

Entrepreneurial CEG staff

Read more
on page 4 >>



Dear reader,

In the foreword to the previous edition, I mentioned four important subjects we will be focusing on over the coming years. One of these is **connectivity**. As a faculty we do not function in a vacuum, but are closely linked to the world around us. A world full of societal problems that can often only be properly tackled by creating ties with other disciplines. The article about Geo-Environmental Engineering Professor Timo Heimovaara's research is a good illustration of this point as is the story about alumnus Stefan Aarninkhof, who 'builds using nature'.

Naturally, our ties don't end at the Netherlands' borders. For instance, there is increasing cooperation with research centres in China. Mainly because there is massive interest in cooperation with TU Delft in China and this is positive for knowledge development and exchange. Furthermore, the unique Chinese research institutes provide us with the opportunity to experiment at a fraction of the cost.

In recent years, we have been able to find young, enthusiastic experts for empty and new chairs. We thereby consciously opted for a number of professors from practice, experts from the business community who guarantee **good ties between science and the market**.

We have been offering online education for some time now. Whereas, initially, this concerned a limited number of subjects, as of September, students can also take our master Watermanagement online. In the meantime, we have also taken the next step with MOOC (massive open online course). This provides anyone in the world with **free online access to the subject Introduction to Water Treatment** as of 16 September 2013.

As a faculty, we try to stay in touch with our alumni. In this edition, we spoke to three graduates who all started their own company. What made them decide to do so and what are they doing at the moment? **We would also like to know where all the other alumni ended up which is why, in the near future, we will be sending out a questionnaire alongside our newsletter.** I hope you will be so kind as to complete the latter and return it to us.

Enjoy the read,

Bert Geerken,
 Dean of the Faculty of
 Civil Engineering and Geosciences



Stefan Aarninkhof spends most of his time working as a programme manager for the Stichting Ecoshape [ecoshape foundation]. He enthusiastically works on challenging hydraulic engineering projects. "I want to add quality by building with nature."
Read more on page 2 >>



TU Delft emphatically stimulates entrepreneurship. We spoke to three graduates who now successfully lead their own companies: Jan van der Tempel (Ampelmann), Rutger de Graaf (Deltasync) and Johan Breukink (Knaek).
Read more on page 4 >>

CEG has many ties with China, the largest trading nation in the world. Various research centres have been set up in China in the fields of Geodesy, Water and Urban Systems & Environment.
Read more on page 6 >>



RECENT PHD AWARDS

Multi-class continuum traffic flow models: Analysis and simulation methods

F.L.M. Kessels

Traffic flows consist of various types of vehicles such as cars and trucks. Nevertheless, many models do not take the differences in dynamics between these vehicles (fast vs. slow, short vs. long) into account even though these make a major difference to traffic flow and, as a result, traffic jams. It is therefore very important to many applications - such as the estimating, predicting and controlling of traffic - to incorporate the differences. Moreover, the applications demand fast simulations. This PhD thesis presents a model ('Fastlane') that does take the differences between types of vehicle into account. The model was compared to similar, existing models. Fastlane is formulated to enable fast, accurate computer simulations. To this end, it utilises a moving (Lagrangian) coordinate system and efficient numeric methods. Thomas Schreiter and Yufei Yuan's PhDs reveal that this research can, among other things, be used to estimate and control road networks with high numbers of trucks.

Eastern Scheldt Inlet Morphodynamics

M. Eelkema

The Dutch Delta's estuaries and tidal basins have been studied and influenced by humans for centuries. The contemporary shape of the delta was, to a great extent, determined by the 1953 flooding disaster. The floods occasioned one of the largest hydraulic engineering projects in the world: the Delta Works. Their objective was to improve flood defence whilst taking the delta's other functions into account. The system of dams, barriers and locks still strongly influences the delta's basins and coastline, in particular those of the Oosterschelde. This study's objective was to gain insight into the mechanisms that determine the exchange of sediment between the Oosterschelde and the coast, and the influence of human intervention on these mechanisms. To gain more insight into the processes that determine the morphology of the Oosterschelde's tidal outlet, the bathymetric and hydrodynamic data was combined with process-based models. This study into the history and future of the Oosterschelde provides an impression of a basin that has undergone radical change in recent centuries due to human intervention. It will take a couple of centuries before the morphological effects of these interventions have run their course.

Details of other doctoral dissertations can be found at: <http://repository.tudelft.nl>

Alumnus Stefan Aarninkhof:

"It's all about being able to make people enthusiastic."

He only just failed to win Engineer of the Year 2013, but if you look at the criteria, the title would have suited him down to the ground. Stefan Aarninkhof works on challenging hydraulic engineering projects with great enthusiasm. "I want to add quality by building with nature."

"It was a sad afternoon," he jokes. He had just heard that although the jury was full of praise, it awarded the prize for Engineer of the Year to one of the other three nominees. He is not that upset although his nomination by Boskalis - where he works for the Engineering Department Hydronamic - was a pleasant surprise. "I was surprised because I occupy a special position at the company; I thoroughly enjoy the link with the world of research and I spend a lot of time on contacts outside the company. However, this was clear token of appreciation for my work and for me, as a person."

Building with nature

Aarninkhof spends the majority of his time as the programme manager for Stichting Ecoshape [ecosshape foundation], a consortium of building contractors, consultancies, knowledge institutes and government bodies that implements the Bouwen met de Natuur [building with nature] programme. "Some 200 people are working on various projects for the innovation project which is worth 30 million euros. The programme's objective is to use nature for construction instead of building in or in competition with nature, and to arrive at a solution with all the parties

"The idea isn't to turn an ecologist into an engineer or vice versa, but we do aim help them understand what their respective worlds look like and what drives them."

involved in water projects." This refers to a multidisciplinary approach in which engineers, ecologists and social scientists chart their joint interests in order to arrive at the best solution for nature, technology and society. Enthusiastically, he adds: "It is enormously interesting to be searching for joint interests with such diverse parties."

"The idea isn't to turn an ecologist into an engineer or vice versa, but we do aim help them understand what their respective worlds look like and what drives them."



Follow your heart

His love of technology started when he was a child. "My heart would beat faster when I saw impressive structures such as the Delta Works and the Prins Clausplein [spaghetti junction]. I followed my heart and then you automatically end up in Delft." A new world opened for me thanks to the knowledge I acquired, but also because of the student activities I became active in. "It was a very formative period during which I did a lot for Sint Jansbrug [student association] and the Waterbouwdispuut [hydraulic engineering club] including organising an extensive study trip to Hong Kong and China. Incidentally, that was my first real introduction to the field and faculty of Hydraulic Engineering."

Getting people enthused

His time in Delft made Aarninkhof, who is originally from the province of Twente, more assertive and open. Alongside professional knowledge he learnt to work in groups which has tremendously benefited his current work. "Bouwen met de natuur is pre-eminently something that involves cooperation. It's about getting people enthused about finding the best solution. And everyone involved has to be open. The idea isn't to turn an ecologist into an engineer or vice versa,

but we do aim help them understand what their respective worlds look like and what drives them. This is everyday business for me."

After a brief hesitation, Aarninkhof says he does believe he has an enormous passion to make Ecoshape something good and to thereby inspire people. He also tries to be open to people, to ensure that everyone can do their work in the best way possible. "If you keep following your heart and do the things you enjoy, it gives you enormous drive."

In practice and research

After a PhD in Hydraulic Engineering, Aarninkhof spent ten years working for what is now known as Deltares. He regularly visits TU Delft and was Professor Marcel Stive's first graduate and PhD. Aarninkhof: "Our contact is still very good. We recently attracted a major STW Perspective programme pertaining to the Zandmotor [sand engine], an experimental sand suppletion off the coast of Delfland. 12 PhDs and three postdocs will work on properly analysing the sand suppletion strategy. It's a unique project that will provide the information enabling the creation of sand engine solutions around the world. The exceptional thing to me is the way in which the research meets everyday practice. Of course, it is fabulous that we can cooperate in this manner. In this sense, TU Delft is very close to the business community."

Adding quality

The transition from Deltares to Boskalis provided him with an opportunity to work on the intersection between knowledge development and practical application. "I loved being involved with civil engineering again in the broadest sense of the term. If you tackle it right, there are an awful lot of options at a company like Boskalis. You have to have an entrepreneurial approach to be able to do this sort of thing."

- **Stefan Aarninkhof (1972)**
Secondary school:
Lyceum De Grundel
(1990, Hengelo)
- **Graduated: Hydraulic Engineering, 1996**
- **PhD: TU Delft, Hydraulic Engineering (thesis 'Nearshore Bathymetry derived from video imagery', 2003)**
- **1996 - 2004: researcher/advisor Delft Hydraulics**
- **2005 - 2006: senior advisor Delft Hydraulics**
- **2006 - present: Senior engineer Boskalis Hydronamic**
- **2010 - present: Programme manager EcoShape Building with Nature (Boskalis)**

I love exploring and enjoy working at a department where I can add quality to projects."

Aarninkhof worked on major international projects including the port development in Khalifa, Abu Dhabi, where strict environmental requirements applied due to the nearby coral reef. "If we, as a team, can accurately predict and monitor the impact of dredging on the nearby reef, thereby safeguarding it - then we have added something. Here too, it is the same multidisciplinary cooperation between engineers and ecologists that brings success. It completes the circle. This is what I'd like to pass on to educational institutions: collaborate cross faculty, be conscious of the wider context. This can make the difference between being right and getting your way."

New at Science Centre Delft is the flooding disaster simulator, a 3D presentation of the events of 1953. Colourful images reveal the depth and dynamics of wild water and visitors can take a virtual aerial tour of the area affected so they can see what happened. Which proves to be a moving experience.

1953 flooding disaster at the Science Centre Delft

Sixty years ago, on the first of February, the dykes broke in over 400 places in the provinces of Zeeland and Zuid Holland. What was the disaster like? This has now been visualised in detail by combining a virtual 3D landscape with flooding models.

The spectacular visualisation should provide water managers and emergency services with improved insight enabling them to make the right decisions in a timely manner should another, similar disaster occur.



The Science Centre Delft is part of TU Delft and is located on the Mijnbouwplein. Further information: www.sciencecentre.tudelft.nl

MSc Watermanagement to go online

On 1 September 2013, TU Delft will start a virtual campus on the basis of the current pilot project for online education. The latter comprises the conversion of the existing MSc subjects into online subjects. The Executive Board selected the MSc Watermanagement to be the only full MSc study programme to participate in the pilot.



The MSc Watermanagement as chosen as the only complete MSc on the basis of this field's international reputation, its staff's experience with online education in their part-time study programme, the OpenCourseWare they provide, the Double Degree programme with the National University of Singapore and the various bilateral educational exchanges with foreign universities.

Education for Watermanagement in Delft makes heavy use of Collegerama (video lectures) and videoconferencing. Other study programmes subjects were selected from include the MSc

AeroSpace Structures & Computational Mechanics and the MSc Engineering and Policy Analysis.

The online courses developed will be provided during the 2013-2014 academic year when the virtual MSc Watermanagement will also start. The Virtual Campus Courses can also be taken individually outside the organisational framework of an MSc study programme. The advantage is that this makes individual subjects globally available enabling students from outside TU Delft to incorporate subjects from Delft into their own curriculum.

The development of Virtual Campus Courses is absolutely crucial to TU Delft due to competition with other universities which are set to provide an increasing number of place and time-independent study programmes and courses.

Further information
www.watermanagement.tudelft.nl

Entrepreneurial CEG staff



Entrepreneurship and TU Delft

TU Delft emphatically stimulates entrepreneurship. The Delft Centre for Entrepreneurship, the Valorisation Centre, YES!Delft, YES!Delft Students and the Climate KIC all provide education aimed at entrepreneurship. For bachelor students there are, for example, three entrepreneurship-oriented minors. Master students can choose from an extensive range of subjects such as the courses 'Turning Technology into Business', 'Starting New Ventures' and 'Ready to Startup'. The latter deals with all manner of entrepreneurial aspects and the participants write a business plan. Master students can also opt for the Master Annotation Entrepreneurship. They then have to take a number of entrepreneurial subjects, take part in an Entrepreneurship Annotation Week whereby they, among other things, visit various companies and incubators, and they complete a graduation project with extra emphasis on entrepreneurship. TU Delft PhDs and members of staff can take the two-day entrepreneurship masterclasses. These are organised by the Delft Centre for Entrepreneurship in collaboration with Delft TopTech and YES!Delft.



There is not only a wide range of subjects for budding entrepreneurs, they can even find all manner of support in Delft. YES!Delft, for instance, provides ten masterclasses including an individual development study and development processes aimed at enabling first-time entrepreneurs to successfully start businesses called YES!Pro. The organisation also organises networking meetings and offers coaching. The YES!Delft incubator allows technical entrepreneurs to avail themselves of office & meeting spaces, a business lounge and

a lecture hall for presentations and meetings. YES!Delft also organises drop in consultancy where specialists in the fields of, for example, intellectual property, finance or subsidies answer questions from first timers. New is the LaunchLab. This programme was specially developed for (young) professionals and scientists who'd like to start a technical company. During the three-month programme, they develop a business model surrounding their concept. Important aspects include testing the business concept on the market, determining financial feasibility and cataloguing potential clients.

After graduating, CEG students end up in all sorts of positions. Some of them start working for the government or the business community while others conduct research or start their own company. We spoke to three graduates who successfully lead their own companies.

Two of the latter are true spin offs, companies that translate educational and research projects into commercial products. Ampelmann's **Jan van der Tempel** developed a plan for a safe transfer platform for offshore applications whilst studying. He detailed it together with a number of other students and started a company. **Rutger de Graaf** of Deltasync carried out doctoral research into the sustainable application of water in urban areas and founded a floating urbanisation consultancy. **Johan Breukink's** Knaek has no direct link to his studies. He started Knaek - that creates discount cards for students - whilst studying Transport, Infrastructure and Logistics. His company is currently the market leader in the field.

Idea born at Berlin bar leads to successful company

Ensuring staff can safely transfer from a ship to an offshore structure is the core business of the Ampelmann Company, which Jan van der Tempel started in 2008. In recent years, the business grew annually by 100% and plans are currently being developed for branches abroad. It all started in the summer of 2002 in Berlin. Jan van der Tempel - who was

conducting PhD research into optimising offshore wind turbines' support structures - took part in the Offshore Wind Energy Conference. A method for safely transferring maintenance staff from a boat to offshore wind turbines was presented there. Together with a colleague from Delft, Jan decided they could do a lot better and they came up with the basic idea for the Ampelmann whilst having a beer outside a Berlin bar.

Prototype

Back in Delft, Van der Tempel decided to detail the concept with a team of students. In 2004, they completed a scale model which they subjected to extensive laboratory testing over the following year. The good test results occasioned the next step: the construction of a full-size prototype. When the latter successfully withstood testing in the port of Rotterdam and on the North Sea, Van der Tempel

founded the Ampelmann Company in 2008. In preparation he and his team attended the 'Writing a business plan' lecture and took various workshops and training sessions at Yes!Delft.

Compensating for movement

"The problem facing people transferring from a ship to an offshore structure is that the ship moves on the waves while the structure is static," explains Van der Tempel. "If the waves are small, transferring is still an option, but if the waves get bigger it becomes an extremely risky manoeuvre. We solved that problem by creating a platform that compensates for the ship's movement. To this end, we utilised the undercarriage of a flight simulator,

a mechanism with six large hydraulic cylinders. Fast measuring and control technology continuously monitors the ship's movements and immediately passes this data on to the cylinders which compensate for the movement. The staff can transfer from the static platform using a gangway."

Global

"It's going really well. Since its inception, the company has grown 100% year on year and we have built 16 Ampelmann platforms which we lease on a project basis. The platforms have enabled hundreds of thousands of safe transfers. Our company's strength is that we are technically excellent, our staff are interested in service and always help our clients co-conceptualise well. We work around the world for all the major oil companies and wind contractors. At the moment, we are contemplating opening foreign branches in, among other places, the Far East. Furthermore, we continue to work on innovations and the optimisation of the existing systems."

Other roles

"When I look back at the past few years, I notice that the challenges kept changing. There were five of us to start with and I spent a lot of time on substantive issues. We now employ 140 staff and plan to develop until we employ 300. This demands a different management approach and other roles. For example, we now have a Human Resources department, bring in external knowledge and expertise and my role is now more that of a 'visionary leader'. I enjoy these role changes. Obviously, they involve hard work. You have to grow into your role and continuously improve your skills that aren't up to scratch yet, for example by taking courses."



Jan van der Tempel



Further information
www.ampelmann.nl

Working on floating cities



for the World Expo in Shanghai and Rotterdam's city council was also highly interested. This made us decide to found Deltasync."

Floating pavilion

"Rotterdam was our first major assignment. The council wants to lead in the field of climate adaptation and asked us to carry out a number of studies and to design a floating pavilion for the Stadshavensgebied [urban harbour areas]. This pavilion was built in the Rijnhaven in 2010. In the meantime, we have worked on countless assignments including recently providing consultancy and support to the development of six floating homes in the Harnaschpolder near Delft. In contrast to many other consultancies and design agencies, we initiate our own research. For example, around our fifth anniversary we studied the utility and necessity of floating construction. Is it more than a cool innovation?"

Spatial problems

"The study led us to conclude that in the long term there will be too little land available for functions such as living and food production. Not only are increasing numbers of people moving to cities around the world, but most of these urban areas are located in deltas with the most fertile soil. The expanding cities are also leading to considerable loss of good agricultural land. This spatial problem can be solved by substantiating further urbanisation with floating cities and sea-based agriculture. You can then close the cycles. You can, for instance, use waste water from the traditional city as fertiliser for sea-based agriculture

which produces food for the urban population."

Small steps

"Rotterdam responded enthusiastically to our vision which we entitled the 'Blue Revolution' and cities such as Jakarta and Manila are also interested. Naturally, we won't be able to instantly gain ground for this new approach to urbanisation. We have therefore decided, in collaboration with our existing network partners, to work towards our goal in small steps. For example, we strive to have built a floating neighbourhood where we can conduct research in five years' time. And it would be great if a small floating town had been built five years after that."

Convincing people

"There are a number of reasons why we have been so successful so far. First of all, we received great support from the Valorisation Centre and Yes!Delft. We were also lucky that we came into contact with innovative civil servants and visionary administrators. Mayor Opstelten in Rotterdam and Councillor Vuijk in Delft were enthusiastic supporters of our plans almost from the start. We would have had a much harder time without that enthusiasm. It also made us realise that achieving your ideas is not so much dependent on brilliant concepts, but much more on your capacity to convince social parties of your ideas."

Further information
www.deltasync.nl

Whilst conducting research for his PhD, Rutger van de Graaf and a team of students took part in a competition. Their design for a floating city won and there was so much subsequent interest that they basically had no choice but to start a company. By now, Deltasync is a successful consultancy and design agency in the field of floating construction.

"Although I sold marbles in the playground as a kid, it was by no means self-evident that I was going to become an entrepreneur," says Rutger van de Graaf. "Actually, it more or less just happened to me. In 2006, during the second year of my PhD research at the Faculty of Civil Engineering at TU Delft, Royal Haskoning organised the Deltacompetitie [Delta competition]. I decided to compete together with a number of students. We developed a design and a development strategy for a floating city on the IJmeer [lake] and won. This led to huge media interest and we were busier than ever. We were invited to discuss a floating building

Unique discount card for student towns



Fold-out booklet

Breukink continues: "I got the idea for the discount card in Spain. Someone there showed me this credit card-sized, fold-out booklet. He wanted to use it for a marketing campaign. Back in Delft I realised a booklet like that had potential as a discount card. The standard ones look like credit cards and the drawback is that you have to go online to see the discounts available. So almost no one does. The Knaek has a magnetic stripe yet is made like a small booklet which lists all the discounts."

Interesting

"Interesting discounts are crucial to a discount card's success. So not a measly ten percent discount, but, for example, the second item free. And not one off discounts, but ones that are valid for a year with no limitations. It was with this message I took to companies in and around Delft together with fellow students and friends. You often had to convince people, but in the end we had enough companies who wanted to take part and were willing to pay to feature in the booklet."

Together with students

"The discount cards proved to be a success and the following year we

issued them in four cities, once again in conjunction with local students. By now we do so in 28 student towns at home and abroad. This year, we also launched the Knaek as an app. This not only provides discounts in all the participating cities, but maps also show you which locations provide discounts."

New customer base

"The card's strength is that we emphatically base ourselves on students' wishes. Together with student representatives in the various towns we ensure that every Knaek has at least five appealing discounts that students will talk to each other about. The card appeals to companies because they can tap into a new customer base every year."

Growth

Over the coming years, Breukink wishes to expand even further with more cards and more towns. He is currently working on a German Knaek and a card for French speaking student towns in Belgium as well as new products such as insurances, travel discounts and festivals.

Further information
www.knaek.nl

Whilst studying Transport, Infrastructure and Logistics, Johan Breukink started the Knaek, a discount card for students. Last year, his company Knaek Promotions distributed 340,000 cards in almost 30 student towns across the Netherlands, Belgium and Spain.

"I don't really come from an entrepreneurial background," says Breukink. "But apparently I can spot opportunities on the market bang on time. I had a consultancy when I was 16 comparable to the Club van Delft which used school children as consultants. I also ran a webshop for soldiers with my business partner at the time."

NEW PROFESSORSHIPS

Prof. (Pieternel) P.F. Levelt
Chair Remote Sensing of the Earth Atmosphere



We can properly chart the ozone layer, airborne pollutants and greenhouse gases using satellite technology. It is however very important to understand that these three subjects are interrelated. This is why air quality policy and climate policy shouldn't be seen as separate issues. What provides positive effects in one field can lead to negative effects in another. Satellite measurements can be used to gain more insight into such complex relationships between air quality and climate, and thereby contribute to smart choices concerning air quality and climate policy. Furthermore, satellite instruments are increasingly good at quantifying certain sources of emissions and they can therefore play an important role in the future in monitoring adherence to (international) policy in these fields by providing an objective comparison of the environmental performance of the individual countries.

Prof. ir. W.G.J. van der Meer
Innovative Water Purification Processes



Sixthousand years ago, simple filtration sufficed to supply drinking water and keep customers happy. Nowadays, drinking water companies have to pull out all the stops to do the same. This is caused by the increasingly rapidly changing world. For example, the sector faces climate change, threats to drinking water sources, increasing demand for sustainability and low societal costs, suffers from the retreating role of government and increasingly critical customers. It is necessary for drinking water companies to prepare for this development by embracing new technologies. Membrane filtration enables the creation of 100% pure drinking water from any source. Combined with the right type of piping the drinking water will remain pure even during transport. Thanks to these measures, the drinking water company of the future will be able to retain and expand the level of quality we are currently accustomed to.

Prof. ir. T.J. Heimovaara
Chair Geo-Environmental Engineering



The awareness has developed that many natural processes in the subsoil make a major contribution to our prosperity and quality of life. This has led to these subsoil 'ecosystem services' being utilised for a number of socially relevant activities. It is the positive applications of subsoil ecosystem services that I am interested in. This chair's research focuses on the opportunity of using natural, biological processes in the subsoil for civil and geo-engineering applications. Among other things, we hereby examine the option of creating sandstone from sand in-situ using micro-organisms so we can improve dyke stability. Another project is looking at combating the corrosion of steel pipes and concrete walls by using micro-organisms in the subsoil to deposit minerals.

Prof. ir. Z.B. Wang
Chair Morphodynamics of Lagoons and Estuaries



The morphological development of tidal basins is studied from multiple perspectives. Field observations are used to describe the morphology and empirical relationships are deduced which can be utilised to estimate the changes to tidal basins due to, for example, certain human interventions. Morphological changes to tidal basins are caused by water flows that transport sediment. By studying these processes on the basis of the laws of physics we can gain improved insight into these morphological developments. In recent years a lot of progress has been made using the process-based modelling of morphodynamic developments in tidal basins. Morphodynamic research over the coming years should try to bridge the gap between the empirical considerations and modelling, on the one hand, and process-based considerations and modelling on the other. A bridge between the two would lead to a paradigm shift in our insights into the morphodynamic development of tidal basins on various scales.

Further information
www.intreeredes.citg.tudelft.nl

China recently became the world's largest trading nation. It is not surprising then that CEG has many ties with China that have often existed for decades. A lot of the time, these consist of personal contacts and projects. But there are also more structural ties such as the research centres in China which opened late last year.

The question that arises how does today's knowledge exchange relate to our future competitive position?

From top to bottom:

Professor Guang Ye receives guest professorship certificate from Professor Sun Wei (Academy of Engineering in China), Southeast University.

Reception in 2012 by the President and Vice President of Beijing Jiaotong University (BJTU). Second from left Professor Ingo Hansen.

Rob Goverde flanked by two guests from Beijing Jiaotong University.



Cooperating with a global power The rise of China

The research budgets are large, the laboratories are exceptionally well equipped, labour costs are low and a generation of young researchers are eager to get to work. An interesting partner. In addition, China is very interested in research from Delft. To reach international level due to the societal problems with water, spatial development and the environment, but also because cooperation with a top institute can be very important when it comes to Chinese government funding. Conversely, there is a lot the Netherlands can learn from China and the country is starting to become a peer when it comes to research.

Cooperation with China is nothing new. The first Chinese student graduated from CEG and professors started travelling to China in the 1930s. After a relatively quiet period, the influx of students started at the close of the 1990s. In 2012, CEG had 53 Chinese students (roughly 2%) and 126 staff (almost 1%). After graduating or receiving their PhD they provide valuable contacts. In both China and the Netherlands there is a desire for more structural cooperation.

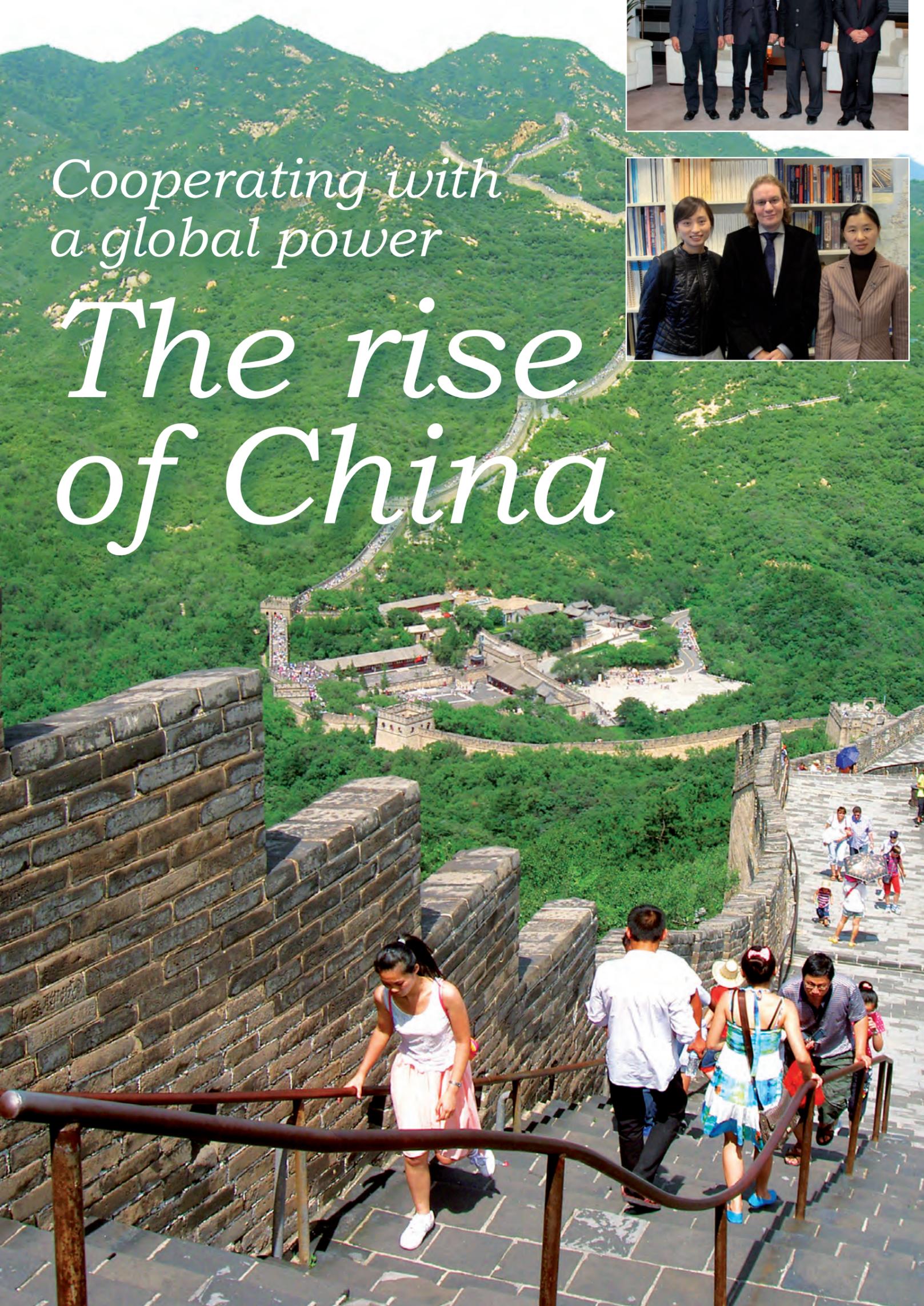
This is why, to start with, three new research centres were opened last November in the field of Geodesy (Wuhan), Water (Nanjing) and Urban Systems & Environment (Guangzhou). Not coincidentally research fields that TU Delft is very strong in. Projects are also underway as part of larger, international, structural cooperations.

Geodesy: Wuhan and Hong Kong

Ramon Hanssen, Professor of Geodesy and Remote Sensing explains that the University of Wuhan, which has thousands of students, is the centre for geodesy in China. He regularly travels there as a guest professor just like his predecessor Professor Teunissen did, and he also supervises PhDs there. "The ties have existed for some 25 years and since the late 1990s we regularly exchange students and PhDs. Alongside Wuhan, where a research centre has now been set up, Geodesy also maintains close ties with Hong Kong Polytechnical University. We exchange students and conduct joint projects in the field of (satellite) monitoring of climate change and the hydrological situation in Tibet."

This is an interesting cooperation for Geodesy also because it is becoming increasingly difficult to find funding for the instrumental aspects of research in the Netherlands as this does not provide immediate output. Hanssen: "In China this is much easier, moreover they have very advanced tools at their disposal. Scale is also of interest - the Chinese won't shy away from using 1,000 people to conduct a measurement if so required, also because labour costs are low."

Hanssen is also of the opinion that we should anticipate developments. "Scientifically speaking things move forward rapidly with such a huge partner. In some fields, China is surpassing us, while in others it is a long term investment. A new global player is emerging with its own agenda. We should keep thinking about what we can add."



Coastal research: Nanjing and Shanghai

Over the past ten years, Marcel Stive, Professor of Coastal Engineering, has seen China's interest in TU Delft gradually expand. A development related to the fact that the quality of Chinese universities and research institutions has recently started being assessed. Stive: "If you wish to bear the name State Key Laboratory you have to prove that you have contacts with top international research institutes and that you are on par with the latter. This then makes you a member of the group of institutions that benefits most. Naturally, students from China have been coming here for over 100 years and we have also always been welcome there."

Stive and his colleague Professor Wang, both have appointments in the framework of the 111 project, a Chinese government initiative to attract top foreign researchers to Chinese universities. Stive: "In fact, the coastal research centre in Nanjing is the initiative's concretisation. In the autumn, my Chinese PhD students will carry out experiments there. It is very interesting; they have unique facilities which run at a tenth of the cost. We exchange students and staff, and also publish together. Furthermore, Wang and I annually provide a week's worth of lectures to PhDs and their partners at Hohai University (Nanjing). The research centre allows us to concretise and embed all the ties that exist."

Part-time Morphology Professor Wang - who grew up in China and - as one of the Top 3 students in his province was chosen to study in the Netherlands - also has a special appointment at the East China Normal University (ECNU) in Shanghai. "That university was originally set up to train teachers," explains Wang. "And has high status in the field of estuarine and coastal research. It has cooperated with the ECNU's State Key Laboratory of Estuarine and Coastal Research for years. There is currently a project underway about the effect of human activity on the eco-morphology of rivers and estuaries that is part of the Programme Strategic Scientific Alliances between China and the Netherlands. This strategic cooperation between the Netherlands (through the KNAW [Royal Netherlands Academy of Arts and Sciences]) and China (through MOST) intends to broaden and deepen Sino-Dutch scientific cooperation."

In the Netherlands there are now six projects being carried out that are part of the programme." Since the end of last year, Wang is a Yangtze Scholar (also translated as Cheung Kong Scholar) professor, appointed by the Chinese Ministry of Education.

The appointment is exceptional as, over the last 15 years, only 20 professors from China and abroad have been appointed at ECNU. "And there is also



Marcel Stive, Professor of Coastal Engineering, has seen China's interest in TU Delft gradually expand.

an NWO [Netherlands Organisation for Scientific Research] project about the development of flats in estuaries as part of the Chinese-Dutch Joint Scientific Thematic Research Programme (JSTP), which we participate in."

Sustainable materials: Guangzhou

In Guangzhou, Structural Engineering is collaborating with the South China University of Technology (SCUT) at a research centre. Just like at the other TU Delft research centres in China the idea is to appoint multiple PhDs there. Urban development in China is very rapid and TU Delft can help to make that development sustainable enabling continued growth. A project in the field of sustainable concrete that was submitted by Guang Ye, associate professor at Structural Engineering has been approved. Alongside his appointment in Delft, Ye is a visiting professor at Wuhan University. In cooperation with Tongji University, Structural Engineering is also carrying out a major project as part of the National Basic Research Program of China (973 Program: 2011CB013800). The Chinese PhD working on it is supervised together with Tongji.

Transport

Alongside the research centre, there is a sustainable agreement between the NWO and the National Natural Science Foundation of China (NSFC). A joint call resulted from the problems developing due to global urbanisation, for example in the field of mobility, and focuses on the theme of 'The Application of Operations Research in Urban Transport'. Three of the seven research projects approved were

submitted by Transport & Planning. The areas of attention they cover are urban traffic control, urban emergencies and traffic control for large-scale urban networks.

There are also links between China and Delft in the rail field. Professor Ingo Hanssen is a guest professor at Jiaotong University in Beijing (BJTU) and the latter had two post-docs in Delft. At China's initiative we are assessing how to further shape the collaboration between the two universities. Rob Goverde, assistant professor: "Railways are booming in China. High-speed lines are being built all over the place and knowledge is desperately needed. There are a lot of interesting projects for us to engage in and the BJTU conducts thorough railway research."

The collaboration is in its infancy, but Goverde applauds concretisation. "We receive an enormous number of requests from Chinese students and PhDs or postdocs who wish to come to Delft. If we can do so through the university in China we will know which people with which skills will be coming here."

Cultural differences

Collaborating with an entirely different culture sometimes leads to surprises. Marcel Stive: "It is very interesting to try an understand Chinese culture. Because the Chinese are, generally speaking, much less direct, what isn't said is sometimes just as important as what is said. We have to learn to understand that." The example he provides is that China has very hierarchic structures and that it is, for instance, not common for a PhD student to have insight into the research as a whole. "This perhaps also has to do with the enormous level of competition. No one talks about it, but the members of a group sometimes don't work together, the way we do in the Netherlands, but keep each other in the dark."

"Due to the hierarchic structure it is also just not done for a student to critically exchange ideas with a lecturer or to take the initiative themselves," adds Ramon Hanssen. "Something that is highly valued in the Netherlands." He also mentioned the difference in decorum that occasionally gets in the way of contact. "A research centre has a completely different dimension than personal contacts. This means there is a lot of decorum involved. Whereas sober-minded Dutch people immediately start talking about the content, there it is also important that a great institute is created where big names come to preside over openings. Naturally, we participate in this, but you do have to find ways to communicate."

The latter proved impossible at the Geodesy and Remote Sensing research centre and so he withdrew from that

takes time. The real challenge is in working with the people there and making sure you get good results. How doesn't really matter that much. I think we should stay critical when founding new institutes to shape the cooperation."

More than knowledge

There is a lot to be learnt in China, besides knowledge exchange. Such as the alignment of scientific findings and their innovative translation into practice. China is very good at that. Stive: "The Netherlands struggles to create links between politics, knowledge and the business community. We used to engage in development cooperation and had government-level contacts, but the business community had to find its own way to join in. In China they understand that you have to be active at all three levels simultaneously." Hanssen thinks there is still a lot to be learnt from China's huge ambitions and would love to carry out projects as part of a larger team. "In general, the Chinese think big a lot more than the Dutch do. As far as that's concerned, our attitudes could be complementary."

It is clear that there are countless (increasing) links with China. International knowledge exchange promotes the development of knowledge, but how cooperation will eventually translate into scientific and economic results over generations remains to be seen. Are we sharing our knowledge with potential competitors or with partners for collaboration? This question should perhaps be studied from a European perspective. Stive: "I think it is very important to

Are we sharing our knowledge with potential competitors or with partners for collaboration?

project. "During the final phase things were modified unilaterally that were of fundamental importance to me. As far as that is concerned the Chinese are sometimes very assertive." Hanssen is lucky in that he has his own contacts thanks to his guest lecturer position. "You have to strike a balance between high and low profile. Founding things

continue to cooperate with such an up-and-coming super power. If we don't do so now, we will have missed our opportunity. We should in any case demonstrate how we convert knowledge into practical innovations. That is our biggest challenge and gives our business community an opportunity we should strive for."

On 31 January 1013, the Faculty of CEG celebrated Chinese New Year. Well over 300 guests enjoyed Chinese snacks, drinks and decorations, demonstrations of Chinese crafts and Chinese performances. Organiser Tianqi Li, a PhD student at Petroleum Engineering and also vice-chairman of the Association of Chinese students and scholars in the Netherlands (ACSSNL) was enthusiastic about the evening.

Chinese New Year

"In China we celebrate New Year with family, but that's impossible for all the Chinese students and staff in Delft. There is a large community of some 800 to 1,000 Chinese students in Delft of whom almost a third study at CEG. This party provided a good opportunity to celebrate with Chinese friends, but also to showcase Chinese culture and traditions and to exchange ideas with one another.

This year, we also wanted our guests to have an experience. Which is why, alongside the traditional snacks, there were also performances and Tai Chi, calligraphy, paper and shadow puppet demonstrations. Visitors could also participate in a typical Chinese quiz - Lantern riddles - and win prizes. Some people discovered their Chinese name and wrote Chinese for the first time!"

"I got the impression that our guests really appreciated the party and they were very interested in China. The seven-person organising committee has worked really hard on this since December. Some guests were already looking forward to next year!"

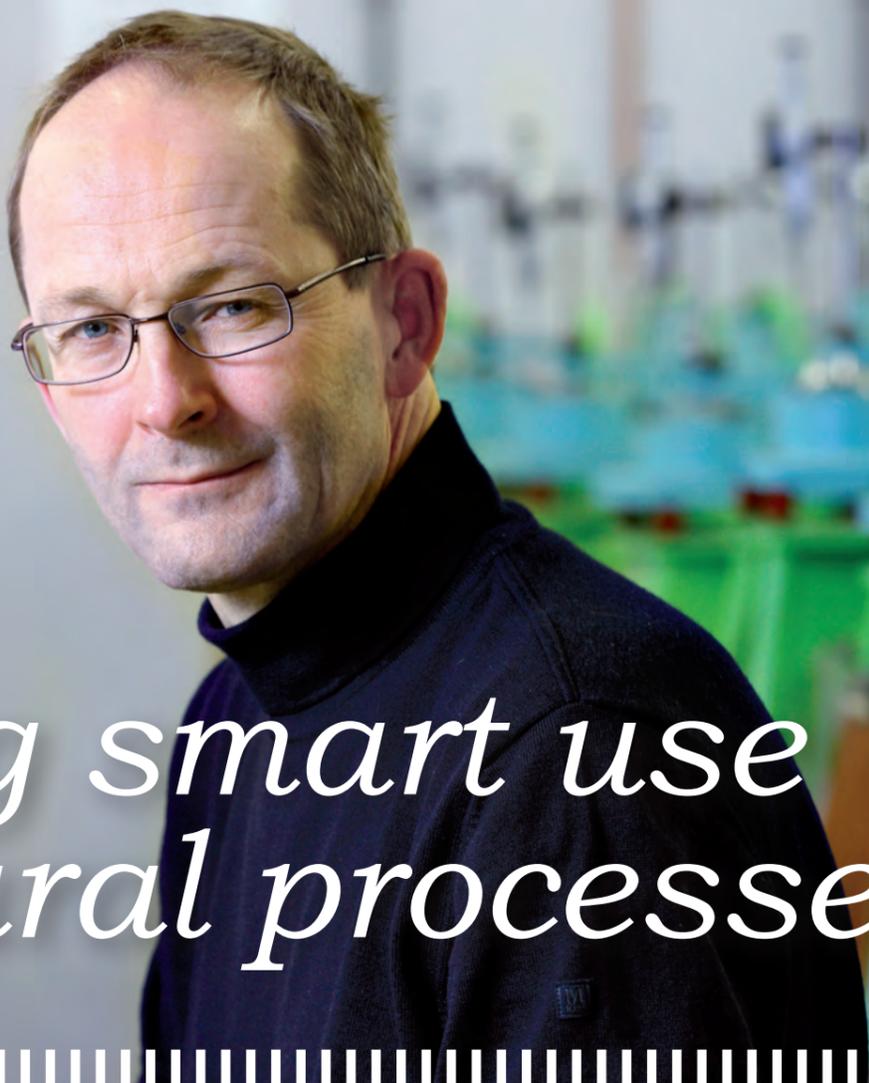
The Year of the Snake

The Year of the Snake is characterised by strong undercurrents in society and dramatic events which can influence the course of history. The fall of the Berlin wall and the attack on the World Trade Centre both took place during the Year of the Snake for example. The snake is an animal that waits patiently, but will definitely strike if it thinks the time is ripe ... The character also stands for beauty, happiness and joy, and is sometimes affectionately referred to as the 'little dragon' by Chinese people.

2013

Making smart use of natural processes is Professor of Geo-environmental Engineering Timo Heimovaara's motto. His group conducts research into, among other things, bacteria that convert loose sand into sandstone and soil organisms that prolong the lifespan of steel sheet piling.

It has not taken Heimovaara and his fellow researchers long to find well over five million euros for this research into 'ecosystem services'.



Making smart use of natural processes

"Utilising natural subsoil processes is nothing new," says Heimovaara. "Agriculturalists have been doing so for thousands of years and drinking water companies have been using the soil's filtering capacity to purify surface water for decades. More recent applications can be found in the field of soil remediation where, for the past twenty years or so, it has been standard practice to have micro-organisms tackle pollutants. Whether they be oil pollution under a petrol station or trichloroethylene under a dry cleaners. I am convinced there are a lot more options. The countless subsoil micro-organisms are part of all manner of processes which we are largely unaware of at the moment."

Trick

"As a group we try to catalogue those processes which have potential for geotechnical and civil engineering applications. We subsequently study how we can stimulate the micro-organisms concerned to do their 'trick' when, where and in the way we want them to. An important precondition for this is cost effectiveness. One of the processes we have, by now, pretty much got under control is the reinforcing of sandy soils using bacteria."

Tasty snack

To demonstrate what he means, Heimovaara grabs a saucer of sand that has a lump of sandstone in the middle. "We made this piece of sandstone ourselves by feeding bacteria a tasty snack that has calcium dissolved into it. Thanks to this 'feed' the bacteria grow really fast and form bicarbonate that deposits and binds the individual grains of sand together. The technique was applied in 2010 during the construction of a gas pipeline underneath the Waal [river] using directional drilling. Due to the presence of a gravel layer there was a risk of drilling fluid leaking away and the bore hole collapsing. A member of our research group, Leon van Paasen, developed a method - in conjunction

with Deltares and Visser & Smit Hanab - which allowed us to bind the gravel together inside a few days so the drilling company could carry out its work risk free."

Alternative

"The drawback of the original method, whereby we injected both cultivated bacteria and nutrients into the subsoil, was that it released ammonium, a substance you have to remove from the soil afterwards. That not only made things expensive, but also environmentally unfriendly. This is why we sought out methods without this type of drawback. We now have an alternative which involves the injection of calcium acetate or calcium nitrate. The bacteria present in the subsoil convert these substances into calcium carbonate and nitrogen gas."

Countless options

"Being able to reinforce sandy soils offers countless options. It can be used to increase the soil's load-bearing capacity and weak links in the dunes can be reinforced. The technology can also be used to prevent flow slide and to combat erosion-prone spots. And, further down the line, we may perhaps be able to use it to tackle piping. This is the phenomenon that water leaks underneath a dyke through a sand layer. If this continues unchecked, the water will start to transport sand which will create a channel under the dyke that can, over time, lead to the water barrier collapsing. By bonding the sand you can prevent channels developing without changing the sand's permeability."

Under control

"The more complex applications, such as preventing piping, will only be serious options once we have complete control of the technique. After all, when it comes to safety and human lives we have to have full control of sandstone creation so that we can have the process take place in

exactly the right spot at the right time. This is why we are still conducting all manner of studies. For instance, how long do the bubbles of nitrogen remain in the soil? How much calcium is required to give sand sufficient strength and what is sufficient strength really? Which waste products can we use to give to the soil bacteria as treats?"

Sheet piling

"Naturally, we are not only studying sandstone creation. In collaboration with Havenbedrijf Rotterdam [Port of Rotterdam Authority] and VOPAK, we are carrying out research into options for prolonging the lifespan of steel infrastructure such as sheet piling and storage tanks. If, for instance, a quay wall is to last 50 years, the port authority now opts for seven centimetre thick sheet piling, just to be on the safe side. Even if corrosion were to occur, that thickness would ensure that the quay wall does not develop leaks. All that steel costs a lot of money and energy. That is why we are studying whether micro-organisms could be used to combat erosion so you could make do with thinner steel."

Tooth plaque

Heimovaara continues: "When old sheet piling is removed from the ground you often see that certain parts of it are covered with a hardened crust which has protected the underlying steel. That crust is formed by soil bacteria which produce something akin to tooth plaque. This biofilm nestles between the steel and the surrounding soil, and slowly turns into a type of tartar. At the moment, we are studying how we can stimulate micro-organisms to create such a 'tartar' layer across the entire surface of the sheet piling. Does the steel need to be pre-treated for instance or is there something in the soil we can adapt?"

Landfill sites

Other research we are conducting involves landfill site sustainability.

Nowadays, landfill sites have to be contained in perpetuity to prevent rainwater gaining entry and leaching out undesirable substances. I don't believe in everlasting containment. Together with waste companies and the Ministry of Infrastructure & the Environment, we are studying whether non-containment combined with the accelerated decomposition of organic materials using micro-organisms might be an option. Our idea is to use the infiltration and recirculation of water - if need be combined with aeration - to speed up the biological stabilisation of waste. We expect to be able to improve the percolate quality to such an extent that future treatment will no longer be necessary."

Linking knowledge fields

"In our research we cooperate with Wageningen University & Research Centre, Utrecht University, the Nederlands Instituut voor Ecologie [Netherlands Institute of Ecology], TU Eindhoven and the Centraal Bureau voor Schimmels [Fungal Biodiversity Centre]. What characterises all our research projects is that they demand both civil engineering and biotechnological knowledge. Linking these two areas of knowledge is relatively new. I have high expectations and luckily so do others.

We have a 3.6 million euro research budget as part of the STW Perspectives Programme. STW funds three quarters and the business community, including Deltares, the Havenbedrijf Rotterdam, VOPAK, Witteveen & Bos and Tauw, supplies the rest. The budget for the landfill research amounts to 1.5 million euros. STW funds two thirds of this and the landfill sector a third. At present, our group has nine PhDs, one postdoc and five masters students. Our plan is to further expand our position by forging ahead. We have sufficient mass now and can publish on a massive scale to garner widespread attention for our research."

Name:

TIMO HEIMOVAARA

Heimovaara, son of a Dutch mother and a Finnish father, studied soil chemistry in Wageningen. He did his PhD at the University of Amsterdam where he developed an innovative method for measuring the water content of the unsaturated soil zone. He subsequently worked at the latter institute for three years as a postdoc studying, among other things, pesticides and metal pollution in the subsoil.

In 1996, he shifted to the business community by joining engineering agency IWACO, that later became Royal Haskoning, as a consultant. There he primarily worked on in situ soil remediation.

Heimovaara subsequently spent two years working for a soil remediation company that primarily worked for industrial companies. There he was continuously challenged to come up with smart solutions for the best possible and cheapest results.

In 2007, Heimovaara returned to academia as associate professor of sustainable soil system services at the Geo-Engineering department. Since July of 2012, he is the full professor of Geo-Environmental Engineering.

Heimovaara is married and the proud father of three daughters. In his spare time he likes to play tennis and hockey. He has also coached his daughter's hockey team for years.

COLOPHON

Production Faculty of Civil Engineering and Geosciences Text Nathalie Hanssen, Peter Juijn, Ina Dijkstra Design and layout Heike Slingerland BNO Photography Ina Dijkstra, Sam Rentmeester Printed by Edauw+ Johannissen, The Hague © 2013, Faculty of Civil Engineering and Geosciences