# ORGANISATION AND MANAGEMENT OF A COMPLETE BACHELOR DEGREE OFFERED ONLINE AT THE UNIVERSITY OF MILAN FOR TEN YEARS

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**ABSTRACT**

This paper is aimed at presenting some reflections on organisation and management of SSRI online: an e-learning initiative started at the University of Milan (Italy) in the academic year 2004/05 and offered to students over the last ten years. The initiative consisted in implementing the online version of an already existing three-year bachelor degree ("Laurea in Sicurezza dei Sistemi e delle Reti Informatiche - SSRI": a Degree on Security of Computer Systems and Networks).

**KEYWORDS**

E-learning, online bachelor degree, online degree organisation, online degree management

## 1. INTRODUCTION

SSRI online is the e-learning version of a traditional, classroom based bachelor degree on Security of Computer Systems and Networks, offered at the University of Milan, Italy since ten years. A detailed description of the project architecture leading to implementation of SSRI online can be found in (Damiani 2005) whereas a deep analysis of students' population registering to the online degree is given in (Frati 2010).

In this paper, after discussing the teaching model adopted for SSRI online, we focus our attention on the organizational model we adopted to handle SSRI online offering, and we present the business model we used to finance the overall project.

## 2. TEACHING MODEL OF SSRI ONLINE

### 2.1 Structure of Online Lectures

The design of the online degree has been supported by consultants from Isvor Knowledge System, an Italian company specialized in the production of e-learning courses. These consultants worked together with the university staff of CTU, the e-Learning Centre of the University of Milan, in defining the teaching model and the technological architecture of the project.

As described in Damiani (2005) the structure of SSRI online can be summarized as follows:

- each online course is structured in modules corresponding to the various topics. Each module is composed of didactical units, associated with the various aspects of the topic and constituted by different activities: lectures, exercises, tests;
- all teaching material is available to students on the CTU web platform, which provides also forum discussions among students and tutors;

- students progresses are monitored by tracking their activities and the results of the tests associated with each online lecture;
- online activities are coupled with face to face meetings with teachers for course introduction, midterm tests and final exam.

Content is distributed mainly by video-lectures characterised by sequences of slides or desktop capturing, both synchronized with the explanation given by the teacher's voice. It should be noted that the average duration of each video-lecture is about one fourth of the corresponding classroom lecture.

The exercises proposed vary from online multiple choices, to closed answer tests, to more complex essays requiring tutor correction, to programming, and to networking exercises that students have to develop using a virtual lab (Frati, 2010) (Anisetti, 2007).

## 2.2 Online Support for Students

CTU designed and implemented the Ariel.net web platform, based on the Microsoft .net technology. This choice dated 2004. At those times, the Learning Management Systems offer was not too wide and, after a benchmarking activity, it seemed easiest and more appropriate to develop a "home-made" LMS, devoted to completely support online degrees or courses. The qualifying functionalities of Ariel.net allow:

- the support of one-to-one as well as one-to-many communications, both asynchronous and synchronous. Besides traditional e-mail and forums, Ariel.net supplies also a private messaging system among students and tutors integrated into each single didactical activity (instant messaging) a virtual bulletin board reserved to tutors to post general interest messages, a virtual classroom support for synchronous meetings among students and tutors/teachers;
- self-planning of learning activities by each student, who has a suggested learning plan, but who can change this plan according to her/his own needs.
- both online streaming fruition of audio/video elements, as well as download for offline fruition;
- the support of the exercising phases of students, tracking their advance and their results;
- the ability to closely follow and support the individual learning process of each student, through a tool allowing each student to annotate her/his own instance of the online material. (Damiani, 2005: 4).

## 2.3 Exams

Taking into account the particular needs of working students (as the majority of SSRI students are) SSRI online has been structured around a three four-month periods calendar, allowing the student to follow a reduced number of courses in each teaching period. Most of the courses plan two midterm tests, used not only for self-evaluation purposes but also for integrating the final grade.

Reserved exams for online students have been planned at the end of each four-month period, before the starting of the next one, in order to clearly separate test times from learning times. Moreover, to help working students, tests and exams have been organized on Friday and Saturday (Damiani, 2005: 5).

# 3. ORGANISATIONAL MODEL OF SSRI ONLINE

## 3.1 Production of Online Materials

As Anderson outlines: "having comprehensive and clearly stated intended learning outcomes, as well as a curriculum and associated teaching approaches designed accordingly, makes the task of building the ideal online learning system so much easier" (Anderson, 2008:124).

Following this statement, to implement the pedagogical design, SSRI online teachers have been supported by a group of instructional designers, coordinated by CTU.

The design activity started from the identification of the learning objectives of each course, followed by a complete re-design to identify a new content structure based on modules and units. Each unit has been organised in several lectures, associated with specific activities.

This macro-design phase has been followed by a micro-design phase, aimed at identifying, for each activity, the most suited way (i.e., slide sequence and/or desktop capturing synchronized with teachers voice, blackboard-like effect recording teachers voice and handwriting, teacher's video recording) to deliver the content. Video-based screen capturing software tools like TechSmith's Camtasia Studio® have been selected to facilitate teachers work, allowing them to produce autonomously almost all video lectures without requiring meeting CTU staff.

## 3.2 Course Tutoring

As already mentioned, SSRI target students are full time workers who hardly cope with their "work – family – study" balance, so assuring them a reliable and continuous support during each step of their learning process has been considered a key feature to improve their chances and finally to successfully achieve a degree. According to these purposes the SSRI online tutoring staff has been organised referring to the national and international literature available in 2004 about to roles and competences of tutoring. The main references were: (Salmon 2000) who grouped the competencies for e-moderators into five categories: (a) understanding online process, (b) technical skills, (c) online communication skills, (d) content expertise, and (e) personal characteristics; (Rotta M. and Ranieri M. 2005) and (Rivoltella 2006) who distinguished three different roles for tutors: instructor, as a content expert; facilitator, charged in scaffolding students; moderator, as a manager of tutors-students and peer to peer discussions.

So two SSRI different tutoring roles have been identified:

- Course expert tutor, who acts as content facilitator (for each course, one course tutor has been selected for each group of 40/50 students);
- Process tutor, who acts as e-moderator, process facilitator, adviser/counsellor.

Duties of course expert tutors and process tutor as well as their preferred interaction media are summarized in Table 1.

Table 1. Duties and interaction media of SSRI online tutors

| ***Tutor*** | ***Main duties*** | ***Preferred interaction media*** |
|---|---|---|
| Course expert | • Clarify course key concepts for the students.<br>• Give students sparks for reflection, evaluating their exercises or open essays.<br>• Answer any question useful to improve the student subject competences.<br>• Support teachers in developing the course contents, in managing exams and face-to-face meetings with students. | • One asynchronous forum for each course, used to promote discussion about course topics and day-by-day peer tutorship.<br>• Email messages from/to students.<br>• Instant messaging system used by students to pose questions directly related to a given learning step. |
| Process tutor | • Manage a preferential channel of communication with students.<br>• Monitor all the communication and relationship processes developing inside the learning environment.<br>• Coordinate and support any organizational and logistic process collaborating with the secretarial staff and the management. | • One asynchronous forum for the overall community of learners.<br>• Email messages from/to students. |

## 3.3 Learners Community Tutoring

The whole online community (students and course tutors) is coordinated and supervised by the process tutor. As (Berge 2000) points out an online moderator has to perform several roles: facilitator, manager, filter, expert, editor, discussion leader, marketer, and helper. (Moisey 2008: 430) also underlines that "the work of the counsellor in an online learning environment has three aspects. The first is to be involved in the development of online resources that help learners to identify and address barriers to reaching their educational goals. The second is to interact with the learners when an intervention is required. The third is to

work with other institutional staff to ensure that processes and procedures support and enhance learning"

Process tutor has to be aware of the online community climate and of the situation of every single student, so she daily interacts with students using both forums and emails, implementing a "push and pull" communication style. She answers to any student question and – at the same time – tries to prevent their inquiring by contacting them directly and scaffolding them in facing each difficulty. The process tutor also tries to keep students engaged in the online classroom activities and to promote as much as possible peer collaboration.

An analysis of the different topics discussed between students and the process tutor allows to understand how the areas covered by this communication process are wide: tips and tricks on course contents and exams, discussions about students study scheduling or about their study method, motivational counselling and sometimes also funny questions to relieve the pressure caused by the stressful daily routine of worker students. Eventually this interaction is intended to develop an empathic relationship with students, since a mutual trusting is essential to make the process tutor support effective.

At the same time, the process tutor pays attention also to all the other communications being developed inside the learning environment – mainly the discussions in course forums – because each interaction may give her interesting hints about the student competence improvements and about the community feelings.

Setting this team of tutors and cope with all its management dimensions – last but not least the economical one – during these first ten years has required a great deal of efforts, but the working students who represent our target found them really helpful.

Student feelings and opinions have been collected year by year through different surveys about their whole learning experience and about each single issue (teaching materials, tutoring services, learning management system and so on). Looking at the quality surveys collected in several years (Frati, 2010) it is easy to see that students always underline the importance of the constant presence and high reliability, the accuracy and fair play of tutors to better organise their time/energy efforts and to achieve their educational goals with a complete satisfaction. Aspects emphasized as the most positive are:

- teaching materials clarity and comprehensibility, precision and completeness, exercises availability and usefulness;
- teachers and tutors willingness and support;
- information availability and clarity about the teaching organization and the related exams.

# 4. BUSINESS MODEL OF SSRI ONLINE

In this section, we discuss the economical effort required to setup and to handle SSRI online during these first ten years, and the decision taken by the University regarding the fees required to students registering to the online version of the SSRI degree.

For the sake of simplicity, we mainly consider direct costs (i.e. money actually spent by the University) without estimating indirect costs due to staff time dedicated to SSRI online and amortization of the technological infrastructures used for this purpose. Rationale behind this choice is the fact that both staff time and infrastructures amortization are costs the University has to afford in any case, regardless the specific activities performed by the staff and the effective usage of the infrastructures. The decision to allocate personnel and resources to SSRI online can thus be considered an investment, which is part of the strategic plans of the University, more than a mere cost.

## 4.1 SSRI Online Implementation Costs

To setup SSRI online, we had to provide during the first three years all the video-lectures of the courses required to complete the degree: 21 mandatory courses and 6 elective courses, for a total of 183 CFUs (university credits, using the ECTS scheme where a full time student is expected to earn 60 credits per academic year).

As discussed in the previous sections, this required first to define a methodology for traditional courses restructuring, to provide guidelines for video-lectures implementation and to support involved teachers in the micro-design process of their restructured course. The private company consultants involved to supply competences not present at that time in the University operate during those first three years, for a total cost of

around € 350.000 including V.A.T. It should be noted that a side effect of this operation has been the knowledge transfer from the private company to CTU, which is now perfectly trained in supporting micro-design and implementation of online courses. In case of future initiatives like SSRI online, the consultancy cost could then be completely avoided.

The second, main setup cost the University had to afford has been an extra salary for teachers involved in the video-lectures implementation, requiring a significant amount of work to be completed within strict deadlines (thus frequently performed during evenings and weekends). To quantify this extra salary, a survey of similar activities in the University of Milan as well as other Italian Universities has been conducted, leading to the conclusion that the amount of work required to teachers can be considered proportional to the number of credits of each course (i.e., to its weight): as a result, an implementation cost per credit (€ 2.000) has been defined as the extra salary unit for the implementation of each course, and a revision costs per credit (€ 200) as the extra salary unit for teaching materials revision (error corrections, self-test updating, etc.) in the first two years after course implementation. Using these cost units, the resulting, total cost for a course of e.g. 6 credits (48 lecture hours in classroom) is € 14.400 over the first three years.

## 4.2 SSRI Online Management Costs

As discussed in section 3, the main activities required to manage SSRI online are:

- teaching support provided by a tutor expert of each course for each group of 40-50 students;
- support to the online community of students guaranteed by the process tutor.

Costs for the first type of tutors have been estimated in terms of hours per day necessary to monitor each course forum answering common questions, to reply to single students email messages, to correct open answer essays of students that cannot be automatically handled by the platform tools. Since these activities are only partially linked to the number of credits associated to each course (i.e. to its length) two cost units have been identified: a tutorship cost per course (€ 1.500 per year) and a tutorship cost per credit (€ 250 per year). As a result, the total tutorship cost for a course of e.g. 6 credits followed by 80 students needs two tutors, each costing € 3.000 per year.

Cost of the second type of tutorship (i.e., the process tutor) is easier to compute: it is the yearly cost for the University (€ 36.000) of an administrative person almost fully dedicated to SSRI online.

## 4.3 SSRI Online Revenues

Since no external financial support (private or public) has been obtained by the University to offer SSRI online, the only revenues come from the enrolment fees paid by the students.

In the University of Milan, the ordinary enrolment fee a student has to pay is based on a declaration of the total income of the student family. For a bachelor degree like SSRI online, it ranges from € 768 to € 3.639 per year, with an average around € 1.450 (computed on the students enrolled in SSRI online over the first ten years). To cover the extra costs of course and process tutorship – as well as some minor structure costs related to exams organised during weekends to facilitate participation of employed students – the University decided to apply an additional yearly fee of € 1.500 (independent from the student family income) which has been reduced to € 1.200 for the first cohort of students (enrolled in academic year 2004/05) taking into consideration the "pioneering" work they did in using for the first time (and sometimes debugging) all the teaching materials.

# 5. EVALUATION OF SSRI ONLINE AFTER THE FIRST TEN YEARS

## 5.1 Characteristics of SSRI Online Students

To evaluate the effectiveness of the online proposal and in particular the overlapping (if any) between the population of students registering to SSRI online and the population of students registering to the traditional, classroom version of SSRI, we took in consideration two main aspects: the age of students and their geographical provenience (i.e., their residence address).

ISBN: 978-989-8704-08-5 © 2014

As far as the age is concerned, SSRI freshmen (i.e., students registering to the first year of the degree) have been divided in three categories:

1. 18-20 years old, where the students who just finished high schools are found;
2. 21-28 years old, where students (partly already working, partly still searching for a job) interested to specialize in SSRI topics are found;
3. more than 28 years old, where working students are found, interested to raise their skills to become more attractive for their companies.

The comparison between SSRI online and traditional SSRI is given in Figure 1. It is easy to note the very limited overlap of the two populations: more than 50% of online students are older than 28 years, and less than 10% come immediately after the high schools, while almost 70% of the classroom students just finished their high schools ad less than 8% are older than 28 years.

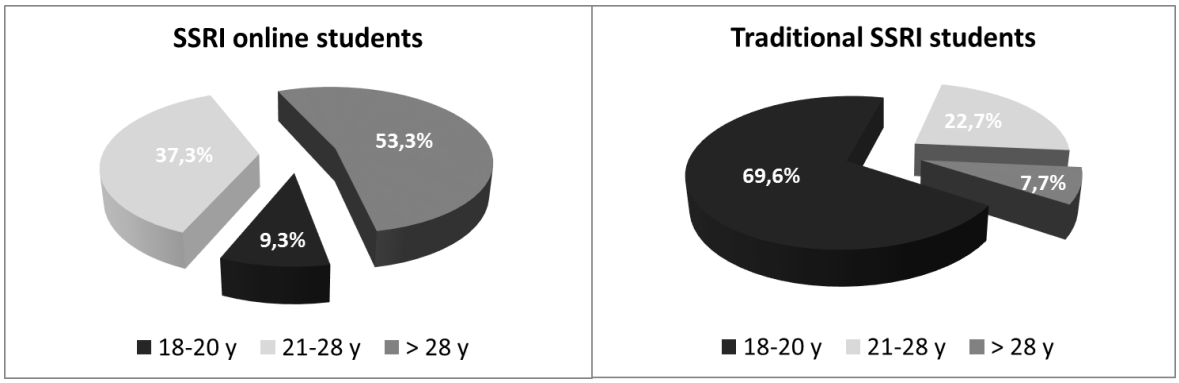


Figure 1. Age of SSRI online students vs. traditional SSRI students

As far as the provenience of students is concerned, again three categories have been identified:

1. students resident in Crema town and its surroundings (a small town 40 km. east of Milan, where classroom lectures of traditional SSRI are held);
2. students resident outside Crema and surroundings but inside Lombardia, the 24.000 $km^2$, almost ten million inhabitants north western Italian region where both Crema and Milan are located;
3. students resident outside Lombardia.

The comparison between SSRI online and traditional SSRI is given in Figure 2. It is easy to note again the very limited overlap of the two populations: more than 50% of online students resided abroad and selected the online version to follow the degree without moving from their home, while two thirds of the classroom students come from Crema and the surroundings area.

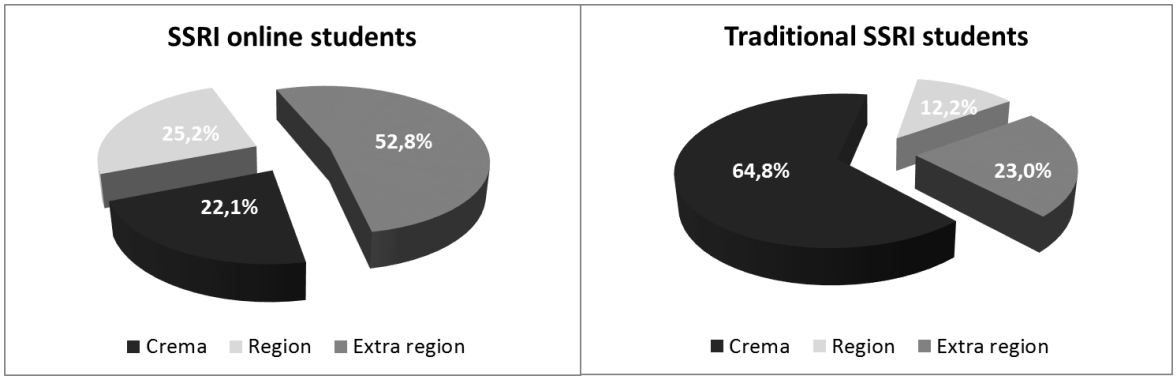


Figure 2. Home residence of SSRI online students vs. traditional SSRI students

From the above comparison, it can be concluded that the SSRI online initiative addressed a type of students different from the "usual" ones: these students would probably never have registered for the traditional classroom version of SSRI, thus the net result is a significant social service, with the improvement of skills of persons not interested to follow a normal degree, and a net increase of the number of University students.

## 5.2 Performances of SSRI Online Students

Online students' behaviour shows in general:

- a slower progression in their career with respect to traditional students; as seen before, most of them already have a job position, thus they have to study during weekends and evenings only;
- higher grades in exams, demonstrating the stronger motivation of online students paying a significant extra fee and possibly stealing time to their families to obtain the degree.

During the first ten years, 20% of online students obtained the degree (with respect to 33% of normal students) but with a final average degree around 100/110 (vs. 95/100 of traditional students).

## 5.3 SSRI Online Economical Results

A summary of the direct costs and revenues during the first ten years of SSRI online is provided in Table 2.

Setup costs (including all taxes) are summarized in the first two columns of Table 2. Note that in 2010 the Ministry of Education introduced some revisions in all Italian University degrees, requiring a further investment in SSRI online during year 2012 to update some of the already available online courses.

Full costs for course tutors are show in the third column of Table 2. The decrease of these costs in the last years are mainly due to the following reasons:

- progressive reduction of the number of students, common to all ICT degrees in Italy (and abroad) – see next section;
- reuse of previous years forums, progressively reducing tutors effort, with a consequent reduction of the cost units defined at the beginning of SSRI online life.

Full cost of the process tutorship is shown in the fourth column of Table 2, where the initial presence of more than one administrative person (even if part-time dedicated to SSRI online) reflected in larger expenses.

SSRI online total revenues are obviously strictly related to the number of enrolled students, as discussed above. As a result, sixth and seventh columns of Table 2 show an initial increase, due to the progressive activation of the three years of the degree, followed by a decrease due to the reduction of freshmen. Starting from last year (2013) a particular attention has been given to the degree promotion through social networks like Facebook, which led to double the first year population (economical results will obviously appear in spring 2014, after final payment of students fees).

It may be interesting to consider the graph reported in Figure 3, which plots the cumulative costs and revenues of SSRI online over the considered period. It is easy to note that the extra fees is almost sufficient to cover direct costs, while the sum of ordinary enrolment fees and extra fees practically double the expenses over the years. By considering that – as previously discussed – SSRI online students population has very limited overlapping with classroom SSRI population, leading to the conclusion that without the online version almost none of these students would have registered for the classroom version, we may conclude that SSRI online surely constitutes a profitable initiative even from the purely economic point of view.

# 6. CONCLUDING REMARKS

The paper presented an analysis of the online version of a bachelor degree in Security of Computer Systems and Networks, summarizing its design model, describing its organizational model and evaluating its business model.

Main conclusions we may draw from this analysis are the following:

- replicating online a traditional, classroom based degree needs a careful re-design of its courses to make it suitable for online students;
- tutorship (both for supporting the learning activities in each course and for helping the student community) is a key factor for ensuring student success;
- the populations of online and classroom students have very little overlapping: this means that an online degree supplies an important teaching service for students who cannot attend a traditional academic degree;
- even without specific funding, the economical result can be definitely profitable, provided that the University supplies human resources especially in terms of e-learning experts.

Table 2. Direct costs and revenues for SSRI online implementation

| | ***COSTS*** | | | | | ***REVENUES*** | | |
|---|---|---|---|---|---|---|---|---|
| | ***setup costs*** | | ***management costs*** | | ***TOTAL COSTS*** | ordinary enrolment fee | extra fee for online services | ***TOTAL REVENUES*** |
| | private company consultancy | teachers extra salaries | course tutoring | process tutoring | | | | |
| **2004** | | | € 33.016 | | **€ 33.016** | | | |
| **2005** | € 132.000 | € 74.855 | € 106.438 | € 24.000 | **€ 337.293** | € 176.816 | € 147.600 | **€ 324.416** |
| **2006** | € 108.000 | € 284.999 | € 170.168 | € 48.000 | **€ 611.166** | € 283.397 | € 279.000 | **€ 562.397** |
| **2007** | € 108.000 | € 159.907 | € 152.180 | € 48.000 | **€ 468.087** | € 384.313 | € 334.800 | **€ 719.113** |
| **2008** | | | € 134.136 | € 36.000 | **€ 170.136** | € 398.366 | € 340.000 | **€ 738.366** |
| **2009** | | | € 106.049 | € 36.000 | **€ 142.049** | € 436.483 | € 334.500 | **€ 770.983** |
| **2010** | | | € 80.734 | € 36.000 | **€ 116.734** | € 402.808 | € 200.000 | **€ 602.808** |
| **2011** | | | € 48.006 | € 36.000 | **€ 84.006** | € 393.069 | € 102.000 | **€ 495.069** |
| **2012** | | € 84.397 | € 52.622 | € 36.000 | **€ 173.019** | € 379.936 | € 43.500 | **€ 423.436** |
| **2013** | | | € 57.759 | € 36.000 | **€ 93.759** | € 342.615 | € 33.500 | **€ 376.115** |

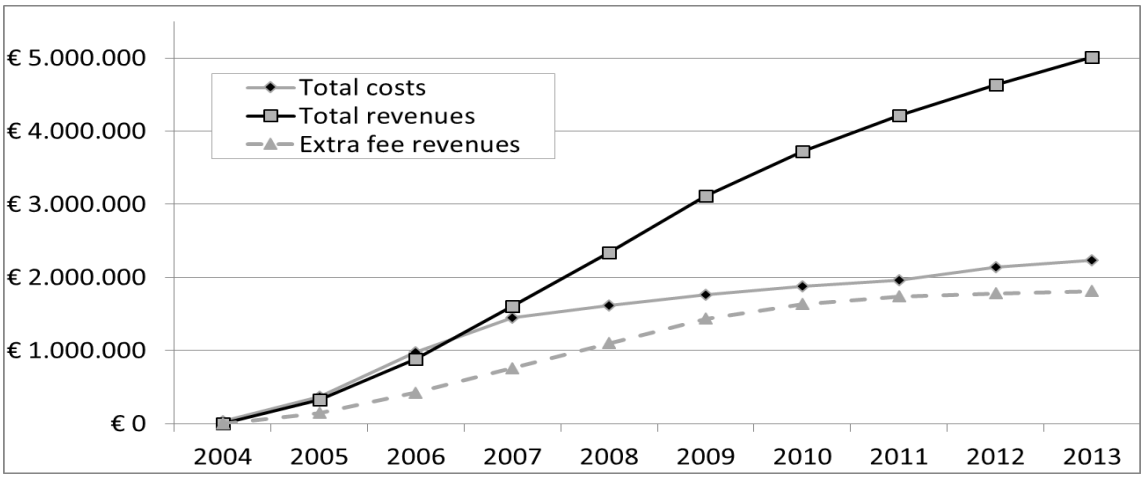


Figure 3. Cumulative costs and revenues for SSRI online over the first ten years

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