



Academic Association of Sales Engineering

AASE Roadmap on Sales Engineering Education

Aschaffenburg, February 2016



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About the AASE

In June 2014, representatives from Austrian, German, Finnish and French higher education institutions came together to found the Academic Association of Sales Engineering AASE.

The objectives of the AASE are

- ❖ to strengthen the image of the Sales Engineering profession in schools, colleges and universities, enterprises, associations, politics and the general public,
- ❖ to continuously improve the education of Sales Engineers,
- ❖ to harmonize sales engineering education programmes and to encourage and facilitate student and teacher exchanges, and
- ❖ to set up sales engineering specific research projects and programmes.

Therefore, the AASE decided to concentrate its work in three working groups:

- ❖ a Research working group,
- ❖ an Education working group,
- ❖ a Public relations working group.

The AASE is open to all people working in sales engineering education at higher education institutions in Europe, such as deans, professors or teachers.

An AASE student organisation has been created too within some of higher education institutions with sales engineering education programmes.

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Executive Summary

The SE profession is actually suffering from a lack of visibility and distinctiveness. Therefore, a SE career is not a natural choice for students. This is closely linked to two other findings:

- ❖ The estimation of annually needed SE for European companies is significantly higher than the graduates of the now identified EuHEI.
- ❖ The identified SE education programmes are mainly concentrated in Germany, with some EuHEI in Austria, Finland and France.

The aim of the present roadmap is to structure the future works of the AASE education WG within several actions to achieve the four following objectives:

- ❖ Increase the knowledge about the SE profession
- ❖ Guarantee high quality, well adapted and attractive SE education
- ❖ Increase the visibility and the acceptability of SE
- ❖ Develop SE education programmes all over in Europe

Therefore, seven actions have been defined contributing to these objectives.

A survey within European companies will set the basis of the subsequent actions and permit to specify more precisely the SE profession, to identify the industrial need on SE and to determine required core knowledge, competences and skills.

Based on these findings, a core basis for SE education will be developed, and existing and future SE education programmes will be harmonised to facilitate students' and teachers' exchanges between participating EuHEI. Common and shared teaching tools and methods will help to increase variety of education and thereby its attractiveness.

The survey results, in combination with the recommendations about the core education basis will help further EuHEI to argue and to implement new SE education programmes helping thereby reducing the gap between the graduates and estimated annual SE needs.

A certification process will help to guarantee high quality and well adapted SE programmes corresponding to industrial expectations. Certification will also contribute to increase the visibility of the SE profession, which will make it an easier career choice for future students.

The creation of officially accepted Bachelor and Master Degrees of Sales Engineering (B.SE./M.SE.) is integrated in the present roadmap as a long-term objective. This step will finally make the SE education as known as engineering or economics studies.



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List of abbreviations

AASE	Academic Association of Sales Engineering
bfi	Berufsförderungsinstitut (Vocational Training Institute)
et al.	et alii / et alteri (and others)
EU	European Union
EuHEI	European Higher Education Institution (universities, universities of applied sciences, schools)
GSSI	Global Sales Science Institute
Ph.D.	Philosophiæ doctor, here: Holder of an academic title of doctor
RDI	Research, Development and Innovation
SC	Supply Chain
SE	Sales Engineer or Sales Engineering (see context)
UAS	University of Applied Sciences
VDI	Verein Deutscher Ingenieure (German Engineering Association)
VDMA	Verband Deutscher Maschinen- und Anlagenbau (German Engineering Association)
VN	Value Network
WG	Working group



1 Introduction

“The awareness that the sale of our products needs the same profound training as their production gains increasing importance especially in today’s economic climate.” This citation extracted from a VDI Activity Report 1928/29 (cited in: Mathieu et al. 1963) is always of high actuality! Nearly 100 years later, the mention “Sales engineer” (SE) is still not clearly defined. It is neither a well-established academic career choice at European Higher Education Institutions (EuHEI) nor is it an officially recognised profession, although SE play a very important role in the valorisation of investment goods, especially in the today’s global market and its international value chains with multiple B2B interfaces. The AASE, founded in June 2014, aims at promoting the SE profession by federating all academic actors implicated in SE education, and at cooperating on educational, research and PR issues.

In line with the AASE objectives, the Education WG intends to participate in the promotion of the SE profession by assisting all member EuHEIs as well as interested third party EuHEI to develop and to offer well adapted, high quality and attractive SE education programmes.

The idea and the concept of this roadmap have been discussed for the first time during the working group meetings in Düsseldorf (Germany) in November 2014, and in Belfort (France) in April 2015. The concept has then been presented and approved at the annual AASE Meeting in Bochum (Germany) in June 2015.



Figure 1: Participants of the AASE Education WG in Karlsruhe/Germany

From left to right: Ludger Schneider-Störmann (Aschaffenburg), Timo Holopainen (Turku), Marion Murzin (Karlsruhe), Oli Mertanen (Turku), Maha Ben Amor (Karlsruhe), Thomas Röhr (Belfort), Tero Reunanen (Turku), Arndt Borgmeier et Jobst Görne (both Aalen)

The aim of this roadmap is to set up a common and concerted framework of actions to reach the objectives described in chapter 4 within the next years.

Some of the questions posed at the beginning of this work are shown in figure 2.



Figure 2: Open questions on SE education
(Source: AASE Education working group, 2014)

A roadmap is a plan that matches short-term and long-term goals with specific solutions and actions to help meet those goals. That's why this approach has been privileged to structure the future work of the AASE Education WG. It helped to reach a consensus about the needs and the actions required to satisfy those needs; and it provides the framework to coordinate and realise the actions.

This document describes the two first steps of the roadmap process:

- ❖ An accepted starting situation, the hypothesis and the objectives.
- ❖ The defined actions and milestones to reach the fixed objectives.

The third step of the roadmap process consists in the follow-up actions and their results. This document doesn't include any results, but the description of those actions seen as essential to reach the goals.

Four AASE partners, Turku UAS (Finland), ESTA School of Business & Technology (France), Ruhr-University Bochum and UAS Aalen (Germany) participated in an Erasmus+-project proposal submitted on February 2015. They have been joined by University of Molise (Italy) and several institutional and industrial partners. The project called "BECOSE - Boosting European COmpetitiveness by introducing professional Sales Engineering education" was intended to work on most of the presented ideas of this roadmap. Unfortunately, BECOSE has not been funded by the European Commission, but all partners agreed to tend a second chance in the 2016 call. This would help to accelerate the work described in this roadmap.

The present document about the AASE Roadmap on Sales Engineering Education is the summary outcome of one year work and reflexions of the AASE Education WG.



2 Starting situation

The economic development of the EU member states is dependent on the ability to sell products and services efficiently within the EU and with best possible profit to outside of EU. If EU wants to keep its worldwide leading position in the designing and manufacturing of complex technical solutions, supporting new technologies RDI (research, development and innovation) will not be sufficient. Future business success will depend upon the long-term customer relationship and the ability of the Supply Chains (SC) and Value Networks (VN) to develop products and services around the current and future needs. Sales is in a crucial role in capitalizing products and services to succeed in the market, like stated in the EU's Innovation Union objective "Getting good ideas to the market" (European Commission 2010).

One company can't anymore handle all needed business activities individually. They have to specialize and focus on their expertise. In modern business-to-business trade companies are not necessary anymore competing against each other's but the competition is between SC/VN. Companies own performance and performance of the SC/VN can't be separated and overall performance is bonded via sales. If this performance - boosted by excellent level RDI or other main factors - is destroyed by poor sales, all other value adding work is lost.

In 2013, the volume of the European investment goods production¹ exceeded 2,000 billion Euros (Eurostat 2014). These sales needed persons able to understand the technical products and to negotiate with the customer. No study could as yet be identified where the number of SE needed by European companies now and in the future had been investigated. Taking some simple hypothesis, an estimation of an annual need of about 11,000 to 12,000 well-formed SE graduates can be deducted, figure 3.

¹ Category codes 22.x to 29.x according to the European 'PRODCOM List 2013





Figure 3: Estimation of the European annual need of SE graduates

EU is funding the technological RDI by the Horizon 2020 programme with more than 40 billion € for the only areas of Industrial Leadership and Excellent Science (European Commission 2013), figure 4. This remarkable investment is gaining new value adding services and products. There is a huge potential to commercialize and sell these new innovations within Europe and around the world if there are sufficient well-educated European SEs.

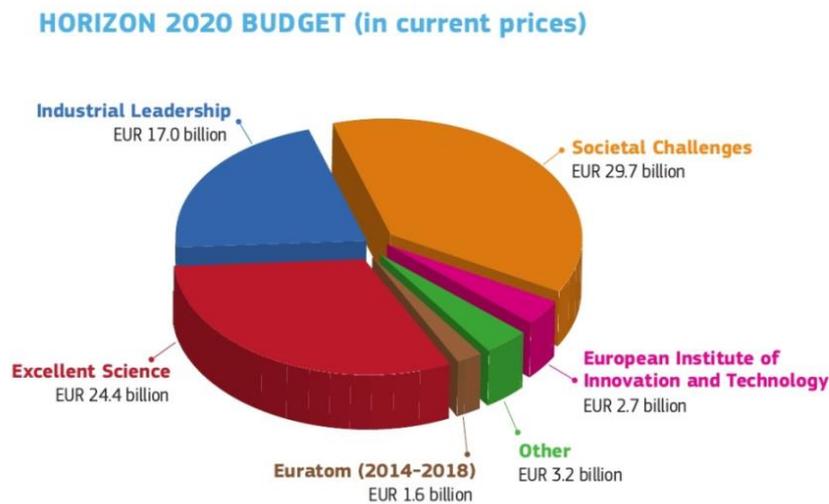


Figure 4: Horizon 2020 budget by main areas (European Commission 2013)

But according to the Global Sales Barometer (Panagopoulos, Guenzi 2011), provided by the Global Sales Science Institute GSSI, the lowest average levels of sales competencies were found in European countries where USA and some Asian countries were outperforming.



A cruel fact is that EU enterprises can't get enough high-class sales professionals with competencies to sell technical products and services in international forums. This weakens EU companies' possibilities to grow or even survive in the global markets. The general solution for the EU companies today is to employ for sales issues technical engineers who never have studied sales and often got just a short training or must learn sales by doing. This fact is underlined by the results of a VDMA study (2013) showing that in 2013 about 28,900 or 16% out of 183,000 German engineers employed in the represented companies with at least 20 employees were working with a sales mission.

A recent panel study (Anlanger et al. 2015) analyses the responses of 262 survey participants. The results are certainly not representative due to the small number of answers, but the study can give some indicator for further reflexions:

The first concerns the gender question. With 85.5%, the great majority of the participants were men. This awareness is astonishing as sales are generally a domain which is quite well adapted to women. For example, the AASE members currently had a female share of 27% within their students², which is much higher than the 14.5% of female participants to the panel study. This can be a problem of the study sample, or a sign that the female share in this profession is changing.

The second reflexion concerns the educational background of those saying that they are working as "sales engineers". More than 75% have a degree of a higher education institution (university, university of applied sciences, other), but nearly one quarter (23,1 %) do not have any higher education, figure 5. Unfortunately, there is no information about the kind of education of the respondents mentioned in the study.

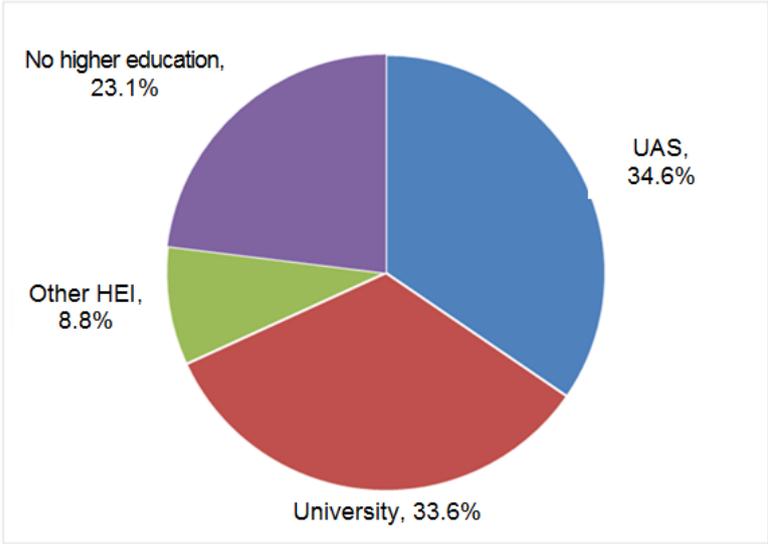


Figure 5: Educational background of participants of the SE panel study (Anlanger et al. 2015)

² Calculated on the basis of 9 answers from the 20 HEI represented in the AASE, figures for students graduated in 2015 or to be graduated in 2016.



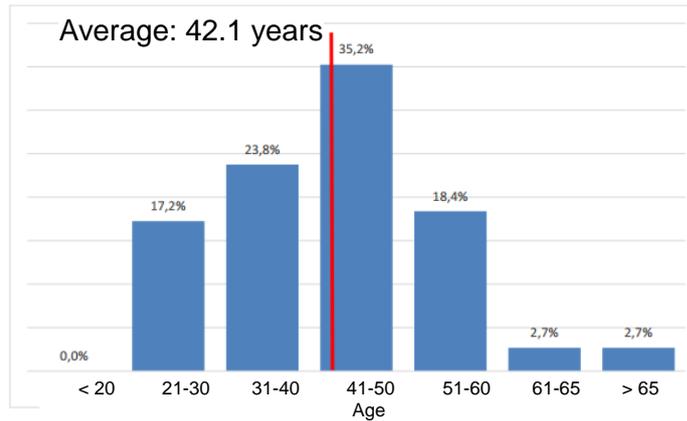


Figure 6: Age repartition of participants of the 2015 SE panel study (Anlanger et al. 2015)

A lot of important information is still missing, and an in-depth analysis of the sales engineering profession is necessary.

But what is exactly a SE? However, no clear definition of the SE exists today and this must be the real starting point of all analysis. The partners of the European BECOSE project (BECOSE 2015) recommended the following definition:

“Sales Engineers (SE) sell technical products and services to companies. They consult the professional customer and suggest technically and economically feasible solutions with an added value for both the customer and their own company. They combine technical knowledge with commercial skills”

This suggestion is very close to the following extract of the introduction of Schneider-Störmann (2015) which can be interpreted as a more complete definition:

“Sales engineers (SE) sell technical products to companies. In doing so, they consult their clients and suggest technically as well as economically feasible solutions, which bring the best (financial, strategic ...) added value to the client and to their own company.

SEs understand the technology of their product (or service) and of its field of application. They possess economic knowledge to understand and consider economic frame conditions. SEs master the combination of engineering and economic sciences, together with legal and psychological competences.

Their communicative capabilities allow them to be the interface between the customer and their own company. They lead the negotiations about technical and commercial elements of the contractual agreement between the companies.

They are engineers and merchants at the same time.”

Both definitions are considered as well describing the SE, and they will be the basis for the AASE works.



3 State of the art of European SE education

As seen before, a simple estimation led to a demand of at least 11,000 to 12,000 newly graduated SE in Europe. As seen too, many engineers seem to work as sales engineers, probably without or with a poor sales education.

In the past, someone who wanted to sell technical products generally had to get first an engineering degree, and then some additional sales competences. As most economic studies focus on management issues, but not on sales specific ones, these sales competences had to be acquired by following specific sales training courses, or by learning by doing. At least the second alternative is not really professional, and engineers with a poor sales formation are source of losses of contracts or of optimal benefits.

Within the last 20 years, the situation changed. Multiple integrated hybrid SE education programmes are now available in Europe, especially in Germany, but also in Austria, Finland, and France. These programmes, combining daily technical and sales/marketing/management issues, had mostly been developed in accordance with personal experiences of the education programme founders as well as with local industrial partners. All existing SE studies follow their own specific curricula, guidelines, focuses, timetables and internship rules. The Bachelor Degrees last six or seven semesters, and the Master Degrees between three and four semesters. Generally, at least one international academic or internship semester is requested as well as an internship of three months or more in a company. Before offering SE education, all hosting EuHEI had a technical education programme, and the SE education benefits from existing infrastructures and lectures for the technical part of the studies.

Engineers have a very structured manner of working and thinking, whereas sales persons need much more flexibility in their way of thinking, experience and intuition. A SE needs to have both manners of working and acting, the one of an engineer and the one of the sales person. Therefore, AASE members consider that such combined hybrid education, where students are daily confronted with engineering as well as sales, marketing or management issues, is the best way to form structured and flexible SE at the same time. And as economy is global nowadays, an additional strong focus on foreign languages, at least English, is also indispensable. So, a typical SE education programme should include the four pillars shown in figure 7



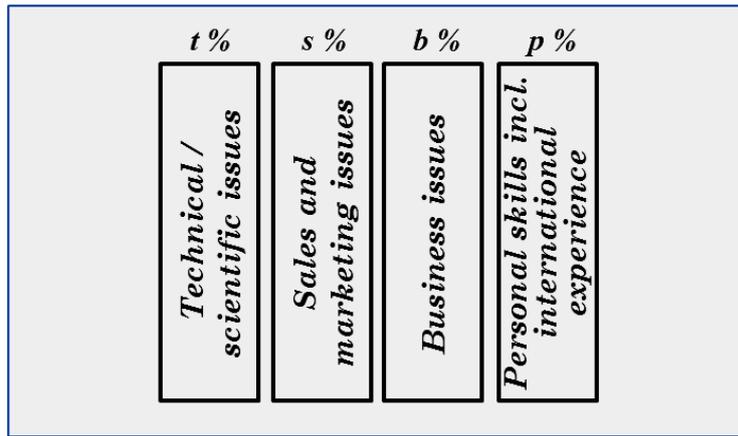


Figure 7: The four pillars of a typical SE education programme

The result of a first AASE intern survey revealed that there exists only very few real SE education programmes in Europe. Most of the identified study programmes are located in Germany. Other offers had been found in Vienna (Austria), in Turku (Finland), and in Belfort (France). E.g., despite an intensive research, any SE study programme could be found neither in Italy nor in Spain. The other European countries have not been investigated yet. Figure 8 shows the development of the identified combined hybrid SE education Bachelor and Master Degree programmes in Europe.

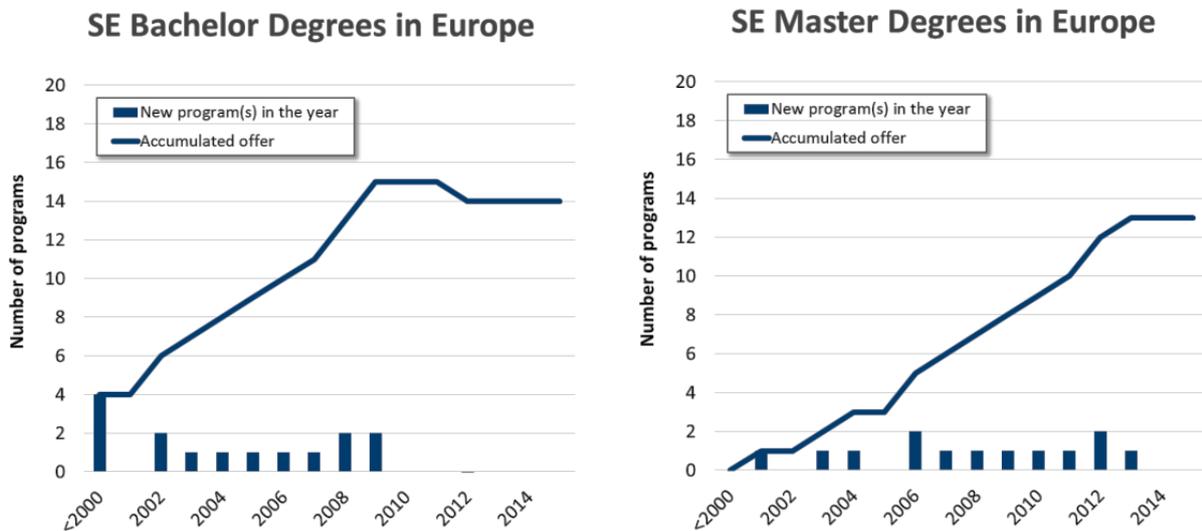


Figure 8: Development of SE education programmes in Germany (AASE, 2014)

Two types of technical education can be found within the identified SE education programmes, cf. figure 9: The first one, based on an available strong technical education at the hosting EuHEI, combines an in depth technical education in one main domain with sales and management education. This type led to a much specialised SE, e.g. in the electronics or in the mechanical engineering sector able to work on very complex products and systems. The second type tends to give a large spectrum of basis technical competences and knowledge.



This led to SE able to work in multiple industrial sectors; but the technical competences in a special domain will be less.

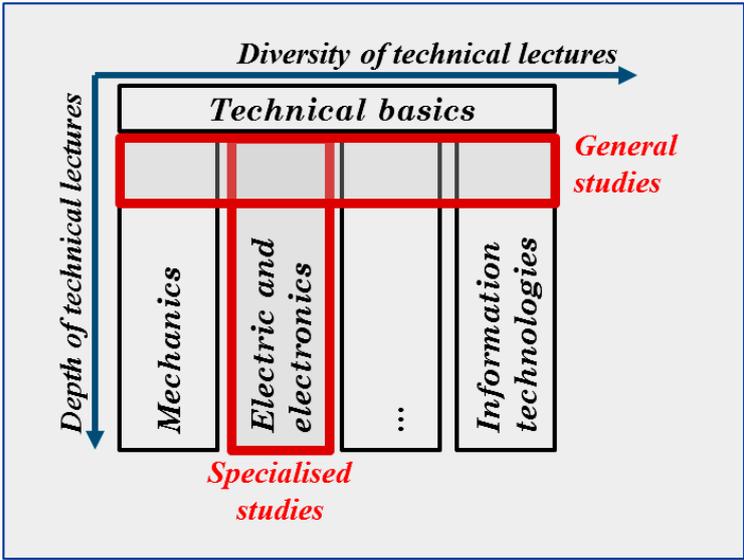


Figure 9: General vs. specialised integration of technical issues in the SE education

All identified EuHEIs together graduate about 750 to 800 SE students per year. Compared to the estimated need, this number is largely insufficient.

To resume, the starting situation is the following: On the one hand, there is neither a clear and generally accepted definition of the Sales Engineering profession, nor exist (case) studies describing the added value of SE, or required skills and competences. On the other hand, the existing offer of integrated hybrid SE education in Europe is quite meagre, and the number of annual graduates is largely behind the estimated industrial need.

Compared to the engineering or economic domains, SE studies are a relatively young discipline, and that is why there is an urgent need to structure and define the necessary contents of the curricula.



4 Target objectives

This roadmap aims at structuring the actions seen as important to reach the following four main objectives:

Increase the knowledge about the SE profession

Most of the AASE members worked as SE in the past, and they have their own ideas on the SE profession as well as many experiences. Their acquired working experiences are integrated in their lectures and mostly in the whole study programme at their EuHEI. They worked in one or few companies before getting professor or lecturer, and in most times only in one special industrial sector.

So, is it possible to transfer these isolated experiences to the whole profession? When searching for information, neither studies nor other publications could be found treating this subject.

It seems to be necessary to work on this question at first. Three aspects are of special interest for the AASE:

- ❖ How many SE do the European companies need every year? What will be the evolution of the need in the future?
- ❖ Which are the skills and competences of a SE the companies require? And as the working environment is heavily changing, this question must be treated for at least two time horizons: today and in five to 10 years.
- ❖ And finally, are there differences between industrial sectors? Within different countries? Depending on other factors?

The so acquired knowledge will help to form the number of SE with the necessary competences and skills corresponding to the industrial expectations.

Guarantee high quality, well adapted and attractive SE education

To guarantee high quality, well adapted and attractive SE education, it is necessary to define the key success factors seen from the point of view of the industry, the student and the university. Each target group has different visions, and the final programmes need to respond to all of them. Figure 10 shows some possible key success factors for each the three target groups mentioned before.

This objective aims at offering SE education responding to all of these and potential not yet identified future key success factors, allowing e.g. an easy exchange of students and lecturers between EuHEI, up-to-date lectures with concrete practical experiences, and first interesting professional missions.





Figure 10: Key success factors of SE education

Increase the visibility and the acceptability of SE

One of the main problems today is the lack of visibility, partly due to the missing official definition of the SE profession. Once this problem solved, e.g. on the basis of the (draft) definition given in chapter 2, actions need to be done to promote the findings vis-à-vis of

- ❖ Companies
- ❖ Politics
- ❖ Future students
- ❖ General public

Even if this aim is mainly pursued by the AASE public relation working group, some of the actions in relation with the other here mentioned objectives will contribute to this one too.

Develop SE education programmes all over in Europe

Investment goods are produced all over Europe. They are sold to other European companies as well as to such ones all over the world. Since many years, the European Commission is financing product and service development through research programmes such as the former R&D Framework Programmes or the current Horizon 2020 programme.

Existing as well as newly developed technical products and services need to be sold. Therefore, a sufficient number well-formed SE is needed!

As shown in chapter 3, the SE educational offer is quite poor. All identified EuHEI together won't be able to graduate sufficient candidates to satisfy the estimated European Companies' need. Therefore, the fourth objective of the actions described in this roadmap is to spread well adapted high quality SE education to further universities and UAS in other European countries.



5 Roadmap Actions

5.1 Overview

Starting from these objectives, the AASE education WG dressed a list of actions to be done within the next years. Table 1 lists these actions as well as the roadmap objectives they are contributing to. The different actions are more precisely described in the following chapters.

Table 1: Contribution of AASE Roadmap actions to the four defined objectives

Action	AASE Roadmap objectives			
	Increased knowledge about SE profession	Attractive high-quality SE education	Increased visibility and acceptability of SE profession	Development of SE education offer in Europe
Survey on ❖ industrial SE needs and ❖ competences and skills	X X	X	X X	X X
Development of a core SE education basis		X	X	X
Harmonise SE education programmes to facilitate student and teacher exchanges		X		X
Development of inter-HEI teaching methods, tools and offers		X		
Setup of a certification process ❖ for SE programmes ❖ for SE teachers ❖ for SE students		X X	X	
Promotion of SE education within European HEI			X	X
Creation of B.SE and M.SE degrees and a SE Diploma		X	X	X

5.2 Survey on industrial SE needs and required competences and skills

Where multiple studies or academic papers discussing competences and skills of engineers (i.e. Riemer 2007, Nguyen 1998, Rugarcia et al. 2000, Del Vitto 2008) or of sales managers (i.e.



Manna, Smith 2004, Ryals et al. 2015) are available, neither such studies describing or discussion competences, skills or performance of SEs could be identified yet, nor European projects dealing with SE issues.

Substantial added value to the definition can only be brought through conducting field research among present actors in the market. This field report should allow comparisons depending on several parameters:

- ❖ the country,
- ❖ the industrial sector, and
- ❖ the target group of the survey.

Four target groups had been identified for this survey about needed competencies for sales engineers:

- ❖ human resources people, who employ sales engineers
- ❖ sales managers in B2B business on technical products and services
- ❖ people in procurement, who deal with sales engineers
- ❖ directors and managers who might have an opinion of their own

This field research should include large scale surveys as well as in-depth interviews with specialists. In each analysed country 2-3 key industry sectors should be selected for exploration. The industries selected depend on their respective importance for the corresponding country's economy. As an example, Germany could focus on automotive industry and Finland on maritime industry. But niche or less known sectors such as e.g. the medical or optical industry must be analysed too.

The survey results should also show the situations when companies are looking for bachelor graduates and those where they prefer master graduates or even Ph.D.

National analysis' aim at giving the necessary arguments to EuHEIs who want to adapt or to implement SE studies. This action is crucial as it will guarantee that the developed SE curricula match the real needs and requirements of the target groups.

5.3 Development of a core SE education basis

In theory, three ways can lead to SE equivalent skills and competences

- ❖ Technical studies followed by sales studies or training
- ❖ A commercial study followed by technical education
- ❖ A combined hybrid study with technical and commercial issues

The first alternative seems to be the state of the art today for salespersons with technical background. The second alternative is probably the exception. And the third one is the emerging new SE education type promoted by the AASE members.

This action aims at defining a core basis for hybrid SE education programmes that can be considered as a minimum standard of what a SE absolutely needs to know and to master. These core competences and skills will be deducted from the survey results of the previous action. It will be the warrantor for an education fitting to industrial requirements.



The core basis must include skills and competences from the four pillars shown in figure 7. It must also comply with two conditions:

- ❖ It must define the competences and contents the industry is looking for. Therefore, this core basis must be based on the survey results
- ❖ The proposed educational schemes must be sufficiently flexible and open so that all EuHEI can respect them, as well as national or local accreditation rules. That's why the aim is to focus on competences and skills rather than on specific contents.

However, all modifications of education programmes need to be validated by local governmental accreditation, guaranteeing that the suggested core programme completed with local specific contents fit into the European Qualification Framework for lifelong learning (EQF) with its eight common European reference levels (European Communities 2008).

One discussed requirement is e.g. to apply all non-technical lectures (economics, marketing, sales, languages ...) where ever possible on technical products and services and to set up a link between them and the contents of the technical lectures.

5.4 Harmonisation of SE education programmes

The AASE wants to facilitate and encourage (international) exchanges of students and teachers between the different member EuHEIs. Such exchange opportunities are seen as a key factor

- ❖ to increase the attractiveness of the SE education for students
- ❖ to initiate students to an international environment as they will find it in their future profession, without losing a semester due to validation problems

Exchange programmes for teachers are an opportunity to share experiences and to create the possibility for international discussions for the students of the hosting EuHEI.

Two strategies on the EuHEI side are conceivable:

1/ The first one consists in trying to build the exchange student's programme based on existing lectures during his stay. Only if it is possible to match a certain number of subjects of the home EuHEI with the host EuHEI programme, this exchange will be successful from the student's point of view. This strategy calls for considerable organisational effort from the host EuHEI, and this will generally be a bilateral or trilateral agreement.

2/ The second strategy is to harmonise one or several academic semesters and to oblige students to carry out their exchange period during these semesters. There is of course an organisational effort too, but it only needs to be done once. Then, all student exchanges come naturally, and it is always guaranteed that the exchange semester(s) are recognized at the home EuHEI.

At mid-term, the AASE education WG wants to initiate the second option as long-lasting alternative. The disadvantage of this option for the EuHEI is that modifications of their curricula may be necessary, and these can only be done when a new accreditation is requested for the degree. In Europe, this is generally the case every five years.



5.5 Development of inter-EuHEI teaching methods, tools and offers

Today, the study programmes and the lectures within the different EuHEI are locally developed and locally applied. Each lecturer has developed his own methods, tools, case studies..., which he is using. Sometimes, lectures are done by industrial or external specialists coming with their own experiences and tools.

This action aims at increasing attractiveness of SE education by commonly developed and shared teaching methods, tools and offers.

First options which have been discussed yet are, e.g.:

- ❖ The construction of a shared database with scientific articles, case studies, project ideas, lectures related and other documents.
- ❖ The development of international project weeks with external professors and students as they still exist at Aschaffenburg UAS and at Turku UAS.
- ❖ The offer of common lectures or projects with students from two or more different EuHEI.

5.6 Setup of a certification process

The SE profession is actually suffering from a lack of visibility and distinctiveness. Therefore, a SE career is not a natural choice for future students. The AASE education WG is convinced that a European certification system in the field of SE will help to overcome these problems.

Quality certification systems for higher education are still existent, such as EQUIS, AACSB and others. But while EQUIS and AACSB are institutional accreditations that focus on organizational and strategic aspects of business schools, EPAS and AMBA are related to specific management programmes. However, all these accreditations are restricted to business and management schools or programmes, but they do not cover hybrid fields such as sales engineering. As a result, sales engineering schools or programmes do not fall into one of these categories and cannot be accredited by any of these. That's why AASE aims at developing a well-adapted certification system for SE.

Generally, such a certification has multiple advantages:

- 1/ Certification ensure the requested level of quality in the curricula and guarantees that the acquired knowledge and competences fully correspond to what the SE will need in his professional life,
- 2/ certificated curricula are a guarantee for companies when they are looking for new SE employees. In this way, certification improves SE students' chances of finding a job.
- 3/ certification is an effective marketing argument to bring this important but mostly unknown profession to the attention of politicians, funding organisations, industrial representatives and the general public.

Different types of certifications are possible:

- ❖ Certification of SE curricula
- ❖ Certification of teachers involved in SE education
- ❖ Certification of SE graduates



This action needs answers to three main questions:

- ❖ Which types of certification (curricula, teachers, and/or graduates) are needed?
- ❖ Which are the criteria a candidate must fulfil to obtain the certification?
- ❖ How will be the application, evaluation, and the attribution process?

While the first point can be discussed and decided rapidly, the second one partly depends on the results of the survey described in chapter 5.2.

5.7 Promotion of SE education within European HEI

Three different diagnoses can be stated at this time:

- ❖ The estimation of annually needed SE for European companies is significantly higher than the graduates of the now identified EuHEI.
- ❖ The identified SE education programmes are mainly concentrated in Germany, with some EuHEI in Austria, Finland and France.
- ❖ All yet identified EuHEI together will be unable to graduate a number of students matching with industrial needs.

Therefore, a wide promotion of the profession and related education programmes is necessary in all European countries. This promotion must address as well the EuHEI as national governments and companies.

This task is mainly handled by the AASE public relation WG. The outcomes of the different actions of this roadmap will indeed provide essential arguments and facts to the AASE public relation WG, but direct exchanges with other EuHEI concerning education programmes and contents will help to spread SE education within Europe too.

5.8 Bachelor/Master of SE

With the signature of the Bologna Declaration in 1999, the signers manifested their voluntary to introduce greater transparency and trust among higher education systems in Europe. That's why the Bologna protocol stipules the *“Adoption of a system essentially based on two main cycles, undergraduate and graduate. Access to the second cycle shall require successful completion of first cycle studies, lasting a minimum of three years. The degree awarded after the first cycle shall also be relevant to the European labour market as an appropriate level of qualification. The second cycle should lead to the master and/or doctorate degree as in many European countries.”* [EHEA 1999]. Starting from various European higher education systems, they decided to simplify to one common education system with two-cycles, undergraduate and graduate studies, of duration of three-four years and one-two years respectively [EACEA et al. 2012].

The types of Bachelor and Master Degrees depend of national decisions. Globally used are Bachelor/Master of Science (B.Sc./M.Sc.), of Engineering (B.Eng./M.Eng.), of Arts (B.A./M.A.) and of laws (LL.B./LL.M.), generally followed by a mention giving more details on the programme. On national level, other Bachelor and Master Degrees denominations can exist.



For example, Wikipedia lists 90 different Bachelor Degrees³ and 169 different Master Degrees⁴ (worldwide)

The aim of this middle to long-term action is to install in the concerned countries specific Bachelor and Master of Sales Engineering Degrees (B.SE./M.SE.) and to get them validated by the national instances.

³ https://en.wikipedia.org/wiki/Category:Bachelor%27s_degrees

⁴ https://en.wikipedia.org/wiki/Category:Master%27s_degrees



7 Conclusion

The present roadmap describes seven actions seen as essential by the AASE Education WG members to achieve the four defined objectives:

- ❖ Increase the knowledge about the SE profession
- ❖ Guarantee high quality, well adapted and attractive SE education
- ❖ Increase the visibility and the acceptability of SE
- ❖ Develop SE education programmes all over in Europe

The seven actions are:

- ❖ Survey on industrial SE needs and required competences and skills
- ❖ Development of a core SE education basis
- ❖ Harmonise SE education programmes to facilitate student and teacher exchanges
- ❖ Development of inter-HEI teaching methods, tools and offers
- ❖ Setup of a certification process
- ❖ Promotion of SE education within European HEI
- ❖ Bachelor/Master of SE

Except from the last action, the implementation of a Bachelor of SE and a Master of SE Degree, all actions should be completed by 2020.

By this, the present roadmap describes the future work of the AASE Education WG.



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Aschaffenburg, February 2016