Exchange of Best Practices of GEO Education to Meet Changing Labour Market Needs in Europe

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Key words: Capacity building; Curricula; Education; Labour Market demands, Life-long learning, Attracting new generations and students, Innovation in surveying curricula, Young surveyor,

SUMMARY

Educating the next generation and making sure they select the courses that make them fit for their professional life in the surveying and geospatial industry is differing in every country.
To tackle the mismatch in quantity and quality of graduates we can learn from each other with examples from tools, insights and methods.
To extend the lessons learned, and thus by enhancing the relevance, the experiences of the Netherlands are shared and exchanged in the Life Long Learning Project on 'Geo Skills Plus' with partners from Belgium, Bulgaria, Lithuania and international branch organisations CLGE and EuroGeo.
With the dissemination of the Dutch insights and the first results of the European project this paper contributes to a more harmonized education community and labour market, worldwide.

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1. INTRODUCTION

Educating the next generation and making sure they select the courses that make them fit for their professional life in the surveying and geospatial industry is differing in every country. Each country has its own challenges with the number of new Young Surveyors and linking the students to the needs from the labour market, both in quality and quantity.

In Europe there is a growing demand for an adequate number of well-trained students on level in fields of land surveying, mapping data collection, storage processing, delivering and turning data into information. But the GEO education community cannot keep up the pace and are not producing enough qualified graduates. To tackle the mismatch in quantity and quality we can learn from each other with examples from tools, insights and methods.

In the Netherlands a foundation was established in 2008. Within the foundation the education sector and the labour market in the Netherlands joined forces for the development of the geo education on vocational, master and bachelor level. The approach of the foundation is based on three pillars: innovation in education, recruitment of young people for the GEO profession and promoting the cooperation between education and employers. After 5 years time the outcomes of the approaches can be measured. And more important, the outcomes contain valuable information for countries with similar challenges.
To extend the lessons learned, and thus by enhancing the relevance, the experiences of the Netherlands are shared and exchanged in the Life Long Learning Project on 'Geo Skills Plus' with partners from Belgium, Bulgaria, Lithuania and international branch organisations CLGE and EuroGeo.

With the dissemination of the Dutch insights and the first results of the European project this paper contributes to a more harmonized education community and labour market, worldwide.

In chapter 2 the developments of the Geospatial industry are described and in chapter 3 the challenges of the education sector. After that the initiatives of at country level in the Netherlands (chapter 4) and regional level in Flanders, Belgium (chapter 5) are described. In the 6th chapter the initiatives to exchange lessons learned at European level in the 'GeoSkills Plus' project are described, before the concluding remarks (chapter 7).

2. DEVELOPMENTS OF THE GEOSPATIAL INDUSTRY

The contemporary society is a spatially aware society. In the last decade the Geospatial industry developed fast with the digital availability of (open) geospatial data. The Geospatial sector is an innovative, vital and dynamic sector with a lot of growth potential.

The society needs and wants a spatially enabled environment provided by both the private and public sector. To take advantage of this potential the Geospatial private and public sector require competent geo professionals with knowledge and skills of the current technologies.

Geospatial professions encompass the disciplines of gathering, storing, processing, delivering, and turning location data into information. European Union legislation reflects this advancing surge of geospatial technologies.

- INSPIRE Directive (May 2007) established an infrastructure for spatial information in Europe to support policies that impact the environment. INSPIRE ensures that data is compatible with each country for societal and economic purposes.
- EC joined forces with European Space Agency to create GMES (Global Monitoring for Environment and Security) Programme. It gathers and filters data from environmental satellites, air and ground stations to provide a comprehensive picture of the "health" of the Earth. GMES data is used to provide environmental and security information on land, ocean, emergency response, atmosphere, security and climate change.
- Europe is building up its own Global Navigation Satellite System to provide accurate and guaranteed positioning information for all types of applications including car navigators, mobile phones, maritime, road, rail and air transport, land surveying, mapping and traffic control.
- EU supported many countries in Central and Eastern Europe successfully building up modern digital land administration and geo information infrastructures (EU-PHARE pre- accession funds). Capacity Building in these countries relates currently to well-trained students in using modern information technologies and equipment.

Due to these developments the Geo information sector in Europe is increasingly important. In every country of Europe impressive activities take place related to collection, storage and supply of geo location data. In many central and eastern European countries land reforms are finishing and public geo information organisations are instituted. The European private sector is developing itself towards provider of a new set of geo information products.

The geospatial education community has not been able to keep up the pace with labour market demands. Adequate numbers of well-trained students in the fields of land surveying, mapping data collection, storage and information supply are strongly in demand in EU labour market. There are too few graduates, at all levels (Vocational Education and Training, College and University).
Besides requirement of skilled graduates, a whole generation geo professionals will retire in coming years. And also other labour market fields (medical care, financial, logistics) are increasingly asking for skills and knowledge related to Geo Information.

If the geospatial Industry is not able to employ sufficient skilled graduates the further development of the above mentioned developments and innovations for a spatially enabled society are at risk.

3. EDUCATION

The geospatial education community is aware of the demands for skills and knowledge that

are required from graduates. At educational institutes worldwide initiatives are taken to adapt curricula and to raise awareness among students. Both initiatives need to result in sufficient graduates with the skills and knowledge that are required by the Geospatial Industry. These developments are supported by Government programmes and international associations.

In order to create sustainable curricula cooperation with the private and pubic sector is required. Working together will enhance the student programmes and improve the quality of the curricula and the skills and knowledge of the graduates. In chapter 4 and 5 national and regional cases are described.

Graduates and professionals need to enhance their skills and knowledge during their careers. Life Long Learning is a recognized principle that education and learning is a continuous process in life. The European Commission embraced this ongoing process of enhancing skills and knowledge with the Lifelong Learning Programme. The programme enables people at all stages of their lives to take part in stimulating learning experiences, as well as helping to develop the education and training sector across Europe.

There are four sub-programmes which fund projects at different levels of education and training:

- Comenius for schools
- Erasmus for higher education
- Leonardo for vocational education and training
- Grundtviq for adult education

Programmes like the Life Learning Projects are useful for the development of the education sector. The outcomes of the projects executed under the program contain information and knowledge that can be applied in other countries and institutions. An example of a Life Long Learning Project is elaborated in chapter 6.

4. THE NETHERLANDS: COOPERATION BETWEEN LABOUR MARKET AND EDUCATION

In early 2008 the Dutch GEO sector consisting of geo spatial related businesses, governmental departments and education institutes concluded that the GEO market is rapidly growing and innovating. However GEO education and curricula was not, it was rather outdated and seemed to be at the end of its life cycle. This was unacceptable to GEO employers both in the private and public sector. In this chapter the combined effort of the private and public sector with the educational sector to tackle this miss match is described.

Between 2008 and 2010, an ad hoc group was formed with organisations representing the private and public sector and the educational sector:

- GEO industry (GBN)
- Dutch association representing GEO education (GIN)
- Dutch Cadastre, Land Registry and Mapping Agency (Kadaster) representing government and public bodies.

Together they gave GEO education a boost by initiating promotional activities, innovating

curricula and bringing education institutes in stronger contact with the GEO labour market. However it became clear that improving the image of geospatial technologies and reforming its education was not as easy as originally thought. Therefore in late 2009, the ad hoc group decided to formalise their activities by establishing a foundation, now known as SAGEO (Stichting Arbeidsmarkt Geo).

4.1 Cooperation Model: Employment Market Foundation SAGEO

The SAGEO Board is composed of organisations which can benefit from the reformation of the educational sector. All board members are representatives of the industry, educational sector and government. Chair of the board is Mr Barnasconi board of directors Kadaster) in his role as employer and government representative.

GEO Branch	Person
Government	Godfried Barnasconi, Board of Directors Kadaster
Education: Vocational Education & Training (VET)	Ed van de Berg, Chairman BHI (industry group) Infrastructure of the VET Council and Executive Board Member Nova College
Education: College (Bachelor)	Ineke van Oldeniel, member Executive Board College Saxion
Education: University (Masters)	Arnold Bregt, Professor Geo information Science Wageningen University and Research Centre
Industry: GIN, association for geo professionals	Louis Smit, Head Surveying dept. Rotterdam, Board member GIN
Industry: GBN, Geo Business Nederland	Fred Janssen, Director Facto Geo Meetdienst, Board Member GBN, member Committee Education & Labour Market.

The mission of the foundations is three-fold:

- Promotion: Various means are used to create awareness among target groups.
- Renewal: Activities are initiated throughout the entire education chain in order to optimally match education developments with labour market needs.
- Connection: Initiatives are developed in order to optimally connect private and public employers with educational and research institutions as well as students.

The first two aspects of the mission focus on improving student enrolment of geospatial technologies curricula. The latter focuses on solving labour market issues, including the demand for good internships and starter jobs.

4.2 Background on Labour market development and research

With the establishment of SAGEO in the Netherlands several reviews and studies are conducted since 2008. The most recent survey was held in February/March 2014. The results for the years 2010, 2011 and 2012 are not yet available[1]. In this chapter the results of these

[1] The results will be available during the FIG Congress 2014 andwill be included in the presentation of this paper

studies are described.

Definitions used in the studies

- Geo information sector: industry where an increase in value occurs because geographic information is created and changed (Geobusiness Nederland, 2009).
- Geo professional: an employee whose main task (over 50%) is the performance of work for geo information products and services (Geobusiness Nederland, 2009).

4.2.1 Geo information sector in the Netherlands

One of the topics of the studies that were conducted was the financial situation of the sector. In June 2014 the complete results from 2010 until 2012 will be available.

	2009	2010 Exp June 2014	2011 Exp June 2014	2012 Exp June 2014
revenue authorities				
Business turnover	968 million €			
Revenue totalled	1,5 billion €			
professionals	15.000			
Turnover by each business	3,4 million			
Professionals in business	9690			
FTEs government	4734	4755		

Figure 1: Turnover overview and professionals over the years (Geobusiness Nederland, 2009).

In the first year after the establishment of SAGEO, there was still some growth in the sector, 8% in the private sector. The trends indicated a shift from 'Business to Business' to 'Business to Government'. There were fewer vacancies and turnover per geo professional was higher than in 2008.
The results of 2010 are only partially available. From these results it is clear that from the 2nd half of 2010 the growth slows down. The trend witnessed in 2009 is confirmed. Most of the private sector orders are coming from the government sector. The main reason for the continuation of this shift is the weak economic growth or even contraction of the economy. In the field of data acquisition there was revenue growth expected due to the arrival of the Key Scale Topography (BGT) (Geobusiness Nederland, 2009).
The global economical crisis influenced the development of the geospatial sector in the Netherlands and tempered the demand for students a little bit. But the demand for skilled graduates is still present.

4.2.2 Labour in relation to supply graduates

In 2008, the demand for graduates was greater than the supply, the curricula of the courses did not correspond well to the needs of employers and the image of the geo information sector was not strong (Sageo, NCG, ITC en GeoBusiness Nederland, 2012).

% of employers that need these skills per educational level	2012 MBO (VET)	2012 HBO (College)	2012 WO (University)	2013 MBO (VET)	2013 HBO (College)	2013 WO (University)
GEO ICT	6	73	70			
Commercial GIS-packages/ and or open source	31	73	60			
Social and communication skills	38	73	70			
Database analysis	0	60	50			
Database management	31	60	30			
Surveying	94	27	0			

Figure 2; graduate skills that employers need per educational level (Sageo, NCG, ITC and GeoBusiness Netherlands, 2012).

Four years later, in 2012, a change in handling geo information on different levels was observed. This was due to the development of geo information applications and the demand from the spatially enabled society. It involved especially the integration of geo information in customer processes, the change of data supply to more consultancy assignments and from visualization of data to applying the information.
In 2012 there was especially a shortage of college level graduates. The employers then had a preference for graduate geo professionals with different skills than in 2008:

- There was a particular need for people who can work with laser data, point clouds, 3D and object-oriented data.
- A surveyor should be able to obtain the data outside and to process the data inside.
- There is a need for people who can structure the data and make the translation of data into information.
- Municipalities have specific need for college graduates who can guide outsourcing and relate local data to key registries.
- There is a need for college and university level graduates with a computer science background who can handle geo data and -software (Sageo, NCG, ITC and GeoBusiness Netherlands, 2012).

In the coming years, many organisations in the public and private sector confirm the need for geo professionals. Of this need, 50 % is VET level, 40 % is College level and 10 % is university educated (NJC Education Expertise, 2011).
However graduates who followed a geo specialization had no preference for a complete geo training. The awareness of geo in the non traditional geo branches was low (Sageo, NCG, ITC en GeoBusiness Netherlands, 2012).

The public and private sector are aware on what is needed to live up to the demands and potential of society. The students still have limited awareness of the possibilities of a career in the geospatial industry. But the first steps to improve the education sector have been taken.

4.2.3 Education development

SAGEO has achieved a lot education level. In recent years with the help of SAGEO three education programmes started in all three levels, VET, college and university.

At VET level a Surveying program is established that students can follow after they have attended the Infrastructure education program for three years. The program exists since 2013. This program is developed in collaboration with employers, the private sector and training centre IPC Groene Ruimte. It is a modern education that will educate skilled specialists. In the nearby future more surveyors are required. As a result many surveyors are employed right after graduation at Kadaster, in building and civil engineering companies, engineering firms with at architectural firms, municipalities, etc.

At college level, there is a new training Geo Media & Design established. This program exists since 2012. In this course you will learn to combine the Geospatial Information for new applications and data visualisation. In 4 years the students explore the worlds of virtual reality, serious gaming, YouTube, visual journalism, info graphics, combined with geography. With Geo Media & Design you create geographical awareness and make complex issues understandable. Students will work with issues and provide ideas and solutions in a spatially enabled society.

The National GI minor was launched in 2012. Knowledge and experience of geo information is compiled in a joint minor by six different universities. Also at the National GI Minor, employers from industry and government are closely involved. The National GI Minor is designed for students at University or College level with basic knowledge of geo information. The minor focuses on third-year students who have completed an introductory geo information course at one of the participating universities. Students at other universities and colleges with knowledge of geo information and professionals who want to learn more about geo information are also welcome to attend.

5. FLANDERS (BELGIUM)

In Flanders, Belgium the same trend is noticeable. Due to a wider application field of geo information, new forms of acquisition, management and delivery of geo data are required. This requires employees with different profiles and new competencies.
For that reason investment in the future of Geo information sector is necessary so that the continuation of the innovative activities are not compromised.

5.1 Geo information sector in the Flanders (Belgium)

The partnership GDI Flanders aims to optimize the production, management, exchange, use and reuse of geographic data sources and geographic services within Flanders. The organisation includes all Flemish authorities.
In 2011, the council for development of Geo Data Infrastructures (GDI Council) wrote a report on the discrepancy between the demand for and the supply of skilled personnel drafted in the geo ICT sector. The main conclusion was as follows: "The Flemish geo ICT sector is facing a shortage of skilled personnel. This applies both for the industry and for the government. There are far too few people who graduate in this direction and this while new

application areas in the geo domain arise. This has an inhibitory effect on the economic impact of the sector.
It is estimated that 75 students are graduating each year in Flanders. This offer can not meet the increasing demand for about 200 employees in Belgium. Given the increasing use of geo information the demand will only increase. For the sector, this shortage is a problem because it brings the continuation of their (innovative) activities at risk."(Department for the General Government Policy, 2012).

5.2 Labour in relation to supply graduates

In 2012, a study was carried out to the required profiles and competencies of employees in the field of geo information. The main conclusions from the study are as follows: "The most important competences of GI-professionals is knowledge of data processing and databases. In terms of data processing (and data acquisition, processing and presentation) are GI-employers satisfied with the knowledge of graduates, while they are less satisfied with the knowledge of databases (and web development and geo -web- development). There is a clear growing demand in the need for geo ICT know-how. Organizations currently handle this mainly to retrain their employers or recruit a specific profile. However, there is not enough supply as regarding to educational programs, because the majority of respondents would find it very useful to have additional geo -ICT trainings organized for their employees. In the case that GI-employers recruit specific profiles, the most desired qualifications for the domains is those of databases, programming, web development and geo -web- development (all geo -ICT domains) that a computer scientist. It is notable that other qualifications (e.g. Geography and Land Surveying / Geomatics) are much less specifically required for the different GI domains, while there is still a need for employees with strong spatial insights and knowledge."

In response to the investigation, the GDI Council made five recommendations.

- make the geo ICT sector known in Education
- Integrate ICT and GDI in geo training
- integrate geo courses in other courses
- bring students into contact with the labour market by the middle of internships
- make work experience certificates (Department for the General Government Policy, 2012).

Both at national level in the Netherlands and at regional level in Flanders private and public sector joint forces to tackle the quest for sufficient qualified graduates.

6. GEOSKILLS PLUS PROJECT

At European level Member States of the European Union are struggling with challenges of linking geospatial education to labour market needs and to share best practices. In this chapter the project Geo Skills Plus is described and information about the background, the aims, partners and work packages is provided.

Education and Culture

Leonardo da Vinci

The project Geo Skills Plus is a "Transfer of innovation" project. The aim of Leonardo da

Vinci Multilateral Projects "Transfer of Innovation" is to improve the quality and attractiveness of Vocational Education and Training (VET) in the participating countries by transferring existing innovations to new legal, systemic, sector, linguistic, socio-cultural and geographic environments through working with transnational partners. Innovation transfer projects generate synergies by exploiting existing VET innovations (no "re-inventing the wheel").

This project will transfer the Dutch experience to Belgium, Bulgaria, and Lithuania (Transfer of Innovation, ToI) and share best practices between the countries in order to avoid reinventing the wheel and unnecessary costs. The overall objective is to encourage cooperation between geospatial vocational education and training (VET) in Europe and the labour market. This will improve alignment between the geo labour market and education in the concerned countries.

The project started in October 2013 and will be finished in September 2015. The first result will be presented during a workshop in May 2014.
The project is financed by a grant under the Leonardo da Vinci Programme of the Lifelong Learning Programme from the European Union. The projects is focusing on Vocational Education and Training (VET). During the project the research will focus on VET level but also take into account the developments at higher education.

6.1 Aim of the Project

The overall objective is to encourage cooperation between geospatial vocational education and training (VET) in Europe and the labour market. This will enhance employability and participation in the geospatial labour market.

The chosen partnerships for this project will ensure that the transfer of innovation is successful as each organisations shares similar problems and they have comparable responsibilities related to the project. In addition, the partnership has been carefully chosen in order to represent in different European levels of maturity, the possibility of adapting geospatial vocational education and training to labour market needs. Ideally this can go beyond the transfer of innovation and lead to stepping stones towards a European approach for other Member States.

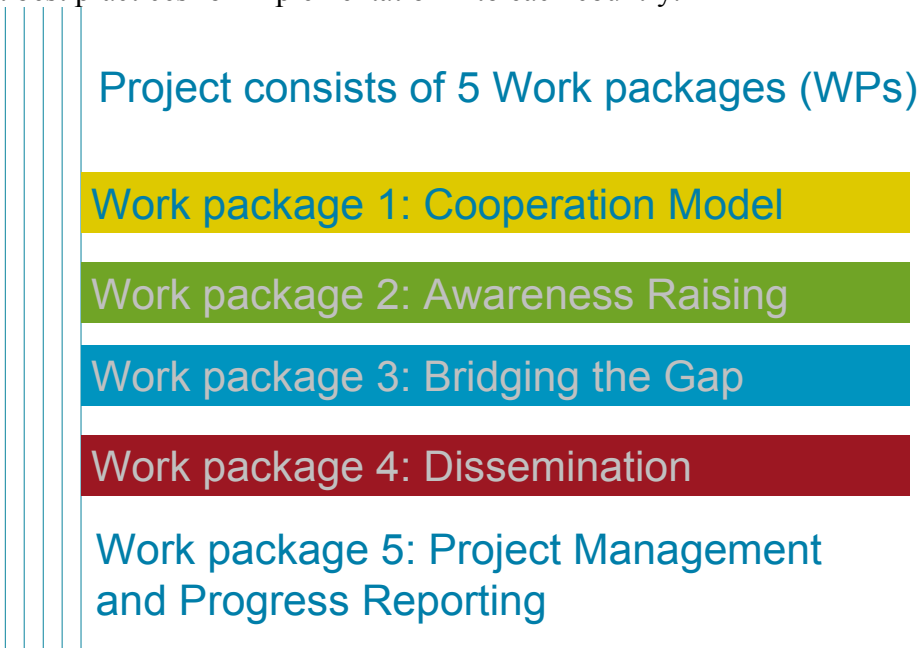
- Dienst van het Kadaster en de Openbare Registers (Kadaster, the Netherlands)
- Belgium Order of Surveyor Experts (BOLE Vzw, Belgium)
- Geodesy, Cartography and Cadastre Agency (GCCA, Bulgaria)

- Vilnius Gediminas Technical University (VGTU, Lithuania)
- Council of European Geodetic Surveyors (CLGE)
- European Association of Geographers (EUROGEO)
- Flemish Association for Geographic Information (FLAGIS, Belgium)
- GEO Employment Market Foundation (SAGEO, the Netherlands)

6.2 Work Packages

The project consists of 5 work packages.

- A **Cooperation Model** (among geospatial labour market, education community and other interest groups) will be developed and implemented in Belgium, Bulgaria and Lithuania. This is a major step towards providing an infrastructure to improve skills for geospatial vocational education and training (VET).
- Define **Awareness Building** approaches for improving cooperation between geospatial education and the world of work. The specific actions will focus on collecting information on existing approaches and analysing them for transfer of innovation to Belgium, Bulgaria and Lithuania. By focussing on awareness building, public/private cooperation, innovation of vocational education and strengthening of relationship between students and employers will be enhanced.
- Transfer/exchange ways to **bridge the gap** between the European geospatial education community and geospatial labour market. Together with the project partners, they will define to which extent a gap exists in Belgium, Bulgaria and Lithuania. They will document existing initiatives in each country that are battling the gap and they will select best practices for implementation into each country.



- **Dissemination** will emphasise the need for all partners to take an active role in spreading the news about the project in their own spheres and countries. This is a great way of producing a multiplier effect.

- **Project management** will be focused on the achievement of all project objectives by carrying out activities in time, with allocated human and financial resources and reported in accordance with LLP-regulations, as well as maintaining the contacts with partners, the National Leonardo Agency and other actors involved within the project.

During a workshop in May 2014 the first result will be presented. During this meeting the definitions and examples and best practices will be discussed for the first three work packages will be presented[2].

7. Conclusion

By achieving harmonisation of education in the geospatial industry it will open possibilities for students towards connecting education programs in other European countries, opening the whole of Europe as a potential job market.
With the implementation of best practices to raise awareness adequate numbers of well-trained students in the fields of land surveying, mapping, data collection and GEO ICT will become available for the EU geo labour market. They will be able to fulfil EU needs for transparent and uniform registrations, processes and products as key assets of a well-functioning European land and buildings market and a European geospatial infrastructure.

The results of the regional, national and local initiatives can be spread globally to enhance the relevance of education in the geospatial industry and encourage the further development of a spatially enabled society.

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Departement Diensten voor het Algemeen Regeringsbeleid (DDAR), Stafdienst van de Vlaamse Regering, 2012, Investeren in de (geo)toekomst door het verbeteren van de aansluiting tussen onderwijs en arbeidsmarkt op het vlak van Geo ICT.

NJC Education Expertise, 2011, Market vocational training geo ICT

[2] The results will be available during the FIG Congress 2014 andwill be included in the presentation of this paper.

BIOGRAPHICAL NOTES

Paula DIJKSTRA, Coordinator Back Office, Kadaster International.
After obtaining her Master Degree in Social Geography and an additional course in Geographic Information Systems, she joined NAVTEQ as a Geographic Analyst, responsible for updating the database using geocoding. After one year she was promoted to Team Leader where she led a team of 11 geographic analysts at 2 locations. Here she developed her project management skills and gained experience in resource management.

In 2008 she joined the Dutch Cadastre, Land Registry and Mapping Agency (Kadaster), leading a team of 40 employees in interpreting digitized official notarial deeds. Also Paula worked as management secretary of one of the management teams of Kadaster. In 2010, Paula changed departments within Kadaster. She became Coordinator Back Office at the Kadaster International department, supporting the Director and Regional Managers. She is responsible for tender management, project risk assessment, project administration and project archiving. She has knowledge of different donor regulations systems for tender procedures. Part of her job is to organise and moderate study visits to Kadaster.

Paula is one of the visionaries behind the establishment of Jong Kadaster, a non profit association for young (new) Kadaster employees. Paula is also a leading player in building a global Young Surveyor Community. She organised the first European Young Surveyors Meeting (Lisbon, 2013).

Bettine BAAS, Project manager, Stichting Arbeidsmarkt Geo/ Kadaster
After obtaining my bachelor degree in Environmental Technology I worked at several jobs, I've been a mailwoman and worked at the Ministry of Agriculture, Nature Management and Fisheries. After that I became an assistant project leader at the Dutch Cadastre, Land Registry and Mapping Agency (Kadaster). Here I worked for two years at the Rural Development Department. I rated objections and I performed the treatment of the complainants. I developed to project leader and then to project manager. As a project manager I lead al sorts of projects and I am responsible to achieve the project goals in the given time and available budget.

The last years I also work for the Geo Employment Market Foundation (Stichting Arbeidsmarkt Geo).
For this work I have a lot of contact with various employers in the geo workfield, with educational institutions and geo students. I provide the general communication and I maintain the platform Geoplaza. On this platform, companies place internships and starters jobs on witch students can apply.

Besides that I was a director at JongKadaster (a non profit association for young (new) Kadaster employees) directly after the establishment. With my co-directors we have put down a well organized association representing the interests of young people in the Kadaster. I am also active in the national and recently established network group JongGeo.

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