

# **Land Surveying Education in Sweden: Addressing Global Challenges**

**Märit WALFRIDSSON, Marina EDLUND and Stig-Göran MÅRTENSSON, Sweden**

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## **SUMMARY**

This paper elucidates changes in knowledge of surveying professionals and how these changes are being addressed by the educational programmes in Land Surveying at the University of Gävle (HiG), Sweden. Specifically, it concerns the Bachelor's programme which runs under a three-year period and is divided into two separate specialisations, namely Land Surveying and Land Management. At present, the graduates of this programme are highly demanded by the labour market and easily employed after graduation. At the same time it comes forward that the educational programme requires a regular revision to best correspond to the ever-changing reality. Specifically, the paper emphasises changes initiated at HiG to address persistent development of profession. Foremost, it concerns a significant modernisation of the existing Bachelor's programme in Land Management and an introduction of a new Master's programme in Land Surveying.

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## 1. INTRODUCTION

The land surveying profession and land surveying education are interconnected and vary around the globe. In Europe, particularly, educational profiles of surveying programmes are very diversified (Mattsson, 2001). For example, in Austria and Germany technically oriented surveying curricula prevail at universities (Allan, 1995). On the contrary, in Nordic countries various economic courses along with courses in planning, urban and rural development are extensively studied (Ernald Borges, 2007). Such an emphasis on planning and economic courses is surely determined by certain tasks performed by surveyors in a particular country. The overarching goal of education is thus to provide students with update knowledge meeting the ever changing needs of the society along with immediate global challenges.

Global challenges such as global warming, causing extreme flooding and severe draughts, concern all the countries, despite their economy and total population. Their negative effects are complemented by population growth that brings up extensive urbanisation with growing informal settlements. To cope with these challenges, the international community has recently adopted the 2030 Agenda for Sustainable Development (UNDP, 2015). The 2030 Agenda is to be achieved through 17 Sustainable Development Goals (SDGs) that come out from the Millennium Development Goals (MDGs) ceased to affect by 2015 (UN, 2014).

Specifically, to meet these complex world problems in a sustainable way requires professionals who are able to tackle various aspects and have specialised knowledge supplemented with knowledge about sustainable development. Universities have to react operatively on rapid environmental, technical and economic challenges by constantly revising curricula. How do universities accommodate these ongoing changes into their curricula, what reasons and justifications lie behind? This article investigates these questions on the example of the Land Surveying education at the University of Gävle in Sweden.

## 2. LAND SURVEYING EDUCATION IN SWEDEN

At present, there are four universities in Sweden, providing a Bachelor of Science (BSc) and/or a Master of Science (MSc) degree in Land Surveying. They are the Royal Institute of Technology in Stockholm (Kungliga tekniska högskolan, KTH), the Lund University (Lunds universitet, LU), the University of Gävle (Högskolan i Gävle, HiG) and the University West in Trollhättan (Högskolan Väst, HV). These universities educate specialists demanded by the Swedish labour market and, as such, provide a variety of courses adapted often to the local conditions (Ernald Borges & Eidenstedt, 2008).

These educational programmes in Land Surveying are being constantly revised for graduates to be able to smoother transfer to the profession and to deal with the complex reality. Recently, for example, the MSc programme in Real Estate Development and Financial

Services at KTH was substituted by the new MSc programme in Real Estate and Construction: Economics, Law and Management. One of the reasons for the curriculum modernisation was to make a new MSc programme more attractive for students and therefore for labour market, especially after introduction of tuition fee for international students in Sweden in 2011 (Vaskovich, 2012).

## 2.1 Land Surveying at the University of Gävle

The Land Management/Land Surveying (LM/LS) study programme was established at the university in 2009. The programme normally lasts three years of full-time studies and covers 180 credits in the European Credit Transfer System (ECTS). This equals to twelve study periods of ten weeks each. Most periods consist of two parallel courses (7,5 ECTS each). The programme is hosted at the Department of Industrial Development, IT and Land Management at HiG. Its predecessor was a traditional Geomatics programme with a limited specialisation in Land Management. Due to a decline in the property market in Sweden at the beginning of 2000, recruiting students to a technical specialisation such as Geomatics was difficult; as was the name itself! Geomatics, by name, was (is) not very well recognised in Sweden, nor what it means. So, a decision was taken to both rename the programme and to reorganise it to contain a lot more land management courses. In fact, the content increased to a level such that the new programme had to be split into two specialisations, i.e. Land Management and Land Surveying. It also offered two types of degrees, a Bachelor of Science (BSc) and a Bachelor of Science in Engineering (BScE). As the name changed – and the programme offered two specialisations – the property market regained – the number of applicants to the new programme increased dramatically (table 1).

**Table 1:** Number of applicants to the Geomatics programme with specialisation in LS and to the LM/LS programme at HiG 2004–2016.

<i>Academic year</i>	<i>Geomatics (LS)</i>	<i>LM</i>	<i>LS</i>	<i>Total</i>
2004/05	15	-	-	15
2005/06	21	-	-	21
2006/07	20	-	-	20
2007/08	14	-	-	14
2008/09	19	-	-	19
2009/10	-	17	34	51
2010/11	-	34	29	63
2011/12	-	25	42	67
2012/13	-	56	62	114
2013/14	-	65	80	145
2014/15	-	55	81	136
2015/16	-	54	56	110
2016/17	-	50	53	103

In 2013 the LM/LS programme was evaluated by the Swedish Higher Education Authority (UKÄ) and both degrees (BSc and BScE) were awarded the highest possible rank “Very high quality”. This is the only study programme in Sweden within the LM/LS area awarded this rank.

To meet the demand of the increasing number of students, a number of qualified staff members have been recruited since the establishment of the new BSc programme. They are both experienced professionals from the field of geodesy/surveying and land management as well as highly qualified (PhDs) lectures and researches. Moreover, the application for the awarding postgraduate and PhD qualifications in Geospatial Information Science comprising LM, LS, Spatial Planning and Computer Science was approved during 2014.

The LM/LS programme deepens students' professional knowledge in Property Law and Economics as well as in Applied Geodesy with a broad elaboration on issues of gender, equality, ethics, democracy, corruption and sustainable development within a professional context. In this way, SDGs are covered by the land surveying curricula. Specifically, students get this update knowledge through a number of courses as *Spatial Planning* and *Earth Science* where these important components are studied theoretically with their practical application. Both specialisations include courses, covering issues of who are entitled to use real property from a gender perspective and how these issues affect profession and the society as a whole. In this way, the graduates are prepared to deal with these problems while facing them in practice after having completed their studies. Moreover, the programmes applies project-based education where these components run as the silver thread through all the courses. Thus, lecturers and researchers of the programme are experienced in project-based education along with emphasising gender and equality aspects of the profession.

### 2.1.1 Modification of BSc programmes in Land Surveying

Since 2009 the existing BSc programme in LM/LS has already undergone a major modification in 2015. This modification has comprised several decisive issues. Specifically, one of the issues has been the number of courses in *Mathematics* in the existing surveying curriculum. How much mathematics do land surveyors need for successful work in practice? Does a land surveyor or a land manager need courses in e.g., *Advanced Algebra* or *Multidimensional Analysis*? Also, such a modification will affect students' need for an option to get a degree not only in science but also in engineering. Is this dual possibility beneficial for students in the future (e.g., does it increase their employability?), or is it reasonable for the university to keep both options (a cost/benefit perspective)? Furthermore, there has been a discussion about how to improve the course in *Urban Development*. The main course challenge was to clarify the interconnection between land use planning/zoning and property formation. The interconnection has become a major issue in Sweden, as in many other countries, due to the emerging need for effective housing supply.

Above all, the following modifications are now in place for both specialisations:

- Closer adaptation to the studies and the profession of land surveyor and land manager.
- Reduction of the number of traditional university courses in *Mathematics* to *Applied Mathematics* (e.g. from 22,5 ECTS to 15 ECTS).
- More adapted introduction to the area of the programme/specialisation.
- Review and updating of software applications used in the programme (e.g. in *Unmanned Aerial Vehicle (UAV)-Photogrammetry*, in *Physical Planning* and in *Construction Aided Design (CAD)*).

- Development of a new course in *Management and Development of the Built Environment*, including implementation processes, stakeholders, roles, etc.

Before modification of the LM/LS study programme, the numbers of joint courses for students of both specialisations used to be 58 % and after modification they are 50 %.

For the Land Management specialisation, a new advanced course in *Acquisition and Compensation* and a course in *Real Estate Economics* with focus on rural economy have been developed. Furthermore, to provide students with an overview of the existing property systems all over the world, the course in *Real Property Systems: National and International* has also been established. This course is introduced due to a common understanding of that students shall have the whole picture of property formation in the world in order to better understand a role of the Swedish property sector and to identify the Swedish problems from an international perspective.

The Land Surveying specialisation has mainly been modified by updating the content of the existing courses. The main idea with course modification is to adapt knowledge, transferred to students, to the ever-changing reality with global challenges, the demand of the society and rapid IT development. Specifically, almost all new courses (except pure technical ones) have been developed in line with important issues such as sustainable development, democracy, gender equality and human rights. For example, the course in *Management and Development of the Built Environment* that has a social component considers land development on a local level as a single whole. It means that issues of social justice, attractiveness of the built environment, health and democracy in planning process are specially emphasised. In turn, the course in *Earth Science and Geomatics* consists of natural components and therefore pays more attention to exploring mainly environmental problems and sustainable development both in Sweden and worldwide.

#### 2.1.2 Establishment of closer cooperation with other BSc programmes at HiG

For the university it is rather unfavorable to run a course with a few students (e.g., up to 15). Since a number of students vary from year to year, it has become more acceptable at HiG to have joint courses with students from the adjacent study programmes. Specifically, students of the LM/LS programme take certain courses together with students from the Spatial Planning and/or the IT Systems Development in Geographical Information Systems (IT/GIS) study programmes. The BSc programme in Spatial Planning has annually approximately 40 students, the BSc programme in IT/GIS – approximately 30 students annually and the BSc programme in Real Estate Agent programme has approximately 120 students. Thus, courses with up to 160 students are a teaching reality at HiG nowadays. In this case, the teaching manpower is used in the most effective manner.

On the contrary, if it would be a course for a few students, the Department would not cover its course expenditure. Another positive moment of having a course for students from different programmes is that students get closer to each other, jointly work within a project and thus exchange ideas from different scientific fields.

### 2.1.3 Demand for single and distance courses

The Swedish labour market is in a keen need of land surveyors with relevant academic education. At present it is, however, difficult to recruit such specialists due to their shortage on the labour market. In reality, employees at land surveying organisations (state, municipal and private) do often lack academic background in land surveying and therefore relevant competence. Thus, these specialists need a solution of where to complement their primary academic education with professional knowledge. The solution is to have e-courses (distance based courses) at universities. These courses might be the courses given within the BSc study programme and accessible for students outside the university. Specifically, some students might complete their academic education and discover difficulties to find suitable employment or even to become uninterested in the chosen profession. Thus, the mentioned groups need a possibility to complement previous academic education with courses covering land surveying and land management.

Furthermore, due to the extended territory of Sweden with its elongated shape and long distances, students may, in some cases, be affected by this geographical factor. For example, some students permanently reside with their families and therefore have difficulties to travel across Sweden for shorter periods. This strengthens a need for distance education when students can freely allocate the time for their studies. Besides, this approach supports gender issue due to an excellent opportunity for women to study and spend time with family at home.

### 2.1.4 Students in the programme

The students enrolled at the LS/LM study programme have their origins from different regions of Sweden. However, there is a tendency towards a dominance of students originating from university surrounding areas. The proportion between male/female students is equal in the programme as a whole. Specifically, percentages of female students at Land Surveying and Land Management are 39 and 63, respectively (based on students started their study the year 2016).

### 2.1.5 New Master of Science in Engineering

The market's need for higher education (i.e. demand for specialists with Master's degree) has recently initiated development of such a programme at HiG. The aim has been to develop a well-known and prestigious *civil engineering programme* adapted to the Swedish circumstances. *Civil engineering*, in the Swedish context, is the opposite of military engineering. The latter was the only way to obtain an engineer's degree in former days. During the 1900<sup>th</sup> century, along with the industrial revolution, needs for professional civil engineers arose and such programmes started in various disciplines, e.g. in Mechanical Engineering, Chemistry, Civil Engineering and Architecture.

With the introduction of the Bologna declaration (Bologna-Declaration, 1999), civil engineering programmes were debated in Sweden. Because of their well-known reputation good reputation, it was decided to keep the programmes even though they did not correspond to the 3 + 2 year educational structure in accordance with the Bologna declaration. Today the

civil engineering programmes in Sweden are five-year programmes. They are generally thought as a one five-year programme, thus not completely in accordance with the Bologna declaration. The thesis project covers the last term of a programme and in a Degree certificate the English translation “Master of Science in Engineering (MScE)” is often followed by the professional specialisation, e.g. Land Management or Land Surveying.

In HiG’s case, the two specialisations LM and LS are going to be merged as close as possible during the five years. This will particularly be true during the first two years when *Mathematics* and *Natural Sciences* will be introduced along with joint introductory subjects like *Geodesy*, *Cartography*, *GIS*, *Spatial Planning* and *Real Property Law*. The following three years will be devoted to each specialisation, while approximately 30 % will be joint courses.

During the introduction of the MScE programme at HiG, the popular three-year Bachelor of Science programme will also be run to cover the demand of professionals for the Swedish market. Future will show if the three- and five-year, programmes will be run parallel or if the five-year programme, in accordance with the Bologna declaration, will be divided into 3 + 2 thus provided a possibility to leave after three years with a Bachelor’s degree. In fact this possibility has already been introduced at several MScE programmes in Sweden.

The MScE programme normally provides students with an opportunity to study for a certain period abroad, often 0,5–1 year, which is another intention with the Bologna process, namely to enhance cooperation among the universities of the European Union. The Bologna declaration has become a fundament for establishment of the European Higher Education Area (EHEA) in 2010. The EHEA serves to make systems of higher education in Europe more comparable, compatible and coherent. During the last decade the EHEA has been consolidated (European Commission, 2015). This allows students to freely travel and study in different European universities and provide an opportunity to share knowledge and experience.

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## **BIOGRAPHICAL NOTES**

Märit Walfridsson works as Director of Studies for the Land Management/Land Surveying study programme, the University of Gävle (Sweden). She has long experience in the LM/LS area, the last nearly twenty years as head of among others indoor education in land administration and land surveying at Lantmäteriet, the Swedish National Mapping, Cadastral, Land Registration Authority as well as at Swedesurvey, the overseas agency of Lantmäteriet.

Marina Edlund has been working as Senior Lecturer in Land Surveying at the University of Gävle. Since 2016 she acts as a process developer at Lantmäteriet, the Swedish Mapping, Cadastral and Land Registration Authority. Her scientific interests lie in the area of land administration with focus on urban development and institutions.

Stig-Göran Mårtensson, PhD and Associated Professor in Geodesy, former Director of Studies, was the initiator of the Geomatics programme, as well as to its transfer to the existing LM/LS programme. He has more than 40 years of experience with LM/LS study programmes and with associated research fields.



## CONTACTS

Märit Walfridsson  
University of Gävle  
801 76 Gävle  
SWEDEN  
Tel. +46705341363  
Email: [marit.walfridsson@hig.se](mailto:marit.walfridsson@hig.se)  
Web site: <http://www.hig.se>

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