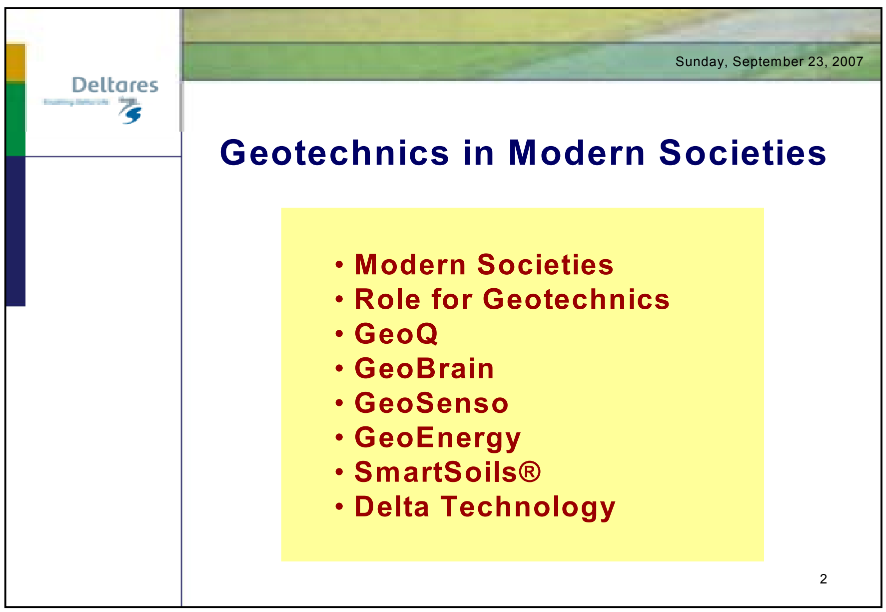
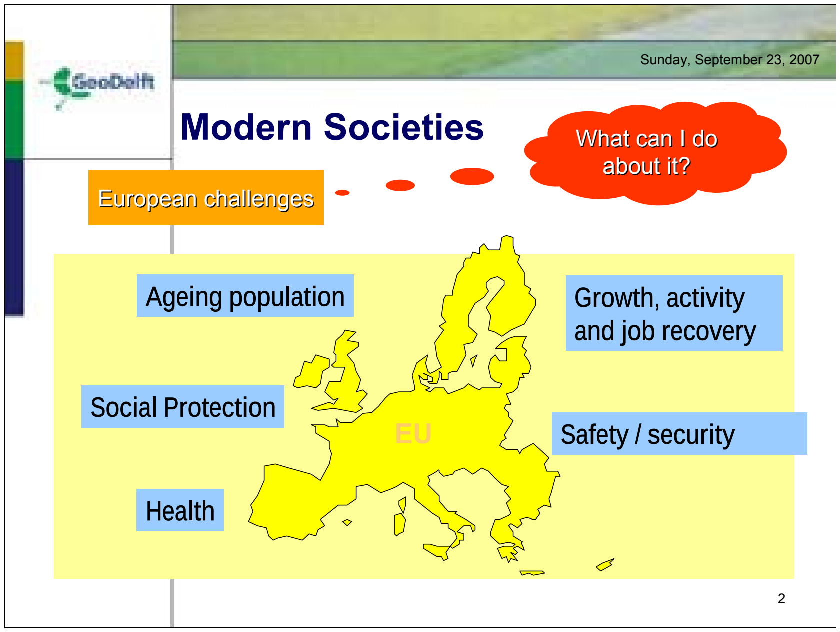
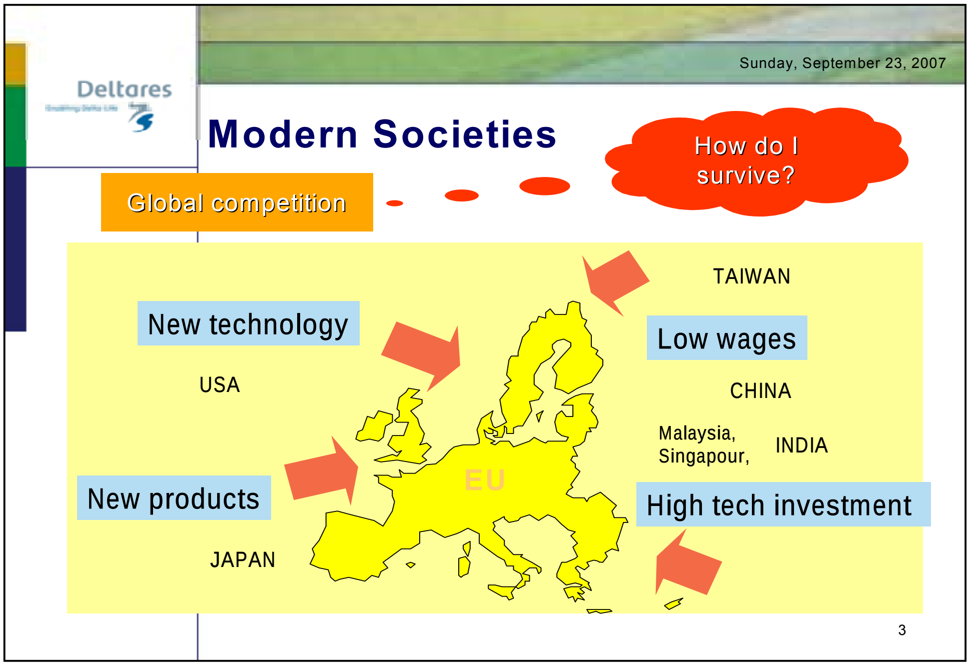


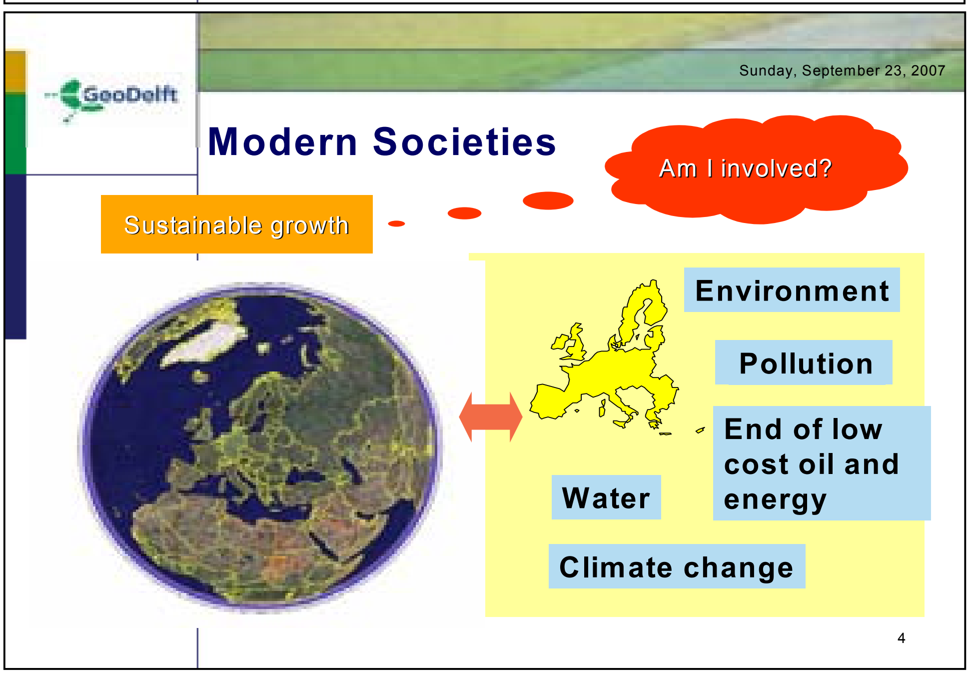
In the spirit of Prof Krebs Ovesen, let us follow his kind and insisting inspiration for a firm and valuable rooting of the geotechnical profession in the present-day society, by establishing a harmonized international design environment in which challenges of today and the future are dealt with in an efficient and creative way. Krebs Ovesen's effort for the Eurocode 7 are notorious in this respect. The present lecture is therefore devoted to the role of geotechnics in modern societies. First, what characterizes modern societies and what differs them from the recent past?, and second, what are some of the prominent challenges and what may be the future of our discipline?



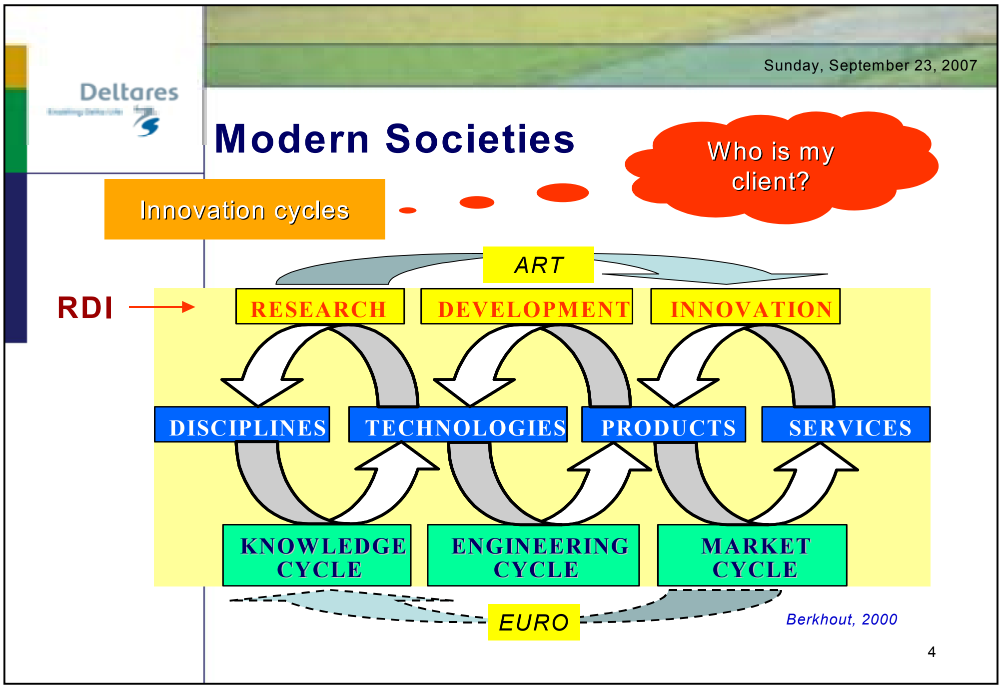
At the eve of the XXIst century, the European Society is facing an overwhelming number of challenges: demography changes, climate change, globalisation, and the gloomy perspectives of declining natural resources such as drinking water, oil. And yet, Society is still expecting better living conditions from its built environment: accessible and comfortable for all, durably enjoyable, flexible to changing demands, available and affordable. We could think of … More human sciences developing customer focus and human-oriented innovative processes. Information technologies at all levels and advanced design based on modeling and simulation, advanced embedded electronics; advanced monitoring techniques and wireless intelligent sensors; integrated demand and asset management. Nano- and bio-technologies for new multifunctional materials. Communication technologies at all levels streamlining the flow of information and irrigating knowledge. Services offered by satellites for positioning and monitoring works. Great challenges!

The global aspects of the European Policy :
- The Lisbon strategic goal (2000) to become by 2010 “the most competitive and dynamic knowledge-based economy in the world”;
- The Barcelona goal (2002) of raising Europe’s overall level of research investment from its current level of 1.95 % of GDP to 3 % by 2010, of which two-thirds should be from private sources,
represent a big challange to the engineering sector, in charge of creating, constructing and maintaining a proper living and working environment with ample place for leasure, growth and nature, in a globalizing world where sharing and competing crosses all borders. Furthermore, social demands must be placed in the perspective of the enlargement of the European Union and development of the single market. Taking into account the continual evolution of the European regulatory framework is an important consideration for any research actions undertaken, in order to anticipate the application of the directives in the context of the sector’s activities, to prepare new products and processes which are called for.



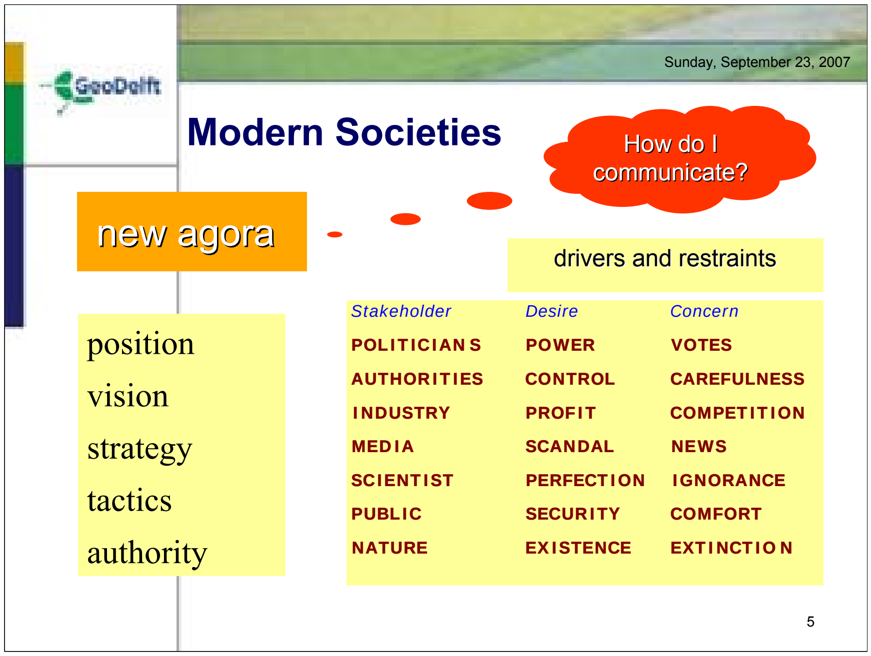


At the eve of the XXIst century, the European Society is facing an overwhelming number of challenges: demography changes, climate change, globalisation, and the gloomy perspectives of declining natural resources such as drinking water, oil. And yet, Society is still expecting better living conditions from its built environment: accessible and comfortable for all, durably enjoyable, flexible to changing demands, available and affordable.



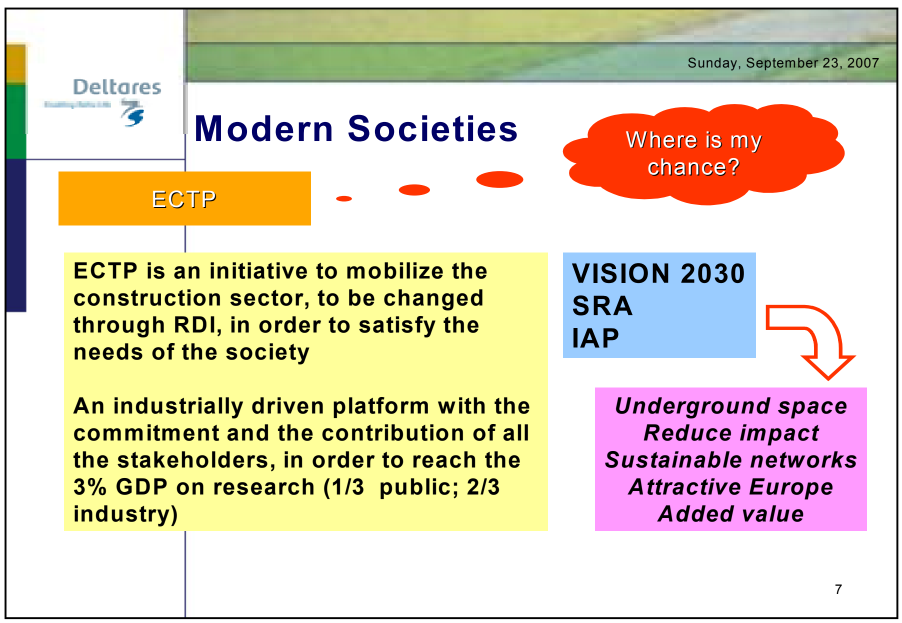
Innovation cycles exist in many forms. Here, three of them are shown: knowledge cycle, engineering cycle and market cycle in connection with the subsequent process of performing research, further development for application and finally the innovation itself, i.e. used in practice. Related output are: disciplines, technologies, products and services. It is worthwhile to notice how money flows in this system. From left to right the knowledge (art) flows to social benefit. In the first cycle money is invested and converted into knowledge, usually money from taxes. In the engineering cycle investments are made, either public or private money. In this cycle there should be some clear view on return of investment. In the market cycle the art is converted into money, usually for shareholders. It would be a much better society if the financial loop is closed, as shown in the slide, which unfortunately is not. The return of investment of money invested in the first cycle is very high in the last cycle, in the order of 20 to 40.

Society counts a variety of species, each with its own desire and concern, or motive and fear. Politicians are not interested in money or cost reduction. At present multi-nationals and politicians seem to be dominant. In the near future a response is expected of a new multi-national society. Authorities become nervous from being accused of negligence and carelessness. Industry is in principle not transparent, and for them profit is the drive. It is not easy to convince them that to some extent sharing knowledge is more profitable than hiding it. A strong role is, and probably will continue to be, played by the media. Damage, failure and corruption are magnified in mass media, as a public trial, producing a negative image. Media are however also the perfect carrier of positive achievement and messages, particularly when they inspire emotion. Scientists complain that economic and political forces are undermining integrity. People require security and comfort in a society where risks are increasing because of its dependency on technology. And technology has to provide the answers. There is no way back.

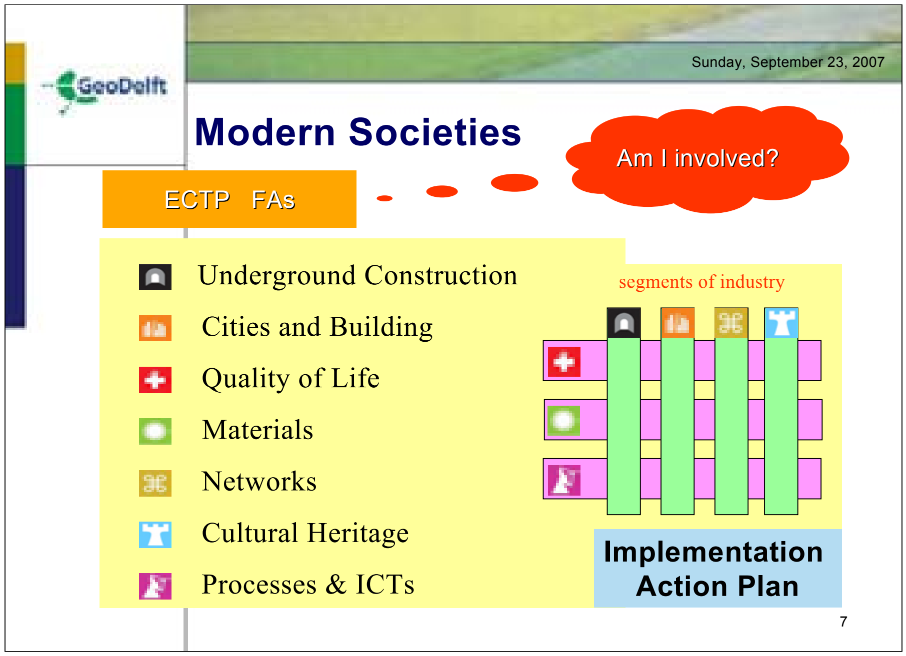


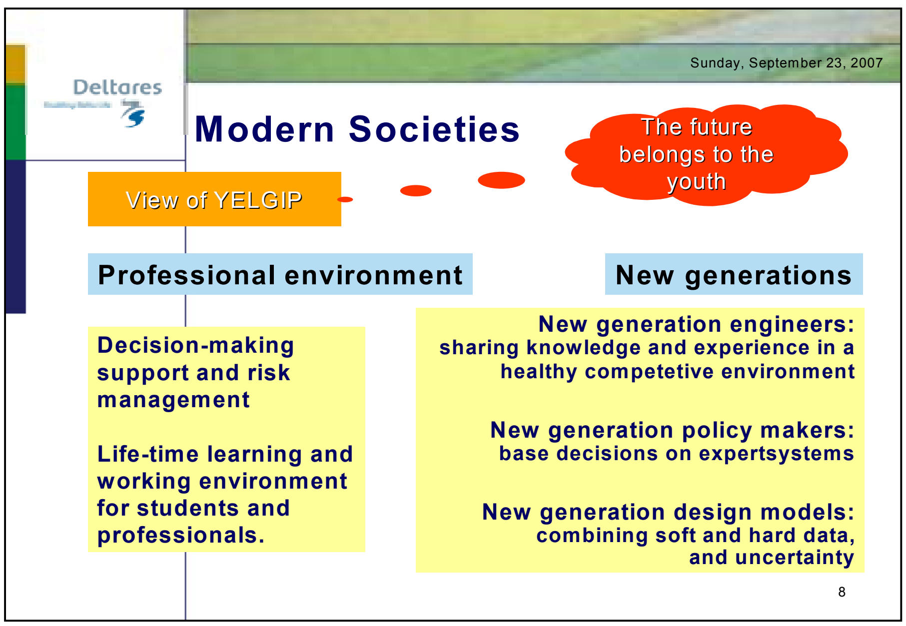
Decisions are made in this new agora where the context is defined, where public and private interests meet, where different opinions emerge, and where – if they want to play a role – geo-engineers must raise their voice. If we express our added value in correct wording, in a context easily understood, our position will gain strength and the value it deserves.

The actual framework program (nr 6) runs for 7 years and contains the following main topics 1. Cooperation (32 billion euro) 10 themes, 2. Ideas (7.5 billion) ERC, 3. People (4.5 billion) a.o. MarieCurie, 4. Capacities (4.2 billion) 5 themes, Joint Research Centre (1.7 billion).



Recently the construction sector organized itself on European level in the ECTP (European Construction Technology Platform), recognized by the European Commission. It produced a vision document Vision 2030, which has been composed from discussions and contributions of a few hundreds of top engineers of European companies, institutes, etc. It also produced next to that the so-called Strategic Research Agenda, which contains many suggestions that should be considered when realizing the Vision 2030. To achieve this research ahs to be undertaken from now. Recently, it produced the Implementation Action Plan, which is a kind of time schedule of prioritized research proposals. This action plan will be considered by the EC when formulating the Calls for the running and future research framework programs (see www.ectp.org).



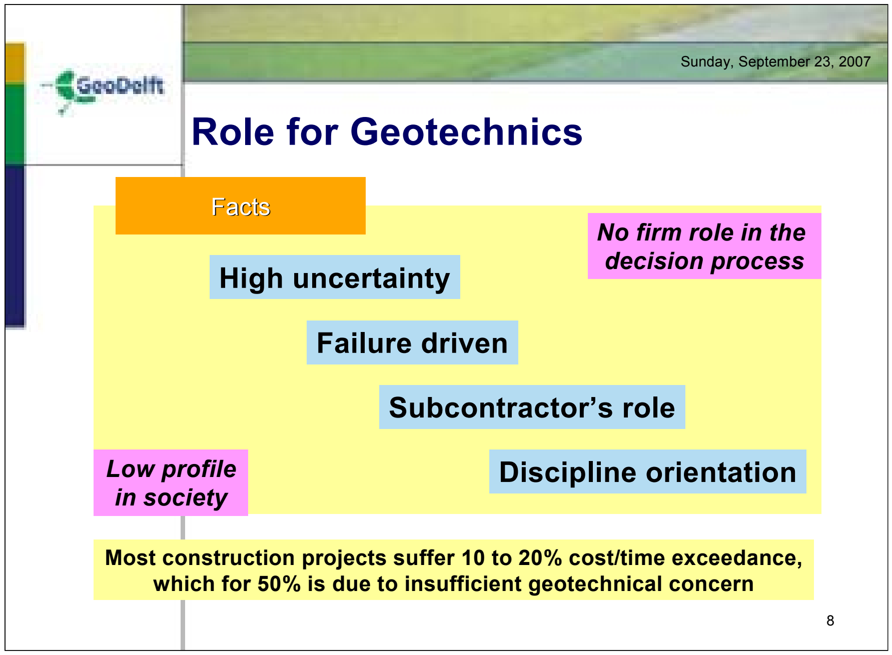


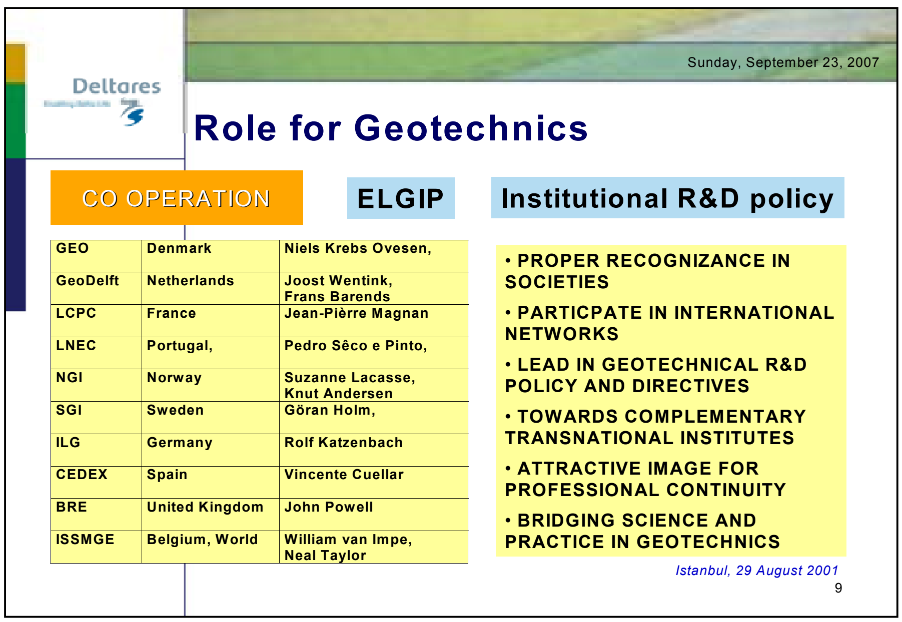
Tthe structure of the ECTP consists of so-called focus areas (FA), object driven and generic.

For further information Bas Hemmen can be contacted. He is the EU-Liaison of ELGIP. b.r.hemmen@geodelft.nl

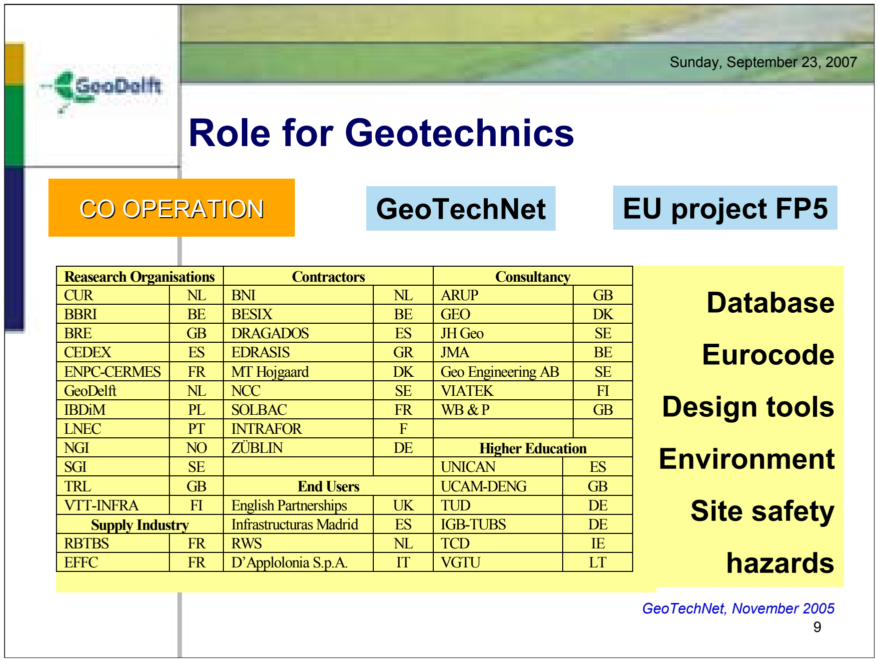
YELGIP is the Young European Large Geotechnical Institutes Platform established in 2004 by ELGIP. Participants in YELGIP are promising researchers - engineers from ELGIP institutes younger than 35 of age.

They organize exchange programs and workshops with a focus on meeting young industrials.





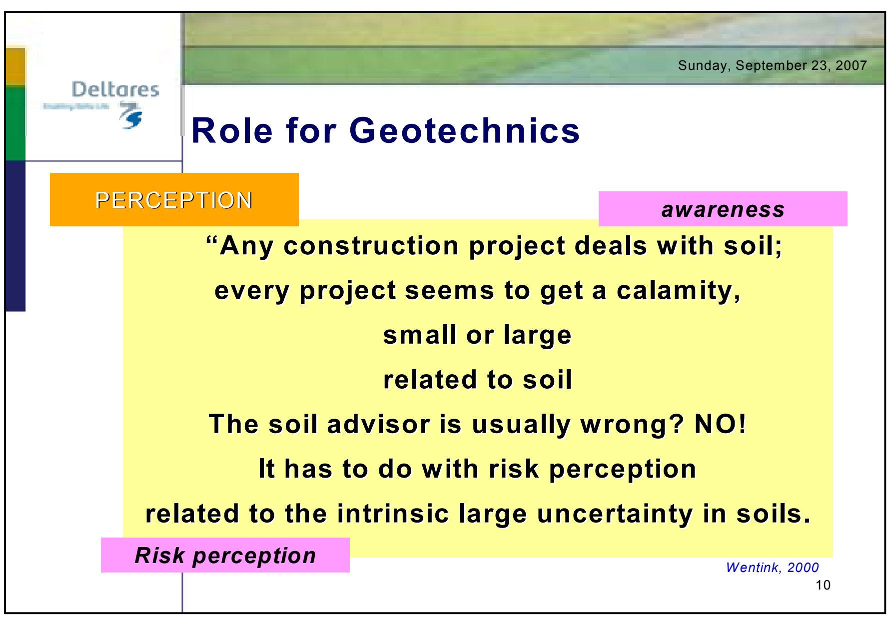
An informal meeting in Istanbul 2001 was the start of institutional cooperation in European states. It lead to the establishment of ELGIP in 2002. ELGIP regroups prominent research organizations from European countries working in the field of geotechnics, one representative institute per state. ELGIP provides an operational framework for the promotion, exchange and integration of expertise, experience and efficiency within a common policy for research, development and innovation. ELGIP is established for society, mankind and nature, to assess, prevent and mitigate at European level the effects of construction costs and risk, effects of natural hazards, and effects of regulations and methods
... in the field of geotechnics (see www.elgip.net).

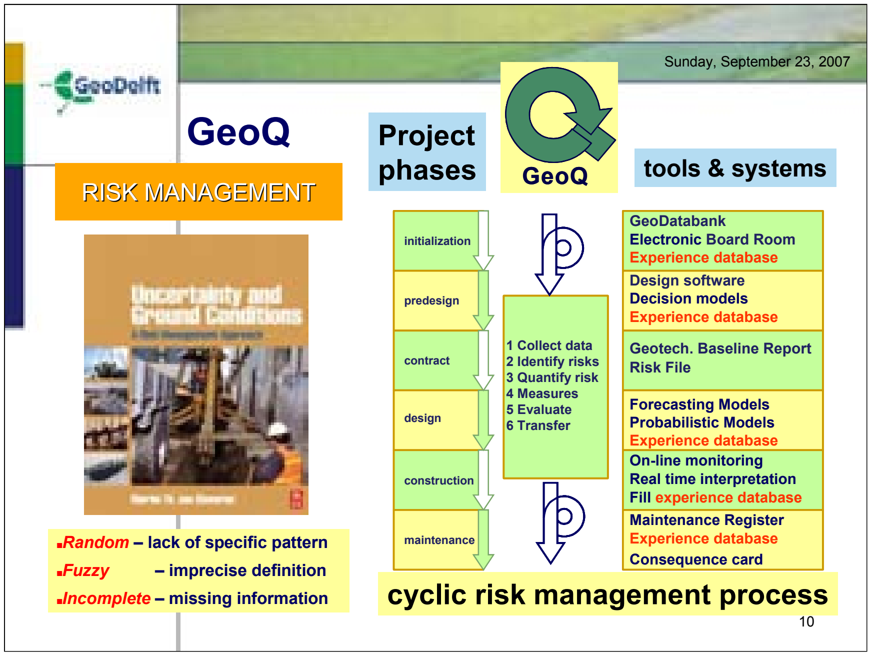


Reasearch Organisations		Contractors		Consultancy	
CUR	NL	BNI	NL	ARUP	GB
BBRI	BE	BESIX	BE	GEO	DK
BRE	GB	DRAGADOS	ES	JH Geo	SE
CEDEX	ES	EDRASIS	GR	JMA	BE
ENPC-CERMES	FR	MT Hojgaard	DK	Geo Engineering AB	SE
GeoDelft	NL	NCC	SE	VIATEK	FI
IBDiM	PL	SOLBAC	FR	WB & P	GB
LNEC	PT	INTRAFOR	F		
NGI	NO	ZÜBLIN	DE	**Higher Education**	
SGI	SE			UNICAN	ES
TRL	GB	**End Users**		UCAM-DENG	GB
VTT-INFRA	FI	English Partnerships	UK	TUD	DE
Supply Industry		Infrastructuras Madrid	ES	IGB-TUBS	DE
RBTBS	FR	RWS	NL	TCD	IE
EFFC	FR	D'Applolonia S.p.A.	IT	VGTU	LT

A leading research/policy achievement was produced by the EU-project GeoTechNet (running under FP5) (see www.geotechnet.org).

Joost Wentink, an experienced contractor and consultant, and not a geotechnician but acquainted with geotechnical specialists as former director of GeoDelft, stated: "Without exception, if you work in the construction sector, in any function, you will be confronted with the aspect soil. Every project seems to get a calamity, small or large, related to soil. I thought that after such an event the soil mechanics advisor was wrong, but now I know that every advisor could be right. The difference is the individual risk perception related to the intrinsic large uncertainty in soils."





The unavoidable ground-related uncertainty, as encountered in any construction project, is put by GeoQ in a structured risk management framework. Risk management aims to minimize failure and costs and maximize purpose and quality by in-depth expertise and experience, cyclic risk management process, and attention to the people factor (communication, dealing with risk perception).

Risk management per project phase determines which ground information is necessary for a successful construction project.

Phase 3: allocating contractual ground-related risk, despite fuzzy ground with random properties and insufficient information, b.e. Geotechnical Baseline Report (GBR).

Phase 4: managing risks in the ground during design (cause reduction) or during construction or utilization (effect reduction), b.e. Failure Mode and Effect Analysis (FMEA), followed by a detailed and risk-driven site investigation.

Phase 5: managing ground risk and opportunities, b.e. observational method.

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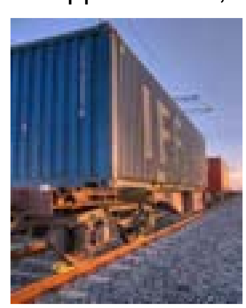
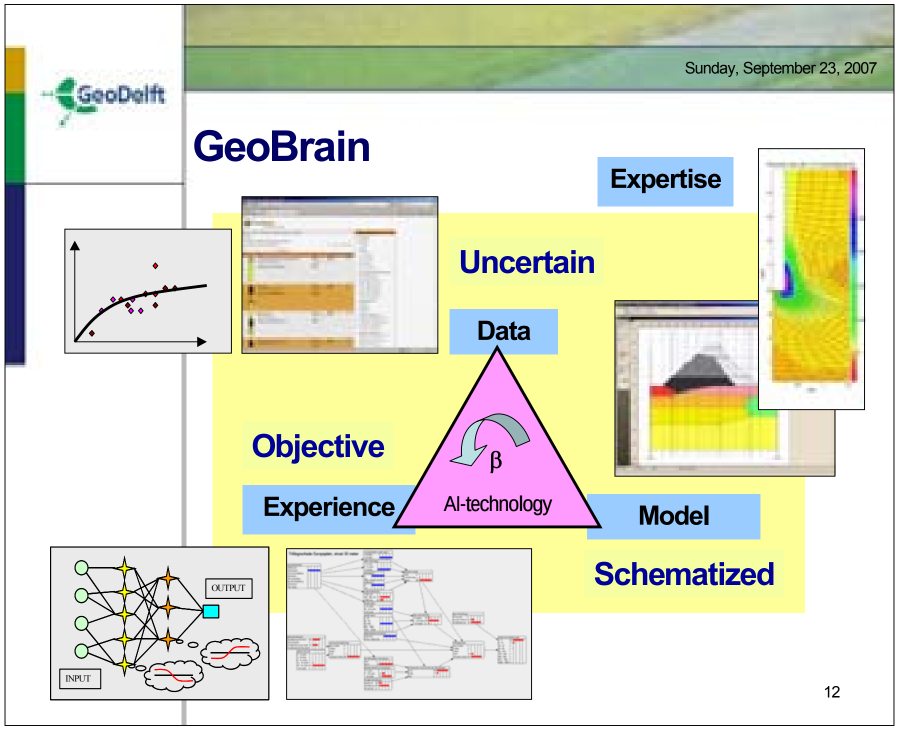


Betuwe Railway Project. By risk management following the GeopQ philosophy the projcet remained within planning and withing the budget (27 M€ saved!).
The extra investing on 0.2 M€ on monitoring saved 4 M€ on sheet piling.
A return on investment factor of 20 (ROI).

The start of large-scale infrastructural projects and, thereafter, the design and construction become more and more complex. Policies concerning multi-functional space use a sustainable building, integral approach of projects, procedures and licenses, existing cables and pipelines, pollution and archeology emphasize that in general the subsoil represents the greatest risk in construction and maintenance. The situation calls for quick and comprehensive answers with the adoption of all available expertise and experience, presented in clear and understandable manner.

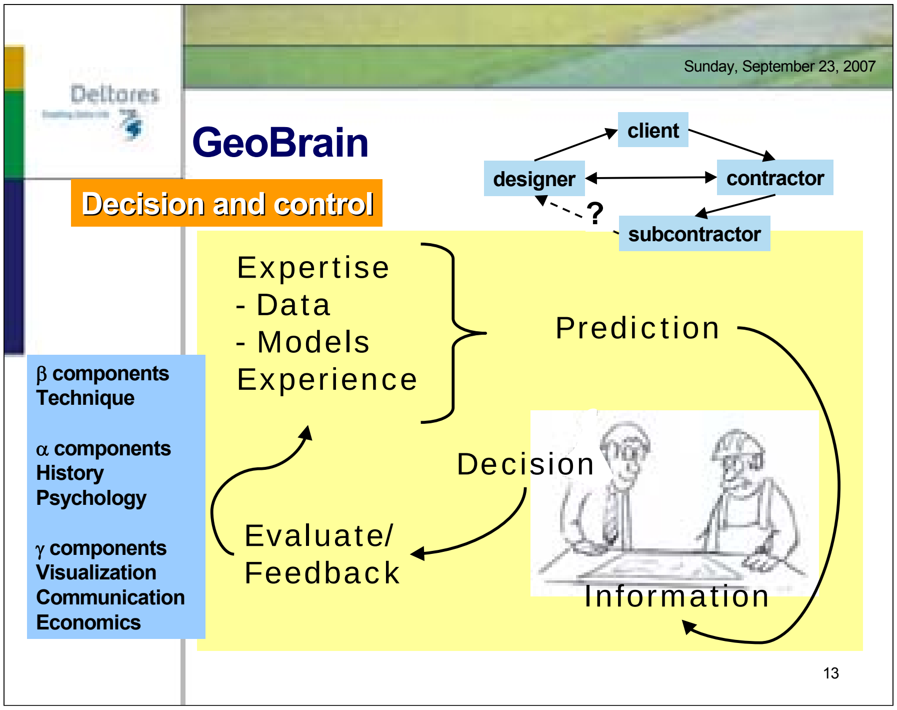
GeoBrain, provides a toolbox for the integral approach of complex situations where the subsoil is an important risk, leading to a view on the objective and reproducible consequences of choices. This development has a strong parallel with some other disciplines, like in the medical science where with diagnostic systems empirical knowledge is being translated into generally applicable concepts. The present-day ICT makes this approach possible.

GeoBrain closes the gap between theory and practice. It is aimed directly at reducing uncertainty and the costs of failure, thereby increasing the quality of profession and minimizing the risk in geo-engineering works. GeoBrain forms a unique facility, the brain-side complementary to common physical and numerical facilities. By artificial intelligence, by neural networks that create new relations between the various knowledge sources and by coupling of numerical prediction models and physical tests the complete set of data interpretations, predictions, practical experiences, expert views and test results can be translated into objective information. For the information transfer the latest presentation techniques are applied.



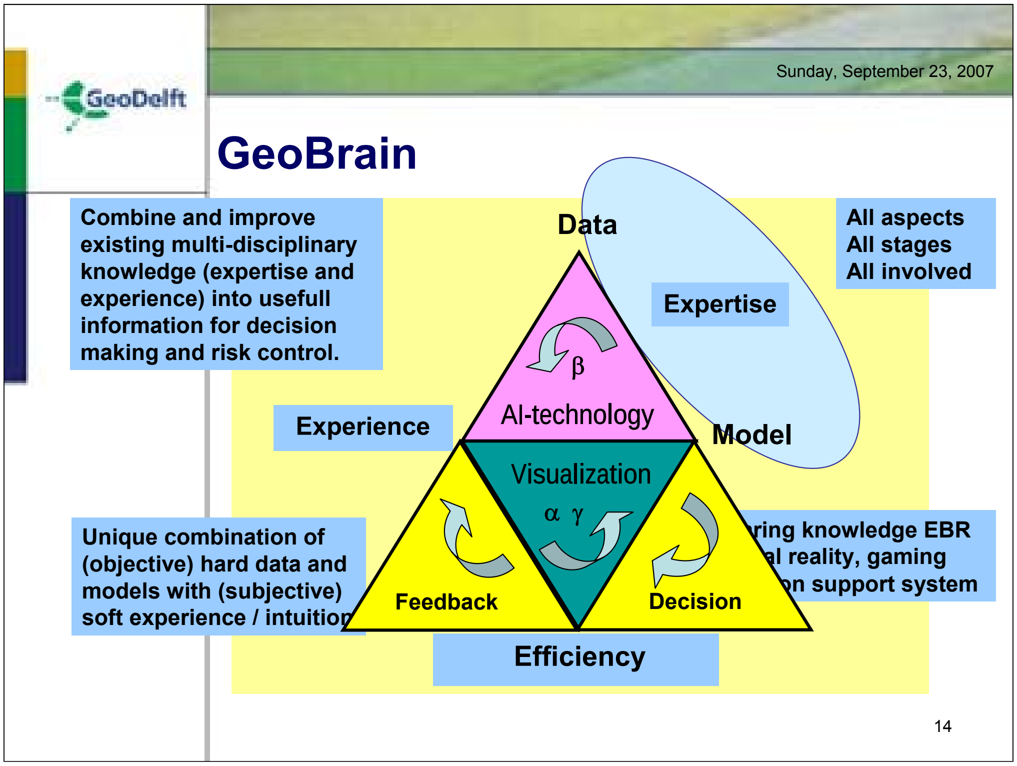
The gap stems from the fact that there has been, hitherto no possibility of systematic learning from case histories of completed projects. Practicing engineers have, from time to time, proposed ad-hoc rules and equations based on experience and field observations but no unified framework of disseminating has been available to engineers till now. In recent years, the development of the tools of computational intelligence such as fuzzy logic and artificial neural networks etc. make it possible for engineers to analyze field or 'monitored' data of construction and truly apply 'observational' methods as recommended by various codes of practice. Up to now geotechnical institutes and engineers have concentrated on the development of computational prediction models to simulate the observations of engineering practice, sometimes with limited success. GeoBrain aims at bringing the vast experience on various aspects of foundation construction together and make it available to design and practicing in the form of readily usable tools for closing the gap between theory and practice.

The general objectives are to decrease risk in construction projects, reduce losses, improve the image of contractors and geo-engineers, improve working conditions, ensure completion of these projects without unforeseen delays and last but not least the reduction of insurance fees. Especially in foundation engineering and the drilling technology it is hard to insure projects. Insurrence fees are high and most of the times the policy does not cover major failures.



GeoBrain is addressing these problems directly by developing an experience database from case histories and disseminating these experiences via the Internet. This database, complemented with expert knowledge, can be used to make predictions with an Artificial Intelligence (AI) based methodology. There are therefore two kinds of output from the total GeoBrain system: experiences and predictions. Experience in its context can be objectivated using obligatory questionnaires, which have been composed together with the users and providers (dropdown list). Predictions are made using a Bayesian Belief Networks, built from expert knowledge and validated by the real case experiences. The Internet is the ideal medium to display the experiences and the results of an prediction (visualization). Assigned users can search on act type or via a map on location. Afterwards queries can be refined. The predictions can be made on the same website.

The participating work groups for foundation engineering and drilling technology consist of several contractors and experienced people from engineering consultancies. Together the questionnaires were made and experts deliver their knowledge for the prediction models. On the input side the clients stimulate the contractors to deliver their data. This is done via the specifications of projects and standard contracts. On the output side the main stimulators are the insurance companies. If a contractor or a client can prove with the use of the prediction models and experience database that there is less risk involved in his project, the insurance companies have a better insight in their risk and are therefore sooner willing to insure the project against a lower fee and or a lower own risk rate.



The users of both the database and the prediction models are: engineers working in client organizations, consultants and contractors, the operating contractor, expertise agencies and risk controllers.

Based on the collected experiences the evidence of failure to surrounding utilities and foundation elements is present in at least 40% of all cases. GeoBrain does promise to make a real difference in geo-engineering and will help the designers with a structural use of experiences. Future plans for GeoBrain are to widen the topics and to internationalize the use.

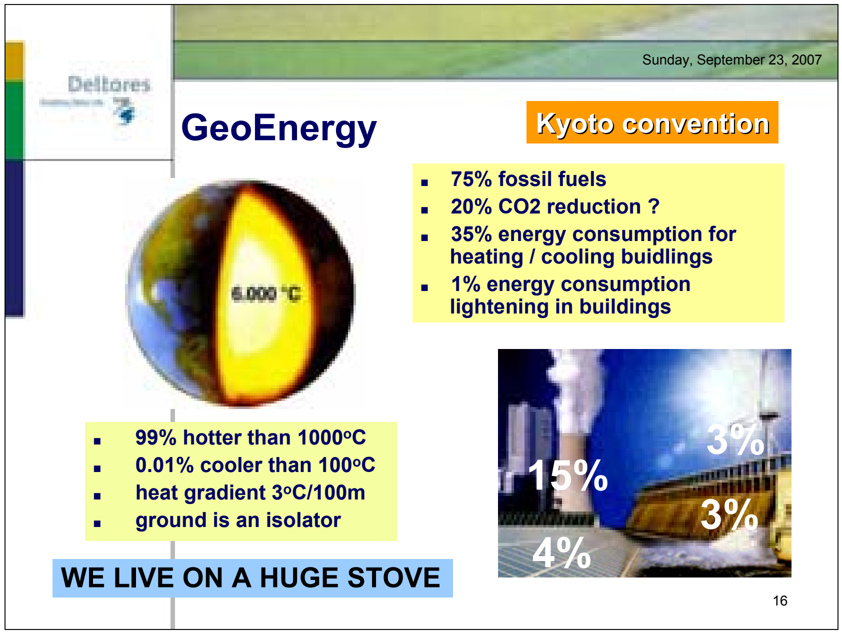
More information can be obtained from m.korff@geodelft.nl

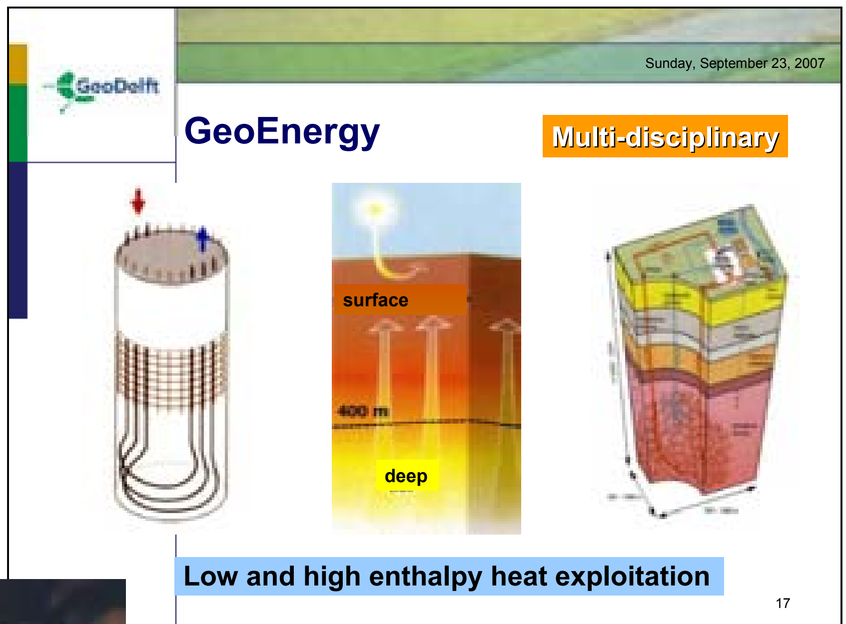
The IJkdijk (calibration dike) emerged as a joint initiative from the sensor and information technology sector and the geotechnical society. It comprises a number of field tests on full-scale embankments, aiming at various failure mechanisms, in order to improve knowledge of these mechanisms and to prove the effectiveness of new sensor techniques under realistic conditions.

The first large scale tests aim at slope stability, to be carried out on an embankment of 5 m high and 100 m long. The international geotechnical society is challenged to predict when failure will occur.

Would you like to join the international calibration test

Construction and sensor installation will be completed in November 2007. Documentation and instructions for prediction will be available in December (www.geodelft.com/prediction). January 31 deadline for prediction submission. February-March 2007 tests will be carried out. (info: a.r.koelewijn@geodelft.nl)

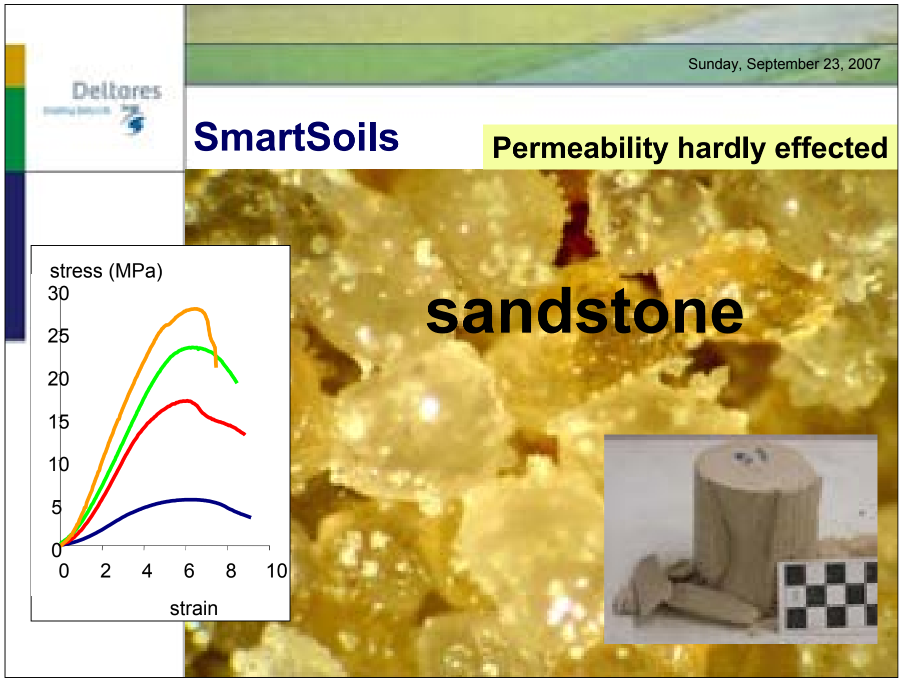




Geothermal energy is a promising solution for the rising global energy problem. Beside shallow heat and cold storage, the deeper earth warmth becomes available with the development of smart wells in the oil industry and higher oil prices. Spatial planners are inclined to consider sustainable energy aspects.

The coming EU directive on soil will probably be a stimulant. Soil mechanics, geohydrologist, geologists, … and many other disciplines should join forces to provide this elegant energy solution.

(katzenbach@geotechnik.tu-darmstadt.ge)



SmartSoils® are technologies that can direct the localization and rate of natural soil processes that influence soil properties. By influencing these processes, there is real potential to alter the properties of the soil (for example, permeability and stiffness). Thus, by means of bio- and nano-technologies, we can generate soil to suit a desired purpose, such as changing the natural soil to make it suitable as a foundation for construction. Some examples from SmartSoils® Toolbox:

- Biosealing: a natural biological process for self-detection and sealing of seepage in water impermeable barriers; specific bacteria appropriately fed will do the job in some weeks time; it has been successfully applied in practice.

- Biogrout: in-situ cementation of permeable soils for strength improvement with retention of permeability; bacteria form sandstone in just a week or so!

Black Clay: active carbon/clay organic barrier for isolating material from the environment

- Drillmix: Fluid for horizontal directional drilling that is suitable for use in salt-water; it has been successfully applied in practice.

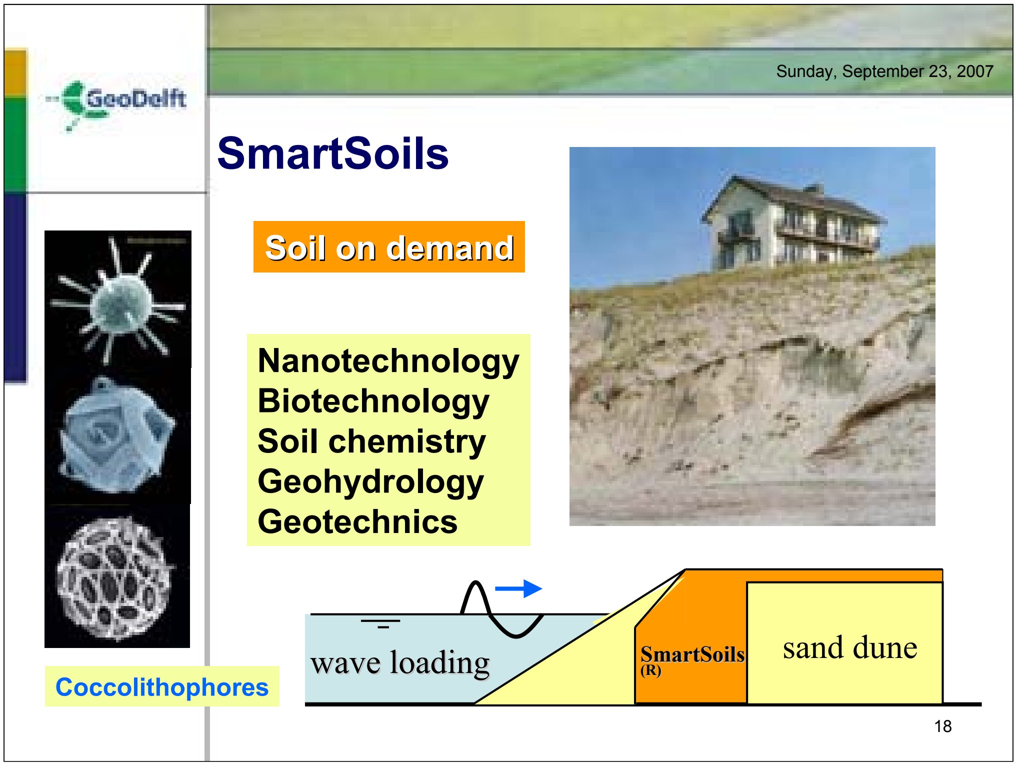
- ETAC: Two-component grout system with an adaptable hardening time for efficient tunnel boring, even in impermeable soils; it is successfully applied in tunnelboring operations.

Preliminary SmartSoils® research for the improvement of soils via biological methods is under investigation in the following areas:

- Organic clay;

- Peat-containing soils; recently a promising method has been found to stop peat oxidation and the corresponding land subsidence.

- Contaminated and uncontaminated dredged sludge.

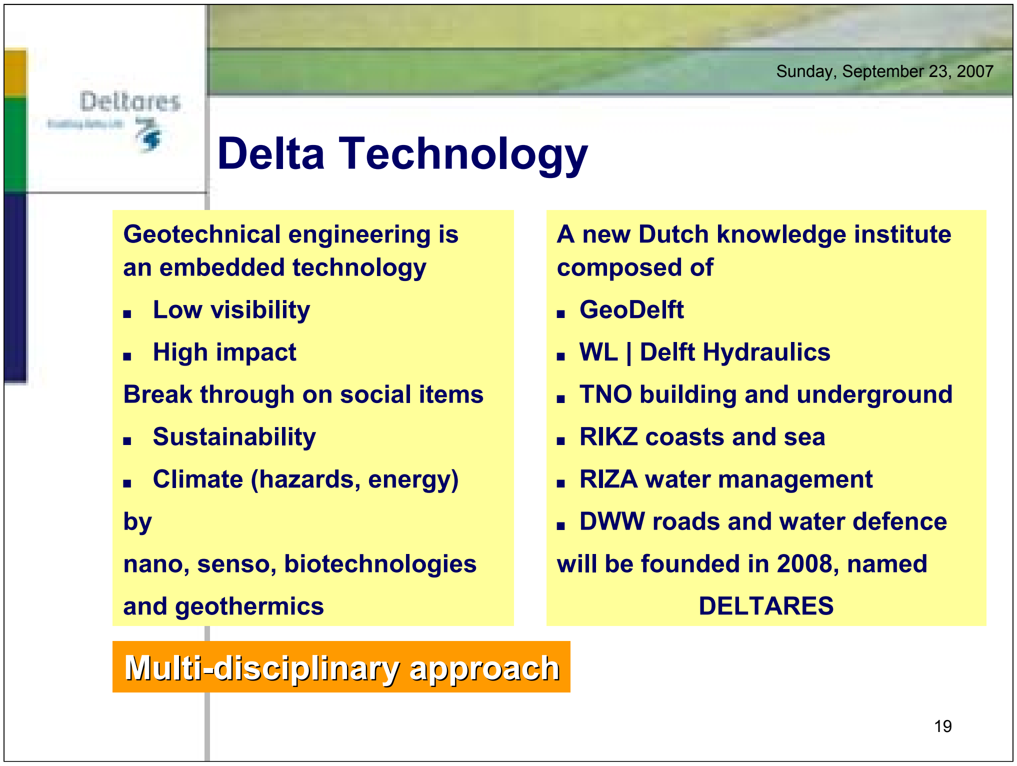


Smartsoils® is a new promising chapter in the history of soil mechanics. By involving the biomass in soil (1 kg soil may contain 10^9 to 10^{12} bacteria), i.e. letting it work for us by proper nutrients in an optimum chemical ambiance, natural processes can be enhanced and controlled. This has been proven at laboratory scale and in some cases also in practice (Biosealing, Etac). Development at large scale within existing technical, environmental and juridical borders is the challenge for the future.

In the Netherlands Biogrout (creating sandstone) is being considered to strengthen dunes against erosion.

Waldo Molendijk (w.o.molendijk@geodelft.nl) is the leading engineer for the Smartsoils® developments. He suggests that it is a perfect topic for a joint technical committee (JTC), since here multi-disciplinarity is indispensable.

Shall we make a JTC on Smartsoils?



The Netherlands is a low-laying country being jeopardized by rising sea level and soft soils. A proper approach for the development of infrastructure etc. requires multi-disciplinarity.

The Dutch government, leaning on various research organizations for its support on this matter, decided to merge several large institutes into one organization and by doing so creating a multi-disciplinary ambience.

In this new institute, called Deltares which officially will start on January 1st 2008, geotechnics, hydraulics, geo-hydraulics, geology are combined from three research institutes and three governmental departments.

The total manpower will reach 800.

Deltares will operate as an independent foundation on the national and international market (R&D and top-consultancy) and with governmental support on so-called national tasks.

(information: peter.vandenberg@deltares.nl)