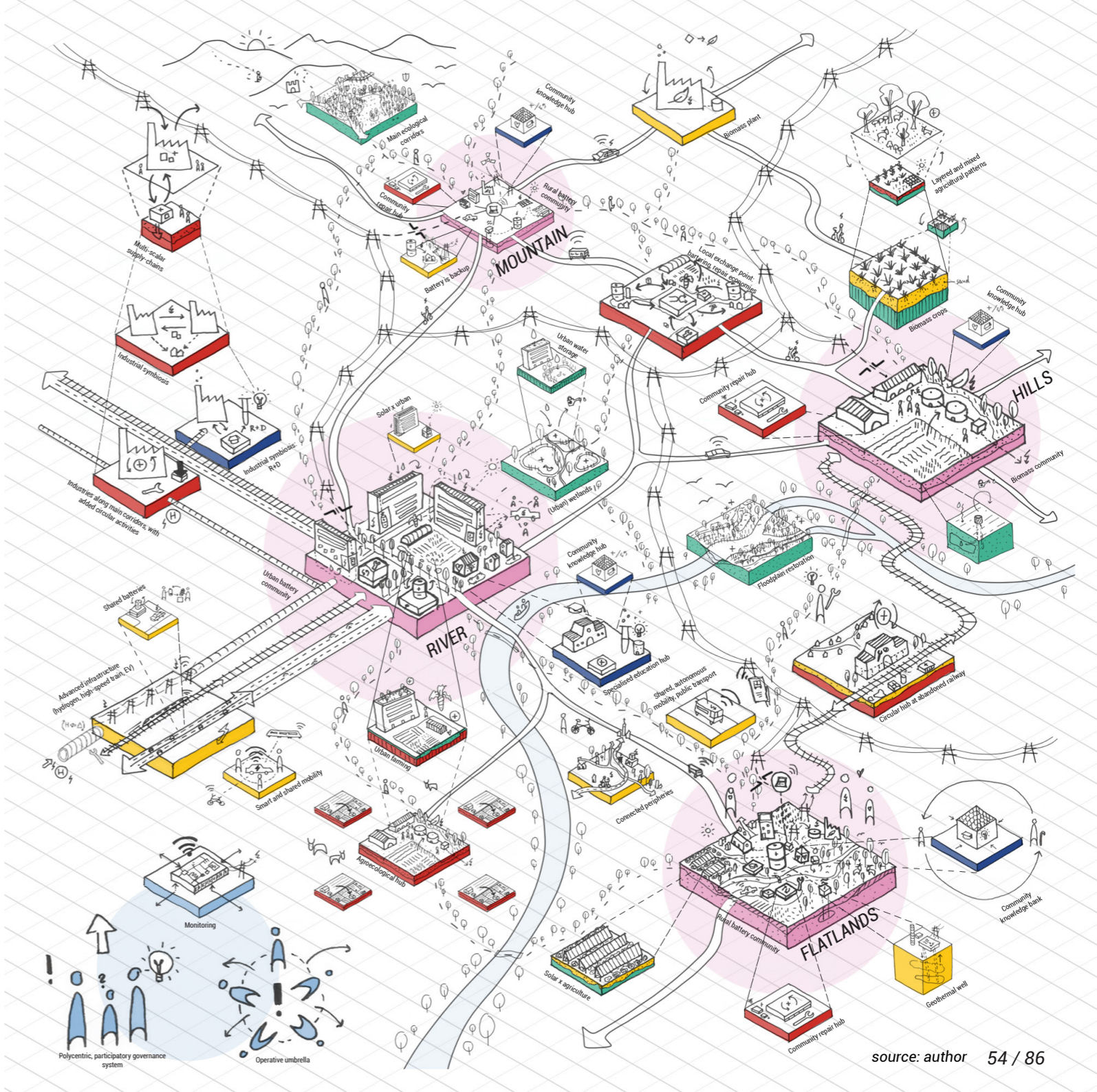
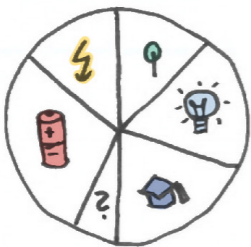


LONG-TERM STRATEGIES
HOSSZÚTÁVÚ STRATÉGIÁK

ONLY BATTERY INDUSTRY



MIXED ECONOMIES



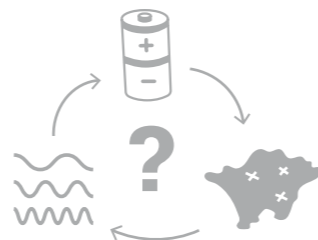


1

Problem Field

2

Transformability

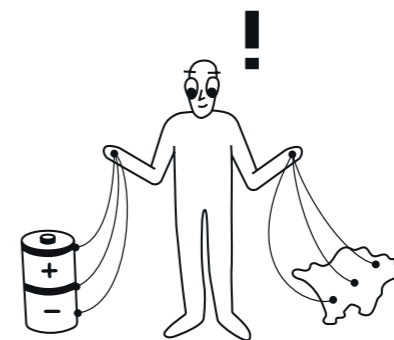


3

Understanding

4

Exploration



5

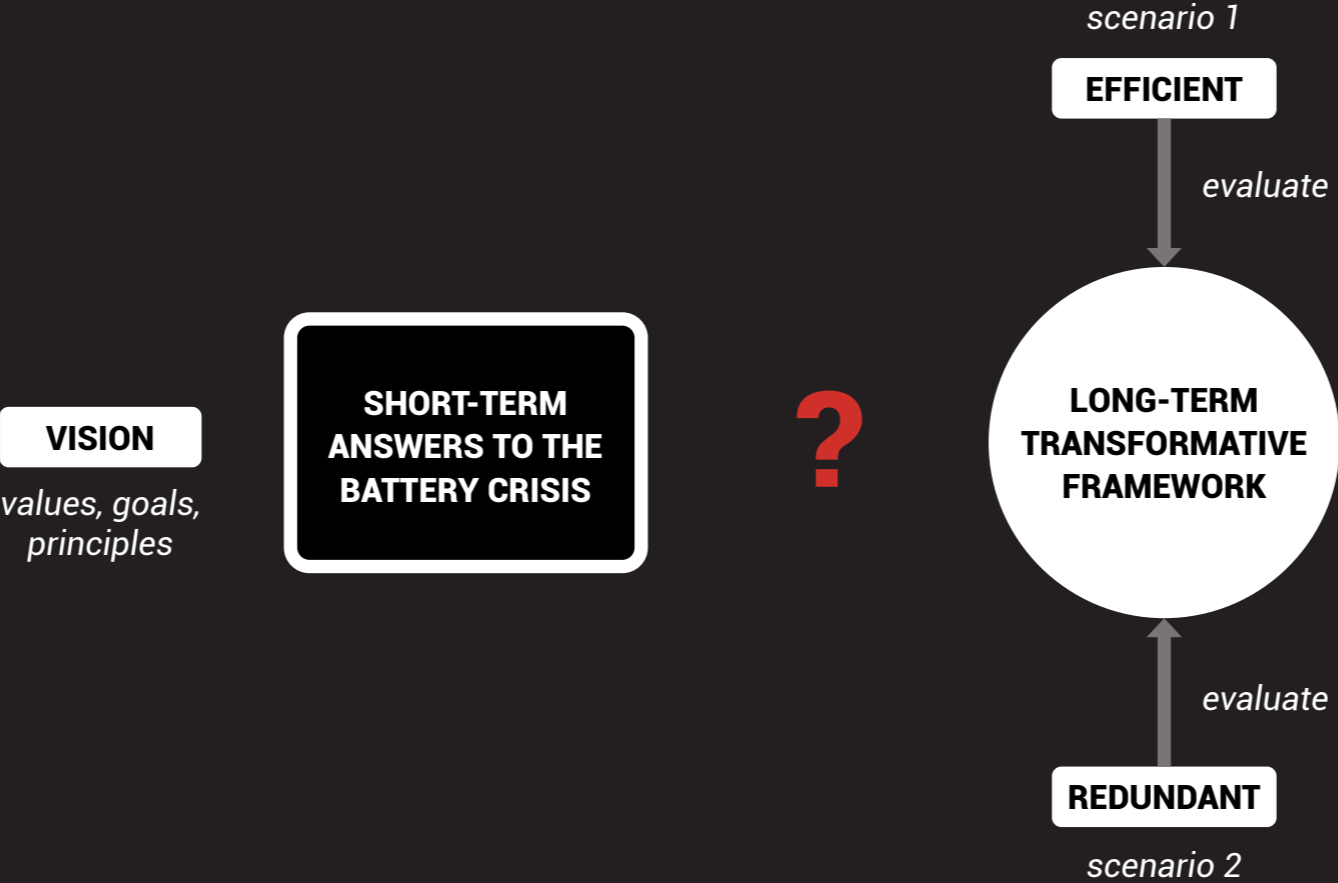
Operationalisation

6

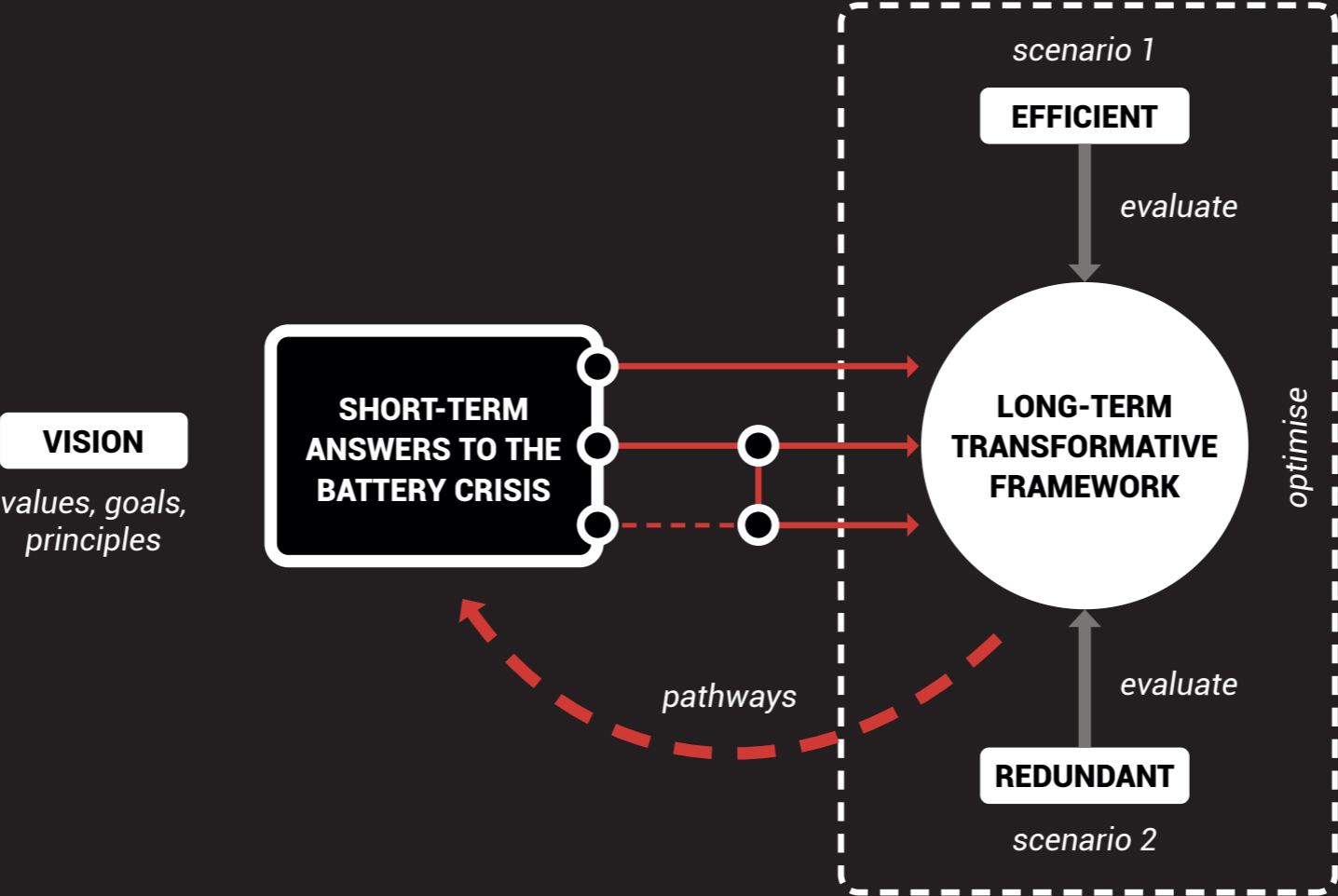
Conclusions



FROM LONG-TERM FRAMEWORK
TO SHORT-TERM SOLUTIONS
*HOSSZÚTÁVÚ TÉRI KERETTŐL
RÖVIDTÁVÚ MEGOLDÁSOKIG*



TRANSFORMATION PATHWAYS
ÁTALAKÍTHATÓSÁGI FEJLŐDÉSI UTAK



LONG-TERM FUTURE GOALS

HOSSZÚTÁVÚ CÉLOK

- pathways
- - - feedback loops
- MEANS towards values
- 'no regret' measures
- vision goals
- natural capital
- settlement capital
- infrastructural capital
- economic capital
- human capital
- social capital



↑ Landscape-based development: soil + water

Localised, multiscalar supply chains

HIGH FREQUENCY OF CHANGE

Natural investments: core flood-drought buffers

Battery communities as a way of life - urban

Specialised knowledge and research hubs

Territorial circularity: multi-scalar network of circular activities

Main nodes are the innovation and service hubs of the region

Battery communities as a way of life - rural

Connected peripheries: local, shared, autonomous networks and vehicles
recreational walkpaths, smart and shared EVs, bikepaths

high frequency of change

LOW FREQUENCY OF CHANGE

Regional floodplain restoration: flexible and multifunctional buffers

Operative umbrella: regional matters and crisis management
top-down

Advanced infrastructure connecting main nodes: hydrogen backbone, high-speed train, shared EV

Multi-pathway governance: top-down x bottom-up

Learning and experimentation

Polycentric and participatory governance structures (co-creation)
bottom-up

Autonomous settlements and communities

Landscape-mosaics: local (community) cultivation, landscape-based layered functions

Balanced human-nature relationship, cultivation

Life long learning, community knowledge banks, mixed livelihood schemes

Local repair economies, surfers, markets landscape-based production

time

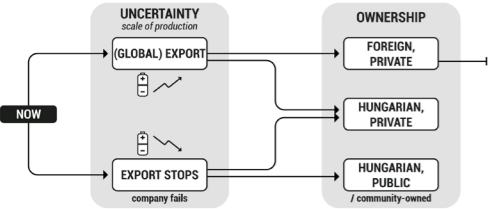
BATTERY VARIABLES - PRODUCTION AND OWNERSHIP

AKKU-VÁLTOZÓK - GYÁRTÁS ÉS TULAJDON

- pathways
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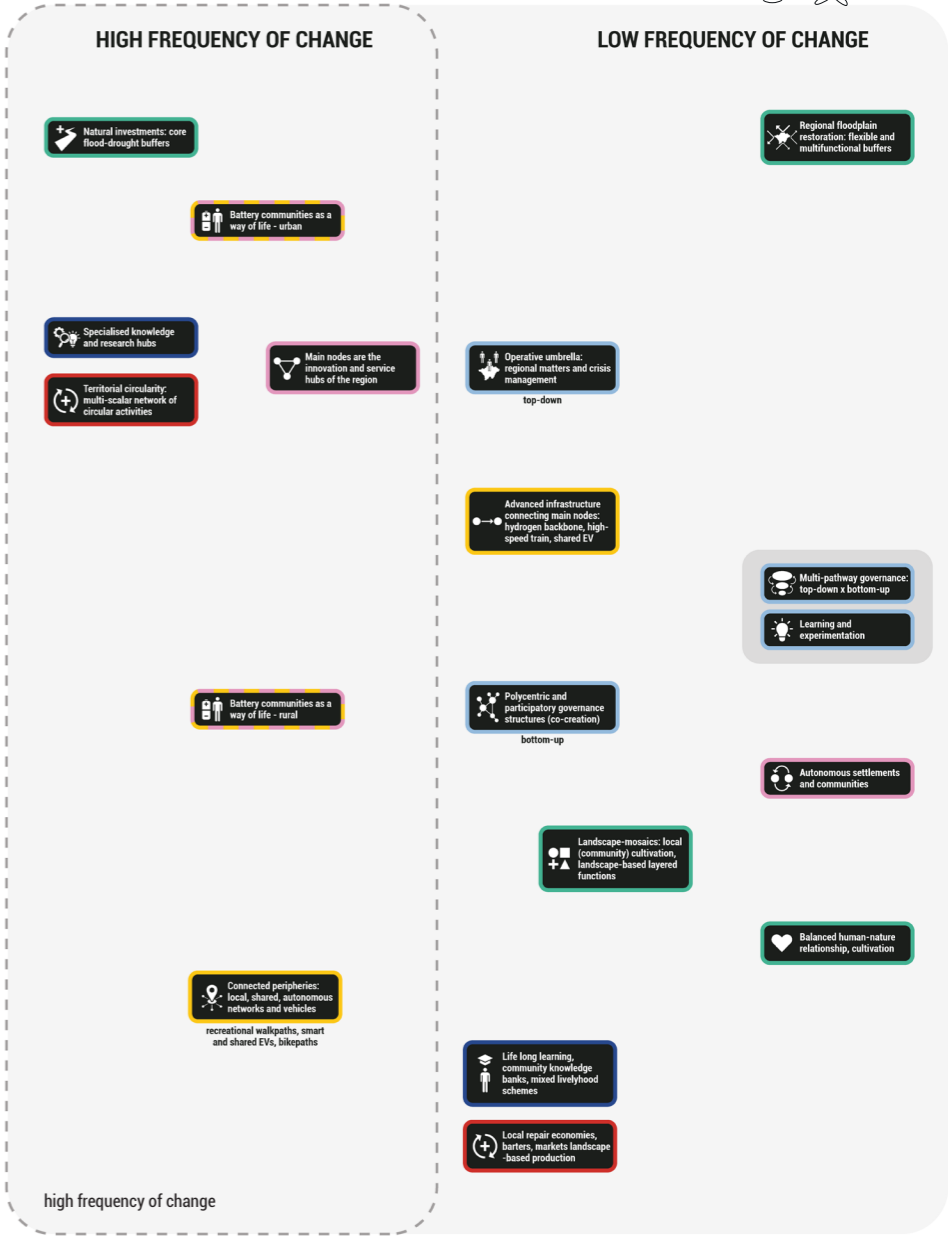


VARIABLES



↑ Landscape-based development: soil + water

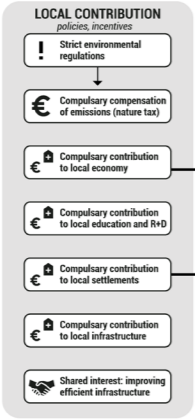
Localised, multiscale supply chains



BASE STEPS AND DECISIONS - INCENTIVES

ALAPLÉPÉSEK ÉS DÖNTÉSEK – ÖSZTÖNZŐK

- pathways
- - - feedback loops
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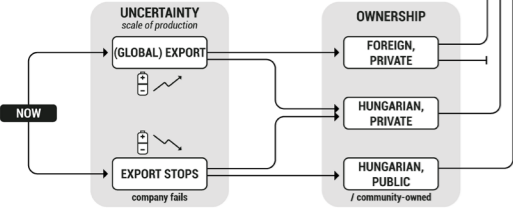


↑ Landscape-based development: soil + water

Localised, multiscale supply chains

Regional floodplain restoration: flexible and multifunctional buffers

VARIABLES



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Learning and experimentation

Autonomous settlements and communities

Balanced human-nature relationship, cultivation

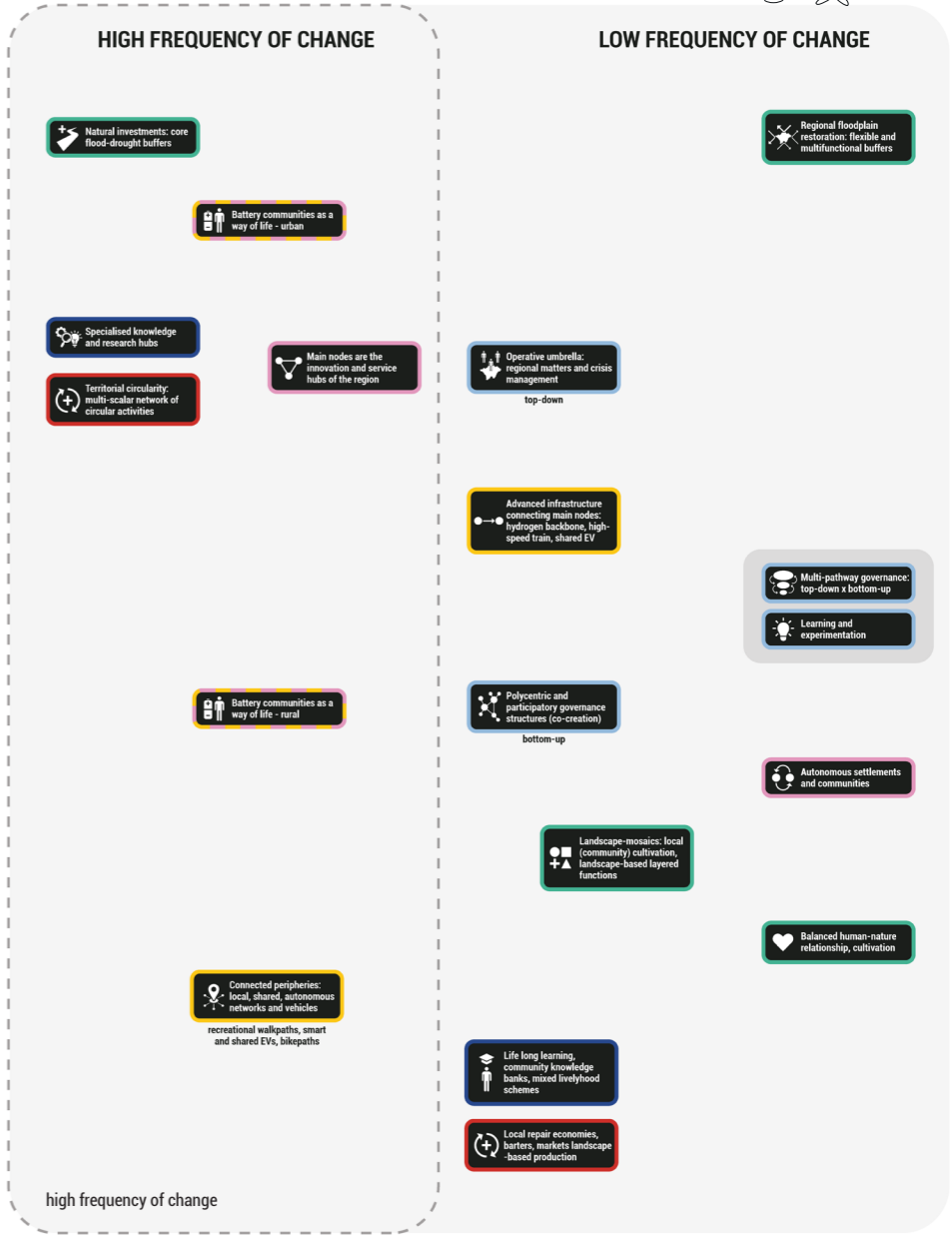
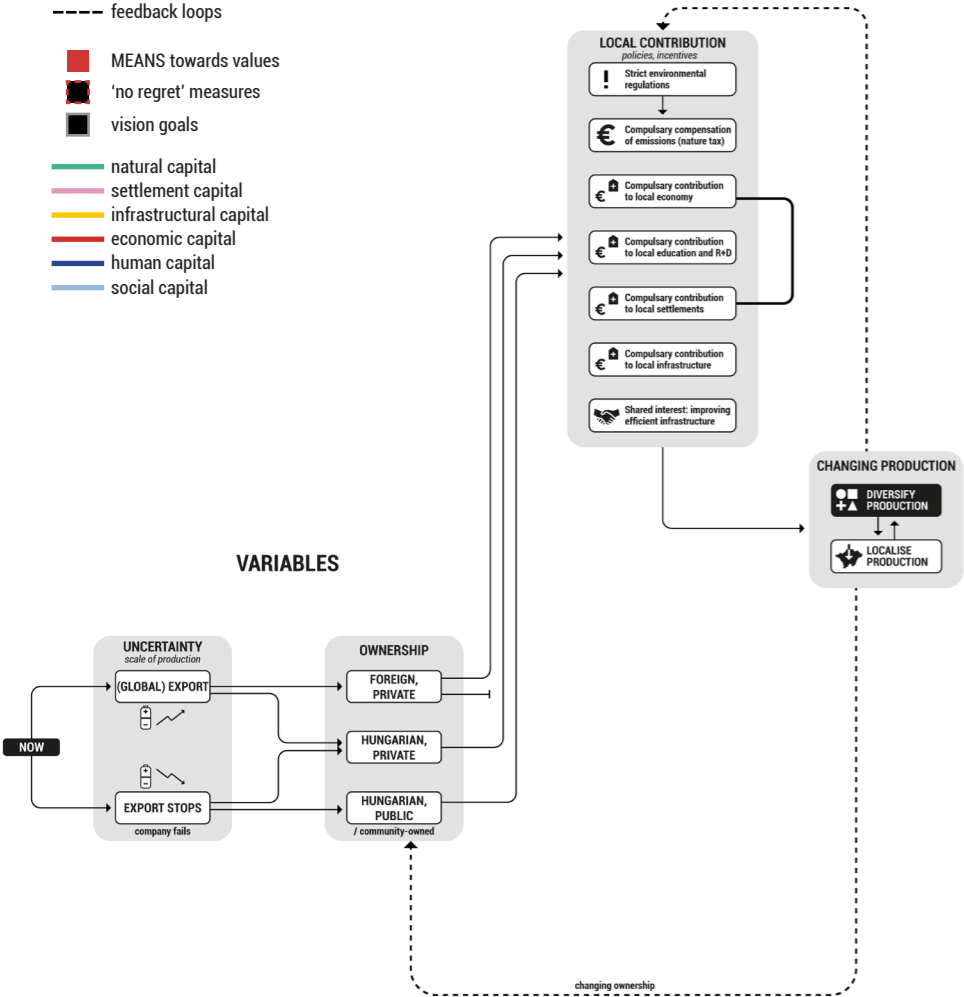
time

BASE STEPS AND DECISIONS - CHANGING PRODUCTION

ALAPLÉPÉSEK ÉS DÖNTÉSEK –VÁLTOZÓ TERMELÉS



- pathways
- - - feedback loops
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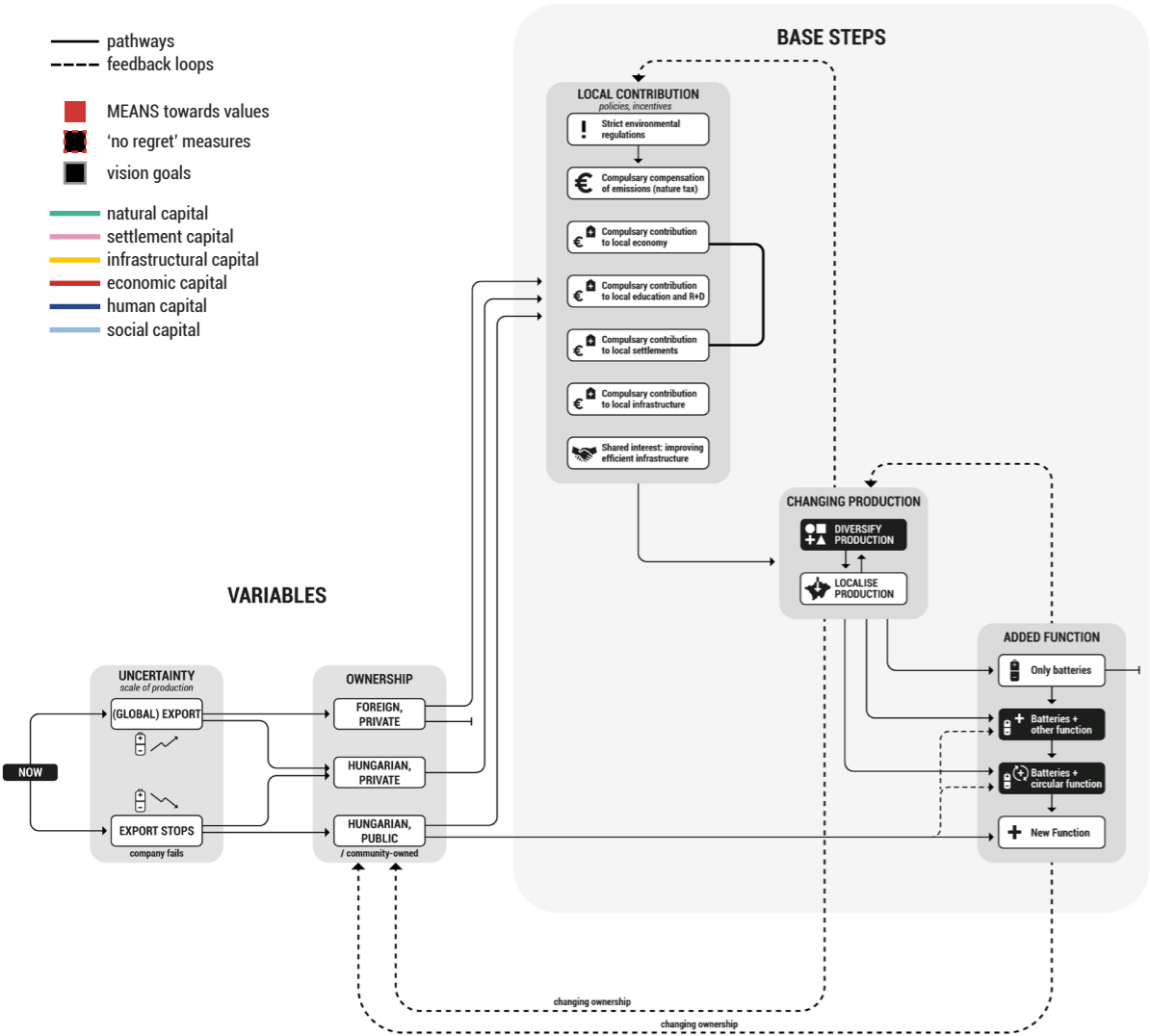


BASE STEPS AND DECISIONS - ADDED FUNCTIONS

ALAPLÉPÉSEK ÉS DÖNTÉSEK – HOZZÁADOTT FUNKCIÓK

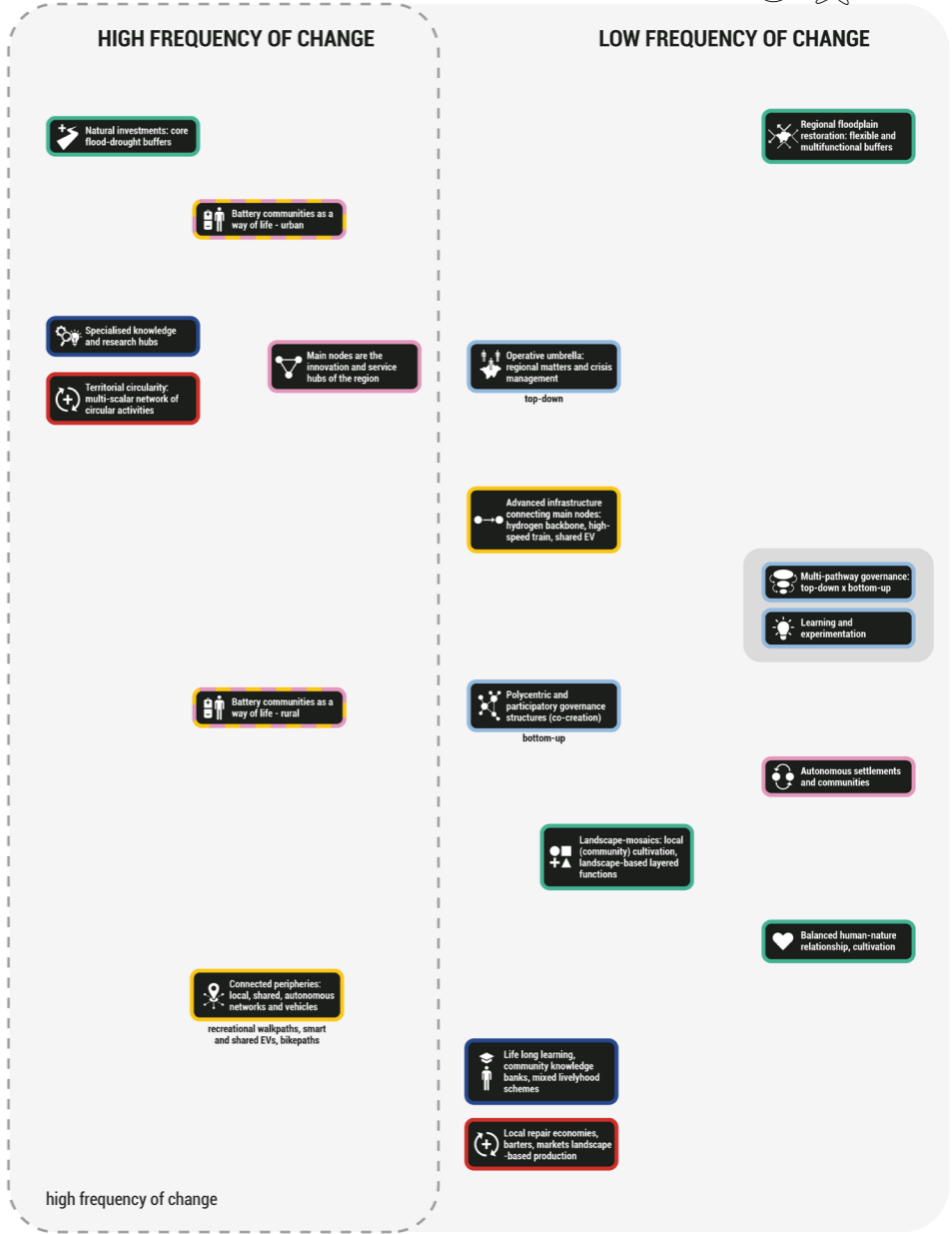


- pathways
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↑ Landscape-based development: soil + water

Localised, multiscale supply chains



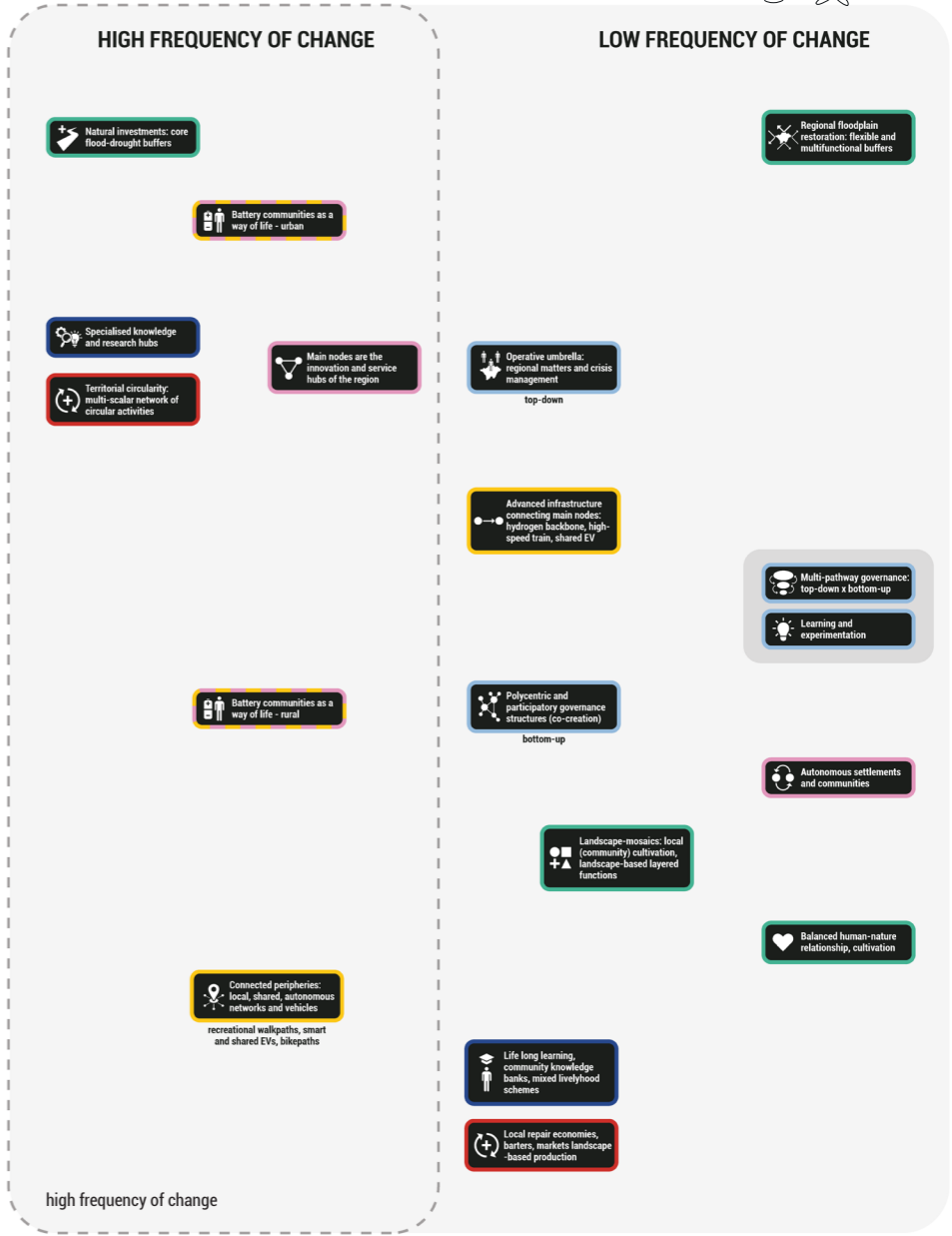
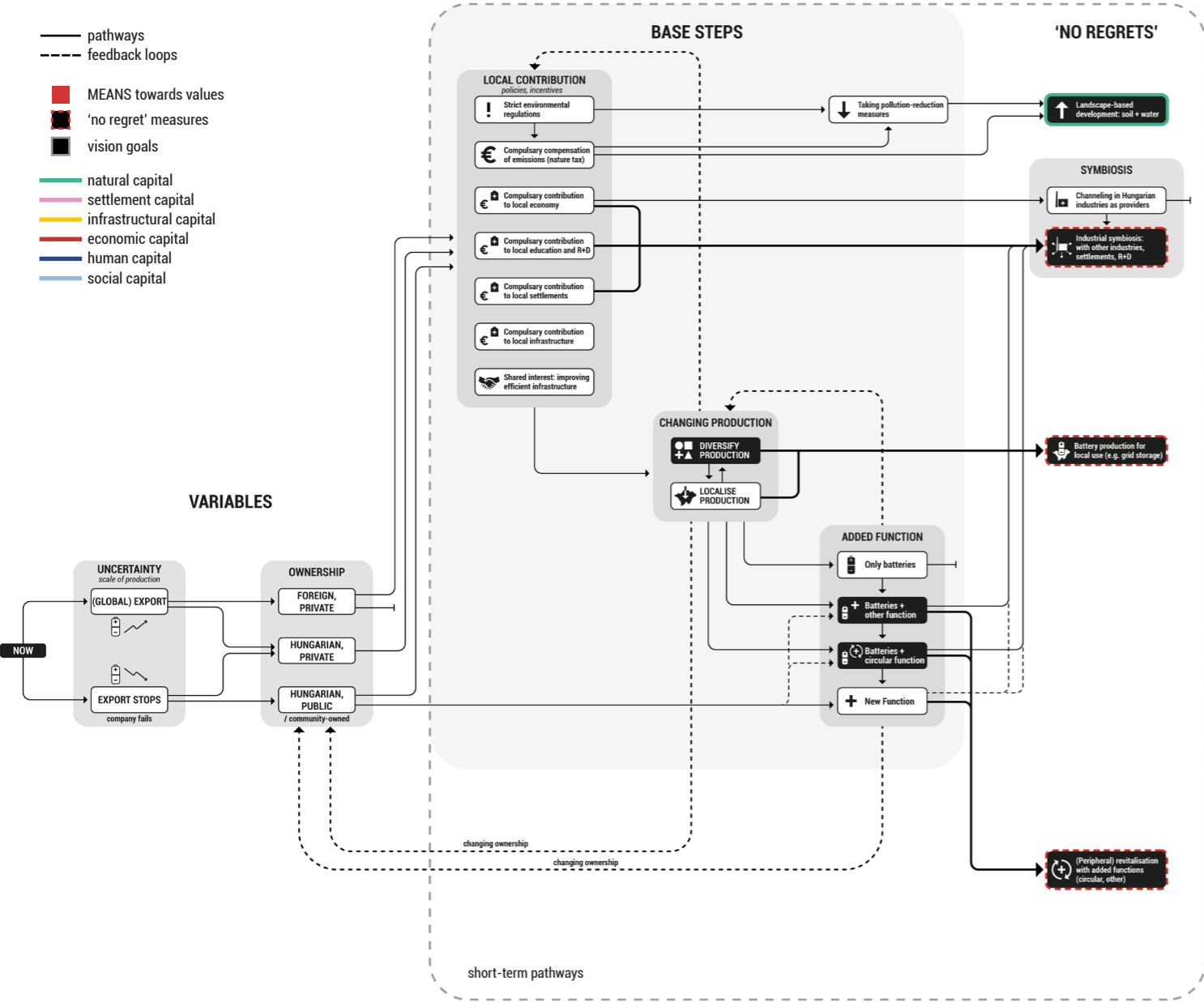
time

'NO REGRET' MEASURES
KOCKÁZAT NÉLKÜLI LÉPÉSEK



- pathways
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- 'no regret' measures
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VARIABLES

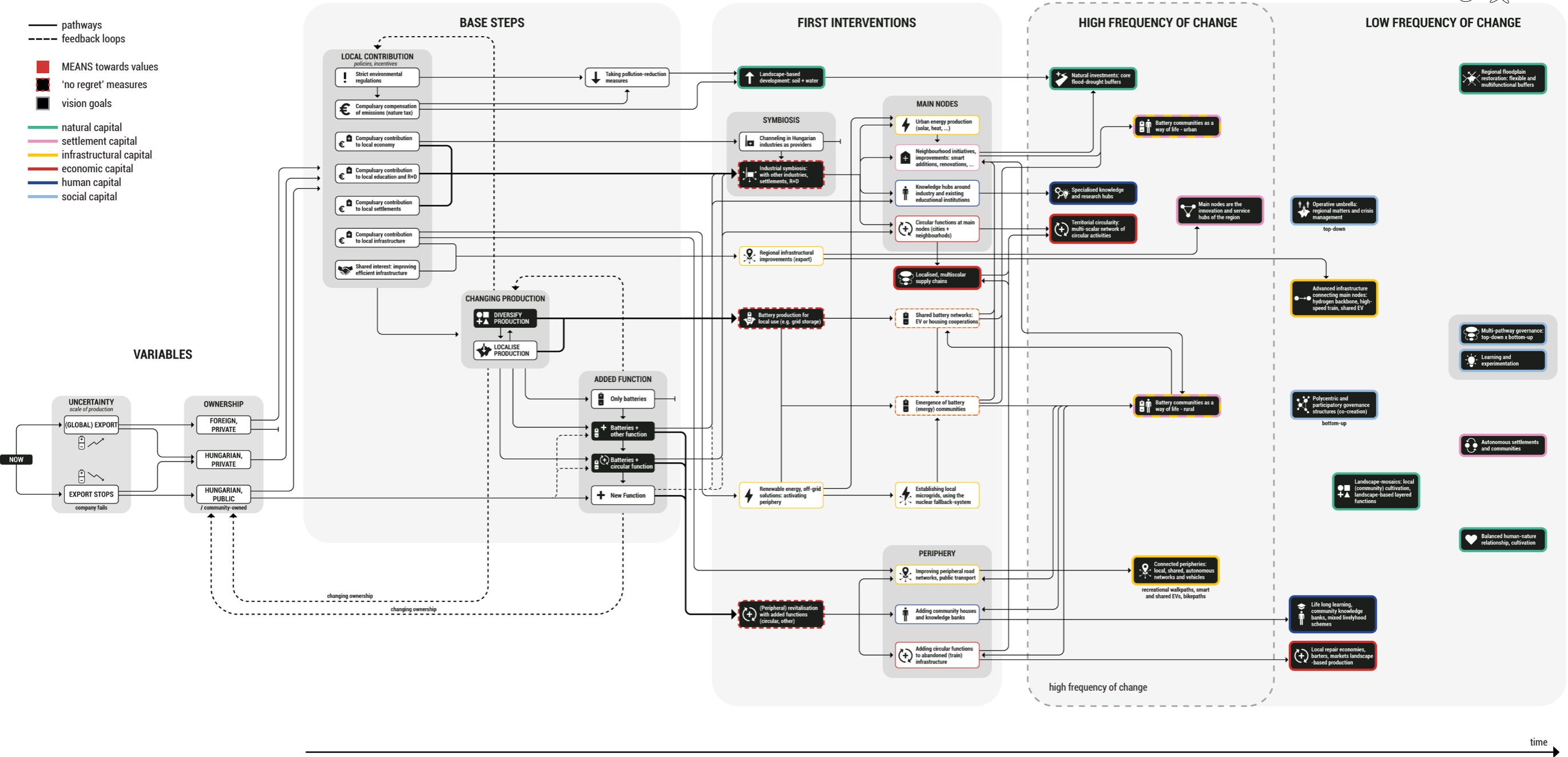


FIRST INTERVENTIONS

ELSŐ BEAVATKOZÁSOK



- pathways
- - - feedback loops
- MEANS towards values
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- social capital



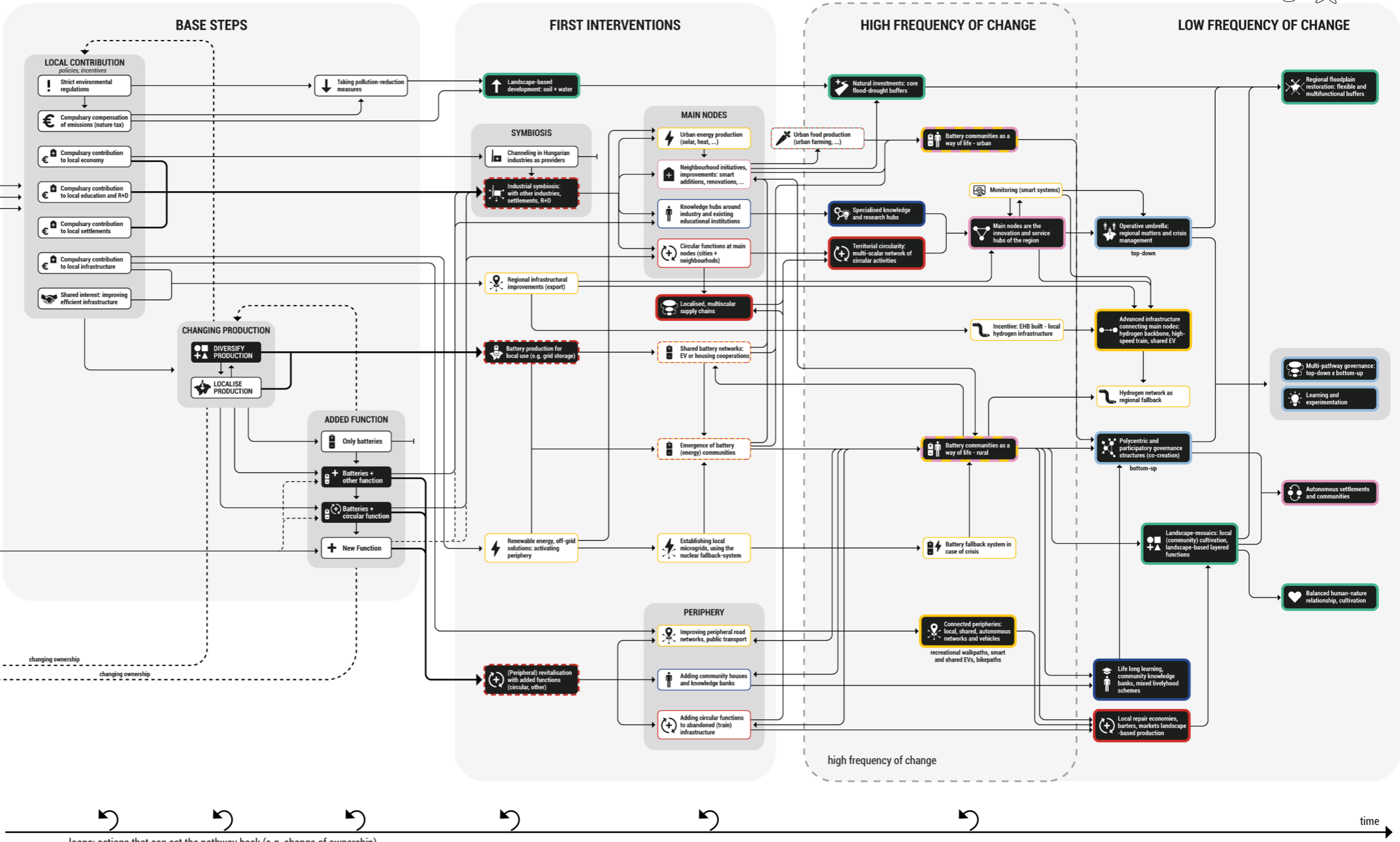
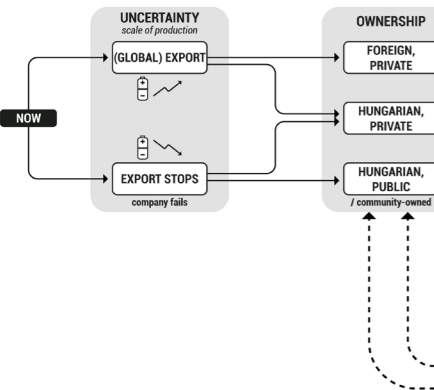
REACHING THE LONG-TERM GOALS

A HOSSZÚTÁVÚ CÉLOK ELÉRÉSE



- pathways
- - - feedback loops
- MEANS towards values
- 'no regret' measures
- vision goals
- natural capital
- settlement capital
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- social capital

VARIABLES

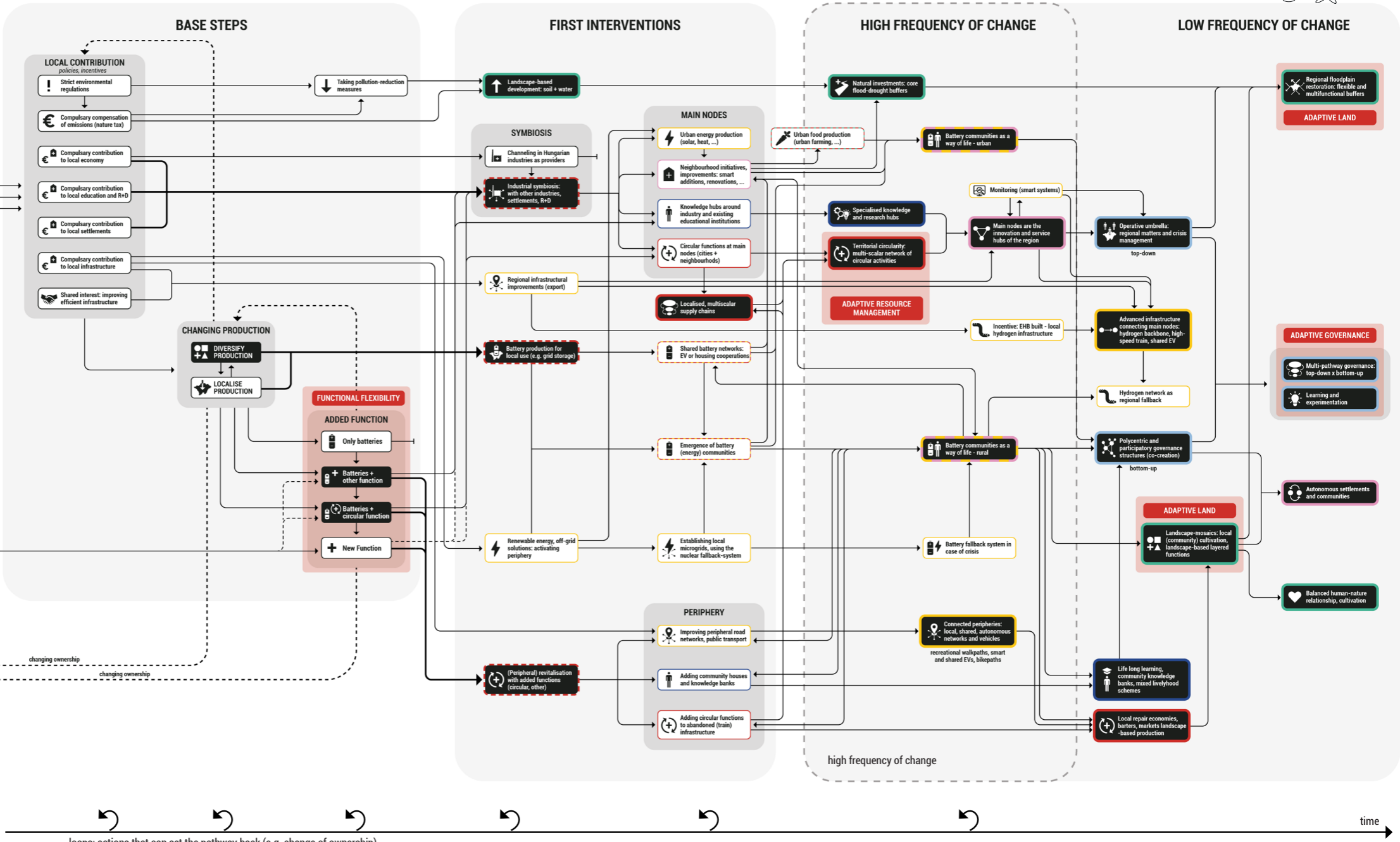
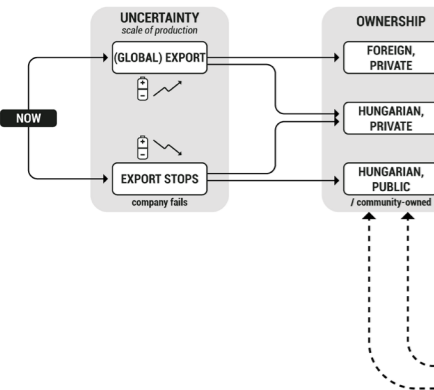


MEANS
ESZKÖZÖK



- pathways
- - - feedback loops
- MEANS towards values
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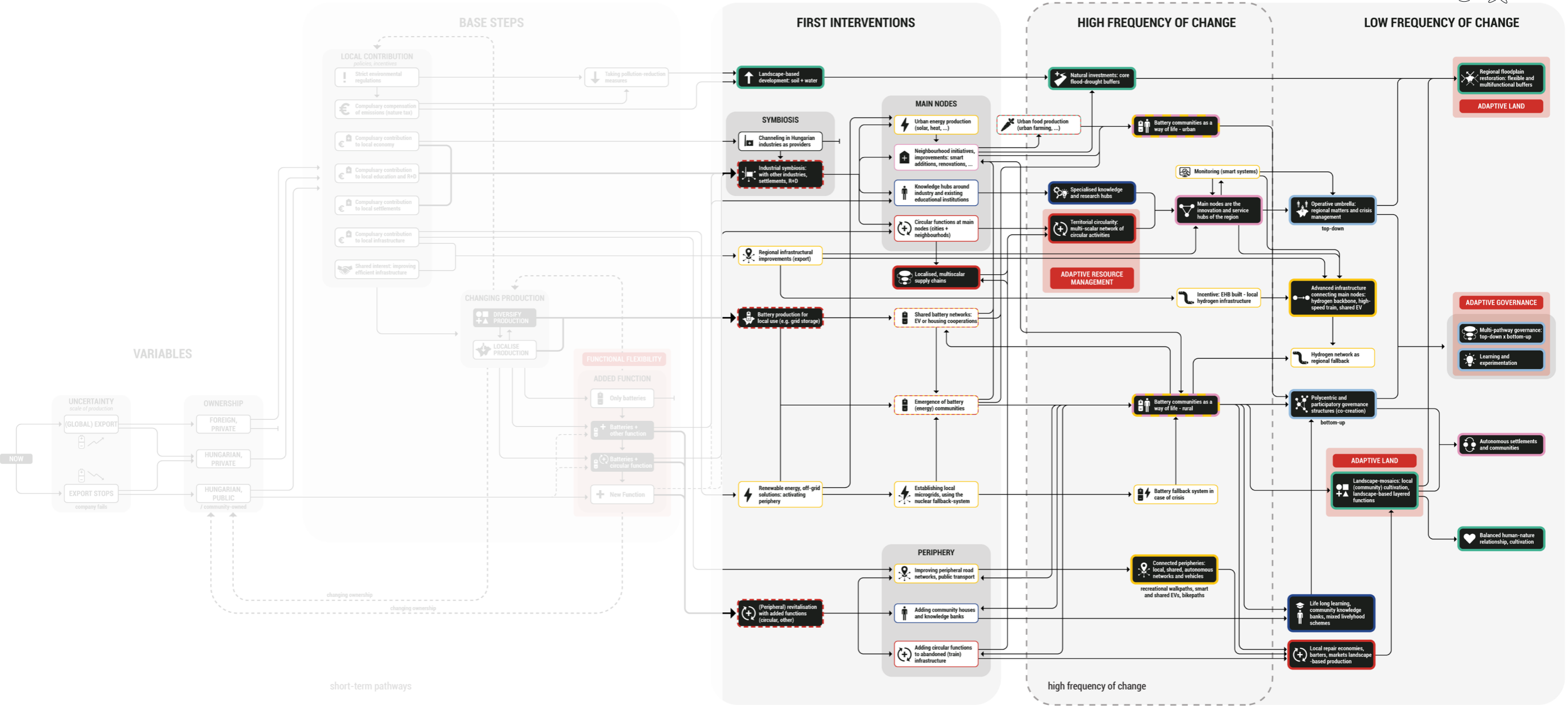
VARIABLES

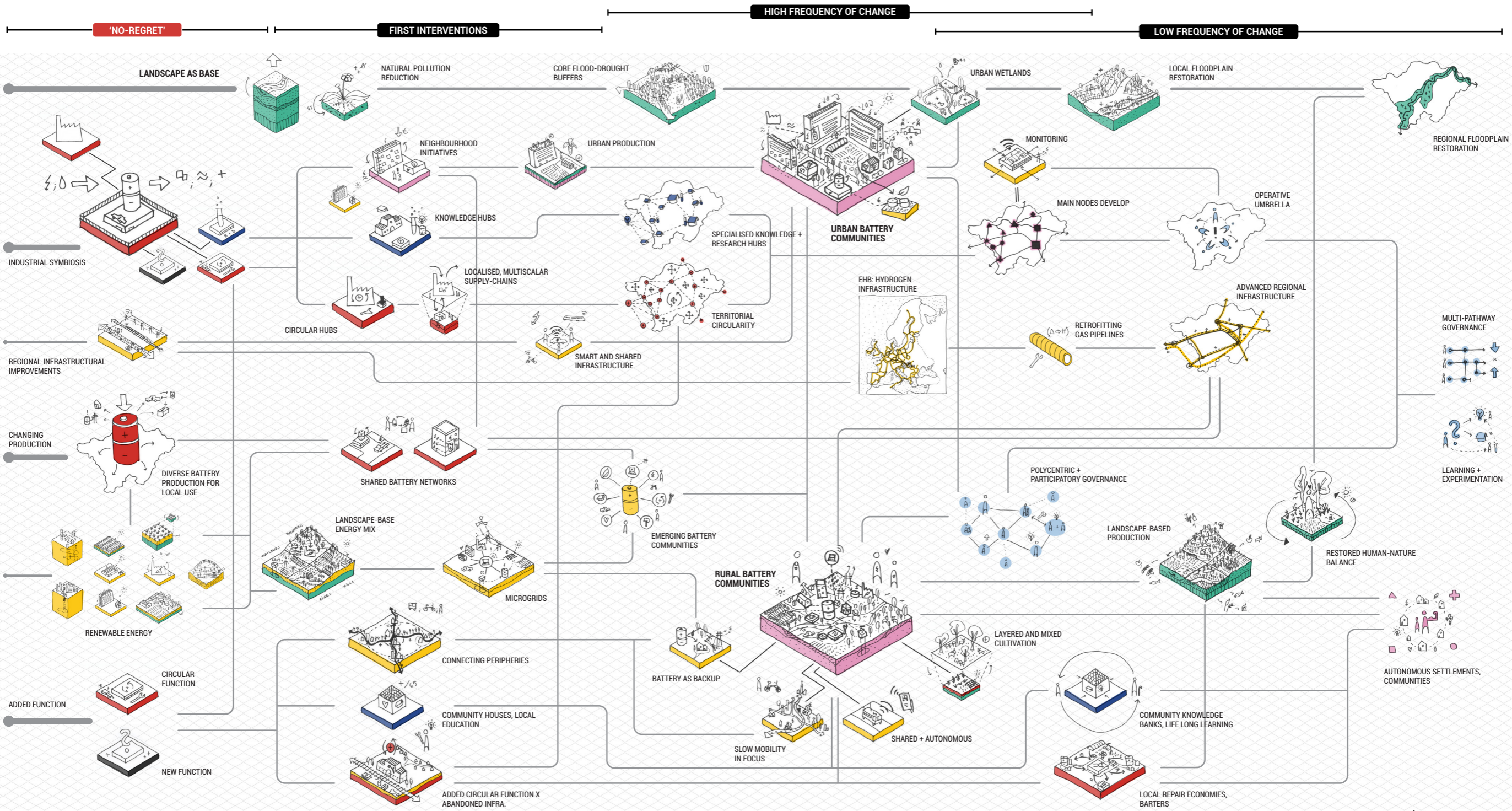


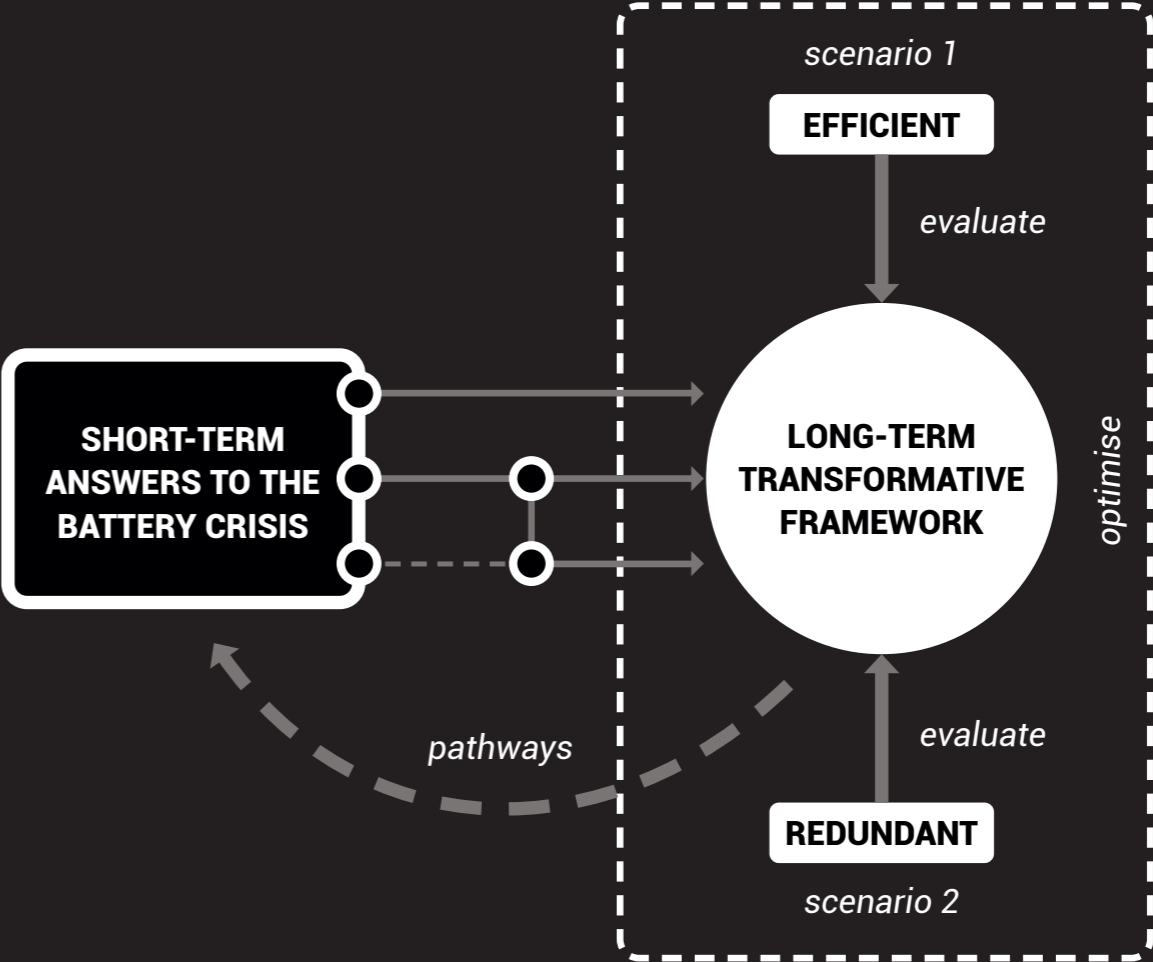
loops: actions that can set the pathway back (e.g. change of ownership)

LONG-TERM GOALS: SPATIALISATION

HOSSZÚTÁVÚ CÉLOK: TÉRBE HELYEZÉS

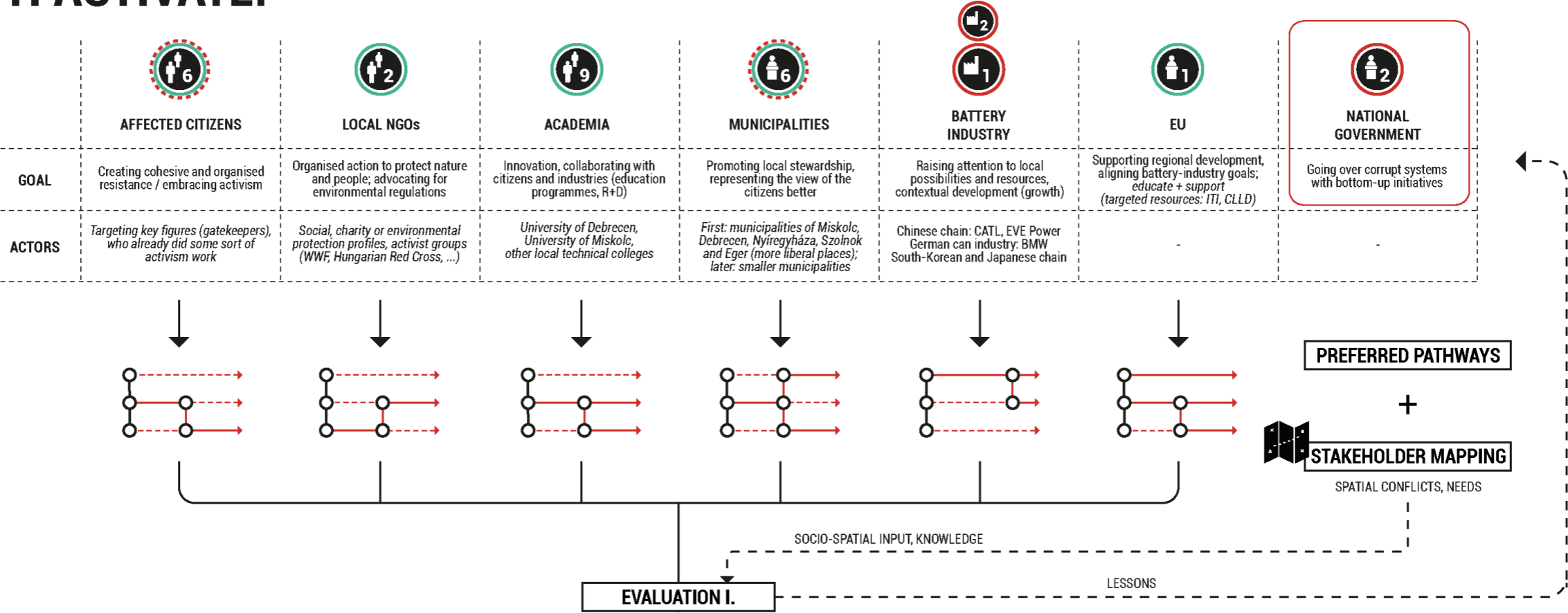








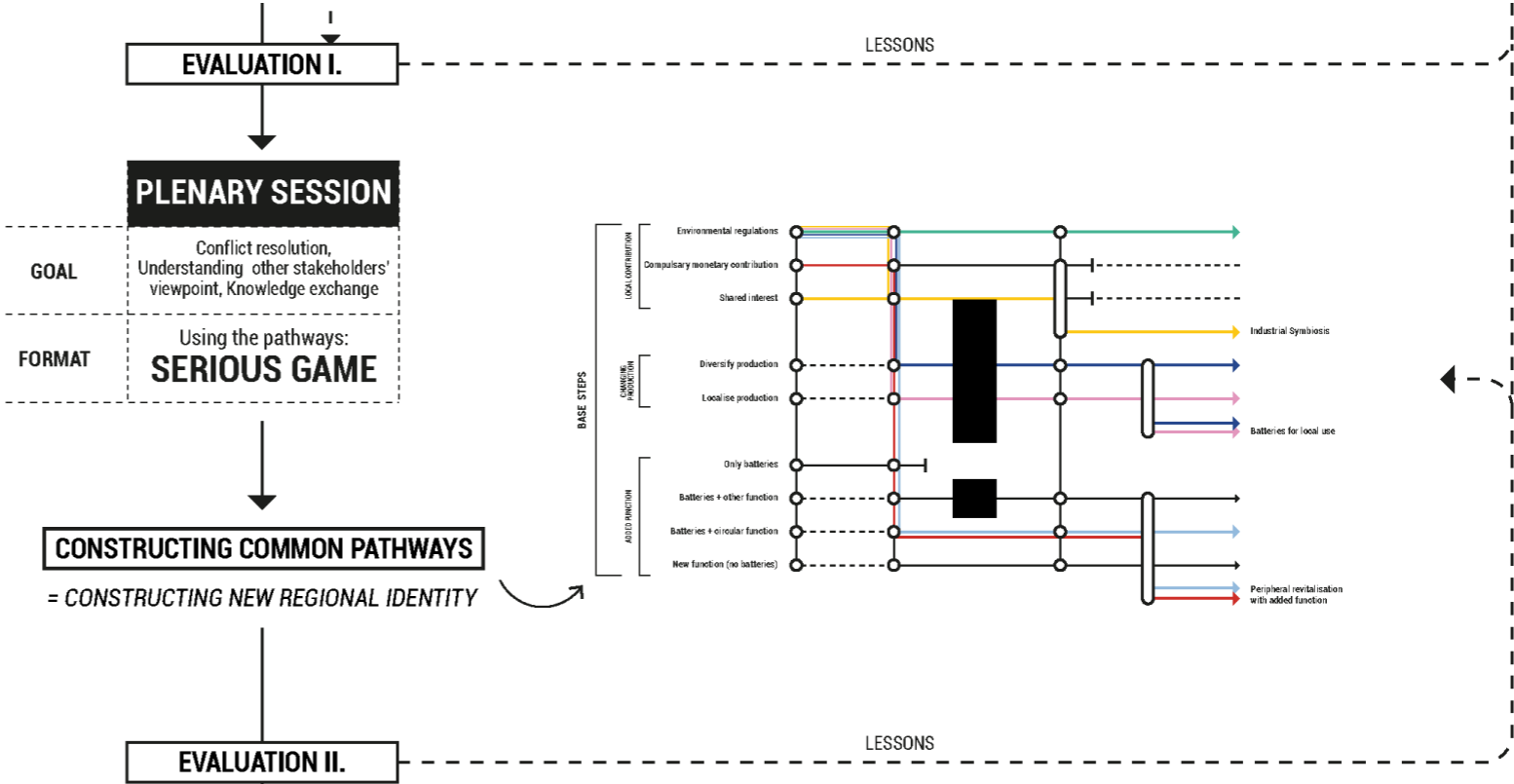
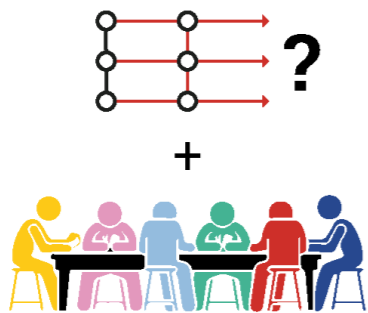
0. AWARENESS
1. ACTIVATE!

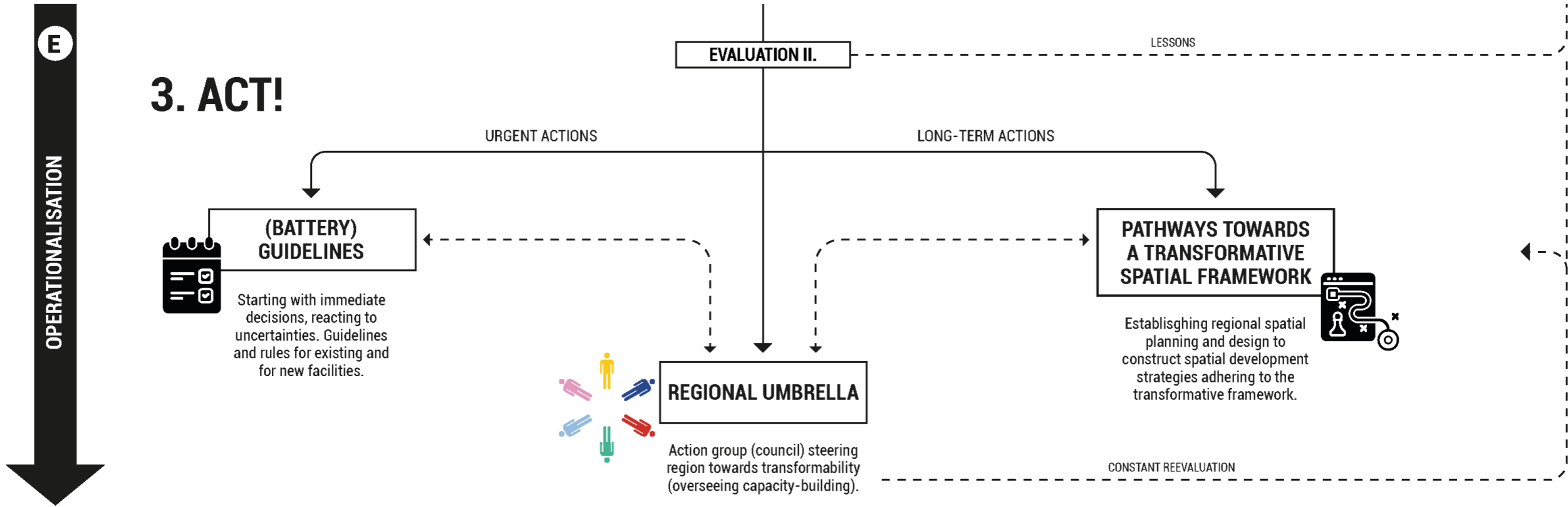




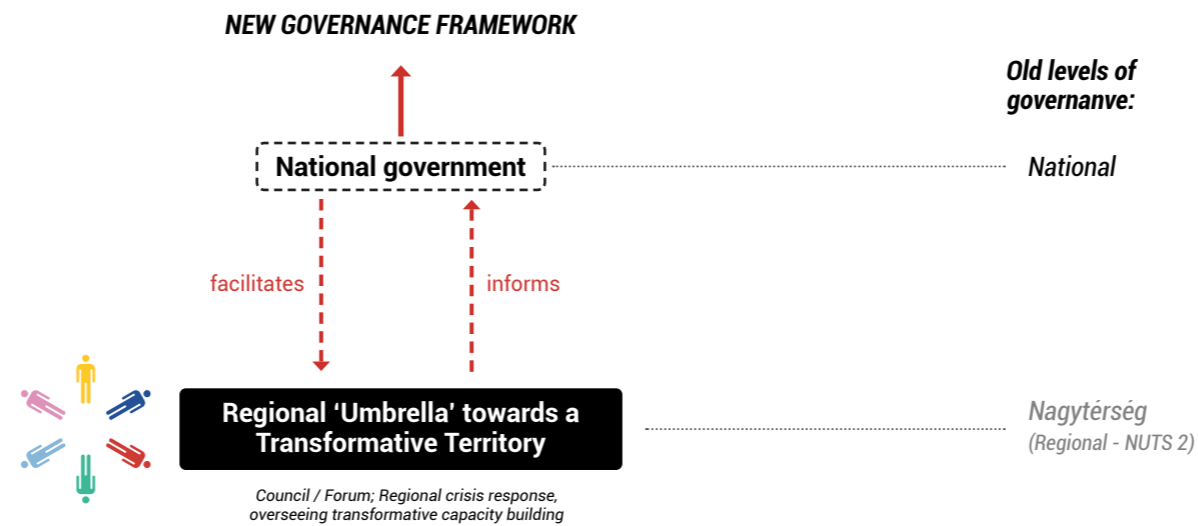
E
COMMON GROUND
E

2. ALIGN!

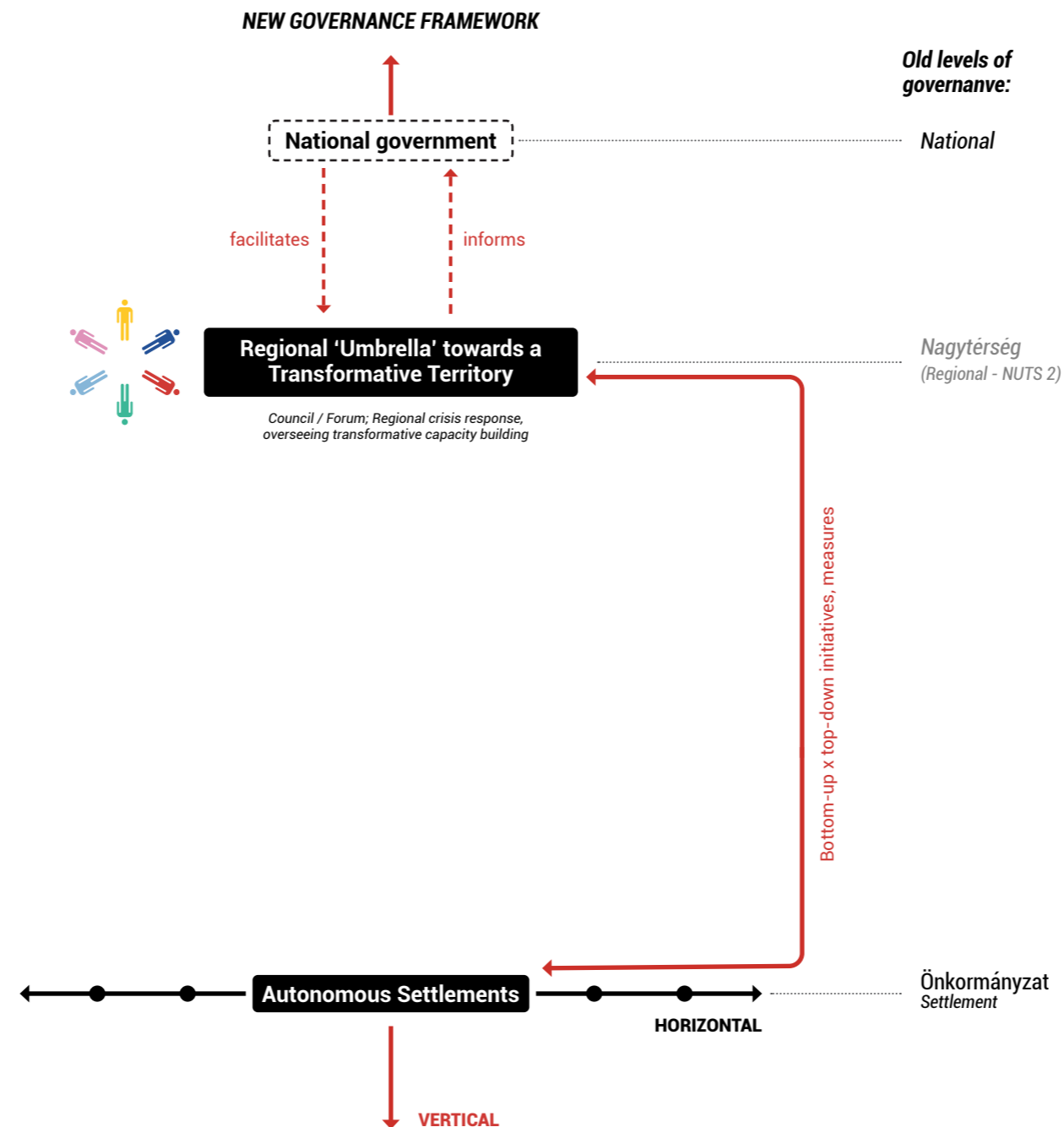




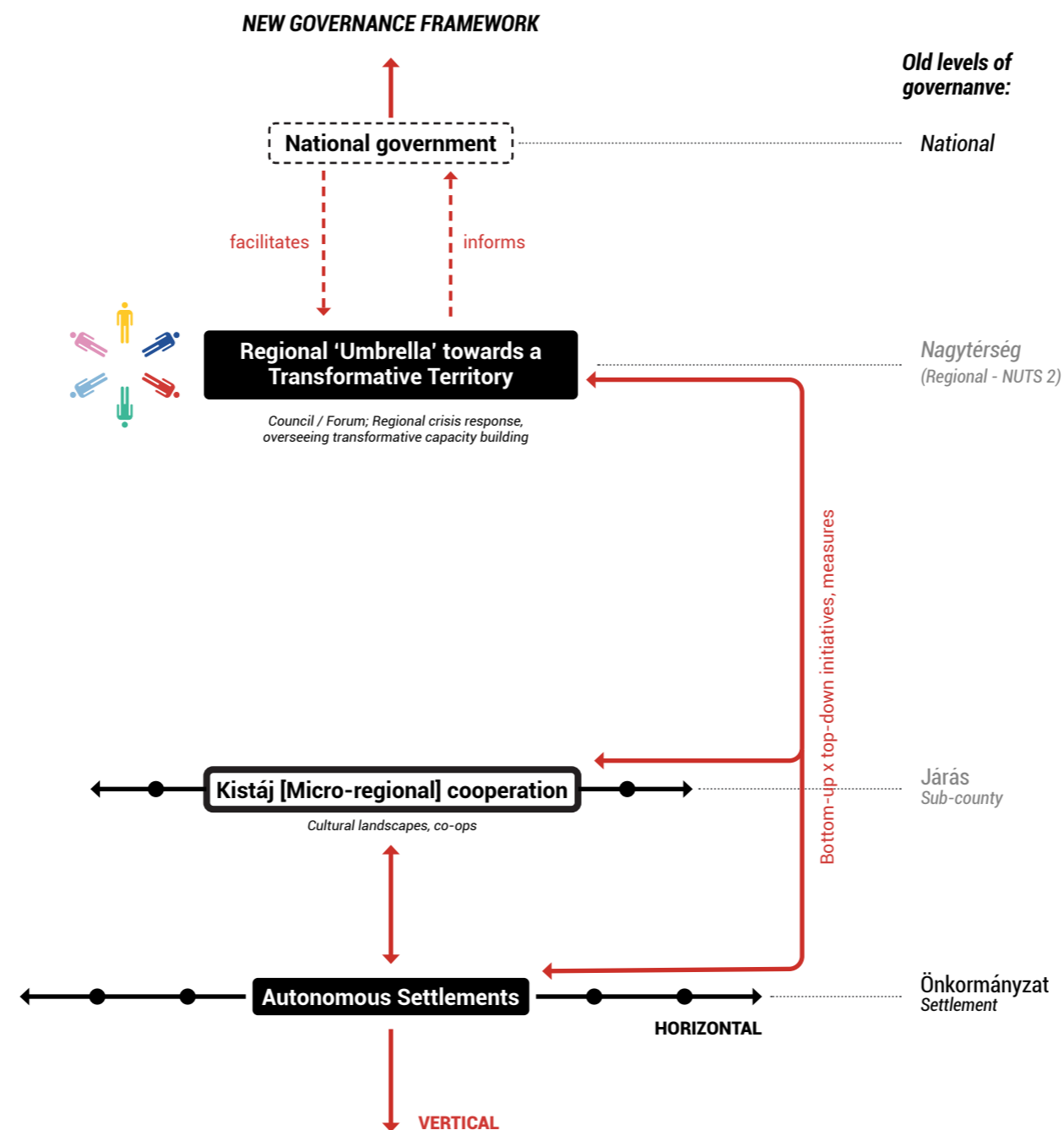
GOVERNANCE FRAMEWORK
KORMÁNYZATI KERET



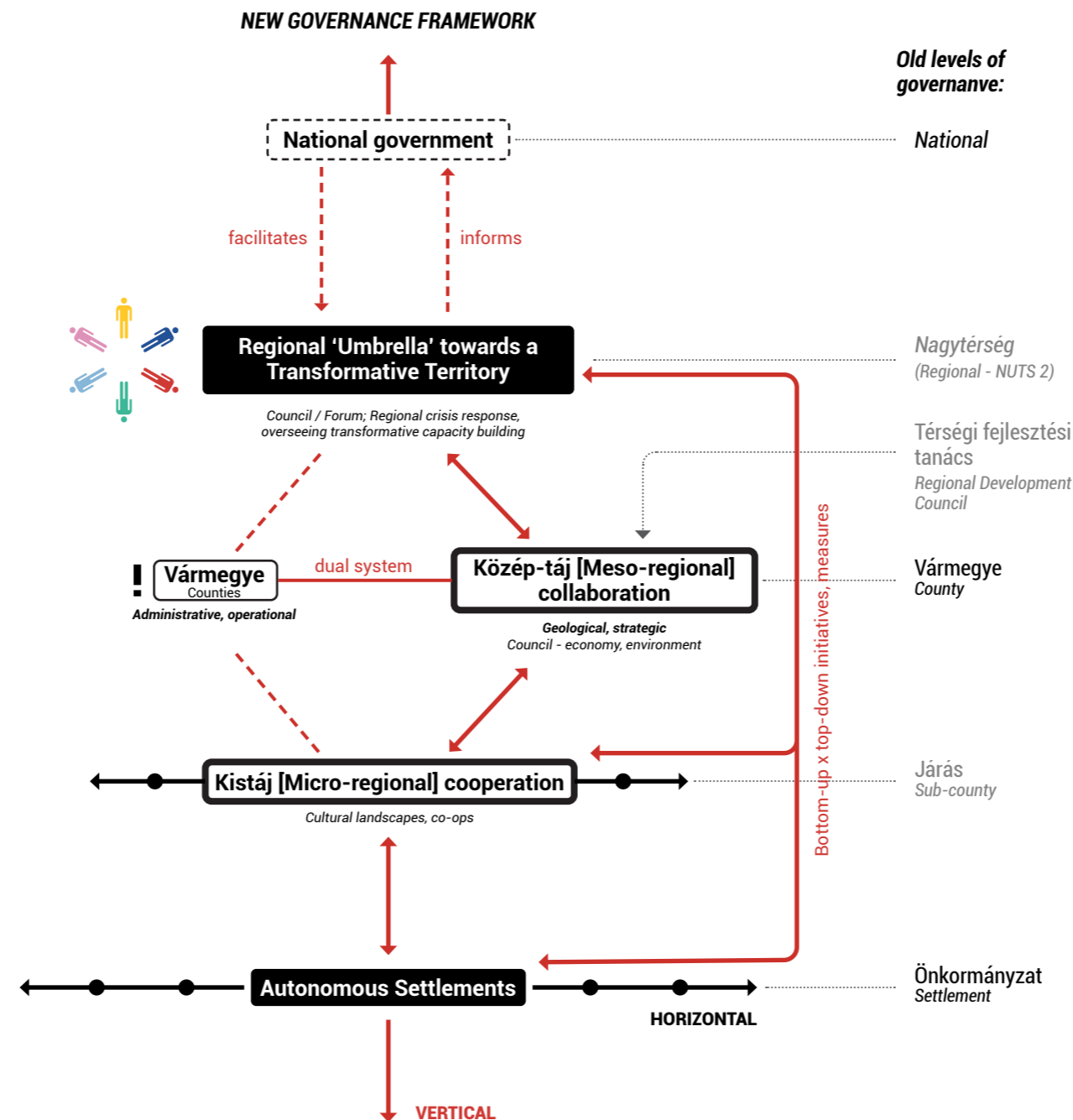
GOVERNANCE FRAMEWORK
KORMÁNYZATI KERET



GOVERNANCE FRAMEWORK
KORMÁNYZATI KERET



GOVERNANCE FRAMEWORK
KORMÁNYZATI KERET



THE NEW 'BORDERS'

AZ ÚJ 'HATÁROK'

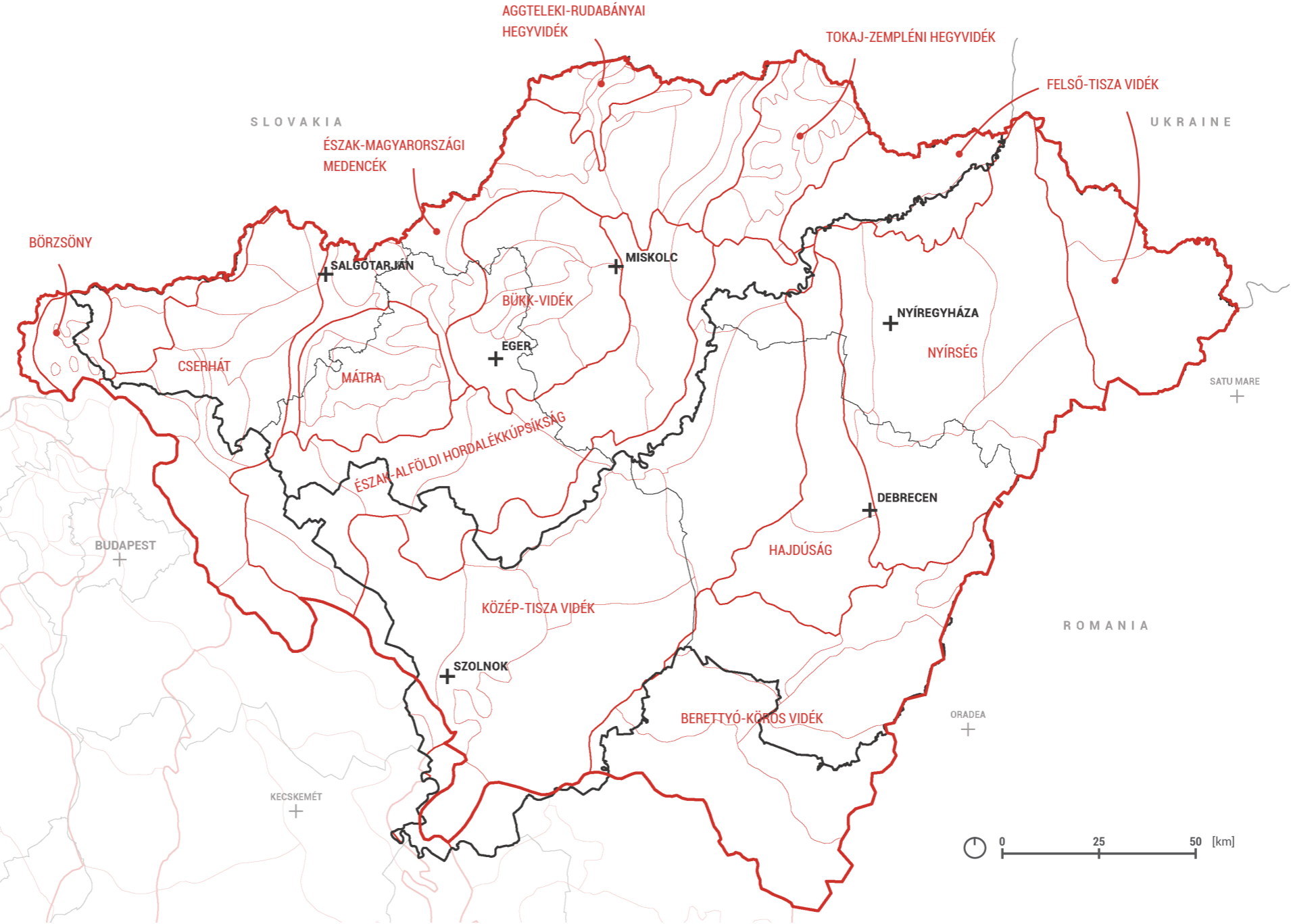


ADMINISTRATIVE BORDERS

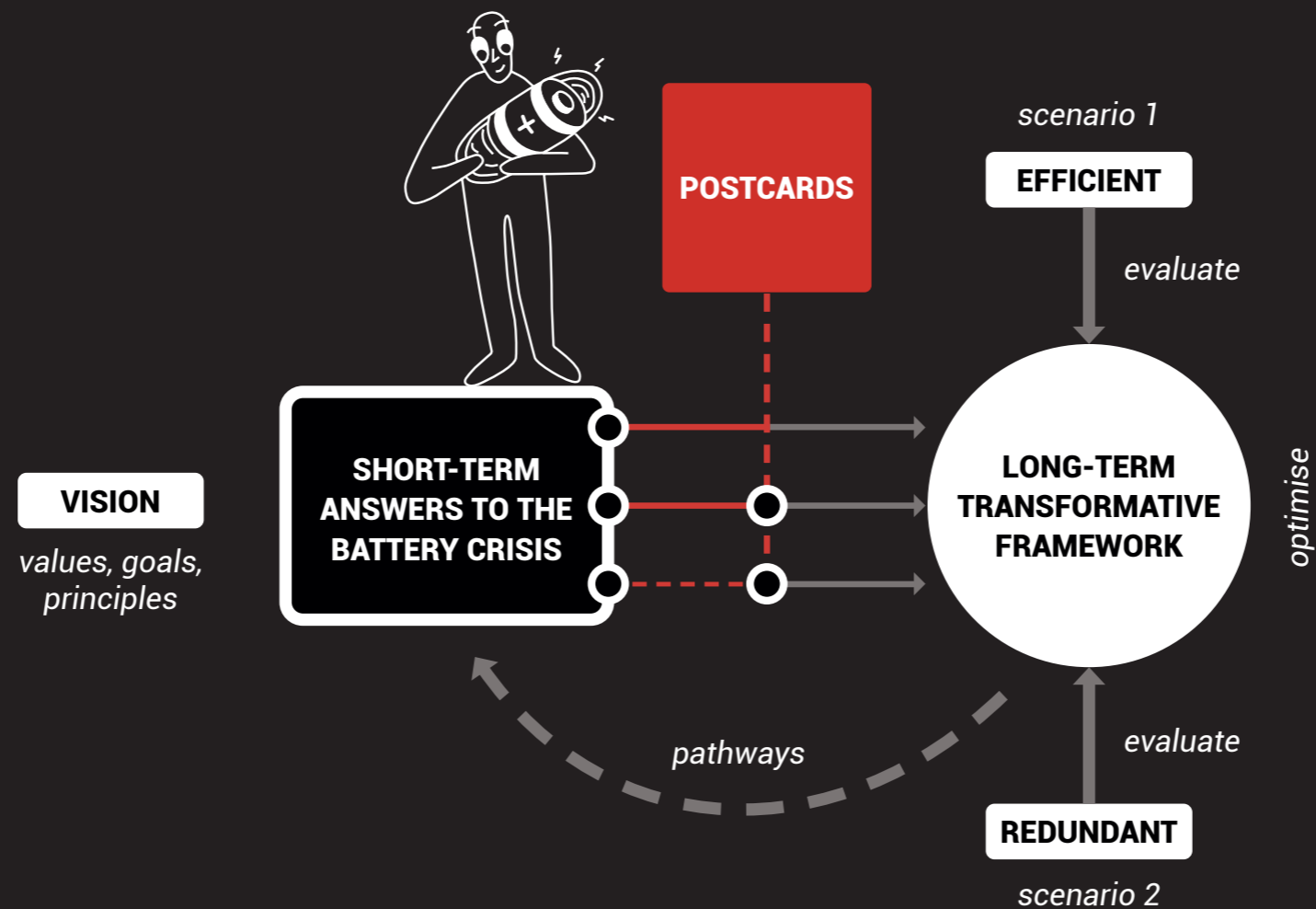
- NUTS 2 regions
- vármegyék [counties]
- + cities with county-rights

GEOGRAPHY-BASED BORDERS

- new outline of North-East Hungary
- középtájak [meso-regions]
- kistájak [micro-regions]

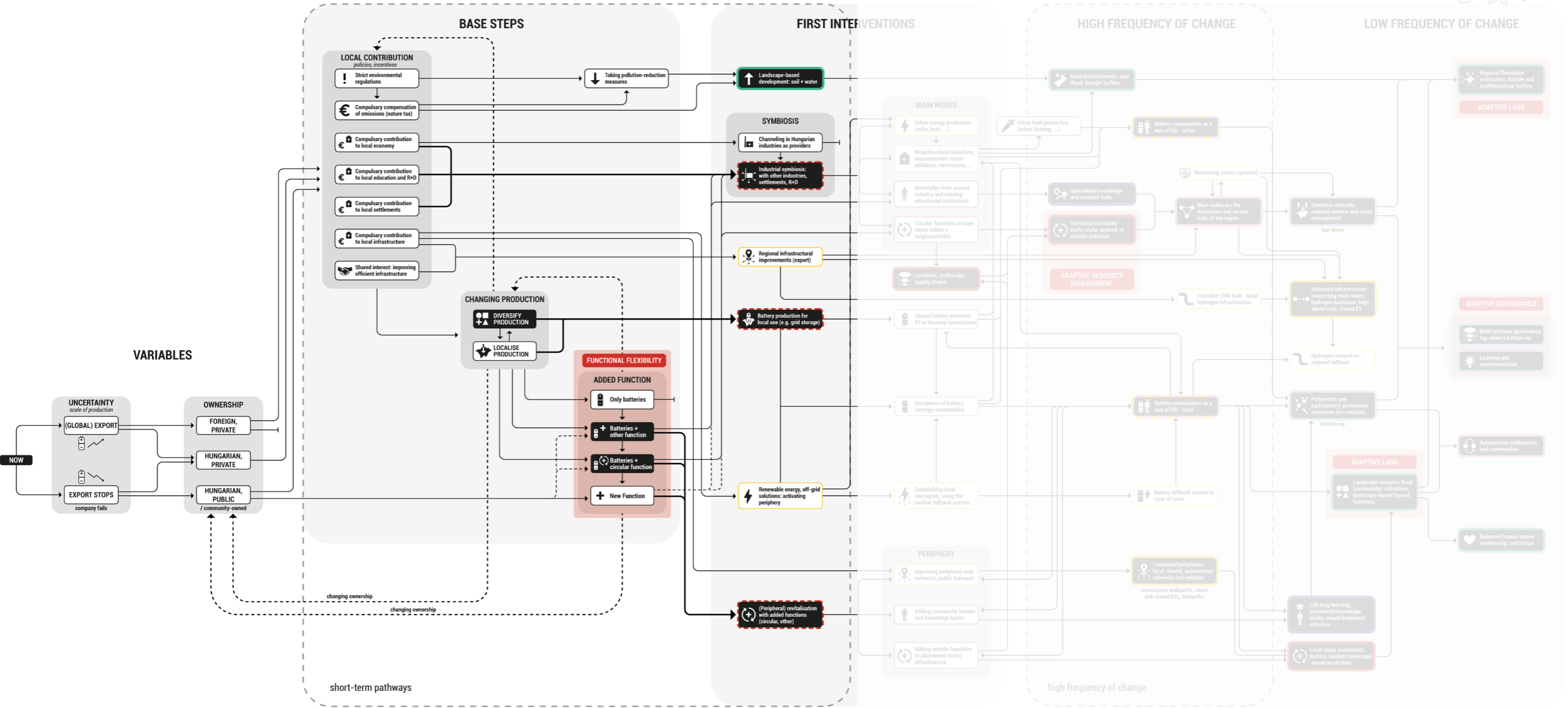


A GLIMPSE INTO THE FUTURE
BEPILLANTÁS A JÖVŐBE



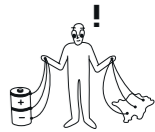
SHORT-TERM PATHWAYS

RÖVIDTÁVÚ LEHETŐSÉGEK

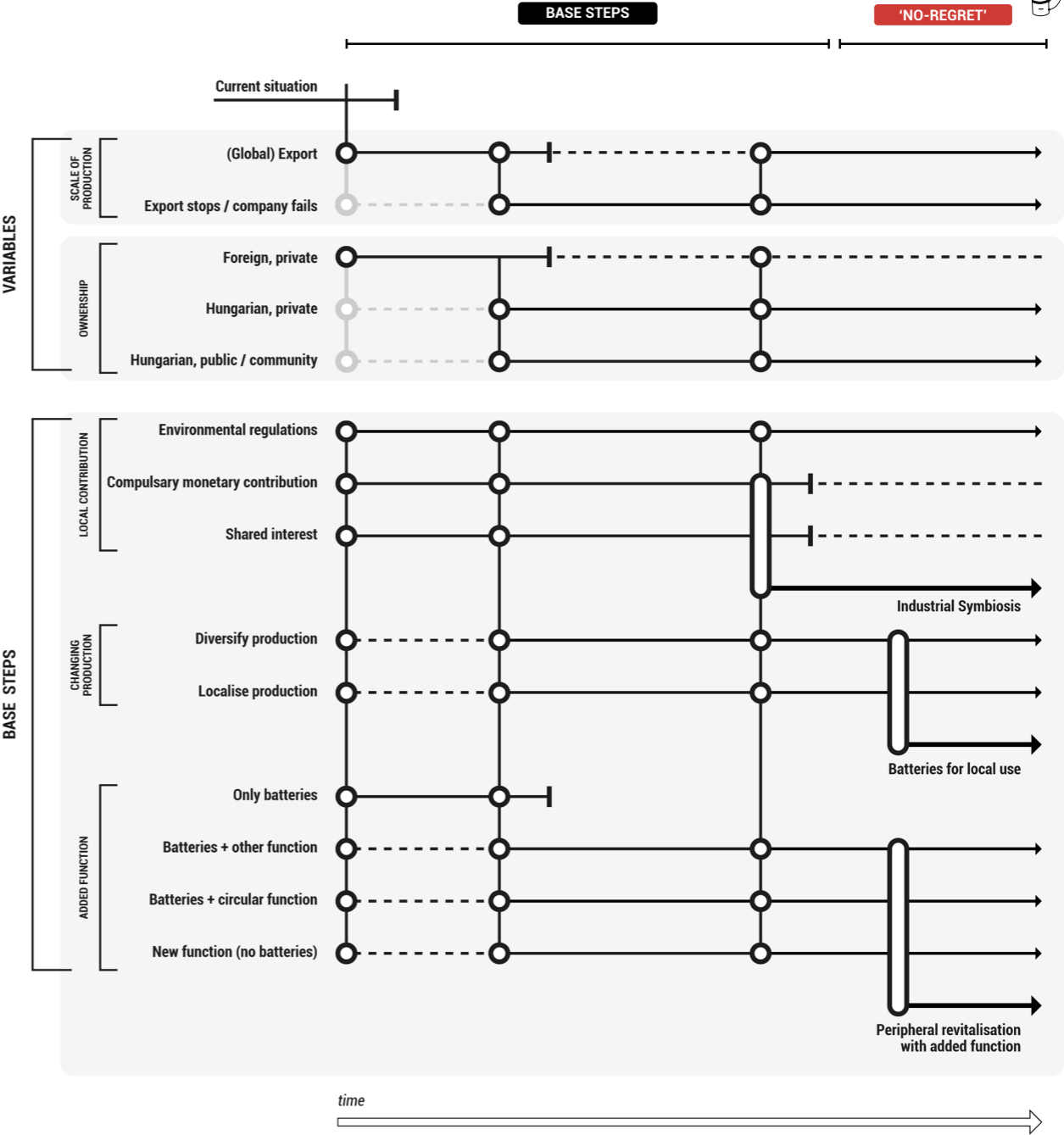
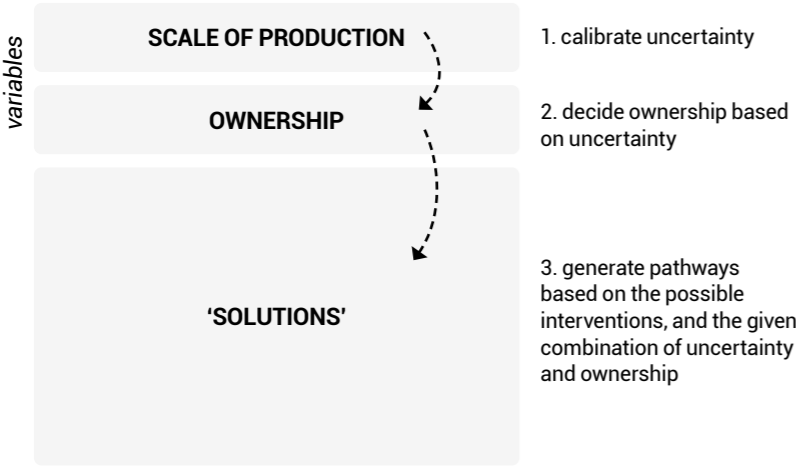


SHORT-TERM PATHWAYS

RÖVIDTÁVÚ LEHETŐSÉGEK



- transfer station to new action
- ┃ adaptation tipping point
- ┃ adaptation (transformation) pathways
- - - pathway that could happen but does not apply to all scenarios

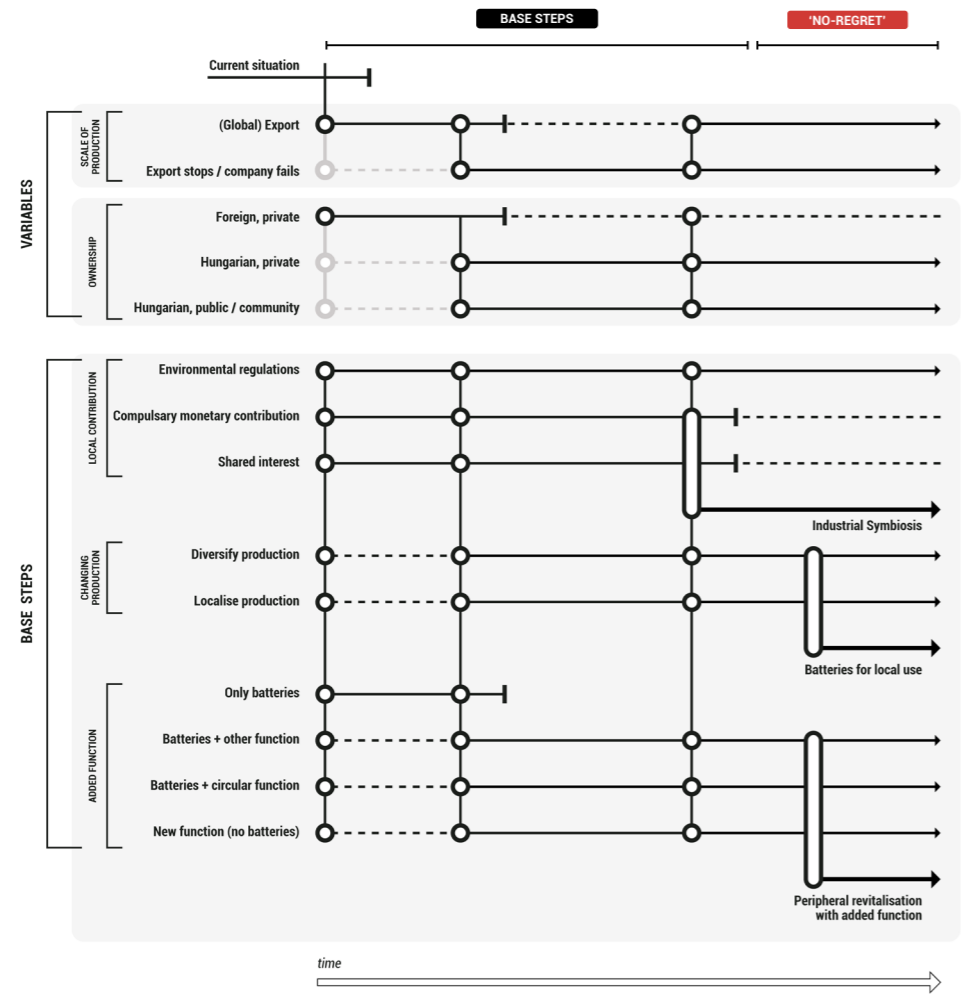


PATHWAYS & POSTCARDS

LEHETŐSÉGEK & KÉPESLAPOK

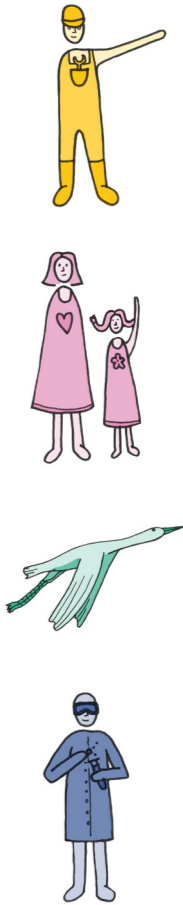


PATHWAY CONFIGURATIONS



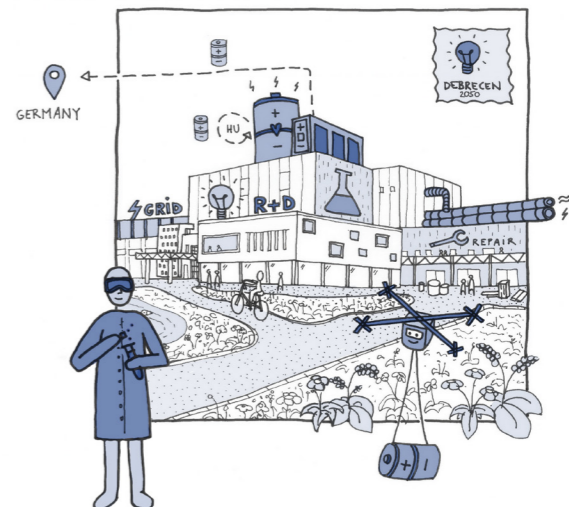
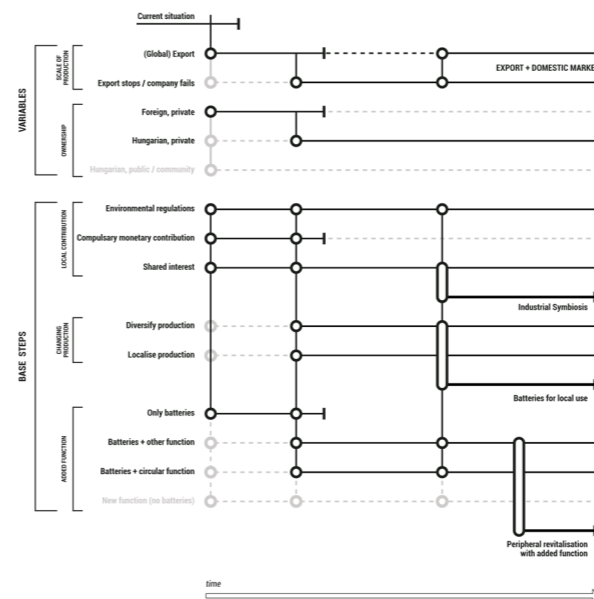
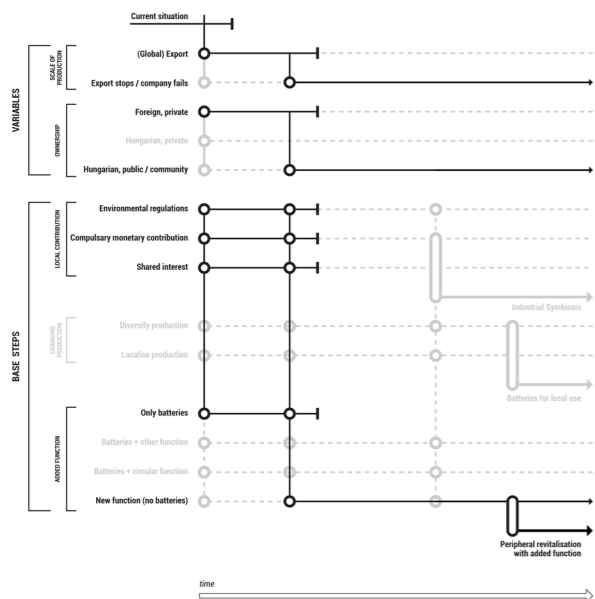
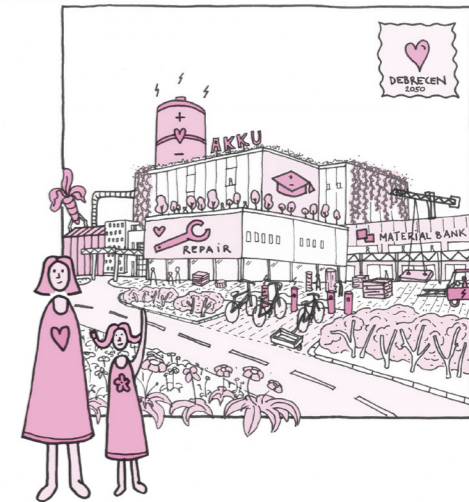
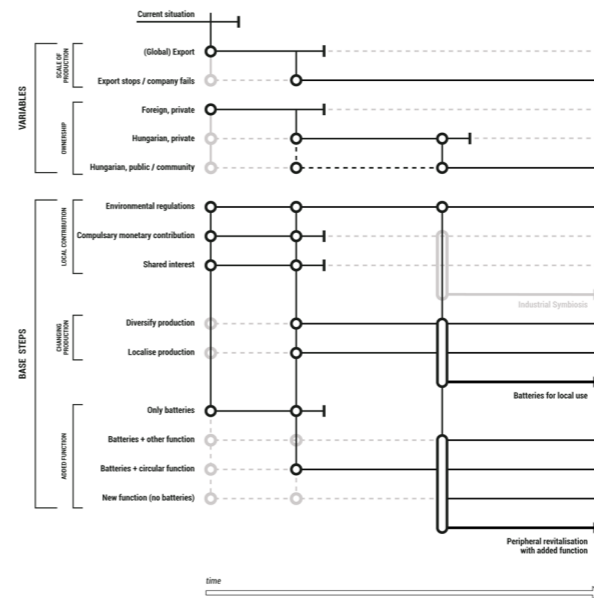
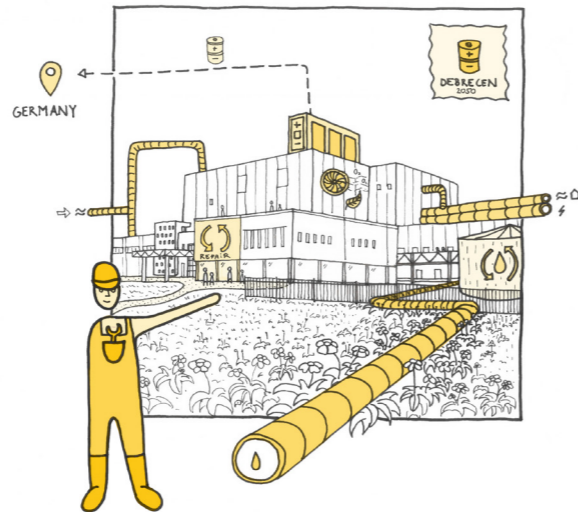
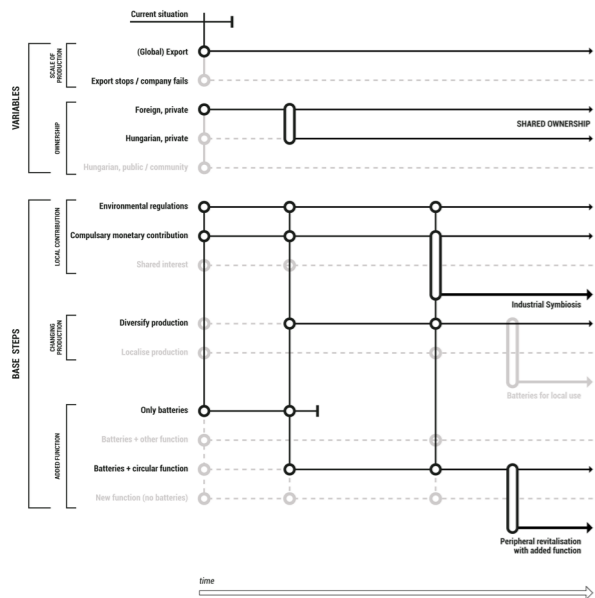
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POSTCARDS WITH STAKEHOLDER VIEWS

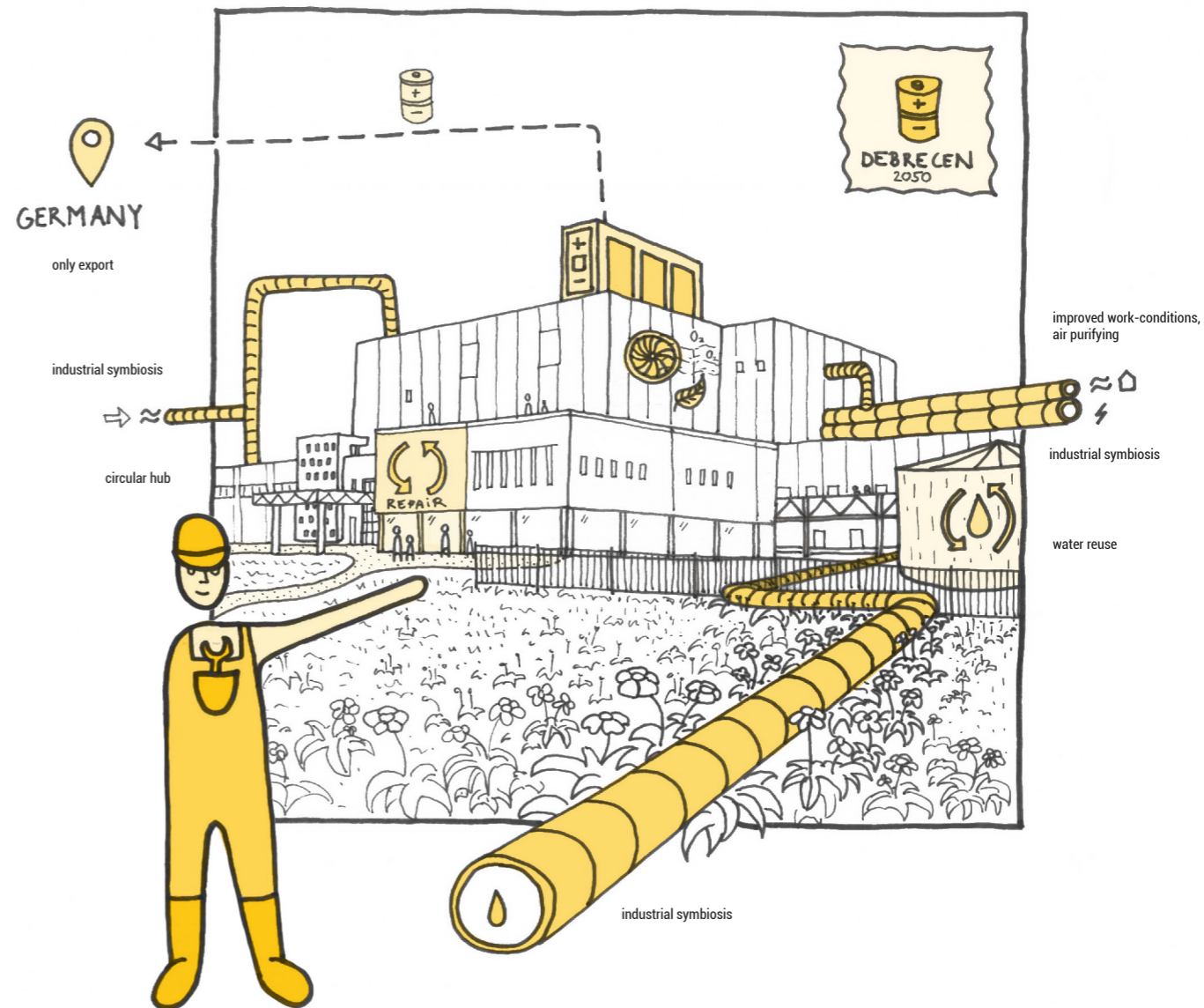
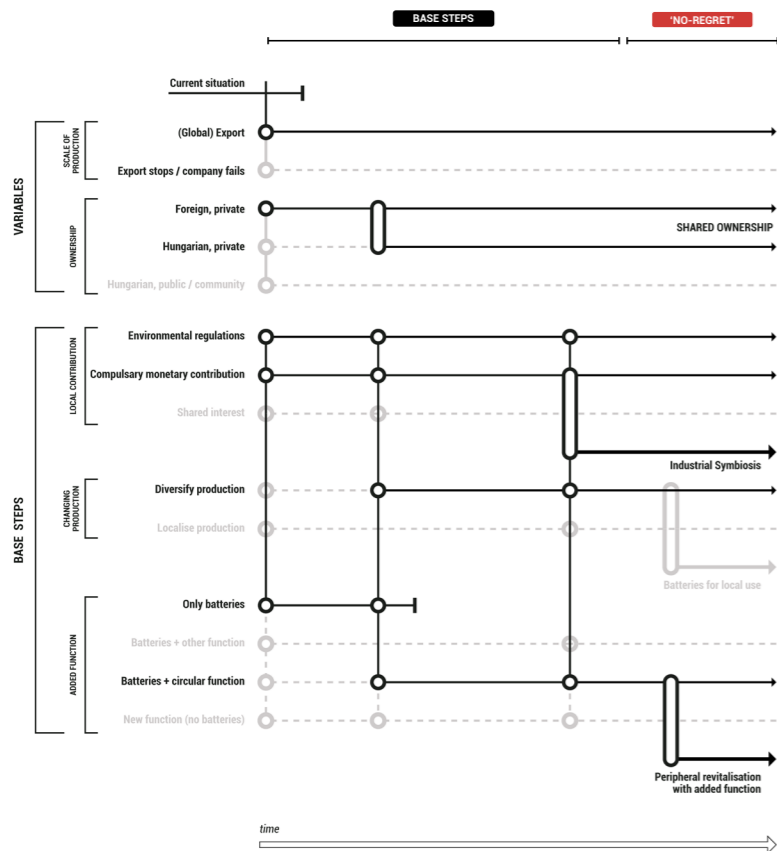


SHORT-TERM PATHWAY VARIATIONS - POSTCARDS

RÖVIDTÁVÚ LEHETŐSÉG VARIÁCIÓK - KÉPESLAPOK



EXAMPLE: EXPORT-ORIENTED APPROACH
PÉLDA: EXPORT-ORIENTÁLT HOZZÁÁLLÁS



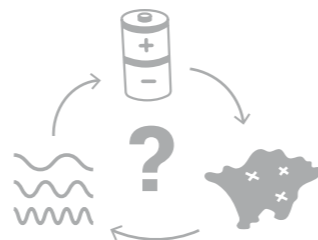


1

Problem Field

2

Transformability

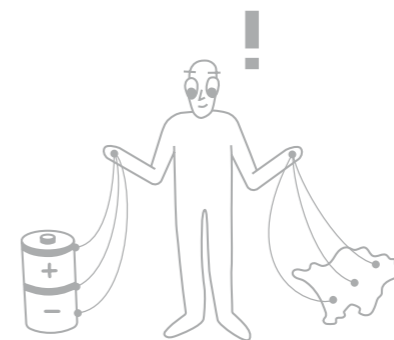


3

Understanding

4

Exploration

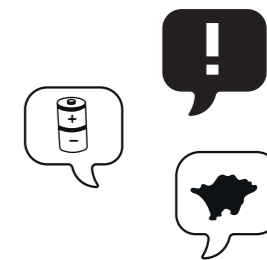


5

Operationalisation

6

Conclusions





How could the **current battery crisis be leveraged** to enable **long-term transformative change** in **North-East Hungary**?



*Success depends not on halting battery development,
but on strategically redirecting its trajectory toward a
transformative future.*

TOWARDS A TRANSFORMATIVE *BATTERY* TERRITORY

A Spatial Exploration of Response-able Future Pathways for North-East Hungary

Fruzsina Kovács | 5675316

23. 06. 2025. - P5 presentation

first mentor: Alexander Wandl
second mentor: Francesca Rizzetto
delegate: Angela Greco

Metropolitan Ecologies of Places Studio, 2024-25

MILESTONES
MÉRFOŁDKÖVEK



- pathways
- - - feedback loops
- Milestones based on existing policy documents
- pathway towards soil health and no net land take goals
- pathway towards carbon neutrality goals

