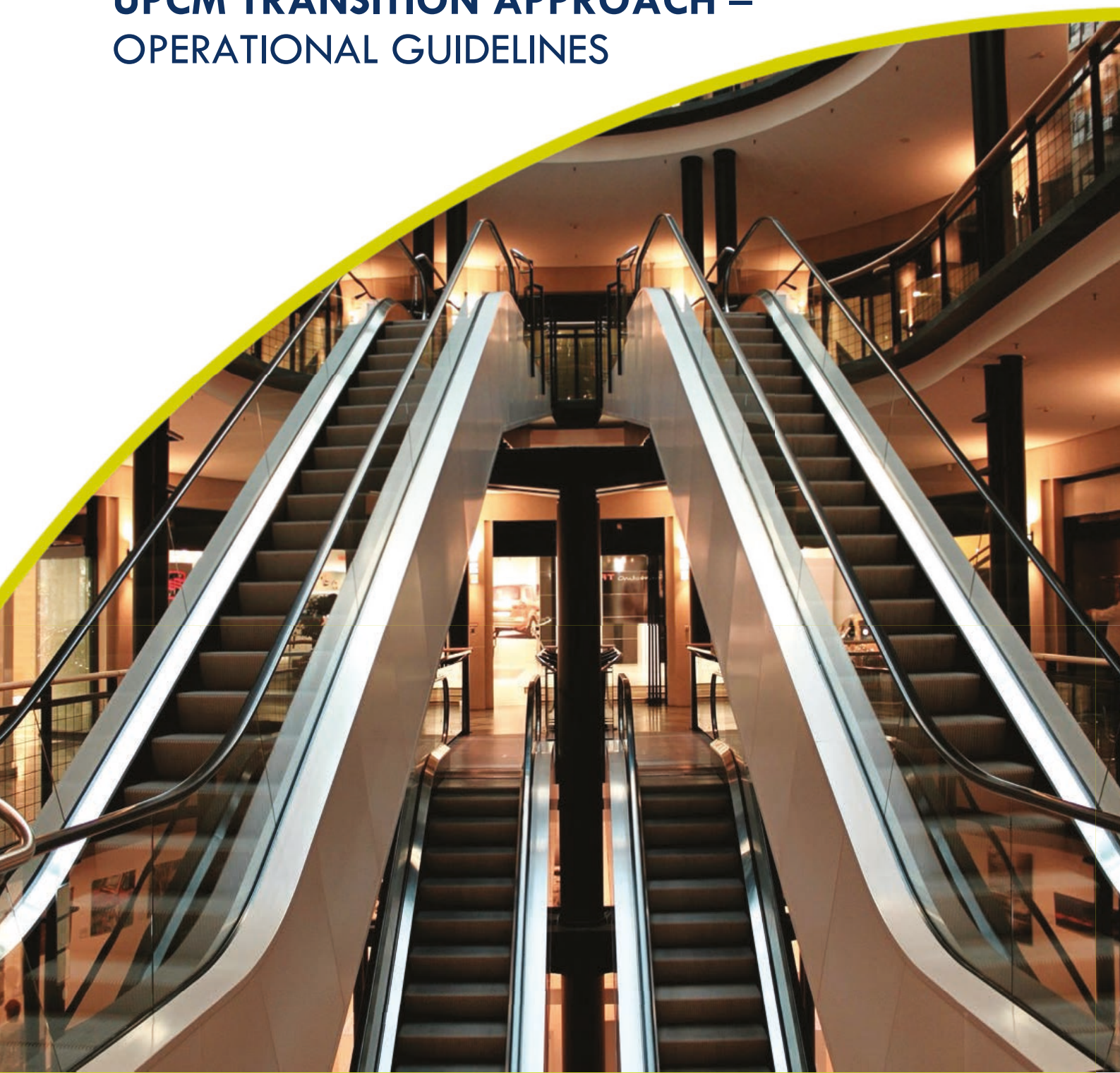
CIRCULAIRE MAAKINDUSTRIE

IMPLEMENTATION PROGRAMME CIRCULAR MANUFACTURING INDUSTRY 2019 – 2023

UPCM TRANSITION APPROACH – OPERATIONAL GUIDELINES



CIRCULAIRE MAAKINDUSTRIE

Transition approach of the Circular Manufacturing Industry Implementation Programme 2019 – 2023 (UPCM)
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The entire publication and its updates can be freely downloaded on: www.circulairemaakindustrie.nl

UPCM has been commissioned in 2019 as an alliance of representatives of, and leaders in, the business community, government, and knowledge institutions. This alliance is committed to stimulate the transition to a circular manufacturing industry through an integrated approach consisting of project development (Realization), knowledge integration (Acceleration) and the activation of entrepreneurs and networks (Upscaling). The core principle of this approach is to join forces and as a result to generate momentum and synergy in the transition.

1. Introduction

This document explains the purpose, the approach and organization of the Circular Manufacturing Industry Implementation Programme (CM Implementation Programme 2019-2023, further abbreviated as UPCM).

The programme was established in 2019 as a collaboration between representatives and leaders from the manufacturing industry, governmental organisations, and knowledge institutions. This public-private partnership is committed to jointly stimulating the transition through project development (Realization), knowledge integration (Acceleration) and the activation of entrepreneurs and networks (Upscaling). The core aim of this approach is for different initiatives, stakeholders, and networks to join forces and as a result generate momentum and synergy in the transition.

The programme is impact oriented. The approach is essentially an integrated methodical framework, in which knowledge and practical experience from various sources is integrated to improve the impact and efficiency of joint activities.

The implementation programme is an elaboration and further improvement of the frameworks and goals that were initially developed in the Dutch National Implementation Programme Circular Economy (Nationale Uitvoeringsprogramma Circulaire Economie) and the Transition Agenda for the Manufacturing Industry 2018 (Transitieagenda Maakindustrie 2018). There is also a connection with Multi-year Mission-Driven Innovation Programmes (MMIPs) of the Climate Agreement and the European CE agenda.

In 2020, the first figures have become available on current emissions in the manufacturing industry, as well as the sector's reduction potential, which once again substantiates the importance of this initiative (see Section 1.2).

1.1. Document structure

Chapter 2 describes the purpose of the transition programme. For the larger framework, please refer to the transition agenda and Appendix 1. Chapter 3 details the integrated approach, such as roadmaps, change strategies, envisioning strategy and the stakeholder approach. Chapter 4 outlines the structure of the teams, the governance of projects and the information and reporting structure. Chapter 5 details the contribution of the various teams, including the team tasks and the roles of team members. Appendices 2 thru 13 elaborate on elements of chapter 3,4 and 5.

Figure 1. Chapter structure.

1.2. Facts and figures

The following facts and figures for manufacturing industry have been compiled from existing data sources and impact analyses for a time horizon of 10 years. The conclusion of this research: The manufacturing industry has a significant potential for reducing CO_2 and other greenhouse emissions, for increasing added value and for reducing supply risks of Magnesium, Titanium, Aluminium, Phosphorus Ore and Antimony, among others. Please find below the figures in three perspectives: the product group perspective, the (supra) regional perspective and the cluster perspective.

1.2.1. Product group perspective

The manufacturing industry	Employed people		People per organisation			Operating income Net turnover	Added value + impact UPCM	Current CO_2 impact – impact UPCM	Material flows - reduction of critical materials
	Jobs	Labour volume	0-50	51-100	> 100				
Product group	x 1,000	x 1,000	number	number	number	x million euros	x million euros/year	x 1,000 tonnes / year	x million kg
20 chemical industries	16	15	825	65	95	9,162	3,381 +135	6,096 -305	11,752
22 Rubber and plastic products industry	40	36	1,155	85	80	10,061	3,102 +248	321 -29	6,349
23 Building materials industry	28	26	1,900	40	45	6,981	2,122 +106	1,774 -160	32,541
24 Base metal industry	24	23	320	15	40	9,375	2,298 +92	6,966 -557	23,049
25 Metal products industry	116	106	12,645	215	145	22,267	7,302 +584	478 -48	6,771
26 Electrotechnical industry	32	30	1,595	40	45	37,076	4,325 ++87	88 -5	1,110
27 Electrical appliances industry	25	23	1,205	35	35	9,736	3,039 +91	172 -10	2,717
28 Machine industry	106	98	2,835	165	195	33,363	12,387 +743	274 -25	8,012
29 Automobile and trailer industry	35	32	680	25	30	18,599	3,132 +31	146 -18	4,066
30 Other transport equipment industry	25	23	1,295	25	35	7,410	1,639 +82	100 -12	117,512
32 Other industry	82	69	5,940	35	105	3,769	3,788 +152	305 -27	3,387
33 Repair and installation of machines	56	50	9,745	65	60	12,160	3,610 +686	100 -15	0
38 Waste treatment and recycling	25	22	770	40	50	7,878	1,000 +120	7,350 -1,103	60,100
Total	608	552	40,910	850	960	187,837	51,125 +3,157	24,170 -2,313	277,366

1.2.2. Regional perspective

These figures are relevant to the (supra-)regional approach described later in this document.

The manufacturing industry	Employed people					Operating income Net turnover	Added value + impact UPCM	Current CO_2 impact – impact UPCM	Material flows - reduction of critical materials
			People per organisation						
	Jobs	Labour volume	0-50	51-100	> 100				
Provinces	x 1,000	x 1,000	number	number	number	x million euros	x million euros/year	x 1,000 tonnes / year	x million kg
Friesland	31	28	2,267	43	47	9,081	2,472 +169	1,003 -104	29,711
Groningen	17	16	1,184	24	28	5,068	1,397 +88	897 -86	8,806
Drenthe	17	15	1,121	23	26	5,138	1,381 +85	602 -59	7,019
Overijssel	46	42	2,848	66	74	14,918	4,027 +244	1,806 -179	18,823
Flevoland	15	13	944	21	24	4,676	1,289 +81	506 -47	7,423
Gelderland	81	74	5,225	115	128	25,746	6,957 +422	3,215 -304	31,907
Utrecht	37	33	2,418	47	56	11,530	3,052 +179	1,390 -140	16,117
North Holland	79	71	5,408	106	127	23,582	6,498 +400	3,391 -324	42,516
South Holland	110	100	7,886	152	170	33,345	9,070 +567	4,067 -377	48,264
Zeeland	17	15	1,272	24	26	4,713	1,355 +94	770 -74	8,794
North Brabant	118	107	7,679	170	187	37,725	10,166 +616	4,348 -412	41,926
Limburg	41	37	2,659	58	68	12,315	3,460 +212	2,175 -205	16,061
Total	608	552	40,910	850	960	187,837	51,125 +3,157	24,170 -2,313	277,366

1.2.3. Cluster perspective

These figures are relevant to the 'cluster roadmaps' described in Chapter 2.

The manufacturing industry in figures	Employed people					Operating income Net turnover	Added value + impact UPCM	Current CO_2 impact – impact UPCM	Material flows - reduction of critical materials
			People per organisation						
	Jobs	Labour volume	0-50	51-100	> 100				
Clusters of product groups	x 1,000	x 1,000	number	number	number	x million euros	x million euros/year	x 1,000 tonnes / year	x million kg
Materials	104	96	3,070	205	265	36,476	9,781 +595	20,733 -1,993	101,250
Consumables	42	33	6,323	108	73	6,340	2,615 +209	171 -17	158
Building and construction	102	98	8,223	148	118	22,908	6,809 +481	2,081 -190	39,154
High Tech (capital goods)	328	301	22,386	361	471	98,483	28,633 +1,830	1,055 -98	132,141
Consumer products	32	24	909	29	34	23,630	3,287 +42	130 -14	4,663
Total	608	552	40,910	850	960	187,837	51,125 +3,157	24,170 -2,313	277,366

2. Purpose

The Circular Manufacturing Industry Implementation Programme is aimed at two strategic goals:

- By 2050 at the latest, we will have reduced the ecological footprint of the Netherlands to the level at which we use one Earth and comply with the agreements made in the Paris Climate Agreement. This is about retention of ecological value.
- In 2050, the manufacturing industry is still an important foundation for our resilient economy. The prosperity and well-being of the Netherlands are maintained or even increase. To enable this, the Dutch manufacturing industry must be able to compete in a global market by increased levels of innovation. Entrepreneurial qualities, such as seeing opportunities, being able to adapt to changing circumstances and having courage and creativity, are prerequisite to maintain and increase these levels over innovation. The transition to a circular economy leads to maintaining employment and an increase in the quality of the work. Social inclusivity is the basic principle in this. We summarise this with the phrase 'economic and social retention of value'.

These strategic goals, in connection with the Sustainable Development Goals, the climate challenge and the energy transition, have been translated into three overall strategies:

- Increasing value retention of products/services in the manufacturing industry.
- Reducing environmental impact of products/services in the manufacturing industry.
- Reducing supply chain risks of (critical) raw materials.

Five cross-sectoral clusters of products have been selected based on complexity and intrinsic value of the products. These clusters (could) form a (mission oriented) innovation system. Cluster roadmaps elaborate strategic goals within a specific context and translate the overall strategies into short-term activities. These roadmaps provide the 'logic' for removing barriers and creating conditions that foster the transition. See Chapter 3 for more information.

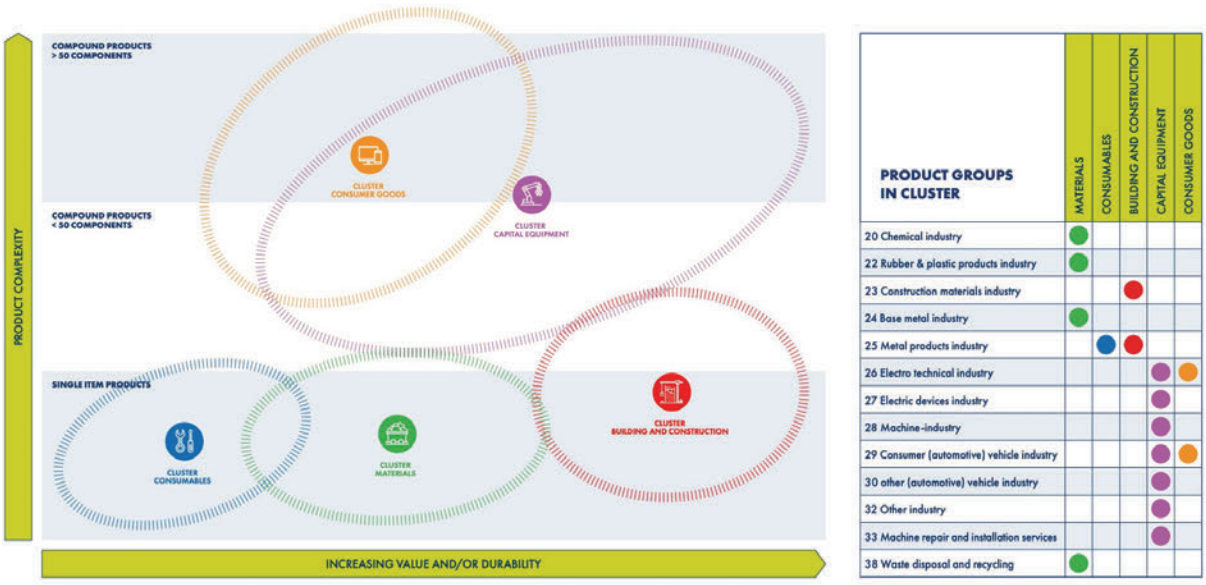


Figure 2. Cross-sectoral clusters of product groups.

3. Approach

We are developing an effective, flexible, and sustainable transition approach while we concurrently execute a portfolio of projects that contribute to the transition. The implementation programme therefor functions as a development model and as a context for new ways to stimulate a circular manufacturing industry.

The integral approach is based on a combination of groundbreaking transition- and change approaches that are continuously validated within the context of field work. Currently the implementation programme is structured along four guiding principles:

- **Doing the right things**: 'cluster' roadmaps that include change strategies for each decision horizon.
- **Doing things right**: Iterative alignment in three pillars.
- **Synergy through cooperation**: creating momentum and synergy using a stakeholder approach.
- **Communication and imagination strategy** in alignment with the vision landscape methodology.

Governmental and social partners develop strategic visions and policy goals that frame the content of the cluster roadmaps. These roadmaps (resources, activities, performance, and impact objectives) are continuously developed in alignment with the national circular economy implementation programme. The following diagram shows this policy theory[1].

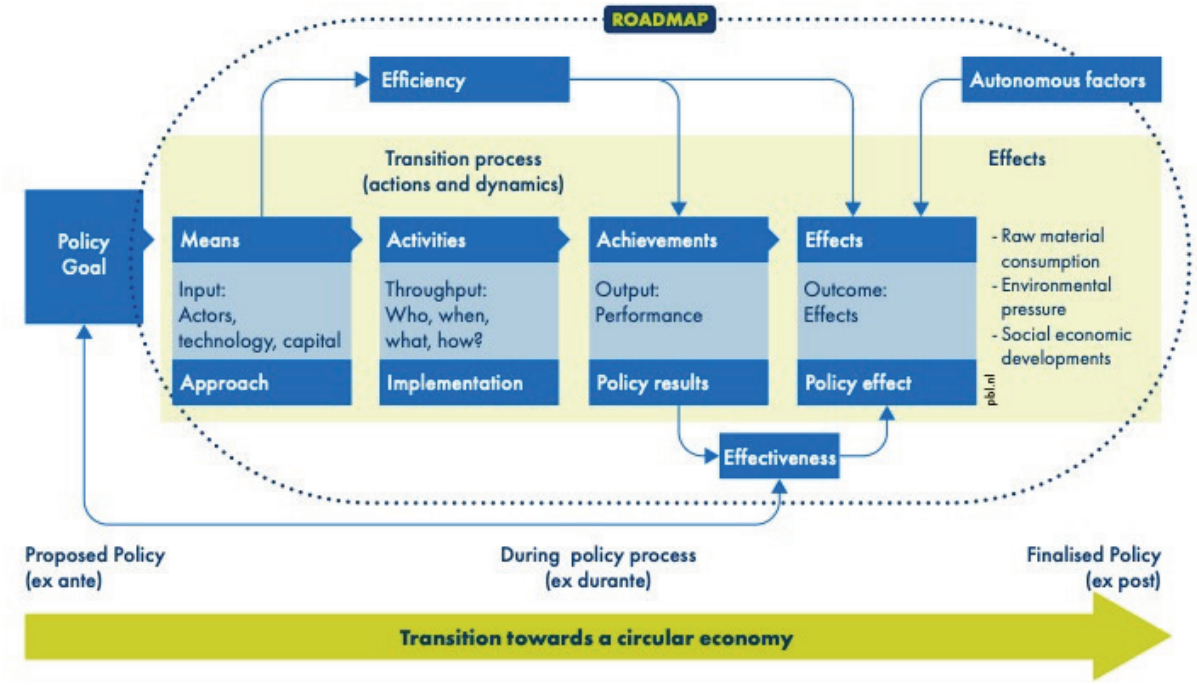


Figure 3. Roadmap and policy goals

[1] Source: General Court of Auditors 2005, adapted by the Netherlands Environmental Assessment Agency (PBL) in: 'Op weg naar een robuuste monitoring van de circulaire economie', 30 January 2020.

3.1. Roadmaps with change strategies per decision horizon

The cluster roadmaps provide a cascaded model of strategic goals and related resources, activities, performance objectives and impact goals for the various decision horizons.

The roadmaps are structured into two dimensions:

- Doing the right things (contribution to the impact goals and strategic goals)
- Doing things right (quality of the strategic visioning process and roadmap activities)

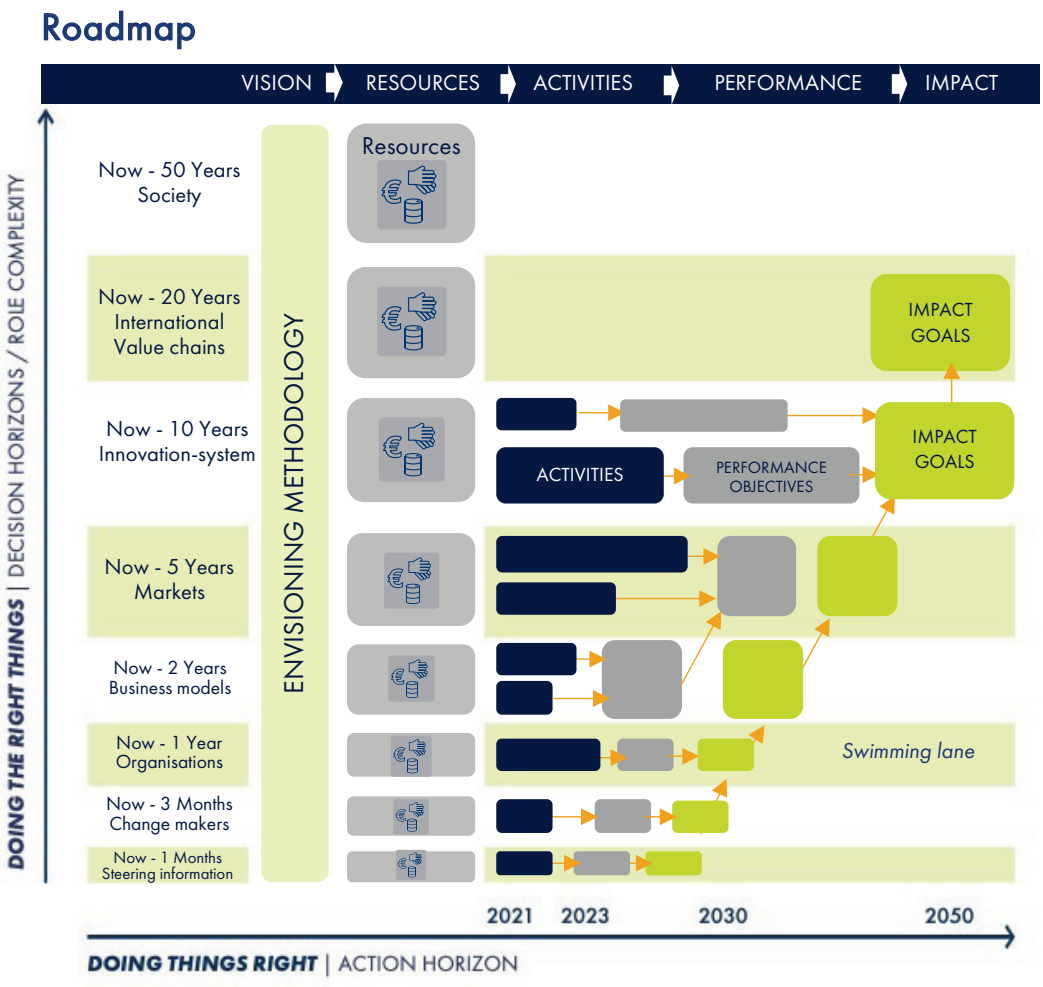
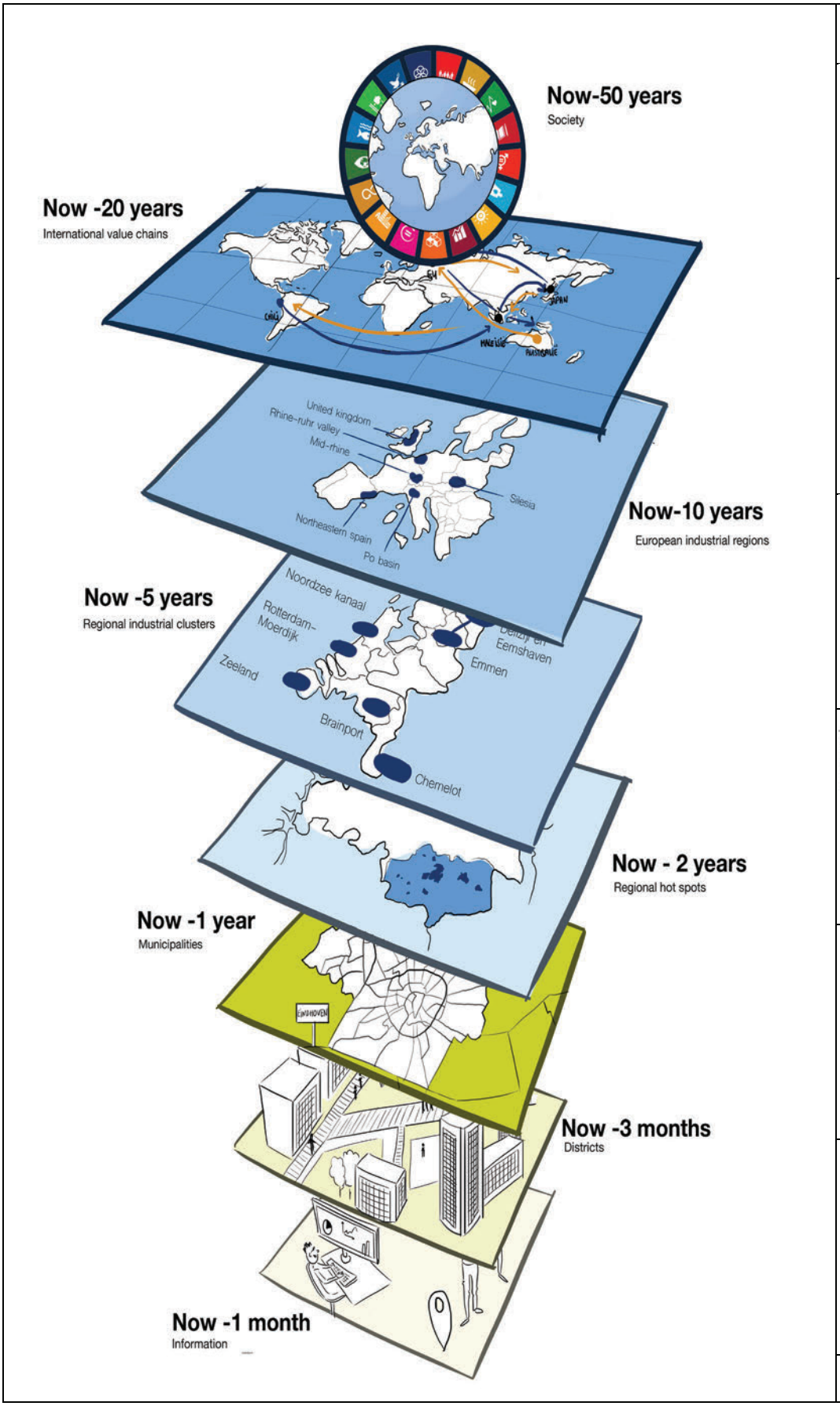
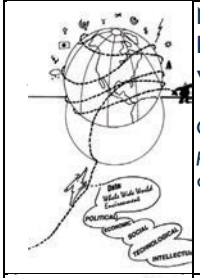


Figure 4. Roadmaps with two dimensions.

3.1.1. Do the right things

Cluster roadmaps are a core instrument for navigation in the complex system change. The key principle in the approach is to create a coherent set of resources, activities, performance objective and impact goals for both the short term, medium term and long term. A key element in the structure of the roadmaps is a set of decision horizons for various timeframes. Each decision horizon provides a map with a different scale and complexity of activities. Iterative alignment of resources, activities, objects, and goals across the various decision horizons creates a higher level of impact in the transition approach.

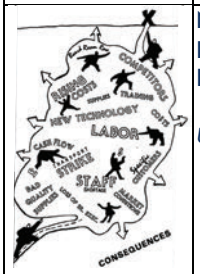




Now - 50 years
Society

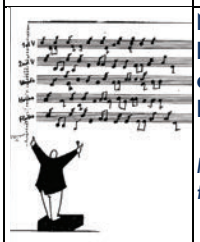
Now - 20 years
International value chains

Cumulative processes - conceptual abstract



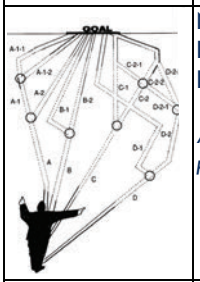
Now -10 years
Industrial area's Europa

Unified action tasks



Now - 5 years
Industrial clusters - Regional

Parallel processes tasks

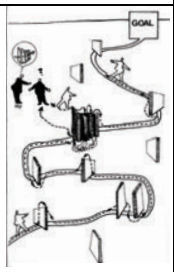


Now - 2 years
Regional locations

Alternative serial paths

Now -1 years
Organization

Diagnostic
Accumulative tasks



Now -3 months
People

Immediate action Tasks

Now – 1 months
Information

Figure 5. Scale and complexity per decision horizon. Source: Requisite organization, Elliot Jacques

This framework of decision horizons enables us to determine the level of complexity of transition issues.

Decision horizon	Level of complexity	Issues
Now - 20 years	*Cumulative processes - conceptual abstract*	How could a cross-sectoral approach accelerate the transition in various chains? How do we prevent sectoral lock-ins that block cross-sectoral cooperation?
Now – 10 years	*Unified action tasks*	Back casting / engineering: What is our vision and ambition in the innovation landscape of 2030? And what systemic interventions are required to get there?
Now – 5 years	*Parallel processes tasks*	How do we stimulate impactful collaboration between market actors to enable the priority chains to increase the level of R-strategy?
Now – 2 years	*Alternative serial paths*	Which value chain processes are required to implement a chosen R-strategy in priority product groups and related value chains?
Now – 1 year	*Diagnostic Accumulative tasks*	How do we reach the relevant target groups in priority value chains and help them take the right steps?
Now – 3 months	Immediate action Tasks	How do we reach out to and connect with the relevant innovators and early adopters that engage and activate the target groups?

For each decision horizon, we specify:

- Impact targets (increased value retention, reduced environmental impact, reduced supply chain risks).
- Circularity objectives (under development)
- Performance objectives (aimed at value retention).
- Activities (projects).
- Resources (financial, knowledge, people, etc.).
- The most effective change strategy.

Change strategies per decision horizon

The integral framework of change consists of various change strategies that are grounded in academic methodologies and practical applications. This framework enables alignment and concerted action across the various decision horizons.

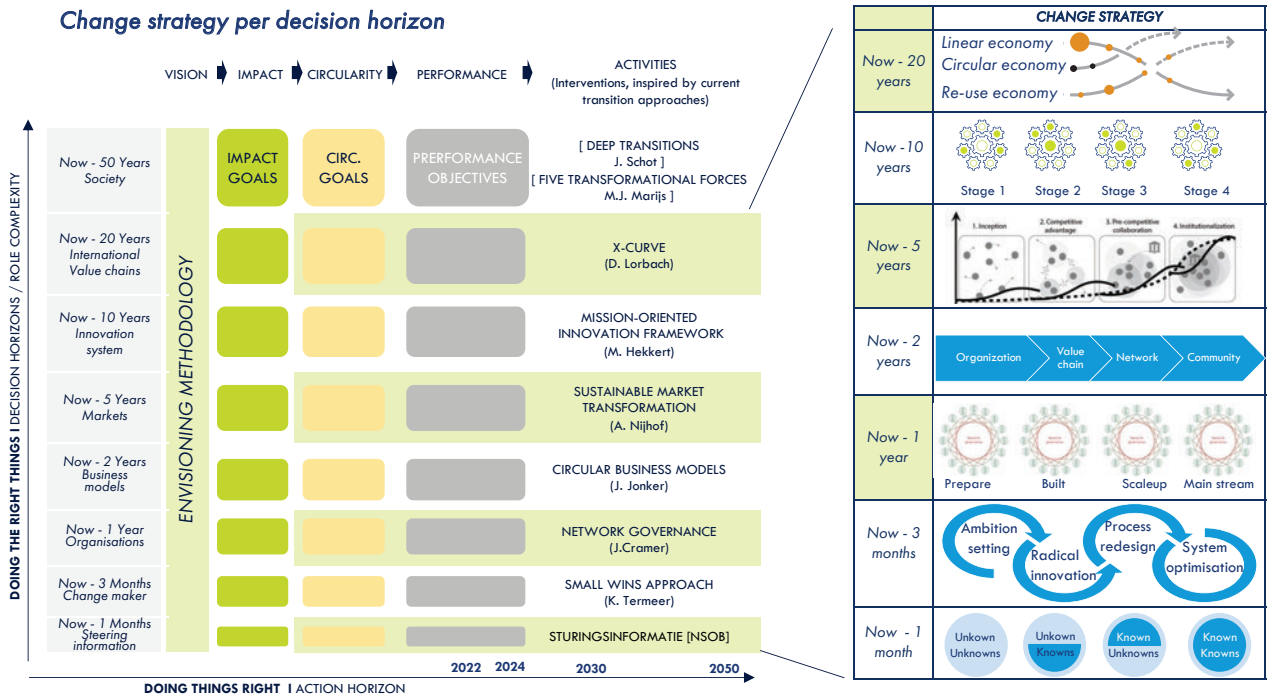


Figure 6. Change strategies per decision horizon.

Decision horizon	Change strategy: focus and intervention scope
Now – 20 years	We focus on the development and stimulation of resilience principles for socio-ecological systems. We contribute to the development of scenarios for a) build up, b) change and adapt and c) phase out as defined in X- curve transition dynamics (Professor Derk Loorbach, Transition Centre Drift), which are explicitly linked to climate and energy transition as well as the digitalisation transition.
Now – 10 years	We focus on the development of mature Mission oriented Innovation Systems for cross-sectoral clusters of product groups ('Mission-driven innovation systems'[2] by Professor Marko Hekkert). Priority interventions are aimed at the following clusters: Capital equipment, Consumables, Materials, Consumer goods and Building and construction.
Now – 5 years	We focus on stimulating market transformation (Sustainable market transformation strategies by Professor Andre Nijhof) for high potential product groups. Interventions are aimed at changing the market dynamics to achieve a higher level of circularity within the scope of the relevant now - 10 years impact goals.
Now – 2 years	We focus on accelerating the application of circular business models (Professor Jan Jonker). Interventions are aimed at the application of key enabling technologies and the development of the relevant underlying (value chain) processes, such as return logistics and chain information systems, to achieve the 0 – 5 years impact goals.
Now – 1 year	We focus on stimulating value chain partnerships which organise the requisite (value chain) processes for the Now -2 years impact goals (Network governance, Professor Jacqueline Cramer). Interventions are aimed at stimulating circular proposition among Early adopters (Rogers adoption theory) of specific target groups / market segments.
Now – 3 months	We focus on activating 'change makers' who engage the Early majority for the now – 1 year impact goals. (Small wins framework, Professor Katrien Termeer). A change maker could be anyone with an influential position, an industry leader or a representative of a sector organisation. Interventions are aimed at building (knowledge) networks.
Now – 1 month	We focus on the exchange of knowledge and best practices among the actors in the transition. Interventions include coherent communication to target groups and related change makers.

In addition to these 'generic' change strategies, the 'Theory of Change' consists of specific intervention logic per decision horizon. The intervention logic is based on the underlying transition theory and describes the most relevant activities (per team). The activities are classified into the four phases of the S-curve, in an ascending order of innovation.

Reasoned from the current practice, each phase needs the lead time of the decision horizon, so for example the four phases on the Now – 1 year horizon take a total of 4 years. However, the estimated systemic acceleration required on each decision horizon will need to be exponential. So not all four phases in X years multiplied by four, but ideally all four phases in X years.

An exponential change requires a shared awareness about the phases and a governance focussed on phase shifts. From a programmatic point of view, it is paramount to recognize in which phase the transition dynamics occur in order to access the time needed to realize a next phase shift.

This Theory of change creates a narrative that could frame the governance and organization of different teams. Using the intervention logic, teams are more abile to design, plan, and execute the necessary activities. The intervention logic is a means to coordinate activities.

At the program level, the intervention logic helps to operationalize the (circularity and) performance goals that stem from the overall UPCE gaol setting process. In chapter 3.1.2 we will elaborate on how teams are organized.

Interventions at the various decision horizons are continuously interconnected and synchronised within the context of projects and change processes. The multi-level and multi-perspective approach enable mutual learning and feeds long-term knowledge development. See Appendix 2 for more details on the change strategies per decision horizon.

[2] Hekkert, M.P., Janssen, M.J., Wesseling, J.H. & Negro, S.O. (2020). Mission-oriented innovation systems. *Environmental Innovation and Societal Transitions*, *34*, 76-79.

3.1.2. Doing things right

The iterative alignment between the various decision horizons consists of coordination and feedback processes for three pillars of activities.

- The 'Realization' pillar includes project development activities for innovation- and investment projects that directly contribute to the transition. Participants in these projects agree on a result commitment and an executive project governance structure.
- Activities in the 'Acceleration' pillar are aimed at knowledge integration and joint course setting. In these interdependent activities, those involved in the 'coalition of the willing' commit to activities and the effort they put in.
- The 'Upscaling' pillar is aimed at reaching more entrepreneurs and connecting to themes on a larger geographical scale (regional, supra-regional, EU). These include activities such as creating awareness/urgency among a wider audience, joining regional clusters or supra-regional cooperation, and addressing bottlenecks within the scope of EU. The network and communication platform connects intrinsically motivated actors and organisations which are willing to develop (joint) activities.

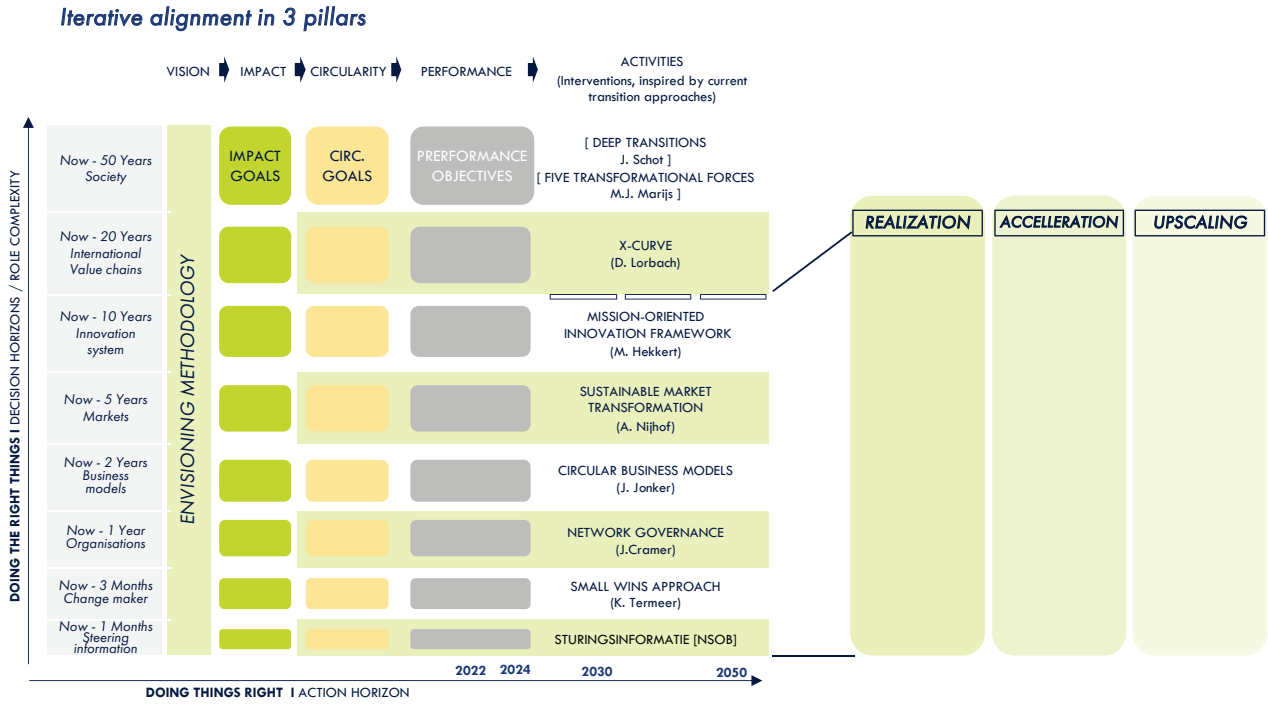


Figure 7. Iterative alignment in 3 pillars.

More information is given in Appendix 3: Basic principles of the circular manufacturing industry implementation programme.

To ensure a coherent transition approach, the change strategies per decision horizon are translated into action perspectives in the three pillars. The action perspective for the Now – 20 years horizon is currently being developed. Please refer to Chapter 4.4 for the related monitoring-, information- and reporting structure.

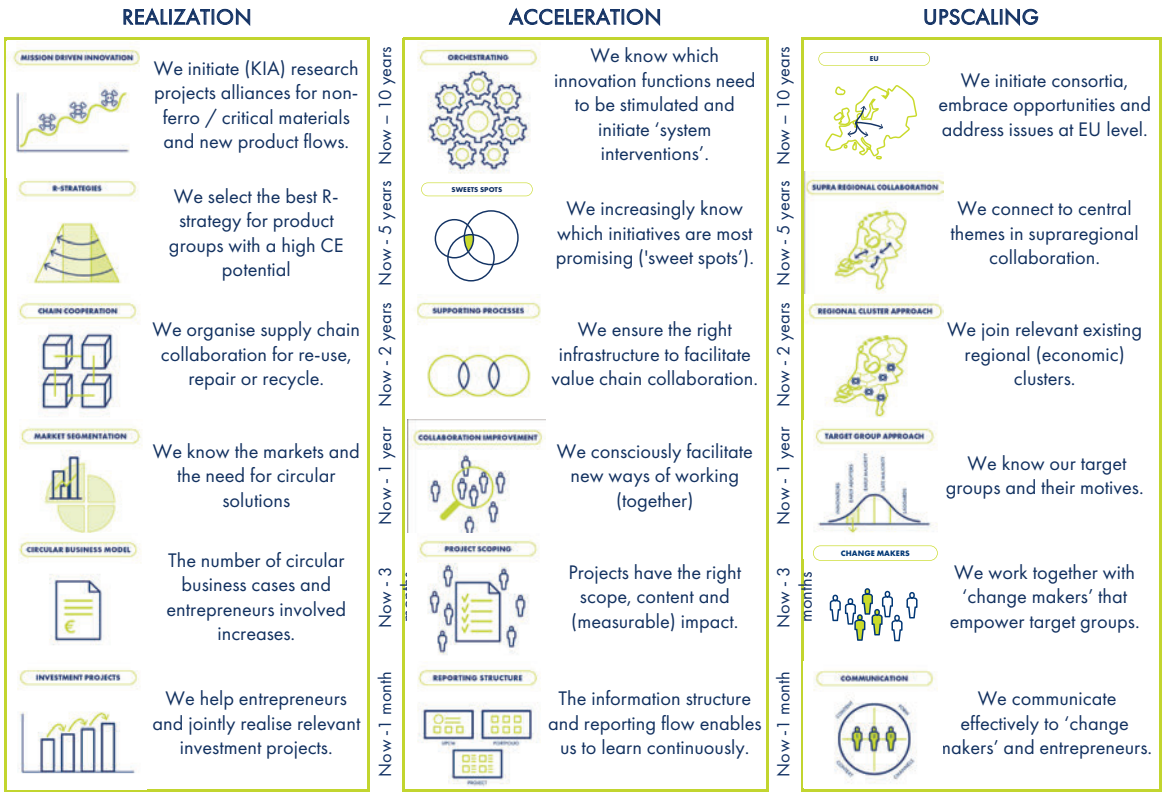


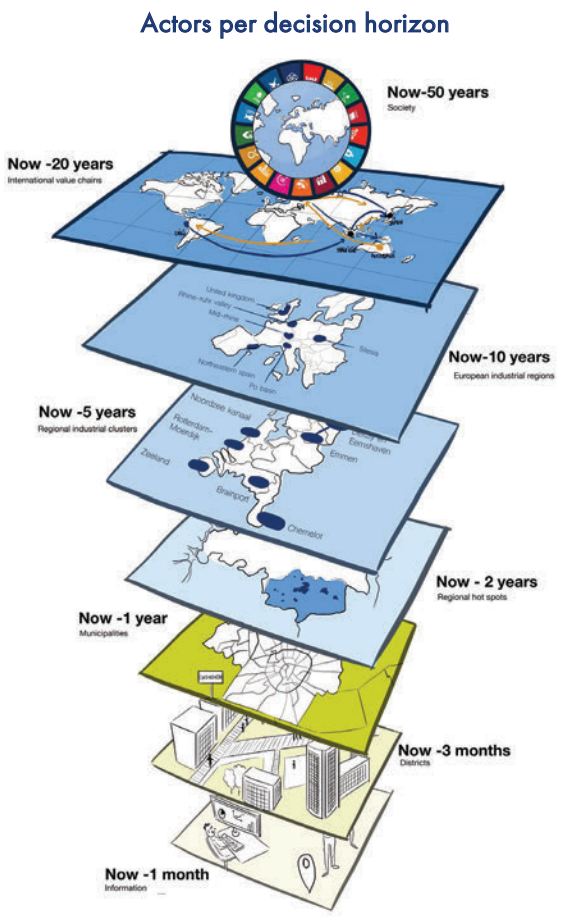
Figure 8. Action perspectives per decision horizon and pillar.

3.2. Stakeholder approach

The UPCM approach is grounded in the principle that transitions are emergent processes, that are enabled when various initiatives, parties and networks join forces. This cooperation will create the requisite momentum and synergy provided these actors work on common goals and engage with their strengths and autonomy. Therefor actor analysis and an effective stakeholder approach is paramount in activating the cooperation.

3.2.1. Actor Analysis

The 'innovation system' of the Dutch manufacturing industry consists of more than 44.000 active companies and numerous other actors such as knowledge institutions, other businesses and industries, financial institutions, government, NGO's, etc. Active involvement of the right actors in a certain phase of the transition, by aligning transition-activities, -initiatives and interventions, will accelerate the transition. The starting point for this actor analysis is a framework of change strategies per decision horizon, with increasing levels of complexity and uncertainty in outcomes.



	ACTORS
Now -50 years	Social-political shifts, ideology, societal level.
Now - 20 years SBI 1 Sectors	Institutions, strategic value chains, infrastructural level.
Now -10 years SBI 2 digit Sub-sectors	Innovation system (actors) / (Umbrella) clusters of product groups, production process-level.
Now - 5 years SBI 3 digit Industries	Market players product group (B2B/B2C/etc), product group-level.
Now - 2 years SBI 4 digit Categories	Value / production chain players, Chain links, level.
Now - 1 year SBI 5 digit Companies	Innovators, organisation level.
Now - 3 months LISA	Change makers, department level, establishment.
Now -1 month	Programme-users, individual level, information channels.

Figure 9. Actors per decision horizon.

A set of tools processes information from many different sources and prioritises actors using intelligent selection logic:

- For the Now -10 years decision horizon a data analysis tool selects the most important (direct and indirect) actors within the predefined clusters of product groups. The innovation scan collects and processes the perception of the innovation functions for these clusters. The context scan consecutively visualises the different value systems of the actors in the innovation system.
- For the Now -5 years decision horizon a data analysis tool creates a map of the interdependences between the most important circular activities in and across regions. This information is upgraded using value chain maps from the project 'Ketens in Kaart'. This project has also resulted in a value chain tool for activity-based modelling of production chains, that helps recognise patterns in decision making.

- For the Now -2 years decision horizon the TNO impact tool is used to identify high impact regional clusters.
- For the Now - 1 year decision horizon a data-analysis tool with a predictive algorithm spots relevant companies in each sector, product cluster and province. This algorithm recognises the 'pioneer level' of actors and their most relevant value / production chain partners.
- For the Now - 3 months decision horizon tools to identify changemakers are not yet available.

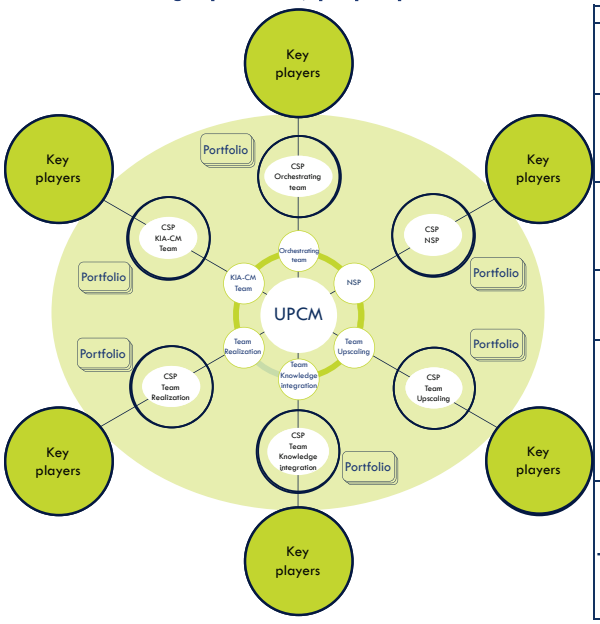
Information and reporting structure

The UPCM information and reporting structure defines the required information and the available data sources for the monitoring of performance objectives and impact goals per decision horizon. The data from these sources, in combination with the actor classification (see above), will eventually enables us to quantify and monitor the impact of stakeholder activation and / or other transition activities. The UPCM information and reporting structure is in alignment with the Integral Circular Economy Report (ICER) by the Netherlands Environmental Assessment Agency (PBL).

3.2.2. Programme stakeholder approach

The UPCM teams (see chapter 5) rely on sufficient resources (technology, funding and competent people). Effective operation of these teams requires active support and pooling of resources of important supporting stakeholders in the transition ecosystem. We secure this with a Course Setting Platform (CSP) per team with committed and relevant stakeholders from the entire value chain. These stakeholders might be involved in several CSP's. We suggest to these stakeholders to pool as many (scarce) 'resources' as possible, such as money, attention and legitimacy, and to run projects under guidance of the relevant UPCM team. As a result, stakeholders work together in executing and supporting the portfolio of projects per team. This also enables a collective evaluation of impact ('are we doing the right things'). Since the leaders of the cross-sectoral themes of the national implementation programme CE participate in the CSPs, targeted improvement proposals can be drawn up to remove barriers in the enabling 'system'. The CSP's create 'lines of sight' which foster fast coordination and adjustment throughout the system to accelerate the CE transition in the manufacturing industry. Requisite political attention and new resource for future activities are mobilised by a specific group of stakeholders: the Key Players. Examples are company directors and large platform organisations. The UPCM teams, (proposed) 'course setters' and key players are described in Chapter 4.

Lines of sight per team/project portfolio



	Key players	Course setters	Portfolio i.e:
CSP Team KIA-CM	• 'Regieoverleg MTIB'	• KIA CE: mission team CE, focus group • DDT (monitoring), knowledge & innovation	• Heavy Duty Batteries (NWO)
CSP Orchestrating team	• 'Bestuurlijk Overleg' • SER DUO commission	• 'SER Reflectiegroep' • 'Interdepartementaal Directeurenoverleg' • 'Opdrachtgevers-Voorzitters-Overleg' (OVO)	• Vision landscape methodology
CSP Netherlands Strategic Platform	• EU (ntb) • PACE, Capital Equipment Coalition • VNO-NCW, FME, KMU, NRK, VNCI	• Provinces • Min EZK, Min BuZa. • Holland Circular Hotspot • DDT international commitment.	• Circulair Wind farms
CSP Team Realisation	• Financiers (banks, DNB, InvestNL).	• DDT financing tools, DDT circular purchasing. DDT market impulses. • ROMs	• Solar PV systems • Batteries • High Tech Equipment
CSP Team Knowledge integration	• VNO-NCW/ MKB-NL • TO2 institutions	• Provinces • FME, KMU, VNMI, MRF, Techniek NL • DDT circular design, DDT prod.-responsibility. • Stichting Open • NEN • PBL	• Heat as a Service • Value chain mapping • Cluster roadmaps • Circular Materials passport
CSP Team Upscaling	• Provincial Executives (Gedeputeerden)	• Smart Industry programme • FME, Koninklijke metaalunie • Min. EZK, Min. I&W • Provinces N-Brabant, Overijssel, Gelderland, Zuid-Holland • DDT Behaviour & communication, education and labour market. • CE regional approach	• Smart & Circular (CESI) • Knowledge dissemination (website, events) • Online communicatin • Raw materials scanner

Figure 10. Lines of sight.

The stakeholder approach (see Appendix 5) includes five iterative steps: stakeholder analysis, playing field mapping, issue analysis, stakeholder engagement strategy and recalibration of the information- and communication structure.

3.3. Communication and envisioning strategy

In transitions, ready-made policy goals do not exist. Policy goals tend to emerge from collective aspiration and visioning processes, that require communication and interaction to integrate multiple perceptions. This is the foundation to work together on the transformation to a Circular Economy in a conscious, methodical, and integrative way. With entrepreneurs as a focal point, an initial communication and envisioning strategy was developed in 2019 to inspire target groups to engage in circular steps (see Appendix 5).

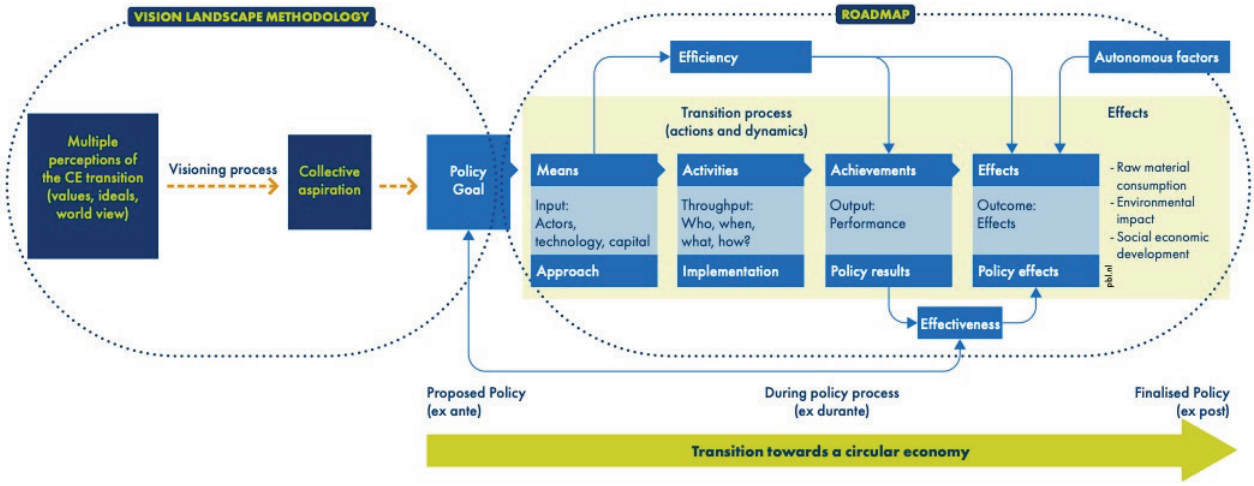


Figure 11. Vision methodology in relation to policy goals.

This envisioning strategy, which in its early stage focused on the initiative landscape of the decision horizon of 0 – 5 years, has been extended to a method for the higher decision horizons. This is in alignment with the 'vision landscape' part of the roadmap (or pathway) methodology. The roadmap methodology is currently in development under the leadership of the Ministry of Infrastructure & Water Management (I&W).

Figure 12. Vision landscape methodology.

A visual representation of roadmap elements (actions, performance objectives, impact goals) in coherence with the following distinct layers of the vision landscape seems possible (see also Appendix 12):

- Initiative landscape (Now – 5 years).
- Intervention landscape with social roles to enable the scale up of initiatives (Now – 10 years).
- Transition landscape with envisioning of circular industry/agriculture/built environment/consumers (Now – 20 years).
- Trend landscape based on the most relevant trends for CE towards 2050 (Now – 50 years).

4. Organisation

The implementation programme is built on partnerships (networks, teams, and other forms of cooperation) that are effective through a coherent vision, common goals and smart coordination in the transition ecosystem. The coordination (iterative alignment) is structured in the three pillars of activities (realization, acceleration, and upscaling) and six interdisciplinary self-organising teams, that form hubs in the connected networks. A support team facilitates cooperation and coordination.

The three tactical teams coordinate and execute activities of the decision horizon Now - 10 years: KIA CM Team, Orchestrating Team and NL Strategic Platform. Three operational teams focus on the decision horizon Now - 5 years: Realisation Team, Knowledge Integration Team and Scaling Up Team. The Orchestrating Team has a pivoting role in converting strategic goals and overall strategies to impact goals for the other teams and in creating the (external)pre-conditions for successful execution. The support team facilitates the other teams and ensures consistency in tactical and operational programme implementation.

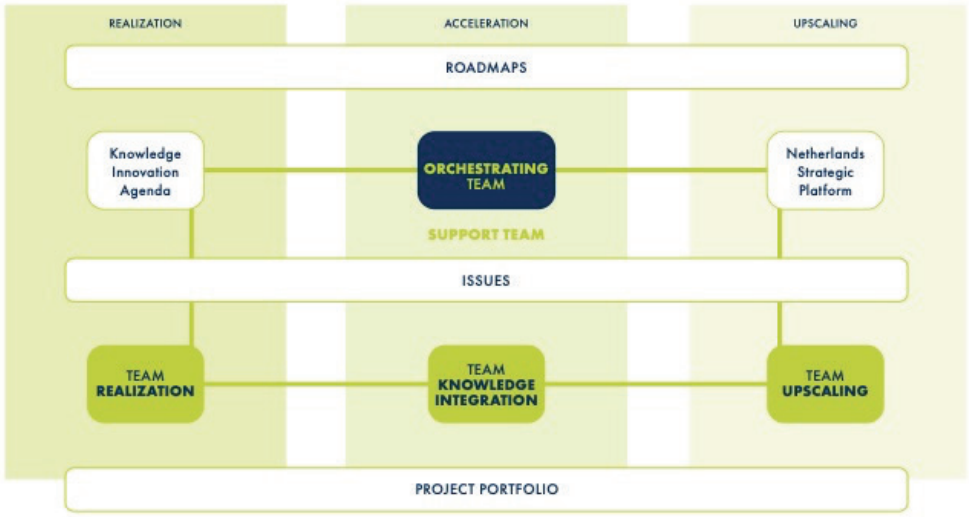


Figure 13. Setup UPCM.

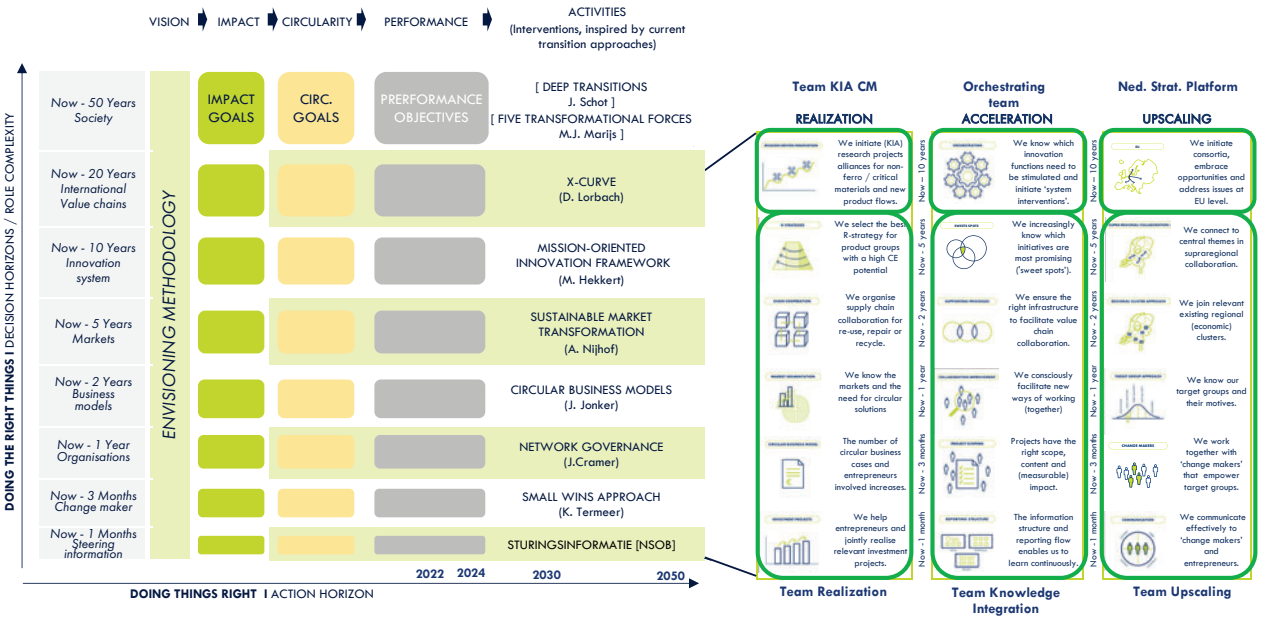


Figure 13. Change strategies and activities per team

4.1. Team overview

REALIZATION	ACCELERATION	UPSCALING
The **Circular Manufacturing Industry Knowledge Innovation Agenda Team** (KIA-CM team for short) identifies and lists the knowledge and innovations that will be needed in 5-20 years to realise a circular manufacturing industry. These are converted into research questions for UPCM priority themes: batteries, electronics, wind farms, solar PV and heat-as-a-service. Research questions are input into programmes and calls for research proposals, where scientists, knowledge institutions, companies and other parties collaborate. The KIA-CM team serves as an arena for the practical implementation of and the feedback on research topics.	The **Orchestrating Team** strives to give direction and guidance, to create preconditions and to promote ownership among and with relevant parties and networks of business, government, knowledge institutions and social organisations. The Orchestrating Team has a pivoting role in converting strategic goals and overall strategies to impact goals for the other teams and in creating the (external)pre-conditions for successful execution.	The Netherlands Strategic Platform (NSP) is the international liaison for the Implementation Programme, with an emphasis on the relationship with the European Union. The liason function is aimed at connecting interests, developments and policies between the national and EU level. The team facilitates European networks for large innovation projects, identifies opportunities for EU funding, addresses legal obstacles through constituency consultations and identifies international vulnerabilities and opportunities for circular economy and/or raw materials. NSP represents the Netherlands in several EU policy working groups, including the European Innovation Partnership on Raw Materials. The team also seeks international cooperation with countries outside the EU.
Team Realization advises and supports in the development and implementation of innovations for a circular manufacturing industry, from idea to concrete project. The team helps companies to formulate promising projects and to find partners and pathways to financing. At the sector level, the team initiates studies to assess opportunities and challenges for circular innovations and technology. Where necessary, the team initiates sector-wide or cross-sector projects.	The **Knowledge Integration Team** collects, develops, shares and applies knowledge related to the circular transition in the Manufacturing industry. The team identifies sweet spots, potential for CO2 reduction and added value, and determines priority themes for sector-wide engagement. The knowledge is developed together with knowledge institutes such as TNO. The team has a pivotal role in stimulating entrepreneurial cooperation across value chains, e.g., via CIRCO tracks.	The **Upscaling** Team transfers knowledge and develops networks to enable the circular transition of the Dutch manufacturing industry. To enable networking, it offers a platform to share case descriptions, projects and documents and to highlight the current state and benefits of circular entrepreneurship in the manufacturing industry. The team actively identifies target groups and stakeholders in need of UPCM knowledge to organise relevant meetings The team ensures proper coordination and integration with the regional cluster approach and supra-regional cooperation.
Programme support team The program support team, with team leads and secretaries of all other teams, facilitates consistency in the implementation of the programme. This team develops the approach, working methods, instruments, and staffing of the programme. It secures information-, reporting- and coordination processes in and around the programme.		

4.2. Governance of projects and project portfolio

Most UPCM activities are organized through joint projects with participants from the underlying networks. Each UPCM team initiates and manages a certain portfolio of projects:

- Investment projects (Realization Team).
- Structural projects (Knowledge Integration Team).
- Activation projects (Upscaling Team).
- Innovation projects (KIA CM Team).
- Course setting projects (Orchestrating Team).
- International advocacy projects (NSP).

The Orchestrating Team sets the performance objectives and impact target in the roadmap(s). This defines the content of the implementation programme on the decision horizon of Now – 10 years and it sets the preconditions, formulated as requisite project quality requirements, for the portfolio of projects.

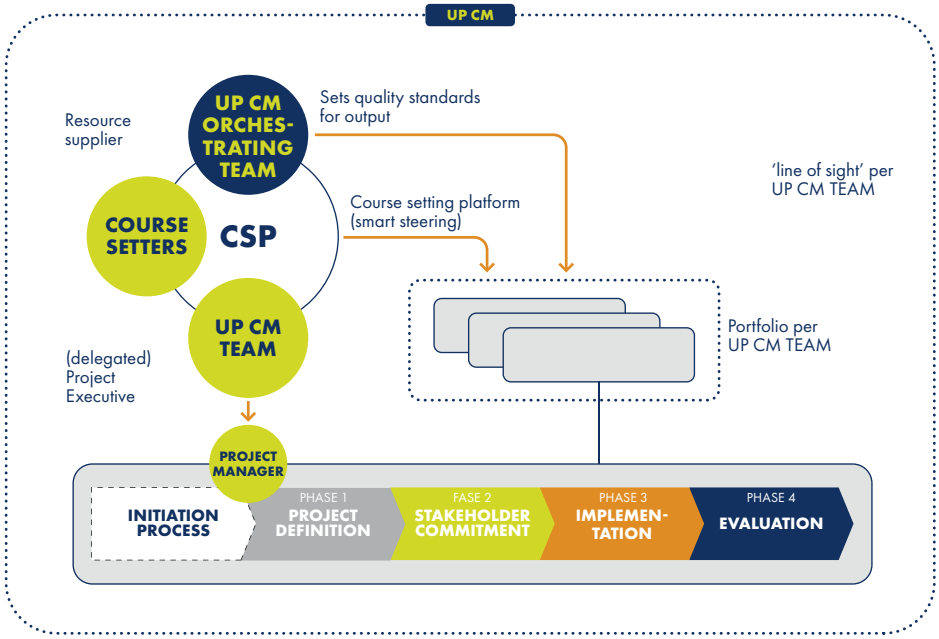


Figure 14. Course setting platform (CSP).

The course setting platform (CSP) per team acts as a 'smart steering committee' for a project or project portfolio. The CSP is made up of relevant 'course setters' (see Chapter 3.2.2.), the team leader of the respective team and the linking pin from the Orchestrating Team who chairs the CSP.

The stakeholders (organisations and networks) represented in the course setters group help mobilise and effectively utilise 'resources' for 'their' team. In fact, they pool each other's available resources within the framework of common goals. Resources refers to financial resources, as well as to access to knowledge, technologies, partners and networks. Course setters work together to mobilise the resources for the required activities on the decision horizons Now – 1 month, Now – 3 months, Now - 1 year, Now - 2 years and Now - 5 years in 'their' team. The team leader is the (delegated) project executive for the projects.

A project guide with binding guidelines (see appendix 6) defines quality criteria for project results and for the project process. This project guide is intended to increase the efficiency and effectiveness of project activities. It includes an impact analysis framework (such as the fingerprint method), a phased approach and specific instruments (such as the context scan).

4.3. Information and reporting structure

Up-to-date information and reporting are prerequisites for the implementation of the guiding principles, such as 'Doing the right things' and 'Doing things right'. The information and reporting structure supports teams and projects to 'choose wisely' in terms of impact and resource depletion. Up-to-date and coherent information and reporting is needed:
supports

- To provide an objective and transparent overview of 'the state of the transition'
- For knowledge sharing on topics such as impact and scope of roadmap activities
- For reporting of activities, resource depletion and performance objectives

In line with the national action- and cluster monitoring (see also the policy theory diagram in Section 3.1.), the information structure provides the required and available management information per decision horizon. This structure is aimed at generating the right steering information on the performance objectives and effect goals from the Road map 2. 0.. The initial version has been established in 2020. Currently, the available data is continuously collected and analysed for guidance in the search for efficient and impactful initiatives.

The main structure of the 'Roadmap 2.0' consists of indicators for performance objectives and impact goals that are linked to decision horizons, change strategies, resources/methods, and data sources/instruments. The table below shows this main structure in an information and reporting format at the programme level (see also Appendix 7).

UPCM 2019-2023 Dashboard – indicators version 20211105

Effect Goals / indicators		Performance objectives		REALISATION-activities		ACCELERATION-activities		UPSCALING-activities	
Monitoring broad prosperity: four forms of capital (Natural, Human, Social, Economic)	Now–50 yr.	Monitoring broad prosperity: results user indicators SDGs	Now–50 yr.	Monitoring welfare prosperity: outcomes Resource and activity indicators SDGs	Now–50 yr.	Monitoring broad prosperity: outcomes of resource and activity indicators SDGs	Now–50 yr.	Monitoring broad prosperity: outcomes of resource and activity indicators SDGs	Now–50 yr.
M: Biodiversity L: Proven reserves, stability and governance in source countries E: Economic Competitiveness (WEF)	Now–20 yr.	Resilience of strategic value chains	Now–20 yr.	Maintain variation and redundancy (Resilience principle)	Now–20 yr.	Control slow variables and feedback (Resilience principle)	Now–20 yr.	Manage connectivity (Resilience principle)	Now–20 yr.
M: Environmental pressure (PEF) L: Concentration of raw material extraction/production, companionality E: Driving employment	Now-10 yr.	Accumulated CE potential : [ ]	Now-10 yr.	Develop key technologies / methodologies: # ongoing r&d projects	Now-10 yr.	Number of innovation functions stimulated: Encouraged/needed	Now-10 yr.	Number of barriers identified at EU level NL innovation functions	Now-10 yr.
M: Raw material productivity, presence of ZZS / CO2eq. L: Absence of recycling. E: Export, employment, education	Now - 5 yr.	Functional value retention: Number of products/services	Now - 5 yr.	Number of product groups with higher R-strategy intervention	Now - 5 yr.	Number of criteria sweet spot determination: ~ number of relevant projects	Now - 5 yr.	Supra-regional connection CESI, HCA, market demand CE: Number of projects	Now - 5 yr.
M: ZZS in emissions L: Price volatility (MMAP 2) E: CAPEX, non-formal education	Now - 2 yr.	Technical value retention: Number of products/services	Now - 2 yr.	Apply key technologies in business-models: # circular business modellen realised	Now - 2 yr.	Supporting chain processes incl. standardisation: number of projects	Now - 2 yr.	Connected regions vs. relevant regions	Now - 2 yr.
M: Resource reduction, water availability L: Export restrictions E: OPEX, informal education	Now - 1 yr.	Increase in Economic Value Preservation: Number of products/services	Now - 1 yr.	Number of market segments involved	Now - 1 yr.	Key enabling methodologies: number of projects	Now - 1 yr.	Identified target groups: Number of organisations	Now - 1 yr.
M: Nox-SO2-PM2.5,-VOC-NH3. L: Lead times (PMI) E: New orders/turnover (PMI)	Now-3 m.	Business cases for Number of products/services	Now-3 m.	Number of circular business propositions identified	Now-3 m.	Number of impact assessments carried out	Now-3 m.	Number of Change makers	Now-3 m.
M: Residual waste companies L: Product stocks (PMI) E: Cash flow	Now -1 m.	Number of circular initiatives	Now -1 m.	Number of entrepreneurs involved	Now -1 m.	Quality of reporting information: % of datasets with good quality	Now -1 m.	Number of followers	Now -1 m.

Figure 15. Roadmap 2.0 structure in dashboard format (under construction).

For projects an impact sheet structure (doing the right things) and progress report structure (doing things right) has been implemented (see Appendix 8).

Example (Project Batteries)

IMPACTSHEET

Description

Goals:

1. Knowledge development on recycling Li-ion batteries.
2. Research new recycling industry in the Netherlands
3. Adding value to the "battery chain" by optimising the use phase, by stimulating reuse in other applications (such as storage of sustainable energy) and by aligning the process of collection, sorting and first (mechanical) recycling steps in the end-of-life phase with the metallurgical follow-up steps.

Results:

1. Chain cooperation within the (bicycle) battery chain in at least 2 active pilot projects.
2. Linking KIA questions to realisation projects.
3. Network within chain (EV batteries/Heavy Duty).
4. Research proposals for R-strategies for batteries.

Milestones 2020 / 2021

1. 2020 realisation of CIRCO track bicycle batteries
2. Outcome of Circotrack at least 1 new chain project
3. 2021 realisation of CIRCO track heavier batteries and energy storage systems

Activities:

1. Inventory of relevant projects (optimisation of (re-)use / recycling or more broadly the R-strategies)
2. Linking relevant projects to UPCM and describing the case for the UPCM site. Make UPCM a logical place to share cases (in collaboration with team Upscaling).
3. Connecting knowledge and experience between the current projects (together with Knowledge integration)
4. Organisation of a Circotrack on the subject of Li-Ion batteries for electric bicycles - exploring model for optimisation of use and technology for recycling.
5. First exploration of possibilities for re-use / recycling of larger batteries such as those of electric vehicles.

Scope

Products:

Product cluster: Consumer goods
Product groups: 29.1, 30.9, 47.6
Modules: 1) Li-ion Batteries in vehicles, 2) Li-ion batteries in household appliances and electronics.

Materials

Critical materials: Mn, Nb, Ge, B, Sc, Sr, Co, PGMs, C(natural)
Size of vehicle batteries
- 100-500 kg per battery
- 400,000 EVs in 2040
Size other:
- 100g-10kg per battery
- 3 Million per year in 2030

Circular strategies/CO2 impact

R0-R2 Circular design	
R3-R7 Longevity	17
R8-R9 Recycling	3

Actors

Stakeholders: Stibat, Bicycle manufacturers, Recyclers, Collection companies, Science, Battery repair companies.
ARN, Metalot, Brainport Development, TU-Delft, TNO, Van Peperzeel, Battery Competence Centre initiative (Brainport Development / DAF / VDL / Damen).
Target groups: Entrepreneurs, scientists, students government as regulator.
Change agents: Bicycle industry, recyclers, Legislator, large-scale consumers, Energiemij.

Impact

Contribution to Effect Goals

Effect goal	Time horizon	Description
environment	0-5 jr	Re-use batteries
Certainty of supply	0-10 jr	Energy transition
Economy	0-5 jr	Repair business

Indicators

environment	Certainty of supply	Economy
CO2: 26 ktonnes/yr	Risk reduction: Some improvement	Added value in mln EUR compared to 2019: 238

Contribution to innovation functions

F1- Entrepreneurship	Unknown
F2- Knowledge development	High
F3- Knowledge exchange	High
F4- Direction of search process	High
F5 – Market-making	Low
F6- Mobilising means	High
F7- Breaking Resistance	Unknown
F8- Coordination	Unknown

Contribution to performance objectives

Performance objective	Time horizon	contribution
Innovation engines	0-10 yr	High
Functional value retention	0-5 yr	Medium
Technical value retention	0-2 yr	Low
Economic value retention	0-1yr	Low
Col business propositions	0-3months	1 - 5

Status per: 15/10/2020

Figure 16. Example Impact sheet.

5. Teams

This chapter details elements of chapter 4. It describes the contribution of the various teams including the team tasks and the roles of team members. Competent human resourcing is paramount in every team. The timeframe of each decision horizons defined the complexity of the tasks and consecutively the complexity of the job profiles.

5.1. Orchestrating Team

The Orchestrating Team consists of leading stakeholders in the transition and is chaired by a figurehead of the sector. The team strives to give direction and guidance, to create preconditions and to promote ownership among and with relevant parties and networks of business, government, knowledge institutions and social organisations. The team endorses UPCM frameworks and instruments, it communicates with the UPCM organisational eco system and it develops strategic partnerships. Within the programme, the Orchestrating Team has a pivoting role in converting strategic goals and overall strategies to impact goals for the other teams and in creating the pre-conditions for successful execution. The Orchestrating Team secures these goals, frameworks and preconditions in the decision-making of the national government and the approval within the SER. The Team inspires (gives meaning, sets goals, ensures commitment), activates (organises, connects, provides resources) and guides (gives direction, manages issues, ensures accountability) to achieve the following results:

- Definition of the core principles of the transition to the Circular Manufacturing Industry, implemented in frameworks and preconditions for the other bodies at tactical and strategic level.
- Position papers and other forms of advice to the Central Government (e.g., the Cabinet, Interdepartmental executives, Ministry of Infrastructure and Water Management's national CE programme).
- Communication and synergy with relevant stakeholders in the transition of the Circular Manufacturing Industry.
- Monitoring and adjusting the Circular Manufacturing Industry Implementation Programme.
- Development of a subsequent Circular Manufacturing Industry Implementation Programme.

	Tasks per decision horizon
	Now – 10 years • Setting tactical performance targets (cluster roadmaps). • Stimulating transition conditions and motors of innovation. • Creating synergy with existing networks such as Economic Boards, NWA, HCH, Field labs, and regional networks. • Strategic cooperation with other transition agendas and Versnellingshuis. • Alignment course setting of national UP CE and UPCM. • Connection to annual cycle and participation in management consultations.

The Orchestrating Team is composed representatives from leading stakeholder groups. If they are unable to attend, they will not be replaced unless requested by the other members. The team may decide to expand the team to include representatives from other groups. Members of the Orchestrating Team participate without instruction or consultation. They bring with them knowledge and the perspectives of their constituencies, but do not act as advocates. The entire team takes the perspectives brought in as legitimate interests. Members commit to participating in the Orchestrating Team for a minimum of two years. Members include:

	Role	**This role is filled by:**
	Now – 10 years	
	Chair	Fried Kaanen
	Vice Chair	Saskia van den Brink
	Secretary	Mattheus van de Pol (ad interim)
	Linking pin KIA CM Team	Ardi Dortmans
	Linking pin NSP	Harald Tepper
	Linking pin Realization Team	Mathieu Sueters
	Linking pin Knowledge Integration Team	Hans van der Weijde
	Human Capital Agenda	Henri de Groot
	Linking pin Upscaling Team	Joost Kuiper

5.2. KIA-CM TEAM

The **Circular Manufacturing Industry Knowledge Innovation Agenda Team** (KIA-CM team for short) identifies and lists the knowledge and innovations that will be needed in 5-20 years to realise a circular manufacturing industry. These are converted into research questions for UPCM priority themes: batteries, electronics, wind farms, solar PV and heat-as-a-service. Research questions are input into programmes and calls for research proposals, where scientists, knowledge institutions, companies and other parties collaborate. The KIA-CM team serves as an arena for the practical implementation of and the feedback on research topics.

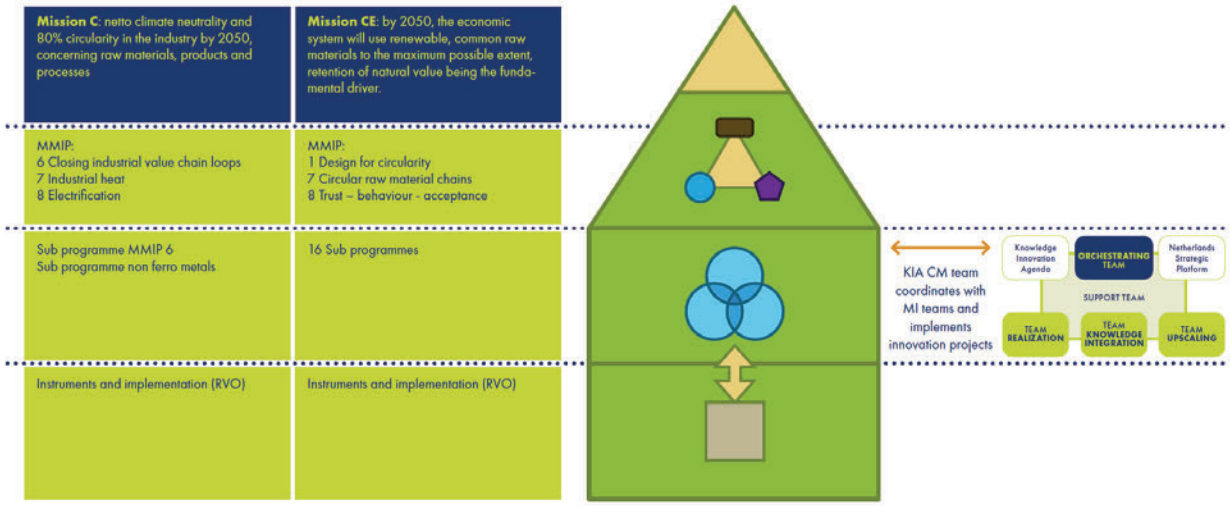


Figure 17. UPCM connection to KIA-CE.

The team develops/co-develops the innovation landscape by building consortia or networks for relevant innovation and research questions within the various MMIPs based on Mission CE and Mission C.

The manufacturing industry is a specific field of knowledge with products that are often a combination of metals and plastics. The performance of High-tech products is depending on highly complex materials combinations that complicate the recovery of the components or materials in the end-of-life phase. New research is needed in this area.

Currently the prime focus of the KIA-CM team is the development of eight enabling technologies (blue flower).

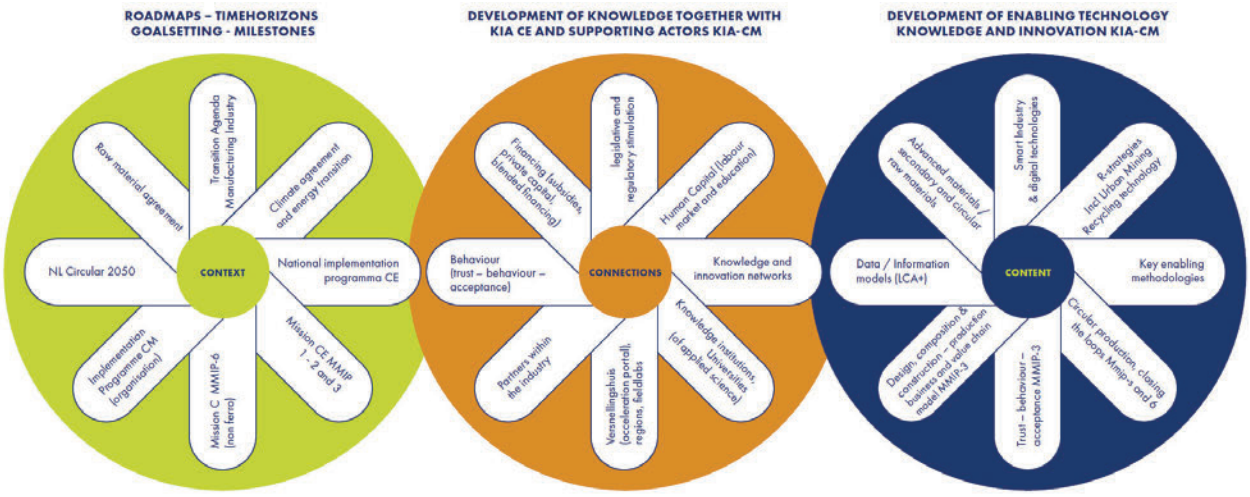
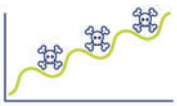


Figure 18. KIA-CM Team focus.

	Tasks per decision horizon
MISSION DRIVEN INNOVATION 	Now – 10 years • Linking mission-driven innovation policy and developing consortia around knowledge questions relevant to the transition to a circular manufacturing industry. • Organising focus and mass in projects relevant to the manufacturing industry. • Addressing innovation challenges from the manufacturing industry. • Bundling metal-related innovation issues Integral Knowledge and Innovation Agenda Climate Change Agreement • Knowledge valorisation: Human Capital (through Orchestrating Team)
R-STRATEGIES 	Now – 5 years • Knowledge valorisation: ○ Transfer of intellectual property on decision horizon 0 – 5 years (through CM Realization Team). ○ Further knowledge development towards market introduction on decision horizon 0 – 5 years in field labs of various priorities (through the team CM Knowledge Integration Team). ○ Broad dissemination of knowledge to SMEs and society on decision horizon 0 – 5 years (through CM Upscaling Team).
CHAIN COOPERATION 	Now – 2 years • Coordination with Knowledge Integration Team on required market creation, such as financial and fiscal incentives or regulations. • Coordination with Realization Team regarding wishes in the area of government procurement policy.
MARKET SEGMENTATION 	Now – 1 year • Coordination with Realization Team on the use of the SBIR instrument
CIRCULAR BUSINESS MODEL 	Now – 3 months • Retrieving knowledge/innovation issues from project portfolio Realization/Knowledge Integration/Dissemination teams.

	Roles per decision horizon	This role is filled by:
MISSION DRIVEN INNOVATION 		
	Team leader	Mattheus van de Pol (acting)
	Secretary	Claartje Thijs
	Linking pin RT	Ardi Dortmans

5.3. NSP (Netherlands Strategic Platform)

The Netherlands Strategic Platform (NSP) is the international liaison for the Implementation Programme, with an emphasis on the relationship with the European Union. The liaison function is aimed at connecting interests, developments and policies between the national and EU level. The team facilitates European networks for large innovation projects, identifies opportunities for EU funding, addresses legal obstacles through constituency consultations and identifies international vulnerabilities and opportunities for circular economy and/or raw materials. NSP represents the Netherlands in several EU policy working groups, including the European Innovation Partnership on Raw Materials. The team also seeks international cooperation with countries outside the EU.

Currently, this translates into four goals:

- **Analysis:** Indicating the European and global challenges, starting with a climate-neutral Europe, to which the circular manufacturing industry can contribute. Addressing relevant legislation and regulations at both European and national level.
- **Advocacy:** Creating joint support and a common vision for research and innovation in programmes and projects. This is made concrete with a scope and direction that accurately reflect the common interest of the parties involved in a Climate Neutral Europe.
- **Policy Framework:** Exploring with stakeholders, such as participants from the Platform for Accelerating the Circular Economy (PACE) and the European Innovation Partnership on Raw Materials (EIP RM Group), what the intended goals/impact goals are that are being pursued at EU level and translating these goals into tactical impact goals such as value preservation, security of supply and environmental impact for various sectors (such as mechanical engineering, road transport, ICT equipment, medical equipment and construction products).
- **Funding for innovation:** Facilitating participation in EU financial programmes that increase the likelihood of forming or scaling up alliances with partners from EU member states and third countries.

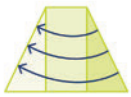
	Tasks per decision horizon
	Now – 10 years • Identifying relevant developments (context) and key tactical impact targets (such as geopolitics and IMVO) for substantive deployment of the Orchestrating Team. • Process support (such as lobbying and coalition building) to translate the content of the Orchestrating Team's efforts at regional, European and international level (for example, utilisation of the European Innovation Partnership on Raw Materials). • Focus group (e.g., vulnerability of value chains and dissemination of raw materials scanner). • Analysis of opportunities and bottlenecks of current EU policies and regulations, based on Mission-oriented Innovation Systems analysisi and analyses of supply uncertainty/circularity. • Advocacy by systematically focusing international priorities on circularity issues in the manufacturing industry, mobilising partners through vision creation. • Drawing up and/or tuning a policy framework by sector based on analysis with opportunities and bottlenecks of current and future EU policy & regulations. • 'Financing for innovation' including an analysis of financial bottlenecks for breakthrough projects, opportunities and bottlenecks of existing policy & regulation, identifying/activating stakeholders at the right policy levels and developing an advocacy plan.

	Individual roles per decision horizon Now – 10 years	**This role is filled by:**
	Team leader (acting)	Mattheus van de Pol, Ministry of Economic Affairs and Climate Policy
	Secretary	John Heynen
	Linking pin RT & PACE	Harald Tepper
	Linking pin Holland Circular Hotspot	Freek van Eijk
	Linking pin Provinces	Waldo Maaskant
	Linking pin Rijkswaterstaat	Cuno van Geet
	Linking pin Ministry of Foreign Affairs	
	Linking pin Min. I&W	

5.4. Team Realization

Team Realization advises and supports in the development and implementation of innovations for a circular manufacturing industry, from idea to concrete project. The team helps companies to formulate promising projects and to find partners and pathways to financing. At the sector level, the team initiates studies to assess opportunities and challenges for circular innovations and technology. Where necessary, the team initiates sector-wide or cross-sector projects.

	Tasks per decision horizon
	Now – 5 years • Connection with KIA CM Team. • Developing operational projects. • Providing knowledge. • Offering a network. • Referral to partners. • Suggesting policy for tightening governmental instruments. • Validating and positioning the intended result in system change.
	Now – 2 years • Organising purchasing power, for example, through ICT Rijk or other market-creation initiatives. • Defining market opportunities and niches in coordination with the Knowledge Integration Team and the Upscaling Team.
	Now – 1 year • Initiating new projects. • Launching investment projects.
	Now – 3 months • Placing knowledge and innovation issues on the agenda for the KIA CM Team.
	Now – 1 month • Connecting project leaders. • Evaluating project performance. • Referral to start-up and scale-up funds, such as HTSM. • Reporting.

	Individual role per decision horizon	This role is filled by:
R-STRATEGIES 	**Now – 5 years**	
	Team leader	Bart Jeroen Bierens
	Secretary	
	Linking pin RT	Mathieu Sueters
	Linking pin KIA CM	Mattheus van de Pol, EZK (acting)
CHAIN COOPERATION 	**Now – 2 years**	
	Project architect	Bert van Haastrecht Martijn Kerssen – OostNL Harald Kerp – M2i Eefke Schramade
MARKET SEGMENTATION 	**Now – 1 year**	
	Financial resources access coordinator	Bart Jeroen Bierens John Heynen
	Procurement coordinator for stimulating circular procurement	
	Legal coordinator	
	Business case developer	
	Project leader investment projects	
CIRCULAR BUSINESS MODEL 	**Now – 3 months**	
	Liaison officer	
	Project activation	
	Onboarding	Bart Jeroen Bierens
INVESTMENT PROJECTS 	**Now – 1 month**	
	Reporter	

5.5. Knowledge Integration Team

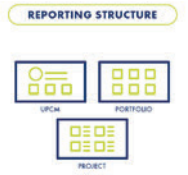
Knowledge development and transfer is a key enabler for accelerating transitions. The **Knowledge Integration Team** collects, develops, shares, and applies knowledge related to the circular transition in the Manufacturing industry.

The team identifies bottlenecks (in the innovation system), sweet spots (potential for CO2 reduction and added value) priority themes for sector-wide engagement.

The Knowledge Integration Team is the link between knowledge institutions and the implementation programme with a focus on application-oriented knowledge for the manufacturing industry. Within the team, various knowledge partners are active and connected to ensure a 'flow of knowledge' with other knowledge networks. The knowledge is developed together with knowledge institutes such as TNO. The team has an important role in stimulating entrepreneurial cooperation across value chains, for instance via CIRCO tracks.

The knowledge integration team has a pivoting role in the (knowledge) alignment across decision horizons and teams. The team facilitates the impact analysis of projects and initiatives of the other teams using an integrated set of data and instruments. Based on the lessons learned it identifies and initiates structural projects, such as material passports to solve generic challenges and/or transform markets. The knowledge integration team (co-)develops the information and reporting structure to monitor the efficiency and effectiveness of the UPCM.

	Tasks per decision horizon
	Now – 5 years • Identifying sweet spots using an integrated methodology. Within these product groups of the five clusters, the most circular potential and desired effects are expected. • Initiating/realising structural projects with policy advice. • Developing and updating roadmaps and target system. • Mapping out the knowledge system (e.g., by means of motors of innovation). • Participation in the PBL supra-regional knowledge infrastructure.
	Now – 2 years • Identifying chains (Van Dongen algorithm). • Developing generic (chain) processes for R strategies for each product group. • Knowledge integration of national and regional CE Manufacturing initiatives. • Knowledge integration of regional cluster approach/regional tool.
	Now – 1 year • Key enabling Stimulate/organise joint learning processes. • Supporting development and rollout of CIRCO. • Facilitating knowledge development, exchange and access.
	Now – 3 months • Learning projects, CIRCO tracks and field labs. • Coordinating with Versnellingshuis. • Supporting analysis of potential CE initiatives.
	Now – 1 month • Developing and managing the information and reporting structure.

	Individual role per decision horizon	This role is filled by:
	**Now – 5 years**	
	Team leader	Jeannette Levels-Vermeer – LBP|SIGHT
	Secretary	
	Linking pin RT	Hans van der Weijde – Tata Steel
	Knowledge integration Roadmap Now – 10 years	Elmer Rietveld - TNO
	Knowledge integration sweet spots - Now – 5 years	Jeannette Levels-Vermeer - LBP|SIGHT
	Financing	
	Representative PBL - monitoring	Maikel Kishna - PBL
	Linking pin supra-regional cooperation.	Marc Pruijn (acting)
	**Now – 2 years**	
	Knowledge integration of chain processes Now – 2 years	Ton Bastein - TNO
	Representative Smart Industry	Jos Mulder – Province of Overijssel
	**Now – 1 year**	
	Key Enabling Methodologies Now – 1 year	Jeannette Levels-Vermeer – LBP|SIGHT
	Representative CIRCO	Bas Hillerstrom - CIRCO
	**Now – 3 months**	
	Quality project result Now – 3 months	Jeannette Levels-Vermeer - LBP|SIGHT
	Quality project processes Now – 3 months	Rien van Leeuwen - Ruysdael
	Representative Versnellingshuis	Marc Beumer – Groene Brein
	**Now – 1 month**	
	Information structure and monitoring manager	Elmer Rietveld - TNO
	Reporter Now – 1 month	

5.6. Upscaling Team

The Upscaling Team strives to increase the number of (Dutch) manufacturing companies that actively engage in circular activities for:

- Increasing value retention of products/services in the manufacturing industry.
  - Reducing environmental impact of products/services in the manufacturing industry.
  - Reducing supply chain risks of (critical) raw materials.

The **Upscaling** Team transfers knowledge and develops communities and networks to enable the circular transition of the Dutch manufacturing industry. To enable networking, it offers a platform to share case descriptions, projects, and documents and to highlight the current state and benefits of circular entrepreneurship in the manufacturing industry.

The team actively identifies target groups and stakeholders in need of UPCM knowledge to organise relevant meetings

The team ensures proper coordination and integration with the regional cluster approach and supra-regional cooperation.

Active engagement of manufacturing companies

Within the broad scope of activating all 40.000+ companies in the manufacturing industry, the team specifically focusses on companies in the high impact clusters (see chapter 1.2.) and that deploy business activities related to the priority projects.

Supra-regional cooperation.

The supra-regional approach of the Upscaling team focusses on relevant themes such as CESI, Human Capital agenda and market demand for circular solutions:

Supra-regional level (decision horizon Now – 5 years):

- *Government-region economic cooperation platform (formerly SME cooperation agenda), CE theme:* The goal is to activate and support the broad range of SMEs in their initial circular action perspectives, in scaling up, and in the knowledge exchange.
- *Regional CE accelerators*: The aim is to form an active coalition or network of leading regions to identify and possibly create the necessary preconditions for a CE transition in the region. The creation of these pre-conditions can be a part of the Regional CE Strategies. This coalition is also a user group of PBL's initiative landscape facilitated by MVO NL.
- Connection to the supra-regional knowledge infrastructure, that is in development by PBL and partners.

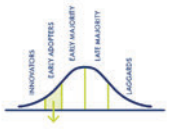
Regional level (decision horizon Now – 2 years):

- Other transition teams execute projects that strengthen the existing clusters of companies in the various regions. In close cooperation with the regional manufacturing platforms, the UPCM Upscaling team focusses on promising target groups (SME and OEM) in the Manufacturing Industry that could contribute to the themes and priorities of the other transition teams in a specific cluster (picking the winner'). In addition, the Upscaling team collaborates with the 'Regio-tool'.

Urban level (decision horizon Now – 1 year):

- Circular neighbourhoods.
- Circular procurement in buyer groups.

	Tasks per decision horizon
	Now – 5 years • Organising the dialogue about CM. • Community forming. • Connecting networks (regional, SME, FME, KMU, etc.) and activating participants. • Linking national and regional CE Manufacturing initiatives. • Strengthen supra-regional cooperation on the themes CE & Smart Industry, human capital agenda and market demand CE. • Alignment with other sectors.
	Now – 2 years • Coordination with regional cluster approach (such as Regiotool). • Connection to MMIP 3 Trust, behaviour and acceptance.
	Now – 1 year • Strategic communication and envisioning strategy (including target groups and analysis of the balance of forces). • Developing and providing awareness-raising tools (such as the Raw Materials Scanner). • Passing on knowledge (e.g., by means of the raw materials scanner, the raw materials knowledge forum, publications, conferences and other events). • Linking communication channels. • Organising events.
	Now – 3 months • Engagement strategy (branch managers, etc.). • Getting participants to CIRCO tracks.
	Now – 1 month • Use of communication tools, such as the circular manufacturing industry website • Spotting and/or passing on opportunities for scaling-up. • Information or question portal for consumers where relevant. • Reporting

	Individual role per decision horizon	This role is filled by:
SUPRA REGIONAL COLLABORATION 	**Now – 5 years**	
	Team leader	Gerard Wyfker
	Deputy Team Leader	Diana de Graaf
	Secretary	
	Linking pin RT	Joost Kuiper - Province of Overijssel
	Regional cluster approach representative	Anja Steentjes - Ministry of Economic Affairs and Climate Policy
REGIONAL CLUSTER APPROACH 	**Now – 2 years**	
	Envisioning strategy	
	Coordinating CIRCO	Bas Hillerstrom - CIRCO
TARGET GROUP APPROACH 	**Now – 1 year**	
	Use of GS/Knowledge forum ('Kennisplein')	Guy Gadiot - Netherlands Enterprise Agency (RVO) Jobert Winkel - RVO
	Communication strategy	
	Coordination with province	Eefke Schramade – Province of South Holland
CHANGE AGENTS 	**Now – 3 months**	
	Engagement (Activating CMK network)	Merel Segers Stephanie Schuitemaker
COMMUNICATION 	**Now – 1 month**	
	Communicating by means of the website	Merel Segers Stephanie Schuitemaker
	Reporter 0 – 1 month	Diana de Graaf

Appendices

Appendix 1. Manufacturing industry chapter from National Implementation Programme CE 2019-2023

The Dutch manufacturing industry wants to contribute to the circular economy, thereby both achieving social goals and strengthening its competitiveness.

Three goals have been formulated in the Transition Agenda Circular Economy for the Manufacturing Industry (CETAM):

- Increasing value retention of products/services in the manufacturing industry.
  - Reducing environmental impact of products/services in the manufacturing industry.
  - Reducing supply chain risks of (critical) raw materials.

The transition agenda for the manufacturing industry includes seven lines of action. In this implementation agenda, there are five leading projects within those action lines. In the coming years, this will be supplemented by more and new projects. A distinction can be made here between concrete investment projects and structure-enhancing projects aimed at improving the preconditions for a circular manufacturing industry.

Urgency and goal

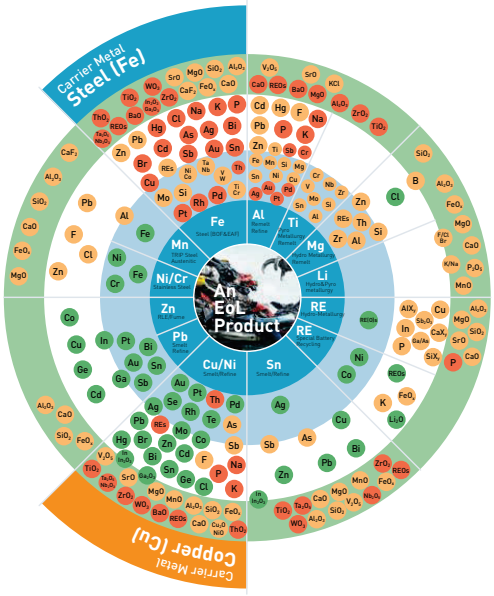


Figure 19. The metal wheel.

Metals play an important role in meeting the growing needs of the world's population.

The main reasons for wanting to close the metal cycle are therefore:

- Climate: The production and remelting of metals has a major climatic impact. By reusing metals, this impact can be reduced.
- Scarcity/Economy: it is necessary to keep sufficient materials available to meet people's needs.
- Environment: the impact on the environment, land use and biodiversity must be minimised.

See also: https://www.researchgate.net/figure/Recycling-Metal-Wheel-reflecting-that-knowledge-of-recovering-carrir-elements-commod_fig2_270048511

The envisaged energy transition will also require a growing quantity of special metals. The availability of these metals is limited, on the one hand, by the available supply in unprocessed form. On the other hand, there is the problem that metals have physical limitations when it comes to recycling and separation when they are used in combination. Moreover, not all metals are always recoverable from a product or alloy. Therefore, it is important to design intelligently and to use products containing metals for as long and of as high a level of quality as possible.

Cooperation will be sought with the Versnellingshuis, and consideration given to the climate envelope, regional resources and possibly European subsidies. The financing of the projects listed below is therefore still in progress.

Action lines and projects

1. Action line - Circular Design in the Manufacturing Industry

In order to further promote circular design, the goal of increased use of so-called CIRCO tracks will be pursued in the coming years. This happens in several areas such as agriculture, plastics, construction and so on, but also for the Circular Metal Chain. At the same time, in consultation with CIRCO, we would like to look at the further development of the CIRCO tracks, for example in the area of Smart Industry/digitisation. The provinces of Overijssel, Gelderland and North Brabant are using the CIRCO tracks in a programme to make industry more sustainable at the cutting edge of circular economy and Smart Industry. This will be done in cooperation with the Ministry of Economic Affairs and Climate Policy. Smart Industry is a programme that promotes the digitisation of industry both nationally and regionally. This will also enable factories to use raw materials and energy more sustainably. In 2019, a study will also be carried out into the concrete impact in terms of CO_2, energy and raw materials of measures taken by companies.

2. Action line - Security of Supply of Critical Raw Materials

Raw material scanner and knowledge forum

In late 2017, the raw materials scanner was launched. This enables companies and chains to gain insight into the risks they run in the supply of raw materials. The Netherlands Enterprise Agency (RVO) manages the raw materials scanner and will promote its use by means of a communication campaign. The raw materials scanner will also be applied in projects from this implementation programme. For example, based on the scanner for 5 to 10 Critical Raw Materials (CRM), pilot projects with business chains will be started, with a focus on energy transition (see below).

The raw materials scanner is currently being translated into English and will also be introduced in international forums. The raw materials scanner will be further developed in the coming years. The Ministry of Agriculture, Nature and Food Quality is currently working on the addition of biotic raw materials to the scanner. The results of the Metal Covenant in the field of international corporate social responsibility (ICSR) will also be incorporated. Finally, in 2019, a study will be launched on the security of supply in chains. The results of this study will also be incorporated into the scanner.

Project: Pilot programmes Security of Supply of Critical Materials for Energy Supply

For energy supply, various critical materials are needed, for example, in wind turbines or solar panels. The rapid growth of renewable energy worldwide will rapidly increase the demand for these materials. Materials are rapidly becoming scarcer, and geopolitical risks may jeopardise future supplies of these raw materials. Research conducted in 2018 by Copper8 and Metabolic, among others, clearly shows this. According to this study, the scarcity of raw materials could pose a risk to the energy transition.

In any case, a more economical use of raw materials, for example through circular design and the recovery of materials, will contribute to solving this problem. To this end, a pilot project is being carried out to see, within a specific chain, how less critical materials can be used throughout the chain and how used materials can be recovered in the recycling process. The first project under consideration is wind energy: a consortium will be set up for this.

Initiator: Netherlands Enterprise Agency and Ministry of Economic Affairs and Climate Policy
Actors: Ministry of Economic Affairs and Climate Policy, companies, industry organisations
Product: Pilot programmes with focus for 5-10 critical materials
Effects: Insight into risks of raw material supply and contribution to raw material requirements for energy transition
Term: 2019-2020

3. Action line - Uniform Principles and Calculation Methods for Product Groups

Uniform standards and calculation methods are needed as a common 'language' in the transition to a circular economy. Although there are already good examples for some product groups, unambiguous and independent standards are still

lacking. A number of different activities has been set up for this purpose. One of these is a national system of environmental performance of products.

Project: Pilot programme National System Environmental Performance of Products

It is important to promote transparency in the environmental impact of products. This helps companies and consumers make better choices and governments to make better policies and buy more effectively. The intended effect is less environmental impact. When doing this, we look at whether the example of the construction industry can be followed, in which a successful application of calculation method (DuboCalc) and database (National Environmental Database) has been developed. To start with, in 2019, three pilot projects will be carried out for three product groups in the manufacturing industry. This builds on previously developed tools in the construction industry. Partners will include governments, the business community and the Foundation for Building Quality.

Initiator: FME and Metaalunie
Actors: Governments, the business community and the Foundation for Building Quality
Product: 3 pilot programmes for 3 products in the manufacturing industry
Effects: Clear and independent standards as a means of reducing the environmental impact of a number of product groups
Term: 2019

4. Action line - Material efficiency

Material efficiency is a key word in a circular system, based on value preservation rather than on costs. It is important to create awareness and support for material efficiency to ultimately base policy and business on it. This is about pushing the following three related 'buttons': First: giving direction to the search process with a vision of transition, with an end-of-life approach: from consumption to use. Second: knowledge about this must be compiled and shared. Thirdly: incentives are required to avoid material consumption and encourage use. Stimulation of demand is also needed. The vision of material efficiency must also be the guiding principle for monitoring.

Under M2i's coordination, a research proposal was submitted to NWO based on, among other things, methods for life extension of products in the electronics industry. If granted, this proposal will contribute to the material efficiency action line, but also to other action lines such as circular design.

Project: Urban Mining Flat Screens

To increase material efficiency, the 'Urban Mining Flat Screens' project will start in 2019. As part of this project, various private parties will be worked with to recover critical materials such as indium and gallium from displays, which are then used in new products. Results of economic feasibility studies are positive. Evidence of the processing of 100 tonnes of discarded electronic products containing 15 to 30 kg of indium, as well as other metals, which are reprocessed into products such as solar cells, underpins the circular economy for critical metals.

The planned pilot programme is expected to result in significant environmental gains, such as greenhouse gas reductions. Per tonne of FPD displays and CIGS solar cells processed, these reductions amount to approximately 1,000 to 1,400 and 1,000 to 2,000 kg CO_2 respectively, depending on the process choices. Recovery and recycling of indium and gallium contribute to security of supply and reduce depletion of these scarce metals.

Wecycle ensures the supply of the required end-of-life products for processing and supports the implementation of successful, innovative processes. Together with Suez Water, TNO develops the innovative processes and ensures that the most sustainable process choice is made from various alternatives. In doing so, consideration is also given to a wider range of applications for elements other than indium and gallium. Suez Water and Coolrec are developing the processes on a pilot scale and are carrying out long-term tests. Solliance reuses the recovered indium and gallium compounds in new solar cells.

Initiator: Coolrec
Actors: Suez Water, Coolrec, TNO, WeCycle, Netherlands Enterprise Agency (RVO)
Product: pilot programme results in knowledge building and sharing
Effects: Preserving value: preventing the consumption of materials and stimulating their use. Reducing depletion of scarce raw materials
Term: 2019

5. Action line – Recycling Technology - Closing cycles

Recycling is an important step in closing cycles, as are refurbishing, remanufacturing and upgrading. The complexity of metal recycling is that not all elements can be recovered from alloys. It is important to optimise not only on quantity, but also on quality. The higher quality and cleaner the input stream, the less loss of kilos and functionality in the recycling process.

Project: Zinc recovery

A project to recover zinc from guard rails will start in late 2018. A consortium of parties will set up a pilot facility in Budel (the Netherlands) at the new zinc-related industrial estate Metalot, which is currently under development. In this facility, the zinc will be metallically recovered from sulphuric acid in a circular manner with the aim of eventually recovering 100% of the zinc in recycling.

The industrial estate is located next to the zinc manufacturer Nyrstar. In the production of zinc, sulphuric acid is released as a by-product. This sulphuric acid can be used for dezincification and can offer 100% recovery of the zinc in Nyrstar's production process. The quantities are large and may reach a total recovery of 170,000 tonnes of zinc in the period from 2018 to 2048. This closes the loop.

The company Arrosso also has the ambition, together with other parties, to dezinc steel in hydrochloric acid instead of sulphuric acid. The pilot facility to be set up should then investigate how the zinc-containing hydrochloric acid can be upgraded to a raw material for industrial use or how the zinc can be recovered.

Dezincification processes produce hydrogen gas. In the test facility, it is Arrosso's ambition to investigate, together with the parties, how this gas can be captured and utilised as an energy carrier. In the period from 2018 to 2048, this could yield 6,000 tonnes of usable hydrogen. For an initial phase of the project, funding is available from the Ministry of Economic Affairs. The project will therefore be ready to start in early 2019. Funding is still being sought for follow-up.

Initiator: Arrosso
Actors: Nyrstar, Tata Steel, Arrosso, national and local government/road authorities
Product: testing facility for circular zinc recovery
Effects: Zinc recovery from production process
Term: 2019

6. *Action line - Circular Business Models*

In the circular economy, business models will be based much more on 'use' rather than 'ownership', with the producer becoming a service provider. The valuation of residual flows is also becoming more important in the business model. As a concrete project, we are going to work with 'Heat as a service'. This also requires a form of business financing that supports these new business models. A roadmap will be drawn up in 2019 to offer practical tools for this for both companies and financiers. This roadmap should give companies and financiers insight into business models and financing options. This will be done in cooperation with the Versnellingshuis.

The manufacturing industry wants to set up 'prosumer' actions in cooperation with consumer goods. Here, together with consumer organisations such as Cooperation of Good, festivals and companies that want to develop innovative circular business models, a living lab will be set up called 'refurbish your lifestyle'. As a result of these actions, for two years, they will learn how active consumers can help make circular business models profitable.

Project: Heat as a service

To accelerate the energy transition and make the heat supply circular, work is being carried out on renewing the way in which heat is supplied, as is currently the case with the installation of central heating boilers. In 2019, the sector aims to have a roadmap ready for this transition. The roadmap will focus on the development of concepts and chain organisation at the level of region (heat networks and the like), building (collective building concepts) and user (individual concepts). The future vision is that heat will be provided as a service with a guarantee of the lowest possible CO_2 emissions at the lowest possible price. In 2019, the concept and chain organisation for the replacement market for central heating boilers (375,000 boilers per year) will be set up as part of a pilot programme. The aim is for boilers to remain the property of the supplier, which will create incentives to develop longer-lasting devices and to use raw materials more sparingly, with greater attention paid to refurbishment and recycling, among other things.

The consortium consists of: VFK (representation of the sector including manufacturers), UNETOVNI (representation of the sector including installers), companies and start-ups in these sectors, cooperatives, real estate/construction companies, Province of Overijssel, recycling companies (WEEELABEX) and energy companies.

Initiator: Consortium (to be determined)
Actors: VFK, UNETOVNI, companies, Cooperatives; real estate/construction companies, Province of Overijssel, recycling companies, energy companies, Ministry of Economic Affairs and Climate Policy, I&W, InvestNL
Product: Roadmap for energy transition; pilot programme for replacement market for central heating boilers started
Effects: Promoting the 'from work to use' business model, thus better use of resources and longer-lasting devices
Term: 2019

7. *Action line - Circular Procurement/Category Management ICT*

When it comes to the movement towards the circular economy, the priority given to price incentives and short-term profit in procurement is problematic. The first knob to turn is to give direction to the procurement search process. An important observation is that procurement must be aimed at retaining lifetime value, must pay off and must stimulate the circular economy. Knowledge development and exchange are the foundation of this search. Governments and large corporations can set an example through circular procurement projects, asset recovery projects and showcasing best practices from the market with sustainable procurement criteria. Circular procurement is also included as a cross-sectoral theme in this implementation programme (see Section 3.4). A project is being started in the field of life-extending refurbishment of ICT hardware in both companies and the government.

Initiator: Ministry of Economic Affairs and Climate Policy/Infotheek
Actors: Governments, big business and manufacturers
Product: Start of a project on LCA information, life-extending refurbishment of ICT hardware, circular objectives and action perspectives for both companies and the government.
Effects: Promote procurement aimed at preserving value and stimulating the circular economy
Term: 2019

Appendix 2. Roadmaps including change strategies per decision horizon

An integral set of roadmaps is a core instrument for navigation in a complex system change. Roadmaps facilitate stakeholders to create a coherent set of resources, activities, performance objective and impact goals for both the short-term, medium-term, and long-term. This enables coordination within the National CE implementation programme and creates alignment across the various transition agendas.

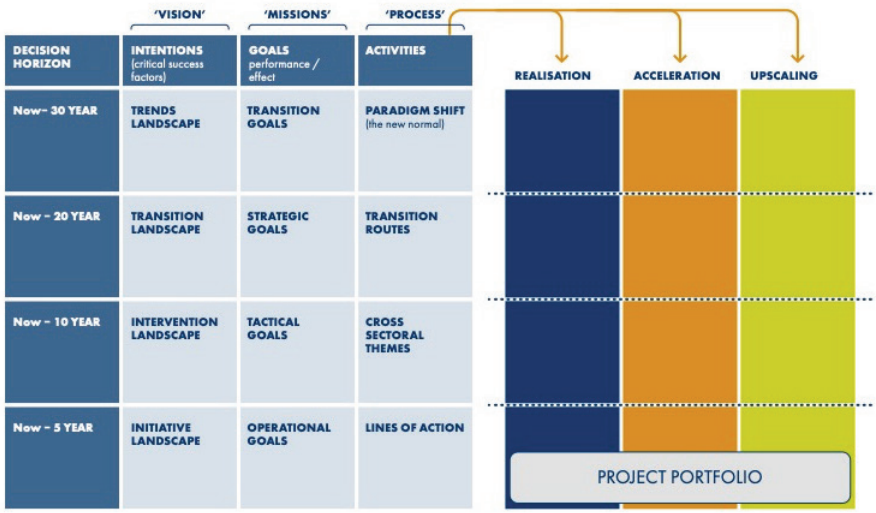


Figure 20. Course setting in decision horizons

1. Roadmap

Roadmaps provide a cascaded model of strategic goals and related resources, activities, performance objectives and impact goals for the various decision horizons. Roadmaps for the Circular Manufacturing Industry Implementation Programme focus on the decision horizons of Now - 10 Years and include 'swimming lanes' for each decision horizon. The scope of these swimming lanes aligns with the clusters of the National cluster monitoring.

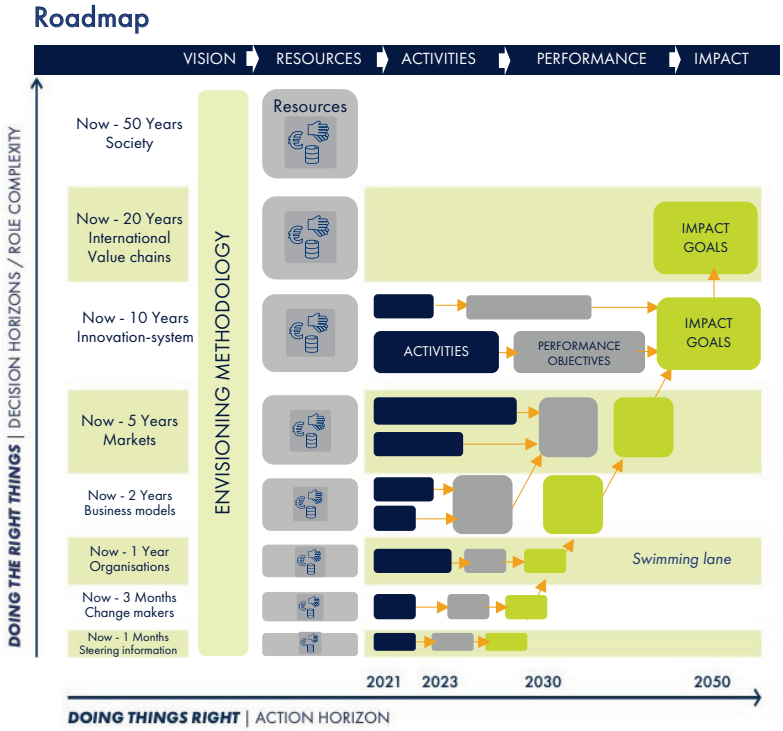


Figure 21. Coherence of actions, performance targets and effects.

Roadmaps enable concurrent guidance at the various levels of abstraction:

- *For envisioning purposes, roadmaps visualize mental maps of the required changes at the society level.*
- *For **strategic** guidance, roadmaps provide system views of the direction and progress of sectoral transitions*
- *At a **tactical** level, roadmaps create a structure for the development of (mission oriented) innovation systems for clusters of product groups*
- *In the **operational** practice, roadmaps connect short term activities with tactical and strategic goals.*

UPCM roadmaps are currently applied for various purposes:

- Internalization of shared views on the 'why', the 'what' and the 'how' of the transition.
- Identification of dependencies and relationships with other (larger) transitions and/or cross-sectoral themes.
- Increasing the effectiveness of resources by a clear focus on performance objectives and impact goals
- Converting impact goals in performance objectives and metrics per decision horizon.
- Decomposition of the long-term impact goals into shorter-term goals for the various decision horizons.
- Top-down (planned) and bottom-up (feedback loops) identification of required resources (actors, money, technologies and so on) and activities.

2. Cluster roadmaps

The cluster roadmaps are a further developed and more integral version of the current National roadmap. Cluster roadmaps are more in alignment with recent developments in the context of the climate agreement, the associated innovation programmes and the mission-driven Top sectors and Innovation Policy, and the monitoring of Climate Policy.

In 2020 the Circular Manufacturing Industry Implementation programme (UPCM) has accelerated the development of the transition approach and the integral methodological framework. The embedding within the Ministry of Economic Affairs and Climate Policy and the Top Sectors and Innovation Policy Directorate anticipates the rapid developments in climate- and energy policies. Here various scale levels or decision horizons are used, that resemble the decision horizons of the UPCM approach. However, the systemic impact of UPCM activities is depending on cooperation with the other transition agendas and the cross-sectoral themes.

KIA CM, a selection of the general knowledge and innovation questions in the Knowledge and Innovation Agenda Circular Economy (KIA CE), drives the innovation scope of UPCM. This applies to all five priorities (transition agendas) of the National Implementation Programme CE. In addition to the current KIA CE, medium- and long-term knowledge questions of the NWA Circular Economy and Raw Materials Efficiency also drive the innovation scope of UPCM. These National Science Agenda (NWA) knowledge questions correspond to the cross-sectoral themes of the national implementation programme CE.

The project 'cluster roadmaps' is the proof of concept for this approach. NWA knowledge questions, in combination with the KIA CE questions are framed to the five sectors of the manufacturing industry: Materials, Consumables, Building and construction, Capital goods and Consumer goods. The project includes the analytical framework of the innovation engines (Mission driven Innovation Systems) of Prof. Marko Hekkert. In addition to the project group, a focus group with relevant persons from the IKIA field (MMIPs 1, 2, 3, 6, 9/10, 13, key technologies) and the national implementation programme CE will be set up.

Product group in cluster	Materials	Consumables	Building and construction	Capital goods	Consumer goods
20 Chemical industry					
20.3 Paint, varnish and printing ink industry	x				
20.5 Other chemical products industry	x				
22 Rubber and plastic products industry					
22.1 Rubber products industry	x				
22.2 Plastic products industry	x				
23 Building materials industry			x		
24 Base metals industry	x				
25 Metal products industry					
25.1 Metal construction products			x		
25.11 Metal construction works			x		
25.5 Forges, profile rolling mills, etc.			x		
25.6 Other metalworking industries		x			
25.7 Metal tools		x			
25.9 Other metal products			x		
25.91 Packaging		x			
25.92 Packaging		x			
25.94 Bolts, screws, nuts, anchors, etc.		x			
26 Electrotechnical industry					
26.1 Electronic components				x	
26.2 Computers and peripherals					x
26.3 Communication devices industry					x
26.4 Consumer electronics					x
26.5 Measurement and control equipment				x	
26.6 Medical / optical equipment				x	
26.7 Medical / optical equipment				x	
26.8 Computers and peripherals					x
27 Electrical appliances industry					
27.1 Electrical equipment				x	
27.3 Electrical cable, switch industry				x	
27.4 Electric lighting industry				x	
27.5 Domestic appliances industry					x
28 Machine industry					
28.1 Motors and compressors				x	
28.2 Machines and equipment - general				x	
28.3 Agriculture and machinery				x	
28.4 Agriculture and machinery				x	
28.9 Special machines and devices				x	
29 Automobile and trailer industry					
29.1 Cars					x
29.2 Chassis and trailer industry				x	
29.3 Automotive parts industry					x
30 Other transport equipment industry				x	
32 Other industry				x	
33 Repair and installation of machines				x	
38 Waste treatment and recycling	x				

3. Cohesion of change strategies per decision horizon

Change strategies are integrated within the structure of the roadmap.

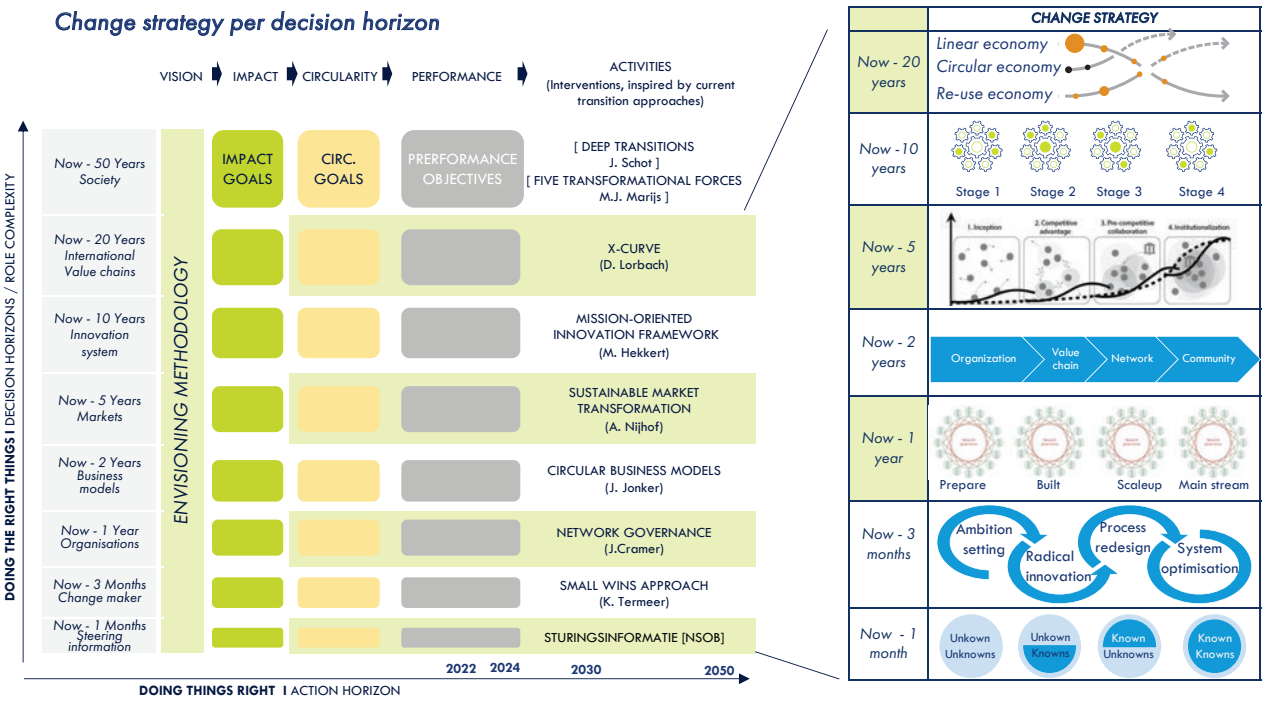


Figure 22. Change strategies integration in roadmap structure.

Decision horizon	Change strategy: focus and intervention scope
Now – 20 years	We focus on the development and stimulation of resilience principles for socio-ecological systems. We contribute to the development of scenarios for a) build up, b) change and adapt and c) phase out as defined in X- curve transition dynamics (Professor Derk Loorbach, Transition Centre Drift), which are explicitly linked to climate and energy transition as well as the digitalisation transition.
Now – 10 years	We focus on the development of mature Mission oriented Innovation Systems for cross-sectoral clusters of product groups ('Mission-driven innovation systems'[3] by Professor Marko Hekkert). Priority interventions are aimed at the following clusters: Capital equipment, Consumables, Materials, Consumer goods and Building and construction.
Now – 5 years	We focus on stimulating market transformation (Sustainable market transformation strategies by Professor Andre Nijhof) for high potential product groups. Interventions are aimed at changing the market dynamics to achieve a higher level of circularity within the scope of the relevant Now10 years impact goals.
Now – 2 years	We focus on accelerating the application of circular business models (Professor Jan Jonker). Interventions are aimed at the application of key enabling technologies and the development of the relevant underlying (value chain) processes, such as return logistics and chain information systems, to achieve the 0 – 5 years impact goals.
Now – 1 year	We focus on stimulating value chain partnerships which organise the requisite (value chain) processes for the Now -2 years impact goals (Network governance, Professor Jacqueline Cramer). Interventions are aimed at stimulating circular proposition among Early adopters (Rogers adoption theory) of specific target groups / market segments.
Now – 3 months	We focus on activating 'change makers' who engage the Early majority for the 0 – 1 year impact goals. (Small wins framework, Professor Katrien Termeer). A change maker could be anyone with an influential position, an industry leader or a representative of a sector organisation. Interventions are aimed at building (knowledge) networks.
Now – 1 month	We focus on the exchange of knowledge and best practices among the actors in the transition. Interventions include coherent communication to target groups and related change makers.

[3] Hekkert, M.P., Janssen, M.J., Wesseling, J.H. & Negro, S.O. (2020). Mission-oriented innovation systems. *Environmental Innovation and Societal Transitions*, *34*, 76-79.

UPCM teams, that each operate at a selection of decision horizons, define related team tasks in the roadmap by using the change strategies as a common set of principles.

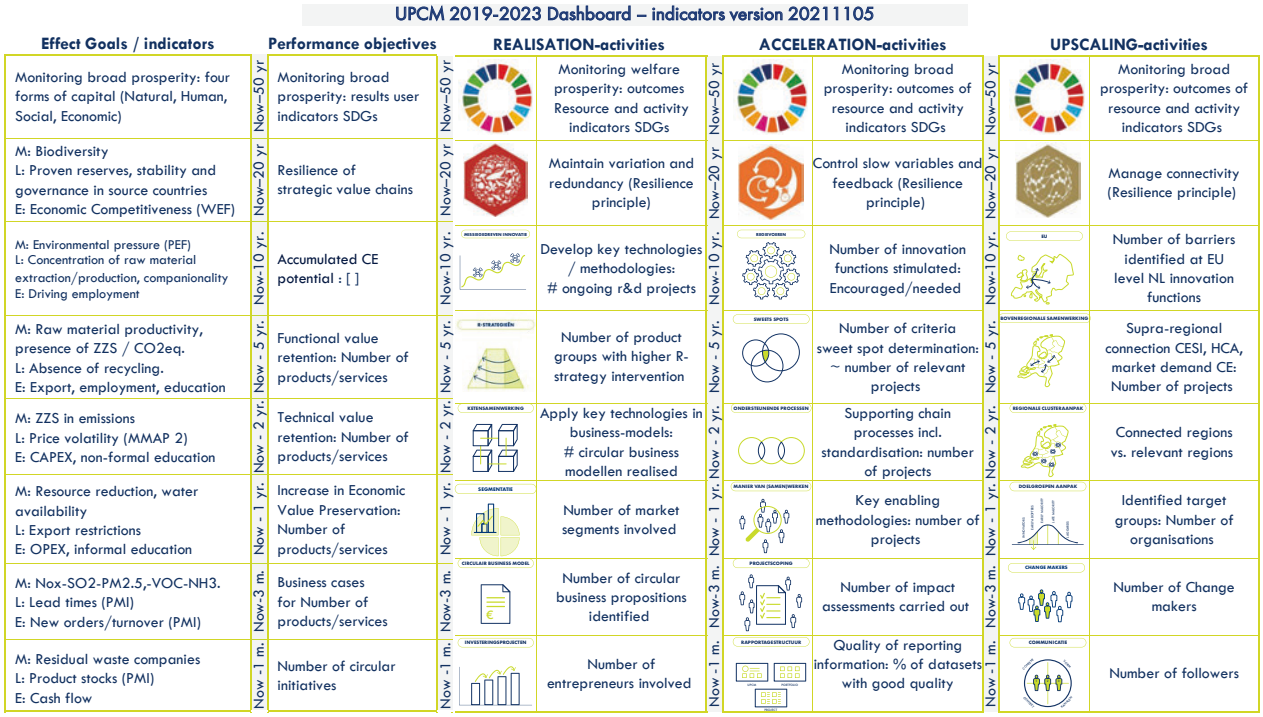


Figure 23. Course setting in decision horizons

4. Underpinning concepts, models, and approaches

4.1 Change strategy Now – 50 Years: Deep transition theory and Transformational forces

The underpinning concepts and models for the 50 years decision horizon are in a very early stage of conceptualization. A rough draft of a possible change strategy is based on the Deep Transitions Theory and on the Five Transformational Forces.

4.1.1. Deep Transition Theory

The text below is a copy of the paper -Introduction to Deep Transitions Thinking: A Springboard to Global Sustainability -. It serves to illustrate a possible change strategy at the decision horizon Now - 50 years.

The First Deep Transition began as the Industrial Revolution. Having begun 250 years ago, the world it produced is unravelling at speed as its methods and values become unsustainable for our planet. To succeed in delivering a better future, the Second Deep Transition needs to place sustainability at its core. Since the First Deep Transition, the world has experienced a succession of surges in economic and social development. This led to modern societies as we know them today. In the Deep Transition theory, we explore underlying drivers in the establishment of our lifestyles, but from an unusual angle. We examine how values and rules are adopted by people and organizations to become defining features across the systems that support us. Traditionally, these rules embrace fossil fuels; linear, 'extract and discard' production; centralised, globalised mass-production and consumption. This has led to 'socio-technical systems' (more on this term below) or infrastructures for the provision of food, mobility and energy (amongst others) that are unsustainable. The First Deep Transition 'rules' are now crumbling away, with the climate emergency necessitating the race-to- net-zero. Deep Transition Futures looks at how these rules, values and systems can be unmade to catalyze a stable, sustainable Second Deep Transition.

A walk through the theory

The academic definition of a Deep Transition is 'a series of connected individual transitions in a wide range of socio-technical systems.'

ONE

Within Deep Transitions theory, numerous dynamic **'socio-technical systems'** are pivotal in transitioning to a sustainable world. Socio-technical systems theory sits within the discipline of **'sustainability transitions'**. Society and technology continually interact to evolve and shape these systems. Alone, technological development does not drive change – we are not 'technology determined'. The shaping forces of people and society on technologies need to be accounted for. These dynamics influence how technologies emerge, their uptake, and their actual end-use and outcome. The interdependency between technology and society needs a systems perspective that includes all the determining factors in a socio- technical system - science and technology, markets & users, governance and cultural conditions. The components of a socio-technical system, using the mobility system as an example, are shown in Figure 1. Initiating sustainable change in a "socio-technical system" means something very different from just developing new radical technological solutions. Without a dual focus on the 'socio' and the 'technical' a transition will not occur. We cannot rely on technology alone: People matter too.

TWO

We use the **'historical imagination'** to understand the creation of these socio-technical systems. Throughout history socio-technical systems have evolved along certain trajectories of development, shaped by many human opportunities and choices. Understanding potential future paths for new sustainable systems needs knowledge of the historical interplays that produced the current world. The 'historical imagination' identifies what yesterday's alternatives were, as well as those of today. Why did they not come to be dominant? By doing so, we can better understand where tomorrow's prevailing socio-technical system may be advancing from. Take the transport and mobility system - could the horse and cart have evolved towards anything but the car? Were there other feasible alternatives? Why did they halt while the car sped on? Will digitally-driven mobility- as-a-service using bikes, trains and other transport modes lead to a trend in non-car ownership that will shape a new sustainable transport system? Will car ownership ever be viewed as vulgar due to its singular use and excessiveness? We have to explore questions like this to better understand how to create the sustainable systems the world needs.

THREE

The power interplay in a socio-technical system is between "regimes" and "niches" that are influenced by "landscape shocks and pressures". These dynamic shapes a whole process known as a "transition" (or "socio-technical transitions").

MLP MODEL

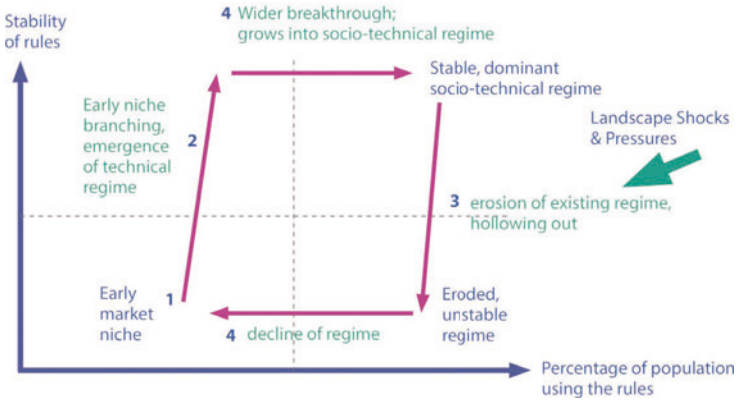


Figure 2: The Multi-Level Model (MLP) showing the dynamic of niches, regimes and landscape shocks (Source: Johan Schot and Frank Geels, 'Niches in Evolutionary Theories of Technical Change', Journal of Evolutionary Economics (2007), 17 (5), 605-622.)

In Deep Transitions theory a socio-technical system is created through the interaction of the dominant system - the "regime" - and emerging, alternative innovations - the "niches". This interplay is shaped by external shocks and mega-trends known as "landscape pressures". A transition in a socio-technical system happens when niches flourish; and the existing, dominant system opens up for reconfiguration due to the pressure of shifting trends in the landscape. For example, the carbon side-effect of fossil fuels is a mega-trend causing global warming andthe climate emergency. This mega-trend exerts 'landscape pressure' that necessitates and bolsters renewable alternatives. The dominant fossil fuel regime is being hollowed out and decentred. Renewable energy, originally a niche player, vies for dominance in the new sustainable regime.

FOUR

In Deep Transitions theory, regimes are seen as consisting of a mesh of "rules" that encompass not only laws and regulations, but societal "rules" around people's routines, expectations, values, norms and mindsets. Regimes are the major configuration at the core of the socio-technical system. Not political regimes but those centred on the social and technological behaviours of actors in the system. These interconnected rules have been shaped through historical trajectories, carved out by a socio-technical system along its rise to primacy. This nexus of rules, that makes up the regime, has a universality across different societies globally; being implicitly or explicitly understood and aligned across multiple actors in the regime – markets, governments, organisations. Alignment and adherence, consciously or unconsciously, to these rules is how a regime remains stable and 'locked-in.' It is therefore hard to change. Niche social and technical innovations can disrupt and 'hollow out' regimes to build fresh pathways to new sustainable systems.

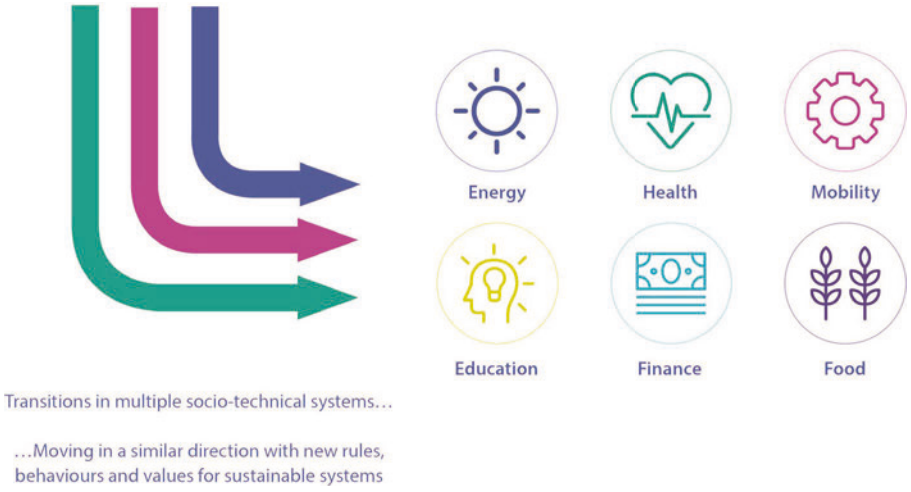


Figure 3: A Deep Transition definition: A transition in direction for multiple, as opposed to single, socio-technical systems. This makes it a 'Deep' transition.

To transform societies towards a sustainable future, we need fundamental change in the organising rules that govern socio-technical regimes. For example, the 'rule' that cars run on fossil fuel is slowly being overtaken by people valuing electricity as a preferred power source. For a sustainable future, rules such as this need to be altered across multiple, interconnected socio-technical systems in society. A 'Deep Transition' (as opposed to a single system transition) occurs when these multiple, interrelated socio-technical systems transform in the same direction. As we will see in point 6, this is a process that is most likely to happen during dramatic 'surges' in technologies or as a response to 'landscape shocks' such as wars or global pandemics.

FIVE

For a Deep Transition to happen, sustainably oriented "metarules" must emerge that succeed in transferring and 'coupling' with other socio-technical systems to inform how they behave as well. For example, the mode of mass production for cars, originating with Henry Ford, and others, in the mobility system, became a "metarule" for manufacturing. Mass production jumped to other systems to create mass consumption opportunities for the production of goods to grow markets. Mass production became the dominant meta-rule of production in multiple systems. For the second Deep Transition, in our sustainable future, will the principles of a circular economy become the meta-rules for production and the manufacturing norm?

SIX

A collection of meta-rules across many socio-technical systems is known as a **"meta-regime"**. These dominated history through **"surges of development"**occurring since the onset of the First Deep Transition in the Industrial Revolution. These meta-regime surges are demonstrated in figure 4.

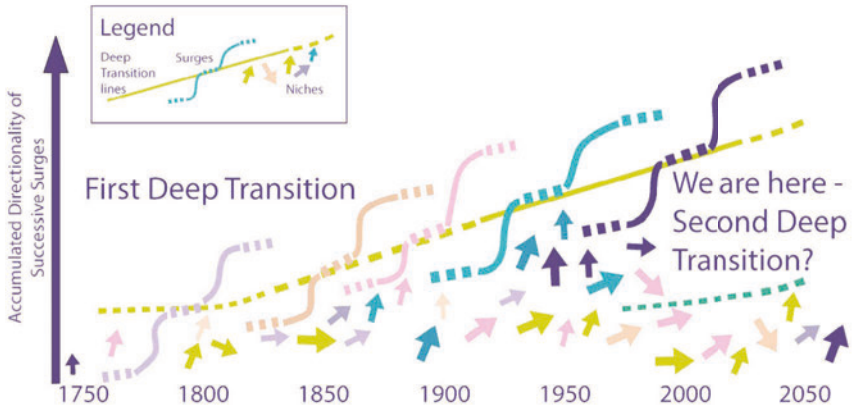


Figure 4: Development surges which create meta-rules and regimes to contribute to the First Deep Transitions progression and directionality (Source: Schot, J., & Kanger, L., Deep transitions: Emergence, acceleration, stabilisation and directionality. Research Policy (2018), 47(6), 1045-1059.)

Since the Industrial Revolution, these surges of development have added layers to the first surge's meta-rule. For example, the hegemony of fossil fuels as a primary energy source is reinforced in successive surges. The accumulation of these meta-rules has propelled the "directionality" of the socio-technical system along an ultimately unsustainable path. These historic surges were driven by public and private investments. Therefore, investments will play a crucial role in shaping the directionality of a Second Deep Transition, and the outcome thereof for our future. This is the principal reason for engaging in the Deep Transitions Futures project.

SEVEN

What does the Deep Transitions theory say about how the Second Deep Transition can be created? A Deep Transitions perspective views the Second Deep Transition as being created through development surges. These surges would be characterised by a stage: **"emergence"** | **"acceleration"** | **"stabilisation"** and **"directionality"**.

The Deep Transitions theory highlights a further five phases in the creation of a transition - the move towards a new meta-regime and how it comes to dominate. For illustration, we can view the ascension of the car through each phase:

Gestation
1801-1890 - The innovative idea of a motorised carriage is developed, becoming a novelty for the rich. In this phase, we see several different technologies being used - there were steam as well as petrol engines at this time, vying therefore, to become the 'rule'.

Irruption
1890-1900 - A rapid proliferation of companies emerged, all focusing on cars for the relatively wealthy as well as some further niches, like race cars.

Frenzy
1900-1903 - Several companies began using mass production, including the one founded by Henry Ford. At this point, Ford was also working on the idea of tractors and farm mechanization - an example of multi socio- technical system thinking, as he began the coupling the rules between the transport and food system. The Ford Motor Company

produces an array of models - A, B, C, F, K, N, R, and S. A similar variety was being produced by others in America and Europe, showing the frenzied activity in the quest for dominance.

Synergy
1908 - Ford introduces the 'Model T' which was intended to be affordable by the people that assembled it. The Model T is a good candidate for the tipping point when one specific new meta-regime prevails. This new regime was then 'locked in'.

Maturity
1945 - Following World War II, the car industry matures with a long run of being the established meta-regime. Prior to WW II there were many couplings that linked car production to other sectors (for example, steel, plastics, glass) in order to service the infrastructure needed for the provision of petroleum, for example paved roads and petrol stations. This demonstrates how links and couplings between socio-technical systems occur and intensify to pervade other systems to influence directionality.

Phase of a surge	Dynamics of Deep Transitions	Characteristics/dependencies	Stage of Deep Transitions
Gestation phase	Parallel emergence in several niches of potential new regimes within individual socio-technical systems operating with different rules and without much coordination.	• Existence of a variety of niche alternatives • Presence of multiple actors • Transnational co-operations	Emergence
Irruption phase	Emerging and incumbent rules compete against each other in individual systems, resulting in conflict between niche and regime actors.	• A mix of anticipated and unexpected interactions occur between niches and regimes and across multiple niches • Pervasive uncertainty about directionality	
Frenzy phase	Different emerging rules of various niches become connected and gradually begin to be consolidated into emerging meta-rules and subsequently produce coordination across the boundaries of new rule-sets and create new links between systems	• Existence of a mix of old and new meta-rules, some of which may be aligned with each other • These meta-rules are promoted by different stakeholders who have different interests and power resources to influence the debate • Functional and structural couplings as well as rhetorical or narrative couplings are produced between emerging niches and among dominant actors with the possibility of coordination between a wide range of actors • The aggregation and intermediation work of national and international organisations may further extend the reach of some meta-rules although alternatives remain in active play and may be endorsed by other national or international organisations.	Acceleration and Directionality
Turning point	Different emerging rules of various niches become connected and gradually begin to be consolidated into emerging meta-rules and subsequently produce coordination across the boundaries of new rule-sets and create new links between systems	• Combined pressure of endogenous and exogenous crises. e.g. the bursting of a speculative bubble around new technologies and nascent industries (endogenous pressure), an exogenous shock or crisis in the larger society (landscape) – tips the contest of the frenzy phase towards the dominance of one or more meta-regimes • Alternative meta-regimes either remain dominant in one specific socio-techncial system or revert to niche remaining, in principle, available as future opportunities. • The newly dominant meta-regime drives directionality across many socio-technical systems and serves as a selection mechanism for further developments	Directionality
Synergy phase	The increasingly dominant meta-regime acts as a selection mechanism for niche rules compatible with its overall logic as well as shaping broader landscape trends	• Continued acceptance of the new meta-regimes from one system to another, resulting in stronger couplings between systems and/or stronger alignment of meta-rules. • Acceptance of compatible technologies and rejecting the non-compatible ones – creating a technological trajectory/path • Manifestations of the surge have becomes firmly embedded in the socio-material fabric of society in a process of sedimentation	Directionality and stabilisation

This Deep Transition Dynamic is illustrated further with detailed graphics demonstrating the phases and coupling mechanism in the Deep Transition Research Paper - Deep transitions: Emergence, acceleration, stabilisation and directionality (Schot, Kanger 2018).

4.1. 2. Five Transformational Forces

Concept approach Visionairy Now - 50 years: 5 transformational forces

Modernistic, Post-Modernistic and Integral society						
Role-Complexity	**Levels of reflection**	**Transformational forces**				
		Imaginative force (Aesthetic) *"Motivation (desire)"*	**Creative force** (Functional) *"Capacity (ability)"*	**Communicative force** (Social) *"Motivation (will)"*	**Perseverance** (Moral) *"Permission (allow)"*	**Inspirational force** (Sense of purpose) *"Motivation (will)"/ Boldness*
Envisioning (Decision horizon Now - 50 Years)	**4th order:** social dynamics >> s->c->r->i (e.g. 'overconsumption')	Theory of Aesthetics (Umberto Eco)	Axioms	Values	Moral imperative ('categories' and intent)	Ultimate purpose (Tleological orientation)
Strategical (Decision horizon Now - 20 Years)	**3rd order:** scale effects, based on lock-in mechanisms and inciting new demand -> c -> r -> i (e.g. optimising 'linear' systems)	Imagination	Methodologies	Legitimation issues ("who is allowed to do what and how do we organise that?")	(Legal)-principles	Commitment-mechanisms ("Interconnectedness") Missions
Tactical (Decision horizon Now - 10 Years)	**2nd order:** consequence- > r-> i (e.g. rebound effect due to increased demand)	Media	Instruments	Lenses ('selective perspectives')	Standards	Change management
Operational (Decision horizon Now - 5 Years)	**1st order:** reaction -> intervention (e.g. price incentives aimed at efficiency improvement)	Design	Techniques	Competences	Rules	Leadership-issues
© Marinus Jan Marijs / Matthéüs van de Pol						

Figure 24. Change strategy based on Transformational Forces

4.2. Change strategy Now – 20 years: X-curve

Change strategy
We focus on the development and stimulation of resilience principles for socio-ecological systems. We contribute to the development of scenarios for a) build up, b) change and adapt and c) phase out as defined in X- curve transition dynamics (Professor Derk Loorbach, Transition Centre Drift), which are explicitly linked to climate and energy transition as well as the digitalisation transition.

The X-curve is a model for transition approach introduced by Prof. Derk Loorbach and is applied by DRIFT. This model combines three perspectives: complex systems analysis, a social-technical perspective and a governance perspective. The focal point is the premise that processes of both buit-up (of new systems and structures) and break-down (of the existing regime) are at the core of every societal transition. A context of autonomous developments (demography, technology, economy and (geo)politics) influences the speed and direction of these processes.

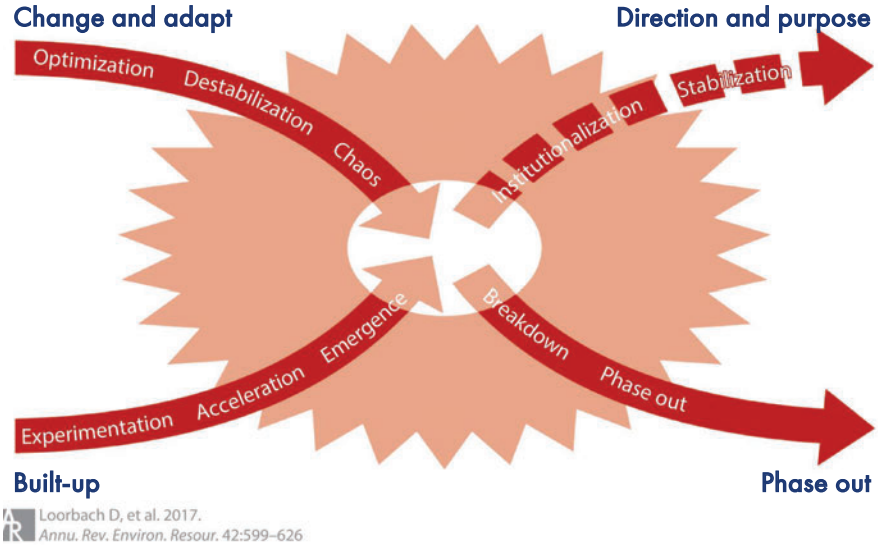


Figure 25. X-curve (Source: DRIFT)

Simultaneous built-up and break-down processes unfold in five consecutive phases:

1. **Optimisation** (of the existing regime) and **experimentation** (radically different visions, structures and practices).
2. **Destabilisation** of dominant systems (crisis and increasing non-functioning) and a concurrent **acceleration** of alternatives where those functions in the system lack. Meanwhile, resistance to change is increasing.
3. **Chaos** due to the (partial) break-down of existing structures, patterns and routines and the seemingly abrupt **emergence** of new solutions and structures. Both the direction of change and the resistance to change manifest.
4. **Institutionalisation** (with new rules, structures and power relations) blocks the reversal of change while old structures, routines, professions, connections and patterns are **breaking down**. Losers are becoming visible. A new status quo is emerging.
5. The old status quo is being **phased out** while the previously alternative structures **stabilize** into a new regime.

Transition points, breakthroughs that disrupt the existing regime and that enable a new phase, often arise from crises, breakthroughs or catalysing events. By collectively embracing these transition points the chances of an effective breakthrough increases. This requires a mix of supporting transition processes: *top-down guidance*, *bottom-up innovation* and *phase-out support*.

The X-curve model can help to understand past and phases* in relation to the ultimate purpose or challenge, to interpret transition dynamics and to reflect on possible future developments.

* The transition of a complex (societal) system never follows one sequential phased path. Each part of the system follows a unique timeline.

4.3. Change strategy Now – 10 years: Motors of sustainable innovation

Change strategy
We focus on the development of mature Mission oriented Innovation Systems for cross-sectoral clusters of product groups ('Mission-driven innovation systems'[4] by Professor Marko Hekkert). Priority interventions are aimed at the following clusters: Capital equipment, Consumables, Materials, Consumer goods and Building and construction.

A Mission-oriented Innovation System (MIS) is defined as 'the network of agents and set of institutions that contribute to the development and diffusion of innovative solutions with the aim to define, pursue and complete a societal mission'. In its essence, the MIS is another type of innovation system, such as the national, regional, sectoral and technological equivalents. However, it differs from the latter in how the system boundaries are delineated, how interactions in this system come about (e.g., demand pull versus supply-push) and what it ultimately produces (e.g., new technological and behavioural solutions).

Agents, or actors, in an innovation system are companies, knowledge institutions, educational institutions, financial organisations, governments and intermediaries. Institutions in an innovation system are laws and regulations, subsidy programmes, formal policy goals, culture, values and habits. Drivers and selectors shape the direction and timeline of the Built-up process of the x-curve (see chapter 4.2.). Drivers, such as entrepreneurs and innovators in innovation hubs, create energy and momentum in the transition. Selectors such as governments, investors and environmental movements can both stimulate and inhibit innovation by influencing legislation and regulations, financing opportunities, lobbying and public opinion and so on.

The (mission-oriented) innovation system model consists of eight processes or 'innovation system functions':

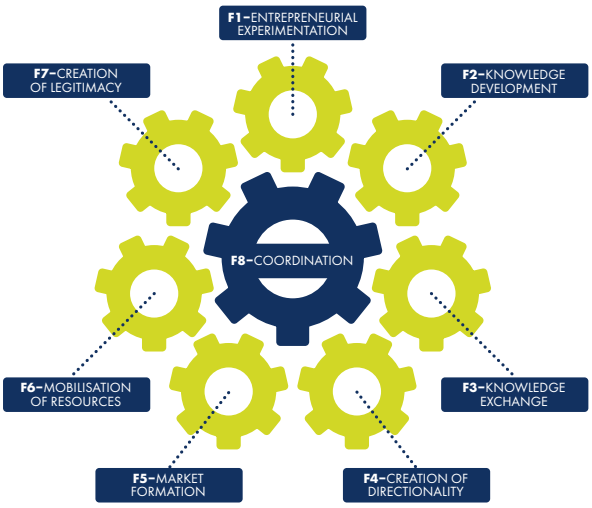
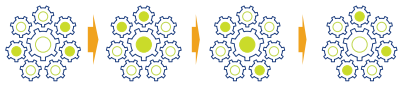


Figure 26. Innovation functions.

These functions can reinforce each other, creating positive feedback and in combination create the preconditions for the Built-up process. These combinations, or motors of innovation, can be used as a framework for designing interventions.



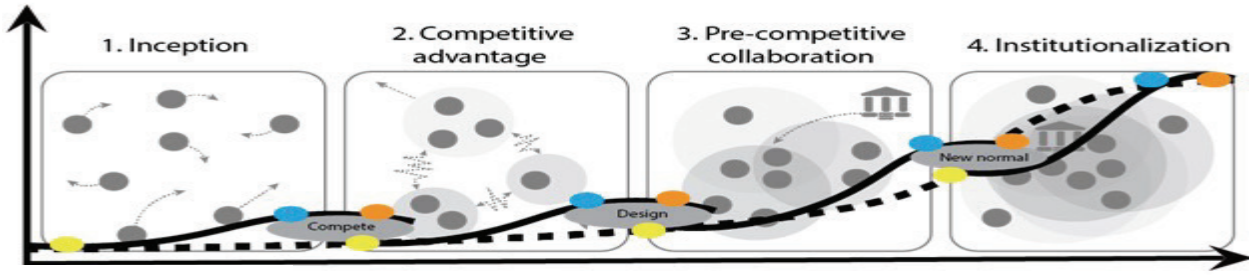
The four successive motors, currently defined (but under consideration), are: the knowledge motor, the entrepreneurial motor, the system building motor and the market motor.

[4] Hekkert, M.P., Janssen, M.J., Wesseling, J.H. & Negro, S.O. (2020). Mission-oriented innovation systems. *Environmental Innovation and Societal Transitions*, *34*, 76-79.

4.4. Change strategy Now – 5 years: Sustainable Market Transformation Strategies

Change strategy
We focus on stimulating market transformation (Sustainable market transformation strategies by Professor Andre Nijhof) for high potential product groups. Interventions are aimed at changing the market dynamics to achieve a higher level of circularity within the scope of the relevant Now -10 years impact goals.

The market transformation model is a framework of multi-actor analysis and systems thinking that can be applied at different scale levels, from individual organisations to national and global levels. This is based on the premise that market transformation for sustainability challenges follow a non-linear dynamic process consisting of four phases:



Awareness and experimental projects emerge but most stakeholders do not engage.	Market leaders try to gain a competitive advantage by focusing on sustainability. This is taken over by competitors	Stakeholders increasingly feel that sustainability challenges as a joint responsibility. This leads to multi-stakeholder initiatives and a sector-wide vision.	A 'new normal' emerges and leaders lobby for legal frameworks that include sustainability. This further normalises sustainable action.

In each phase the dynamics differ. There are different actors and scale levels of organisation, different barriers and opportunities arise and even the pace of transition differs. The market transformation model helps stakeholders to understand these dynamics and to develop strategies and interventions to progress in the market transformation.

Elements	Phase 1: Inception	Phase 2: First mover	Phase 3: Critical Mass	Phase 4: Institutionalization:
Triggers for change	- A publicly visible **crisis** raises awareness, and leads to public pressure to act	- Problems in the sector persist, but there is increasing realization that sustainability can be leveraged as a competitive advantage	- Industry actors realize that the problem will not be solved by competing organizations and isolated efforts, and **efficiency can be found in collaboration** - **Increased awareness** that sustainability issues cause supply chain risks and threaten business models	- **Harmonized initiatives** - Joint capacity building - **Institutionalization** - Involvement of national governments and international bodies
Initial response and level of awareness	- Initial projects start when **public pressure** offer a significant **reputational risk** - Problems are misunderstood resulting in **isolated projects** only addressing visible symptoms	- More should be done to address problems, otherwise they will persist - First Movers realize that they can benefit from **first-mover-advantages** and **marketing sustainability** - Laggards maintain a low profile hoping that attention to the topic fades	- High awareness of the severity of the problems as it threatens business continuity with the level of supply chain risks, and **limited results of previous efforts** - There is a need for the industry and national governments to collaborate, invest and **change the rules of the game**	- High level of awareness of the **interconnectedness** of the sector - How do we **organize ourselves** to change the rules of the game?
Willingness to collaborate with others	- There is a low level of confrontational relationships with industry competitors - There is **growing willingness to cooperate** on projects with those who have credibility, for shared resources and recognition	- **Willingness to collaborate is growing** and other (non-competitors) players can become partners	- Companies are aware that they **need to collaborate**, though they are still relatively suspicious in the beginning, as they remain competitors in the marketplace: there is a need to clarify competitive vs non-competitive issues	- Level of **willingness to collaborate is high**; however, when regulation becomes effective, competitive behavior increases again
Drivers	- To avoid reputational damage - **Quick fixes** proposed as solutions - The focus is on storytelling and **marketing**—'being seen to act'	- NGO campaigning and **media pressure** continues; lawsuits appear - First Mover advantages include marketing & CSR promotion, whereas laggards experience limited pressure to change	- Longer term vitality of the sector - Securing sustainable sourcing - Efficiency of sustainability efforts - **Sharing risks and costs** - Collaboration increases influence on key stakeholders	- Compliance with standards becomes a qualifier for doing business
Limitations to impact & barriers to change	- Projects are **fragmented and competitive** with limited, temporary scope and impact - Projects are **not scalable**, with no real exit strategy, resulting in problems resurfacing due to the root causes not having been addressed	- Farmer change is mainly driven by premiums, expensive **certification programs** and NGO capacity building support for farmers: however, programs can only reach a certain number of farmers and resource use is inefficient due to proliferation, fragmentation, and **competition of standards** - At some point, the **added marketing value declines**, while the costs of the programs continue to rise	- To **build trust** between the parties to collaborate and **share knowledge** can be challenging, as well as determining where the industry works together and where it competes	- Despite having moved the sector on a particular issue, **new issues have already been identified**, progress on which is generally at the start of the curve
Main change agents	- NGOs, media, outsiders, concerned individuals, leveraging public pressure	- First mover companies - Standard organizations	- Neutral **convening platforms** and industry representative groups - Leading **industry groups** in which former competitors work together - At this point, **governments may follow** and support	- Industry lobbies for **level playing field** - Governments and trade organizations protect the rules - **Law enforcement** and monitoring
Main opponents to change	- Beneficiaries of the business-as-usual scenario, often industry, the financial sector, and (local) gov'ts	- Project owners of the first phase of market transformation - NGOs who resist working with the industry out of ingrained distrust - NGOs or capacity builders with vested interest in the booming 'projects industry'	- Resistance or heel-dragging may come from key change makers of previous phase (standard organizations, NGOs, companies), who perceive a threat to their central role as key change-makers; - National governments may resist change as they are expected to commit to something they have not been involved in creating	- Laggard companies, national governments - Standard organizations

Figure 27: *The Market Transformation Matrix with stakeholders, triggers, and barriers.*

4.5. Change strategies for other decision horizons

More in-depth information on the other horizons is available on the website www.maakindustrie.nl . The following documents provide more specific information:

Change strategy 0-2 years

- Circular Business Models: Quick Scan Circular Business Models, Inspiration for organizing value retention in value retention in cycles, Jan Jonker, Niels Faber and Timber Haaker. (Circulaire Business modellen: Quick Scan Circulaire Business modellen, Inspiratie voor het organiseren van waardebehoud in kringlopen, Jan Jonker, Niels Faber en Timber Haaker.)

Change strategy 0-1 years

- How Network Governance Powers the Circular Economy, Ten Guiding Principles for Building a Circular Economy, Based on Dutch Experiences, By Jacqueline Cramer, Amsterdam Economic Board.

Change strategy 0-3 months

- Small Wins: Catrien J.A.M. Termeer & Art Dewulf (2019) A small wins framework to overcome the evaluation paradox of governing wicked problems, Policy and Society, 38:2, 298-314, DOI: 10.1080/14494035.2018.1497933

Change strategy 0 - 1 month

- Tijdig Bestuur, Strategisch omgaan met voorspelbare verrassingen, prof. dr. Martijn van der Steen, NSOB.
- Decision Making under DeepUncertainty, From Theory to Practice, Vincent A. W. J. Marchau, Warren E. Walker, Pieter J. T. M. Bloemen, Steven W. Popper Editors

The change strategy at 0-1 month requires further elaboration. Several UPCM evaluation meetings show bottlenecks in the communication and information transfer. Examples are shown below.

Bottleneck 1: Too easily we assume shared meaning of key information and we act to quickly.			
Known known's	**Known unknown's**	**Unknown known's**	**Unknown unknown's**
"Which companies have applied circular business models?"	"How does smart industry enable a circular economy?"	"How to apply artificial intelligence in a circular economy?'	"What do we mean when we say that we aspire a fully circular economy in 2050?'
Desk research	Interviews/ analyses	Cross-sectoral applications	Envisioning/ philosophy

Bottleneck 2 Knowledge transfer is hampered by different levels of experience and the related frame of reference of the actors involved in de transfer.			
Unconscious incompetence	**Conscious incompetence**	**Conscious competence**	**Unconscious competence**
"We just have to close the loop"	"What are the "quick wins"	"We need this process of exploration"	"Intuitively I feel what we need to do"
Metaphoric solutions	Reflective analysis focused on a predetermined goal or objective.	Working methodically towards a predetermined goal or objective.	Flow of micro interventions towards an emergent goal

5. Intervention logic

How was the intervention logic developed?

The intervention logic was developed in the UPCM in 2021as a next step in the development of the theory of change framework. Several knowledge transfer meetings, working sessions and consultations with the Professors that developed the various frameworks provided the input. This work was integrated and reviewed in June 2021during a large-scale knowledge transfer meeting. After this work continued to define phase specific activities.

At the end of 2021, the recommendations of PBL, the SER reflection group and the Public Value Scan were discussed in the UPCM orchestrating team and it was recommended to:

- *develop a 'roadmap' in which the integral vision on Circular Economy is further elaborated in phases with roles for the government, businesses, consumers and other stakeholders and link these phases to the concrete objectives.*

What is the intervention logic?

In addition to these 'generic' change strategies, the 'Theory of Change' consists of specific intervention logic per decision horizon. The intervention logic is based on the underlying transition theory and describes the most relevant activities (per team). The activities are classified into the four phases of the S-curve, in an ascending order of innovation.

Reasoned from the current practice, each phase needs the lead time of the decision horizon, so for example the four phases on the Now – 1 year horizon take a total of 4 years. However, the estimated systemic acceleration required on each decision horizon will need to be exponential. So not all four phases in X years multiplied by four, but ideally all four phases in X years.

An exponential change requires a shared awareness about the phases and a governance focussed on phase shifts. From a programmatic point of view, it is paramount to recognize in which phase the transition dynamics occur to access the time needed to realize a next phase shift.

This Theory of change creates a narrative that could frame the governance and organization of different teams. Using the intervention logic, teams are more able to design, plan, and execute the necessary activities. The intervention logic is a means to coordinate activities.

The table below structures the main activities per phase and per decision horizon. This is a first concept that needs to be developed in close cooperation with the Professors that developed the various frameworks.

Change strategy	Intervention	Phase 1	Phase 2	Phase 3	Phase 4
Now -20years: X-curve (Derk Loorbach)	Maintain variation and redundancy	[Mobilise resources adn experiment]	[Create relevant new coalitions and networks]		
	Control slow variables and feedback	[Increase external pressure and urgency]	[Challenge existing structures]	[Break dow.. adopt, phase ou.]	
	Manage connectivity				
Now -10 years: Mission-oriented innovation systems (Marko Hekkert)	F4 Directionality of problems and solutions	Develop TRL/SRL innovation funnel	Portfolio governance KET's/KEM's	[Select key enabling technologies]	EU innovation framework
	F8 Coordination	[Governance perspective DRIFT/NSOB]	[Governance perspective DRIFT/NSOB] [Challenge establishment]	[Governance perspective DRIFT/NSOB]	[Governance perspective DRIFT/NSOB]
	F5 Market creation	Stimulate local experimentation space Enable scale-up (X-curve)	Adjust EU legal frameworks Connect and structure (x-curve)	Stimulate symbiosis with EU Region Define direction (X-curve)	Consolidation of EU legal frameworks
Now - 5 years: Sustainable Market Transformation (Nijhof/Simons)	F1 Entrepreneurial Activities	Define market (maturity)	Stimulate competition (certification, benchmarks)	Pre-competitive collaboration	Adjust investment frameworks
	F2 Knowledge development	Analyse sustainability issues & system loops	Improve of develop pricing platforms	Mapping required systemic interventions (DDT's)	Define education requirements
	F3 Knowledge diffusion	Select sustainability issues & define market vision	Combine supra-regional market demand (e.g. circular procurement)	Develop sector strategy	Adjust supra-regional conditional policies
Now -2 years: Circular Business Models (Jan Jonker)	[KET & practice]	Experiment using alternative business models	Improve or develop financing instruments	Organise field labs ecosystem	Organise theme specific financing
	Standards	Clarify shared principles	Facilitate standards / monitoring frameworks	Stimulate network data-integration	[Analyse consumer behaviour]
	[Regio-versnellers]	Combine and transfer experience / knowledge	Strengthen diffuse regional network(s)	Inter-regional knowledge transfer	[Diffuse community knowledge]
Now -1 year: Network Governance (Jacqueline Cramer)	Transition broker (Prof. Rogers)	Matching (innovation. – internal problems.)	Redefine/ restructure	Clarifying	Routinizing
	Support	Survey innovation(s)	Apply Key Enabling Methodologies	Cost / benefit balance	Monitoring
	Commit actors	Define action plan	Analyze stakeholders & actor groups	Communicate success stories	Communication strategy
Now -3 months: Small Wins (Katrien Termeer)	'Deep change'	Provocative ambition	Proposition definition	'Experiment'	Define Business case
	'Scale-up'	Problem analysis	Integrated scoping	'Connect' (across scale & domains)	'Robustness'
	'Diffuse' (Prof. Rogers)	Support early adopters	Mobilise influencers	Convince early majority (logic of a.)	'Dissemination'
Now -1 month: Steering information [NSOB]	'Versnellinghuis'	The journey	Customize	Match making	Referral
	Deep uncertainty	Foresight	Adaptivity	Extrapolate	Casuistry
	'Circularities'	Active practice	Conceptualize	Reflective observation	Concrete experience

Appendix 3. Basic Principles of the UPCM

The Circular Manufacturing Industry Implementation Programme (UPCM) is based on the following basic principles:

- Goals and targets are initially derived from the vision and ambition in the transition agenda
- We distinguish several decision horizons.
- Goals and objectives are aligned with the UPCE integrated goals- and objectives system ('doelensysteem')
- Programme setup with a three-pillar structure and steering.

In the current (2019) coalition agreement, the development of the circular economy is framed by the climate challenge. This includes a focus on the implementation of CO_2-reducing projects and actions.

Transition agenda
The Dutch manufacturing industry wants to contribute to the development of the circular economy to both achieve social goals and strengthen its competitiveness. This is implemented through cooperation between the business community, knowledge institutions, the authorities and civil society organisations. The strategic goals, vision, analysis and action lines from the Circular Economy Transition Agenda for the Manufacturing Industry (CETAM) serve as the initial framework for the implementation programme. The seven defined lines of action provide the focus for accelerating a successful transition. The agenda is reviewed annually and updated if required.

Integrated goals and objectives system
Strategic decisions (results and goals) in the CM implementation programme are aligned with the 2050 ambition for the circular economy.

Programme setup in three pillars
The programming is organised along three crucial governing pillars of activities:

- **The implementation of innovation- and investment projects through selection and resource management.** By mobilising resources to stimulate new and impactful projects that directly contribute to the goals of the transition agenda we increase the alternatives in the transition process. The portfolio, the criteria for these projects and a substantive roadmap are currently (2019) in development.
- **Accelerating the transition by sharing knowledge and experiences.** The transition will benefit from a specific learning and knowledge infrastructure. This requires the development of an active network of stakeholders who contribute to this learning process. Among others, the network consists of the innovators, early adopters and knowledge institutes.
- **Awareness and dissemination.** The transition will emerge as a result of shared responsibility and ownership from industry, government and society. Therefore, the Circular Manufacturing Industry approach heavily relies on building up the CM community, linking up with other relevant initiatives (national and international) and activating 'new behaviour'.

In essence, transitions are emergent processes, that are enabled when various initiatives, parties and networks join forces. Every activity in the system is significant for other parts the system. The success of all activities is highly dependent on the synergy that occurs between actors that work within their own strengths and autonomy. This synergy towards common goals is more likely to occur through alignment, coordination, and direction than through hierarchical control. At the same time, a certain formal structure is needed to deploy resources effectively and make crucial decisions. It is the art of finding the right dynamic balance.

The three pillars function as a backbone of communication between the teams, organisations, partnerships and networks. The realization pillar governs result commitments (performance and/or effect goals) from the parties involved. In the acceleration pillar, cooperation is based on best efforts agreements. The awareness and dissemination pilar (upscaling pillar) the governing is implemented via a coordination process among actors in the 'coalition of the willing'. The phrase 'upscaling' has been chosen as a synonym for 'increase in scale'. It is about upscaling in the broadest sense of the word – actors, chains, product groups.

In each pillar, we ensure integral adjustment of goals, objectives and activities at the various decision horizons.

Dimension	Realization	Acceleration	Upscaling
Primary success factor for accelerating the transition	Realise, or stimulate, a portfolio of investment projects	Development and/or transfer of knowledge and best practices	Collective awareness or sense of urgency among a wider public (market and society)
Type of activity	'Autonomous' and/or independent activities	Interdependent activities (e.g., value chain cooperation)	Awareness and dissemination
Agreements	Result commitments	Best effort agreements	Willingness to coordinate
Roles	Accountability ('mandate')	Interdependency	Social responsibility
Required Support	Executives	'Coalition of the essentials'	'Coalition of the willing'
Adaptivity	Hierarchical ('top-down')	Holacratic ('bottom–up' & 'top-down')	Open networks

Each actor has a role in the multi-level and multi-actor governance. Roles are designed to enable effective cooperation and execution of activities. In practice, this means, for example, that collaborations focus either on the Now – 5 years or on the Now – 10 years decision horizons. Depending on the purpose of the pillar, team objectives and the related project portfolios differ as well.

Governance functions

Developing a coherent governance system is not a simple task. Governance functions enable actors to set up mutual governance agreements, that detail effective governance processes and responsibilities. The adjacent table gives an overview of these functions. This aims to support the development of a coherent government system[5] and related Public Administration tasks.

Decision horizon	Realization pillar	Acceleration pillar	Upscaling pillar
Now – 30 years	Determine CE ambitions on time horizons and envision transition approach	Develop transdisciplinary visions of the future	Create relevant social and political interaction
Now – 20 years	Commit partners to collective realization efforts	Adjust the search process and directionality (roadmaps, transition paths)	Antenna function
Now – 10 years	Organise collective efforts in public-private partnerships	Continuous development of 'CE intervention expertise'	Stimulate (regional) networking
Now – 5 years	Set up and execute programmes and projects	Knowledge transfer in projects and applications	Disseminate knowledge and accelerate existing initiatives

The implementation of these governance functions is preferably aligned with existing infrastructures and networks. It is prerequisite that existing organisations are willing and able to take responsibility for the functions (with corresponding responsibility for the goals that are defined in the 'doelensysteem'). (Source: 201812102 Advies Governance Rijk CEM.docx)

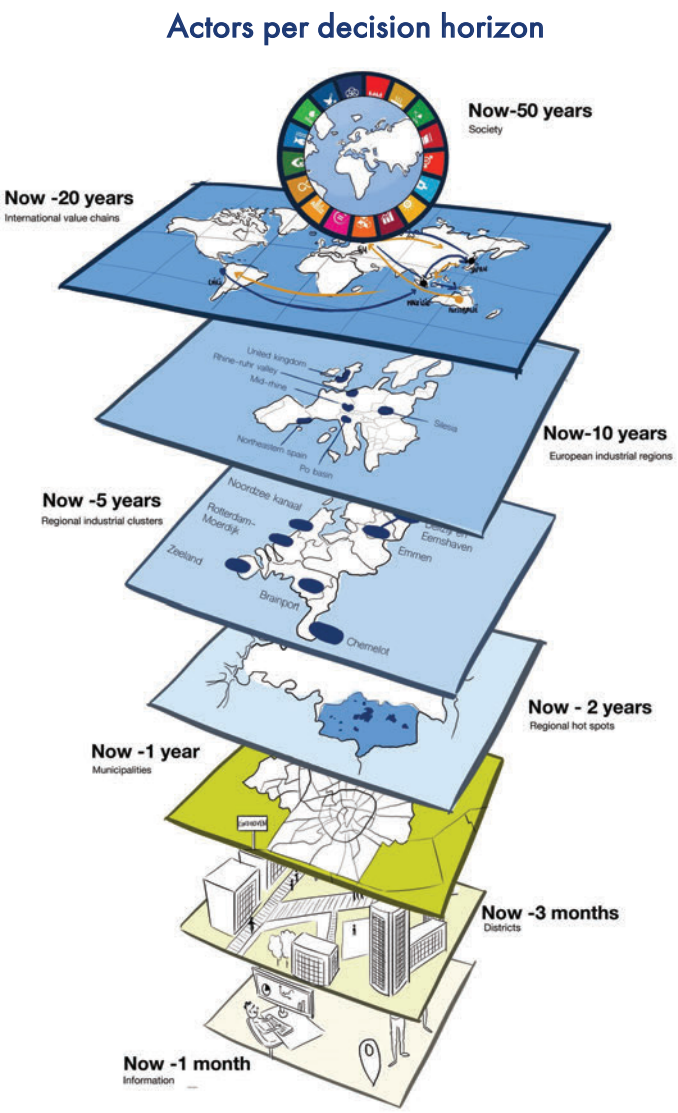
[5] Note in June 2019, these governance functions were translated into and implemented in the CM 2019-2013 implementation programme. This can also be used in other implementation programmes.

Appendix 4. Stakeholder approach

The UPCM approach is grounded in the principle that transitions are emergent processes, that are enabled when various initiatives, parties and networks join forces. This cooperation will create the requisite momentum and synergy provided these actors work on common goals and engage with their strengths and autonomy. Therefor actor analysis and an effective stakeholder approach is paramount in activating the cooperation.

5.6.1. Actor Analysis

The 'innovation system' of the Dutch manufacturing industry consists of more than 44.000 active companies and numerous other actors such as knowledge institutions, other businesses and industries, financial institutions, government, NGO's, etc. Active involvement of the right actors in a certain phase of the transition, by aligning transition-activities, -initiatives and interventions, will accelerate the transition. The starting point for this actor analysis is a framework of change strategies per decision horizon, with increasing levels of complexity and uncertainty in outcomes.



	ACTORS
Now -50 years	Social-political shifts, ideology, societal level.
Now - 20 years SBI 1 Sectors	Institutions, strategic value chains, infrastructural level.
Now -10 years SBI 2 digit Sub-sectors	Innovation system (actors) / (Umbrella) clusters of product groups, production process-level.
Now - 5 years SBI 3 digit Industries	Market players product group (B2B/B2C/etc), product group-level.
Now - 2 years SBI 4 digit Categories	Value / production chain players, Chain links, level.
Now - 1 year SBI 5 digit Companies	Innovators, organisation level.
Now - 3 months LISA	Change makers, department level, establishment.
Now -1 month	Programme-users, individual level, information channels.

Figure 28. Actors per decision horizon.

A set of tools processes information from many different sources and prioritises actors using intelligent selection logic:

- For the Now -10 years decision horizon a data analysis tool selects the most important (direct and indirect) actors within the predefined clusters of product groups. The innovation scan collects and processes the perception of the innovation functions for these clusters. The context scan consecutively visualises the different value systems of the actors in the innovation system.
- For the Now -5 years decision horizon a data analysis tool creates a map of the interdependences between the most important circular activities in and across regions. This information is upgraded using value chain maps from the project 'Ketens in Kaart'. This project has also resulted in a value chain tool for activity-based modelling of production chains, that helps recognise patterns in decision making.
- For the Now - 2 years decision horizon the TNO impact tool is used to identify high impact regional clusters.
- For the Now - 1 year decision horizon a data-analysis tool with a predictive algorithm spots relevant companies in each sector, product cluster and province. This algorithm recognises the 'pioneer level' of actors and their most relevant value / production chain partners.
- For the Now - 3 months decision horizon tools to identify changemakers are not yet available.

Information and reporting structure

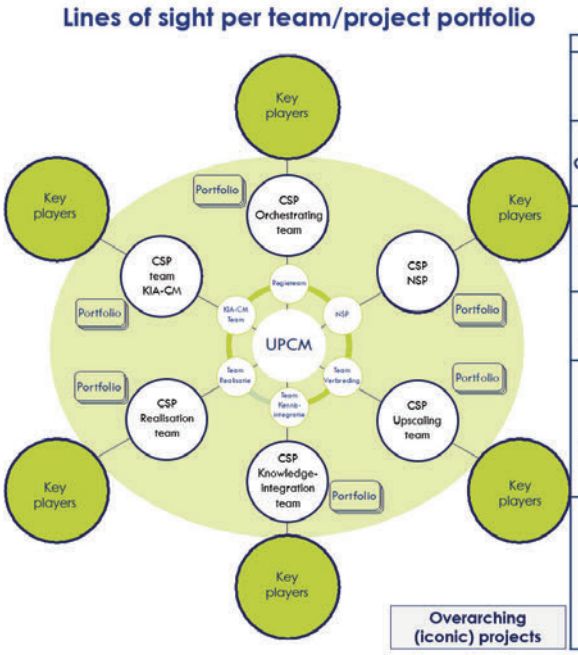
The UPCM information and reporting structure defines the required information and the available data sources for the monitoring of performance objectives and impact goals per decision horizon. The data from these sources, in combination with the actor classification (see above), will eventually enables us to quantify and monitor the impact of stakeholder activation and / or other transition activities. The UPCM information and reporting structure is in alignment with the Integral Circular Economy Report (ICER) by the Netherlands Environmental Assessment Agency (PBL).

5.6.2. Programme stakeholder approach

The UPCM teams (see chapter 5) rely on sufficient means (technology, funding and competent people). Effective operation of these teams requires active support and pooling of resources of important supporting stakeholders in the transition ecosystem.

We secure this with a Course Setting Platform (CSP) per team with committed and relevant stakeholders from the entire value chain. These stakeholders might be involved in several CSP's if required. We suggest to these stakeholders to pool as many (scarce) 'resources' as possible, such as money, attention and legitimacy, and to run projects under guidance of the relevant UPCM team. As a result, stakeholders work together in executing and supporting the portfolio of projects per team. This also enables a collective evaluation of impact ('are we doing the right things'). Since the leaders of the cross-sectoral themes of the national implementation programme CE participate in the CSPs, targeted improvement proposals can be drawn up to remove barriers in the enabling 'system'.

The CSP's create so-called 'lines of sight' which foster fast coordination and adjustment throughout the system to accelerate the CE transition in the manufacturing industry. Requisite political attention and new resource for future activities are mobilised by a specific group of stakeholders: the Key Players. Examples are company directors and large platform organisations. The UPCM teams, (proposed) course setters and key players are described in Chapter 4.



	Key players	Course setters	Portfolio i.e:
CSP Team KIA-CM	• 'Regieoverleg MTIB'	• KIA CE: mission team CE, focus group • DDT (monitoring), knowledge & innovation	• Heavy Duty Batteries (NWO)
CSP Orchestrating team	• 'Bestuurlijk Overleg' • SER DUO commission	• 'SER Reflectiegroep' • 'Interdepartementaal Directeurenoverleg' • 'Opdrachtgevers-Voorzitters-Overleg' (OVO)	• Vision landscape methodology
CSP Netherlands Strategic Platform	• EU (ntb) • PACE, Capital Equipment Coalition • VNO-NCW, FME, KMU, NRK, VNCI	• Provinces • Min EZK, Min BuZa. • Holland Circular Hotspot • DDT international commitment.	• Circulair Wind farms
CSP Team Realisation	• Financiers (banks, DNB, InvestNL).	• DDT financing tools, DDT circular purchasing. DDT market impulses. • ROMs	• Solar PV systems • Batteries • High Tech Equipment
CSP Team Knowledge integration	• VNO-NCW/ MKB-NL • TO2 institutions	• Provinces • FME, KMU, VNMI, MRF, Techniek NL • DDT circular design, DDT prod.-responsibility. • Stichting Open • NEN • PBL	• Heat as a Service • Value chains identified • Cluster roadmaps • Circulair Materials passport
CSP Team Upscaling	• Provincial Executives (Gedeputeerden)	• Smart Industry programme • FME, Koninklijke metaalunie • Min. EZK, Min. I&W • Provinces N-Brabant, Overijssel, Gelderland, Zuid-Holland • DDT Behaviour & communication, education and labour market. • CE regional approach	• Smart & Circular (CESI) • Knowledge dissemination (website, events) • Online communicatie • Raw materials scanner

Figure 29. Lines of sight.

The UPCM's stakeholder approach is structured in five iterative steps:

- Step 1 – Stakeholder identification. Identification of the most relevant stakeholders per decision horizon for achieving the performance objectives.
- Step 2 – Playing field mapping, creating a coherent picture of the playing field
- Step3 - Issue analysis. What are the stakes of the identified stakeholders?
- Step 4 – Strategy definition. In this step we decide how to engage important stakeholders or change makers in participating in the UPCM organisational ecosystem.
- Step 5 - Recalibrating the information and communication structure. In this step we recalibrate, update and filter existing sources of information in preparation of the next cycle, starting from step 1.

Stakeholders	Playing field	Issues	Strategy
For each (group of) actor(s) in the organisational ecosystem of the programme: • Relevance for performance objectives and impact goals • Perceived sense of urgency • Attitude towards change strategies • Role (commissioner, buyer, supplier, executor)	1. Influence-matrix (importance/influence) 2. Playing field mapping with the Innovation scan (innovation system functions or barriers) and the context scan (value systems)	Per group of actors: • Important issues and themes of the relevant stakeholders. 	• Which approach will enable a successful realisation of the change strategy per decision horizon? • Which players to involve and with what purpose?
Output: Who has or could have what role in the organisational ecosystem of the programme: - CSP. - Teams. - Projects.	Output: Playing field map	Output: An overview of issues that require attention and / or an intervention.	Output: • Team tasks • Targeted communication strategy

Figure 30. Iterative steps of the UPCM stakeholder approach.

Step 1: Stakeholder identification

We identify relevant (groups of) stakeholders for each decision horizon:

- **Decision horizon Now – 5 years**: Identifying subgroups of organisations for the relevant sectors in the manufacturing industry based on the SBI code(s) of these organisations.
- **Decision horizon Now – 2 years**: Identify relevant (impactful) value chains and related organisations.
- **Decision horizon Now – 1 year**: Identify innovators and early adopters (Adoption theory of Rogers)
- **Decision horizon Now – 3 months**: Select relevant change makers. Change makers are important people or networks in the transition to a circular manufacturing industry. Directors/owners, innovation managers, technicians, consultants or people in sales and marketing.
- **Decision horizon Now – 1 month** (reporting / communication): Identify reporting a communication to four types of stakeholders: users (output side = target groups UPCM), implementers (cooperation side = implementation within UP CM teams), suppliers (input side = course setting meetings) and decision makers (control side = governance UP CE).

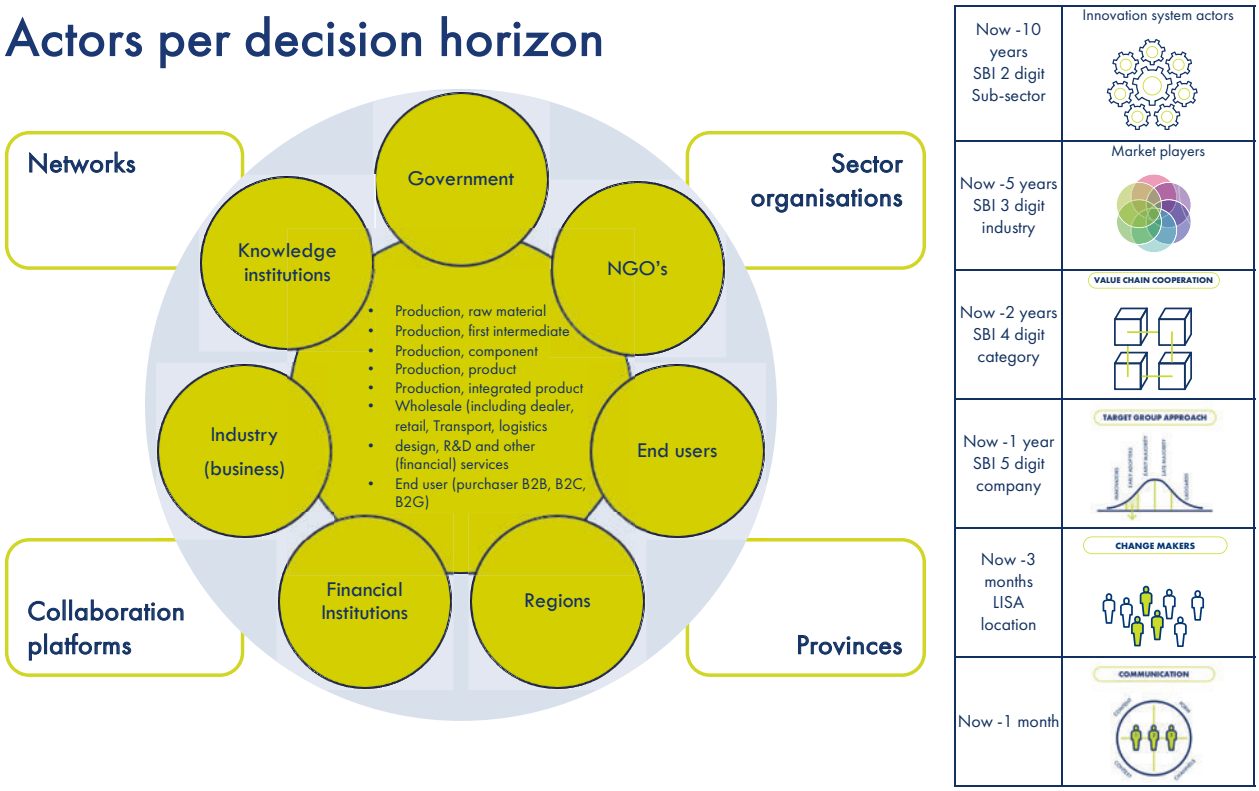


Figure 31. Actors by change strategy and decision horizon: corner stone of the stakeholder analysis

Step 2: Playing field mapping

Previous steps provide the input for this step. We create map of the playing field in three dimensions: actor relevance for the innovation system functions (to be defined), the mendalow dimensions (see below) and de values system analysis (see Appendix 6 project guidelines, context scan).

The Mendalow matrix maps players based on influence and importance. Both positive and negative interest is relevant to determine and involve players. Influence is determined by several factors: money and power, but also for example prestige, network and knowledge.

- High level of influence – high degree of importance: important stakeholders, such as the project sponsors, who can help with budget, capacity and knowledge need to be informed and involved at an early stage.
- High level of influence – little importance: the 'potential bomb'. Players with little but growing interest or importance that need to be on the course and status of the programme.
- Little influence - high degree of importance: the 'cheerleaders', those who support CE and the Circular Manufacturing Industry but have little influence. Important partners for the envisioning of the future.
- Little influence – little importance: Don't spend too much time on these parties. Monitor relevant players.

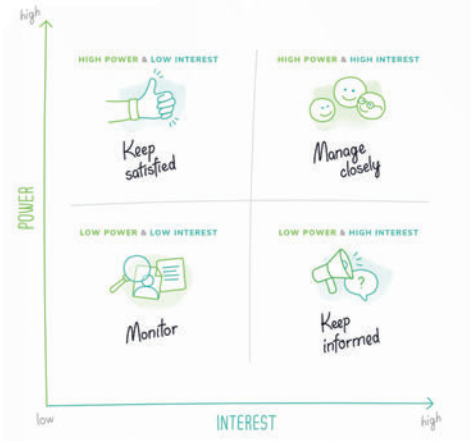


Figure 32. The Mendalow matrix.

Step 3: Issue analysis

The objective of the issue-analysis is to create a collective understanding of specific interests of all actors in the playing field:

- What opportunities and threats do they perceive?
- What benefits could be achieved?
- What's in it for them? How can they score with CE?

The actors are further categorized into their role:

- Users: output side; or UPCM target groups.
- Executors: partnership side; or execution in UPCM teams.
- Suppliers: input-side / course setting platforms.
- Decision makers: steering side / governance (Implementation Programme Circular Economy (UP CE)

Step 4: Strategy definition

This step is focussed on identifying stakeholders and / or change makers which need to be involved in the projects, teams or the course-setters' meetings. It is also important to identify what other stakeholders in the organisational ecosystem of the UPCM need to be mobilised to ensure continuity and progression in the transition. The approach for defining the change makers strategy is still being elaborated.

Step 5: Recalibration of Information and communication structure

In this step we recalibrate, update and filter existing sources of information in preparation of the next cycle, starting from step 1. Recalibration is also aimed at the structure and content of reporting.

Appendix 5. Envisioning and communication strategy

Introduction

The circular manufacturing industry implementation programme (UPCM) aims to support companies in the transition to circular solutions and processes. Awareness- and competence levels among the companies differ from no awareness and competence at all to skilled innovators.

Interviews were the input to an initial communication and envisioning strategy to activate companies via the UPCM. The goal: ***to inspire companies to take circular steps***. These interviews focussed the question: What stories and images activates companies to take next steps towards a circular economy? Subsequently the answers form a content and communication platform for effective communication to the various target groups.

Target groups

Within the scope of de Rogers adoption model, we focus primarily on (creating) an early majority. This implies a transfer of inspiring stories and images from the 'innovators or early adopters' (manufacturing companies that experiment with circular solutions) to the early majority.

Message

Circularity is an important enabling factor in reaching global sustainability goals. Circularity implies another way of thinking and working with guiding principles such as:

- sustainable design for disassembly and repair.
- high-quality reuse of materials and products.
- recovery of components or raw materials at the end of a product's life cycle.

This requires the development of new techniques and new ways of producing and consuming. New opportunities arise for the manufacturing industry. The existing technical knowledge creates a competitive advantage.

"Fascinating new technology and new business models. It is precisely now that the manufacturing industry has the opportunity to step up towards working circular."

Transitions are a process of discovering possibilities step by step. A process of prototyping and selecting the best practices. To change is easy when you change collectively with others in the value chain. The Sustainable Manufacturing Platform (red.: UPCM) helps you to take steps in this fascinating and technically innovative transition.

Aim

Communication aims to inspire companies to take steps towards a circular way of working.

Knowledge: I know what circularity entails and that it offers fascinating opportunities in terms of technology and business models.

Action: I search for inspiring examples from fellow entrepreneurs. I apply the advice and tools from UPCM in my business context, both as an individual company or as part of the values chain cooperation.

'Inspire companies to take steps'

Core message

"Transition step by step, at the pace that suits your business or aligns with chain developments.'

The circular way of working is technically fascinating and innovative; it offers companies the opportunity to get a head start and be prepared for the future.

It also offers opportunities due to new business models (for example, product as a service).

Joining the circular economy movement is a step-by-step development process.

Promise to the target group: We help you take steps into the fascinating and technically innovative world of working circular.

Visual concept

Basic principle
The concept must fit the target group, be appealing and distinctive. The interviews show that the target group appreciates images that connect technology with people. For the main images, we make portraits of people (entrepreneurs) who already made an inspiring step on the road to working circular. These portraits will be made in an environment that is related to this step (technology).

Image characteristics
The images need a number of characteristics. These include:

Light and bright
The circular future is positive. So, we assume images with a lot of light. Bright Factory floors, white workspaces and sunny outdoor locations.

Concentration
The entrepreneurs do not pose and are not portrayed straight on from the front. They do not look straight into the camera either. 'Action' photos portray the entrepreneurs as if they are 'caught in the act', in a moment of concentration. That concentration represents their fascination with technology and innovation. Other people in the background indicate shows that you are doing it together.

"Ondernemers worden 'gevangen' in een moment van concentratie."

Basic principles of the image database

The image database must be flexible and deployable for a long period of time
- Content must not be too specific.
- Content must be easy to expand.
- Content must offer enough variety.

The images must be of good quality
We want a serious, business-like appearance with a good image quality in terms of composition, colour and so on. No snapshots.

Building an image bank
Create a distinction primary and supporting images.

Primary images (minimum 5)
Proprietary photography, conceptually appealing. To be used for landing page, front cover brochure and posters.

Supporting images
Stock photography or proprietary photography. Informative and supporting text. Use for follow-up pages, web environment and brochures, presentations.

Appendix 6. Project guidelines

The project guidelines provide binding quality criteria for the selection, definition, implementation, and evaluation of projects that are carried out with funds provided by or through the UPCM. The aim is to make the best possible use of the programme- and project resources and to ensure that the combined project portfolio contributes to the programme's goals. It is about a balance between impact (doing the right things and agility (doing things right).

A project is a collection of activities with a specific output (activity result) that contributes to the impact goals of the roadmap and that meets the following criteria: a) clear executive, b) unambiguously defined result, c) delivery date, d) available resources and e) verifiable quality criteria.

Project phases:	INITIATION PROCESS	PHASE 1 PROJECT DEFINITION	FASE 2 STAKEHOLDER COMMITMENT	PHASE 3 IMPLEMEN-TATION	PHASE 4 EVALUATION
Quality criteria - Result	• Contribute to roadmap • Within scope	• Commitment probability • High impact	• Context alignment • Joint commitment • Interdependency • Resource allocation	• Contribute to impact goals (roadmap) • Specific criteria	• Achieved project objectives • Contribution impact goals • Adjustment of roadmap
Quality criteria - Process	• Context scan • Assessment framework • Project criteria	• Stakeholder Analysis • Fingerprint analysis • Project Brief • Required resources	• Stakeholder Analysis • Fingerprint analysis • Project Contract • Other quality criteria	• Report • Risk analysis • Critical path analysis • External communication	• Evaluation report • Learning session
Coherence and alignment with	Necessary roles within UPCM				

Figure 33. Project guidelines.

For each phase, binding quality criteria have been defined to assure the quality of results (doing the right things) and to assure the quality of the process (doing things right).

Quality criteria for project results are derived from the goals and scoping in the roadmap. The roadmaps are approved by the Orchestrating Team. Project executives might add other specific criteria. Minimum quality criteria for the process are determined by the support team.

The overall project portfolio governance is detailed in Chapter 4.2. of the 'UPCM Transition Approach'. Project set up might differ per project. It is the intention to apply principles and best practices as described in 'Projectmatig Creëren 2.0.'. Basically, the project leader has a pivoting role in the communication and in aligning executives, project members, suppliers and users.

The project leader is responsible for:

- Context alignment (business eco-system)
- Increasing joint commitment
- Creating awareness of interdependencies and social cohesion
- Mobilising resources
- Quality assurance of results and project process
- Reporting, planning and time management

The team leader of the relevant team is the project principal.

The project leader communicates with other relevant roles within the implementation programme to ensure a coherent quality assurance and project control. See the complete version of the guide (in Dutch) for a description of the roles.

Requisite role alignment

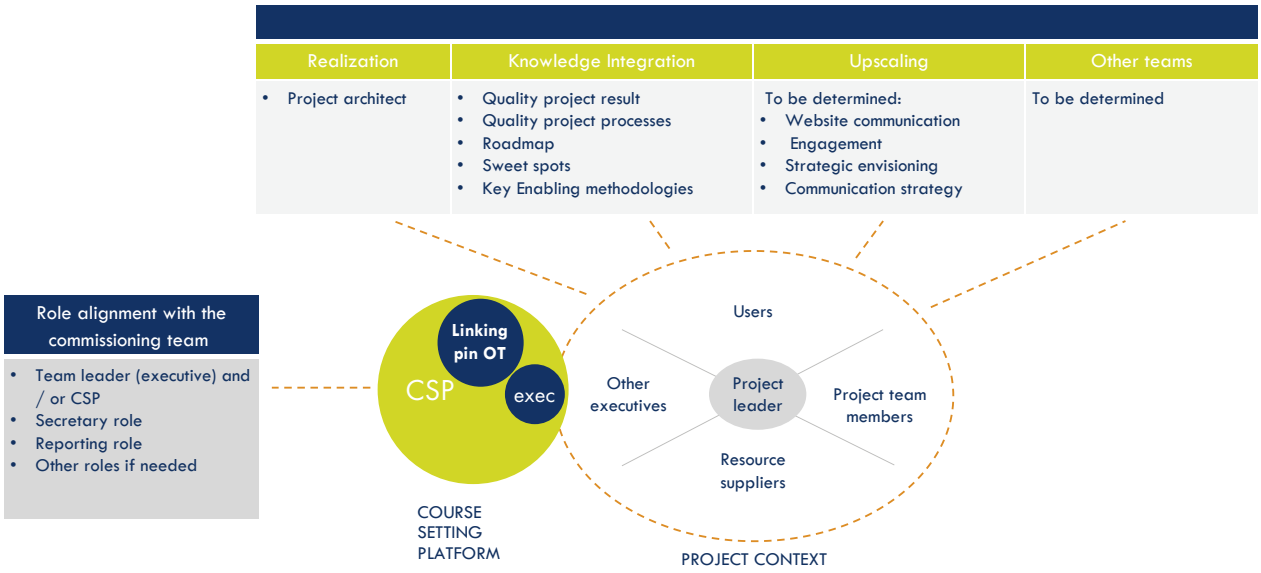


Figure 34. Role alignment in the project environment.

Initiation process

The initiation process precedes the project, and a project leader is not appointed yet. In this stage opportunities and initiatives emerge, but a project is not yet feasible. This stage ends when the following criteria have been met:

Quality criteria result (doing the right things)

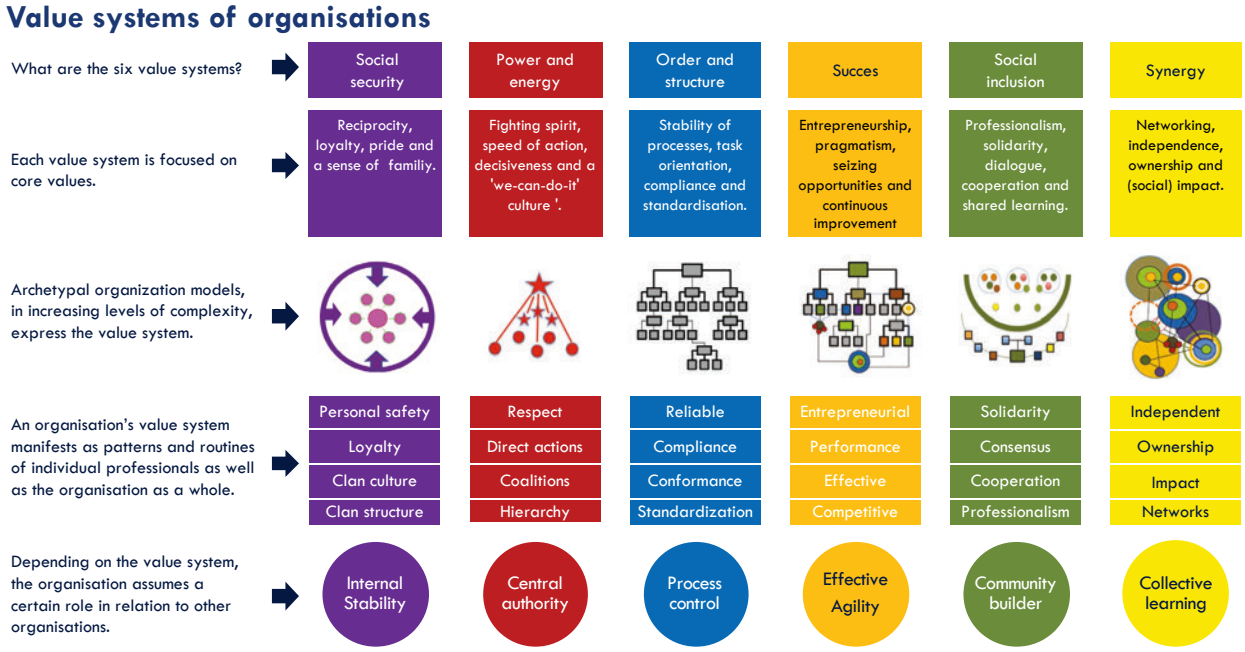
- The project contributes to the performance objectives and/or impact goals in the roadmap.
- Project results are within the UPCM scope (sweet spots.
- The intended project leader has been selected.

Process quality criteria (doing things right)

1. Initiation process has been coordinated with the relevant roles in the UPCM.
2. Quality criteria for results have been assessed using UPCM tools:
    a. roadmap 2.0 (contribution to goals).
    b. impact indication projects (checklist to determine project impact potential).
    c. context scan (assessment of project environment).
3. In this phase, the UPCM team leader ensures that:
    a. Project executive is identified (the team leader of the team that coordinates the project portfolio) and 'course setters' commitment is feasible
    b. a clear onboarding profile for the recruitment of the project leader.
    c. Results are defined (in the form of a 'project proposal').
    d. Expected delivery date is defined
    e. Funds are or will be available from the team budget, from the programme budget or through the course setters.
    f. it is clear how the success of the project will be assessed (verifiable quality criteria for the project result).

Context scan

Projects are nodes in a network of organisations. The project team is both an extension of those organisations and a team with its unique identity and role. Hence, there are several perspectives, stakes, and underlying values that shape the playing field around the project. For the project team the project environment is a context with people, organisations, structures, and values systems. The context scan provides an overview of the various perspectives.



Marcel van Marrewijk (2011, 2014) Cubrix, zicht op organisatieontwikkeling en performance verbetering/Handboek Organisatieontwikkeling – bouwstenen voor beter organiseren (Boom)

Figure 35. Value systems of Organisations.

Survey results from various participants create a context-profile, clarifying in what way(s) the environment (context) may influence operational, tactical, and strategic decision making and how to collaborate in a project, programme, or value chain. This context-profile can be used in a learning session to create a share vision on topics such as communication, governance, and cooperation within the team and with other stakeholders.

	Action perspective partnership
Communicative paradigm	• Discuss cohesion and dependencies • Jointly evaluate and learn. • Focus on envisioning the future • Align cooperation, synergy themes and system view with with stakeholders.
Control paradigm	• Agree on process, purpose, performance objectives and impact goals. • Focus on milestones, results, budget and scope • Align process and monitoring with stakeholders.
Authority paradigm	• Agree on responsibilities. • Identify stakes and focus on autonomy . • Align frameworks with stakeholders.

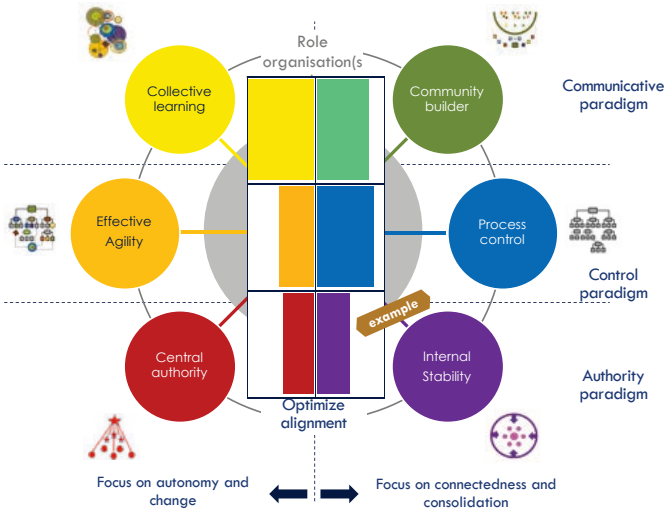


Figure 36. Action perspective in and of the partnership

Project definition (Phase 1)

The definition phase is initiated in course setting platform. The objective of this phase is to complete the project proposal, to assess the potential impact and to create the first inner circle of stakeholders. The project principal (team leader of UPCM team) and project leader ensure result- and process quality criteria are met in all phases.

Quality criteria result (doing the right things)

- The project contributes to performance objectives and/or impact goals in the roadmap.
- Project results are within the UPCM scope (sweet spots.
- Commitment probability is high

Process quality criteria (doing things right)

1. Relevant UPCM roles have been consulted.
2. Quality criteria for results have been assessed using UPCM tools:
    a. roadmap 2.0 (contribution to goals).
    b. project impact assessment (fingerprint).
    c. context scan (list of questions about the project environment).
3. Other process quality criteria:
    a. a stakeholder analysis shows commitment probability.
    b. A fingerprint analysis shows potential impact.
    c. Project results are unambiguously defined in a project letter (project fiche).
    d. Expected delivery date is realistic and required resources are specified.
    e. Other verifiable quality criteria for the project result have been well-defined.

Stakeholder commitment (Phase 2)

The stakeholder commitment phase formally starts after the definition phase. In practice, this phase parallels the definition phase in a repeating cycle to gradually obtain a sharper definition and better stakeholder commitment. The stakeholder commitment phase aims to mobilise the resources and strengths of the relevant (strategic) stakeholders in and around the project within the framework of the project definition, such as key players, course setters, client(s), suppliers, and implementers. With sufficient stakeholder commitment, the transition to phase 3 is made: Realization.

Quality criteria result (doing the right things)

- The project contributes to performance objectives and/or impact goals in the roadmap.
- Project results are within the UPCM scope (sweet spots).
- Project results are sufficiently aligned with important stakeholders in the environment of the project
- Relevant stakeholders show a joint commitment to proceed
- All parties involved understand their interdependencies and are willing to cooperate
- Sufficient resources have been allocated.

Process quality criteria (doing things right)

1. Relevant UPCM roles have been consulted.
2. Quality criteria for results have been assessed using UPCM tools:
    a. roadmap 2.0 (contribution to goals).
    b. stakeholder analysis (showing commitment probability).
    c. Fingerprint analysis (showing potential impact).
    d. Approved project contract that includes at least:
        i. an unambiguously defined scope and results (project letter of project fiche).
        ii. Assurance quality criteria of previous phases have been met.
        iii. Expected project delivery date (is realistic)
        iv. Overview of required and allocated funds.
        v. Initial risk analysis.
        vi. Definition of additional quality criteria that test project success.

Implementation (Phase 3)

The implementation phase start after the project contract has been approved in the course setting platform. The purpose of this phase is to realise the results as defined in the project contract.

Quality criteria result (doing the right things)

- The project contributes to performance objectives and/or impact goals in the roadmap.
- Project results are within the UPCM scope (sweet spots).
- Quality criteria, that are defined in the project contract, have been met.

Process quality criteria (doing things right)

- Relevant UPCM roles have been consulted.
- Critical path analysis, risk analysis and stakeholder analysis are continuously updated.
- Verifiable quality criteria of the project result are well-defined.

Evaluation (Phase 4)

The evaluation phase begins after sign-off of the implementation phase. The aim of this phase is to enable and to feedback collective learning experiences to the other UPCM teams. This will support the improvement of knowledge products and key enabling methodologies.

Quality criteria end result (when is the result good?)

- Evaluation of the project result according to the quality criteria in the project contract.
- Improvement proposals for subsequent projects.
- Suggestions for improvement of the UPCM instruments.

Process quality criteria (when is the quality of work good?)

- An effective learning meeting with (representatives from) the project team, relevant stakeholders and UPCM roles that were involved in the project.
- An evaluation report that, among other things, evaluates the project's impact assessment.

Appendix 7. Information structure

Up-to-date information and reporting are prerequisites for the implementation of the guiding principles, such as 'Doing the right things' and 'Doing things right'. The information and reporting structure facilitates teams and projects to 'choose wisely' in terms of impact and resource depletion. Up-to-date and coherent information and reporting is needed:

- To provide an objective and transparent overview of 'the state of the transition'
- For knowledge sharing on topics such as impact and scope of roadmap activities
- For reporting of activities, resource depletion and performance objectives

In line with the national action and cluster monitoring (see also the policy theory diagram in Section 3.1.), the information structure discloses the required and available management information per decision horizon. This structure is aimed at generating the proper steering information related to the performance objectives and impact goals in the roadmap 2.0. Now that the initial structure has been established, the next step is to collect and analyse the available data to use it in guiding the initiatives and interventions in the manufacturing industry. The main structure of the roadmap 2.0 consists of indicators for performance objectives and impact goals that are linked to decision horizons, change strategies, resources/methods and data sources/instruments. The information structure aligns with this structure and thus structures available data sources and data.

Quantitative impact measurements are not possible yet, because sufficient information is lacking for certain objectives and goals. However, the current information structure enables a learning and dynamic system to measure qualitative progress on the goals. By linking available data to projects, portfolios, and the programme, we create a continuous feedback loop. This, consecutively, helps us to improve the quality of information.

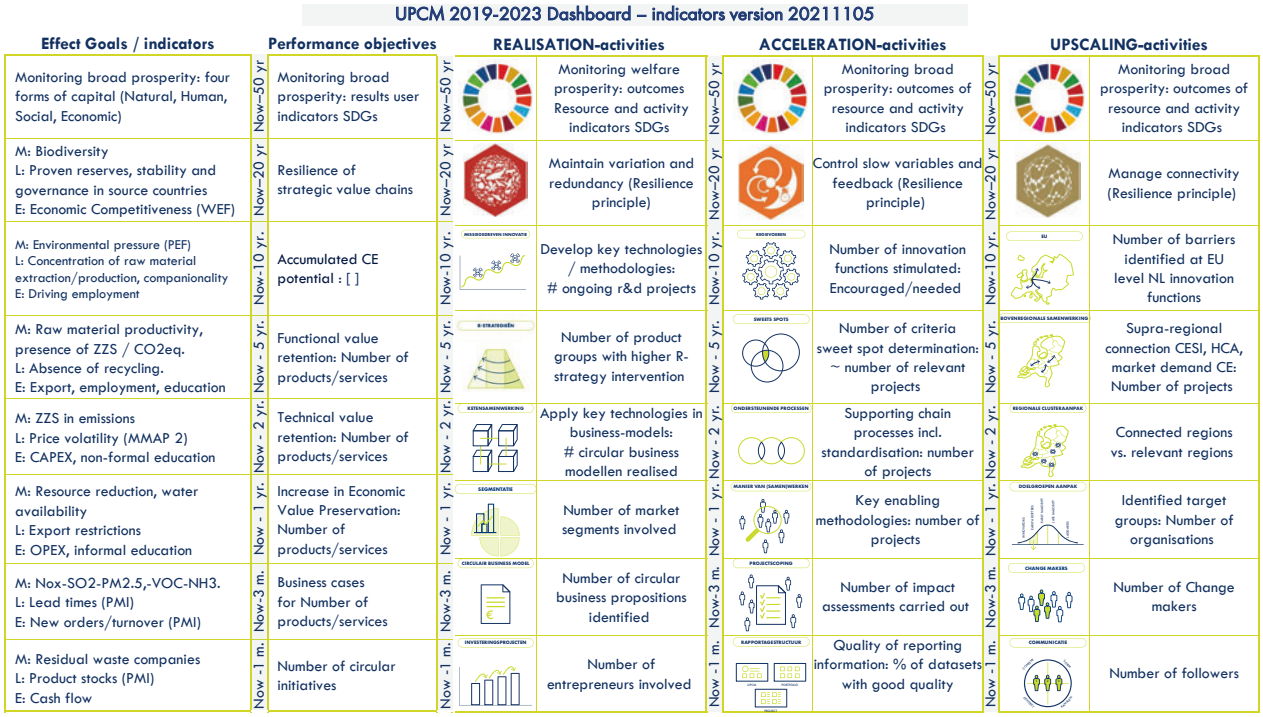


Figure 37. Reporting and information structure.

This dashboard structures indicators for different time horizons and activities in the three pillars: Realization, Acceleration and Upscaling.

Understanding different dimensions

The transition path towards achieving performance objectives- and impact goals, always begins today, but is expected to end at varying moments in the future. These decision horizons are explained in chapter 3. Performance objectives and impact goals are different dimensions. Performance objectives relate to 'controlled change' in a bounded linear system. Impact goals relate to 'emerging innovation' in a complex non-linear system with a scale of society and planet.

A performance objective can be set as a target, where responsibility can be taken for the output. An impact goals can also be achieved but is never a simple sum of performance targets. This can be illustrated by the following logic:

- More than 70.000 companies operate in the Dutch economy, making numerous strategic decisions every year. The number of decisions made by foreign manufacturing industries that impact these companies in the Netherlands is even greater. On top of that, public policy and the numerous choices made daily (in the Netherlands) by nearly 18 million consumers create a dynamic playing field. It is impossible to promise or commit to impact goals as a result of a set of performance objectives. Even afterwards, this link is hardly to claim.

To avoid political opportunism, policy makers need to truly comprehend the difference between these two dimensions.

Closer look: Detailed examples of performance targets and impact targets

A performance target in a certain industry could be defined as a percentage of the number of transactions realized through a servitisation business model, instead of a traditional supply chain business model in which the focus is on purchasing products.

- Currently, impact targets for reducing environmental impacts are partly secured in national and international policy goals. Impact targets for supply risks and broad prosperity have not (yet) been set. A set of guidelines for ZZS[6] (Substances of high concern for human safety and health) exemplify impact targets. The control, monitoring and reporting obligations[7] have also been laid down in this context. Emissions of ZZS are expressed in mg per m3 or Toxicity Equivalents (TEQ) if the potential negative impact of a substance is high.

Discussion: differing relevance of Smartness in relation to decision horizons and the two dimensions.

All goals and objectives are, by preference, formulated according to SMART principles (Specific, Measurable, Achievable, Relevant and Timely). However, the five elements of the SMART method have different relevance on different time horizons. Find below four statements that are meant to trigger further discussion on this topic:

1. Relevance is of major importance to impact goals made SMART. Both political commitment and thorough (scientific) comprehension of the (underlying) urgency, need to be ensured. The climate goals are evident examples of shared impact goals. Policy to reduce greenhouse emissions will hence be useful. However, an effect goal concerning added value or increased competitiveness by means of trade surpluses, may well prove controversial. More than is the case for the other SMART elements, a shared perception of Relevance (acceptance) of effect goals by all parties involved is essential.
2. SMART elements such as timeliness and achievability are relatively easy to adjust for effect goals.
3. Achievability (realism) is especially important for performance goals. It is important that all parties involved comprehend the cause and effect of efforts (to be) made. The performances of metal recycling are an evident example of achievability or a realistic cause and effect relationship between effort and result. However, a performance goal concerning the difference in impact of (raw) material use in conventional business models versus that of servitisation business models, may well prove controversial. More than is the case for the other SMART elements, all parties involved should have consensus on the attainability of performance goals.
4. SMART elements such as Specific and Relevant are relatively easy to adjust for performance goals.

[6] ZZS beleid - Kenniscentrum InfoMil
[7] https://www.infomil.nl/onderwerpen/lucht-water/lucht/zeer-zorgwekkende/vaststellen/emissiegrenswaarden/

Appendix 8. Reporting structure examples

Projects are the building blocks for coherent initiatives that accelerate the transition. Impact indicators, and related information, enable UPCM to determine if and how (the portfolio of) projects could contribute to the goals of the Circular Manufacturing Industry Implementation Programme. Impact indicators are linked to the UPCM dashboard, which combines reporting of project activities and other tasks. Impact sheets provide information on activities, performance objectives and impact goals per relevant decision horizon. See Figures 37, 38 and 39 with examples of the dashboard, the project impact sheet, and the project progress report.

Example (Project Batteries) — **IMPACTSHEET**

Description

Goals:
1. Knowledge development on recycling Li-ion batteries.
2. Research new recycling industry in the Netherlands
3. Adding value to the "battery chain" by optimising the use phase, by stimulating reuse in other applications (such as storage of sustainable energy) and by aligning the process of collection, sorting and first (mechanical) recycling steps in the end-of-life phase with the metallurgical follow-up steps.

Results:
1. Chain cooperation within the (bicycle) battery chain in at least 2 active pilot projects.
2. Linking KIA questions to realisation projects.
3. Network within chain (EV batteries/Heavy Duty).
4. Research proposals for R-strategies for batteries.

Milestones 2020 / 2021
1. 2020 realisation of CIRCO track bicycle batteries
2. Outcome of Circotrack at least 1 new chain project
3. 2021 realisation of CIRCO track heavier batteries and energy storage systems

Activities:
1. Inventory of relevant projects (optimisation of (re-)use / recycling or more broadly the R-strategies)
2. Linking relevant projects to UPCM and describing the case for the UPCM site. Make UPCM a logical place to share cases (in collaboration with team Upscaling).
3. Connecting knowledge and experience between the current projects (together with Knowledge integration)
4. Organisation of a Circotrack on the subject of Li-Ion batteries for electric bicycles - exploring model for optimisation of use and technology for recycling.
5. First exploration of possibilities for re-use / recycling of larger batteries such as those of electric vehicles.

Scope

Products:
Product cluster: Consumer goods
Product groups: 29.1, 30.9, 47.6
Modules: 1) Li-ion Batteries in vehicles, 2) Li-ion batteries in household appliances and electronics.

Materials
Critical materials: Mn, Nb, Ge, B, Sc, Sr, Co, PGMs, C(natural)
Size of vehicle batteries
- 100-500 kg per battery
- 400,000 EVs in 2040

Size other:
- 100g-10kg per battery
- 3 Million per year in 2030

Circular strategies/CO2 impact

R0-R2 Circular design	
R3-R7 Longevity	17
R8-R9 Recycling	3

Actors
Stakeholders: Stibat, Bicycle manufacturers, Recyclers, Collection companies, Science, Battery repair companies.
ARN, Metalot, Brainport Development, TU-Delft, TNO, Van Peperzeel, Battery Competence Centre initiative (Brainport Development / DAF / VDL / Damen).
Target groups: Entrepreneurs, scientists, students government as regulator.
Change agents: Bicycle industry, recyclers, Legislator, large-scale consumers, Energiemij.

Impact

Contribution to Effect Goals

Effect goal	Time horizon	Description
environment	0-5 jr	Re-use batteries
Certainty of supply	0-10 jr	Energy transition
Economy	0-5 jr	Repair business

Indicators

environment	Certainty of supply	Economy
CO2: 26 ktonnes/yr	Risk reduction: Some improvement	Added value in mln EUR compared to 2019: 238

Contribution to innovation functions

F1- Entrepreneurship	Unknown
F2- Knowledge development	High
F3- Knowledge exchange	High
F4- Direction of search process	High
F5 – Market-making	Low
F6- Mobilising means	High
F7- Breaking Resistance	Unknown
F8- Coordination	Unknown

Contribution to performance objectives

Performance objective	Time horizon	contribution
Innovation engines	0-10 yr	High
Functional value retention	0-5 yr	Medium
Technical value retention	0-2 yr	Low
Economic value retention	0-1yr	Low
Col business propositions	0-3months	1 - 5

Status per: 15/10/2020

Figure 38. Sample impact sheet per project.

Project nr 20-004

Project 4 Critical Materials energy transition (batteries)

Milestones

	INITIATION PROCESS	PHASE 1 PROJECT DEFINITION	FASE 2 STAKEHOLDER COMMITMENT	PHASE 3 IMPLEMEN-TATION	PHASE 4 EVALUATION
Start	21/12/2021				
End					

Project progression

Current phase	Initiation trajectory
Project result % finished	10%

Dependencies
- Cluster roadmaps
- Supra-regional approach provinces

Done
- Leaders meeting held
- First stakeholder analysis
- First fingerprint done
- Project letter drawn up
- Required resources determined
- Planning established
- Result quality criteria drawn up

Completed
- Project definition completed

Risks/Issues

Risks
- Insufficient support with:
  ...

Issues
- Connection to roadmap 2.0

Financial	Per 1-4-2021
Total project budget required	100.000
Allocated project budget	80.000
Of which through RVO	60.000
Of which through others	20.000
Total project budget depleted	40.000
Current balance	40.000
Budget required (gap)	20. 000

Figure 39. Sample progress report per project.

Appendix 9. Roles and tasks of the support team

Support team
Role The program support team, with team leads and secretaries of all other teams, facilitates consistency in the implementation of the programme. This team develops the approach, working methods, instruments and staffing of the programme. It secures information-, reporting- and coordination processes in and around the programme.
Tasks ➢ Secretariat Orchestrating Team, NSP and PPS CM. ➢ Organising meetings, communication and decision-making. ➢ Creating an overview of programme progress. ➢ Overall Portfolio management. ➢ Preparation of management processes in cooperation with all teams.

The individual roles and tasks in the support team are adjusted every two weeks in a governance meeting(Holacracy approach) to align roles with the changing environment.

Support team set up	
Support team coordinator:	Mattheus van de Pol
Team Link Realization:	Bart Jeroen Bierens
Team Link Knowledge Integration:	Jeannette Levels-Vermeer
Team Link Upscaling:	Gerard Wyfker (acting: Diana de Graaf)
Team Link Orchestrating Team:	Ad interim Mattheus van de Pol
Team Link NSP:	Ad interim Mattheus van de Pol
Team Link KIA CM Team:	Ad interim Mattheus van de Pol
Process and team development:	Rien van Leeuwen

Individual support team roles (for illustration, still under development)	
Process developer role Monitoring internal consistency and coherence of structure and process between UPCM teams.	Tasks: • Designing and monitoring work processes between teams. • Consistency-monitoring in language and forms of envisioning • Professionalising issue management by means of holacracy rules. • Quick iterations of existing documents (UPCM transition approach, standard presentation).
Team Link role Maintaining consistency and coherence (structure and process) of their own team with other teams.	Tasks: • Keeping language and forms as developed by DIG up to date in their own material. • Contributing to approved processes between teams (such as portfolio management, issue management and internal communication). • Timely review of joint documents.

Role of OT coordinator
 	
Monitor consistency of UPCM.
	Tasks:
	
	• Drawing up the agenda for the support team.
	• Owner of process 'direction preparation'.
	• Responsible for process governance adjustment
	  ◦ Position of partners in governance.
	  ◦ Reaching agreements on resources.
	  ◦ Reaching agreements on order management.
	• Quartermaster new business.

Appendix 10. Highlight report UPCM results June 2020 – June 2021

The Circular Manufacturing Industry Transition Team is a partnership of representatives from business, government, and knowledge institutions. They work together in seven teams to accelerate the transition in conjunction with the Sustainable Development Goals, the climate challenge and the energy transition. They have jointly set up the Circular Manufacturing Industry Implementation Programme (UPCM) and are actively involved in the execution.

In the past year, within the scope of the Transition Agenda Circular Manufacturing[6], in addition to operational activities, effort has been put on properly building the strategy, the goals and the approach and the set up an effective organisation.

The two strategic goals of the Circular Manufacturing Industry Implementation Programme have been translated into three tactical goals. (See Chapter 2 of this document).

Results

In the past year, the groundwork has been established for the transition of the Dutch processing industry to a circular economy. In addition, the following achievements, both nationally and at the European level, are cornerstones for future developments.

- **Breakthrough project Circular Wind farms**: a European wind energy coalition has now been formed with more than 150 (inter)national parties. The value chain approach, aimed at a wide spectrum of actors, includes a knowledge hub, a policy hub and an investment hub. Currently, research of the coalition is focussing on jointly reducing raw material risks for countries that are largely depending on those materials.
- **Breakthrough project Circular Batteries**: Several parties created an integrated battery vision, which covers battery development as well as reuse and recycling strategies. In cooperation with top teams HTSM, Energy and Chemicals next steps and a cross-sectoral approach is in development. The scope is on the field of innovation and industrialisation for battery technology and links with the European Batteries Alliance.
- **Breakthrough project Circular Solar Parks**: The province of Zuid-Holland and the UPCM jointly put solar parks in the spotlight of Dutch innovation agendas. In addition to the organisation of Circo tracks and the definition of an integrated roadmap, a 'helpathon' showed the engagement of many SMEs. Advocacy efforts made sure that this theme was also put on the agenda of the European Raw Materials Alliance. Next steps focus on projects that experiment on a large scale and that demonstrate the business case.
- **Breakthrough project Heat as a Service**: Through the UPCM, a CE pilot was carried out in cooperation with the province of Overijssel, the installation sector and the heating industry. The results of the pilot project were used to develop a mathematical model for the assessment of both the environmental impact of materials and the energy consumption for circular heat strategies. Currently, as a next step, a roadmap is in development.
- **Breakthrough project Capital Equipment**: In cooperation with FME, KMU and the provinces of Noord-Brabant and Gelderland, Overijssel and Zuid-Holland, a OEM supply chain project was started. This project for the machine building industry aims to support smaller SMEs in implementing circularity in their business operations. The next step is to jointly develop a roadmap for circular mechanical engineering that aligns with the
- **Breakthrough project Circular Economy and Smart Industry** ('CESI'): UPCM, in close cooperation with the provinces of Zuid-Holland, Gelderland, Overijssel, Noord Brabant, FME, KMU, VNO-NCW and EZK, develops a programmatic approach for the integration of smart industry technologies in circular solutions. This includes the integration of digitisation goals into the circular design approach of the Circo foundation, the facilitation of a Community of Practice for 'product as a service', the development of an awareness and self-assessment tool ('Wegwijzer') and the development of circular field labs.

Appendix 11. Vision landscape

The envisioning methodology, as an integrated part of roadmap development and alignment, is described in chapter 3.3. The envisioning strategy, which in its early stage focused on the initiative landscape of the decision horizon of now – 5 years, has been extended to a method for the higher decision horizons. This is in alignment with the 'vision landscape' part of the roadmap (or pathway) methodology. The roadmap methodology is currently in development under the leadership of the Ministry of Infrastructure & Water Management (I&W). An example of the basic structure of the vision landscape is depicted below.

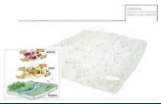
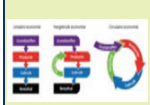
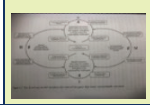
Decision horizon	To what?	Why & how		2021 → 2050		
Trend landscape Now -50 years			Desired trends in the right direction	Neoliberal economy 		Wellbeing economy 
Transition landscape Now - 20 years			Evolution of Economies I.e. Electrical grids Microfactories and local manufacturing	Linear Economy 	Reuse Economy 	Circular Economy 
Intervention landscape Now -10 years			Integral value structure	Current value systems (Blue) 	Value system shifts 	Circular-proof value systems (Yellow / New Blue) 
Initiatives landscape Now - 5 years			Sustainable + mature markets Product groups (TNO)	Create shared vision 	Use phases model to transition towards new normal 	Mature market – the new normal 
Operational landscape Now - 2 years			Current product chains Applied R-strategies by businesses	Linear product chains 	Implementation of 'higher' R-stategies 	Useage of circular businessmodels 

Figure 40. Basic structure of the vision landscape

Appendix 12. Job profiles based on complexity of roles

The setup of the teams, including role definitions, is based on the scale and complexity per decision horizon as described in Chapter 3. Professional competence is crucial for the challenging and complex task ahead. It is paramount to select people with requisite competences for the level of complexity of their task. A first draft of job descriptions or profiles has been developed for the 0 – 5 years decision horizon.

As described in Chapter 4. Organisation, the type of work and the context of each team varies. These 'horizontal distinctions', such as 'realisation', 'acceleration' and 'upscaling', add a second dimension to the 'vertical distinctions' of the decision horizons.

The required job profiles for roles within and around the Implementation Programme consist of both 'vertical' and 'horizontal' components. The 'vertical' component describes the job and tasks, based on the levels of complexity as elaborated by Professor Elliot Jacques. The horizontal component is based on the methodology of value rating, applied to the contexts of the different teams.

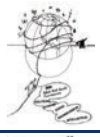
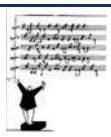
Decision Horizon	Criteria[1] → / Role complexity[2] ↓	Tasks					Autonomy					Knowledge & skill		Network	
		Complexity	Goal	Effect	Approach	Dynamics	Discretion	Complexity	Effect	Framework	accountability	Knowledge and insight	Skill	Complexity	goal
0- 20 years															
0-10 **years**															
0-5 years		*5*	*5*	*5*	*4*	*4*	*4*	*5*	*5*	*4*	*5*	*5*	*5*	*4*	*5*
0-2 years															
0-1 year															
0-3 months															

Figure 41. Job profiles based on complexity of roles

[1]) These criteria are based on Fuwasys.
[2]) The job profile is based on the levels of complexity as elaborated by professor Elliot Jacques