1
Transition management: From Vision to Action

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1.1 TOWARDS TRANSITION

Driving forces behind Sustainable Development mix up moralism and strategic pragmatism (Figure 1.1). The focus of moralism is on the benefit of community, future generations and bridging the welfare gap. The focus of strategic pragmatism is on the benefit of long-term continuity of economy, trade and industry. Business concerns for continuity of operations on the long term for private companies like SHELL, UNILEVER and many others united in the World Business Council for Sustainable Development. Governments concern for long-term stable socio-economic development of nations. Consumer concern for long-term availability of goods and services of acceptable quality at acceptable prices. Morality and strategic pracmatism increasingly mix up in the entanglement of people and organizations.

Figure 1.1: Sustainable Development: Morality and Strategy

Sustainable development may be looked upon as an ongoing process, the origin of which was marked with warning signs like “Silent Spring” (Carson 1962) and “Limits to Growth” (Club of Rome 1972) and actions like the first World Environment Conference in Stockholm (1972) announcing UNEP the United Nations Environmental Programme. In this process the complexity and scope are continuously increasing (Figure 1.2).

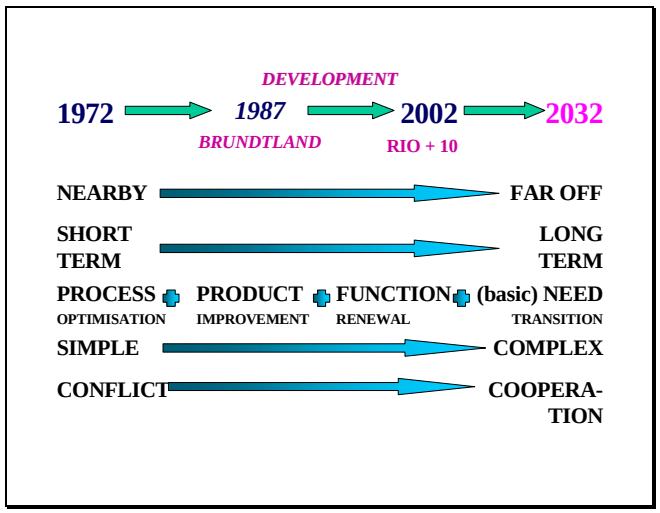


Figure 1.2: Increasing complexity in environment and development

Over time several modes can be recognised: cleaning up the environment and optimisation of existing consumption and production processes to begin with in the early 1970's. This was gradually paralleled in the early 1980's by improvement of existing production and consumption within the existing structures with end-of-process and process-integrated measures. Later at the end of the 1980's by end-of-product measures like reuse and recycling and in the early 1990's by product-integrated measures like redesign for the environment (Greadel et al. 1995) have been introduced.
The Brundtland Report " Our Common Future" (Brundtland et al.. 1987) confirmed the name of this transition process and broadened its view in time as well in its content: "Present and Future generations" and integrating "Environment and Development". The report induced the next phase in the transition towards a society in sustainable development marked by attempts to make more fundamental approaches to the restructuring of the production and consumption system and to make it more operational, like by UNEP, the World Council for Sustainable Development (WBCSD), the "factor approach" (Factor 10 Club 1997, Jansen 2002), Industrial Ecology (Allenby et al. 1999) and in policies like the First National Environmental Policy Plan "To Choose or to Loose" in the Netherlands (NEPP's 1989, 1993, 1997, 2001), opting for a sustainable Netherlands within one generation.
Holdren and Ehrlich (1974) gave the origin of the factor approach as early as in the early 1970's in the equation relating the pressure on the environment with the size of the world population, the welfare per head and the conversion metabolism from extractions out of the environment to products and services.

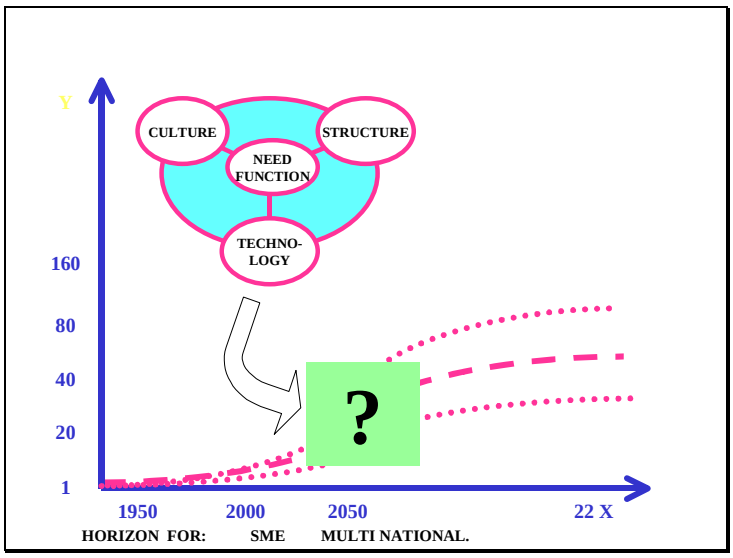


Figure 1.3: The challenge of sustainable development

The challenge (Figure 1.3) given for the first half of the 21st century is a renewal of the production consumption system to improve the conversion mechanism dramatically by on the average a factor 10 or more expressed in the so called eco-efficiency or the Materials Intensity Per Service Unit or MIPS (Schmidt Bleek 1994). This challenge induced research on the ways and means by which to achieve this goal in the interest of a sustainable society for future generations.

1.2 SOCIAL INVOLVEMENT

In parallel and in interaction with emerging environmental concern since the late 1960's, dramatic changes occurred in the involvement of civil society in the processes of societal and political decision-making. The 1968 movement induced democratisation measures and legislation to ensure the influence of workers. This development was supported by the creation of successive instruments of participation supporting the influence of citizens and other stakeholders (Figure 1.4).

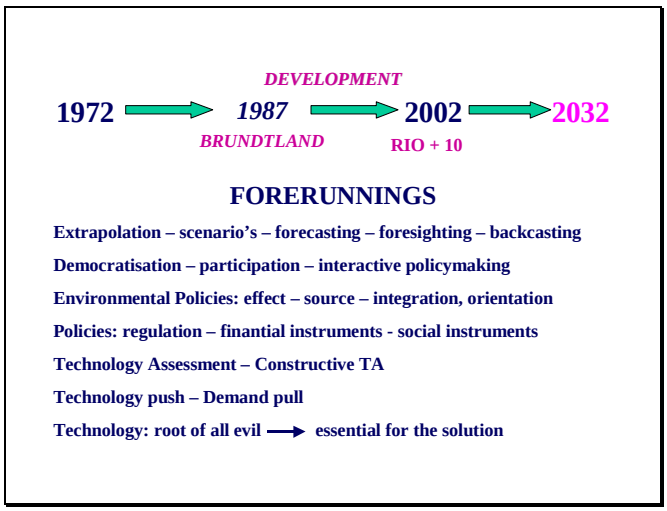


Figure 1.4: Increasing social involvement in the development of our society

Illustrative of this are:

- Legislation on employees participation
- Legislation on participation and right of appeal for citizens in physical planning and in (environmental and spatial) licence policies
- Technology assessment policies, resulting in the Office of Technology Assessment in USA (abolished) and the Dutch Office of Research on Technological Aspects (NOTA), later the Rathenau Institute
- Constructive technology assessment (Smits et al. 1991)
- Public debates on energy policies e.g. in UK, Austria and the Netherlands (Jansen 1985)
- Involvement of stakeholders in the preparation of the Dutch National Environmental Policy Plans (1987,1993,1997, 2001)

Towards the end of the 20th century this development created an attitude oriented at the involvement of stakeholders in major questions influencing their welfare and well-being. The concept of the Dutch Sustainable Technology Development programme took advantage of these experiences (Jansen 1993).

1.3 SYSTEMS RENEWAL: WAYS AND MEANS

Research delivered several approaches (Robèrt et al. 2002) to develop new ways to meet the challenge of sustainable development. One of them - the Sustainable Technology Development approach - was investigated in a Dutch Inter-Ministerial Research Programme (Jansen et al. 2001, Weaver et al. 2000) from 1993 - 1998. The mission of this Research programme was: "*To explore and illustrate, together with policy makers in industry and government, how technology development can be shaped and organised, from future orientation on sustainability and develop instruments to implement this.*"
The architecture of the programme was based upon:

- Orientation on needs as the starting point for technology renewal
- Backcasting from future images to the present and from needs to products on a systems basis, inspired by the work done in Sweden on Energy (Goldemberg et al. 1985)

- Future images on needs based on a factor approach with the "factor 20" (Weterings et al. 1992,)' as a target-metaphor for improvement of the eco-efficiency to be reached within 50 years from a starting point in 1990,
  The factor 20 was based on the following assumptions made in 1992: a growth of the world population by a factor 2, an average growth of global welfare per capita by a factor 5 and a reductionon of the environmental burden by a factor 2. As these figures differntiate depending on the environmental item, the region , the type of need, the number 20 has to be regarded as a metaphor to express the magnitude of the challenge of sustainable development.
- Iterative and interactive search
- Participation of Stakeholders
- Interaction 'Culture - Structure - Technology'

In "learning by doing"- research in a variety of projects covering domains of needs a 7-step procedure (Jansen et al. 1998) was developed and tested as a generalisable methodology for setting up and carrying through sustainability-oriented research and development programmes (Figure 1.5).

DOMAIN	ILLUSTRATIVE PROCES
FOOD SUPPLY	NOVEL PROTEIN FOODS SUSTAINABLE LAND USE HIGH-TECH AGROPRODUCTION WHOLE CROP UTILISATION
TRANSPORT SYSTEMS	PIPELINE TRANSPORTATION OF GOODS COMPUTERISED PROCESSING OF TRANSPORT DEMAND HYDROGEN FOR MOBILE APPLICATIONS
SHELTER	SUSTAINABLE DISTRICT RENEWAL IN ROTTERDAM SUSTAINABLE OFFICE BUILDING
WATER CHAIN	INTEGRATED SUSTAINABLE URBAN / RURAL WATERCHAIN
CHEMISTRY	CONVERSION OF HYDROCARBONS (C1-CHEMISTRY) NEW CELLS FOR PHOTOVOLTAIC SOLAR ENERGY WHOLE CROP UTILISATION FINE CHEMISTRY PROCESS TECHNOLOGY NATURAL FIBRE - REÏNFORCED COMPOSITE MATERIALS

Figure 1.5 Projects in the Sustainable Technology Development program

In an evaluation round some years after completion of the STD program it appeared that most of the initiatives were still followed up (Coenen 2001). The STD-program was the precursor of transition management approaches in the Netherlands at least. The program delivered a distinct contribution in creation of approaches to transformation and to shaping a context for political formulation of transformation policies.

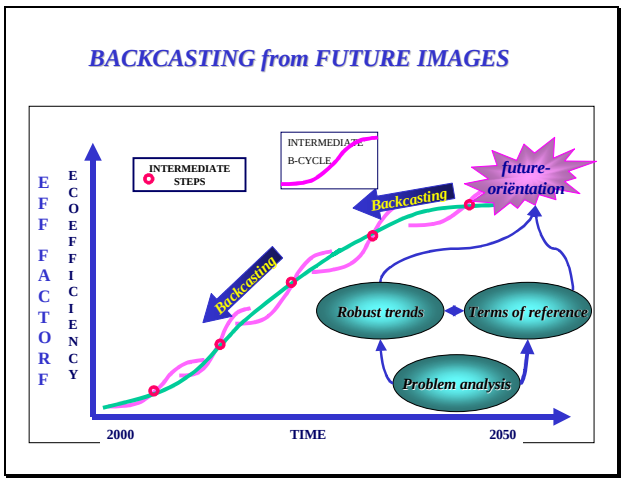


Figure 1.6: Backcasting

The backcasting and systems approach (Figure 1.6) was also applied to the development of the national economy of New Zealand (Reeve et al. 2000) and served as a review on agricultural research (Jansen 2000).

1.4 SYSTEMS RENEWAL AS A COMPLEX SOCIETAL PROBLEM

Around the turn of the century several Dutch Research organisations each exploring development of future oriented research programmes exchanged their experiences and observations. These organisations handle(d) complex explorative search processes (Table 1.1), which have the following characteristics in common: Long-term future orientation for a variety of stakeholders in fields of conflicting interests in an environment with large uncertainties.

Table 1.1 Organisations exploring future oriented technology R&D

STT	Foundation for Future Technology Research e.g.Exploiration future chances of Nanotechnology.
Rathenau Institute Former NOTA	(Technology) Assessments for parliament. Dutch Office for Technological Aspects research e.g. Exploiration of policy and public perceptions on genomics
NRLO	Dutch Council for Agricultural Research Development of basics for renewal of the dutch agricultural system.
DIMI	Dutch Institute for Management and Innovation Management of knowledge transferr and dissemination.
STD	Sustainable Technology Development program Generation of sustainable lang-term future options for technology development

Apart from specificities related to the domain of research, there were common elements in the backbones of their approaches and procedures:

An iterative and interactive process in which relevant stakeholders are involved. The iteration comprises creative generation of products and their assessment by stakeholders to improve products and to gain stakeholder support in successive steps of a search process. The "products" comprise:

A problem definition
Generation of a vision, a strategy
Derivation of Options
Formulation of selection criteria
Making proposals (for R&D programmes)

As such these are "normal" steps in project management. The particularity lies in the nature of their management including the full involvement of stakeholders. Given the role of people in these processes in sharing their knowledge the process (Figure 1.7) was named : KNOWLEDGE FUSION

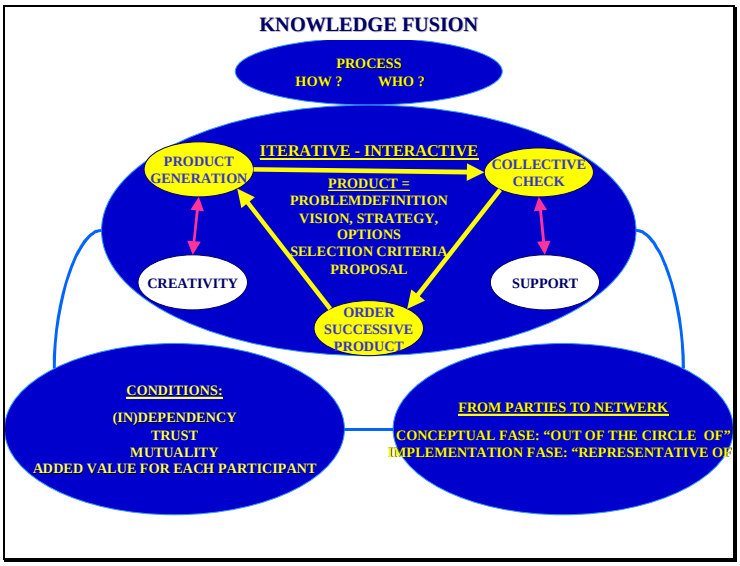


Figure 1.7: Fusion of people's knowledge to support sustainable development

1.5 SYSTEMS RENEWAL FOR SUSTAINABLE DEVELOPMENT: EDUCATION AND PRACTICE

The ambition is to handle the tension between the urgency to renew numerous systems to fulfil people's needs and the inertia to processes of fundamental change. On the one hand, overacting and neglecting the inertia of change may be counter - productive. On the other hand, the pace of change has to be sufficient to achieve the timely renewal of major systems.

Given the urgency and the necessary scale of Systems Renewal for sustainable development, the proposal is to attain an ongoing process of Systems Renewal in the industrialised as well as in the developing nations within the next 15 years. In general, this approach consists of a process of interactive and iterative search in co-operative arrangements among private parties, science and technology, and governmental parties that take the interaction of "culture - structure - technology" into account. The application of this approach must respect specific national and regional cultures and traditions.

The scale of a specific Systems Renewal process must be proportional to the scale of the system and its effects. Top-down and bottom-up approaches appear to be complementary.

The Copernicus Charter (a RIO 1992 initiative to integrate sustainable development in higher education world-wide) must be implemented within 10 years (by 2015) to guarantee sufficient capacity building. Experience with the embedding of Sustainable Development in educational systems gained up to now should be extended and practised. In the first EESD – conference (Engineering Education in Sustainable Development) at the Delft University of Technology in October 2002 to be succeeded by EESD 2 in Barcelone in October 2004.

Backcasting as developed and practised in the STD program (see § 1.3) suggests the step-wise approach based on exchange and parallel development in the practice of Systems Renewal and Edicational Renewal as shown in the next Figure 1.8:

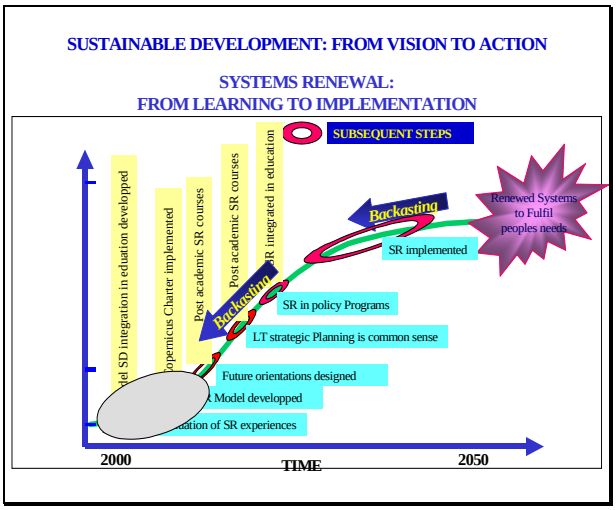


Figure 1.8 . Steps on the way to systems renewal for sustainable development: in education and governance

1.6 RESEARCH AND TECHNOLOGY DEVELOPMENT FOR SUSTAINABLE DEVELOPMENT.

In the late 1990's the question of "HOW" to design and support sustainable development through research and technology programmes was put on the agenda in the EU 5th Framework (e.g. in the EU JRC STRATA programme). The core of a contribution to the European Conference on Cleaner Production in Lund, May 2001 (Jansen 2002), was presented earlier in a STRATA workshop in Maastricht in January 2000. Since then the Factor 10 Institute has published an analysis of complementary approaches to the "HOW" question (Robèrt et al. 2002)[15]. And the EU JRC has set up an inventory and analysis of sustainability-directed research programmes (Whitelegg et al. 2001). In the STRATA programme, the AIRP project was started in January 2002 with the goal of answering this question by mid 2003 (Hinterberger et al. 2001). This project aims to deliver recommendations for setting up and evaluate new programmes on options for sustainable development and their contexts. The final report has been delivered to the EU.

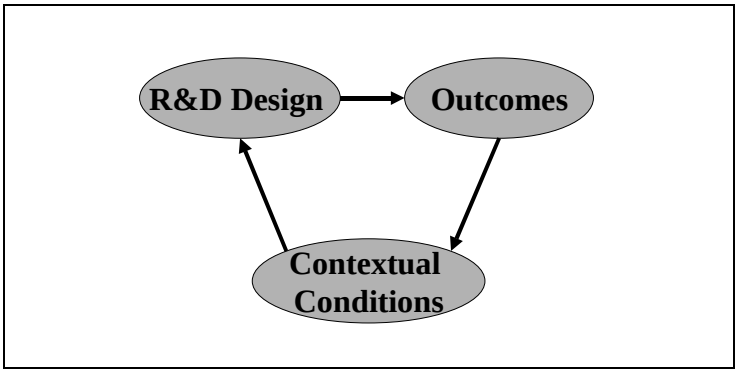
The programmes (Table 1.2) are analysed (Table 1.3) and judged to gain experience in using the preliminary evaluation methodology on the following elements: Outcomes: (Nature and quality), Design and Process characteristics, (what, how and how well) and Contextual conditions: (Dominant factors).
The programmes selected had to meet some essential criteria like availability of information, orientation on sustainable development and future and innovativity.

Table 1.2: Selected RTD programmes in STRATA - AIRP

Name	**Abbreviation**	**Country**
Eco-cycle Programme	Ecocycle	Sweden
Socio-Ecological Programme	SEP	Germany
Austrian Program on Technologies for SD	ATSD	Austria
Austrian Landscape Research Programme	ALR	Austria
Sustainable Technology Development Programme	STD	Netherlands
Habiforum	Habiforum	Netherlands
Human Resources and Employment in the Fishery Sector	Mahre	Portugal
Consumer Unity and Trust Society	CUTS	India
Zero Emissions Research and Initiatives	ZERO	International

Table 1.3: Hypotheses in the analysis of RTD Programs

Hpothese I	Hypothese II	Hypothese III
Design and Process characteristics of the programmes strongly influence the nature and quality of Outcomes of a programme and are depending on contextual conditions.	The degree of correspondence to sustainability orientation of Design and Process characteristics of the programmes strongly influence the nature and quality of Outcomes of a programme.	Contextual Conditions, Design and Process characteristics, and Outcomes of a programme are interconnected in a loop.



Confirmation of these hypotheses would identify tools to improve the ways and means of Sustainability directed research programmes. Contextual conditions such as public and political awareness of the necessity of sustainable development, availability of definition of societal challenges, availability of scientific and social (human) capital, adequate organisation of science could open opportunities for adequate process design and management. The Table 1.4 gives an overview of some relevant areas of interest, which could be a point of action for improvement.

Table 1.4: Areas of interest and investigation in research for sustainability.

CONTEXT	Design / Process	OUTCOMES
Developmental and sustainability status and trends. Understanding and conceptualisation of sustainability within society and at political and research policy making levels. Organisation of science and research. Status of scientific capital and capacities. Status of social capital and capacities.	Management and Finances. Research design and management. Communication. Decision making / Stakeholder involvement Handling Risks / Uncertainties.	Contribution: of proposed or actual solution to expansion and quality of choice. to achievement of sustainability goals and objectives. to strategic reorientation and path finding. to transition management. to scientific capacities and capital. to social capacities and capital. to influencing and transforming stakeholders, actors, and those both inside and outside the programme.

1.7 TRANSITION FOR SUSTAINABILITY

In successive Dutch National Environmental Policy Plans increasing attention was paid to the role of technology for sustainable development and broadening the scope to its interrelation with socio-economic, socio-cultural and institutional aspects:

NEPP 1 1987: Recognition of the role of Technology expressed in strategies expecting a contribution to sustainable development.

NEPP 2 1993: Differentiation between Systems Optimisation, Improvement and Renewal and identifying different policy instruments.

NEPP 3 1997: Recognition of the necessity of Interdisciplinary cooperation,and Breakthroughs, and announcing the Dutch Sustainable Development Initiative (NIDO)

NEPP 4 2001: Transition Policies to cover persistent sustainability problems and to be initiated in the sectors: Energy, Agriculture and Transportation.

In the STD Programme, a follow up of the NEPP 1, the systems approach was experienced in / applied to a variety of systems in different domains of need and in different sectors (see Figure 1.5). The programme itself originated from a policy need to understand the role of technology in a transformation towards sustainable development. In the projects, each of which was oriented at a specific production-consumption system, common principles and contextual conditions for all of the projects appeared. Also system-specific conditions and principles prevailed, which might be expected as the specific systems belong to a hierarchy of systems (specific – sectoral – societal). A similar hierarchy can be observed in regional development consisting of development of coherent geographic systems (Table 1.5).

Table 1.5: Transition areas

Future orientation And System Renewal		
Needs	Sector providing means	Regional
Transportation	Chemistry	Urban
Nutrition	Agriculture	Rural
Shelter	Mech. Industry	Integral U - R
Water	Services	

In its fourth National Environmental Policy Plan: “A world and a will, work on sustainability”(NEPP 4, 2001) the Dutch Government announces transition policies for traffic and transportation, agriculture and energy to cope with persistent problems and to step on the path to a sustainable future.
Martens and Rotmans (2002) describe transition as “the result of developments in different domains, as a set of connected changes which reinforce each other but take place in several different areas, such as technology, the economy, institutions, behaviour, culture, ecology and belief systems”. They regard transition as a “spiral that reinforces itself; there is a multiple causality and co-evolution caused by independent developments”.
Freeman and Perez (1988) look upon successive technologies and sources for energy provision as the origin of the so-called Kondratieff waves. Another example concerns the changes as a result of successive transportation techniques in the 19th century (Grübler and Nakicenovic 1991). These phenomena, shifts in energy systems and transportation systems from canal boats to trains respectively may very well be understood as successive transitions induced by changes in energy /transportation technology.
A long-lasting common societal orientation may be essential for a transition. As examples for such orientations may serve:

- The orientation in Western (continental) Europe on reconstruction in the 1940s and 1950s after the Second World War.

- The vision behind the physical and social build up of the city of CURITIBA in Brazil. A decades long consistent policy implementation based on integral development of economic, social, cultural, environmental views resulted in a physical and cultural appearance of the city, its infrastructure, its (public) transportation system and its place for nature completely different from the usual appearance of fast growing cities in developing nations. It is looked upon as an example for development also in the developed world.
- The international policy orientation on the removal of barriers to trade and the liberalisation and globalisation of the world economy
- The international (policy) orientation on sustainable development brought about by the Brundtland report.

1.8 CONCLUSIONS

The main conclusions to be drawn on the process of transition of the current development to sustainable development are:

- The driving forces behind transition have to be based on moralism towards future generations and the environment and on strategic pragmatism and concern of business, government and citizens / consumers.
- Three parallel trajectories cover the path towards sustainable development: (1) Optimization in the short run, (2) Improvement in continuation of current environmental development in medium terms both to gain time for (3) Renewal of production and consumption systems in the long run.
- The use of the environment at large has to be around twenty times as efficient in comparison to the years around the turn of the century to fulfil the needs of future generations in the next fifty years to be attained finally along the third trajectory.
- Systems renewal appears to be a complex social process, which requires an adequate process management.
- Conducting research into systems renewal for sustainability might show up mechanisms of a spiralling connection between research contexts, research management and design for sustainability-oriented R&D, and research outcomes (including societal influences). Outcomes from one sustainability-oriented research programme may in their turn influence favourably both the context for and the research management and design of subsequent programmes on systems renewal for sustainability.
- The next phase of integration of renewal of systems in a societal transition process is investigated, announced and prepared in, for example, the fourth National Environmental Policy Plan of the Netherlands.

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