Zurich University
of Applied Sciences

School of
Engineering

INE Institute of
Sustainable Development

Vicente Carabias-Hütter, Anita Brunner, Beat Brüngger, Urs Hohl, Erich Renner, Harry Spiess, Thea Weiss Sampietro, Clive Winters

Enhancing Regional RTD and Innovation Development through Foresight & Mentoring

Scenario Development and Action Plan for RTD and Innovation Promotion up to 2020 in Zurich, Switzerland

Contributions to Sustainable Development
No 7/2007

Institute of Sustainable Development INE
ZHAW Zurich University of Applied Sciences

Impressum

Enhancing Regional RTD and Innovation Development through Foresight & Mentoring

Vicente Carabias-Hütter, Dipl. Natw. ETH, Institute of Sustainable Development, ZHAW
Anita Brunner, lic. oec. publ. MA, Institute of Sustainable Development, ZHAW
Beat Brüngger, Dipl. Ing. FH, Institute of Sustainable Development, ZHAW
Urs Hohl, lic. oec. HSG, Institute of Sustainable Development, ZHAW
Erich Renner, Prof. Dr. sc. nat. ETH, Institute of Sustainable Development, ZHAW
Harry Spiess, Dipl. phil. II/NDSU, Institute of Sustainable Development, ZHAW
Thea Weiss Sampietro, lic. phil. I, Institute of Sustainable Development, ZHAW
Clive Winters, Coventry University Enterprises Ltd, UK

Zurich University of Applied Sciences ZHAW, Institute of Sustainable Development INE: Contributions to Sustainable Development No 7/2007.

ISBN: 978-3-905745-11-5

Contact:
Zurich University of Applied Sciences
Institute of Sustainable Development INE
Vicente Carabias-Hütter
P.O. Box
CH-8401 Winterthur

Phone: ++41 (0)58 934 70 15
Fax: ++41 (0)58 935 70 15
cahu@zhaw.ch
www.ine.zhaw.ch

Table of Contents

Summary

The "Regional Economic Research and Technological Development Policy through Foresight & Mentoring" (REFORM) project was one of 18 projects funded under the Sixth Framework Programme within the ‘Regions of Knowledge 2’ call, which were launched in 2006 with the aim to promote increased and improved regional investment in research and development through mutual learning, coordination and collaboration between regional policy developers and regional initiatives. It is accepted that it is essential to enhance the integration and coordination between private and public Research and Technological Development (RTD) investments, and to provide appropriate support through RTD policy and infrastructure, to promote economic progress in Europe.

The REFORM project developed, supported and implemented a variety of measures and activities which enable regions to understand their particular needs in view of increased RTD activity and investment in the future. Through mechanisms such as Foresight and a new Mentoring Programme, the project developed a number of individual action plans for partners, which will provide the infrastructure for new RTD policy and its implementation, and thus increase the economic growth of the EU as a whole. Additional actions, including study visits, workshops and a conference supported the transfer of good practice and knowledge to those regions in the developmental stages of increasing RTD investment, increasing the rate of transfer through hands on support, promotion and participation.

This report focuses on the regional scenario construction process, starting with a general description of scenarios and highlighting the realisation of the scenarios workshop in the Zurich region. As outcome the action plan for RTD and innovation promotion up to 2020 in Zurich, Switzerland is presented.

1 Introduction

The integration and co-ordination between private and public Research and Technological Development (RTD) investment, and appropriate support through RTD policy and infrastructure is essential in enabling the economic progress of the European Research Area, but also in the establishment of the social and economic structures on a regional level throughout Europe.

In the project "Regional Economic RTD Policy through Foresight & Mentoring" (REFORM) the regions of Zurich (Switzerland), West Midlands (England), Galilee (Israel), Lower Silesia (Poland), Bucharest (Romania) and South-East Ireland have come together to collectively develop foresight and mentoring mechanisms to influence RTD policy, investment and activity.

1.1 Objectives of REFORM

A key objective of REFORM was to develop European regional foresight scenarios, based on the use of benchmarking, trend analysis and the results of the individual study visits and knowledge exchanges during the project.

Within 12 months all partner regions carried out scenario workshops as part of the project. The aim of the scenario-workshops was to develop – together with regional experts – scenarios for RTD & innovation development and to assess these scenarios regarding plausibility and desirability. During the workshops, each region developed both regional and European scenarios with a time frame of the year 2020. The scenarios were characterised by 13 impact variables. These impact variables were grouped in the following 7 sub-systems: population, education, economy, governance, research & innovation, infrastructure, and quality of life. Furthermore, the influences of these scenarios on the economic development were explored. As a result of these workshops each partner region was able to recognise future trends and drivers in RTD and innovation development as well as to develop a regional Action Plan, identifying the mechanisms and approaches necessary for the development, implementation and support of regional RTD policy and investment.

1.2 Target Group

The REFORM project provided a clear opportunity to contribute directly to RTD policy development at regional, national and international level. Activities included the bringing together of regional policy and financial influencers, with SMEs and other organisations directly involved in the development and delivery of RTD (both strategic and delivery).

For the partner regions in this project, the impact was direct and marked. Each region was able to work closely with their own actors, but also to interact directly with those in other partner regions, understanding the issues, options, and impacts of frameworks, identifying the demands and opportunities within their region and, through the continuous mentoring element of the project, be supported through the development, imple-

mentation and, potentially, evaluation of RTD policies.

An essential aspect of this project was the support and mentoring of those regions which are in the developmental stage in terms of establishing the means to support the appropriate levels of investment in RTD. By providing hands on support and advice, this project enhanced the pace of the transfer of good practice. Through this support, developing regions were able to learn at a much faster rate, with the mentor regions able to provide information relating to the potential issues and factors affecting RTD policy development, implementation and investment.

1.3 Supporting the transfer of good practice and knowledge

Actions, including study visits, workshops and conferences endorsed the transfer of good practice and knowledge to those regions in the developmental stages of increasing RTD investment, increasing the rate of transfer through hands on support, promotion and participation. The regional study tours allowed representatives from both the public and private sector, who were involved in the development and delivery of successful initiatives, to visit partner regions. The tours involved a substantial amount of information exchange in a fairly short period of time. They included highly intensive knowledge transfer about successful actions, policy development and areas of increased RTD activity and investment. In addition, at formal conferences the broad theme of RTD and innovation policy was discussed, especially focussing on RTD policy implementation, technology transfer, industry clusters and Regional Innovation Strategies.

2 Scenario construction

Scenario construction is probably the best known and most important of foresight tools. It is also by far the most difficult to master. Nevertheless, when properly applied, scenarios are a very valuable counterweight to traditional planning techniques or quantitative projections. A scenario is a story that connects a *description of specific future to present realities* in a series of causal links that illustrate *decisions and consequences* (Glenn & Gordon, 2003). Scenarios may be presented singly or as a set of contrasting alternatives (Fig. 1). They are built around assumptions which do not necessarily have to be based on real evidence or visible trends but should always be consistent and believable (UPGRADE, 2004).

Fig. 1: A variety of scenarios (UPGRADE, 2004).

2.1 Description of scenarios

Thinking about the future is often done by developing scenarios. Theoretically speaking, scenarios are hypothetical sequences of events, constructed for the purpose of focusing attention on causal processes and decision-points. In practice, scenarios are archetypal descriptions of alternative images of the future, created from mental maps or models that reflect different perspectives on past, present and future development. Scenarios are not equivalent to images of the future, but they include images of the future. Images of the future are static snapshots of future states, whereas scenarios are dynamic movies that consist of a logical sequence of images of the future. However, scenarios do not only contain sequences of images of the future, but also include driving forces, events and actions that lead to the future conditions as visualised in images of the future. Ideally, scenarios should be internally consistent, plausible and recognisable stories exploring paths into the future. Although many definitions of scenarios exist, most of them come up with the following characteristics (Rotmans, van Asselt, Anastasi, Greeuw, Mellors, Peters, Rothman & Rijkens, 2000):

- scenarios are *hypothetical*, describing possible future pathways;
- scenarios can be *qualitative or quantitative* (Van Notten, Rotmans, van Asselt & Rothman, 2003);
- scenarios describe *dynamic processes*, representing sequences of events over a period of time;
- scenarios consist of *states, driving forces, events, consequences and actions* which

are causally related;

- scenarios start from an *initial* state (usually the present), depicting a final *state* at a fixed time horizon;
- scenarios can have as a goal *scientific inquiry or real world planning*.

Scenarios are not predictions or forecasts, but rather projections of the future. So the value of scenarios does not lie in their capacity to predict the future, but in their ability to provide insights into the present to ease decision taking and planning of the future. By helping to identify weak signals of change which could become major future developments, the implications of those changes could be unfolded. It is important to recognise the weak signals, the so called seeds of the future, which could be dominant in a future world. There are, however, no specific scientific methods that help to identify the weak signals. All we can do is learn from the past by drawing analogies between historical and current situations, and use our *intuition, imagination and creativity* to trace them.

Nowadays it is generally accepted that scenarios do not predict, but that they paint pictures of possible futures and explore the different outcomes that might result if basic assumptions are changed, for instance regarding policy interventions. *So the only relevant question that scenarios can address is not whether an event will happen but what we could do if it did happen*. In this way scenarios help us to articulate our key considerations and assumptions, but by doing this they also help to identify constraints and dilemmas. Scenarios may also help to expand our mental model beyond the conventional thinking into more surprising developments (Rotmans et al., 2000).

The purpose of scenarios is to (systematically) explore, create, and test both possible and desirable future conditions. Scenarios can help generate long-term policies, strategies, and plans, which help bring desired and likely future circumstances in closer alignment. They can also expose ignorance; show that we do not know how to get to a specific future or that it is impossible.

Exploratory or descriptive scenarios describe events and trends as they could evolve based on alternative assumptions on how these events and trends may influence the future. *Normative scenarios* describe how a desirable future can emerge from the present (Glenn & Gordon, 2003). *Forecasting scenarios* are forward-directed, i.e. they explore future consequences of a sequence of assumptions. *Backcasting scenarios* on the other hand are backward directed, i.e. they start from some assumed final state, and explore the preconditions that could lead to this state, including a palette of strategies to reach this situation. While *quantitative scenarios* are often model-based, *qualitative scenarios* are based on narratives (Rotmans et al. 2000).

Although it is not possible to know the future, it is possible to influence elements of it. The forces of nature, social and political dynamics, scientific discovery, and technological innovation largely determine the future. However, human choice increasingly shapes the future. This influence makes the effort to consider the balance between what we want and what is possible worthwhile.

Finally, the role of scenarios in exploring critical uncertainties is increasingly recognised. They reveal *possible options for action to lead the development into a desired direction*. Planning and designing a scenario construction, it is important to consider

this major condition. But there are further relevant conditions that have to be taken into account. A scenario construction process can be characterised as a function of the defined goals, the chosen methodology and the expected results. Further the quality of the operating agents will influence these mentioned factors (Schmid, 2005).

The *goal of generating scenarios* is to understand the mix of strategic decisions that are of maximum benefit in the face of various uncertainties and challenges posed by the external environment. Scenario building, in conjunction with a careful analysis of the driving forces, fosters systematic study of potential future possibilities – both good and bad. This forecasting approach enables decision makers and planners to grasp the long-term requirements for sustained advantage, growth, and avoidance of problems and to develop policy options on the basis of well-grounded decisions.

2.2 Basics of functional scenario construction

In general, scenario construction is conceptualized as a more or less structured procedure to generate descriptions of future alternative system states (Wiek et al., 2006).

A scenario describes a hypothetical future state of a system and provides information on its development up to this state. This is done by introducing so-called *impact factors*. An impact factor is simply a system variable that describes the current state and dynamics of the system. Impact factors are also called **impact variables**. The art of scenario analysis consists of creating a sufficient set of impact variables and linking the variables in such a way as to gain a valid system description.

The scenario construction procedure comprises an iterative sequence of steps/methods. Recently, it is often distinguished between formal and intuitive construction approaches (Van Notten et al., 2003; Wiek et al., 2006). The major modules defining the method of a typical scenario construction process (Fig. 2) can be processed using either a formative or an intuitive manner (Scholz & Tietje, 2002).

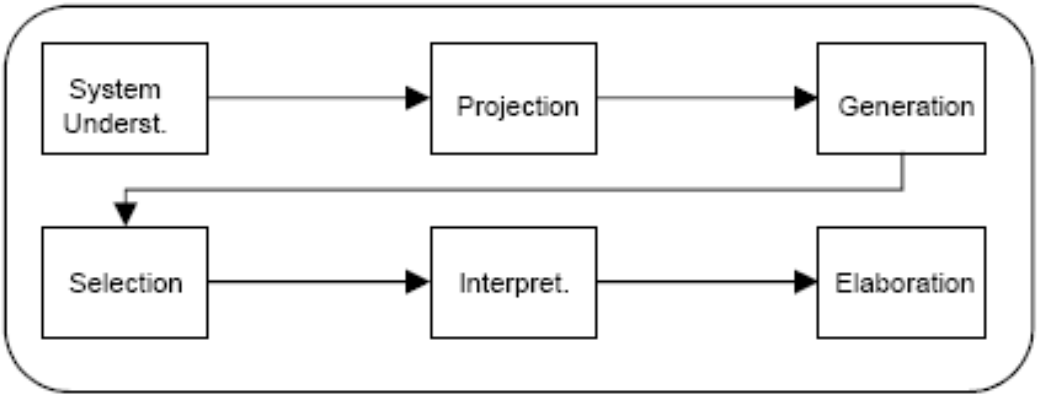


Fig. 2: Major modules within a scenario construction process (Schmid, 2005).

In **formal approaches**, clearly structured steps are executed applying formal (scientific) methods. It is important that for every module certain formalising tools are provided. Those tools should support the operating agents by decomposing the tasks into subtasks that can be handled easily. Typical examples are the cross-impact analysis

(for system understanding) and the consistency analysis (for the scenario generation). Where no such decomposing processes are available, it is important that the operating agents integrate the knowledge of experts in their work. Processes like literature research, expert interviews, expert panels and structured brainstorming with experts are predestined for the inclusion of expert knowledge (Schmid, 2005).

Based on a defined goal, relevant impact variables of the system (‘‘driving forces’’, ‘‘causal factors’’) are selected by conducting content analysis, surveys, structural analysis, impact analysis, MICMAC Analysis, etc. (Scholz & Tietje, 2002). Based on the future projection of these variables, a consistency analysis is applied to all possible combinations of these projections. The formal school tends to work from quantified knowledge and often uses computer simulation techniques in its scenario development (Van Notten, 2003). Finally, the procedure leads to a spectrum of a small number of consistent (i.e. plausible, coherent) future system states. Although the procedure is depicted as linear, it is evident that it is iterative. It can be conceived of as an ‘‘adaptive coil’’, successively integrating new insights at each stage (system analysis, future projection, consistency analysis).

A variety of methods can be applied to support a formal scenario construction process, such as Delphi technique, Backcasting, Historical analogy. Advanced approaches extend the approaches described above in that they integrate the possibility of surprises (‘‘wild cards’’) occurring or that they calculate occurrence probabilities for scenarios using, for instance, cross-impact analysis (Wiek et al., 2006).

To summarize, the *formative scenario analysis* (Scholz & Tietje, 2002) is a scientific technique to construct well-defined sets of assumptions to gain insight into a system and its potential development. With this approach the study team is guided towards a differentiated and structured understanding of a system’s current state and its dynamics. It is usually performed by small groups with specialized expertise about different aspects of the system, which they share with one another.

In **intuitive approaches**, scenarios are formulated relying on analogical conclusions, imagination and creative thinking. This “hypothetical” procedure consists of only one working step: the scenario generation. A person would be asked to design a few scenarios without the help of any tool. This kind of construction is labelled “hypothetical” because there are arguments which lead to the conclusion that it could be impossible to gain valid results due to the overarching system complexity (Schmid, 2005).

The intuitive scenario process leans strongly on qualitative knowledge and insights from which scenarios are developed. Creative techniques such as the development of stories or storylines are typically intuitive approaches to scenario analysis. Interactive group sessions with a high variety of people are often central to storyline development. The storyline approach is flexible and can easily be adapted according to the needs that emerge from earlier steps in the scenario development process. The intuitive school considers scenario development as an art form as illustrated by publication titles such as *The Art of the Long View* and *The Art of Strategic Conversation* (Van Notten et al., 2003). Qualitative storylines can be communicated easily to non-experts and enable the construction of highly complex, integrated scenarios.

In order to handle a complex system intuitively, the method has to be formalised in a certain manner. "Formalised intuitive processes“ that bring together several experts

(e.g. Expert Delphi or Expert Brainstorming) are proposed for various modules. It can be assumed that the organisation of a process including several experts, leads to a certain formalisation that allows the experts to cope with complex systems (Schmid, 2005).

Formal approaches are appropriate for stakeholders or laymen as they provide structures for knowledge and competence generation, whereas intuitive approaches are appropriate for experts, whose expertise minimizes mistakes in system representation and consistency appraisal (Wiek et al., 2006).

In empirical scenario studies, the differentiation in formal and intuitive approaches becomes fuzzy as intuitive elements are often part of formal constructions and vice versa (Godet, 2000). Therefore, the first steps have been taken towards an approach explicitly integrating the formal and intuitive aspects of scenario construction (Van Notten et al., 2003). The scenario construction process proposed by Scholz and Tietje (2002) includes both a formative and an intuitive generation of scenarios. For such methods it has to be considered how the results of the two pathways will be merged.

In Schmid (2005) the following structure for a combined scenario construction (Fig. 3) is proposed. Two pathways for the generation of scenarios are described. On the left side of the Fig. 3 given below the formative modules (F2-F5) can be found while on the right side the intuitive modules (I2-I5) are indicated. Important is step 6, where the results of both paths are reconciliated. The main condition to work out this step is that the scenarios are comparable by the means that they both are characterised by the same system variables.

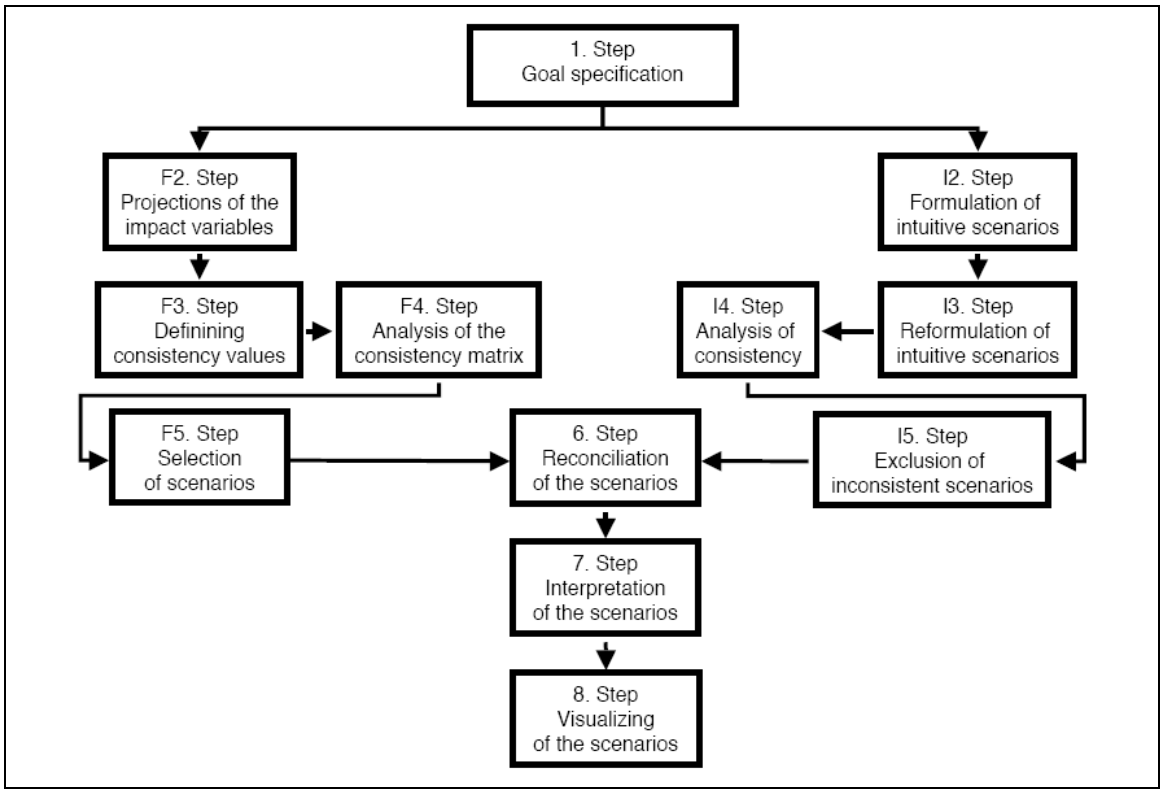


Fig. 3: Structure of a combined scenario construction (Schmid, 2005).

Thus, it is necessary to formalise both pathways to a certain degree. This formalisation is a quite delicate task especially for the intuitive modules. If the formalisation is defined too lose, the results might not fit anymore to the ones generated in the formative pathway; a reconciliation becomes impossible. Is the formalisation too pronounced, it will not be possible anymore to work in an intuitive manner.

2.3 Experiences with the Formative Scenario Analysis

The experience (e.g. Spiess, von Allmen & Weiss Sampietro, 2005) with scientific applications of formative scenario analyses has shown

- the qualitative steps (such as the definition of impact variables and their levels, the consistency assessment, and the scenario interpretation) are related to the goals and the topic of the scenario analysis and have to be conducted carefully and in close cooperation of experts for the system and for the method
- the problems and difficulties related to the formal and quantitative step of scenario selection have largely been resolved

More detailed experiences can be summarized under the four topics (1) definition of impact variables and levels, (2) scenario construction and consistency assessment, (3) scenario selection, and (4) scenario interpretation.

(1) Definition of impact variables and levels

This is closely related to the goals and the topic of the scenario analysis and thus has to be done with great care. It is crucial for the consistency assessment, because the expert assessments directly depend on the clear understanding of the impact variables and their levels. It is also crucial for the scenario interpretation, namely the derivation of scenario narratives (*'storylines'*) and the quantification of the scenarios for a further modeling.

The whole study team usually performs the selection of the impact variables. However, definition of the impact variables and elaboration of the relations between the variables should be investigated individually or in subprojects. The impact matrix initiates the synthesis process by rating the variables' current, direct, mutual impacts. The assessment of mutual impacts requires being knowledgeable about the system and recognizing the variables' dependencies (Scholz & Tietje, 2002).

(2) Scenario construction and consistency assessment

Scenario construction relies on parsimony in the number of impact variables and their levels. Consistency analysis is an analytic procedure for cleaning up a set of scenarios. The rationale behind is logical consistency. For a given scenario, specific combinations of levels may be relatively inconsistent. If, for one scenario, all pairs of impact variables are rated, whether their levels are consistent or not, we get information about the scenario's logical consistency.

The consistency assessment provides the data basis for the formative scenario analysis. Therefore the quality of the scenarios depends on a careful assessment, e.g. in a group discussion or review process. A good cooperation between the experts assessing the consistencies and a method expert – who may organize the discussion as

a moderator and provide information about the details of the method – is essential for mutual understanding.

Consistency analysis yields possible, logical, coherent scenarios that represent future states that a system could have. However, there are no definitive normative rules for determining when a scenario is consistent or not.

(3) Scenario selection

The construction of a consistent set of scenarios to fill the scenario trumpet (Fig. 4) is the final stage. In Formative Scenario Analysis, a scenario is formally defined by a combination of levels of all impact variables. Thus, the study team also portrays those possible future states of a system.

Related to the selection of scenarios the following experiences from various applications can help:

- In general, three to six scenarios are usually sufficient (Glenn & Gordon, 2003)
- Criteria for selecting scenarios: consistency, plausibility, desirability, and probability
- Scenarios should be as consistent as possible
- Scenarios should be extreme and contain surprises
- "Good" scenarios are plausible (a rationale route from here to there make causal processes and decisions explicit), internally consistent (alternative scenarios should address similar issues so that they can be compared) and sufficiently interesting and exciting to make the future "real" enough to affect decision-making (Glenn & Gordon, 2003)
- Key variables shaping the future are identified using a wide range of sources

According to the experiences from multiple scenario processes all these points support an adequate scenario selection.

(4) Scenario interpretation

Each of the selected scenarios must have a short and relevant title. The comparison of the selected scenarios based on the impact variable levels provides a good basis for finding the title and derivating a narrative storyline or even a scenario quantification.

2.4 Scenario Analysis Workshops

Scenario methods enable us to build internally consistent pictures of future possibilities, so as to examine the implications of uncertain developments and courses of action. Foresight exercises usually work with 'multiple scenarios', taking alternative courses of development into account; with 'aspirational scenario' approaches (which are usually informed by a multiple scenario exercise) the focus is more on elaborating a vision of a desirable and feasible course of development, and the steps needed to realise this. Scenarios may be developed by taking a workshop through a systematic evaluation of trends, drivers, and alternatives, or by smaller expert groups (Miles, 2002).

There are many scenario development methods, and scenario workshops are just one

way in which they are produced. (Often scenarios are produced by smaller expert groups, and in some cases this can be a valuable approach – for example where there is an explicit effort being made to develop and contrast scenarios based on different theoretical perspectives. Scenarios may be used as part of modelling exercises, where special efforts will be required to frame them in terms of the parameters of the model.) There are dangers with scenario approaches, where the end-states developed may be perceived as the only possible futures – or, often, that one scenario is implicitly the "most likely" scenario, with a couple of minor variations deviating from it.

This can facilitate systematic comparison of different scenarios, and force the developers of the scenarios to achieve consistency in terms of the elements of each scenario that are addressed (FOREN, 2001).

Scenarios consist of visions of future states and courses of development, preferably organised in a systematic way as texts, charts, etc. There are many ways of preparing scenarios, but a common method involves group-work. Scenario planning is organisational learning. This method consists of organising information and future possibilities into alternative visions for the future. It is especially useful to comprehend events that seem to contain a mixture of unrelated information. Scenario methods can be extrapolative or normative, depending on the starting point.

The starting point for a scenario analysis is the system in its existing state. A sufficient set of impact variables is used to construct a simple system model. The state of the system – described by levels of these impact variables – varies depending on the changes in and development of its internal and external system variables. The more time has passed, the greater the change and deviation from the system's initial state. Disturbances or interventions can affect the discourse and future state of a system. This is displayed in the scenario trumpet (Fig. 4) given below. At the time horizon of the scenario analysis a scenario is formally defined by a combination of levels of all impact variables.

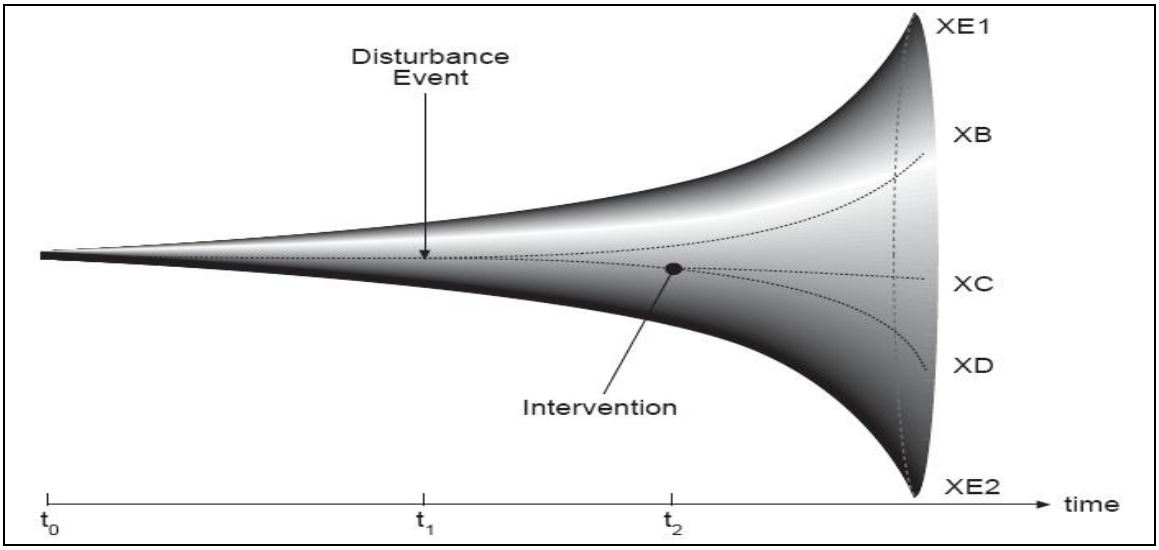


Fig. 4: The scenario trumpet metaphor (Scholz & Tietje, 2002). The starting point of scenario analysis is t_0. All possible future states of the system are represented in the trumpet. The upper and lower margins represent the most optimistic and pessimistic states. Deviations from surprise-free development (i.e. the trumpet's midline) may be caused by disturbance events at t_1 or interventions at t_2. XB, XC, and XD represent different scenarios. XE1, XE2 are also scenarios, but extreme ones).

Finally, the interpretation of the formal scenarios that describe possible future states often aims to result in both, a qualitative storyline and a quantitative assessment. The subsequent steps can be a quantitative modeling, an evaluation of the scenarios, or the derivation of best reply strategies (Scholz & Tietje, 2002).

The scenario analysis helps to shape the virtually infinite number of possible futures that could be described down to a manageable size of three to four 'futures possibilities' on a specific organisation's future. Scenario planning aims for the intervention of strategy and the testing of related organisational characteristics against multiple representations of the future of business environment (FOREN, 2001).

Who participates and how?

Participants should include the final users of the scenarios, and people knowledgeable of the socio-economic contexts of the region. Diversity of experience is an asset to the success of the scenario exercise. The scenario building helps participants to gain a new understanding of how change could be managed as a result of the scenario building experience. Also external people can be included especially original thinkers (FOREN, 2001).

How does it work?

Scenarios would work only if they meet five conditions that instil rigor: relevance, coherence, plausibility, importance and transparency. Numerous methods have been developed to create scenarios. Most approaches recognise the need to understand the system under study and identify the trends, issues, and events that are critical to this system.

In general, independently of the process chosen, there are some basic requirements:

a) A scenario planner, i.e. workshop organiser

b) A group of participants (ideally 7 to 12), representing the main issues

c) Time (at least two or three days to be divided in different sessions)

Scenario workshops are one possible way to build scenarios. Firstly, a small group will be constituted – or sometimes, parallel small groups will explore different scenarios. A process will be used to obtain views as to critical choices and drivers that could differentiate or lead to distinctive futures. The most important of these will then be selected and used as the basis of an elaboration of the sorts of events that can unfold, the sorts of end-states that might be reached. The group will then typically be requested to consider what the strategic options might be for the specific scenario to be achieved, or for the key actors to be able to cope with the situation represented (FOREN, 2001).

How can we use the output?

This method can provide planners with one point estimate of innumerable possibilities of what the future unfolds. This method allows participants to develop plans that are viable over the wide range of possible futures also with a process that helps manage uncertainty. This method helps participants to radically alter the way they think about the future. Optimisation against a specific future target is replaced by a balanced evaluation of the range of strategies that may be required. Participants understand better the alternative needs of futures and are able to develop better-informed strategies and pol-

icy options (FOREN, 2001).

How it is used with other techniques?

Scenarios are often used in combination with SWOT analysis (strengths, weaknesses, opportunities and threats). SWOT is very useful to provide the scenario planner with a useful insight into the strategic agenda of the final user of the scenarios.

What are the drawbacks?

Users may find difficult to deal with multiple images of plausible futures. Some scenarios stay at the level of broad generalities lacking supporting analysis and quantification, and are thus not very operational. However, the method can be employed in a more rigorous manner, e.g. with extensive use of tables and other techniques for systematisation of the analysis (FOREN, 2001).

3 The Scenario-Workshops

A key objective of REFORM is to develop European regional foresight scenarios, based on the use of benchmarking, trend analysis and the results of the individual study visits and knowledge exchanges during the project.

All partner regions were guided to carry out a standardized scenario construction process in their regions with local experts (see annex 1).

3.1 Goals of the Scenario Workshops

- Development and evaluation of scenarios for the RTD and innovation development in the region and in Europe as well as their influences on the economic development.
- To recognise future trends and drivers in RTD and innovation development.
- As a result of these workshops each partner region is required to develop a regional Action Plan, identifying the mechanisms and approaches necessary for the development, implementation and support of regional RTD policy and investment.

For the most plausible scenario developed within the Scenario Workshop “RTD and Innovation Promotion up to 2020 in the Canton of Zurich, Switzerland” a storyline / novel was expected to illustrate the scenario for 2020. This storyline should interpret the output for the respective regional scenario summarized in the scenario-variables-matrix (with the definitions given for the variables and parameter values), i.e. based on changes to business / work life, mobility, governance, home-life (i.e. sub-systems).
By describing a scene in a company, in a RTD institution, in a park, in a public place, where different persons talk or act in relation to the 2020 expected parameter values of each impact variable, the scenario should be recognized in the storyline.

3.2 The Realisation of the Workshop in Zurich

The scenarios were developed intuitively during the workshop. In order to achieve the objective, experts from as various fields of expertise as possible have been invited:

- Dr. Sebastian Brändli, Director Academia Department of the Canton of Zurich
- Willy Frank, Board Member of the Swiss Excellence Foundation
- Dr. Hanja Hansen, Science Office for Strategic Concept Work
- Fredy Hasenmaile, Researcher at CS Economic Research Zurich
- Dr. Werner Hediger, Researcher at the Center for Corporate Responsibility and Sustainability at the University of Zurich
- Pirmin Knecht, Deputy Director Coordination Office for Environmental Protection of the Canton of Zurich
- Dr. Margot Tanner, Head Research and Development at Zurich University of Ap-

plied Sciences Winterthur (ZHW)

- Dr. Martin Wörter, Researcher within the Industrial Economics Research Group at the Swiss Institute for Business Cycle Research (KOF-ETHZ)

The experts received as preparation for the Scenario Workshop not only the agenda, but also the full SWOT-analysis for Zurich, the impact variables with their respective parameter values (see annex 5) and a proposal for the Trend-Scenario to be studied by all experts in advance.

After having presented the SWOT-analysis for the Zurich region / Switzerland along the subsystems (see annex 4) and having introduced the scenario analysis methodology as well as all participants, the experts were divided in two small groups for starting the discussion in order to intuitively develop visionary scenarios. Besides, they were asked to discuss and improve the suggested Trend-Scenario[1].

A film of the workshop has been produced by Karin Baltisberger, student in video journalism at ZHW. All participating experts agreed to appear in the film.

Some pictures taken from the film to give an impression of the workshop:





3.3 Regional Scenario: Knowledge-Based HighTech-Switzerland, 2020 for the Zurich Region

On the 22nd November 2020, Mr Benjamin Baumann, co-owner of the 4 year old company RobiRep Ltd, left his office in a light-hearted mood. True, the response to his patent registration was taking rather longer than ever before, but obviously several applications from researchers, inventive young entrepeneurs (among which more women than ever before) within the Greater Zurich Area were also being considered at the same time. “In truth it’s really gratifying that there is such an abundance of innovative talent in our region”, peruses Ben Baumann as he makes his way to his local, the Silicon Bar. He reckons his ‘CaRep 3’, a 2.5 centimetre high robot that can be fully incorporated into a car bonnet, and which is designed to detect and repair on the spot the most common defects of a fully running car engine, has good market potential. He calls up the co-developers of CaRep 3 in both Lima and Bucharest on his cell phone to proffer his greetings.

The Silicon-Bar is frequented by a lot of young people who work in the 53 small and larger research and development companies located around Winterthur’s former industrial zone of ‘Töss’. Ben Baumann is accurately aware from their clothes, their skin colour and the variety of English accents, that many people in the bar are not originally Swiss, but are from either Asian or eastern European countries. The measures taken 9 years ago to make it easier for well qualified people from countries such as India, Chi-

[1] See the minutes in Annex 2

na, the Ukraine and Russia to enter and integrate into Switzerland are paying dividends: the recent High Tech boom within the Swiss economy is, amongst other things also driven by them.

Over a glass of champagne, Ben Baumann gets into conversation with Miriana Marcovic, a university student. Miriana is 24 years old and is studying economics. She talks good-humouredly about her previous career. She is happy she can study with no problems, although she comes from a relatively poor background. Her mother had fled from former Yugoslavia to Switzerland in the 1990's during the Balkan wars, finding work in a hotel. Bringing up 2 daughters single-handed meant money was scarce in the Marcovic household.

She talks about her recently completed dissertation. "I have examined how the structure of economic activities has developed over the last 15 years: Our economy has become much more diverse. Today graduates have an interesting array of business options to choose from. These range from financial services, biotechnology, nanotechnology, medical technologies, service engineering, artificial intelligence technologies to electrical and mechanical engineering.

The bar keeper, Alois Amrain, joins in the conversation: "For people in my profession there are more and more lucrative jobs around now, and the same goes for culture, entertainment, relaxation and wellness. The turnover of this bar has been steadily increasing for years – indicative of a general increase in the regions standard of living – a 15-year-old success story. And the best of it is: Switzerland is not the only one. Things look just as positive throughout the whole of Europe." - "At last essentials such as education, money for research (investment in research and development), infrastructure, migration, demographics and economic policy in the rest of Europe are comparable to Switzerland", adds Miriana Marcovic.

Now, Ben Baumann, the proud young entrepreneur tells Miriana about his newly registered invention and how it came about. "Way back in 2009 the Swiss government decided to invest more public funds in research and development projects. Because of this, many large companies as well as some small and medium sized ones also managed to substantially increase their own research budgets. Funds for my most recent project came from the private and public money put into RTD projects, so I have benefited enormously. My research conditions are without doubt better than those of my colleagues 15 years ago. And I am not the only one to grasp golden opportunities. Many colleagues from my student days have chosen to follow successful careers in the research and development sector. – You should meet my friend Vladimir Clausen: his zero-emission car is about to hit the scene worldwide. We celebrated it here last Friday with our work colleagues from Porto Alegre, Chengdu and Detroit. What a really great zero-emission party that was!"

At the bar, Miriana also reckons she has good future career opportunities. When she graduates next year, she would first like to be involved in research projects in the field of social sciences. "After that I would like to move into the consultancy business: Many HighTech-spinoffs would dearly like support in producing their business plans. So maybe I'll become a young female entrepreneur pretty soon too! Knowing that these days access into 'venture capital' is both easier and virtually free of bureaucracy gives me greater confidence".

Bar keeper Amrain adds: “Our favourable economic situation is probably linked to the country’s overall economic policy: compared to 2006, the system has become increasingly liberalised. We hardly pay tax anymore.”

Marcovic responds: “What bothers me is the noticeable difference in salaries that has evolved over the past few years. There are extremely rich people and extremely poor people in our region. This is not right.” She drinks up her glass of water (local water, from the tap, of very good quality) and sets off home. She takes one of the frequent and speedy regional buses operated by Zurich’s transport company. The traffic is calm and without hindrance. Last summer, Miriana usually rode her bike everywhere. She appreciates the extensive network of cycle paths and the good quality of air in the town: Air quality has improved even in Winter to such an extent, that it is no more necessary to flee town during the weekend.

When she goes away, she prefers to go for longer periods: She had spent the whole of June on a Croatian beach, and in late summer she had spent 7 weeks in Calancatal, an isolated and remote alpine valley. In both locations she was able to make good headway with her dissertation as well as enjoy the sports and recreational facilities: The excellent technical infrastructure also available in these more isolated places (ADSL, wireless LAN, telepathy, satellite connections) made interviewing specialists, video (webcam) discussions and virtual library visits possible with no problem at all[2].

3.4 European Scenario: The Knowledge Based, Economically Diverse Europe of 2020 (based on all regional outcomes)

Economic growth in the regions of Europe has risen significantly over the past decade to 2020 and is set to do so for the future. Regions have become more self sufficient and economically diverse leading to an increase in research and development as regions with their universities and enterprise strengths are being used to harness research and development for the future. Thanks to the European Union’s harmonization power, regional economies have converged by clearing the predominant discrepancies of the last century.

Way back in 2009 national governments in Europe decided to invest more public funds in research and development projects. Because of this, many large companies as well as some small and medium sized ones also managed to substantially increase their own research budgets. Now, the economic sector invests hugely in research and development, because they acknowledged that research is good for business. And this change of attitude is due to an ethos of collaboration. The secret is a deep and formalised cooperation between universities, research institutes and industrial enterprises. Every academic works with at least a research institute and an enterprise. The collaboration is also beneficial because you can start a business in a new field using the knowledge stored in universities and institutes. The result is a diversified structure of economic sector.

[2] The views contained within this scenario description are not necessarily those either of the organisations and companies involved, or of the participants of the workshop conducted on this subject the 20th June 2006 in Zurich, Switzerland.

The education system and opportunities in the regions have become more equal. This is due to the fact that young people have been monitored individually from a younger age and have been nurtured to participate in what they are interested in and what their strengths are. There is also greater emphasis on entrepreneurial and innovative activities giving younger people a wider variety of skills and ability.

Today graduates across Europe have an interesting array of business options to choose from. These range from financial services, sustainability sciences, biotechnology, nanotechnology, medical technologies, service engineering, artificial intelligence technologies to electrical and mechanical engineering.

Immigration has fuelled growth and prosperity across Europe. The measures taken 9 years ago to make it easier for well qualified people from Asian countries, such as India and China, to enter and integrate into Europe are paying dividends, around one third of all researchers are non-european: the recent High Tech boom within the economy is, amongst other things also driven by them. An open-door approach to migration has enabled long-term vacancies to be filled and a pan-european policy has reduced immigration in several member states. However, in most European regions the productive share of the population could be increased.

People in 2020 have become more risk averse as venture capital and bank funding is more available, and the ideas that individuals have are more enterprising and more thought out. This has had a knock on effect with lower unemployment as people are now creating their own jobs in line with the needs of the economy and the society as they have the skills and knowledge to do so.

Patent applications in Europe are at record numbers and are a significant result of an enterprise culture where individuals have been encouraged to develop new ideas and products. With an increase in business start up activity, Europe has seen more innovative ideas being created and hence more patent applications. While patent registration is taking rather longer than ever before in essence this is a result of the abundance of innovative talent within the regions of Europe.

The European regions in particular have seen a greater and much improved development to their local structure. In particular the 2012 Olympics in London had to a certain extend helped and required the regions of the United Kingdom to be improved. Due to the Olympics the regions have seen a huge improvement in airports, train systems, and road links. Elsewhere even the most committed conservationists realised that regions' needed to be wealth generating if they were to protect their physical and cultural heritage. As a result, clean drinking water and good air quality is almost all over Europe available. Proposals for the improvement of local infrastructure have been embedded in the broader visions' of the future for European regions. These visions were socially inclusive in shape: improving transport links, bringing opportunities to disadvantaged communities, transforming land values and re-investing the gain in the public realm[3].

[3] The views contained within this scenario description are not necessarily those either of the organisations and companies involved, or of the participants of the workshop conducted on this during 2006 and 2007 in all REFORM partner regions.

4 Zurich Action Plan

For the most desirable scenario, regions were expected to develop an **Action Plan** to get there (focusing on the key drivers). The experts participating at the Scenario Workshop held in Zurich the 20th June 2006 ranked the scenario "Attractor Quality of Life" (see scenario description in the annex 7) as the most desirable one. Actions should focus on the sub-systems identified as relevant for the development of visionary scenarios: population, education, economy, governance, research & innovation, infrastructure, and quality of life (see annex 6).

This Action Plan has been developed based on relevant documents and on interviews held with Dr. Sebastian Brändli, the Director of the Academia Department of the Canton of Zurich, as well as with Dr. Stephan Kux, the Head of Economic Development (the location promotion agency) of the Canton Zurich.

Introduction of Zurich region

The Zurich Canton occupies an area of 667 square miles (1,729 km2) making it the seventh largest canton of Switzerland, but with nearly 1.3 million inhabitants it is the most densely populated. Zurich has a population of 339,000 and is Switzerland's largest city and the economic and cultural centre for the canton. Winterthur (90,000 inhabitants) is the second largest conurbation in the canton; Uster, Dübendorf and Dietikon all have populations of more than 20,000. The canton of Zurich is made up of 171 communes divided into 13 districts, all governed by a 180-member Cantonal Parliament; the Executive Council has seven members, each of whom presides over the various departments. The city of Zurich is governed by a Communal Council with 125 members; executive authority is exercised by a nine-member Municipal Council. Councillors are elected to these bodies by voters every four years.

The Canton of Zurich's economic significance is apparent from two statistics: first, almost 20% of Switzerland's GDP is generated in the canton and second, its per capita net product as a share of the GDP is one of the highest in Europe. Zurich is one of the world's leading financial centres; numerous banks, industrial enterprises and insurance companies have their head offices in the canton of Zurich. The aggregate economic performance in terms of GDP (Gross Domestic Product) growth in Switzerland (1.9%) is still not very satisfactory although the growth rate is slightly higher than one year ago. In contrast, the GDP growth rate dropped from 2.3% to 1.6% in 2005 in the EU25. The unemployment rate increased from 2.6% in 2000 to 3.8% in 2005, but it is quite low compared to the EU25 average (8.7%); the current tendency is clearly downwards (Arvanitis and Woerter 2007).

Factors that have contributed to Zurich's success as a business location are the favourable state conditions for companies, moderate taxes, a highly qualified local workforce, optimum rail, road and air transport connections and excellent infrastructure. The proximity to internationally renowned universities (Swiss Federal Institute of Technology ETH, the University of Zurich and the Zurich University of Applied Sciences Winterthur) is a further advantage - a cluster of financial service, Life Sciences, and information and communications technology companies has developed in the Zurich area, profiting from local expertise.

4.1 RTD and Innovation Development in Switzerland

4.1.1 Innovation performance and respective policy objectives

Several competitiveness indicators show that Switzerland is an internationally quite competitive country. The intensity of foreign direct investments is still above EU25 level, Switzerland is a very interesting destination for companies, as indicated by the unit labour cost development and the business investments. Furthermore, the indicator for relative unit labour costs (Switzerland relative to OECD average) shows a favourable development for Switzerland for a long period in time (1990-2002). The high international competitiveness of Switzerland can be seen also in export statistics, especially with respect to exports of high-tech goods (emphasising chemical sector) and knowledge-based services (financial services, insurance) (Arvanitis & Woerter, 2006 and 2007).

Switzerland is among the leading countries in Europe according to the European Innovation Scoreboard 2005 (EIS 2005[4]) country summary. In most of the innovation indicators Switzerland lies well above the EU average (e.g. with respect to lifelong learning, EPO patents, USPTO patents). Only three indicators (Science & Engineering S&E graduates, enterprises receiving public funding and business-financed university R&D) show a level below EU25 average. The indicator for the S&E graduates shows a positive trend, although it still grows weaker than the EU25 average. The rather low level of "enterprises receiving public money" can also be understood – opposite to the usual interpretation – as a quality sign for the public funding scheme, if we take into account the above-average innovation performance of Switzerland. Such an interpretation of this indicator would mean that public funding of applied R&D is quite efficient. Furthermore, it has to be considered that the mainstream doctrine with respect to innovation and technology policy among Swiss policy makers is that firm innovative behaviour is mainly a consequence of market incentives, therefore there is only little scope for successful subsidy-based policy in this field. In case companies have a promising R&D project, which they do not afford to finance all by themselves, public funding is provided if they co-operate with public research institutions to carry out this project, whereas only the public side is funded. Thus, the Government helps innovative companies to exploit the public knowledge at universities and other research institutions. There is no direct funding of private R&D in Switzerland (except in the context of EU Framework Programmes).

In order to further improve the innovation performance and as a consequence of the economic performance of the country, public innovation policy makers strongly rely on the excellence of Swiss universities (including the federal institutes of technology and universities of applied sciences). Therefore, and in the context of innovation promotion, knowledge and technology transfer between universities and companies and the "valorisation of knowledge" are among the main challenges for the Swiss innovation system (Arvanitis & Woerter, 2006).

[4] http://trendchart.cordis.lu/scoreboards/scoreboard2005/Switzerland.cfm (16.02.2007)

4.1.2 The "Knowledge Location" Switzerland at present

As a small, autonomous country, Switzerland wants to count among the best in the world when it comes to research and development. To compete on the world stage entails high performance and skill at all levels and in all areas. The capacity and the desire of well educated, well trained and motivated people are the driving forces of sustainable success.

It is imperative for Switzerland to place greater emphasis on research and development. Only in this way can its place on the world stage as a knowledge-based, employment and finance-oriented country be assured; only in this way can it secure its future as a successful, international economic area, and improve its own standard of living (Forum Wissens- und Werkplatz Schweiz, 2006).

This difficult but fascinating goal can only be achieved if universities, state institutions, economic institutions, and society as a whole work hand in hand towards a common goal.

Enhanced knowledge and its speedy application to economic practices is the key to economic dynamism. Collaboration between Universities and companies is covering more areas and becoming more intensive. A company 'Esprit' and a greater willingness to take more overall risks are becoming a part of university culture.

Enhanced knowledge means better work performance. Good education and training means greater equality of opportunities and increased competitiveness. This can only be achieved if local politics and society are committed to Switzerland's future as a knowledge-location, and will require transparent funding at state and cantonal levels by means of efficient reliable frameworks and structures designed to encourage creativity. Dialogues between Universities and society will clarify how education and research are being applied, and used in order to achieve unanimous support from all social groups.

The transfer of knowledge and technology strengthens the innovative capacity of a company, generates new products with higher export potential, and promotes more cost-effective production techniques. It also has a positive effect on employee productivity.

Contacts between companies and research institutes hardly ever emerge from collaborative research projects. From the point of view of the companies, informal contacts are far more important, since this gives them access to researchers and information as well as education and further education opportunities.

Companies place great worth on the human capital provided by Universities, and many companies recruit their qualified staff from them. The opportunities for further education are often cited as a motive for cooperation between companies and universities. Universities of Applied Sciences – 7 in all spread over 30 locations – form an important, but still often under valued avenue into the knowledge and value network. In addition to their contractual obligation to provide tertiary education and further education, since 1999, universities have also been legally obliged to provide application oriented research and offer services. Thus, they also have to address economic and socio-political issues, and, in collaboration with partners from society and the economy develop solution-oriented approaches, recommendations and products.

Universities of Applied Sciences could continue to develop their research potential. However, limited public funding means they are not able to reach the levels of research they would like or have planned. As a result, more and more universities of applied sciences are turning to the economic sector for partners and funding. For example, the SME (small and medium enterprises), often faced with a lack of funds to tackle their own research and development, take advantage of such opportunities to cooperate with the business world.

In some cantons, university autonomy is greatly conditioned by the political and administrative stance of the canton, which in turn limits their initiative capacity.

According to the latest OECD report (OECD, 2006), Switzerland has a solid innovative base. First class universities have greatly contributed to this innovative status. Conversely, the lack of unity between the areas of science, technology and innovation is considered a weakness, as is the lack of public funding specifically for research and development within the private sector. Reforming the tertiary education system is underway, and is heading in the right direction. However, further specialisation and consolidation is needed within the universities of applied sciences. The proportion of female students in universities and the scientific sector is still too small. Plus the fact that the education sector is challenged with the task of satisfying the finance industry's hunger for a more than adequate supply of well educated graduates to fill junior posts. Globalisation has also put an edge on the competition for SMEs. The OECD report (OECD, 2006) recommends that the overall conditions for innovation need further improvement. To this end, revising the domestic trading laws, and facilitating better access to EU markets would constitute substantial milestones. This could be achieved by reducing administrative, regulatory and financial barriers. In the same way, priority should be given to the provision of public funds for science, technology and innovation.

4.1.3 The EU Lisbon goals and innovation: an appraisal

The State Secretariat for Education and Research (SER) in November 2004 published a statement on the Swiss position on the European Commission's Communication "Science and technology, the key to Europe's Future" presented in June 2004. As to "Lisbon and Research" major Swiss stakeholders agree on the importance of research and innovation for economic growth, also on the assessment that adequate funding for activities is indispensable. While the overall goal of a ratio of two-thirds private and one-third public funding for R&D (already the case in Switzerland) is undisputed, a purely input-oriented view of the "3% objective" is not sufficient. "Systematic monitoring of the effects and impact of European public research funding and especially its leverage on private R&D spending is required" (BBW/SBF, 2004). Furthermore it was stated that an increase of the budget of the 7th framework programme (FP7) should be balanced with national public R&D funding in the individual member or associated countries.

4.1.4 Proposals for future structures

Suggestions

In order to secure the Knowledge Location Switzerland, a wide range of suggestions are offered (Forum Wissens- und Werkplatz Schweiz, 2006):

- **Secure the best talent:** Universities wishing to attract the most talented people worldwide into their folds have to take on board such important factors as market-competitive rewards for top class researchers, flexible working environments and family friendly structures. It is not only absolutely vital to simplify the regulations governing foreign students and researchers wishing to join Swiss universities, it is also necessary to make it easier for foreign graduates to settle in Switzerland.
- **State solution for grants, expansion of options for loans:** Regulations and finance for grants should become an integral part of the state budgetary process. In order to improve the quality of teachers, and provide financial resources for grants, term fees should be increased in stages. The new grant system should be performance based, thus promoting the incentive to give the best performance to the best educational institutions. At the same time, financial institutions are called upon to create innovative new ways of providing student loans.
- **Empowering universities with a stronger strategic position:** Armed with greater autonomy, universities are free to specialise and streamline what they offer, enabling them to compete with other institutions on both a national and international level. They actively seek cooperation with other universities at home and abroad, and strengthen their business potential.
- **Making university management more professional:** The management, strategic policy and communication network of university directorship must be substantially improved. This can be achieved by means of performance related agreements, a system of incentives and training programmes for management.
- **Greater commitment and better overall conditions for private sector investments:** As part of their entrepreneurial obligation, universities increase their commitment and structure the acquisition of sponsor funds and other financial contributions in a professional manner. With regard to the possible fiscal benefits attached to voluntary contributions, cantonal regulations should at least be made to tailor with those at state level. Inheritance and donation taxation should be defined and established at cantonal level. The question of VAT relative to institutional donations and the introduction of EBICCT (Earnings before interest, charitable contributions and taxes) also need to be tackled.
- **Economy and universities strengthen the cluster:** Strengthen both the economy and the universities, supported by an attractive political framework and the existing research cluster, and begin initiatives to embark on a new, future-oriented breeding ground for research, development, production and marketing. In the common interest, the value-chain should be based on the knowledge-work-finance ethos.
- **Promote entrepreneurship:** Working with the economy, universities strengthen both their entrepreneurial potential and intake of students and researchers. They achieve this by means of the courses and incentives they offer together with practice-oriented services in the area of coaching.
- **Facilitate access to seed money and regulate the rights to intellectual property:** In order to facilitate entrepreneurial initiatives for universities and their researchers, an improved, more transparent market for seed money is necessary. It is equally necessary to simplify the regulations pertaining to intellectual property

rights.

- **More competition in the area of funding research:** State funding for research and teaching staff, hitherto based on student numbers, should, in the mid-term, be based on a new, competition-oriented model. The state only provides a basic sum to Federal research institutions (ETH), all additional, and substantially higher funding is supplied by the Swiss Science Foundation, and in addition by the Swiss Innovation Agency. All funds will be attributed by competitive processes. A new plan aims to provide contributions to research projects with a 40% premium, an umbrella contribution for the infrastructure of research facilities. Implementing these proposed research concepts will, in the long term, encourage an annual real term growth of 4% in state funds destined for research.
- **Ensure the continuity of basic research:** The funding organisms (both federal and cantonal) provide an attractive research environment (infrastructure, favourable employment packages etc) thus ensuring the long-term continuity of research at tertiary level. In the future, higher educational institutions should be no less well funded by their paymasters than they have been up to present – such funding should also take account of surcharges, rising prices and demographic shifts.
- **Communication, dialogue with society and transdisciplinarity:** Universities actively and attractively enter into communication about their research projects, and train their research staff accordingly. They collaborate closely with interested parties (e.g. media). They take a more willing part in public debates on pertinent issues within society, presenting their research with a view to providing viable solutions. To get to grips with such complex issues, relevant research projects of an inter- and trans-disciplinary nature have to be organised, and the researchers concerned commensurately recognised.
- **Efficient structures:** To become more competitive, the overall complex organisational structure of universities in Switzerland must be dramatically simplified. Greater autonomy, entrepreneurial responsibility and professional management within a competition-oriented framework is the vital key to tackling the challenges of the future with a view to ultimate success.

Significant investments in the area of education, research, and innovation must be made in the coming years in order to safeguard Switzerland's position as a leading research location.

Finally, the current spectrum of instruments is mentioned, these being the selective promotion of a research project with funds from both the Swiss National Science Foundation (SNF) and the Commission for Technology and Innovation (KTI). Provision of this funding also takes account of the expected 'implementation' of the research results. Taking this perspective, where the difference between basic research and application oriented projects is unashamedly considered as 'increasingly artificial', the ideas already discussed are adopted with the aim of merging SNF and KTI (Credit Suisse Economic Research, 2006a).

Major innovation challenges and policy responses

In order to further improve the innovation performance, policy makers strongly rely on the excellence of Swiss universities (incl. federal institutes of technology and universi-

ties of applied sciences). Therefore and in the context of innovation promotion, knowledge and technology transfer between universities and companies and the "valorisation of knowledge" are main challenges for the Swiss innovation system. To some extent this is also indicated by the EIS 2005. Furthermore, as pronounced by different experts and studies the climate for entrepreneurship has to become more attractive. The framework conditions for start-ups should be improved and an entrepreneurial culture has to be (further) developed in order to foster the formation of new companies in promising fields leading to an increase of innovative activities. Especially young people should be encouraged to think in a career as an entrepreneur. Furthermore Switzerland has to enrich and better utilise its knowledge base for an efficient application and further development of new technologies in order to remain competitive at an international level. There are essentially three challenges to be emphasised (Arvantis & Woerter, 2007):

Challenge 1: New Fields of Technology

Switzerland's industry is traditionally strong in manufacturing technologies. Based on rather radical innovations in various fields of sciences a number of promising technologies have been developed. In order to remain competitive also in the future, Swiss companies have to be able to further develop these technologies and, more important, to successfully commercialise these technologies through product innovation. Thus, this challenge is not a "defensive" one, derived from deficits indicated by some indicators. It is rather an "offensive" one, because it aims at anticipating future developments, based on some scenarios for the future of the manufacturing industry in Switzerland in an increasingly globalised economy.

In order to address this challenge several programmes have been launched focusing on new technologies at a national as well as international basis: Biotechnology – Life Science, MedTech – Life Science, Nanotechnology and Microsystemtechnic, Enabling Technologies, e.g. ICT, Discovery Projects primarily focussing on national promotion of new innovative technologies, ManuFuture aiming at fostering Swiss manufacturing within an European context through comparative advantages based on the use of new technologies. At an international level Swiss representative joined a number of "ERA-Net" groups, recognizing the international character of technological promotion and development.

Evaluations of the KTI projects in general as well as of the specific MedTech programme have taken place in 2005: KTI funded companies show a significantly better innovation performance than comparable companies without KTI support. International experts stated that the MedTech programme is basically well designed and meets the needs of the applicants. However, some modifications were suggested, related to the diversity of topics and management of the programme.

Challenge 2: Valorisation of Knowledge (Knowledge and Technology Transfer)

Given the world-class standard of Swiss universities, especially in the field of natural sciences, many observers argue that the knowledge generated in the Swiss universities is only partially utilized in the innovation process of private enterprises. Thus, there must exist deficits in the valorisation of scientific knowledge, i.e. knowledge and technology transfer between scientific institutions and enterprises that have to be removed through appropriate policy measures. These deficits in combination with the relatively

small share of public funding of applied R&D are main challenges to be addressed by policy in order to further improve the Swiss innovation performance. If this assessment holds true, reaching a more effective technology transfer between public research institutes and business companies and strengthening applied research must get a high priority in the agenda of technology policy.

To address these challenges several initiatives were undertaken by Government agencies. “Knowledge valorisation” is addressed by different funding programmes based on the principles of “indirect” support and the “bottom-up” approach of the KTI. Actually, the KTI funding approach focuses on knowledge and technology transfer (KTT) in general. Especially the following programmes have to be mentioned in this context: (1) Innovation and valorisation of knowledge. This programme aims at strengthening the efforts of the KTI and SNF (Swiss National Science Foundation) with respect to the valorisation of knowledge. This measure supports the transfer of technology between universities and industries by creating a "network for innovation". Universities, universities of applied sciences, research institutes and companies should be part of this kind of networks. (2) KTT is a very new measure that also has a special focus on the “valorisation of knowledge”. This measure fulfils a kind of "trigger" function for knowledge and technology transfer (KTT). Five consortiums consisting of KTT service centres have been already built. These service centres aim at reinforcing the demand of companies for university knowledge and research results, enabling companies to better identify existing knowledge and future requirements, and reinforcing companies, above all SMEs, in their contacts with universities.

One might assume that policy instruments that improve the industry-science interface, would indirectly contribute to an improvement of the innovation performance of companies. This means that basically the application of such a policy is a step in the right direction.

Challenge 3: Entrepreneurial Spirit

Although the GEM (Global Entrepreneurship Monitor) 2005 ranks Switzerland above average in “entrepreneurial indicators”, it is stated by the authors (Volery, Bergmann, Haour & Leleux, 2006) that further improvements are possible. In order to keep the high standard of living in Switzerland and to remain competitive on an international level, it is necessary to intensify the entrepreneurial spirit and to develop a culture for innovation. In this context, the Government has already chosen to prioritise the promotion of “entrepreneurial” activities in Switzerland in its respective programme paper. Thus, several programmes have been launched to promote entrepreneurial behaviour in Switzerland: (1) Promotion of start-ups and entrepreneurship. This measure should foster an inspiring environment for start-ups and promote entrepreneurial spirit within the Swiss society. Young entrepreneurs receive professional support at the beginning. Young people should be motivated to engage themselves professionally in science and technology; they should be encouraged to become entrepreneurs. Outstanding start-up companies are awarded with the KTI Start-up label. (2) Venturelab - promoting an entrepreneurial culture, innovation management training, start-up coaching. Venturelab is an initiative launched by KTI in order to promote entrepreneurship in Switzerland. It is carried out in co-operation with the federal institutes of technology, universities and universities of applied sciences. Venturelab provides customised education tools to promote innovative young entrepreneurs and to inspire students for entrepreneurship.

Challenge 4: Strengthening and optimisation of the Education, Research and Innovation area

During the next few years (2008 - 2011), the state intends to invest around 21 billion Swiss Francs to promote efficient, practice-oriented and innovative research projects, especially in the areas of occupational training and courses at universities of applied sciences, as well as in applied research and development via the Commission for Technology and Innovation.

Bringing the areas of economy, education and research closer (EVD 2003):

1. It would be advisable to ensure that the same language is spoken (interfaces, research and business) when knowledge and technology are transferred.

2. In this regard it is also necessary to inform the cantons more effectively and to encourage them to better incorporate the education, research and technology potential into their economic policies (institutional interfaces), whilst at the same time improving the general conditional framework in favour of promoting innovation (promoting competition, setting up and financing new businesses, E-Government, reducing bureaucratic red-tape, promoting exports, etc.).

4.2 Conclusion: Significance for the Zurich region

Quality of life, moderate taxation and excellent educational institutes are Zurich's key factors for location competitiveness. The Greater Zurich Area wants more investment in education and Zurich to become the 'location of the knowledge-based city of tomorrow'.

A good precondition for this is the excellence of Zurich universities (including the federal institutes of technology, the university as well as the universities of applied sciences). Therefore, and in the context of innovation promotion, knowledge and technology transfer between universities and companies have to be promoted.

The metropolis of Zurich, in its knowledge-based guise, is destined to play a prominent role in the future. Its incomparable quality of life, good infrastructure, excellent security, liberalised economy, moderate taxation and clarity of identity as a small metropolis all conspire to create an alluring atmosphere which is greatly appreciated by highly qualified people, and which, in its particular form, is almost impossible to find elsewhere. This means that in the future Zurich will have a reservoir of some of the best qualified people available, and this, in turn, constitutes a very attractive proposition for companies. Even Zurich's ‚cosy' aspect (presumably more of a disadvantage from a competitive point of view) is good for networking, and helps to establish creative milieus, considered equally important by specialised people. Tolerance and cosmopolitanism are highly expected as well as low administrative burdens. The overall reputation of a location is important in order to nurture the feeling that life goals can be achieved in this one specific place.

Human capital plays a fundamental role as both the economy and society become more knowledge based. The potential of highly developed political economies like Switzerland – especially advanced in knowledge-based and product oriented industry and services - lies in their international competitive propensity. Companies active in

these areas are attracted by the availability of qualified and highly qualified people Zurich has to offer. It is therefore essential not to let this turn into a recruitment bottleneck. The concentration of global companies within the economic and metropolitan areas of Zurich where the greatest concentration of qualified and highly qualified employees are to be found, can be explained from this point of view. From the 1000 largest Swiss companies, 67% are located within the metropolitan area of Zurich.

However, in Switzerland in general, and specifically in Zurich, there is too little secondary growth in the mathematical, scientific and technical areas of study. In contrast, subject areas such as publishing, teaching and psychology are increasingly popular among students. It should not be forgotten that the high tech industry and its related fields of competence are important product pointers within the Zurich area. The future need for scientists and engineers can in part be covered by the influx of foreign personnel. It is therefore essential to increase the recruitment of students completing their studies in scientific and technical areas in order to augment the reservoir of available qualified people. Already the interest in the more technical subjects being generated in schools, and at little cost, is paying dividends, and more school leavers are showing interest in taking up corresponding university courses (Credit Suisse Economic Research, 2006b).[5]

[5] The views contained within this Action Plan report are not necessarily those either of the organisations involved, or of the participants of the interviews conducted on this subject during 2006 and 2007 in Zurich, Switzerland.

List of Figures

References

Ansoff, H.I. (1980): Strategic Issuemanagement, In: Strategic Management Journal, Vol. 1, No 2, 131-184.

Ansoff, H.I. (1984): Implanting Strategic Management, Englewood Cliffs, New York.

Ansoff, H.I. (1976): Managing Surprise and Discontinuity – Strategic Response to Weak Signals, in: Zeitschrift für betriebswirtschaftliche Forschung, Vol. 28, 129-152.

Arvanitis, S., Woerter, M. (2006): Annual Innovation Policy Trends and Appraisal Report Switzerland 2004-2005. European Trend Chart on Innovation. European Commission DG Enterprise, www.cordis.lu/trendchart.

Arvanitis, S., Woerter, M. (2007): Annual Innovation Policy Trends and Appraisal Report Switzerland 2006. European Trend Chart on Innovation. [forthcoming].

BBW/SBF (2004): Swiss Position on the European Commission's Communication "Science and Technology, the key to Europe's Future". SBF, Bern.

BMI/BDI (Hrsg.) (2002): Nachhaltigkeitsmanagement in Unternehmen, Konzepte und Instrumente zur nachhaltigen Unternehmensentwicklung. Lüneburg: Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit/Bundesverband der Deutschen Industrie e.V.

Chase, W.H. (1979): Public Issuemanagement: The New Science, In: Public Relations Journal, Vol. 33, No 10, S.25-26.

Credit Suisse Economic Research (2006a): Geht die Schweiz innovativ mit Forschung um? Economic Briefing No 44. Credit Suisse, Zürich.

Credit Suisse Economic Research (2006b): Standortmonitoring Wirtschaftsraum Zürich 2006. Greater Zurich Area AG, Zürich.

Europäisches Innovationsportal: http://trendchart.cordis.lu/scoreboards/scoreboard2005/Switzerland.cfm (16.2.2007).

EVD (2003): InnoNation Schweiz. Aktionsplan des Eidgenössischen Volkswirtschaftsdepartements zur Förderung von Innovation und Unternehmertum Juni 2003. Eidgenössisches Volkswirtschaftsdepartement, Bern.

FOREN (2001): A Practical Guide to Regional Foresight. Foresight for Regional Development Network. European Commission Research Directorate General STRATA Programme, Brussels.

Forum Wissens- und Werkplatz Schweiz FWWS (Hrsg.) (2006): Wissensplatz Schweiz 2015. Impulse für eine dynamische Schweiz. Zürich, Zeitungsbeilage.

Glenn, J. C., Gordon, T. J. (2003): Futures Research Methodology Version 2.0. Chapter 13 Scenarios. American Council for The United Nations University, Washington.

Godet, M. (2000): The Art of Scenarios and Strategic Planning: Tools and Pitfalls. Technological Forecasting and Social Change, 65, 3-22.

Miles, I. (2002): Appraisal of Alternative Methods and Procedures for Producing Regional Foresight. Paper prepared for the STRATA-ETAN Expert Group Action on "Mobilising the regional foresight potential for an enlarged European Un-

ion". University of Manchester.

OECD (2006): OECD Science, Technology and Industry: Outlook 2006. OECD, Paris.

Rotmans, J., van Asselt, M., Anastasi, Ch., Greeuw, S., Mellors, J., Peters, S., Rothman, D., Rijkens, N. (2000): Visions for a sustainable Europe. Futures, 32, 809-831.

Scholz, R. W., Tietje, O. (2002): Embedded case study methods: Integrating quantitative and qualitative knowledge. Thousand Oaks: Sage.

Schmid, M. (2005): Formative Scenario Analysis & Intuitive Scenario Construction. Diploma Thesis. ETH Zurich.

Spiess, H., von Allmen, M., Weiss Sampietro, T. (2005): Szenarien. Wertschöpfung und Transferzahlungen im Jahre 2030 im Schweizer Alpenraum. [Scenarios. Value Added and Subsidies in the year 2030 in the Swiss Alps]. (Projekt FUNalpin - Arbeitsbericht 7). St.Gallen/Rapperswil/Winterthur: ZHW.

UPGRADE (2004): Foresight strategy and actions to assist regions of traditional industry towards a more knowledge based community. Blueprints for Foresight Actions in the Regions. Dissemination Conference, Brussels.

Van Notten, P.W.F., Rotmans, J., van Asselt, M., Rothman, D. (2003): An updated scenario typology. Futures, 35, 423-443.

Volery, T., Bergmann, H., Haour, G., Leleux, B. (2006): Global Entrepreneurship Monitor. Bericht 2005 zum Unternehmertum in der Schweiz und weltweit. Swiss Executive Report.

Wiek, A., Binder, C., Scholz, R.W. (2006): Functions of scenarios in transition processes. Futures, 38, 740-766.

Annex

A 1: Guidelines for a scenario construction process for REFORM partners

Dear colleague

As you know, WP2 consists of the implementation and the assessment of several, relevant scenarios. We will support you to implement a workshop where you will develop these scenarios for your region in a standardised form in order to be able to compare the results. To achieve this purpose, you will get the necessary information in 3 packages (for details, see annex procedure).

This is information 1, in which we kindly ask you to invite the necessary experts (when to invite, who to invite, for what purpose?). You will get more information about the implementation of the workshop as such (which will have to take place in June) by the end of May.

The aim of the scenario-workshop is to develop – together with regional experts – scenarios for RTD & innovation development and to assess these scenarios regarding plausibility and desirability. During the workshop, each region will develop both 4 regional and 4 European scenarios with a time frame of the year 2020. The scenarios will be characterised by approx. 13 impact variables (see annex 3). These impact variables can be grouped in the following 7 sub-systems: population, education, economy, governance, research & innovation, infrastructure, and quality of life.

The most important criterion for the choice of your experts is that all expertise from all 7 sub-systems should be represented by at least one expert. This means, that your expert group should consist of no less than 7 people. Furthermore, the group should be as diverse as possible regarding the representation of economic interests (SMEs) as well as key actors in RTD policy and investment. Then, males as well as females, urbanites and rural population, various economic sectors and political interests should be represented.

Once you have developed a priority list (including substitutes) of your experts, please make sure to invite the experts as soon as possible for the date you have chosen. Then, please do not forget to replace those experts that cannot attend with adequate substitutes. Do not be disappointed: it is highly likely to get a lot of cancellations due to the short notice.

Please, plan to invest about 6 hours in the event together with the experts (e.g. 9-12 and 13:30 -16:30, including an invitation for lunch).

Any questions so far regarding the organisation of the workshop? Please contact within ZHW, your partners in Switzerland:

Harry Spiess, Fon. +41 52 267 79 31, E-Mail: sph@zhwin.ch

Vicente Carabias, Fon. +41 52 267 76 74, E-Mail: crb@zhwin.ch

CUE, your partners in England:

Clive Winters, Fon. +44 24 7623 6812, E-Mail: C.Winters@cad.coventry.ac.uk

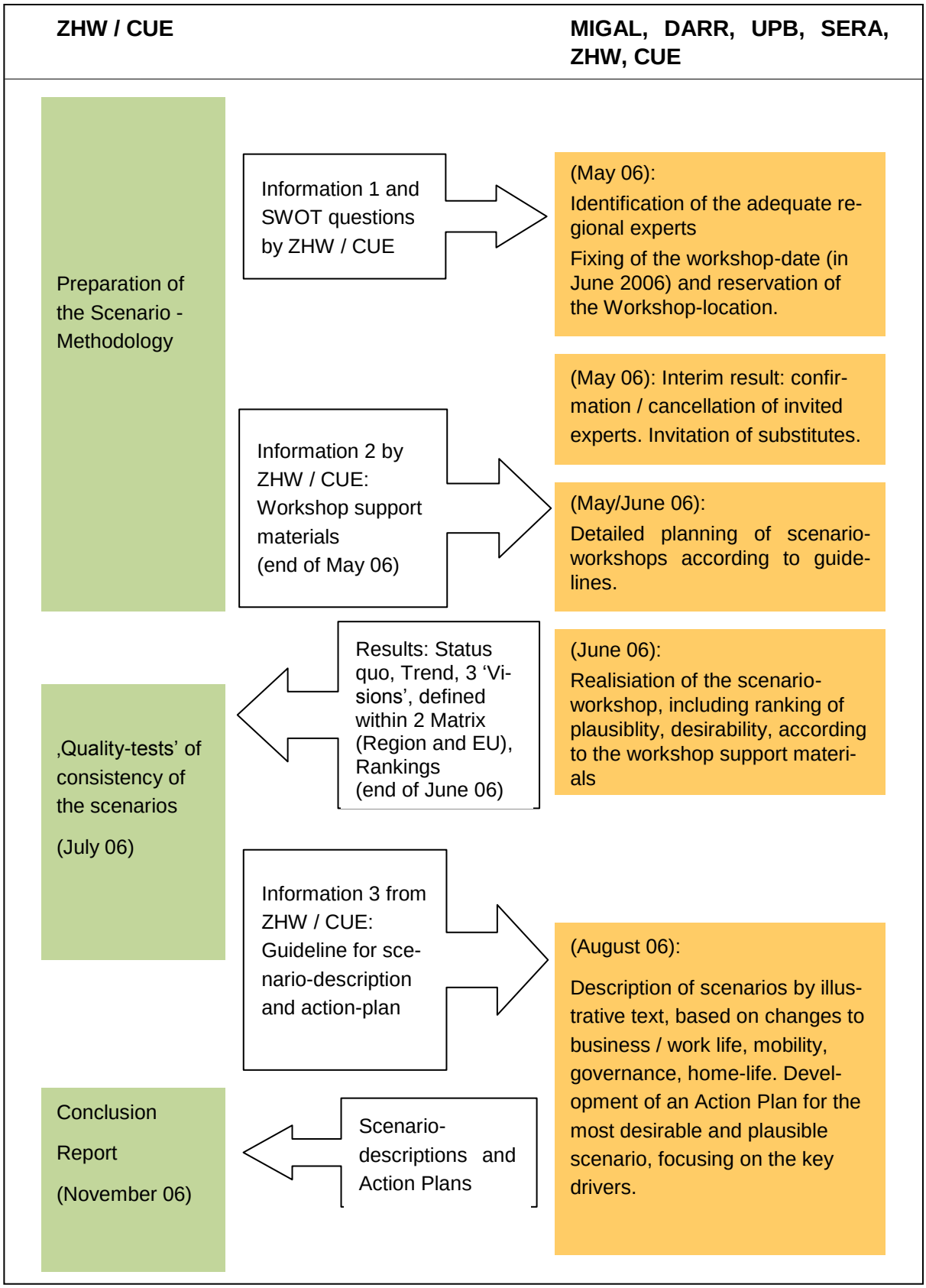
Khezir Akhtar, Fon. +44 24 7623 6245, E-Mail: KAkhtar@cad.coventry.ac.uk

By the end of May, you will get a precise guideline for the implementation of the workshop. Good luck for the organisation of the workshop. We are looking forward to exciting results.

Best regards

Vicente, Harry, Urs, Thea, Clive, Khezir

Annex: Procedure (flow chart)



Procedure (Flow Chart)

A 2: Discussions within the Expert-subgroups during the Scenario Workshop in Zurich, Switzerland (in German)

Group A:

Dr. Hanja Hansen (HA), Pirmin Knecht (KN), Dr. Martin Wörter (WÖ), Willy Frank (FR)

Phantasiephase: Thema Forschungsinnovation

FR: Immigration sollte nicht die eigene Reproduktion von Forschenden ersetzen, Soziologie, Politologie, etc. -> eher für die sekundäre Wertschöpfung (WS), nicht für primäre WS, Ingenieure in der primären WS

HA: Zuständigkeit des Ausbaus der Passerellen, Stärkung der FH-Schullevels, wichtig Know-How im Land aufbauen und erhalten

FR: Vermisst grundlegende Bildung an der Schule, wird technisches Wissen nicht vermitteln

WÖ: will FR nützliche und breite Ausbildung?

FR: technische Redaktoren sinnvoller wie Publizistik

KN: was wollen wir jetzt?

WÖ: noch andere Variablen?

Crb: Endziel, Wirtschaftsförderung?

KN: Vision von 2020 -> noch mehr aus dem Ausland, Pool in CH zu klein, Unterschied Qualität der Studien an der ETH wird immer grösser (ist Doz. an der ETH)

Grund: immer mehr gehen studieren

-> wir brauchen die besten, deshalb Einwanderung

FR: wichtig dennoch: Grundbildung

HA: aber gibt es nicht noch andere Möglichkeit –> Region nur stärker, wenn internat. Netzwerke erlaubt

WÖ: Unterschied in der Bildung nimmt zu, aber Bildung gegenüber der übrigen Gesellschaft nimmt ab

Indikatoren:

- Patentindikator an der ETH nicht mehr -> Geheimhaltung
- Anteil innovativer Produkte am Gesamtumsatz einer Firma (KOF erhebt seit Mitte 90er Jahre dieses)

HA, FR: Definition von Innovation?

WÖ: was ist brauchbar? -> Fokussierung je nach Unternehmen anders

FR: Innovation schwierig, Input von Markt: Wir brauchen etwas!

Innovation: stark gebunden, als echtes Marketing, d.h. latente Bedürfnisse, aufspüren und entwickeln, -> Molekül?

Liberalisiertes Wirtschaftssystem, zügellose Wirtschaft, Freiheit

HA: Motor für Innovation ist ein Problem

FR: F&E-Anteil

Branchenstruktur gut

Wenig Regulation

Patentanträge allein bringen zu wenig, weil zu wenig

HA: welche Probleme sind 2020 wichtig? Für den Kt. ZH

FR: Energie und Umwelt

In CH, sehr viel Know How, es fehlt das Zusammenfügen zum System

KN: 2020 Standort für Energie Know How, möglichst aufbauen, Autonomie in Energieversorgung, Attraktivität steigern

Erfolgreich um mit entsprechenden Köpfen als Standort CH -> Qualitäten schaffen

- Bildung ok
- Lebensqualität
- Sicherheit, Gesundheitskosten?

FR: „Insel der Seligen“ schafft Immigrationsdruck

Wichtig deshalb Know How an China verkaufen im Bereich Umwelt und Energie

- Know How Export
- Wenn sie selber Wärmepumpen bauen, Know How Verlust

KN: EU macht jetzt schon gezielte Einwanderungspolitik

HA: (Skizze, siehe Flip Chart Blatt)

WÖ: Verlagerung von F&E-Entwicklung nicht subsitutiv, sondern komplementär, CH profitiert

Crb: Titel: Netzwerk, Freiheit, Attraktor Lebensqualität, Freiheit (politisch), BrainValley, Autarkie (auf Energieversorgung bezogen), Lebensqualität, gezielte Migration, Offshoring

FR: aber Region muss ausgedehnt werden auf Elsass, Baden-Württemberg

Szenario „Attraktor Lebensqualität“ (crb)

Migration

HA: sollte nicht physisch anwesend sein

BIP

WÖ: Auswirkungen nicht

Branchenstruktur

Zulieferung z.B. zum Umwelt und Energiesektor, DL etc. lassen heterogene Struktur erwarten

F&E-Investitionen

-> Innovationsintensiv

Wirtschaftspolitik

HA: Liberalisierung wäre für Innovation in Energie- und Umweltbereich förderlich

KN: unsicher bezüglich Ausprägungen

WÖ: Unternehmen gehen dorthin wo liberales System und tiefe Steuern

KN: aber Argument Netzwerk, Lebensqualität, weiche Faktoren werden immer wichtiger

WÖ: Verlagerung Konzernsitz, Forschungsstandort werden andere Kriterien grundlegend sein, Bsp. Biotechnologie

WÖ: für liberalisiert

KN: für reguliert

Patentanträge

Steigend, auch wenn Firmen gewisse Patente verdecken, aber immer mehr andere Schutzbestimmungen

Venture Capital

Einkommensverteilung

KN: alles kostet bisher, daher TopShots, die mehr verdienen -> mehr Ungleichheit

Europäisches Szenario:

Rahmenszenario für Szenario „Attraktor Lebensqualität“

HA: unklar

KN: inkonsistent, für CH kostet, für EU mehr Dinge die nichts kosten

WÖ: tiefe Steuern, was heisst das, für Private, für Unternehmen? -> unterschiedliche Auswirkungen auf die Wirtschaft auf Standortqualität

KN: Trinkwasserqualität, Umweltqualität im Moment schwer zu halten

4.2. Wirtschaftliche Stagnation

6.2. Abnahme der Investition in F&E

Szenario Mauer, „Abschottung“ (KN) (Negativszenario)

4.2. Wirschaftliche Abschottung

6.2. Abnahme der Investition in F&E

HA: warum negativ?

WÖ: zeigt Kritik auf; Unterscheidung Steuern und Steuersatz

Einkommensverteilung

WÖ: Schere geht jetzt schon auseinander

KN: Druck auf Landschaft steigt

Globales Szenario „Abschottung“

Widerspruch, warum jetzt Rahmen, wenn Abschottung

WÖ: vor allem im Bereich der Wirtschaft grosse Verflechtungen, d.h. CH kann nicht stagnieren, wenn EU-Umfeld floriert

Warum? Wachstumsschwäche EU

WÖ: Konservierung im Sinn von Stillstand

„Stillstand“

Trend-Szenario

WÖ: Branchenstruktur -> Mono, kaum Gefahr, Tendenz der Tertiarisierung wird zwar zunehmen, aber Industriebereich wird nicht abnehmen -> Heterogenität

Venture Capital, spiegelt CH kleinräumige Struktur nicht wieder -> viele Kredite im normalen Kreditverfahren vergebbar, es mangelt etwas am Angebot

Diskussion

Beim Szenario „Attraktion“ -> erschwerter Zugang…

Wirtschaft global

WÖ: 2004 CH stärker gewachsen als EU

Wachstumsimpulse zwar in den alten Händen im Moment, aber bis 2020, weil kleine Volkswirtschaft keine grossen Impulse mehr zu erwarten

Aber für CH Wachstumsimpulse durch internationel Beziehung

Inkonsistenzen?

HA: Optimismus (veränderungspotential) gross

- Wenn Markt mit der demografischen Entwicklung
- Jede Gesellschaft versucht sich zu stabilisieren

KN: etwas pessimistisch, wir sind oben, es ist schwierig sich zu halten

WÖ: 90er Jahre in Aufschwung mit EU-Beitritt

Group B:

Dr. Sebastian Brändli (BR), Fredy Hasenmaile (HAS), Dr. Werner Hediger (HE), Dr. Margot Tanner (TA)

HE: hat Erfahrung im Modellieren, immer gleich 2 gegensätzliche Visionen erstellen

z.B. EU-Beitritt der CH bis 2020,

baldiger Entscheid dass CH nicht der EU beitritt

Sph: Vorgehen wird also geändert, gleich 2 Visionen erstellen, ohne fixe Vorgaben

TA: bedeutet kein Beitritt Weiterführung des Bilateralismus?

HE: wird es weitere Verträge mit der EU geben?

TA: keine EU bedeutet keine Assoziationen grosser Verlust in F&E

Führt zu mehr Offshoring von Forschung z.B. über Tochterfirmen

BR: der Unterschied zwischen EU-Beitritt und Bilateralismus ist klein im Bereich F&E

Partnerregionen ausserhalb Europa fehlen in REFORM (z.B. USA)

Durch EU zu grosser Fokus auf Europa

HAS: Unterschied Beitritt / Verträge mit EU ist klein, kaum ein anderes Land ist so gut in die EU integriert wie die CH

EU-Länder haben Reformschwierigkeiten

CH ist Rosinenpicker

Bei allfälligem Beitritt wäre die Zusammenarbeit mit der EU strukturierter

Die EU kann viel von der CH profitieren (z.B. Geld)

CH soll für die EU nicht zum Präzedenzfall werden (Rosinenpicker)

BR: F&E: Life Science ist in der CH so gut, dass sie das auch in 10 Jahren noch sein wird

CH kann hier Partnern Hilfe bieten

HE: Bilateralismus ist s.w. dem Trendszenario unterlegt

Die Löhne der Akademiker in der CH sind zu hoch

Trotz Verträgen braucht es für Schweizer Arbeitsbewilligungen z.B. in England die

Mobilität ist eingeschränkt

Bei der Besetzung von Stellen spielen nationale Entscheide eine Rolle

BR: die Arbeitsqualität in der CH ist gut

HAS: EU-Beitritt führt zum Aufbrechen von Strukturen (wie in Österreich auch)

EU-Beitritt unterstützt Reformen, aber danach herrschen starre Strukturen in der EU

HAS: Reformen durchführen ist auch im Alleingang möglich

Reformen im Binnenmarkt wichtig, mehr Wettbewerb, Staat zieht sich aus der Erstellung zurück, gibt nur Rahmenbedingungen vor

Bereitstellung der Infrastruktur soll Monopol bleiben

Dienstleistung wird nicht von Staat erbracht

Föderalismus ist nicht schlecht

HE: nationales Monopol muss nicht staatlich sein, wie z.B. die Wasserversorgung im Kt. ZG

BR: Föderalismus? Es gibt sehr viele Player, man muss immer beachten, was andere machen

HE: CH ist eine protektionistische Volkswirtschaft, jede Branche profitiert von den Grenzen

HE: die CH hat keine Ressourcen, dafür Dienstleistung und Know How Vorteile in der Hochtechnologie

BR: Unterschied „Billig HighTech“ und „nachhaltige HighTech“ muss beachtet werden

HE: zum Glück hat die CH wenig Ressourcen

HE: die Unterteilung Bund/Kanton/Gemeinde ist in der CH sehr stark

Starke Reibungen auf kantonaler Ebene

Die Kantone haben die höchste Souveränität (wird allerdings kleiner)

Kt. ZH funktioniert nicht schlecht

Die GZA (Greater Zurich Area) bricht diese Struktur auf, Kooperationen auch ausserkantonal

BR: Die Kantone sind nicht nur historisch, die Kantone haben sich auch modernisiert, die Kompetenzen auf Kantonsebene wurden angepasst

Bietet die Volkswirtschaftslehre Möglichkeit zu zeigen wo der Föderalismus förderlich ist und wo nicht?

Die kant. Kompetenzen im Bauwesen sind riesig

HE: Der Föderalismus ist gut erforscht: für jeden Bereich optimalen Grad an Föderalismus

HAS: Kompetenzen, Mittel und Aufgaben müssen abgestimmt sein, sonst gibt es Friktionen → effizient, egal auf welcher Ebene (Bund/Kantone/Gemeinde)

Zu tiefe Ebene → ist zu kompliziert

Zu hohe Ebene → zu schwerfällig und ineffizient

HE: HighTech ist exportorientiert

Grösste Kooperation CH/EU ist Maschinenindustrie, …

Wenn HighTech mit anderen Ländern geteilt wird, hilft dies allen Beteiligten

Falls die CH nicht der EU beitritt und nicht mehr Rosinenpicker sein kann, verläuft die Zusammenarbeit mit der EU

Falls es keine echte Zusammenarbeit mehr mit der EU gibt, wird die CH reines Dienst-

leistungsland

HAS: Dank dem hohen Lebensstandard und den hohen Löhnen kann die CH Forscher importieren

HE: ETH will mehr ausbilden

BR: Die Diskussion, dass es zu wenig Ingenieure in der CH gibt, ist alt

HighTech wird in der CH zu wenig ernst genommen

In der ETH ist der Fokus zu stark auf Biotechnologie

HE: Kt. ZH: Zusammenarbeit Uni/ETH verstärken

BR: bleibt Bilateralismus Uni/ETH?

TA: Forschungsgelder gehen über Tochterfirmen immer mehr ins Ausland CH bildet vor allem aus

HE: Was wird ins Ausland verlagert, was kommt zurück?

HAS: Das Abfliessen der Forschungsgelder ist eine Folge der Globalisierung Arbeitsteilung

Wo sind komparative Vorteile der CH? Life Science? Präzisionsindustrie?

Identifikation der eigenen Stärken ist wichtig

Ziele nicht durch Trends bestimmen, sondern aufgrund komparativer Vorteile

TA: Bevölkerungsstruktur in der CH: wenig Leute, was ist nötig um die Leute hier zu behalten oder (z.B. aus Asien) zurückzuholen?

HAS: In der CH bommen die Geisteswissenschaften, natur-wiss. Studiengänge werden seltener gewählt bessere Information der Schüler nötig

HE: Lehrlingsausbildung in zukunftsträchtigen Branchen wichtig

BR: verlieren wir volkswirtschaftlich etwas, wenn Strukturen aufgebrochen werden?

Vorteil von Handwerkern: übersichtlich

HAS: wenn Binnenmarkt reformiert wird, können Handwerker auch wichtiger werden, wenn die Nachfrage danach stärker ist

HE: Submissionen werden internationaler, Handwerker z.B. aus Deutschland

Bei hohen Einkommen auch Nachfrage nach Produkten hoher Qualität?

Sph: Auswahl zweier Stichworte…

HE: weg von Industrie, hin zu HighTech oder zu Dienstleistungen in den nächsten Jahren

Handel, Versicherung, Banken, …

HAS: Geschichte: Textilherstellung führte zur Textilindustrie und diese wiederum zur Chemieindustrie (z.B. Farben) und Maschinenindustrie

In der Textilindustrie entstand auch eine Spezialisierung (z.B. Segeltücher)

Sph: 2 Szenarien:

- Staat reformfähig und steuernd
- HighTech-CH (BR: hierbei breiter Begriff von HighTech, auch Banking und Finance)

HAS: Dienstleistungs-CH, HighTech-CH: beides ist wertschöpfungsstark

Diskussion Trendszenario

BR: zu positiv, Inkonsistenz BIP/Zunahme der F&E-Investitionen

HE: falls Stagnation sicher F&E-Investitionen tiefer

Was meint der Begriff Trend? Extrapolation?

Ist inkonsistent

TA: zahlenbasiert?

HE: Szenarien lassen sich zahlenmässig nicht fundieren

BR: Im Moment ist in der CH tatsächlich wirtschaftliche Stagnation und erhöhte F&E-Investitionen, dies ist aber längerfristig nicht möglich

HE: wegen Stagnation und tiefer Steuern müssen F&E-Investitionen auch anteilsmässig sinken

Sph: auch wegen langem Horizont

HE: sobald Arbeitplätze bedroht sind, wird Umweltschutz nicht mehr so ernst genommen

HAS: was sind die Voraussetzungen?

BR: kein Indikator ist reine Voraussetzung resp. reine Wirkung

HE: eine gute Infrastruktur ist kein Garant für Aufschwung, dies hat sich in der CH eindeutig gezeigt

BR: falls die Ausprägung der BIP-Entwicklung im Trendszenario auf Zunahme, wäre das Szenario s.w. konsistent

BR: es ist nicht sicher, dass bei mehr Geld auch die F&E-Investitionen steigen

Sph: zwei Änderungsmöglichkeiten des Trendszenario:

Variante A:

- F&E-Investitionen sinken
- Evtl. sinkt Lebensqualität
- Evtl. sinkt Niveau der Infrastruktur
- Liberalisiertes Wirtschaftssystem, aber höhere Steuern

Variante B:

- Regionales BIP steigt

BR: liberalisiertes Wirtschaftssystem muss nicht mit tiefen Steuern zusammenfallen

TA: wieso Monostruktur, einseitige Branchenstruktur?

Sph: Kt. ZH ist jetzt bereits recht einseitig (Banken)

HAS: alle Dienstleistungen im Kt. ZH zusammen machen nicht 40% der Wertschöpfung aus (siehe Ausprägung)

Allg. ist die Abgrenzung der Branchen problematisch

Im Kt. ZH gibt es aufgrund der Grösse eine so einseitige Branchenstruktur

Aktuell sind die Dienstleistungen zusammen im Kt. ZH ca. 35% □ Kt. ZH ist nicht einseitig jetzt

TA: wenn die Struktur so einseitig wäre, wäre der Anteil der tertiär Gebildeten nicht so hoch

HE: die Gefahr einer Monostruktur ist in Randregionen grösser

HAS: Niedergang der Swissair ist relativ glimpflich abgelaufen

Presentations of the developed scenarios in the subgroups

HE: institutionelles und wirtschaftliches Szenario erstellt

Die Einkommensverteilung hängt von der Sozialpolitik ab

Europäisches Szenario war sehr schwierig zu bezeichnen

Europa wird ganz sicher höhere F&E-Investitionen haben

Würde lieber volkswirtschaftliches oder systemdynamisches Modell zugrunde legen

HAS: konsistenteres Szenario, erwünscht

Tieferer produktiver Anteil an der Bevölkerung: Alterung, hohe Erwerbstätigkeit, Wohlstand (Frühpensionierung)

HE: im Kt. ZH sind die Ausgaben einer Familie für die Gesundheitskosten höher als die Steuern

HAS: Europaszenario ist genau gleich wie das des Kt. ZH

Sph: bedeutet das Szenario wissensbasierte HighTech-CH zwingend den EU-Beitritt?

HAS: muss nicht unbedingt sein

HE: wollte 2 Szenarien: 1. mit EU-Beitritt, 2. bilaterale Beziehungen gehen nicht weiter

1) institutionelles Szenario (EU) -> reformfähig und steuernd

2) wirtschaftliches Szenario -> wissensbasierte HighTech CH

HE: 1) Ausgangslage: reformfähig und steuernd

Diskussion

WÖ: Liberalisierung und Wirtschaftswachstum

Nach HE eher Wirtschafts- und Systemtheoretisches Modell als Erklärung

2) wissensbasierte HighTech CH

Demographie starke Triebfeder

HE: was fehlt ist Gesundheitsausgaben, AHV, etc.

Crb: stellt Statements vor

Was sind Probeleme 2020?

Umwelt und Energie

Diskussionspunkte

Szenarien 2 und 3 bis auf punkt 2 gleich: Bevölkerungsstruktur

Es gibt gewisse Konkurrenzsituation CH und EU

-> „Attraktor Lebensqualität“ schon heute top

weshalb Szenario, KN-> Erhaltung erfordert Innovation

4. Szenario „Status Quo“, Stillstand

Vergleich mit EU: Immigration in F&E

HE: logisch, Modell: Glas Wasser

Trendszenario

Unterschiedliche Anapssung

Aber bez. Monostruktur

HA: Wertewandel und Lebensstil, überhaupt gesellschaftliche Formen wenig berücksichtigt

Integration tertiär gebildeter Frauen noch ungenügend

Ranking of the scenarios by plausibility and desirability

The remaining 5 experts (TA, KN, HE, HA, WÖ) have each 6 points to distribute with maximum

3 and minimum 0 points per scenario for both rankings.

- Plausibility (heisst in sich konsistent)

    1. wissensbasierte HighTech CH 10 Punkte
    2. Attraktor Lebensqualität 8 Punkte
    3. Trend 2 6 Punkte
    4. Stillstand 5 Punkte
    5. Reformfähig 1 Punkt

- Desirability

    1. Attraktor Lebensqualität 14 Punkte
    2. Wissensbasierte HighTech CH 13 Punkte
    3. Trend 2 2 Punkte
    4. Trend 1 1 Punkt

WÖ: klar, dass die beiden Szenarien HighTech-CH und Attraktor Lebensqualitität so ähnlich sind als gleich bewerten

Es ist schwierig den Trend und den Status Quo zu bewerten.

Fand das Ziel des Tages sehr ambitiös (Vorhersage für 2020), hat aber im Verlauf des Tages den Sinn des Vorgehens begriffen. Je weiter man in die Zukunft schaut, desto kleiner ist der Bezug zur Gegenwart (Vorhersagen werden dadurch einfacher).

Empfand den Tag insgesamt als positiv.

KN: Ist Irritiert, dass sich die Resultate so ähnlich sind. Sind „nur“ Wunschszenarien entstanden? Realitätsbezug?

Ist sich als Raumplaner gewohnt frei in die Zukunft zu schauen.

HAS: Plausibilität: erstaunlich, dass das Trendszenario als nicht sehr plausibel erscheint.

Einigkeit ist erstaunlich und erfreulich, wenn Experten unterschiedlicher Herkunft gleicher Meinung sind.

Fand die Auswahl der Variablen und Ausprägungen schwierig.

Die Standardisierung (nur zwei Ausprägungen) beeinflusst das Ergebnis.

Beim freien Diskutieren ist es schwierig, gemeinsame Themen zu finden.

HE: Das Ranking ist nicht erstaunlich.

Szenario Attraktor Lebensqualität ist soziale Wünschbarkeit, HighTech-CH wirtschaftliches Szenario.

Eigentlich ist nur 1 Szenario entstanden Szenarien verschmelzen

TA: Die Szenarien Attraktor Lebensqualität und HighTech-CH könnten aus einem Bericht von economiesuisse sein die Präsenz der angesprochenen Themen in den Medien hat Ergebnis beeinflusst.

Wo war ein Weiterkommen im Gegensatz zu dem was man schon weiss?

Fand Unschärfe in den Definitionen schwierig.

Was sind Treiber, was sind Hemmer des Systems?

The resulting Visionary and Trend Scenarios from both subgroups:

Regional scenarios	**Zurich (CH)**					
	Attractor Quality of Life	Stagnancy	Ability to reform and pilot	Knowledge-based HighTech-C	Trend 1	Trend 2
1. Migration of tertiary educated people	1	2	1	1	1	1
2. Population structure	2	1	2	1	1	1
3. Education opportunities	1	1	1	1	2	2
4. Regional GDP at PPP per capita	1	2	2	1	2	1
5. Diversified structure of economic activities	2	2	2	2	2	2
6. RTD-Investments as a percentage of GDP	1	2	2	1	2	1
7. Economic Policy (De-/regulation)	1	2	1	1	1	1
8. Patent Applications (Innovation)	1	2	2	1	1	1
9. Number of jobs in RTD (public and private)	1	2	2	1	1	1
10. Public infrastructure	1	2	1	1	1	1
11. Availability of 'venture capital'	1	2	2	1	2	1
12. Income distribution (Gini coefficient)	2	2	1	2	2	2
13. Environmental pollution (water and air)	1	2	1	1	1	2

Global scenarios (Europe)	**Zurich (CH)**					
1. Migration of tertiary educated people	1	1	1	1	1	1
2. Population structure	2	1	1	1	1	1
3. Education opportunities	1	1	1	1	2	2
4. Regional GDP at PPP per capita	1	2	1	1	1	1
5. Diversified structure of economic activities	2	2	2	2	2	2
6. RTD-Investments as a percentage of GDP	1	1	1	1	1	1
7. Economic Policy (De-/regulation)	2	2	1	1	1	1
8. Patent Applications (Innovation)	1	1	1	1	1	1
9. Number of jobs in RTD (public and private)	1	2	1	1	1	1
10. Public infrastructure	2	2	2	1	1	1
11. Availability of 'venture capital'	2	1	2	1	1	1
12. Income distribution (Gini coefficient)	2	2	2	2	2	2
13. Environmental pollution (water and air)	2	2	1	1	1	2

Most plausible scenario
Most desirable scenario

Final feedback of the Scenario Workshop

WÖ: „Attraktor Lebensqualität“ und „wissensbasierte High-Tech CH“ Szenarien trotz unterschiedlichem Hintergrund den Erwartungen entsprechend praktisch gleich (Wunschszenario).

Evtl. Trend vergleichen mit Zustand

Zum Tag: zunächst sehr ambitioniert

Im Verlauf des Tages: positivere Zukunftsgestaltung, Gegenwart in den Hintergrund (Arbeit am KOF, wo man wagt nur 2 Jahre zu prognostizieren) hat Fantasie angeregt

KN: Irritation, dass Ergebnis so uniform, auch unterschiedliche Gruppen (evtl. Beeinflussung durch Medienpräsenz)

Wird Aktionsplan auf Wunschszenario entwickelt

Als Raumplaner wenig Probleme Visionen zu entwickeln

Hintergrund: ähnliche Bildung

HA: Fortschreibung mit Trend kommt etwas schlecht weg -> so kann es nicht weiter gehen

„Planung ist nichts anderes als Zufall durch Irrtum“

Einigkeit irritierend, aber auch erfreulich

Grund: man weiss, aber setzt nicht um

Allgemein: Schwierig Auswahl Variablen, starke Einengung, Tendenz zum Ausschweifen -> hier ist sicher Standardisierung der Übungsanlage wichtig, aber es beeinflusst auch Ergebnis

Aber interessant als Gegenpol, daher nicht so viel Kritik an Untersuchungsanlage

HAS: Trade-off zwischen „Freiem Visionieren“ und „Einbettung in Raster“

Optimum zwischen Lebensqualität und Wirtschaftsentwicklung

Vision ist Wagen auf dem Weg

HE: Lebensqualität aus gesellschaftlicher Sicht, HighTech wirtschaftlich

Kritik an Übungsanlage: kein Null

Verschmelzen:

HighTech + Lebensqualität

Trend 2 + Stillstand

-> Reformbewertung zeigt, dass Reformierung seitens Staat nicht Mittel ist

TA: Szenarien, die ausgewählt wurden könnten auch aus dem economiesuisse-Bericht sein: alle wissen, dass wir dorthin wollen, aber wie?

- was braucht es für ein Setting
- hat Probleme damit, dass jetzt daraus Empfehlungen für die EU abgeleitet werden
- was für Störfaktoren müsste man sich denken

- Probleme mit den definitorischen Unschärfen
- Hat die Methode wirklich ermöglicht, alle Szenarien die denkbar sind zu finden
- Was sind Treiber, was sind Hemmer, das hätte stärker herausgearbeitet werden müssen, für die Ableitung müsste das geklärt werden

Crb: nächste Schritte, Treiber und Hemmer allenfalls nochmals mit Expertengruppe zurückgeben: andere überzeugen; was sind Treiber, was sind Hemmnisse für diese Szenarien?

A key objective of REFORM is to develop European regional foresight scenarios, based on the use of benchmarking, trend analysis and the results of the individual study visits and knowledge exchanges during the project.

A 3: Development and Assessment of European and Regional Foresight Scenarios

Objectives

- 3 plausible scenarios for the RTD and innovation development of 6 European regions to 2020.
- 3 plausible global scenarios for RTD and innovation development to 2020.
    a. To recognise future trends and drivers in RTD and innovation development
    b. To inform RTD and innovation policy-making
    c. To identify key impact variables relating to the economic development of regions

System boundaries

- spatial (regional): e.g. Canton of Zurich
- spatial (global): Europe
- time: 2020

Target groups

- key actors in RTD policy and investment
- SMEs in key regional sectors/clusters
- scientific community

The Impact Variables selected per Sub-system are: (→ **bold** = target impact variables)
Population - Migration of well educated (tertiary level) people - Population structure (e.g. ages: < 15, 15-64, > 64)
Education - Education opportunities - (Cross-cultural and language competencies)
Economy - **Regional GDP per capita (at purchasing power parity)** - Diversified structure of economic activities
Governance - **RTD investments as a percentage of GDP** - De- / regulation (economic policy)
Research & Innovation - **Number of patent applications per capita** - Number of jobs in RTD (public and private)
Infrastructure - Public Infrastructure - Availability of venture capital
Quality of Life - Income distribution (Gini coefficient) - Environmental pollution (water and air)

These impact variables should be considered in the SWOT analysis.

A 4: Development and Assessment of European and Regional Foresight Scenarios – Subsystems defined

Globalization is the process by which the world has become more inter-dependent and interconnected. It involves the increasing volume of trade, the growing complexity of trading relationships, the increasing movement of people, goods, and capital around the world, and the growth in digital communications, which enables people to know in seconds about events on the other side of the planet (WBCSD, 2006).

Population

In sociology and biology, a population is the collection of people, or organisms of a particular species, living in a given geographic area.

Today the world has around 6.5 billion people. By 2020 it is expected to have more than 7.5 billion, of whom nearly 90% are forecast to live in developing countries. There will be a shift in the distribution of populations. While populations grow in developing countries, they will age in the developed world. In several countries, including Japan, Italy, and Singapore, the median age will rise to over 50 by 2050. An ageing population means that many large companies face escalating costs resulting from their commitments to provide health care for retirees (WBCSD, 2006).

Population aging occurs when the fertility rate declines. This means that, for a period of time, the ratio of old to young will be higher than average. It also occurs due to increasing life expectancy and / or migration. Japan and Western Europe are the two regions which are most confronted by severe population aging in the near future.

Education

The goal of education is the transference of ideas and skills from one to one, one to many, many to many and many to one with the possible high transfer rate and volume of knowledge under the possible shortest time duration at any place and circumstance. Current education issues include which teaching method(s) are most effective, how to determine what knowledge should be taught, which knowledge is most relevant, and how well the pupil will retain incoming knowledge.

Education is development. It creates choices and opportunities for people, reduces the twin burdens of poverty and diseases, and gives a stronger voice in society. For nations it creates a dynamic workforce and well-informed citizens able to compete and cooperate globally – opening doors to economic and social prosperity.

Key issues are not only a comprehensive, standards based curriculum, but a new approach of bringing the teacher, the student, and learning together. Combining the best of traditional educational methods with technology culminating in a complete educational opportunity for all students anytime and anywhere could be the future.

Economy

Economy covers the activities related to the production, distribution, and consumption of goods and services in a particular geographic region.

Economic indicators are among the most closely watched pieces of news in the investment world. Practically every week there is some announcement that affects investors' predictions about the future of the economy. Leading indicators are those which are believed to change in advance of changes in the economy, giving you a preview of what is going to happen before the change actually occurs.

The most important indicator is the GDP report. Basically, the GDP is the widest measure of the state of the economy. The GDP is the aggregated monetary value of all the goods and services produced by the entire economy during the quarter (with the exception of international activity).

Governance

Public sector governance refers to the way the state acquires and exercises the authority to provide and manage public goods and services – including both public capacities and public accountabilities (The World Bank, 2006).

However, we can distinguish governance, as modes of social coordination, from governing, which can be understood to centre on purposeful efforts to steer, guide, control and manage (sectors or facets of) society. Governance is understood to mean how one gets to such acts, through what types of interactions (deliberation, negotiation, self-regulation or authoritative choice) and the extent to which actors adhere to collective decisions. It involves the level and scope of political allocation, the dominant orientation of state, and other institutions and their interactions. Governance structures (institutions) organize negotiation processes, determine objectives, influence motivations, set standards, perform allocative functions, monitor compliance, impose penalties, initiate and/or reduce conflict, and resolve disputes among actors

Research & Innovation

Research is an active, diligent, and systematic process of inquiry aimed at discovering, interpreting and revising facts. This intellectual investigation produces a greater understanding of events, behaviors, or theories, and makes practical applications through laws and theories. The term *research* is also used to describe a collection of information about a particular subject, and is usually associated with science and the scientific method.

Basic research (also called *fundamental* or *pure* research) has as its primary objective the advancement of knowledge and the theoretical understanding of the relations among variables. It is *exploratory* and often driven by the researcher's curiosity, interest, or hunch. It is conducted without any practical end in mind, although it may have unexpected results pointing to practical applications. The terms "basic" or "fundamental" indicate that, through theory generation, basic research provides the foundation for further, sometimes applied research. Applied research is done to solve specific, practi-

cal questions; its primary aim is not to gain knowledge for its own sake. It is almost always done on the basis of basic research.

Innovation is defined as *the process of making changes to something established by introducing something new*. The term Innovation refers to both radical or incremental changes to products, processes or services.

Although 50% of Europeans declare they are not interested in Science & Technology, 70% believe it makes life better. By 2010 the EU plans to increase RTD expenditures to 3% of GDP and attract an additional 700,000 researches. The new member states represent a huge human potential, but more cohesion, funding, and citizens' interest in RTD are needed. Europe needs to concentrate on innovation and developing a solid partnership between private, government, and academic sectors in order to keep its dimension of competitively (ACUNU, 2005).

Infrastructure

Services and facilities that support day to day economic activity. Infrastructure includes roads, electricity, telephone service, and public transportation. Infrastructure has traditionally been provided and maintained by the government. However, some nations are currently experimenting with privatization of some elements of the infrastructure as governments seek to cut their expenditures.

Infrastructure, most generally, is the set of interconnected structural elements that provide the framework for supporting the entire structure. It usually applies only to structures that are artificial. The term is used differently in a variety of fields; perhaps the single most well-known usage is in economics, where it refers to physical infrastructure such as buildings and roads.

The notion that a structure has an *internal framework* is popular especially in business organizations where a dependency on interconnected information technology systems has become as prevalent as a city's dependency on interconnected conveyance systems for power, people and things.

Quality of Life

The well-being or quality of life of a population is an important concern in economics and political science. There are many components to well-being. A large part is standard of living, the amount of money and access to goods and services that a person has; these numbers are fairly easily measured. Others like freedom, happiness, art, environmental health, and innovation are far harder to measure. This has created an inevitable imbalance as programs and policies are created to fit the easily available economic numbers while ignoring the other measures, that are very difficult to plan for or assess.

Human activity over the past 50 years has changed the world's environment more extensively than ever before, largely to meet growing demands for food, fuel, fresh water, timer, and fiber. The use of natural resources has advanced human development, but at a growing environmental cost (WBCSD, 2006). Especially in economically intensive used regions the quality of life is affected.

References

ACUNU (2005) by J. C. Glenn and T. J. Gordon: “State of the Future 2005”. American Council for The United Nations University, Washington.

The World Bank (2006): “Global Monitoring Report 2006”. Washington DC.

WBCSD (2006): “From Challenge to Opportunity. The role of business in tomorrow’s society”. A paper from the Tomorrow’s Leaders group of the World Business Council for Sustainable Development, Geneva.

A 5: Development and Assessment of European and Regional Foresight Scenarios

Impact Variables and their Parameter Values for 2020 to be selected:

1. Migration of tertiary educated people

Definition:

Migration of skilled S&E workers across borders is increasingly seen as a major determinant of the quality and flexibility of the labor force in most industrial countries. The knowledge of scientists and engineers can be transferred across national borders more easily than many other skills. Additionally, cutting-edge research and technology inevitably create unique sets of skills and knowledge that can be transferred through the physical movement of people.

The share of tertiary educated immigrants is observed.

Parameter values 2020:

1. **High share of tertiary educated people among immigrants**: The share of tertiary educated people among immigrants (which immigrated during the last 5 years) is higher than 60%.
2. **Low share of tertiary educated people among immigrants:** The share of tertiary educated people among immigrants (which immigrated during the last 5 years) is lower than 40%.

2. Population structure

Definition:

Population structure of the region is summarized by the dependency ratio. The dependency ratio is the ratio of the economically dependent part of the population, to the productive part. The economically dependent part is recognised to be children who are too young to work, and individuals that are too old, that is, generally, individuals under the age of 15 and over the age of 65. The productive part makes up the gap in between (ages 15 - 64).

$$dep\_ratio = \frac{N_{0..14y} + N_{65y+}}{N_{15..64y}}$$

Parameter values 2020:

1. **The productive share of the population decreases:** The dependency ratio increases over the value of 0.6.
2. **The productive share of the population increases:** The dependency ratio decreases below the value of 0.4.

3. Education opportunities

Definition:

Student performance differences in reading literacy (as compared in the PISA study) by socio-economic background, migration background and gender.

Parameter values 2020:

1. **Equal opportunities in education:** The difference in reading literacy between the top and bottom quarter of index of socio-economic status in the PISA study is below a value of 50. The difference between female and male students is below a value of 15.
2. **Unequal opportunities in education:** The difference in reading literacy between the top and bottom quarter of index of socio-economic status in the PISA study is above a value of 130. The difference between female students and male students is above a value of 50.

4. Regional GDP at PPP per capita

Definition:

Size of a region's economy measured as Gross Domestic Product (GDP) at purchasing power parity (PPP) per capita: GDP is the market value of all final goods and services produced within a country during a given period of time (Johnston and Williamson 2006).
Purchasing power parity (PPP) weights are conversion factors that eliminate the difference in price levels between countries (The Economist Intelligence Unit 2006: 8).

We use the Real GDP, which is the dollar value of production using a given base year prices. For example, real GDP in 1990, $7,112 billion in year 2000 dollars, is calculated using 2000 prices for goods and services (Johnston and Williamson 2006).

Parameter values 2020:

1. **Strong economic growth:** The average annual growth 2006-2020 (GDP at PPP per capita) increases compared to the last 14 years (1991-2004).
2. **Stagnation or shrinking of economic growth:** The average annual growth 2006-2020 (GDP at PPP per capita) decreases compared to the last 14 years (1991-2004).

5. Diversified structure of economic activities

Definition:

Quota of value added at current prices in a region and during a given period of time, split up according to the economic activities (UNSD 2006, Source OECD 2006).

Parameter values 2020:

1. **Mono structure or unilateral structure of economic activities:** One economic activity has a quota ≥ 40% of the regional value added.
2. **Diversified structure of economic activities:** The biggest economic activity has a quota ≤ 20% of the regional value added.

6. RTD-Investments as a percentage of GDP

Definition:

Gross domestic expenditure on R&D (GERD) as a percentage of GDP.

Total expenditure on R&D (GERD) is composed of: Business enterprise expenditure in R&D (BERD), Higher Education expenditure in R&D (HERD), Government expenditure in R&D (GOVERD) and Private Non-profit expenditure in R&D (PNRD) (Eurostat Metadata).

Parameter values 2020:

1. **Increase of RTD-Investments:** The share of the RTD-Investments of the GDP will increase until 2020 over 3%.
2. **Decrease of RTD-Investments:** The share of the RTD-Investments of the GDP will decrease until 2020.

7. De- / regulation (Economic Policy)

Definition:

The system's overriding purpose is to help trade flow as freely as possible – so long as there are no undesirable side-effects. That partly means removing obstacles. It also means ensuring that individuals, companies and governments know what the trade rules are around the world, and giving them the confidence that there will be no sudden changes of policy. In other words, the rules have to be "transparent" and predictable. (WTO 2006a)

A Set of WTO-rules: At its heart are the WTO agreements, negotiated and signed by the bulk of the world's trading nations. These documents provide the legal ground-rules for international commerce. They are essentially contracts, binding governments to keep their trade policies within agreed limits. Although negotiated and signed by governments, the goal is to help producers of goods and services, exporters, and importers conduct their business, while allowing governments to meet social and environmental objectives.

Parameter values 2020:

1. **Liberalised economy, low taxes:** In a liberalised economy all important economic issues are carried out by private and the taxes are relatively low.
2. **Regulated economy, high taxes:** In a regulated economy an increasing number of services is carried out by public and the taxes are relatively high.

8. Patent Applications

Definition:

Number of patent applications to the European Patent Office (EPO) per million inhabitants.

Parameter values 2020:

1. **Increase of patent applications:** The number of patent applications to the EPO per year and per million inhabitants is at least 50 above the value in 2006.
2. **Decrease of patent applications:** The number of patent applications to the EPO per year and per million inhabitants is below the value in 2006.

9. Number of jobs in RTD (public and private)

Definition:

Share of research and development personnel (% of the labor force)

Parameter values 2020:

1. **Increase of jobs in RTD:** The number of jobs in RTD increases by at least 40% compared to the year 2006; (whereas a minimum of 50% of all RTD workplaces can be found in the private sector).
2. **Decrease of jobs in RTD:** The number of jobs in RTD decreases compared to the year 2006.

10. Public infrastructure

Definition:

The public infrastructure consists of all basic facilities, services, and installations needed for the functioning of the regional community such as transportation and communications systems, water and power lines, public institutions (including R&D), and post offices.

Parameter values 2020:

1. **Modern and efficient public infrastructure:** Efficient intra- and inter-regional transport options are available. The supply of drinking water and electricity is guaranteed at all times. Public RTD-institutions and libraries are abundant. Modern communication infrastructure (broadband) are available for everybody.
2. **Underdeveloped public infrastructure:** Inter- and intra-regional transport options are inadequate and out-of-date. Problems in the supply of drinking water and electricity are frequent. The supply of RTD-institutions and libraries is limited. Modern facilities of communication are available after long delays.

11. Availability of venture capital

Definition:

Venture capital is defined as shares in young SMEs in a state of development of great risks but high potential. The term ‚private equity' is closely connected venture capital. Private equity is a generic term for the equity capital of privately owned, unlisted companies. The terms venture capital and private equity are used in different ways in literature. Private equity can be distinguished as follows:

Seed, Start-Up, Expansion, Replacement Capital, Buyouts.

Wherever possible, the anglo-saxon definition of ‚venture capital' has to be applied here. It only encompasses investments in 'seed' and 'start-up' companies.

Parameter values 2020:

1. **Access to venture capital quickly and unbureaucratically:** Young entrepreneurs and SME's have access to venture capital quickly and unbureaucratically.
2. **Access to venture capital difficult:** There is a very limited willingness to provide venture capital. There are substantial obstacles to access it.

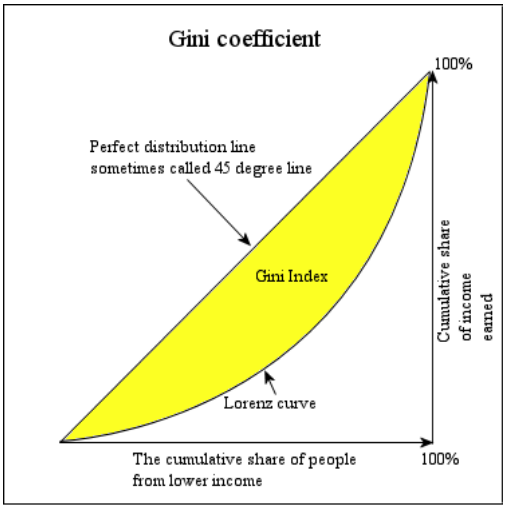
12. Income distribution (Gini coefficient)

Definition:

The Gini coefficient is a measure of inequality (often for measuring income inequality). It is a number between 0 and 1, where 0 corresponds to perfect equality (e.g. everyone has the same income) and 1 corresponds to perfect inequality (e.g. one person has all the income, and everyone else has zero income).

The Gini coefficient may be derived from the Lorenz curve (see Fig. 1), which plots cumulative shares of the population, from the poorest upwards, against the cumulative share of incomes that they receive (UNDP 2004). If incomes were equally distributed, the plot would trace a diagonal 45°-line ("line of perfect equality"). At the other extreme – if the richest unit received all income – the Lorenz curve would lie along the horizontal axis, and then along the vertical axis at the 100 per cent income share ("line of perfect inequality"). The Gini coefficient is defined as the area between the Lorenz curve and the 45°-line, taken as a ratio of the whole triangle.

Fig. 1: Graphical representation of the Gini coefficient



Parameter values 2020:

1. **Equal income distribution:** Compared to today, the inequalities in income are re-

duced. The Gini-coefficient is less than 0.25.

2. **Unequal income distribution:** Compared to today, the inequalities in income are increased. The Gini-coefficient is higher than 0.4.

13. Environmental pollution (water and air)

Definition:

Air and water quality in the Region: Access to clean drinking water and compliance with threshold (air and water).

Parameter values 2020:

1. **Clean drinking water and good air quality:** The whole population has access to clean drinking water in sufficient quantity. The air quality is adequate. Threshold values are exceeded only in exceptional situations and for short periods.
2. **Degradation of drinking water and air quality:** Clean drinking water is scarce and expensive. Air quality is inadequate to the extent that health problems might occur. Threshold values are exceeded on a regular basis and during long periods.

A 6: REFORM Canton of Zurich, Switzerland

Taking the Zurich regional RTD strategy forward towards the scenario “Attractor Quality of Life”

THE ACTION PLAN

Action	Sub-system	Coordinator	Timescale	Funding
Promotion of start-up companies*	Economy		ongoing	Public Private Partnerships, PPP
Setting up firms, attracting investors*	Economy	Location promotion, private initiatives	ongoing	PPP
Improve national Location Promotion*	Economy	seco		Government
Securing the succession (e.g. in family owned companies) by improving information*	Economy	Universities, economic associations		PPP
Promotion of an entrepreneurial culture among young people [4]	Economy	Education system		
Promotion of innovative start-ups [4]	Economy	Universities, economic associations		
Search for excellence in education*	Education			
Endeavour to reduce time spent studying*	Education	Universities		
Diversification of research instititutes*	Education	Universities, Universities of Applied Sciences		Universities Councils
Guide students to the best universities by means of quality criteria	Education	Universities, Universities of Applied Scienc-		

[1]		es		
Inform students about developments in the employment market by means of requirement estimates (short and mid term) [1]	Education	Universities, economic associations		Government
Promote technical and natural sciences to attract more students	Education	Universities, Universities of Applied Sciences	asap	Universities, economic associations
Furhter reinforce vocational curricula and expand lifelong learning [3]	Education	Universities, Universities of Applied Sciences	ongoing	
Pursue the reform of the whole university system [3]	Education	Universities, Universities of Applied Sciences	ongoing	
Increase women's interest in sciences and engineering from an early age [3]	Education	Education system	ongoing	
Encourage universities to be more dynamic to promote greater independence and more efficient management*	Governance	Federal and cantonal authorities		
Reduce administrative burdens and workload for companies (eg. by improved e-Government)*	Governance	Economic associations, federal and cantonal authorities	4 years	Administration
Reform of universities of applied sciences. Competitive attribution of research grants*	Governance	Federal and cantonal authorities	2011	Government
Encourage companies and research institutes to set up (by increasing R&D investments)*	Governance	Location promotion	ongoing	

Marketing of “Knowledge Location” Switzerland*	Governance	Location Switzerland	4 years	PPP
Making donations tax deductible*	Governance	Federal and cantonal authorities	asap	
Pre-Venture-Funds: finance the “proof of concept studies” (feasibility studies and prototype developments)*	Infrastructure	Canton ZH	4 years	
Improve the institutional and legal framework for venture capital [3]	Infrastructure	Administration		
Continuously improvement of good infrastructure for knowledge location	Infrastructure	Administration		
Maintain attractive quality of life	Quality of Life	Administration	ongoing	
Enhance social balance and support social education	Quality of Life	Administration	ongoing	
Free exchange of specialists with countries that are important trading partners*	Population	Federal authorities, Chambers of Commerce	circa 10 years	
Develop strategies for further education*	Population	PPP	circa 5 years	Private, unemployment insurance fund
Integration of immigrants (not by force)*	Population			
Improved fringe benefit packets for top people*	Population			
Improved integration of the population in production processes*	Population	Private companies	ongoing	
Support for universities and universities of applied sciences in the process of commercialis-	Research & Innovation	Universities, Universities of applied sciences		Funds for licences

ing their patents*				
SNF (Swiss National Science Foundation) and KTI (Innovation Promotion Agency) receive more funding and earmark these funds according to competitive criteria [1]	Research & Innovation	SNF, KTI		Swiss government
Stronger co-operation between SNF and KTI [1, 4]	Research & Innovation	SNF, KTI		
Stronger result orientation and collaboration with the private sector economy [1]	Research & Innovation	Universities, Universities of applied sciences		
Enhancing the competitive capacity of research and innovation by a clear increase in funding destined to promote competition that favour federal research and innovation strategies [2]	Research & Innovation	Funding agencies		
Give public funding for research a high priority [3]	Research & Innovation	Funding agencies	ongoing	Government
Intensify co-operation in international research [3, 4]	Research & Innovation	Universities, Universities of Applied Sciences	ongoing	
Increase private funding of university research [3]	Research & Innovation	Private companies		PPP
Stimulate applied research by increasing the KTI resources [3]	Research & Innovation	KTI		Government
Improve the interface between universities and private companies in order to enhance the commercial use of promising research results [4]	Research & Innovation	Universities, Universities of Applied Sciences, private companies		

Promotion of co-operation between science and business	Research & Innovation	Universities, private companies		

* based on interviews held with Dr. Stephan Kux, Location Promotion Zurich, and with Dr. Sebastian Brändli, Academia Department of the Canton of Zurich.

[1] Credit Suisse Economic Research (2006)

[2] The Federal Council Dispatch on Education, Research and Innovation (2007)

[3] OECD (2006)

[4] Arvanitis & Woerter (2007)

A 7: Zurich Scenario "Attractor Quality of Life"

Target variables: regional GDP (PPP) per capita, R&D investments as share of GDP, number of patent applications

Throughout the scenario „attractor quality of life“, the economy will continue to grow intensely, both investments in R&D as well as patent applications will increase.

Subsystem Population

Because of the qualitatively adequate offers both in the system of (further) education (Universities/Federal Institute of Technology) as well as in the job market (e.g. private research centres) a high number of highly qualified people are moving to and settling in the Canton of Zurich. More than 60% of the immigrants that are expected in Switzerland between 2015 and 2020 in this scenario will have a tertiary education.

The effect of the aging of the general population can be softened/diminished by this immigration trend. As mainly people in the ‘productive stage of life’ are immigrating to the canton of Zurich, the ratio between productive and non-productive share of the population does not change significantly. The dependency ratio shrinks to a value of below 0.4.

Subsystem Education

Independent of gender, origin or socio-economic status, the opportunities for education are more or less equal for all members of the population. This can be measured in the level of literacy which serves as an indicator for all abilities belonging to the basic education in our context.

Subsystem Economy

Regional GDP (PPP) per capita is expected to grow at a higher rate in the years from 2006 to 2020 than in the preceding years. The economy is booming and no recession is on the radar. This growth is achieved mainly due to the excellent productivity and the high quality of the products and services.

The economy is highly diversified. Therefore, no cluster-risks are to be assessed in the region. There is no single sector of the economy that contributes more than 20% of the regional ‘added-value’. A formation of clusters in order to build up synergies between companies is possible due to the size of the canton of Zurich.

Subsystem Governance

As the economy is booming, it is possible to increase investments in research and development. This applies both in the human resources sector as well as in the infrastructural sector of research. Qualified people and adequate infrastructure are available in a sufficient amount.

In a liberal economic context, the most important economic activities are provided by the private sector. Therefore, public administration can be reduced to a minimum which

also means that taxes can be reduced further. There are hardly any monopolys, oligopolys or cartels left. The free market economy (the invisible hand) makes sure, that prices of products and services are at an optimal level.

Subsystem Research & Innovation

High quality in R&D produces an abundance of innovative ideas that enable a high amount of patent applications. These patent applications come from both the private and the public research institutions.

Increasing R&D-investments are preceding a growth of jobs in the R&D-sector. Again, both the private and the public research institutions are contributing to this trend. The research institutions in the Canton of Zurich have a worldwide reputation and are thus able to increase their services. Compared to 2006, in the year 2020 the number of jobs in research will grow by a minimum of 40% of which at least 50% will be supplied by private companies.

Subsystem Infrastructure

The public infrastructure does not suffer from the liberal economic system. Public transport is qualitatively and quantitatively well developed. Supply of electricity and water is guaranteed. Modern communication infrastructure is available at short notice. The offers of the public administration (incl. R&D-Institutions) are of good quality. The public life is flowing smoothly.

Venture capital for innovative companies is available immediately and unbureaucratically. Therefore, a high number of patent applications can be implemented as innovative products. Spin-off companies from the universities are an ideal connector of research and economy.

Subsystem Quality of Life

It has to be taken into account, that even in a flourishing economy not everybody can be a ‘winner’. As an example, income distribution is very uneven. The Gini-coefficient has a value that is higher than 0.4. A minority of people with a top-income are pushing the average wages to a high value. This, however, cannot cover up the fact that there is a substantial share of people who belong to the ‘working poor’ and they hardly dispose of the power to change their own status.

The entirety of the population has access to drinking water in sufficient amount and the quality of the air is satisfactory. Threshold values are exceeded on rare occasions and then for just a short time. Despite the fact that environmental pollution is basically neglectable, investments in environmental protection continue to be substantial. Renewable energy sources and efficient use of energy are subsidised.

Contributions to Sustainable Development

Publication series of the ZHAW Institute of Sustainable Development. The volumes can be ordered or downloaded at:

ZHAW Zurich University of Applied Sciences
Institute of Sustainable Development INE
P.O. Box
CH-8401 Winterthur
Phone ++41 (0)58 934 77 41, info.ine@zhaw.ch, www.ine.zhaw.ch

Published until now:

No 1 free download (pdf)	Furrer, B., Weiss Sampietro, T., Seidler A. (2006): **Swiss CSR Monitor 2006 - Die gesellschaftliche Verantwortung von Unternehmen in der Wahrnehmung der Schweizer Bevölkerung:** Mit einem Schwerpunkt zu Banken und Pensionskassen. Contributions to Sustainable Development 1/2006. Winterthur: Zurich University of Applied Sciences. ISBN 3-905745-03-8/978-3-905745-03-0
No 2 free download (pdf)	Teuscher, P., Stäheli, M., Furrer, B. (2006): **Bestimmung relevanter sozialer Themen, Diskussionspapier zum Sozialmanagement.** Contributions to Sustainable Development 2/2006. Winterthur: Zurich University of Applied Sciences. ISBN 978-3-905745-05-4
No 3 free download (pdf)	Dubielzig, F. (2006): **Management sozialer Informationen, Diskussionspapier zum Sozialmanagement.** Contributions to Sustainable Development 3/2006. Winterthur: Zurich University of Applied Sciences. ISBN 978-3-905745-06-1.
No 4 free download (pdf)	Winistörfer, H., Hohl, U., Stiller, S. (2006): **Kommunikation sozialer Leistung, Diskussionspapier zum Sozialmanagement.** Contributions to Sustainable Development 4/2006. Winterthur: Zurich University of Applied Sciences. ISBN 978-3-905745-07-8
No 5 Color printing, bound: CHF 38.-	Winistörfer, H., Teuscher P., Dubielzig F. (2006): **Sozialmanagement im Unternehmen - Ausgewählte Instrumente für die Praxis.** Contributions to Sustainable Development 5/2006. Winterthur: Zurich University of Applied Sciences. ISBN 3-905745-05-4/978-3-905745-05-4
No 6 free download (pdf)	Hongler, H., Kunz, M., Prelicz-Huber, K., Wolff, R., Fricker, J. (2007): **Partizipative Stadtteilentwicklung Winterthur-Töss, Evaluationsbericht zur Startphase.** Contributions to Sustainable Development 6/2006. Winterthur: Zurich University of Applied Sciences. ISBN 978-3-905745-10-8