

Assessing and realizing the potential of new technologies

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The concept of „Integrated Technology Roadmapping“

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- Me & IZT
- Introduction: Methods for predicting the future
- Basics: The Integrated Technology Roadmap
- ITR: The five step concept with some examples

- scientist and project coordinator at the IZT since 1995
- Study of chemistry and philosophy
- Research areas: real estate, environmental education, resource management, service research, instruments for innovation management
- projects: BewareE – reducing energy consumption by behavioural changes (EU), powerado – experience of renewables (BMU), service engineering & benchmarking sustainable services (EU and BMBF), cost-effective building (BBR), roadmap fire protection (Hekatron), resource conflicts and rare metals (UBA)



- **independent, non-profit research institution in Berlin**

- founded in **1981**, 20 scientists in 2010

- **objectives:**

realisation of research projects

development of future options

advising stakeholders

- **clients:**

European Commission, Federal Ministries, Federal

companies and associations



Introduction:

There are a lot of methods to predict the future

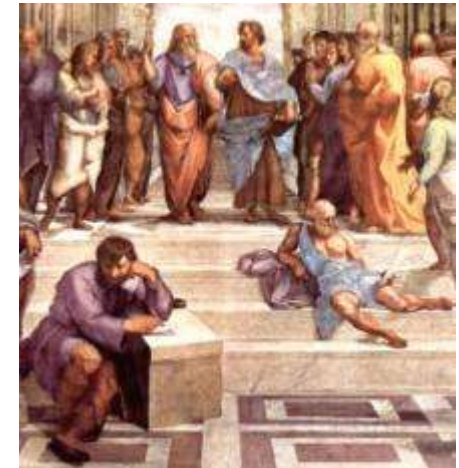
You can cogitate



You can consult the crystal ball



You can arrange a convention






Attention:

- Answers are always related to the type of actors you involve
- Very often a prolongation of trends is mixed with personal desires

Introduction:

Actors are often lead by personal desires

	Common citizens	Companies	Experts
Desires	better income, health care, education for children, house, car	better products, market share, lower staff costs, economical freedom	more sophisticated, but sticking to objects of research
Future Vision	<p>lifestyle like the upper class in Singapore or New York</p> 	<p>to be a company like Microsoft or Airbus</p> <div>   </div>	<p>Thomas Watson (CEO of IBM): „<i>There is a worldwide future market for 5 computers</i>“</p> <p>Bill Gates: „<i>640 kB (of storage capacity) is enough</i>“</p>

Introduction:

General risks for predicting the future

Be careful:

- a vision of the future should not be short termed – it should be long termed
- a prolongation of foreseeable trends is helpful, but it provides no creative visions
- to materialize “personal” desires is an inconvenient job which is rarely useful for the society
- if you see “future” as something coming from outside it overpowers you
- if you build on trend analysis, you neglect your opportunities to create a future

Best Way:

Intend to realize a common agreed future

Introduction:

One example of realizing the future

Example: The Apollo programme

- in 1961 J.F. Kennedy announced “his” vision:
- ***I believe that this nation should commit itself to achieving the goal, before this decade is out, of landing a man on the moon and returning him safely.***
- 8 years later Armstrong made his famous step for mankind

Methodology:

- considering possible goals (think the impossible)
- selecting one of them (according national opportunities)
- founding an institution (NASA)
- mapping all technologies and services needed to fulfil the goal



Introduction:

One example of realizing the future

Example: The Apollo programme

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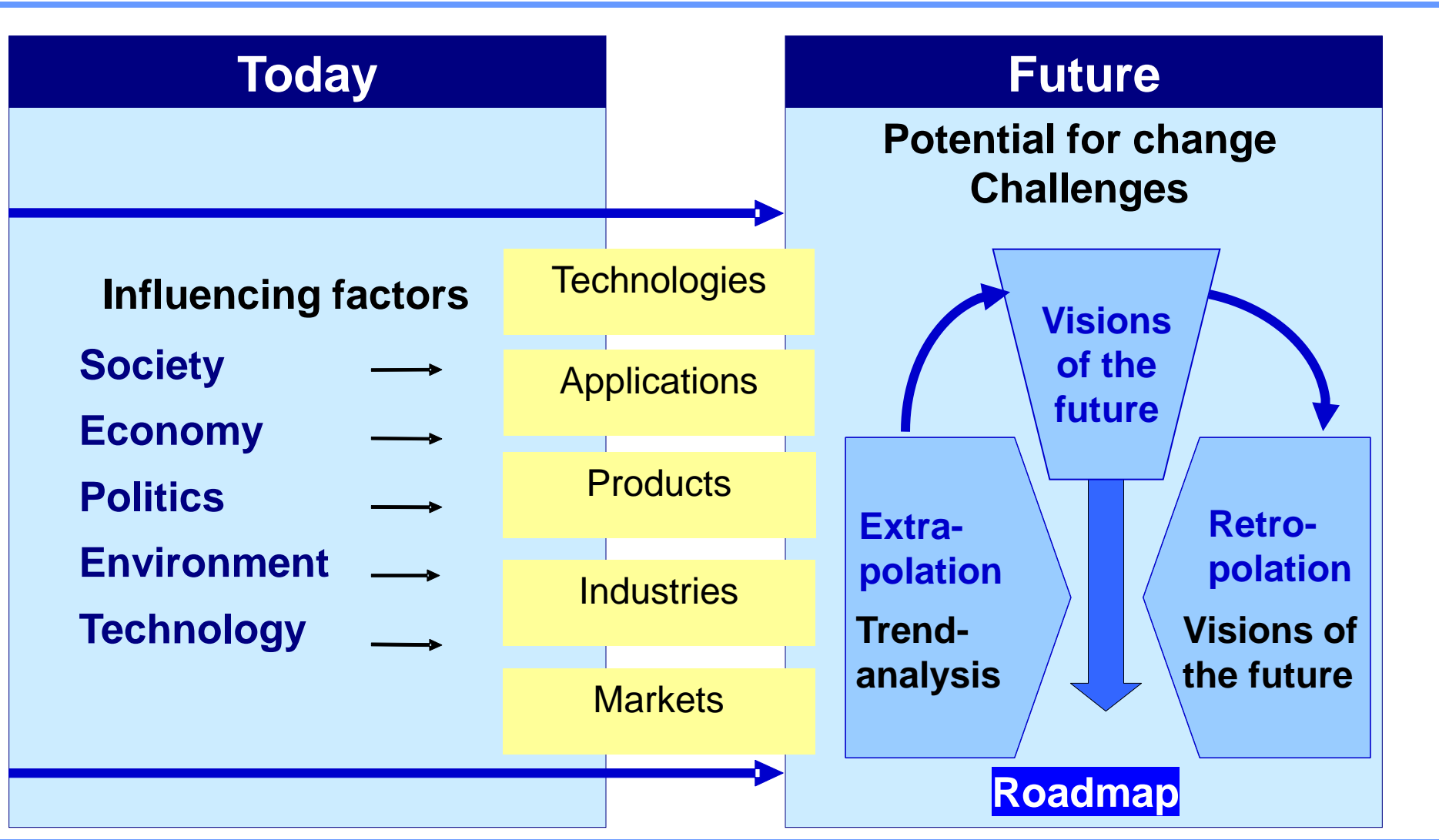
**In principle: a process of
Integrated Technology Roadmapping**

- consider the goal
- select the key technologies (opportunities)
- found the necessary resources
- mapping the path to the goal (services needed to fulfil the goal)



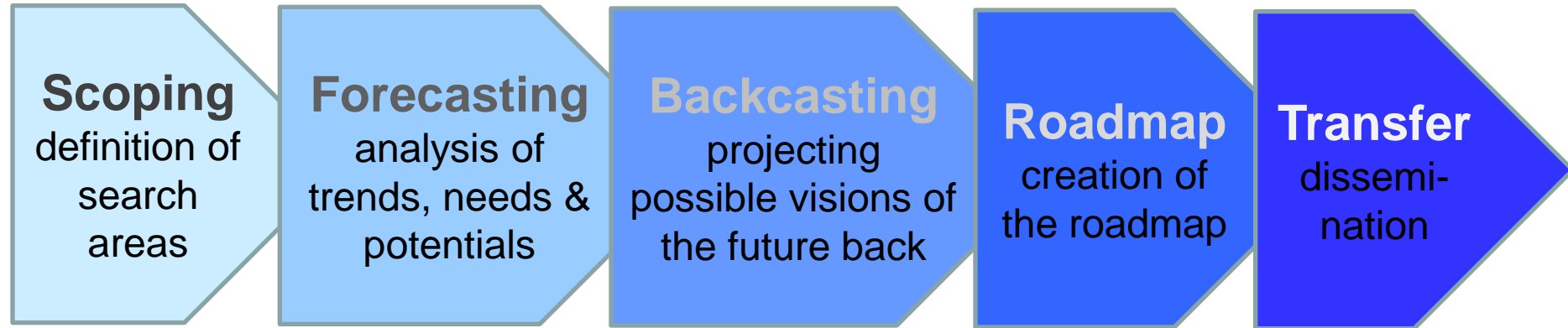
Integrated Technology Roadmapping

Basics: the idea of a roadmap process



Integrated Technology Roadmapping

Basics: 5 step concept & principles (1)



- ITR is a strategic process which shall provide knowledge for orientation
- ITR shall include all relevant stakeholders of the innovation process
- ITR has several goals like early detection und long term planning
- ITR shall concentrate on an accurately defined topic (products, technologies, or matters connected to these)
- ITR shall result in a landscape or a time table for the future = roadmap

Integrated Technology Roadmapping

Basics: 5 step concept & principles (2)



- methodical bundling from possible paths of development
- matching/coordinating different expectations (of involved actors)
- illustration/description of the state of the art (for selected products or technologies) within a context of innovation
- mix of instrument/methods: trend analysis, scenario development, Delphi-polls, stakeholder dialogues
- identification of precise requirements, options for action, development of milestones and actions/tasks
- visualisation within a two dimensional search space/area (roadmap, time-table)

Integrated Technology Roadmapping

5 step concept - Scoping



Task: Defining the basic framework for the process

- **define objectives:** type (for a company, a sector, for a problem, for research & development etc.), targets of your roadmap (new products or process, adopting R&D to mega trends etc.)
- **specify the search field:** reference point for the examination and evaluation of innovation trends and technologies
- **define filters:** restricting the research and the actors involved, the technological range (a technology, a process or much more broader) and market segments (potential future markets, lead or niche markets)
- **scale timeline:** short, medium or long-term perspective
- **define geographical area:** your country, your region, worldwide
- **last but not least:** be aware of your own resources

Integrated Technology Roadmapping

5 step concept – Scoping example

Scoping

Fore-
casting

Back-
casting

Roadmap

Transfer

Roadmap Fire Protection 2020+

- **roadmap objectives:** roadmap for a company (Hekatron), target identifying possible products ideas
- **search field:** trends in building and living influencing development of fire protection systems
- **filters:** only trends influencing habitation, development of products, market segments belongig to Hekatron product
- **timeline:** 2020 (12 years)
- **geographical area:** trends in Germany, administrative law in Europe
- **resources:** 1scientist 4 / staff of the Hekatron 1 month

today



2020

????

Integrated Technology Roadmapping

5 step concept - Forecasting



Task: identifying relevant potential for change

- **analysis:** starting conditions (description of current situation)
- **identification of trends:** literature, databases, web research (methods); executive summary of trends and methodology (results)
- **validation of trends:** qualitative interviews, focus groups (methods); summarizing research theses about trend weighting, dependencies, needs, estimation of effects and potentials (results)
- **weighting of theses:** discussion of developed theses with focus groups (including stakeholders and users), Delphi expert & online user survey (methods); exploration potentials for change e.g. of needs (results)

Result: Anticipating future trends & their potentials for changing the existing situation (or needs)

Integrated Technology Roadmapping

5 step concept – Forecasting example



Roadmap Fire Protection 2020+

- **analysis:** use of smoke alarm devices (market, technologies, legislation)
- **identification of (e.g. economic) trends:** rising energy and operating costs, more stock investments, competition with Chinese products, consumer interest in ICT-products
- **validation of trends:** 10 qualitative interviews with experts (associations, insurances, installers, scientists)
- **weighting of theses:** workshop with Hekatron staff, selecting most important trends affecting the product portfolio, demand for new products

Results: Energy reduction will be most important for consumers, Hekatron has no products to fulfil this need but the technological competence to develop



Integrated Technology Roadmapping

5 step concept – backcasting



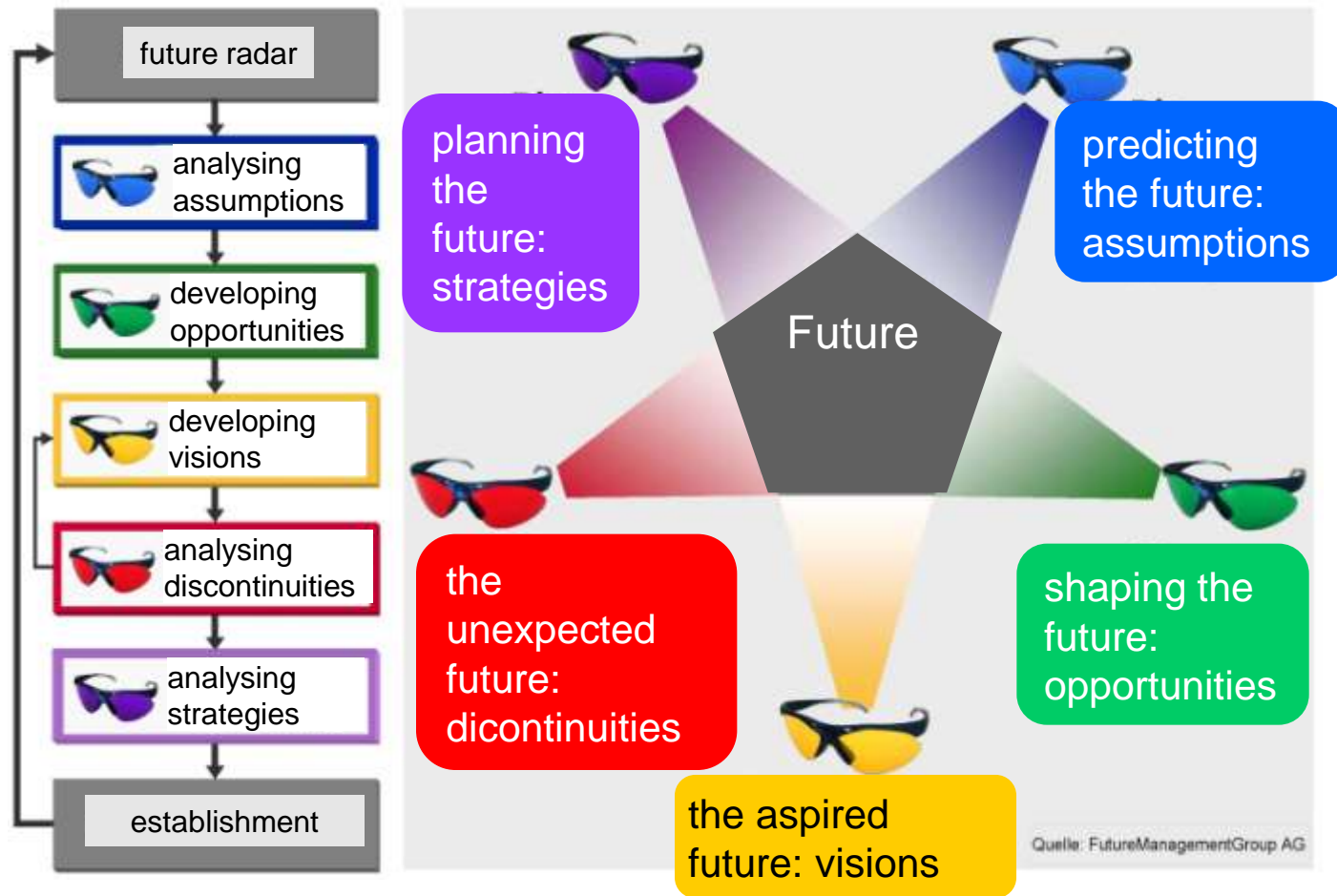
Task: projecting possible visions of the future back

- Including relevant stakeholders and users in the backcasting process
- development of visions of the future summarized in form of scenarios (bundeling the trends)
- diversification: make possible and desirable (or undesirable) scenarios, use wildcards which can strongly influence the scenarios
- identification of new technologies, applications and services
- interpretation of the results in respect of temporal relevance, drivers and obstacles
- discuss the scenarios with all relevant stakeholders and users

Result: identification of tasks and problems regarding the fulfilment of (future) market and consumer requirements

Integrated Technology Roadmapping

5 step concept – backcasting



Multiple futures generated from different perspectives

Integrated Technology Roadmapping

5 step concept – wildcard – think the impossible

New energy crisis Drastice price hike for fossil fuels	++++++
Threat to exposed automation systems Attack on critical infrastructures	++++++
Shortage of engineers Scarcity of the next generation engineers	++++++
Terrorism Terroristic attacks on critical infrastructure	++++
Stagnation in software and IT performance The time of phenomenal advances is drawing to a close	+++
Scarcity of strategic metals Drastice price hikes for Neodym, Indium, Germanium and Gallium	+++
Break-through technologies Higly innovative new materials and technologies	+++

Integrated Technology Roadmapping

5 step concept – backcasting example



Roadmap Fire Protection 2020+

- including staff of Hekatron & external experts
- developing visions of futuristic systems like intelligent command of fire brigades by fire alarm control stations
- wild card events like an EU-initiative to deregulate market barriers – fire alarms systems using IT-lines and web are allowed (competition with proprietary systems)
- identification of technology demands for web-based fire information systems energy monitoring systems or
- interpretation of this technology demand in respect to technical competences of Hekatron

Result: developing a multifunctional sensor for smoke, energy and room-to-room communication



nowadays:
smoke alarm device

integrating
thermal
Sensors,
loudspeaker,
microphone



future:
talking energy displays



Integrated Technology Roadmapping

5 step concept – roadmap



Task: condensing the results of the process

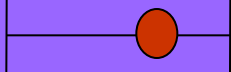
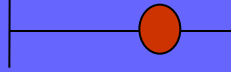
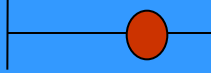


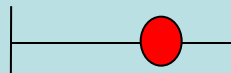
- translate results into milestones with timeframes
- derive recommendations for the actors
- define activities for the actores
- analysis of completeness and consistency by an internal review
- visualisation of results

Result: Roadmap with actions regarding needs, markets, products and services

Integrated Technology Roadmapping

5 step concept – roadmap example

Roadmap photovoltaics: reduction of the material impact in PV

measure	reduction potential	importance low – middle - high	obstacles
new processes for contacting at the front	Si: -21% (c-Si)		low and additional processes
reduction of glass thickness	rolled glasses: -50%		missing focus
substitution of silver by copper	-		R&D necessary, oxidation of Cu
frameless modules	energy pay back: -1,2m		firmness of modules, lifetime
CIS: absorber thickness	thickness: -50%		Higher production complexity
more conductible TCO	-		R&D necessary

Integrated Technology Roadmapping

5 step concept – transfer



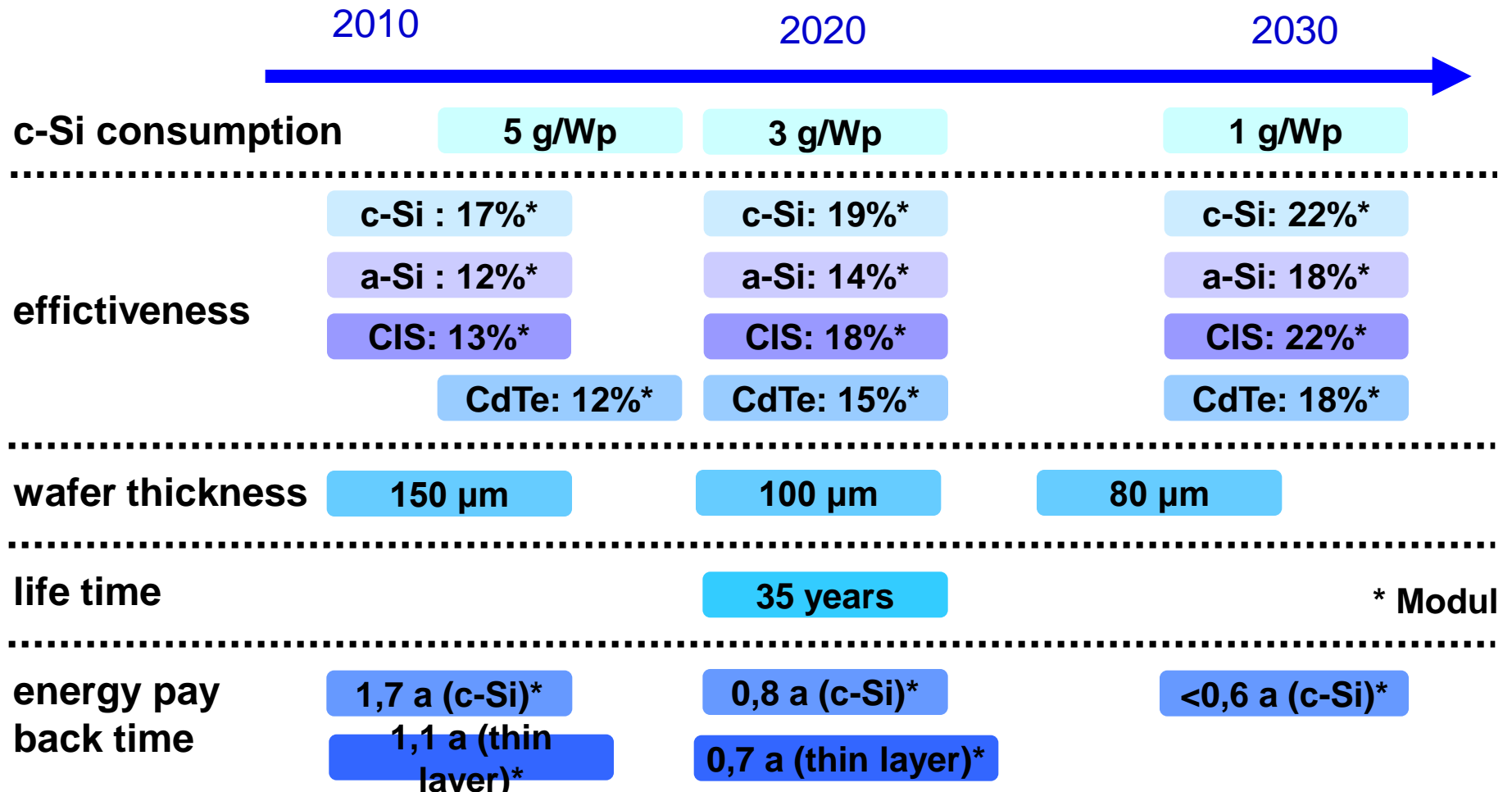
Task: Transfer of the results to stakeholders

- preparation target and user specific materials
- communicate the results – if possible – to relevant stakeholders

Result: common perspective for involved stakeholders

Integrated Technology Roadmapping

5 step concept – transfer example



Roamap photovoltaics: definition of product goals

Integrated Technology Roadmapping

5 step concept – transfer example

roadmap automation 2015+

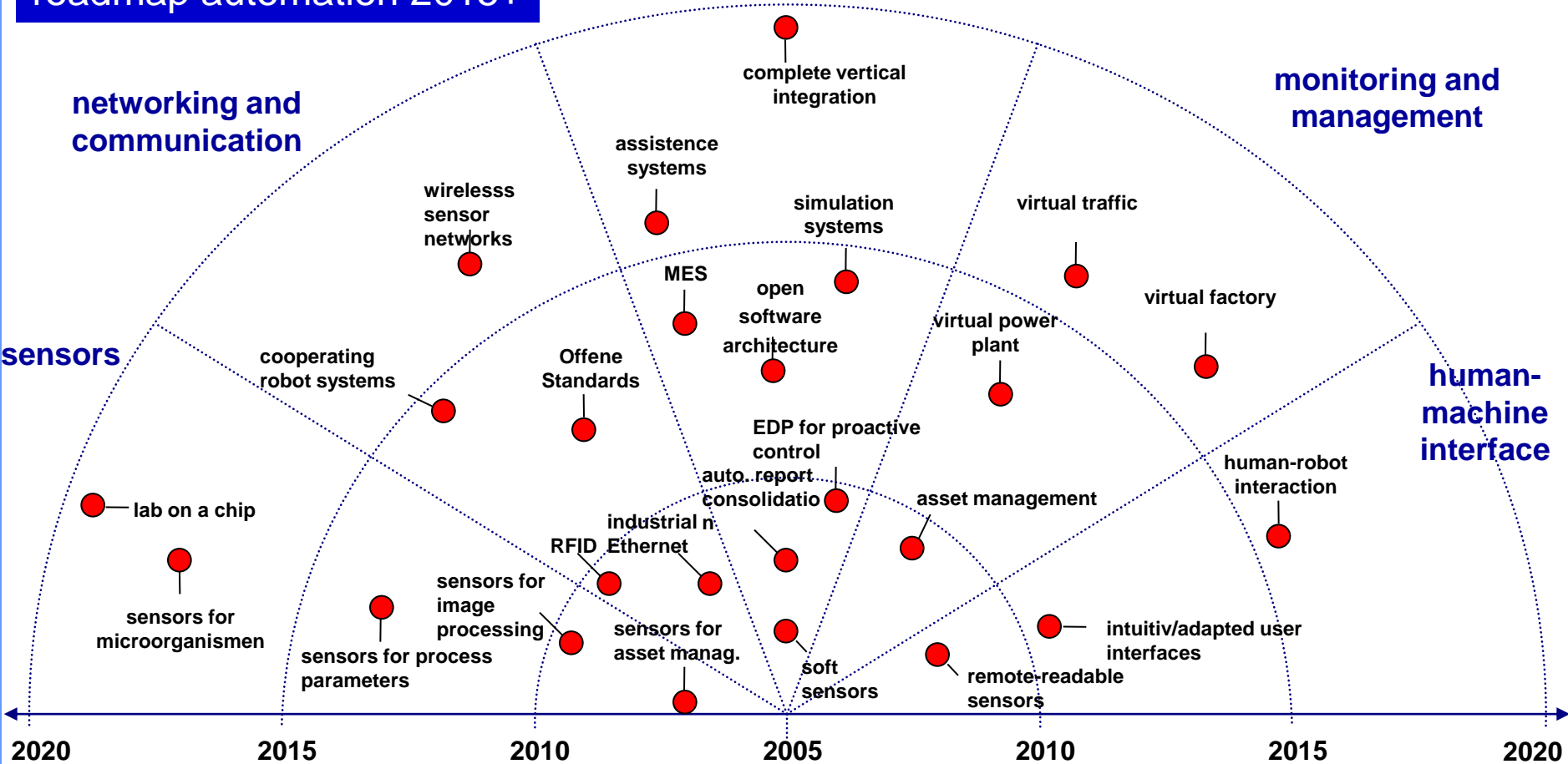
software and
modelling

monitoring and
management

networking and
communication

human-
machine
interface

sensors



Mitigation of climate change



The answer of an innovative shoe maker
Thank you very much for listening