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The Uni1 Project (2016)

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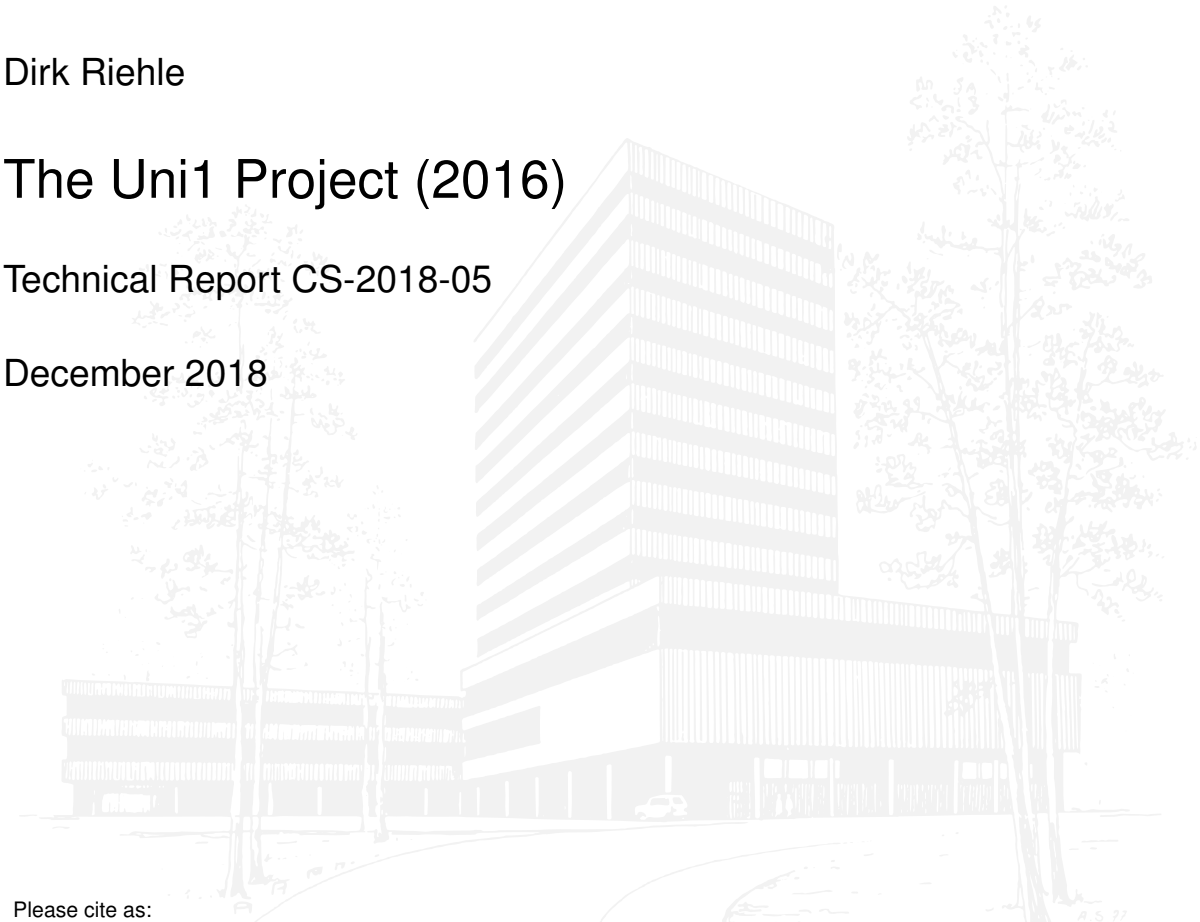

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The Uni1 Project (2016)[1]

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1 This technical report is a translation of: Dirk Riehle, "Das Uni1 Projektkonzept (2016)," Friedrich-Alexander-University Erlangen Nürnberg, Dept. of Computer Science, Technical Reports, CS-2016-04, May 2016.

Abstract

The aim of this project outline is to describe how universities and other higher education institutions (HEIs) can work with businesses to conduct teaching projects for and with students. Both parties stand to benefit; the projects generate recruitment, outsourcing and innovation (ROI) for businesses and provide HEIs with new partners for cooperation, a source of funds, and a boost to the attractiveness of their teaching.

1. Overview and philosophy

Involving businesses in teaching at HEIs has numerous advantages. Projects extending across a semester give teaching more of a real-world edge and motivate students, as well as helping academic staff form and expand connections with businesses that may prove useful in regard to future research. There are, however, numerous factors and potential difficulties to consider before launching cooperative efforts of this kind. How can academics find businesses keen to work with them? How can they ensure the organization they collaborate with will be able and willing to consistently do their bit? And how to make sure that the project will meet students' learning objectives? Finally, and importantly, what agreements need to be made on the issues around any intellectual property that comes into being during the project work? This project outline, based on a long track record of experience of teaching projects with businesses here at Friedrich-Alexander-Universität Erlangen-Nürnberg (FAU), will answer these questions and numerous others. We are aware that, despite our wealth of experience, the outline presented here isn't perfect; we'd be delighted to receive any feedback or ideas for its ongoing improvement.

1.1 Why work with businesses? Key objectives

This document describes a process for setting up teaching projects in the context of a seminar or other course at a HEI that revolve around a business need of, or a commission from, a company that sponsors the course. Projects as defined by this concept have a duration of at least three months, and therefore often take place during the lecture period of a semester.

1.1.1 'Real-world' teaching and learning

One central benefit of these projects in HEI teaching is the 'real-world' experience they make accessible to students simultaneously increases their interest in engaging with the content communicated via this method.

- Teaching in this way offers more of a real-world view of theoretical content as the problems businesses contribute for the students to solve come directly from their day-to-day operations. This gives students a more close-up insight into how business works than an academic is usually able to.
- At the same time, these projects make the relevant class or seminar more appealing to students who place significant value on gaining practical insights and experience in the course of their studies. The view from the world of work which these projects inject into HEI teaching helps students make links between theory and practice and facilitates understanding.

All in all, students participating in this type of project get a better idea of the practical application of what they are learning, as well as being more motivated and open and therefore more likely to meet their targets and objectives.

1.1.2 Great projects with and for business and industry

Most businesses will not embark on a project without first being sure their involvement will make sense and create value. We like to use a familiar abbreviation, reinterpreted for our framework, to describe the value businesses can expect from entering into this type of cooperation. They will receive ROI, which we use to stand for

- **Recruitment**,
- **Outsourcing** and
- **Innovation**.

Our experience is that businesses only get on board when they consider at least one of these three objectives to be attainable, and then actually achieve it in the course of the project.

1.1.3 Building trust with businesses

A successful project with which the business is happy is a double success for the HEI and the academic or academics involved. Along with providing teaching that is more attractive with an increased relevance to real-world applications, they have built trust between their institution and an organization, trust that will make it easier to initiate more or larger-scale projects later on.

1.1.4 Generating financial resources

Our outline assumes that companies will pay, in line with the value created by the project for their business, for the developments or services rendered in the project that go beyond the academic's specific teaching remit. The willingness of an organization to pay is a measure of its attitude to the project and indicative of a commitment across its entire duration. In some instances, the

professor running the project may be able to generate significant income that can be reinvested in improving teaching or training staff.

1.2 Central challenges

Running a teaching project in a seminar or similar course is a promising idea, yet experience shows that the path to its realization is not always an entirely smooth one. There are a few hurdles to overcome:

1.2.1 Defining separate learning objectives and project aims

Involving businesses in teaching at a HEI calls for a clear, robust and distinct definition of the learning objectives which students will be expected to meet as opposed to the aims of the project itself, via which students will engage with the seminar's content.

1.2.2 Finding potential partners

Finding businesses prepared to invest time and money in bringing students into contact with the world of work and to commission projects is another challenge.

1.2.3 Choosing the right ideas

Not every idea that might occur is suitable for helping students meet the objectives of the specific seminar or course. Finding the right project will depend substantially on the nature of those objectives.

1.2.4 Agreeing on intellectual property issues

In the first instance, intellectual property rights in the results of work done by students within seminars or other courses remain with the student or students who carried out the work. It is not permissible to pay students for work conducted in this context. At the same time, the company that commissioned the work has a legitimate interest in being granted, at the least, rights of use in the results of this work.

1.2.5 Establishing robust cooperation

The active involvement of the business will be crucial to the project's success. Such involvement might entail, for instance, assistance with expertise specific to the relevant field and providing constructive feedback. Such active involvement must be safeguarded in the framework of the course, as this involvement is unlikely to gain momentum 'out of nowhere'.

1.2.6 Helping students achieve learning objectives

The achievement of the course's intended learning objectives should be substantially independent of the planned result of the project, in order to avoid conflicts of interest. Students will need to be supported to achieve the learning objectives regardless of how well the actual work with the company goes.

1.2.7 Making the business happy

The professor's first duty and loyalty is, of course, to his or her students. However, the company's interest in achieving its aims is legitimate, and it would be inappropriate to neglect it; its representatives will need support just as the students will.

1.3 Our projects

At FAU, we have been running these types of projects for a number of years, in accordance with a structure and schedule that are effectively identical from project to project. Before the teaching semester commences, we invite businesses to propose ideas for projects to be carried out in one of our courses. If an idea works, we draw up a contract and treat the project as a commission that we then place in the hands of a team of students. There can be multiple projects, and by extension clients, within one seminar or course.

1.3.1 Real-world applicability

We use this concept for our AMOS, ARCH, PROD and NYT courses:

- **The AMOS Project** (AMOS) is our agile methods course that teaches students Scrum and XP via a software development project.
- **Software Architecture** (ARCH) is, as the name suggests, a project-based course in which students document, analyze and evaluate a software architecture and draw up suggestions for its improvement.
- **Product Management** (PROD, http://pmby-case.com) gives students the opportunity to conduct a project assessing the chances of a specific idea on the market and creating specifications for a product with the potential to make best use of the opportunities identified.
- **Nailing your Thesis** (NYT, http://nythesis.com) is our research course, where students conduct qualitative and quantitative data analysis to the end of finding a solution to a research question or testing a hypothesis.

We don't offer a project-based course on testing for software quality assurance, as our institution runs various courses of this type. Such a course, if we ran one, would lend itself well to cooperation projects with businesses.

The AMOS Project, based around software development, is by far the most successful project of this type. We will refer to it as an example in the discussion that follows.

2. Marketing and project acquisition

Acquiring projects for seminars and courses is essentially a sales activity, and, as sales is a process, it is not comparable to writing a funding application. Understanding client needs and speaking their language in order to communicate effectively are important, but only half the story; you need to be prepared to enter into dialog and build a relationship, out of which the commission will hopefully emerge.

2.1 Understanding client needs

Understanding our prospective client is the first step. What do they need? Obviously, exact needs will vary from business to business. However, our experience over the years has enabled us to identify three principal categories of need and interest that we can leverage to approach businesses as potential customers. We summarize these categories using the familiar abbreviation 'ROI', although in our concept it does not stand for Return on Investment, but instead for Recruitment, Outsourcing and Innovation. Our experience has taught us that these are the three drivers that convince the overwhelming majority of businesses to agree to commission a student project. These categories are not mutually exclusive and often overlap.

2.1.1 Advancing recruitment

In our context, recruitment is all about the client's need to meet students who may potentially be suitable for more substantial internal projects or as part-time support during their studies and later for joining the company's full-time staff.

Working together on a project in the context of a seminar or course enables both student and business to get to know each other better and work out whether they are a good fit for each other, while students get to discover a potential passion for what the company does day to day. Joint project work helps both parties find out about these important issues early on, smooths the subsequent recruitment process and makes it likelier that it will lead to good decisions.

2.1.2 Enabling outsourcing

Outsourcing is about the client's need to get a usable result out of contracting out this particular piece of work – be it a software solution, a report or even just a single unit of data - in the context of a student project. The aim of the project is to achieve the desired result. As far as the client is concerned, they have outsourced the process of this achievement.

The result of a project such as this can only be as good as the students working on it. This means that there's a lot of potential for things to go wrong in this respect. It also means that under no circumstances should the contract you conclude with a company with regard to a project contain any clauses guaranteeing a particular deliverable – not because you do not intend or seek to deliver, but because it's important to manage expectations from the outset. You should therefore take care to word the contract in such a way as to remove this risk; you might, for example, refer to the development of a prototype rather than a component that can be used in production right away.

This is also why we always take care to communicate to the business that it will need to provide at least one position for a student to remain at the company afterwards in order to evolve and implement the project's results and so preserve its value for those involved.

2.1.3 Inspiring innovation

Innovation is about the client's need to overcome the inability to see the wood for the trees that inevitably arises within an organization from time to time. Students are often full of creative and inspiring ideas that would not have occurred to staff members who have been with the company for a while. Given an appropriate degree of free rein in the context of a project, they can generate results that benefit the business.

Students' innovative ideas are of particular significance when businesses consider the fact that students are potential future customers or users of a product. In this way, getting involved with a project at a HEI represents a specific method of market research, which can help businesses understand what's important to this target group.

2.2 Approaching businesses successfully

Once you are clear as to what you are offering businesses and how to communicate it, you can start the process of approaching potential project partners. An easy method we use regularly is sending out an email describing the courses planned for the coming semester and the types of project companies can get involved with.

Our experience has shown us that businesses very frequently do not immediately understand what we are offering. The best case is that the business gets in touch to find out more and you can explain the idea and clear up any misunderstandings. The worst case is that the email simply gets ignored.

This means that your email will need to be specifically tailored to explaining the idea and the project(s) as clearly as possible. We tell our potential partners in sim-

ple and unfussy language about the benefits working with us can provide (ROI), and supply illustrative supplementary materials in the form of a brochure which covers the entire relevant ground, from giving companies a sense of what we are about (links to blog entries, photos taken during previous projects) to discussing the formalities (how involved the company will need to be, related issues and conditions).

We have found that it's particularly helpful to businesses if we present them with outlines of the 'ideal project', using actual examples if we can. In the context of AMOS, for instance, a typical project might involve the creation of an exploratory prototype for a business to approach the potential use of an innovative technology. Two recent examples of this (from 2016) are the implementation of a simple application on the basis of OpenStack and the realization of an application using the Watson AI services developed by IBM.

The use of illustrative and real-life examples such as these makes it more probable that businesses will understand what we are aiming for and, importantly, may inspire them to develop creative associations and trains of thought leading to ideas for projects that might be useful for them.

2.3 The marketing and sales funnel

There are many reasons why a business might not respond to an email trying to get them on board for a project. Perhaps the email never arrived; perhaps whoever read it didn't understand what it was about; perhaps it didn't go to the right person; there may not be the funds available for a project of this kind; nobody had a good idea for a project; and plenty of others besides. There's always a little bit of lucky chance involved in successful sales and marketing endeavors.

A useful model for understanding how the sales process works is what is known as the sales funnel. The idea is to put as many contacts as possible in at the top of the funnel. Only a few – those who actually commission a teaching project – will come out at the other end. There are several stages within the funnel, each one representing a step on the way to getting a company to sign up for a project.

At the beginning of the process, you will have a range of contacts. Then some will perhaps respond with interest to the email; of these, some will ask about the specific terms and conditions and some of these may propose a project idea. At the end of the process are negotiations around, and finally the signing of, a contract. Businesses fall away at each of these stages as the funnel becomes narrower. There is a great deal of literature on this topic that provides guidance with sales and marketing processes.

2.3.1 Talking to the right people

It's sensible to pay particular attention to people within a business who appear particularly promising to talk to. In the first instance, these may be people with whom you have a pre-existing relationship, such as:

- Friends and family members; people you know socially
- Clients from previous projects
- Current or former partners on research projects
- Ex-students of yours with whom you have stayed in touch

There are theoretically unlimited possibilities for networking and finding project partners. We will discuss these further in future work.

2.4 What will it cost the business?

Companies should pay for the project or projects they commission (paying for each one individually in the latter case). It's usually a good idea to leverage as much in the way of financial resources as possible and sensible.

You will need to decide whether you will charge each company that enters into a project with you the same price (which will mean that, in order to be fair, the quality of each project team will need to be comparable) or whether you will negotiate an individual rate for each project.

2.4.1 Fixed price lists

The advantage of a fixed price list is that there is no need to spend time negotiating a rate. The disadvantage is that it stops you from maximizing your profit, as some clients will end up paying less this way than they might otherwise have been prepared to agree on.

There are a number of routes you can use to setting your prices:

- You can align your prices with those of others providing the same service, i.e. in this case other academics.
- You could attempt to work out the intrinsic value of the service or work you will be providing, by, for example, calculating a rate for your students' working time. A project (worth 10 ECTS credits) carried out by four students each receiving (fictitious) hourly remuneration of 10 euro would amount to 300 hours x 4 students x 10 euro/hr = 12,000 euro.

- If you are aware that the company or companies you are keen to work with is/are particularly interested in a specific benefit, you might attempt to place a financial value on this motivation. If most businesses you will be approaching are interested in recruiting new talent, for example, you can cite well-known cost factors such as the average cost of recruiting a graduate, which stands at approximately 6,000-10,000 euro.

Be aware of differences in attitudes and financial means from business to business. A large company will have little issue with a cost of 10,000 euro, say, for your project, but a small one may well struggle with this amount of money. Accordingly, you may wish to define reductions in line with appropriate criteria, such as the size of the business.

2.4.2 Individual pricing

The advantage of individual pricing is that it may allow you to negotiate the maximum possible rate for your and your students' work. The time and effort that goes into this negotiation represents a disadvantage, as does the ensuing higher complexity involved in producing a tailored project as opposed to a 'standard' project from a fixed price list.

Individual pricing is subject to considerations similar to those recommended when drawing up a fixed price list. Variations in the product, such as agreeing to assign more or higher-performing students to the project or carrying out tasks requiring rare technical competencies, can justify higher pricing.

2.4.3 Other relevant factors

It's important not to lose sight of your core task, that is, running good courses for your students. Some projects are more suited to achieving this aim than others, and it may well be sensible to prioritize these, even if more money could be made from others.

3. Contracts and intellectual property

Conversations with numerous colleagues have taught us that issues around intellectual property (IP) can prove difficult to handle. Many businesses wish to claim exclusive rights in any IP produced in the course of the project. To a degree, the use of an open-source approach can avoid or avert the multitude of problems to which this situation can give rise.

This section outlines the legal situation with regard to IP and presents two approaches to the issue, the transfer of exclusive rights to the business and – our preferred option – running the cooperation as a joint project.

3.1 What the law says

A project within a seminar or course at a university or other higher education institution (HEI) involves at least three parties:

- Students
- A business or organization
- The HEI

3.1.1 The students' rights

From the overall perspective of the project, the students do the primary work involved, realizing the idea behind the project and creating its tangible result or results. Accordingly, they are the holders of the rights in the work or IP they create. However, the students are not permitted to receive payment for their work as the assessment it undergoes forms part of their degree.

3.1.2 The business' rights

The business supplies the project idea, provides specialist support to the students and invests money. In most cases, the idea itself is not patentable and does not constitute IP in and of itself. Similarly, the support given to the students does not usually amount to a share in any IP rights in the project's results.

The money invested by the company only results in IP insofar as the contract with the HEI stipulates this. In this context, professors can only grant to the business as much as they are willing and able to.

3.1.3 The HEI's rights

The HEI only gains rights in the work done if any of its employees are part of the team carrying out the project. In most instances, this will either not be the case or to only a negligible extent, as academics' direct involvement in the project work would usually run counter to or undermine the project's teaching purpose. The case is similar regarding the specific rights of a professor.

3.2 Transfer of exclusive rights

Businesses should pay a not insignificant sum for participation in a HEI teaching project. This payment is a sign that the business takes the endeavor seriously and helps reduce the risk of it abandoning the project part way through, by extension ensuring that the students will be able to achieve their learning objectives.

At the same time, a company may associate making a payment with the expectation of exclusive rights in any IP generated during the project. If you agree to this and promise the business exclusive rights, you will need to ensure that the students' rights are transferred to the business.

There are several disadvantages to acceding to a request for exclusive rights:

1. The business may make the transfer of exclusive rights in the students' work a precondition for its participation in the project:
    - It is ethically problematic to expect students to renounce all rights to their own work.
    - Transfer of rights will usually take place on the basis of a contract drawn up by the business. This means that the professor will be in the position of requiring students to sign a document that he or she will usually be unable to properly assess due to a lack of expertise in the specific setting.
2. The project process becomes more complex and time-consuming:
    - Rather than one single standard contract, various contracts come into play, with a different one needed for each project; each will require time and work which the income the project promises to generate may not justify.
    - Meeting specific stipulations on the business' part leads to greater variations in the development environments and technologies used.

It may be considered acceptable for students to have to renounce their IP rights if they are not reliant upon the course in order to complete a specific component of their degree, i.e. if alternatives are available to them via which they can complete the component without having to attend a course that expects them to give up their IP rights in the results of their work.

There is one advantage of transferring exclusive rights to the business; it increases the value of the students' work in the eyes of the business, which means that you can ask for a higher amount in payment and that this amount may cover the additional work and time required.

In our experience, a project in which a business expects to receive exclusive IP rights is rarely particularly fit for purpose. This expectation on the part of the business is an expression of another expectation, namely that the results of the students' work will be usable straight away and will deliver a competitive advantage for the business. In most cases, this is an inaccurate view of what students are able to produce and indeed, what they should be producing. The section on marketing as the ROI of HEI teaching projects contains a description of a more realistic perspective.

3.3 Joint projects

Changing our view on what a teaching project actually is can help us get round the question of transferring exclusive rights and the associated issues.

3.3.1 Equal, non-exclusive rights of use

At FAU, we see these projects as joint efforts in which all involved (the students, the business and the university) receive equal rights. This means that all parties concede to all other parties a non-exclusive, but complete right of use in the project's results. This arrangement gives all those involved in the project the right to individually do as they wish with its results after the project's conclusion.

This way of handling IP respects the contribution of all parties to the project and puts them on a fair and equal footing. As IP rights are exclusive, this arrangement prevents one individual from the project group from issuing a prohibition to the others on using the IP generated in the course of the work.

- The students, after the project's conclusion, will therefore be able to make use of the product, results or findings, either individually, as a team or in multiple different teams, and no individual from the former project group can prevent them from doing so. This enables students to pursue their work further in a start-up business.
- Both the business and the HEI can continue the work where the students left off, either with or without the same or other students, without needing to gain permission or explain their activities to others.

We use a standard contract (see Appendix) for each project; our partners have become familiar with its form and content over the course of our work together.

3.3.2 Contributor License Agreement

We assign IP rights in accordance with these principles on the basis of a contributor license agreement (CLA). Frequently used on the open-source scene, this type of agreement provides for a developer to grant another legal entity an unlimited right to license the product.

Rather than having each individual involved sign n-1 CLAs (where n is the number of people on the project team), we ask the students to sign a CLA granting the right of further licensing to the relevant professorship at our university. In turn, we grant all parties the rights thus accorded to us as a package. This process results in everyone involved receiving complete, non-exclusive rights of use.

The business will have already been granted these rights in the contract they signed at the outset of the project. We do, however, reconfirm the rights in the letter we send them at the project's conclusion. Students receive a letter confirming their rights upon request.

We use version 1.5 of the SUN Contributor Agreement, to which there is a link in this document's appendix.

3.3.3 The value of open-source working

Most of our projects involve open-source development. The AMOS project, for instance, develops open-source software, which means that we can use services, such as GitHub, Travis-CI und Jira, that are free of charge for open-source software. This has a number of advantages:

- Students are able to familiarize themselves with widespread services
- Access to project artefacts is as easy as it can possibly be for all involved
- Students are able to help one another across projects
- The academic has very little or no admin work

While projects don't necessarily have to be open source, this way of doing things does increase student trust in the enterprise, as they have a sense of not solely working in the interests of a business. Additionally, our project courses define skills in using open-source software and the relevant tools as learning objectives.

The usage rights pertaining to the parties involved in the project are not limited as long as the students do not incorporate any contributions from external entities in the project work or results. They should therefore be told to reject any attempted contributions from outside the team. Doing this is part of good open source governance which the students should be reminded to practice.

You can prevent outside parties appropriating the work by using a reciprocal license whose terms are formulated as aggressively as possible. The appropriate license for software is AGPLv3. Taking these steps will ensure that no competitor of your partner's will be prepared to touch work that is thus protected. The business itself will not have to worry about the license due to the contractual rights they will previously have been granted.

4. The process

HEI teaching projects bring with them specific challenges that run-of-the-mill seminars and courses do not encounter.

4.1 Fitting the project to the teaching context

As explained, we conduct these projects in the context of regular courses (seminars etc.; modules). The size of the student teams required and the amount of work per person vary from project to project (please refer to Table 1).

On average, students earn between 5 and 7 ECTS credits in the course of a project, which is equivalent to 150+ hours of work. In almost all cases, the project work itself is added on to an existing (often subsequently reduced) lecture worth 5 ECTS credits, resulting in a project worth a total of 10 ECTS credits. The lecture takes care of communicating the theoretical course content that is put into practice during the project.

The exact details of who earns what in the way of credits vary from course to course. Specifically in the AMOS project, there is distinction according to the students' role. Scrum product owners (PO) only earn 5 ECTS credits, while software developers (SD) earn 10. These static, assigned roles are a local particularity relating to the strict disciplinary separation at FAU between information systems and computer science.

In our experience, student teams need guidance from an academic staff member at their HEI who can help should things fail to run smoothly in the team (see section on 'Working with student teams'). Members of my team of academics take on this role in our case, as do I. We limit the teaching workload per team to 2 semester hours per week in the form of a 90-minute team meeting which forms part of our assessment of the students.

Our project courses are all part of our range of elective options, which means that we are not overrun with stu-

TABLE 1: TYPES OF PROJECT, SIZE OF TEAMS AND ECTS VALUE

Type of project	Abbreviation	Min. number of students per team	Max. number of students per team	Value in ETCS credits
Research	NYT	2	4	5
Product management	PROD	3	5	5-7
Software architecture	ARCH	3	5	5-7
Agile methods	AMOS	6	8	2-10

dents. The AMOS project has now reached the point at which the numbers of businesses interested in working with our students exceeds the number of teams we can provide. In the summer semester of 2016, for instance, we were able to realize seven projects, each of which had a team of two product owners and 5-6 developers. You can find out more about the topics of these projects at http://osr.cs.fau.de/2016/03/04/announcing-the-2016-amos-project-line-up/.

4.2 Working with student teams

As a professor, you have a contractual or at the least, a moral duty to the business to deliver a result that is of some use – how much use precisely is a matter closely related to the quality of the project team and its work.

4.2.1 Creating the team

A successful student team will be

- the right size
- competent, motivated and internally compatible.

The more students sign up for the course, the more likely it is that the teams subsequently formed will be of the right size, competent, motivated and able to work together smoothly and harmoniously. Don't be shy to 'advertise' your courses to students.

The ideal size of a team varies from course to course. It is important for them not to be too small; this helps balance the impact of any underperformers in the team.

Our experience is that projects such as AMOS need a minimum of four developers. Five is better, but more than six will be uneconomical, in that case, it would be better to launch a new project with a new team.

You can choose whether you let the students form their own teams or assign teams yourself.

The advantage of the former approach is that you will generally end up with teams that are a good fit and will work well together because students who want to work together will put themselves in the same team. The drawback is that quality and therefore performance may vary a great deal from team to team, which is why we take the approach of putting the teams together ourselves. Beforehand, we use a survey to find out about our students' level of competency (in terms of experience), their motivation (by asking about which project/s they would like to be assigned to), and the combinations of teams that might work (by asking who they would like to be in a team with).

We use this information to put the teams together, giving motivation the most weight, followed by which combinations will work, followed by competency. There's never a perfect solution with which everyone is completely happy all round, but communication is key to finding acceptable compromises.

4.2.2 Managing the student teams

Teams into whose composition enough thought has gone should be able to deliver quantitatively and qualitatively solid work and meet the expectations of their HEI and the business.

However, experience shows that a lot of students do not possess the competencies and experience they need to successfully tackle the challenges with which the team situation confronts them. Many of them will not have had serious teamworking experience before coming to our project.

A further complicating factor resides in the transient nature of the project work, with some students failing to see why they should attempt to get on with their teammates outside the project situation. Students' focus on grades may also influence their motivation and their way of working, distorting the teamwork principle. All this can lead to conflict within the team being 'bottled up' and impacting its work, sometimes to the extent of causing the whole project to fail.

Interpersonal conflict in the course of teamwork is a frequent phenomenon with many potential ways of managing it. You will need to approach it proactively, which means taking appropriate measures to:

1. prevent conflict from arising in the first place,
2. recognize conflict as it arises and resolve it before it can escalate,
3. tackle and resolve instances of full-blown conflict.

Examples of measures for reducing or resolving conflict are the team agreement, the 'happiness index' and an intervention.

- **Team agreement:** We expect our project teams, before they commence work, to reflect and agree on the aims of the project, the procedures and standards by which they will work, and rewards and sanctions relating to their teamwork, and draw up a written agreement which they submit to us, signed by each team member.
- **Happiness index:** Our students are requested to comment regularly and anonymously to their team and us on how 'happy' they are with how things are going. If we record persistent unhappiness, we can get involved and encourage the team to address the problems.

- **Intervention:** Should problems, as indicated by the happiness index, prove resistant to attempts to resolving them, or should the team fail or refuse to find solutions, you may need to stage an intervention. This will involve one of the academics looking after the team requesting a meeting to discuss and resolve the issues.

It is helpful if the academics who will be supervising and looking after the teams can receive training in this task, paid for by funds earned through previous projects.

4.3 Working with businesses

Our teaching projects are not one-offs, for which reason we are keen to establish long-term, win/win relationships with businesses. Companies who have taken part in one or more of our projects in the past and therefore understand the idea are a lot less 'high-maintenance' than those who are on board for the first time.

4.3.1 Managing expectations

It's important to clearly communicate, from the acquisition stage onward, the extent of the realistic expectations a business can have of a teaching project. You can find examples of effective communication on this in the section on marketing above.

Managing expectations requires thorough discussion of the project's content. In the ideal case, the contract's formalities can originate directly from a standard template. However, another part of the contract will need to be project-specific, and made the subject of a discussion whose purpose will be managing expectations.

Our experience tells us of the difficulty of making reliable predictions regarding the work of teams composed of students whom we may not yet know well, or indeed at all. It follows that a business will need to be aware of the potential for the students' work to fail to meet expectations. You should warn businesses not to commission a deliverable on which they will be reliant in any shape or form.

What makes a good or suboptimal project depends on the specific course. As a general rule, project work should not require very extensive or complex training prior to commencing. It's important to make the business aware that their support is important not only for the students, but also for improving the chances that the business will achieve what it has set out to.

As a rule, abandoning a project before it begins is better than pushing on with a bad project that disappoints the business and loses them as a future cooperation partner.

The appendix to this document contains a link to a simple and consciously brief project description template. More than one page's worth of deliverables will be unlikely to be appropriate to the nature of student projects.

4.3.2 Launch time

The business should designate a point of contact for the project who will supervise its progress. In some cases, this will not be the same person as the individual who negotiated the contract. You shouldn't assume that clear communication within the business on expectations and objectives associated with the project has happened as a matter of course. A change of contact when the project gets going means that you, the academic supervisor/s, will have to go back to square one with regard to communicating objectives and managing expectations. Using templates for emails and other communications can help save time.

A kick-off meeting attended by the student team, the academic supervisors and the representative or representatives of the business is an important component of a good start for the project. It can serve as a venue for discussing the project's content and technical issues as well as matters around communication and the availability of all involved.

4.3.3 Ongoing support

Businesses need ongoing support just as the student teams do. The extent of this support will depend on the type of course and the expected results, as well as the students. Some students are gifted relationship managers, but many are not. Accordingly, the academic supervisor/s should contact the business' representative at appropriate intervals to get a picture of the project's progress from the 'other side of the fence' and intervene if required.

4.3.4 Wrapping up

There are several components to a proper conclusion to a project:

- Presentation of project results or outcome in the students' course
- Presentation of project results or outcome to the business
- Formally concluding the project and wrapping up all legalities

The presentations are vital components of a successfully completed project. Their specific form may differ considerably according to project type, but they will often involve giving a talk on a report.

A talk and/or a demonstration to representatives of the business is important because it allows its audience to ask questions and better understand and absorb the results. It will often be easier for employees of the business to attend a presentation on their premises than to travel to the HEI. The presentation also enables students to ‘advertise’ next year’s teaching projects.

A ‘demo day’ is a good way to round off a software-related project. For AMOS projects, we organize a ‘trade show’ at which all partners, along with the general public, can gain an idea of what the projects entailed and what the teams have achieved. A public ‘demo day’ has proved a very good way for us to acquire new project partners – one year they are able to witness what our students are capable of achieving, the next year they commission a project of their own.

Once the last presentation is over, the last demo has been held and all relevant data have been collected, we write to the business to formally conclude the project, thank it for its involvement, outline the results and deliverables, mention the form of their presentation to the company, and declare the project completed.

5. Acknowledgments

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6. Supplementary material

6.1 Sample brochure for recruiting project partners

Example of letter and project type description:
see http://uni1.de.

6.2 Sample contract

Example contract to be concluded with a business on their agreeing to commission a project:
see http://uni1.de.

6.3 Sample project description

Project description template:
see http://uni1.de.

6.4 Sample CLA

The OSR Group Contributor Agreement:
see http://uni1.de.