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Published in:
From Oracles to Dialogue; Exploring New Ways to Explore the Future

Publication date:
2007

Document Version
Publisher's PDF, also known as Version of record

Link back to DTU Orbit

Visions and visioning in foresight activities

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The paper discusses the roles of visioning processes and visions in foresight activities and in societal discourses and changes parallel to or following foresight activities. The overall topic can be characterised as the dynamics and mechanisms that make visions and visioning processes work or not work. The theoretical part of the paper presents an actor-network theory approach to the analyses of visions and visioning processes, where the shaping of the visions and the visioning and what has made them work or not work is analysed. The empirical part is based on analyses of the roles of visions and visioning processes in a number of foresight processes from different societal contexts. The analyses have been carried out as part of the work in the COST A22 network on foresight.

A vision is here understood as a description of a desirable or preferable future, compared to a scenario which is understood as a description of a possible future. Visioning processes are understood as processes where a vision is developed or where visions get a role in societal discourses. The actor-network approach is used as the theoretical background

The theoretical part of the paper describes different characteristics of visions like
- The time horizon
- The scope (society, sector etc.)
- Whether the vision is an end-point presenting a future and whether it includes descriptions of the paths towards the desirable future
- The roles given to different actors and objects (actants) like a certain technology area
- The peripheral characteristics of the vision like the expectations to the surrounding society, its infrastructure etc.
- The differences between the present conditions and the future which the vision describes.

An important part of a vision is the visioning processes leading to the development of the vision. In visioning processes actors, objects, societal discourses are inscribed into a vision through co-shaping of the vision and its elements. This may include creation of an obligatory passage point, where certain actors, technologies etc. are given roles, which all other elements in the vision have to relate to. Another important aspect of visioning processes include the types of actors participating in the processes and the types of expertise included in the processes (scientific, lay, business etc.).

The empirical part of the paper analyses eight national foresight activities from Denmark, Germany, Hungary, Malta, Portugal, Slovak republic and The Netherlands and the role of visions and the visioning processes within and/or following the foresight activities. The analyses of the eight cases show three overall values as basis of visions in foresight (national competitiveness, environmental protection and human development). Technologies were in some cases playing a central role in the visions. It has not been possible in most of the cases, to assess the robustness of these expectations and the co-shaping of actors and technologies. Visions have had three intended roles in the cases: as frame for development of strategies, as inspiration for discussions about future development and as products of stakeholder dialogues. A societal impact is seen in three cases (on research, legislation and the national training system). The societal impact of several of the other visions seems to have been limited or absent. There is not enough information about the visions and their role afterwards to assess the mechanisms behind impact or lack of impact. The impact of the visioning processes and the dialogue between different stakeholder groups in the foresight activities seems in some cases to have been bigger than the role of the visions and may lead to further co-operation among stakeholder groups that may not have co-operated before.

1. Introduction:

This paper discusses the roles of visioning processes and visions in foresight activities and in societal discourses and changes parallel to or following foresight activities. The overall topic can be characterised as the dynamics and mechanisms that make visions and visioning processes work or not work. In the paper a vision is understood as a description of a desirable or preferable future, compared to a scenario which is understood as a description of a possible future. Visioning processes are understood as processes where a vision is developed or where visions get a role in societal discourses. A distinction is made between the visioning, which is part of a formalised foresight activity and where visions are developed, and visioning, where a developed outside the foresight activity is gaining or not gaining support. The paper presents an actor-network theory approach to the analyses of visions and visioning processes, where the shaping of the visions and the visioning and what has made them work or not work can be deconstructed and analysed.

The first section gives a short introduction to three approaches to future thinking, including the visionary mode of thinking and the backcasting approach which combine development of visions and paths that may lead to the realisation of the visions. In the following sections the characteristics of visions and of backcasting are discussed. The next section discuss the visioning process, where visions are developed and thereafter follows a section where the mechanisms when visions gain support or not - and the mutual shaping of actors and visions which is part of these enrolling and inscribing processes. The last sections present eight national foresight activities, where visions and visioning processes have been part, and discuss the characteristics of the visions and the role of the visions and the visioning processes.

2. Exploring the future:

According to Dreborg (2004) (citing among others Bell and Marien), there are three modes of thinking about the future with each their methodologies – the predictive, the eventualities and the visionary mode of thinking (see table 1 for a more elaborated description).

Mode of thinking about the future	Type of futures in focus	Characteristics	Aim
The predictive mode of thinking	Probable futures	Working with indications of what will happen. Trying to find the most likely development	Be better prepared to handle emerging situations
The eventualities mode of thinking	Possible futures	Openness to several different developments	Be better prepared to handle different situations that might emerge
The visionary mode of thinking	Preferable futures	Envisioning how society can be designed in a better way	Suggest solutions to societal problems

Table 1: Modes of thinking about the future (based on (Dreborg, 2004) and own elaboration)

The predictive mode has a long tradition based on the idea to get an indication of what will happen. The pre-scientific approach was based on detecting and interpreting signs of what was to come. Later, mathematical models were developed based on empirical observations. The aim is to explain observed phenomena with reference to patterns in the observations and rules or laws that are based on the observations. Predictive modelling, exploration of trends and the Delphi-methodology are examples of methodologies within the predictive mode of thinking (Dreborg, 2004).

The eventualities mode of thinking is open to the difficulties of prediction and recognise that different futures are possible. Explorative scenarios are a way of systemising this mode of future thinking. The American think tank RAND and Shell have contributed to the development of the methodology of this kind of scenarios as a tool for strategic planning. Exploration of

different developments, especially trend-breaking ones, and strategies to cope with or be prepared for them, is an important element in this forecasting methodology (Dreborg, 2004).

The third mode of future thinking is the visionary mode, where it is envisioned that the society or a part of it could be developed to a better way than the present way of functioning. An early example of a vision is Thomas More's Utopia, which is a vision based on a fundamental reshaping of the society. According to Dreborg (2004) these early visions paid little attention to ways of reaching this preferable future. In the 1970'ies backcasting was developed as a method in the development of paths and strategies for reaching a preferable future.

Pure forms of future studies seem by far to be the most common. However the prospective mode, developed by Goudet is a combination of exploratory and visionary elements (Dreborg, 2004). The use of visions and backcasting in an actual planning situation calls upon a combination of the visionary mode and the exploratory mode.

3. Visions:

As mentioned earlier a vision is a desirable or preferable future. Such preferences are of course not universal, although some visions have gained a lot of support. A number of visions these years are focused on the need for a more sustainable development, which since the Brundtland report 1987 and the Rio Summit in 1992 has gained a lot of awareness. Maybe so much that many countries and many companies today try to describe themselves as sustainable or at least developing in a sustainable direction although this can be questioned. Another type of visions are focused on the so-called 'information society' or 'knowledge economy' and is very often technology-based visions focusing on the use of information- and communication technology (ICT).

Smith et al (2005) point out that visions by some scholars are called 'guiding visions' and refer to the role of codified representations of technological expectations in framing socio-technical problems and motivating actors to try and solve them. In their discussion of governance of sustainable socio-technical transitions Smith et al (2005) presents a number of functions that visions have (Smith et al, 2005):

- Mapping a 'possibility space'- by identifying a realm of plausible alternatives for socio-technical functions and for the means of achieving them

- A heuristic – by defining the problems that need to be solved

- A stable frame for target-setting and monitoring – by stabilising innovative activity by serving as a common reference point for actors collaborating on its realisation

- A metaphor for building actor-networks – by specifying actors to be included or excluded and by acting as symbols that tie together communities of actors

- A narrative for focusing capital and other resources – by becoming an emblem that is used in the attraction of resources from outside

By pointing to the inclusion and exclusion of actors (as above) Smith et al (2005) argue that visions are not to be seen as universal but as carried – directly or indirectly – by some actors and not by others.

An actor-network approach can be used as the theoretical background for characterising and analysing visions. Some other characteristics of visions, supplementing the characteristics from (Smith et al, 2005), are:

- The time horizon of the vision (short-term or long-term)

- The scope (a whole society, a specific sector, a 'need' area etc.) and aspects included (social, environmental, technological etc.)

- Whether the vision is an end-point presenting a future and whether it includes descriptions of the paths towards the desirable future

- The roles given to different actors and objects (actants) like a certain technology area

- The peripheral characteristics of the vision like the expectations to the surrounding society, its infrastructure etc.

- The differences (and thereby maybe tensions) between the present conditions and the future which the vision describes.

The actor-network approach argues that a technology is not just working through a technical artefact, but as "an emerging and increasingly stabilised network of associations between diverse material and non-material elements – artefacts, humans, texts, symbols, concepts etc". The approach follows the network-building strategies of an actor and stresses the mutual constitution and transformation of elements in the process and in the generation of agency, knowledge, institutions and power – as effects of the network-building (Russell & Williams, 2002): "Actant" is used as a common notion of both the human and the non-human, and both material and non-material elements in an actor-network. The notion actor-network refers to the definition of actors through the network relations they are part of. In a foresight project an actor-network approach can be useful in the analyses of both emerging and existing applications within a technology area and of the priority mechanisms in research and development and the visions about future applications. The approach supports a focus on all the elements that seem to make a technology work or not work. Thereby the approach ensures a broader focus than for example a single high technology element like nanoparticles, but also a focus on the standards and measurement protocols, which the particles would need in order to work in a technically and socially acceptable way, and the societal agendas they refer to (about competitiveness, health, environment etc.). What is the role for example some scientists are anticipating, for example nanoparticles, will have (for example a certain behaviour in terms of reactivity, stability etc.), who are expected to be the future users, in which technological systems does this imply that the nano particles will be integrated etc. This understanding draws on the actor-network theory by focusing on actors and material objects (the "actants"), which the researchers and developers try to enrol and delegate roles to in the future use of a technology in order to make it work (Callon, 1986): What are the necessary scientific and technological breakthroughs, which are considered as necessary in order to obtain the results and obtain a 'working' version of whatever component it might be?

In the analyses of visions it is important to analyse the understanding of problems and possible solutions a vision is based on. Within an actor-network approach to socio-technical changes it is avoided devoting social and environmental impacts to technologies themselves, so that technologies are said to be "good" (for example being "green" or "sustainable") or "bad" (for example having negative environmental impact). However, such associations of meaning and utility to technology can e.g. often be found in the discussion of environmental aspects of the technologies in the so-called high tech area. ICT is often said to be an immaterial technology, because it only handles information. Biotechnology is seen as environmental friendly because it is based on biological materials and processes and nanotechnology for example as a technology, which might enable reduction of the resource consumption due to the tiny dimensions of nanotechnology (Jørgensen et al, 2006).

4. Backcasting:
As earlier mentioned the backcasting approach has been developed as an element in the visionary mode of thinking. In stead of making projections from the present into the future, backcasting starts with the design of visions (or 'Images-of-the-future' (Dreborg, 2004)) that show how a solution to a major societal problem might look. Afterwards, possible paths to reach the vision are developed. The development of the visions and the paths to their realisation may take place in an interactive way.

Dreborg (2004) argues that the time horizon should be sufficiently far off to permit 'real change' to take place. The idea is that this time horizon, ideally, should allow the participants to free themselves of present trends and make it easier to find interesting options. When a vision has been developed and validated as to their feasibility in a credible way, one or more paths leading from the present to the visions are developed. Early examples of societal backcasting studies were a series of Swedish energy futures. Amery Lovins was the first to propose backcasting as an alternative planning technique for electricity supply and demand in the 1970s (Quist & Vergragt, 2004). This type of backcasting studies was especially concerned with so called soft

energy policy paths, taking as a starting point a low energy demand society that relies on renewable energy technologies. The backcasting from different energy futures was supposed to reveal the different implications of different policy goals. In the 1990s several backcasting studies of sustainable development were carried out (Dreborg, 2004).

Dreborg is not saying what is meant by visions 'validated as to their feasibility' and how this could be done. Dreborg (2004) argues that backcasting is especially promising in case of complex problems, when there is a need for a major change and when dominant trends are part of the problem. The results are not meant to form a basis for single big decisions or a detailed plan or a blueprint but as a background for opinion forming and decision making to policy makers and interested citizens. Whether it is possible to create an atmosphere of need for change is not discussed by Dreborg. It could be expected that the 'atmosphere' depends on the participants in the foresight activity, their vested interests and how important the foresight activity is seen.

Dreborg (2004) compares the backcasting approach with the external scenario approach (the eventualities approach) and points to the following as the most apparent differences:
- Scenarios in scenario planning are beyond the control of the user of the scenarios, while the scenarios in backcasting focuses on what is possible to affect

- External scenarios describe possible developments that are neutral, while backcasting scenarios are normative

Furthermore, Dreborg (2004) discusses the distinction between external and internal factors, where the notion 'external factors' are understood as what can not or should not be regarded as subject to policy. These choices are normative and should be seen as an important element in the analyses of the development of visions and ways of reaching the preferable future.

Dreborg (2004) distinguishes between a think-tank model (with experts) and a participative (participatory) model for design of futures. Quist & Vergragt (2004) present – based on a literature review - an elaborated description of participatory backcasting consisting of five stages or rather different activities:
- Strategic problem orientation

- Construction of visions

- Backcasting stage

- Elaboration, analysis and defining follow-up activities and action agenda

- Embedding of action agenda, activities and generating follow-up and implementation

A checklist for the strategic problem orientation in stage 1 is
- What is the problem at stake? Who are the problem-owners?

- What are the major trends?

- Who are the stakeholders – now and in the future? What are their problem definitions? What are their interests, relations and resources?

- What kind of possible solutions do the stakeholders see? How do other stakeholders perceive these? Who might have an interest concerning the solution and who does not?

In Stage 2, the development of visions, the visions developed can be more or less detailed. In some projects the visions are elaborated with storyboards depicting daily life stories. It has not been evaluated systematically whether the development of single visions or several visions are the best. According to Quist & Vergragt (2004) visions can either stress the vision part, the feasibility or the creative part. The visions may also contain more or less elaborated assessments of particular aspects like consumer acceptance, socio-economic aspects etc.

Stage 3 is the least developed although it is this stage that has given the approach its name. The idea is to realise the gap between the present situation and the vision. As methods can be

used elaboration of the future visions, writing of essays, explorative research, expert workshops and stakeholder workshops. Different approaches may be

- A quick approach just meant for identifying attractive solutions

- A more elaborated approach focusing on describing the changes necessary for achieving a special future vision, e.g. technological, cultural, structural, institutional etc. changes

- A very detailed approach defining and describing in-between stages.

The further elaboration of the visions and of follow-up activities and agendas (stage 4) depends on the capacity, budget and time available. The embedding of action agendas (stage 5) depends on the actors that inscribe the vision as part of their own agenda. This co-shaping of vision and actors is discussed later in a section about visioning as societal activity.

The description above of the five stages can be used as inspiration for the planning and the analysis of visions and visioning processes.

5. Visioning as foresight activity:
An important part of a vision is the visioning processes leading to the development of the vision. This is equivalent to the stages 1-4 in the description of backcasting in the previous section. As earlier mentioned, a distinction is made, in this paper, between visioning as foresight activity and visioning as a societal activity. This distinction may seem a little artificial but the aim is to distinguish between activities taking place as a part of the foresight activity and activities taking place outside the foresight activity. Most foresight activities are part of a societal discourse about a problem and/or a technology area so in that sense foresight processes are almost always part a societal activity. However, we want to distinguish between the visioning taking place at foresight meetings, workshops etc. and then the activities taking place outside the formal foresight activities, whether it takes place parallel to and/or after the formal end of the foresight activity, where a vision has been developed.

An overall characteristic is the role of the visions and the visioning processes: whether the intended role is to open the mindsets of the participants in a foresight activity (visions as a tool or instrument) or the development of the visions is a goal in itself.

In the visioning processes leading to the development of the vision actors, objects, societal discourses etc. are inscribed into a vision through co-shaping of the vision and its elements. This may include creation of an obligatory passage point, where certain actors, technologies etc. are given roles, which all other elements in the vision have to relate to. Important aspects include the types of actors participating in the visioning processes and the types of expertise included in or excluded from the processes (scientific, lay, business etc.).

It is important not to see the role of technological visions and the related technological expectations as the result of a rational seeking of solutions to problems. The notion "laboratory programmes" can be used in the analyses of how researchers and developers organise the focus of their research and development activities and is based on the assumption that research and development processes are not arbitrary, non-biased search processes. Through the concept of laboratory programmes it is possible to identify what is influencing the choices and drawing the attention of the researchers and developers. The notion should be understood as a way of avoiding a focus on the single scientist as a "hero" or the laboratory as a rational space for scientific practice. Rather the idea is to relate to the notion of the laboratory as a place for reducing and ordering complex processes (Jørgensen & Sørensen 2002, p. 204). The concept of laboratory programmes argues that the "world" is researched and addressed by the way the researchers and the developers understand the world, which could be called the researchers' "map" of the world. This means that research and development in foresight projects should not be analysed as researchers' and developers' simple search for solutions to well-defined problems. Rather the problems addressed should be seen as shaped parallel to the solutions developed in research and development, when certain achievements are reached. This implies that the "solutions" sometimes are found first, and afterwards the researchers and developers try to identify societal problems, which they think could be solved by these solutions. This implies so to say that what is legitimate as parameters, problems etc. within a researcher's or

developer's understanding and what is outside an understanding is shaped at the same time. An example of a reverse or at least interactive search process is the development in the discourses around genetically modified (GM) food and plants. GM researchers and companies pointed initially to pesticide resistant plants as an efficient agricultural strategy and only after critique from the environmental movement, also as an environmental strategy referring to its claimed potential for reduced pesticide consumption. Later, in the paragraphs about visioning, the processes of recruiting or seeking support for a vision are discussed.

When Smith et al (2005) include the role of a vision as a heuristic for problems to be solved it is clear that visions also play a role in framing the present and the past. It has for example often been said that citizens in Europe do not understand all the benefits genetic modification of plants can give and that more knowledge is necessary. However, the Eurobarometer measuring the attitude or position to genetic modification shows that the more citizens know about the technology area, the more sceptical they are. However, a framing of a vision about the role that genetic modification ought to play, by referring to the problems with the technology as a problem of lack of knowledge will also frame a vision in another way.

6. Visioning as societal activity:

This section describes characteristics of visioning processes outside the foresight activity itself. Such visioning processes, where visions gain (or not gain) support, may follow or take place in parallel to the foresight processes. This includes processes where promoters of visions try to enrol other actors into the vision and when other actors try to gain support by inscribing the vision into their strategies. In this kind of processes the vision acts as a boundary object. One aspect of the analyses of these processes is the analysis of the mutual shaping of the vision and the actors, objects and the societal discourses getting enrolled into the vision.

Smith et al (2005) point to the importance of storylines in the enrolment of actors into coalitions or networks for change. Such storylines codify the vision and may be shaped for specific audiences and by specific circumstances. A vision may only be vague and not very elaborated from the beginning, maybe just a framing of a problem. The degree of interpretative flexibility in storylines and the adaptability to different circumstances may influence the coherence and the robustness of the coalition organised through it. Flexibility in the interpretation of the vision can widen the relevance to more actors. However, too much flexibility can introduce instability and harm the robustness. A recent Danish example is the support from the energy sector to plans for an increased wind power capacity, which has broad support from the political parties and the parliament. The energy sector argues that the energy from the windmills needs back-up capacity, when then the wind is not blowing. Therefore there is still need for the coal-fired power plants, which is the dominating energy plant in the energy sector. The example shows how a strong actor tries to gain support by supporting a popular vision. However in the inscribing of the vision into their strategy the energy sector changes the vision completely and argues that renewable energy needs back-up capacity. In stead the energy sector could, in principle, have pointed to the need for development of a backup capacity from storage technologies like batteries. Visions contain, explicitly or implicitly, assumptions – for example through the way problems are framed – and this can have influence on the attractiveness to different stakeholders (Smith et al, 2005).

Hermund & Broberg (2003) describe – with reference to Latour (1987) – different strategies that actors may pursue in order to gain support for a certain understanding of problems and solutions by enrolling other actors:

- Linking 'your' interests to other actors' interests and vice versa

- Reconstructing a problem so that a certain solution fits to 'your' understanding of the problem

- Claiming that a certain group has a certain problem – which fits to 'your' solution

One example of attempts to enrol actors to a vision these years is seen in relation to functional food and nutrigenomics, where some industries and researchers try to construct citizens as being in need of special food fitting to their genetic pattern.

An important element of foresight is the quality of the processes of developing expectations and methods for judging the robustness and pertinence of these expectations (Brown et al, 2003). Grove-White et al (2004) discuss genetic engineering as an example of the way how scientific research is informed by tacit visions and imaginaries of the social role of technology (Grove-White et al 2004, p. 3). Although utopian, these visions form the basis on which research priorities are negotiated and planned. Furthermore, such visions are seldom subject to public discussion and debate, before the priorities for research and innovation are made. One aspect in the analyses of societal visioning processes in connection to foresight activities should be the extent to which the visions are articulated by their scientific authors and subjected to wider social deliberation, review and negotiation (Grove-White et al, 2004). An example of such storylines and the integrated technological expectations is the attempts to give genetic modified plants a social image by referring to the possibilities of solving problems with hunger and nutrition deficits in developing countries. One of the visions focuses on the so-called "golden rice", which is claimed to be able to solve problems with vitamin A deficit in developing countries. However, the rice does not contain vitamin A but only a precursor and this precursor is only transformed into vitamin A in a ration of 1:12, which means that people has to eat an unrealistic amount of rice. A much better solution, if the concern really is the vitamin A deficit, would be to promote more widespread use of green leaf vegetables or local roots and plants that contain much more vitamin A and will be less expensive.

In analyses of the roles of visions, which have been developed in a foresight process, obtain afterwards different types of actors may be identified. Some actors can be viewed as being enactors of a vision. This means they build, among themselves, a repertoire of promises and expectations and strategies how to position the vision and its elements. Other actors might see themselves as outsiders or comparative selectors, who do not see a necessity to buy into the constructed vision or expectations, but are assessing whether a certain field seems to be relevant for their own interests, compared to other possibilities. It might also be possible to experience "mutual positioning', where some actors try to exclude others by for example referring to them as too much into "hype" in relation to a vision (Rip, 2004).

Information from the different actors has to be deconstructed and compared in order to identify mechanisms in applications and in research and development processes and draw up possible (maybe conflicting, maybe converging) scenarios. Increasing support to a vision may be recognised from so-called "emerging irreversibility", which can be recognised through (Rip, 2004):

- Shared research agendas among actors

- Collective learning processes, maybe as forced or antagonistic learning

- Emerging mutual dependencies in network linkages

Indications of emerging irreversibilities might also be seen from parallel or related changes at the following three levels (Rip 2004):

- Macro level: overall societal visions

- Meso level: research programmes and investments

- Micro level: heuristics in actual research practice

When analysing the development of support to a vision and its elements it is important also to include aspects of contingency and unpredictability of socio-technical change, and on the other hand the structures and constraints shaping the changes. Among the concepts used to describe regularity in socio-technical changes are (Russell & Williams 2002):

- Trajectories and paradigms (developed by Dosi (1982))

- Regimes as the combination of rules etc. supporting a trajectory and guiding innovation.

A technological trajectory is the pattern of problem solving activity within a given technological paradigm. Economic priorities, together with social and institutional frames, will operate as selective devices as new trajectories emerge. Dosi defines a technological paradigm as "a model and a pattern of solution of selected technological problems, based on selected principles derived from natural sciences and based on selected materials technologies" (Dosi, 1982). In (Russell & Williams, 2002) a regime is defined broader than paradigm, which is said to focus

primarily on the socio-cognitive and technical community and exclude technical artefacts. A regime includes elements like scientific knowledge, engineering practices, technologies, skills etc. The elements of the regime work as reducers of uncertainty and of the amount of information needed and influences the search space. A related concept is "search rules", which is a sociological version of another concept from the evolutionary economics (for example Nelson & Winter (1977)). Search rules include technical standards, the rules of the market, user requirements and rules laid down by governments, investors etc. Such rules guide, but do not fix, the kind of commitments for example a company is likely to undertake (Geels, 2002).

The concept of development arena focuses on the configuration of spaces where different actors interact and compete in shaping future developments. This concept is providing a spatial expression of the processes of competition and co-operation among different visions and different understandings of problems and their solution. A development arena is defined as a "cognitive space that holds together the settings and the relations that comprise the context for product and process development" and includes (Jørgensen & Sørensen, 2002):

- A number of elements such as actors, artefacts and standards that populate the arena

- A variety of locations for action, knowledge and visions that define the changes of this space

- A set of translations that have shaped and played out the stabilisation of relations and artefacts

The concept conveys a flexible view of the space in which technologies are being envisioned and developed. Thereby it is a useful element in analyses of foresight activities, not least because it may help identify directions from where potentials and risks are coming, because it concentrates on a problem or solution space and not on specific technologies or markets.

7. Analysis of the roles of visions and visioning in foresight cases:
In the Cost A22 Working Group no. 3 "Interactions between Researchers, Decision makers and the Public" a number of foresight activities from a number of different countries have been analysed in relation to the dialogue processes, the role of visions and visioning processes and the dissemination from the foresight activities. This section of the paper analyses the roles of visions and visioning processes in a number of these foresight activities. The discussion is based on the following eight cases:

- Denmark: An overall green technology foresight project (GTF) and a focus green technology foresight on sustainable agriculture (GTF Agriculture)

- Germany: A foresight project about the future research priorities (FUTUR)

- Hungary: An educational foresight "Vocational training and future"

- Malta: The national foresight exercise as part of the eFORESEE project ("exchange of Foresight Relevant Experiences among Small Enlargement Economies")

- The Netherlands: A project about strategies for reduction of greenhouse gas emissions "Climate OptiOns for the Long-term" (COOL)

- Portugal: Foresight components in the Portuguese Economic and Social Development Plan 2000-2006) (PNDES 2000-2006)

- The Slovak Republic: A science and technology foresight

These eight cases can be divided into four groups:
- Overall national foresight projects: the Portuguese foresight PNDES 2000-2006

- Foresight projects with a main focus on research, science and technology: The German FUTUR project, the Maltese part of eFORESEE and the Slovak science and technology foresight

- Foresight projects with focus on education and training: the Hungarian foresight on vocational training

- Foresight projects with a dedicated environmental focus: The two green technology foresight projects from Denmark and the Dutch COOL project

Also characteristics related to the countries where the foresight activities are carried out, may be relevant as aspects shaping the role of visions and visioning processes. These characteristics could for example be:

- Old market economies: Denmark, Germany, Malta, The Netherlands, Portugal

- Economies under transition (new market economies): Hungary, The Slovak Republic

- Young democracies: Portugal

In the following sections the four groups of foresight activities will be described and analysed based on the concepts presented in the theoretical part of the paper.

Overall national foresight projects:
The PDNES 2000-2006 was a long-range planning exercise carried out 1998-2000 that led to the regional development plans for the period 2000-2006 and the plan for EU support for Portugal. Two different visions were developed during the foresight activities: a preliminary vision and a strategic vision. The preliminary vision aimed at inspiring the debate and influencing the activities leading to the development of a comprehensive strategic vision together with environmental scanning, trend analysis and identification of driving forces. The strategic vision was described as a number of transformations that were seen as desirable to Portugal (Alvaranga, 2006):

- Strategic moves from a peripheral European towards a more centralised position in the world economy

- A quicker transformation towards the activities, technologies and competitiveness factors that is supposed to characterize the world economy

- Reforms for a better management of the demographic dynamics towards an ageing, but also active population

- Improve effectiveness, quality and accessibility in a number of service systems

- Valorisation of the human resources

The strategic vision included a description of the end points and a detailed description of the paths and strategic options towards the preferred end points. There were references to sustainable development and to technological changes in the vision.
During the debates the visions gave a common framework for discussion. One role of the strategic vision was the opening of the mindset of the civil servants, which implied changed beliefs about possible futures. New concerns and new vocabulary also entered the discourse of decision-makers and opinion-makers. Although the starting point of the visioning was different frameworks of knowledge, the visioning process managed to bring uncertainty related aspects concerning the future into the debate and thereby introduce the idea that the future could be influenced (Alvaranga, 2006).

Foresight projects with a main focus on research, science and technology:
Three of the cases were foresight exercises with a special focus on research, science and technology.

The German Research Dialogue, the FUTUR project, was an attempt to broaden the normally rather narrow stakeholder participation in the decision-making processes for the selection and priority-setting for research programmes of the German government. The process was run by a consortium of several institutions with different professional background. FUTUR was a rather long process during 2001-2005 and involved 1100-1200 experts in a number of different processes with working groups, workshops, on-line voting etc. The result so far has been the selection of four so-called lead visions, which are supposed to guide parts of the future allocation of research funding. Each vision consists of a goal and the vision, a description of the related research topics and their relevance for industry and civil society. Seven more visions

have been proposed selected and another ten proposals got substantial support among the participants. None of the 17 "candidates" for lead visions have been published. The published four lead visions focus on a) understanding how the brain works, b) open access to education in the future, c) healthy throughout the life through prevention and d) the life in a networked world. Some research activities have been initiated within each of the four areas. There seems to have been some disappointment about a rather technology-oriented approach in the lead visions and in the research activities initiated with reference to the lead visions (Göll, 2006) (Giesecke, n.a.).

The Maltese part of the eFORESEE was carried out 2001-2002 and aimed at supporting the transition of Malta (and the two other new, small EU countries Cyprus and Estonia) in meeting challenges and pressures imposed by the EU membership within strategic planning for the future and policy adaptation for better integration into the EU research structures (Pace, 2006) Another aim was to contribute to the further development of the Maltese competitiveness. With respect to visions and visioning it was the aim to capture the ongoing strategic conversations on Malta's future and to build upon various ongoing discourses and influence visions, policies and strategies in the making by considering the role and impacts of science, technology and innovation on the economy (Pace, 2006). Within the project three analyses were done with focus on a) futures in information and communication technology (ICT) and education, b) realising a strong Maltese biotechnology industry and c) enhancing the marine sector's contribution to the Maltese economy. There was a strong techno-economic focus, though also social aspects were included, like the recreational value of the Maltese coastline. Scenario workshops were used in all three analyses with a stronger expert input in the analyses about biotechnology and about the marine sector. Within all three areas visions were developed. In relation to ICT and education the focus was on the creation of a knowledge society and in relation to biotechnology and the marine sector focus was on which niche areas Malta could focus on. The impact of the project was i) increased awareness on the importance of long-term planning and policy making and the role of foresight methodologies, ii) opening the mindset of the participants who afterwards transferred their foresight skills to other areas and iii) feeding into national policy on research, technology, development and innovation (RTDI).

The third case is the Slovak foresight exercise carried out 2003-2004 as a science and technology foresight until 2015 and aiming at identifying the most important systematic and thematic research and development priorities (Nemcová, 2006). The background of the foresight exercise was the pressure from the overall globalisation on the new member countries in the EU, which was seen as a pressure to specialise and develop coherent policies. The foresight exercise was therefore expected to contribute to modification of the national science and technology policies towards continual competitiveness and growth in performance (Nemcová, 2006). Participation of stakeholders from a broad spectrum of branches was chosen as methodology, as opposed to a more narrow expert driven foresight exercise. The overall idea was to look at GDP, the political environment, the industrial structure and the importance of manufacturing, scientific research (basic and applied) etc. One part of the foresight was a foresight until 2015 of the mentioned indicators and the other part was a foresight on development and utilisation of science and technology. Two scenarios were developed, a pessimistic one based on the role of the Slovak Republic in the EU as manufacturing country and a positive scenario where the role is based on a knowledge-based economy (Nemcová, 2006). The vision, the optimistic scenario, was based on the understanding that it is not enough to provide financial and other resources to make science prosper. It is also important that society benefits from the scientific development, which is said to rely on the identification of important technologies and an allocation of resources in relation hereto. The experience from the foresight shows that the broad involvement and the interactive processes benefited all participants and can facilitate future co-operation (Nemcová, 2006).

Foresight projects with focus on education and training:
The project "Vocational training and future" was carried out based on inspiration from a World Bank project with focus on the development of human resources. The Future Studies Department from the Budapest University of Economic Sciences led the project that was carried out as a two phase project 1992-1996. The scope of the project was the education sector and its embedding into society and economy (Hideg et al, 2006). The role and position of vocational training was studied in different developed countries (Japan, USA, Europe, and South Africa).

Participatory dialogues were organised with different stakeholders (school teachers, students, parents, employers, policy makers and scientists) and created an atmosphere of social learning, since the participants were able to learn from each others perspectives (Hideg et al, 2006). The socio-economic environment and the socio-economic functions and systems of vocational training were summarised as basis for workshops, where different visions for the vocational training were developed and later summarised into two so-called "complex visions" (Hideg et al, 2006). One of the visions is based on a functional change of the educational/vocational training system, which is supposed to meet social demands and improve its service functions. The second vision was built around a less fundamental change in the sector with focus on so-called "flexible adaptation" and demand-orientation (Hideg et al, 2006). Paths to the end points were described during the vision-building workshops using the backcasting approach. The intended role of the visions were to describe possible, desirable and affordable directions for the future development, open the mindset of the participants and provide proposals and directions to policy makers and decision makers (Hideg et al, 2006). A new modular vocational training systems and school model were developed, based on the project outcomes.

Foresight projects with a dedicated environmental focus:
Three foresight cases (one Dutch and two Danish) had a dedicated environmental focus as basis, although the focus of the two Danish projects was a combination of an environmental focus and a focus on national competitiveness.

The aim of the Dutch COOL project was to develop strategic notions on how to achieve drastic reductions of greenhouse gas emissions in the Netherlands in the long run. Two other parts of the project focused on reduction of greenhouse gas emissions at a European and a global level. The project was financed by the Dutch Ministry of Environment through a national research programme on global air pollution and climate change and was conducted by a research consortium coordinated by Wageningen university. Four groups were put together based on the sectors with the largest greenhouse gas emissions (Industry & Energy, Housing & Construction, Traffic & Transport, Agriculture & Nutrition) (Stalpers et al, 2006). Future images were developed as more detailed descriptions of what the four sectors would look like in a world, where the greenhouse gas emissions in the Netherlands and Europe have been reduced by 80%. The scientific support group developed two visions within the 80% reduction scenario, one based on "market thinking" and one based on "concern for the environment" (Stalpers et al, 2006). The role of these visions was to test the robustness of reduction strategies. The pathway towards the end point (backcasting) was developed through stakeholder workshops, where the visions gave focus to the dialogue. The visions inspired the participants and they learnt to develop visions and do backcasting and have at the same time also developed their own visions. However, the use of the results of the dialogue process has remained low (Stalpers et al, 2006).

In Denmark three green technology foresights have been carried out in the period 2002-2006. The first green technology foresight was an overall foresight aiming at identifying areas with important environmental problems, potential technological solutions and competencies in the Danish innovations system. These areas were then supposed to be analysed further in some focused so-called Phase 2 Green Technology Foresights (Jørgensen, 2007).
The Phase 1 foresight project was organised by the Ministry of Science, Technology and Innovation and was carried out 2002-2003 with a participatory approach by appointing a national panel with participants from business, research, government, environmental NGOs and independent certified knowledge institutions. The panel was supported by a consultancy company, who carried out data collection and analyses between the meetings in the foresight panel. By organising the panel with this mix of stakeholders, the Ministry was aiming at having strategic intelligence in the panel about environmental problems, technological solutions, corporate strategies and innovation processes. The project was seen by the Ministry as part of an attempt to develop an integrated environmental and innovation policy. The participatory approach was aiming at creating consensus, which would have a high degree of societal legitimacy, in the panel about the important environmental problems and some strategically important technologies seen from an environmental perspective and from a trade and industry perspective. The visions were developed through scenario exercises in different working groups organised within the panel, where scenarios were developed based on a classical scenario matrix built around two critical (which here means important and uncertain) parameters or aspects, and the visions were chosen as those which the working group of that field found

desirable. Based on the scenario exercises five visions were chosen: renewable energy, energy savings and renewable energy in buildings, organic farming, precision farming and green products and materials. The Ministry and the chairman of the panel urged the panel to find consensus about a limited number of strategically important technological solutions in order to make it probable that follow-up projects could be started afterwards about each of these solution areas. The panel was urged to merge organic farming and precision farming (based on artificial fertiliser and pesticides) under one heading ("more sustainable agriculture") in order to limit the number of areas although the value base of the two approaches are quite different (Jørgensen, 2007). This meant that the Phase 1 green technology foresight proposed four technology areas for Phase 2 in-depth studies. The final analyses and the recommendations for the further analyses of the four technology areas were based on analyses of previous innovation processes and on a path creation and path dependency perspective.

The project had the immediate impact that two Phase 2 green technology foresight projects were carried out: One about environmental friendly agriculture (Borch, 2006) and one about environmental potentials and risks from nano-, bio- and ICT-technology (Jørgensen et al, 2006). The Phase 2 foresight about environmental friendly agriculture is discussed in the following.

The aim of the green technology foresight on environmental friendly agriculture was to examine those environmental challenges which the agriculture is up against in the future and point towards technological and structural solutions to how agriculture could develop from 2004 and 20 years ahead, based on stakeholder dialogue and environmental considerations. The environmental focus was especially on quality of water, air and soil and to some extent also the aesthetical landscape (Borch, 2006). The technology foresight was co-ordinated by Risoe National Laboratory on behalf of the National Forest and Nature Agency within the Ministry of Environment. The foresight was carried out in dialogue with a combined panel of experts and agricultural players, including organic and conventional farmers, the Agricultural Council, the Danish Society for Nature Conservation and the Co-operative Retail and Wholesale Society of Denmark. Two types of visions were developed in the foresight. First some extreme visions about future agriculture were developed in order to open the mindset of the participants. Later on some more detailed visions were developed based on a number of so-called "green technologies" (gene technology, bio-energy production and automation) applied within two overall farming orientations: industrial-oriented farming and organic-oriented farming (Borch, 2006). The work with the development of the more detailed visions seem to have given the participants a more holistic picture of the environmental problems and means to reduce the environmental impact, although the stakeholders within organic farming and conventional farming may have got a different view on the potentials and barriers of the different "green technologies". Based on these detailed visions, roadmaps were developed for future technological development. There seems to have been some influence from this foresight on national research programmes and on legislation (Borch, 2006).

8. Discussion:

The analysis of the eight cases showed four different types of foresights, where visions are developed and/or applied:

- An overall national foresight project

- Three Foresight projects with a main focus on research, science and technology

- A foresight project with a focus on education and training

- Three foresight projects with a dedicated environmental focus

The cases show different types of values that are in focus on the visions developed and/or applied in the cases:

- Strengthened national competitiveness

- Improved environmental protection – in some cases combined with strengthened competitiveness

- Improved human development

Some visions have primarily had a focus on the end-points, while there in several projects have been developed pathways towards realisation of the visions through backcasting exercises, although the information about these processes have not been detailed enough to discuss the actual backcasting and the role given to governmental regulation or other institutions or to different stakeholder groups. The time horizon of the visions differs from six years (the Portuguese national foresight) and up to around 50 years (the COOL project).

Visions have had three different intended roles in the foresight projects:
- As a given framing of the dialogue, the development of detailed visions and strategy development (the COOL project)

- As a tool in opening participants mindset towards discussions about future development, visions etc. (for example in the Danish foresight on environmental friendly agriculture)

- As a product of stakeholder dialogue (like in most of the other foresight activities)

Specific technology areas are given roles in several of the visions:
- The role of ICT in the German, the Maltese and the Slovak cases

- The role of biotechnology in the Danish cases and the Maltese case.

The analyses of the four technology areas prioritised in the Danish Phase 1 green technology foresight were based on analyses of previous innovation processes and on a path creation and path dependency perspective. However, the information available about the other foresight processes is not detailed enough to assess whether and how a co-shaping of actors and technologies or technology areas have taken place and how detailed the discussions of the expectations to technology development or application of technology – and the prerequisites of these expectations – have been. Therefore it is not possible to assess the robustness of the technological expectations developed in several of the projects. Neither has it been possible to assess how existing trajectories or regimes have influenced the visions developed, like in the Danish green technology foresight about environmental friendly agriculture and the role given to biotechnology or the roles given to technologies in some of the German FUTUR lead visions.

The visions have in several cases been developed by a broad group of stakeholders in order to develop detailed visions (the Hungarian foresight) or to develop visions with a high social legitimacy (the Danish Phase 1 green technology foresight, where there was a strong focus on creating consensus among the panellists and the Danish green technology foresight about environmental friendly agriculture, but also the Slovak case and the German case seem to have had a high priority on participation or representation from a broad group of stakeholders).

A societal impact from the foresight activities is seen in the Danish case about environmental friendly agriculture (impact on research and legislation), in the German case FUTUR (on research funding) and on the changes in the Hungarian vocational training system based on the foresight about that sector. However, the present available knowledge about the mechanisms behind these impacts is not detailed enough to explain the influence. For example how much the developed visions have got a role as stable frames, metaphors or narratives for focusing resources and framing societal discourses and how much such impact is based on legitimacy from a broad stakeholder involvement or maybe from the visions themselves. In the German case it may be so that some of those stakeholders, which were part of the dialogue process, are not pleased with their influence on the results or may feel that have been indirectly enrolled into some more technology-based research priorities than they have agreed upon is workshops, in on-line voting etc.
In some of the cases it is said that the societal impact of the visions have been limited. The difference between the presence and the vision may play a role here. There has, for example, not been much direct impact of the visions and the plans developed in the COOL project although the foresight was carried out in a participatory way. The reason could be the big difference and tension between the present emissions of greenhouse gasses and the dramatic reductions, which the visions have been built around, as given condition from the organisers. The reason could also be that changes towards these visions would demand further stakeholder

dialogue in order to develop plans for governmental regulation and obtain stakeholder commitment, which could enable a change in the direction of the visions.

Although there, in some of the cases, has been no or limited impact of the developed visions, it is mentioned in some of the cases that the dialogue and co-operation among the participants (what could be called the visioning processes) implied a new perspective on "the future development" – as in the Portuguese case where the civil servants experienced that it became more normal to discuss the future development as something that could be influenced. This foresight seems to have added the "possibility space" - as defined by (Smith et al, 2005) - to the vocabulary of the civil servants. Furthermore, there seems to be an impact from the processes of foresight and visioning in the Slovak case, where the dialogue among stakeholders as part of the science and technology foresight may enable future co-operation among the stakeholders. Also the Hungarian foresight about vocational training showed the value of the foresight concept and implied that a new foresight project on professional qualification was started.

9. Concluding remarks:

The paper has described different theoretical approaches to future thinking with the main focus on the visionary mode of thinking and the so-called backcasting approach. These descriptions may be used for considerations about the planning of backcasting activities, but also as a framework for characterising visions and the visioning processes, they have been part of, either as part of a foresight activity or "outside" the activity - parallel to and/or after the foresight activity.

The analyses of the eight cases have shown three overall values as basis of visions in foresight (national competitiveness, environmental protection and human development). Technologies were in some cases playing a central role in the visions. It has not been possible, however, in most of the cases, to assess the robustness of these technological expectations and the co-shaping of actors and technologies. Visions have had three intended roles in the cases: as frame for development of strategies, as inspiration for discussions about future development and as products of stakeholder dialogues. A societal impact is seen in three cases (on research, legislation and the national training system). The societal impact of several of the other visions seems to have been limited or absent. There is not enough information about the visions and their role afterwards to assess the mechanisms behind impact or lack of impact. The impact of the visioning processes and the dialogue between different stakeholder groups in the foresight activities seems in some cases to have been bigger than the role of the visions and may in some lead to further co-operation among stakeholder groups that not have co-operated before.

10.Acknowledgements:

The authors want to thank the Cost A22 Working Group 3 on "Interactions between Researchers, Decision makers and the Public" for their contribution to the empirical basis of this paper by providing case studies as a joint resource to the activities in the Working Group.

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