

Roadmapping For Strategy Exploration

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Abstract

In this presentation, we show the process of constructing a roadmap. The Dutch energy system is taken as an example.

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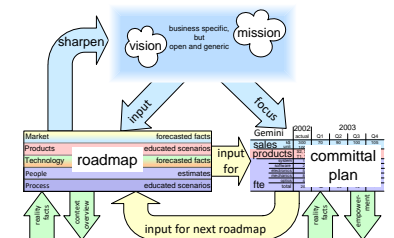
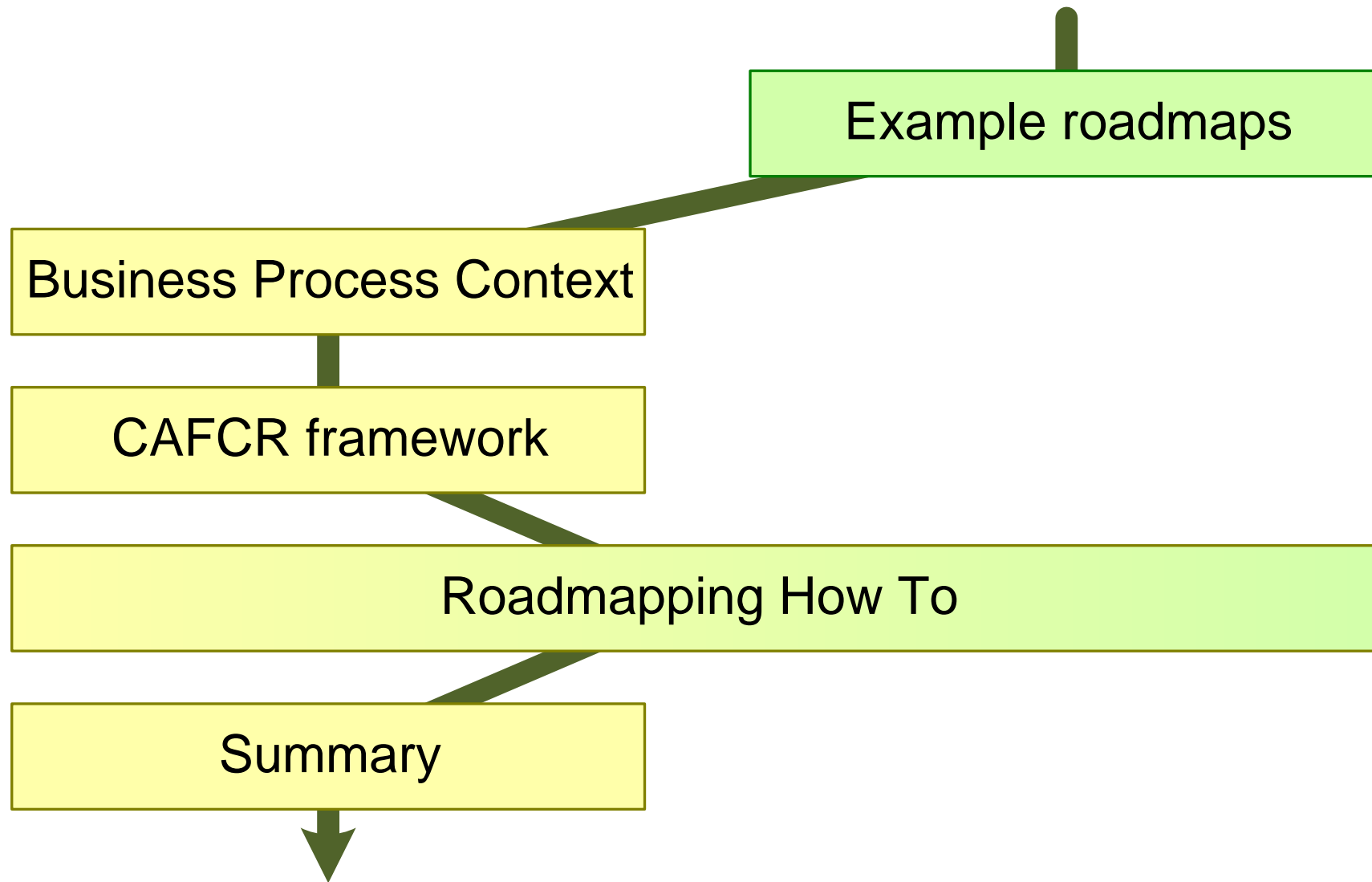
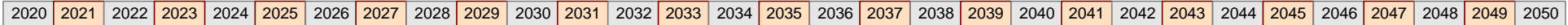


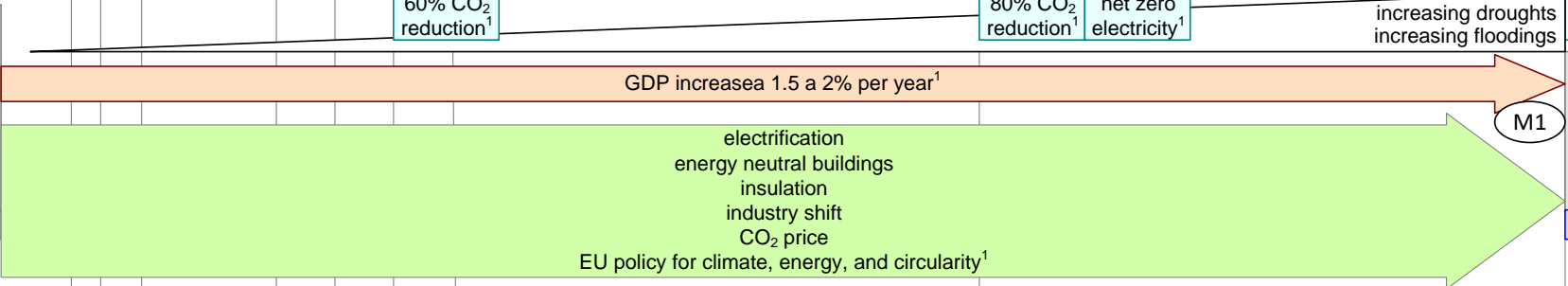
Figure of Content





market

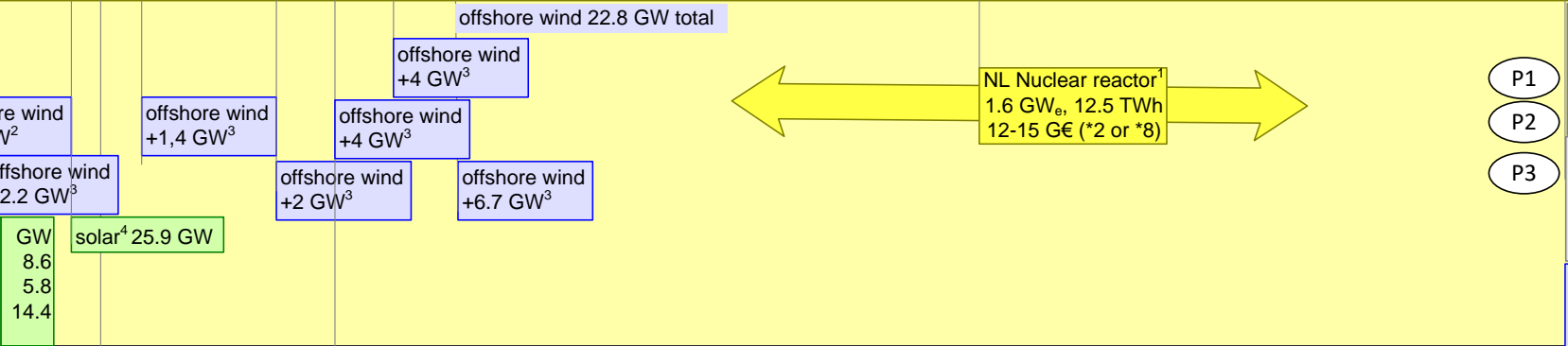
consumption ¹	TWh
heat industry&agro	140
heat buildings	120
materials	145
mobility	125
electricity	110
losses	190
total	830
bunkers ¹	170



consumption ¹	TWh ¹
electricity	300
final energy	450-500
primary energy	650-700
bunkers	150-200
total primary	800-900
peak power	45GW ¹

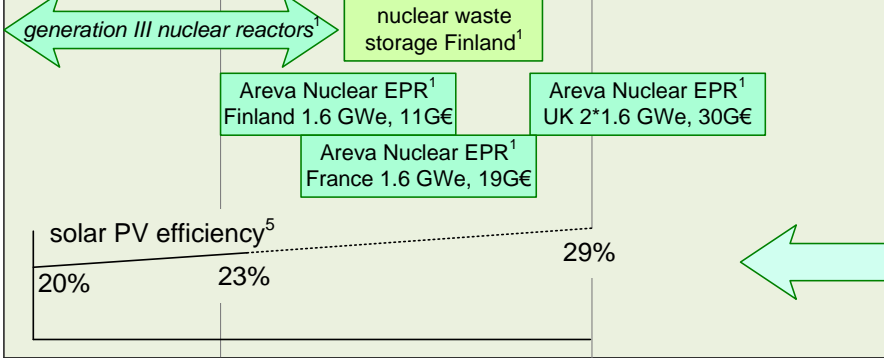
product

sources ¹	TWh
gas	370
oil	300
coal	50
renewable	85
nuclear	10
other	15
total	830



sources ¹	TWh ¹
wind land	20-25
wind offshore	308-330
solar	100-120
total	450
heat	TWh
geo, aqua	80
environment, sun	50
rest	50
total	180
power ¹	GW ¹
wind land	8
wind offshore	75
solar	125
electrolyser	51
H ₂ generator	45
battery (short)	200
transmission	100

technology



small nuclear reactors¹
 HTGR Pebble Bed reactor (China)
 Rolls Royce reactor (UK)
 NuScale reactor (USA)
 Molten salt reactor ('thorium reactor')
 Stable Salt Reactor (Canada)
 U battery (Urenco UK).

¹INCOSE lecture 21-3-23 Prof. Dr. Wim Turkenburg
²<https://windopzee.nl/onderwerpen/wind-zee/waar/>
³<https://open.overheid.nl/documenten/rnl-7438902539596226b438ef329f782cf1a8a05aee/pdf>
⁴<https://www.rijksoverheid.nl/binaries/rijksoverheid/documenten/rapporten/2022/09/30/monitor-zon-pv-2022-in-nederland/Monitor+Zon-PV+2022.pdf>
⁵<https://www.cleanenergyreviews.info/blog/most-efficient-solar-panels>

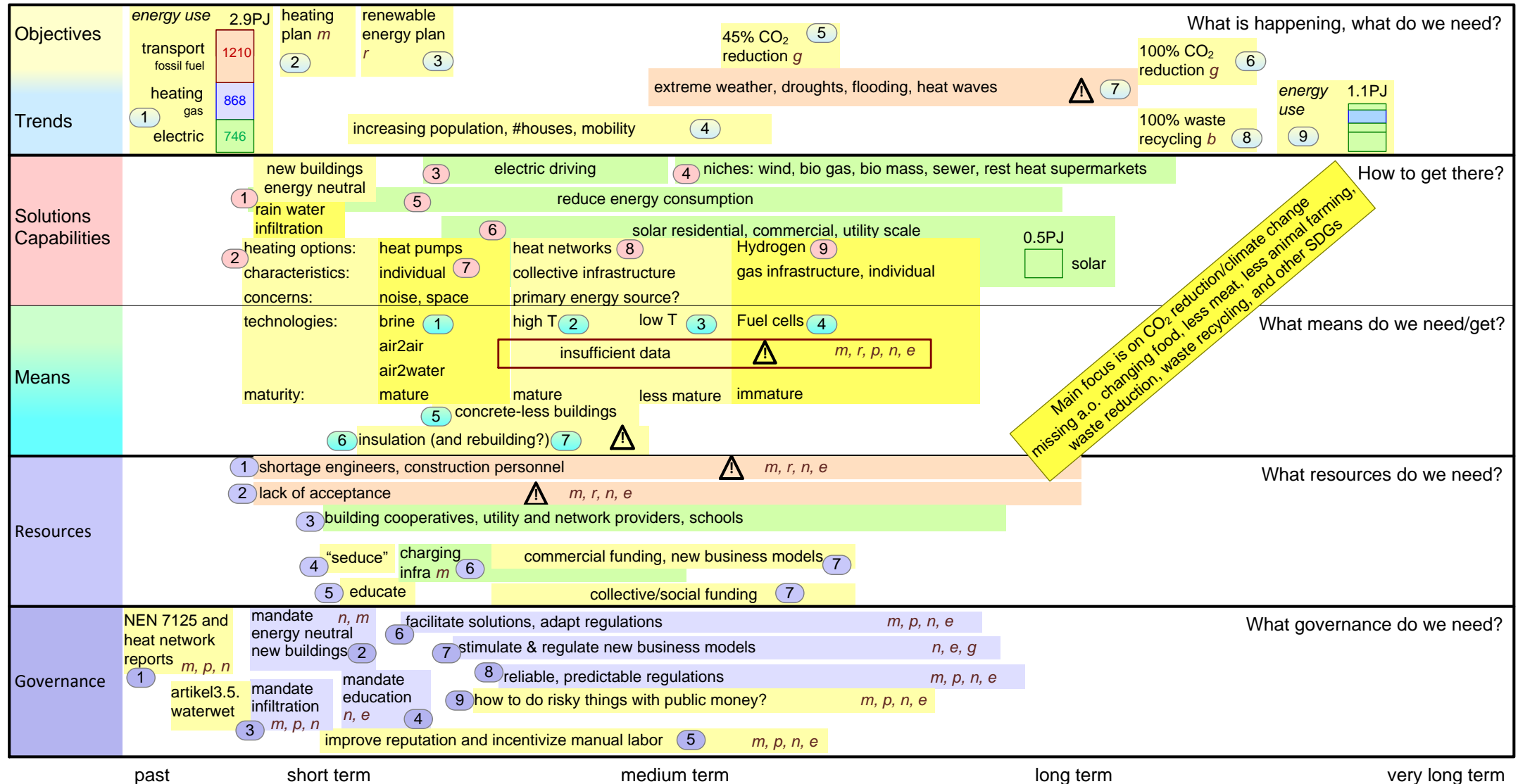
people, competence

process

Colophon
 This work is using a lot of information from the presentation that Prof. Dr. Wim C. Turkenburg gave at INCOSE on March 21 2023 in Eindhoven for INCOSE-NL. The affiliations of Prof. Dr. Wim C. Turkenburg are Copernicus Instituut voor Duurzame Ontwikkeling, Universiteit Utrecht Wim Turkenburg Energy and Environmental Consultancy, Amsterdam

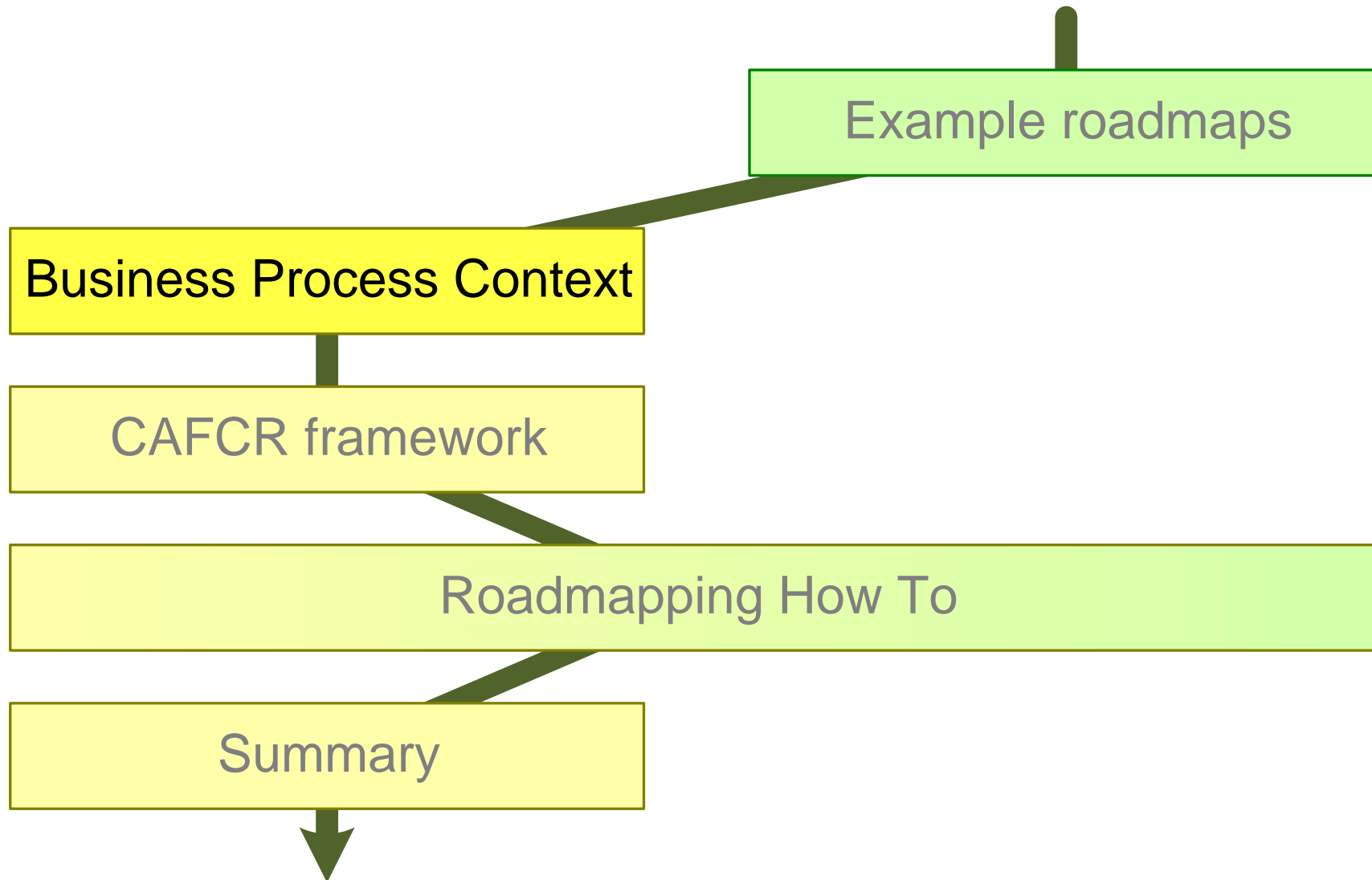
M1 excluding¹ Direct Air Capture CO₂
 M2 +15% for stability¹

P1 renewables cover ~50%¹
 P2 mind the losses!¹
 P3 heat covers low temp needs only (<<100TWh)¹

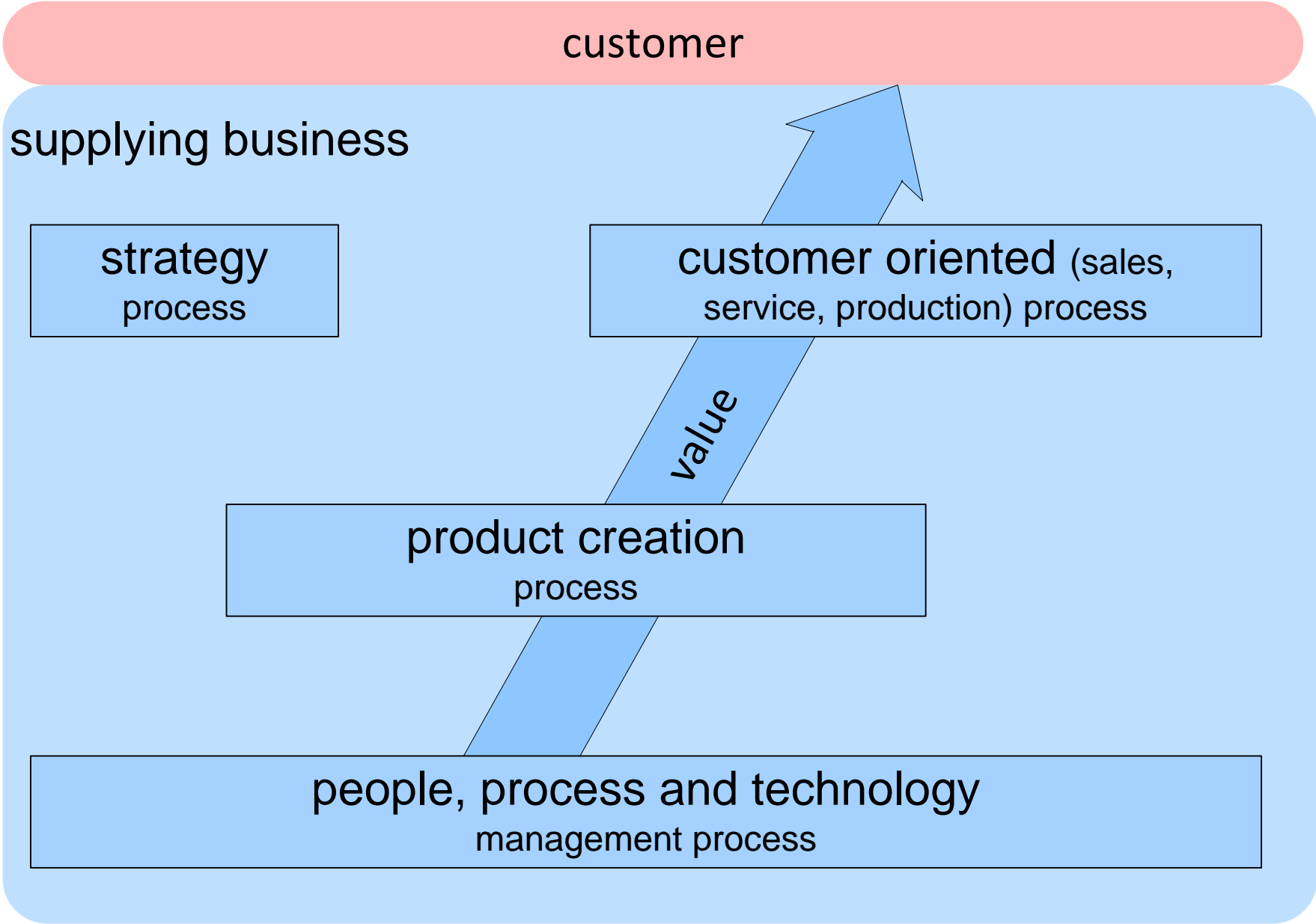


Main focus is on CO₂ reduction/climate change missing a.o. changing food, less meat, less animal farming, waste reduction, waste recycling, and other SDGs

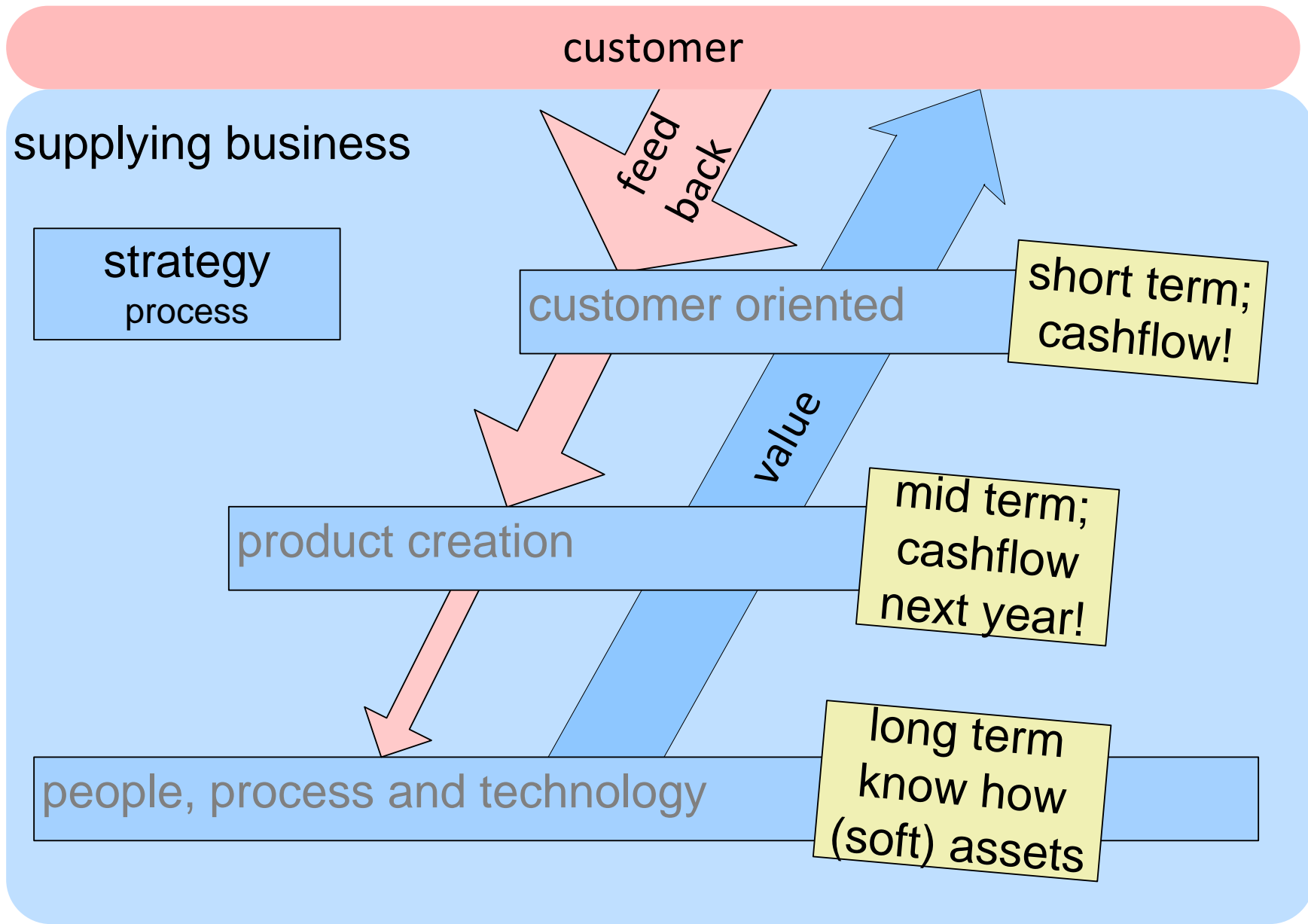
<p>1 energy use 2017</p> <p>2 mandatory 2020 heating plan per neighborhood</p> <p>3 mandatory 2021 regional</p> <p>4 small increase per year</p> <p>5 IPCC 2018</p> <p>6 IPCC 2018</p> <p>7 may increase energy use</p> <p>8</p> <p>9 energy use after full electrification and some reduction</p>	<p>1 make all new developments sustainable</p> <p>2 selection of options for heating plan</p> <p>3 transport is major CO₂ producer</p> <p>4 niche solutions in Best</p> <p>5 reducing energy consumption is must</p> <p>6 all forms of solar may result in 0.5 PJ/yr</p> <p>7 mature; noise, space is concern</p> <p>8 few rest heat sources; large collective infrastructure investment</p> <p>9 long-term option; re-use gas infra</p>	<p>1 air2air for heating is efficient; how to get tap water?</p> <p>2 compatible with older houses; challenge data is not public due to commercial interests</p> <p>3 efficient allows re-use of any rest heat; storage is the big challenge</p> <p>4 source to use little efficient; solves seasonal storage; production infrastructure expensive</p> <p>5 concrete is major CO₂ producer</p> <p>6 insulation is first step; external insulation needed?</p> <p>7 when is rebuilding better (justified and acceptable)</p>	<p>1 action plan to attract and educate</p> <p>2 involve, engage, seduce, incentivize</p> <p>3 roadmap and master plan to coordinate</p> <p>4 more effective than enforcement</p> <p>5 primary, secondary schools; avoid overload</p> <p>6 enable electric driving</p> <p>7 be creative to get economy and funding working</p>	<p>1 7125 and reports overrate sustainability of bio mass and rest heat sources; lack absolute data</p> <p>2 ASAP! waiting increases problem</p> <p>3 vng.nl/3-gemeentelijke-watertaken; should be standard operation when maintaining streets</p> <p>4 how to do this effectively?</p> <p>5 culturally ingrained</p> <p>6 agile (fast response) governance</p> <p>7 facilitate and regulate</p> <p>8 past pitfall; blocks investments</p> <p>9 major dilemma for 6, 7, and 8</p>	<p>legend</p> <p><i>b</i> Best Duurzaam</p> <p><i>m</i> municipality</p> <p><i>r</i> regional</p> <p><i>p</i> province</p> <p><i>n</i> national</p> <p><i>e</i> Europe</p> <p><i>g</i> global</p>
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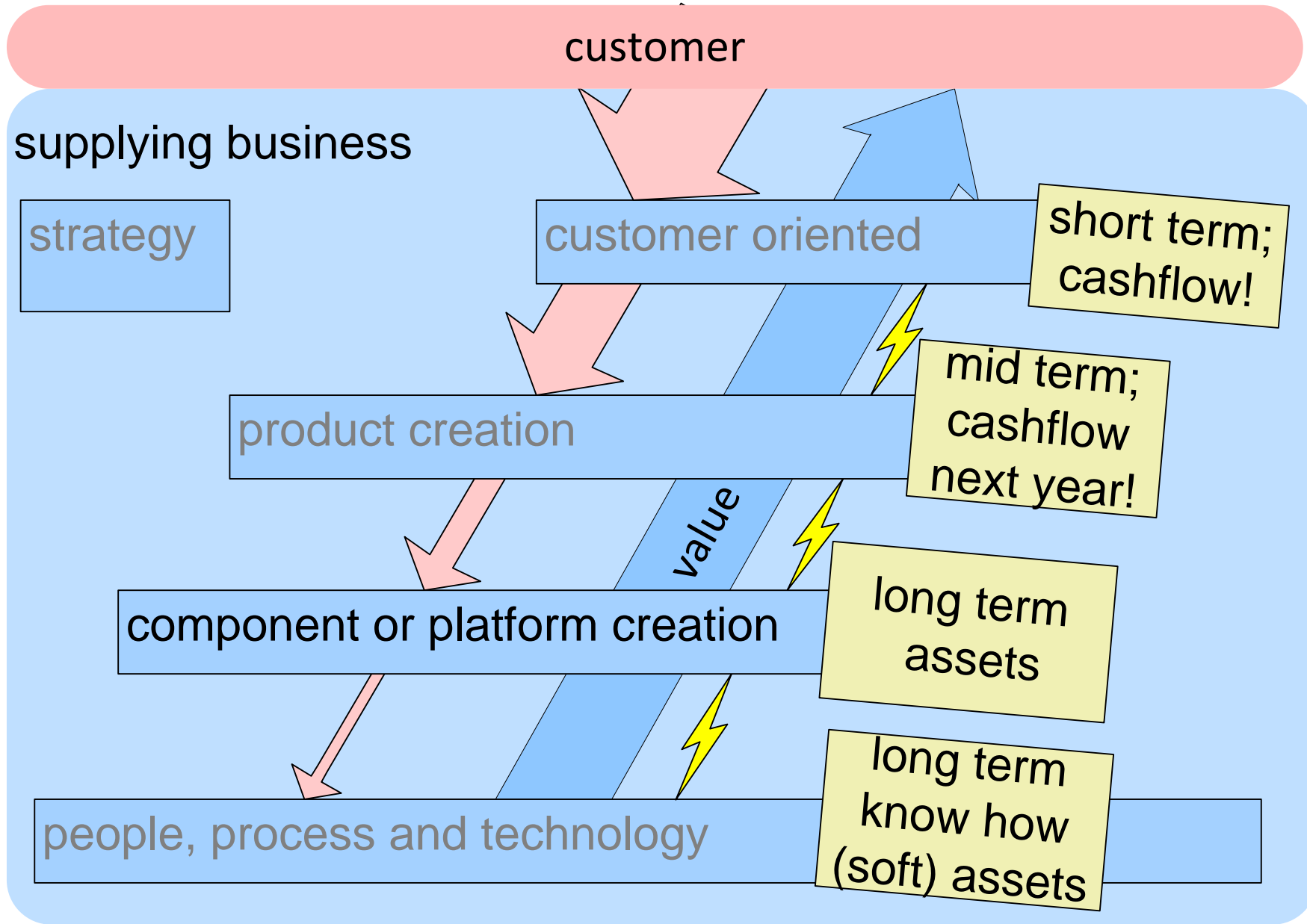
Simplified process view

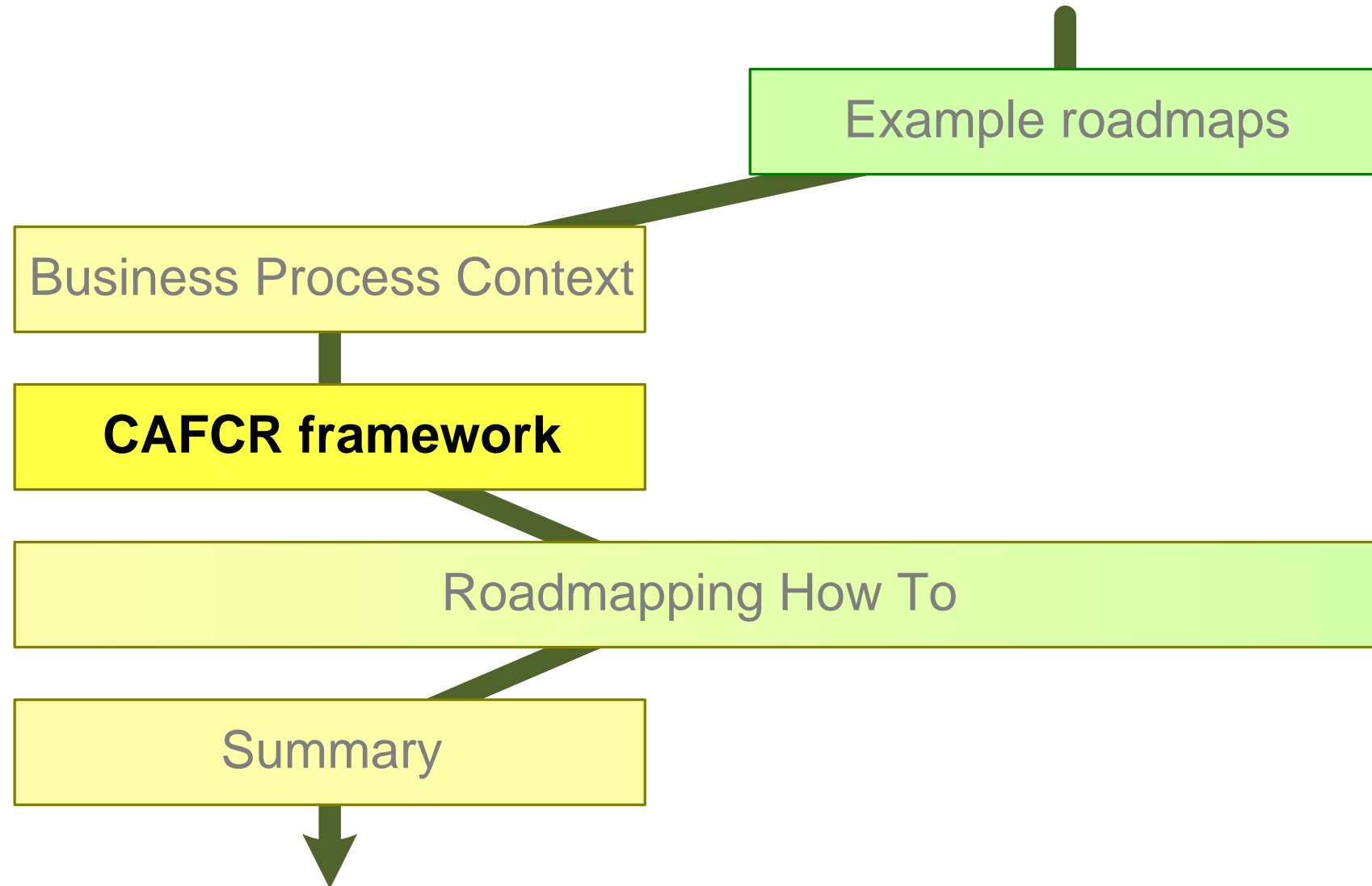


Tension between processes

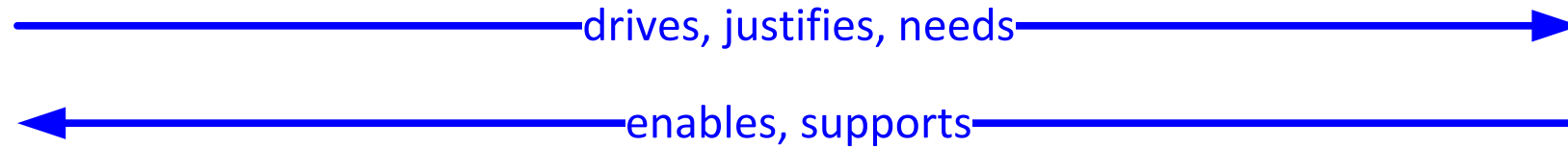


Platform strategy adds one layer

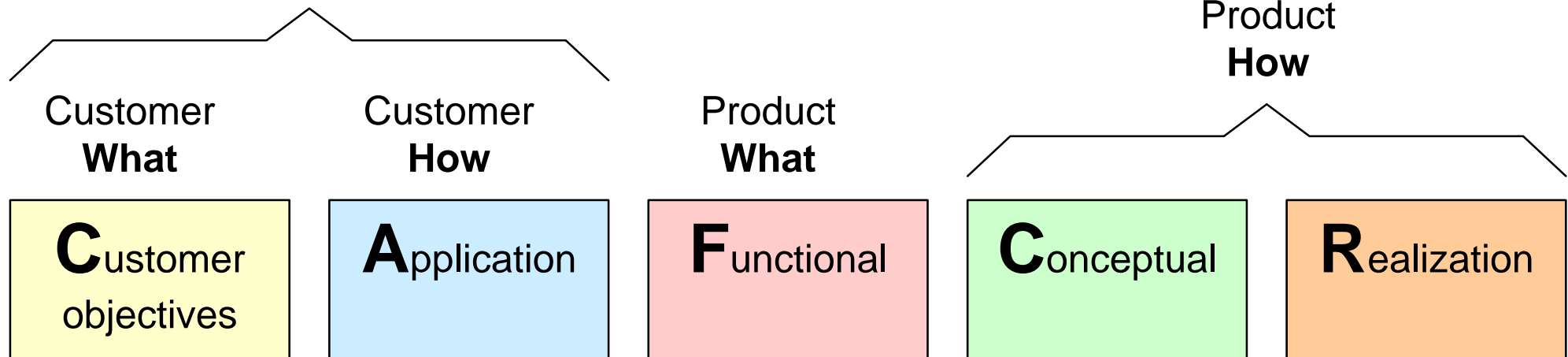




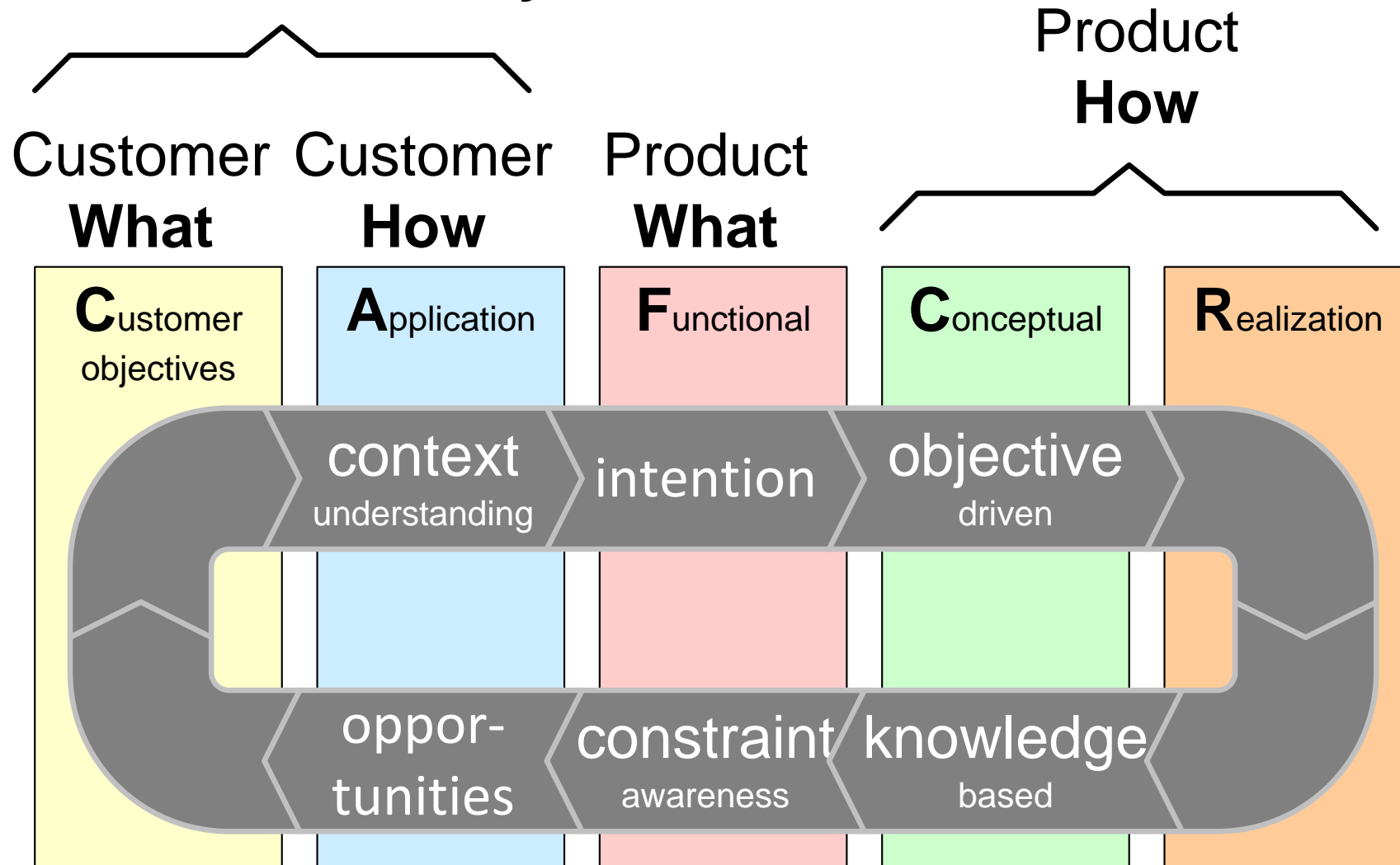
CAFCR Framework for Architecting



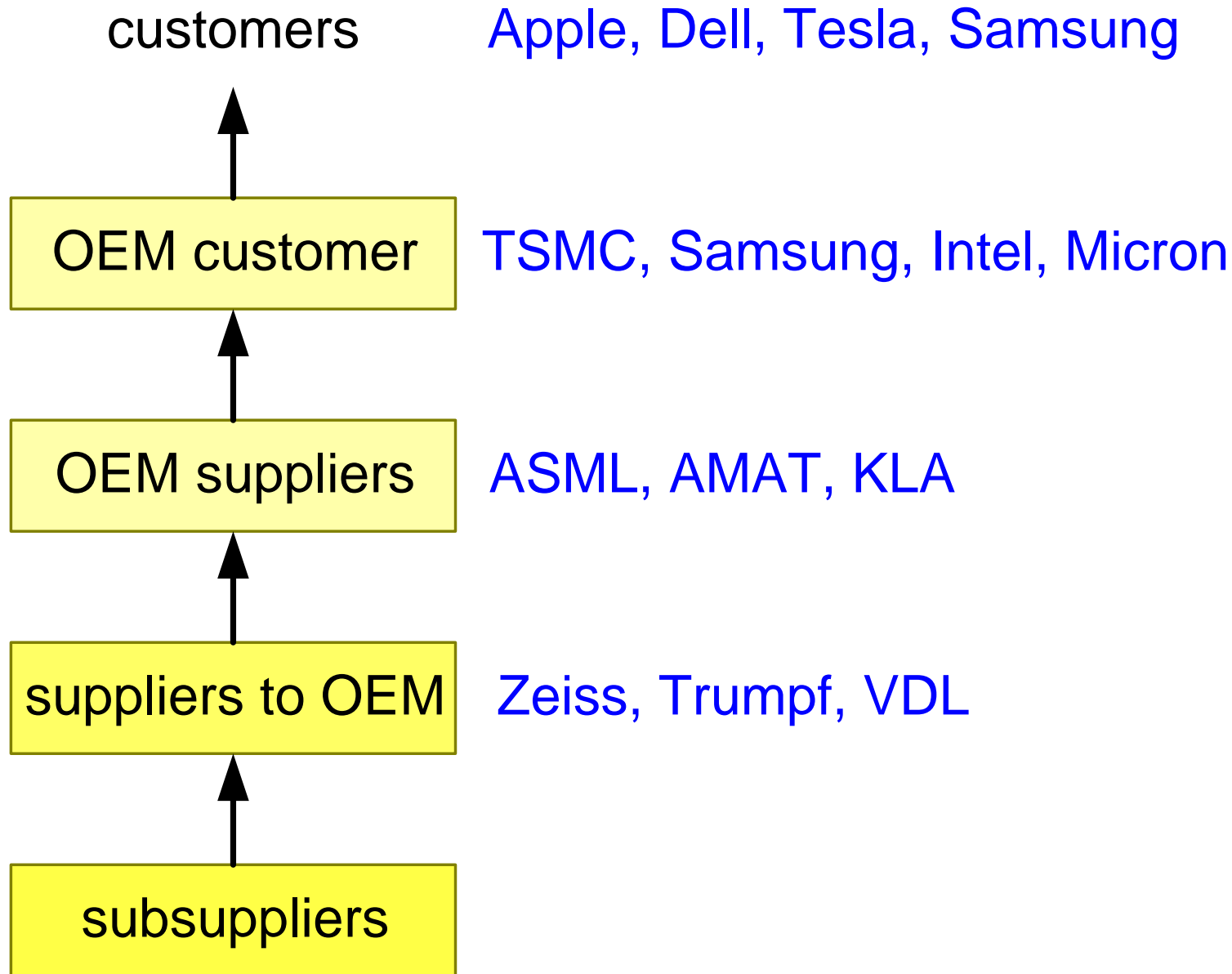
What does Customer need
in Product and **Why?**



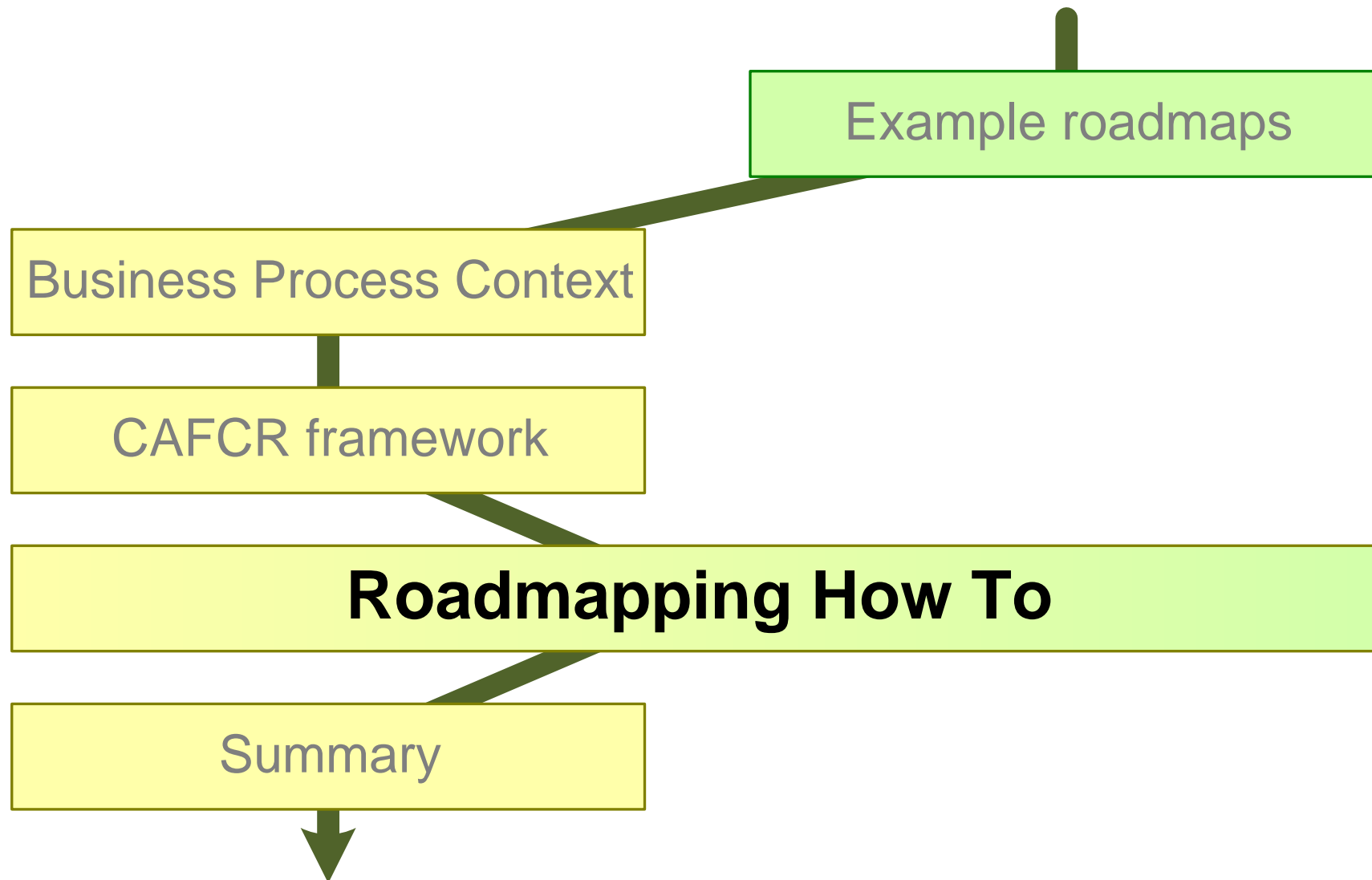
What does Customer need
in Product and **Why?**



Use CAFCR Recursively



Roadmapping How To



From Ideas to Communicatable Roadmaps

Share domain understanding market, applications, stakeholders

Formulate initial strategy mission, vision

Gather data and synthesize roadmap A3 data and roadmap

Package roadmap for target groups (over) simplify

Use a few half to full day workshops to explore the domain and map it.

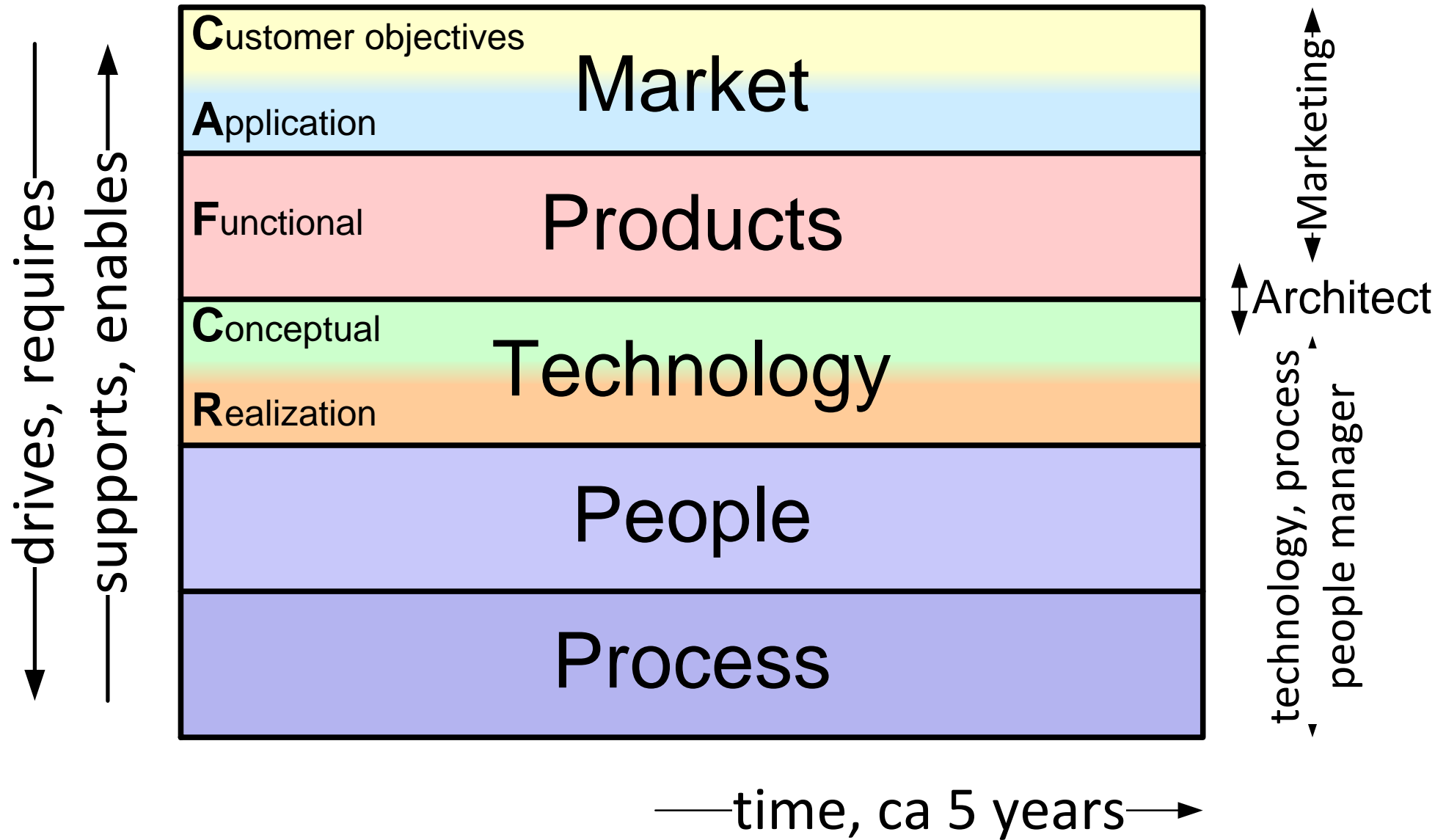
Potential tools:

- Systems Oriented Design <https://systemsorienteddesign.net/>, using
 - Gigamapping
<https://systemsorienteddesign.net/how-to-gigamap/> and
 - ZIP analysis (Zoom-Innovation-Potential)
<https://systemsorienteddesign.net/zip-analysis/>
- CAFCR analysis <https://gaudisite.nl/ArchitecturalReasoningBook.pdf>

Result of 3-day CAFCR Workshop



The Roadmap Integrates Five Views



From generic mission to factual roadmap

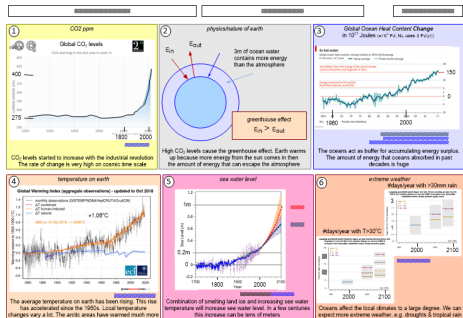


business specific,
but
open and generic

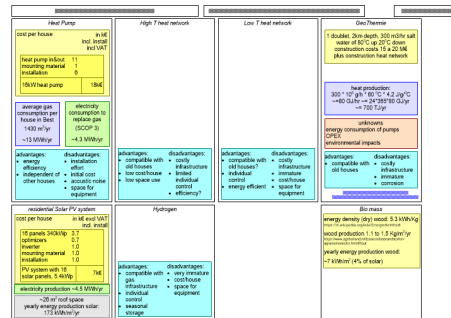
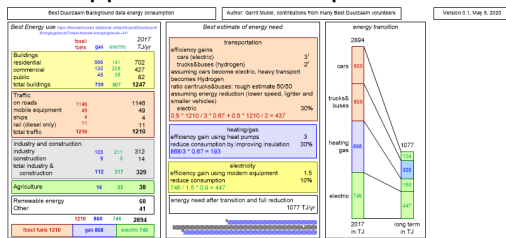


Market	roadmap	forecasted facts
Products	roadmap	educated scenarios
Technology	roadmap	forecasted facts
People	roadmap	estimates
Process	roadmap	educated scenarios

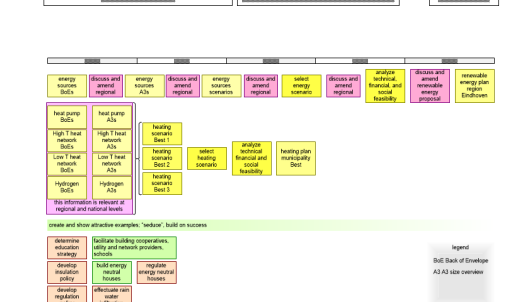
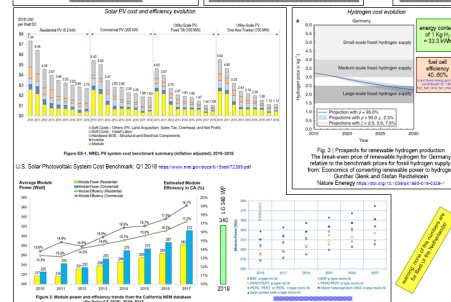
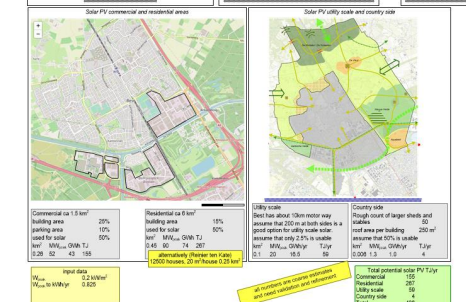
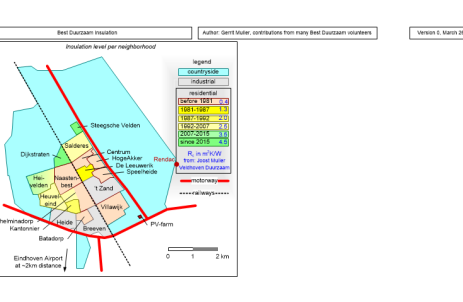
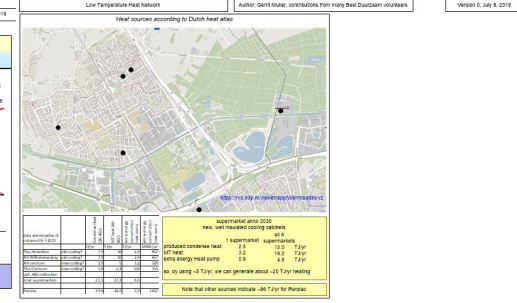
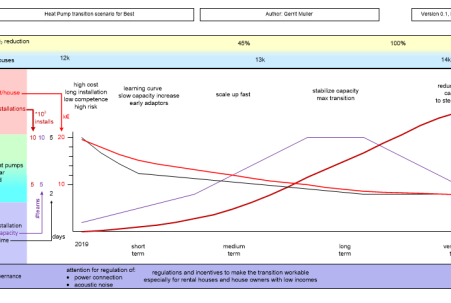
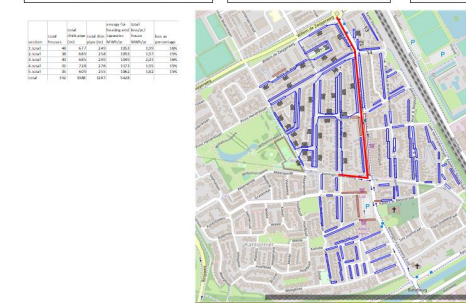
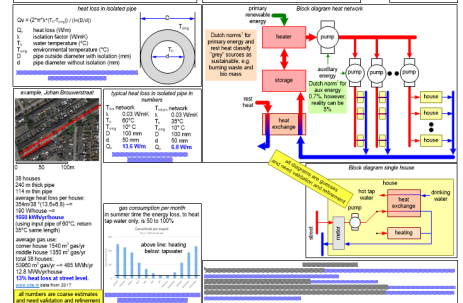
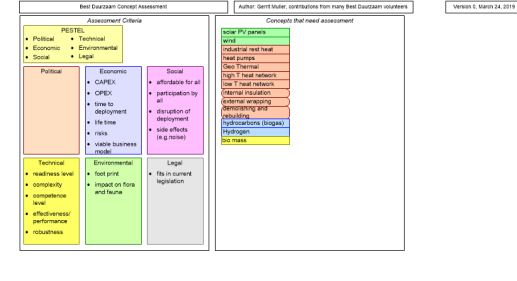
Example of Data Gathering Sustainability Roadmap



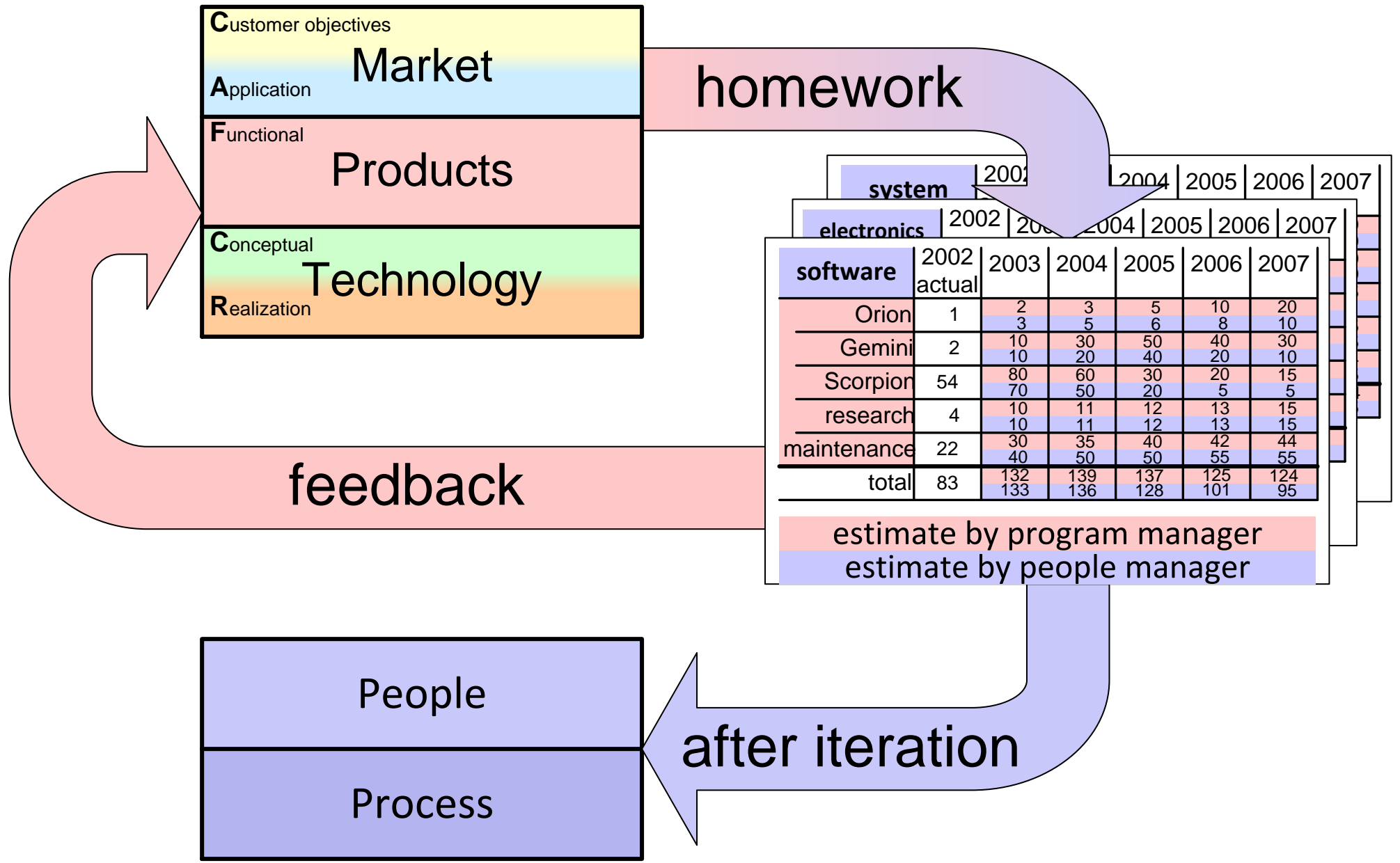
Best Duurzaam A3s to Support the Roadmap Creation



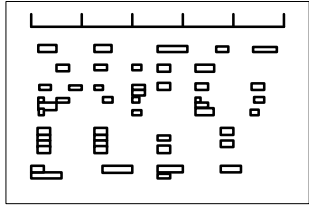
STRSroadmapA3s



From Market, Product, Technology to People, Process



Granularity of Roadmap Material

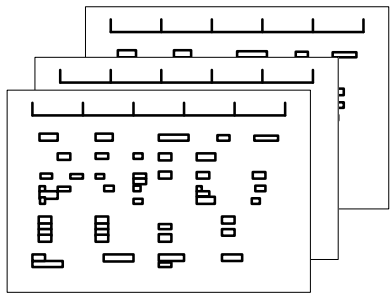


Top-level
roadmap

Single page

Poster

part of many presentations

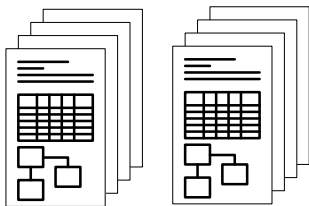


Supporting
roadmaps

Single page
per view
or per driver

Poster

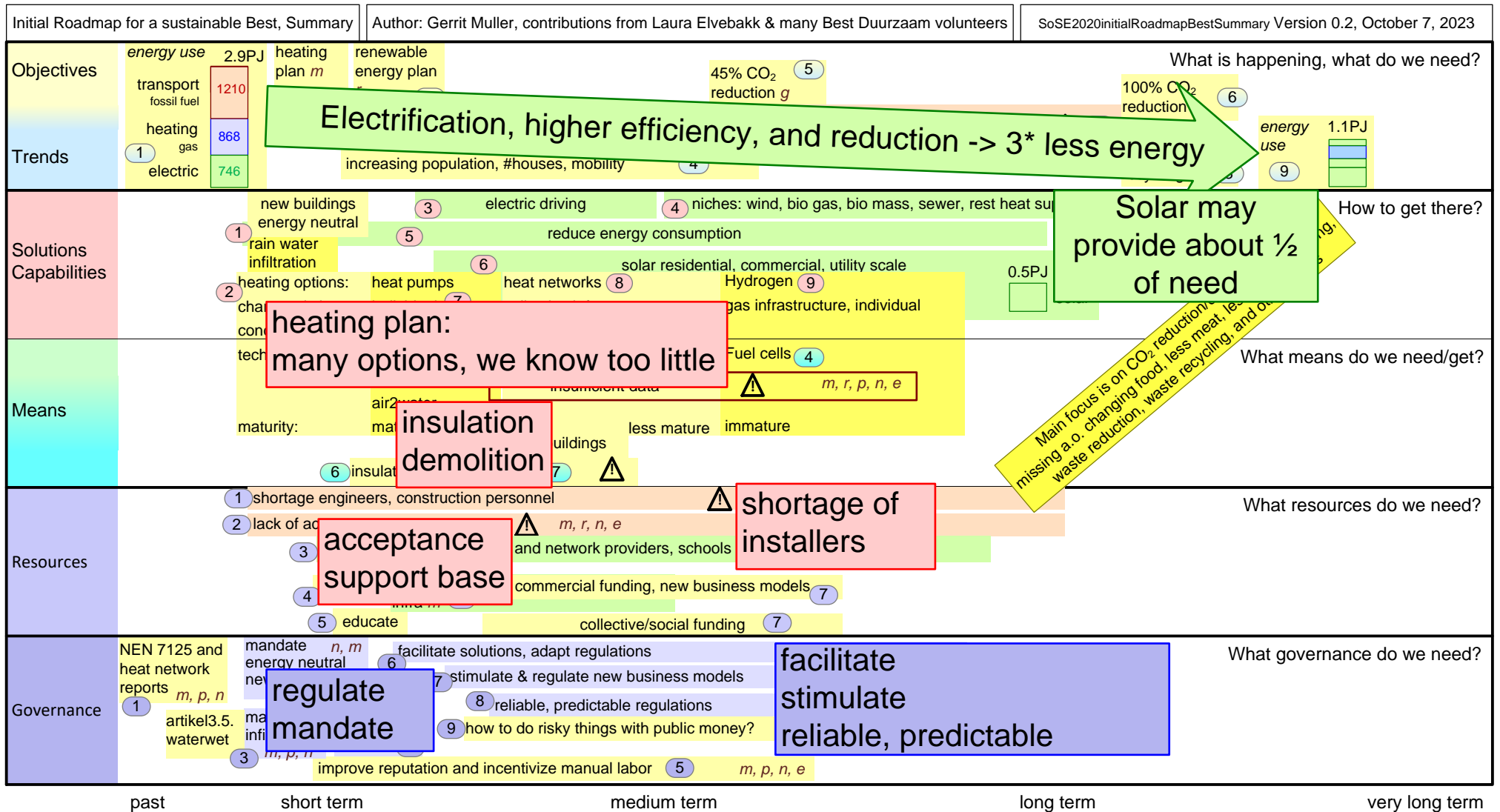
part of many presentations



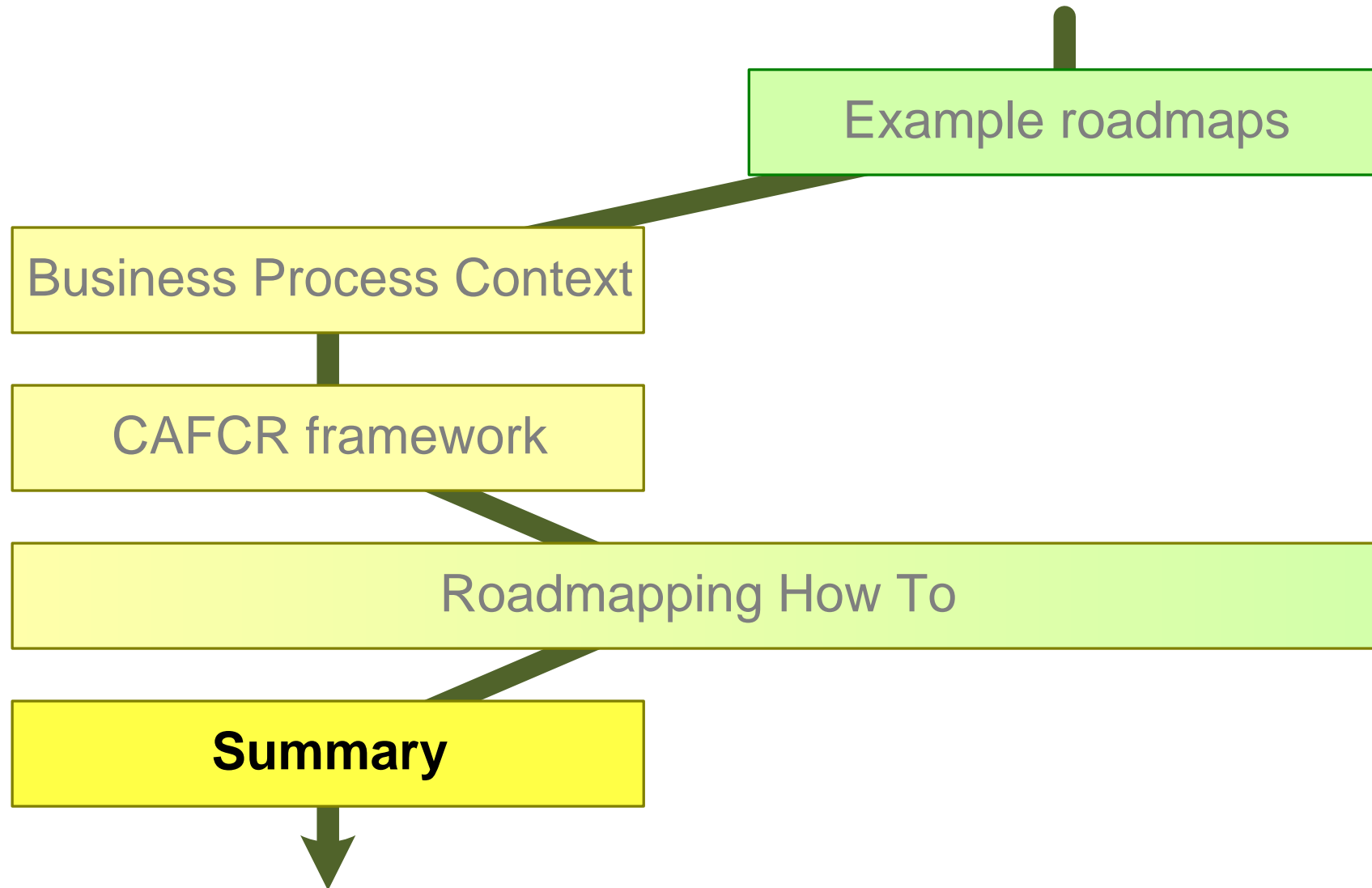
Supporting
reports

Document
per relevant
subject

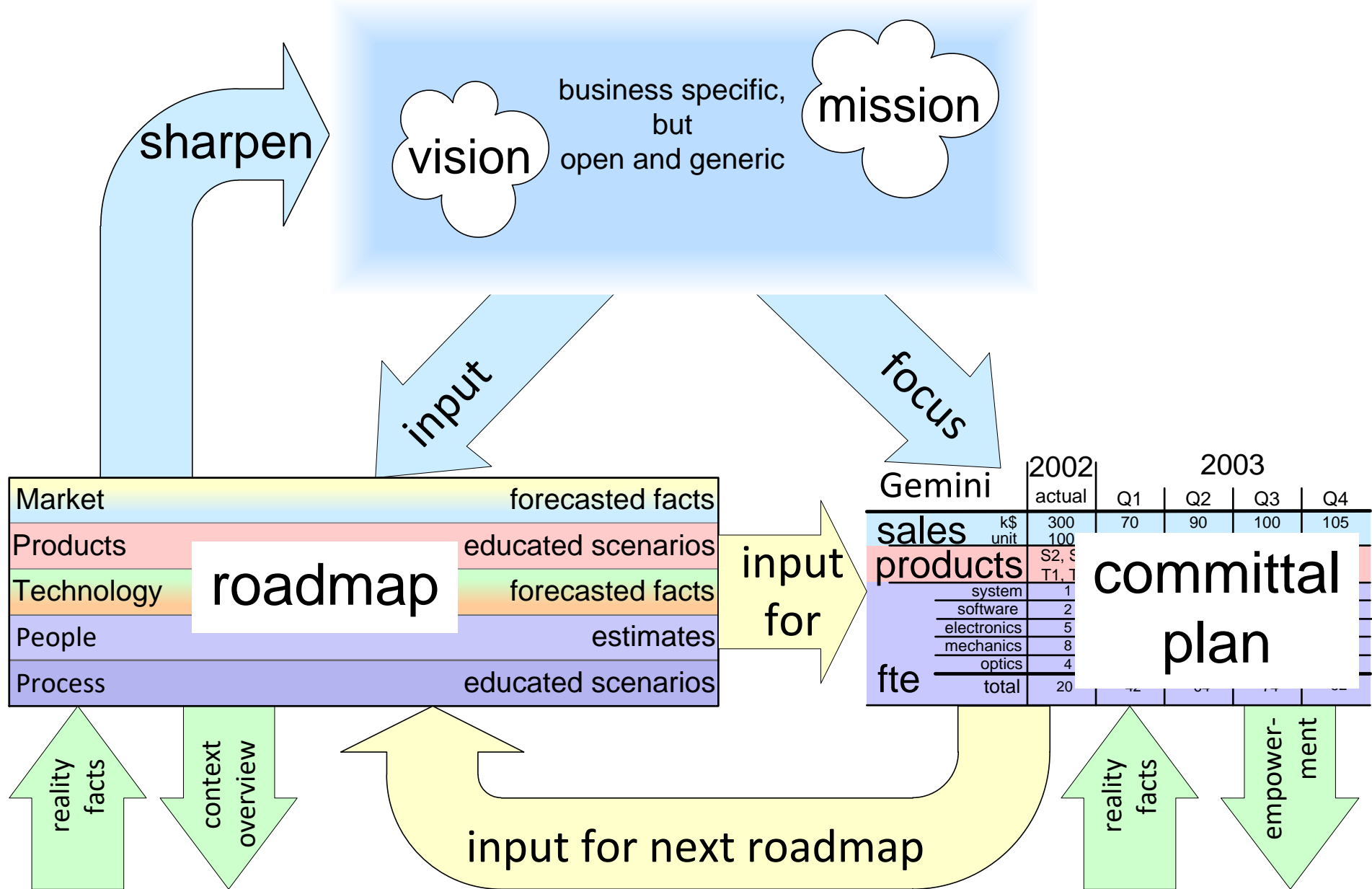
Package Roadmap for Target Groups



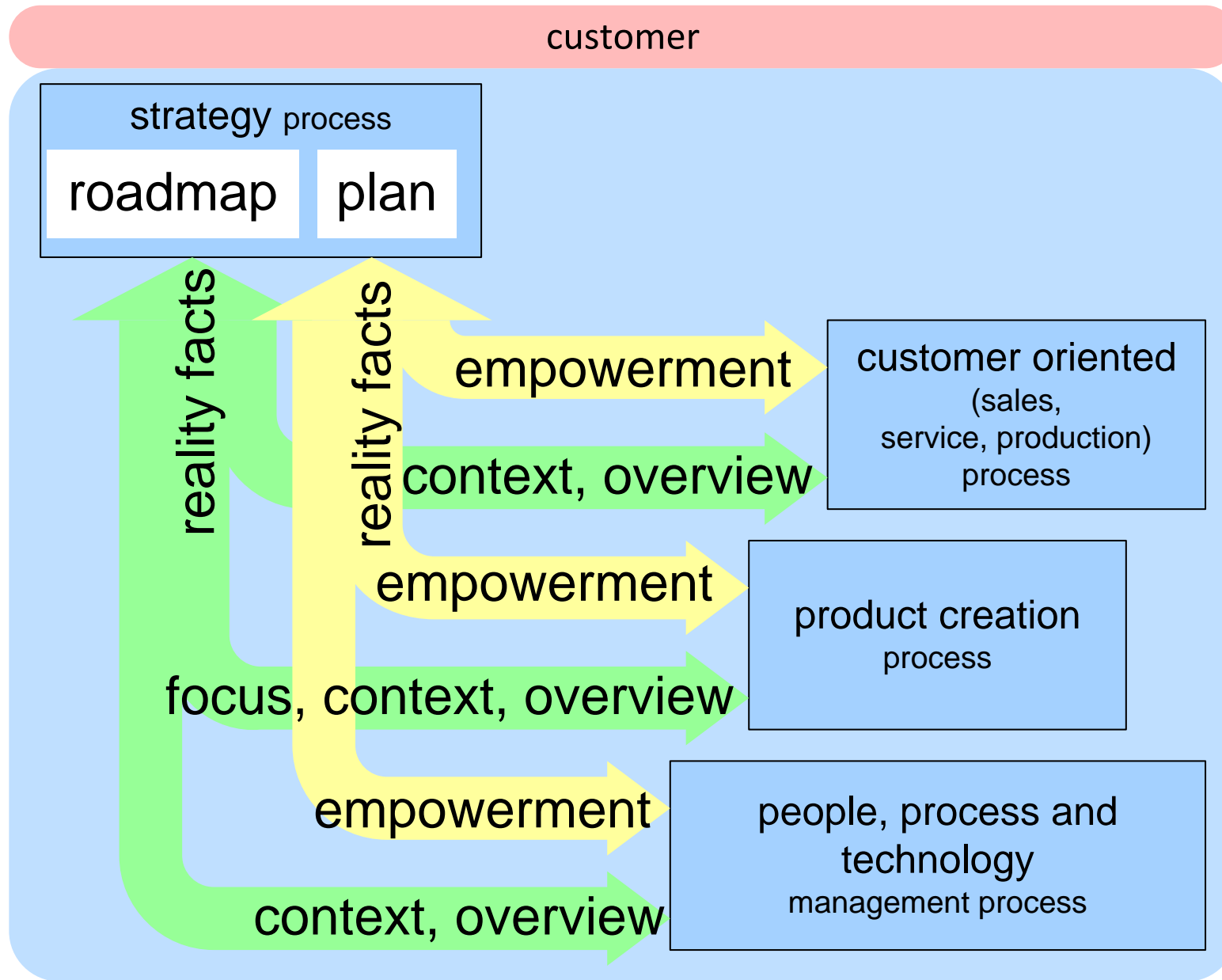
Summary



Summary of strategy process



Summary of role in business



Cambridge Roadmapping by Rob Phaal

<http://www.cambridgeroadmapping.net/>

Gaudisite Roadmapping Module

<https://gaudisite.nl/ModuleRoadmappingPaper.pdf>

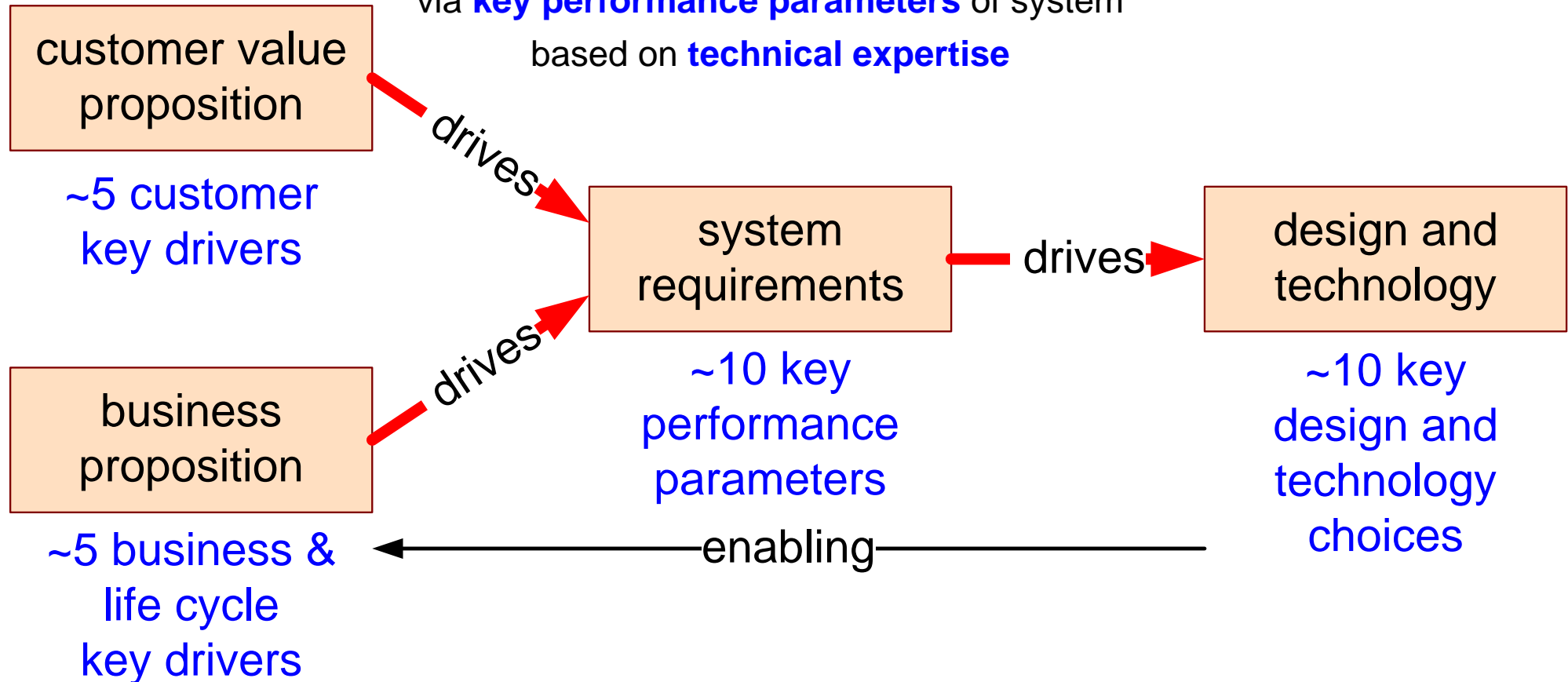
Applying Roadmapping and Conceptual Modeling to the Energy Transition: A Local Case Study by Gerrit Muller

<https://www.mdpi.com/2071-1050/13/7/3683/pdf>

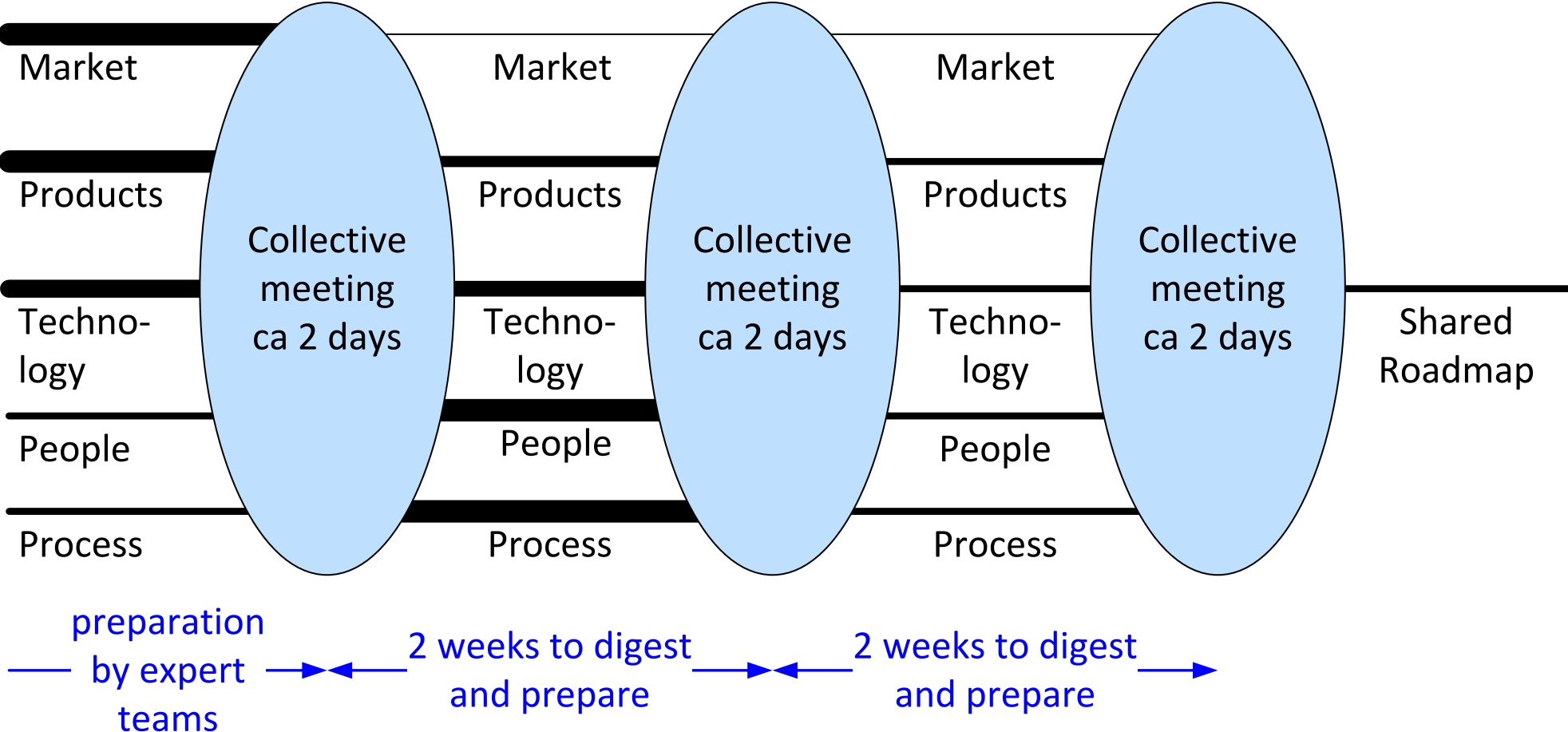
The Architecture Captures the Rationale

Systems Engineering: *Fitness-For-Purpose*

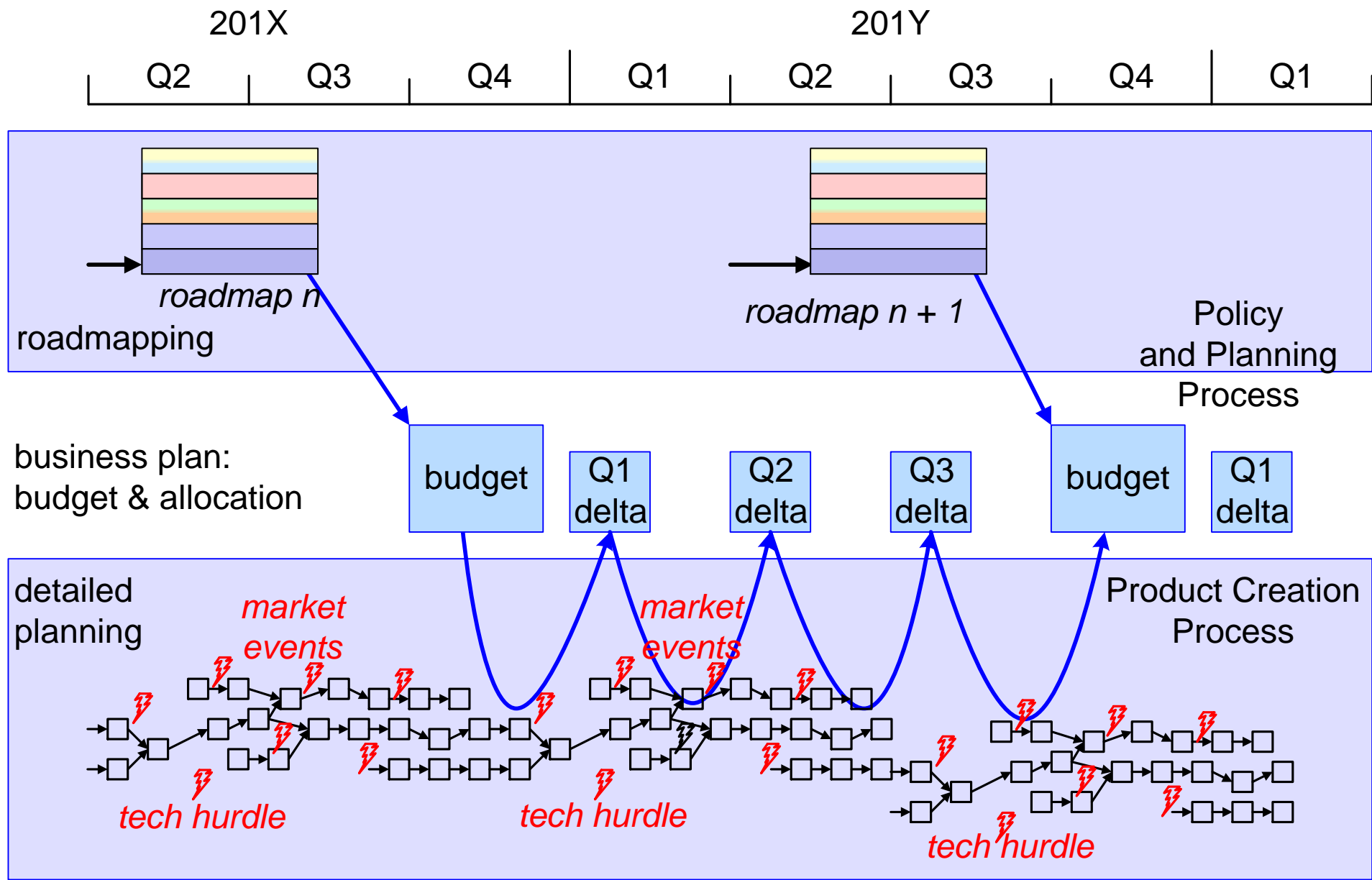
Achieving **customer** and **business key drivers**
via **key performance parameters** of system
based on **technical expertise**



Creation or Update of Roadmap in Burst Mode



From Roadmap to Detailed Plans



3-Tier Approach

	<i>horizon</i>	<i>update</i>	<i>scope</i>	<i>type</i>
roadmap	5 years	1 year	portfolio	vision
budget	1 year	3 months	program	commitment
detailed plan	1 mnth-1yr	1 day-1 mnth	program or activity	control means