External Evaluation Report
June 2015

University of Prishtina

Faculty of Mathematical – Natural Sciences

- **Computer Science (Master)**
- **Financial Mathematics in Banks and Insurances (Bachelor)**

Authors (External Experts Team):
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1. Introduction

1.1. Context

The present document is the evaluation report 2015 about two study programs at the Faculty of Mathematical – Natural Sciences of the University of Prishtina, Kosovo:

- Computer Science (Master)
- Financial Mathematics in Banks and Insurances (Bachelor)

The report is the result of the joint work of a team of the two external experts appointed by the Kosovo Accreditation Agency (KAA), where Prof. Buchberger focused more on the Computer Science program and Prof. Deistler focused more on the Financial Mathematics program.

The evaluation report is based on

- two self-evaluation reports of the University of Prishtina (UP), Faculty of Mathematical – Natural Sciences, 2015, containing detailed information on the two study programs,
- the visit of the team of experts at the University of Pristina on June 10-11 2015,
- additional information provided by UP on request from the team of experts after the visit,
- comments given by the Department of Mathematics on the draft version of this report, in particular on our recommendations.

1.2. Team of Experts

The team consisted of the following external experts:

- Prof. Dr. Bruno Buchberger (Johannes Kepler University, Linz, Austria),
- Prof. Dr. Manfred Deistler (Technical University of Vienna, Austria).

The team expresses its gratitude to the representatives of the University of Prishtina for the excellent cooperation and warm hospitality. We also thank the representatives of KAA for their outstanding support and organization before, during and after the visit.

1.3. Evaluation Procedure

1.3.1. Preparatory Documents: Self-evaluation Report and Additional Documents

In preparation of the site visit, KAA sent two **self-evaluation reports** (on the two study programs) of UP, Faculty of Mathematical – Natural Sciences, 2015, plus some additional documents (in particular, the evaluation reports of previous years) to the team of experts.

The two self-evaluation reports were the central document for the evaluation. However, the **on-site visit was of crucial importance to give us a clear picture** about some essential issues of the programs. Also, some information delivered after the on-site visit could clarify some open questions.

1.3.2. On-site visit

June 10, 2015, 18:00: Preparatory Working Dinner

Participants:

Fisnik Goshi, KAA

Bruno Buchberger, Team of Experts

Topic: Discussion and organization of the visit program.

June 11, 2015, 7:30 – 8:30 Preparatory Working Breakfast

Participants:

Fisnik Goshi, KAA

Bruno Buchberger, Team of Experts
Manfred Deistler, Team of Experts

Topic: Discussion and organization of the visit program.

June 11, 2015, 9:00 – 9:30: Meeting with the Management

Participants:

Tahir Arbneshi, Dean of the Faculty

Agim Gashi, Vice Dean for Teaching

Florim Isufi, Vice Dean for Finance

Regjep Gjergji, Head of the Department of Math

Jeton Hyseni, Secretary of the Faculty

Kimete Lluga, Coordinator for accreditation of programs and ECTS

Fisnik Goshi, KAA

Bruno Buchberger, Team of Experts
Manfred Deistler, Team of Experts

Topic: General questions by the team of experts.

June 11, 2015, 9:30 – 11:30: Meeting with Persons Charged with Presenting the Two Study Programs

Participants:

Muhi Blohaj

Faton Berisha

Valentin Toçi

Ramadan Limani

Armend Shabani

Edmond Aliaga

Artan Berisha

Fisnik Goshi, KAA

Bruno Buchberger, Team of Experts
Manfred Deistler, Team of Experts

Topic: Detailed discussion of the two mathematics programs.

June 11, 2015, 11:30 – 12:00: Visit to Mathematics Facilities

Participants:

Fisnik Goshi, KAA

Bruno Buchberger, Team of Experts
Manfred Deistler, Team of Experts

Topic: Visit to math library, lecture room, computer lab.

June 11, 2105, 12:30 – 14:00: Working Lunch with KAA

Participants:

Fisnik Goshi, KAA

Bruno Buchberger, Team of Experts
Manfred Deistler, Team of Experts

Topic: Discussion of important insights of the morning meetings and organization of the afternoon meetings.

June 11, 2105, 14:00 – 15:15: Meeting with Mathematics Staff Involved in the Study Programs Proposed

Participants:

Qëndrim Gashi

Menderes Gashi

Bujar Fejzullahu

Naim Braha

Eliot Bytyqi

Fisnik Goshi, KAA

Bruno Buchberger, Team of Experts
Manfred Deistler, Team of Experts

Topic: Discussion of main discussion points from the morning meetings from the perspective of the teaching staff.

June 11, 2105, 15:15 – 16:00: Meeting with Students

Participants:

Kaltrina Sylaj

Albulena Bytyqi

Kushtrim Bacaj

Genc Blakqori

Fatos Morina

Rozafa Lloshi

…….. Destani

……

Fisnik Goshi, KAA

Bruno Buchberger, Team of Experts
Manfred Deistler, Team of Experts

Topic: Discussion of some critical points from the perspective of the students.

June 11, 2105, 16:00 – 16:15: Wrap-up with KAA Representative

Participants:

Fisnik Goshi, KAA

Bruno Buchberger, Team of Experts
Manfred Deistler, Team of Experts

Topic: Short summary of findings, organization and time table for final report delivery, request for additional documents.

June 11, 2105,, 16:15 – 16:30: Closing Meeting with the Management

Participants:

Tahir Arbneshi, Dean of the Faculty

Agim Gashi, Vice Dean for Teaching

Florim Isufi, Vice Dean for Finance

Regjep Gjergji, Head of the Department of Math

Jeton Hyseni, Secretary of the Faculty

Kimete Lluga, Coordinator for accreditation of programs and ECTS

Fisnik Goshi, KAA

Bruno Buchberger, Team of Experts
Manfred Deistler, Team of Experts

Topic: Agreement on the schedule for preparing the report of experts.

June 11, 16:30 – 17:00: Internal Meeting of Team of Experts

Bruno Buchberger, Team of Experts
Manfred Deistler, Team of Experts

Topic: Organization of the work on the evaluation report.

1.3.3. Additional documents

A couple of additional / improved documents were requested from the management via KAA, which were provided within two days.

2. Evaluation of the Computer Science Master's Program

External expert: Prof. Dr. Bruno Buchberger.

2.1. Summary Recommendation about Accreditation of the Computer Science Master's Program

We **recommend accreditation of the proposed computer science master's program** based on the following facts:

- **The program is absolutely essential** for the University of Prishtina and the state of Kosovo as a basis for the development of all scientific disciplines, all technologies, the economy, and the society in Kosovo. (In fact, establishing a computer science master's program as a continuation of the successful computer science bachelor program within the mathematics department was **a recommendation of the 2014 expert evaluation** of the mathematics program.)
- Developing this **program within the mathematics** department is a very sound decision. It opens the program for a wide range of bachelor graduates in Kosovo.
- The **study program** corresponds in terms of content (curriculum), extent (ECTS valuation of courses), and requirements for the master's thesis the **EU standard for "Master of Science"** programs, in particular in the area of computer science.
- **The academic staff involved is capable** of offering the program both in terms of contents as well as in terms of management.
- **The available infrastructure is sufficient** for running the program**.**

However, **many improvements are possible**, which we explain in detail below. The department chair and **the staff should be encouraged and monitored** to implement the improvements recommended **in** parallel to running the program.

Attention: The academic degree conferred by this program should be an **"MSc" (Master of Science)** and not an "MA" (Master of Arts) as erroneously stated in the self-evaluation report.

2.2. Detailed Evaluation

2.2.1 Academic Program and Student Management

The curriculum proposed, basically, **corresponds to typical and traditional computer sicence curricula at established EU universities**. However, the essence of today's curricula for creative math / computer science graduates, in particular master's graduates, who should be able to contribute to innovation in

industry, economy, and society, is that they learn to manage and implement **the entire problem / solution cycle**

- **starting from the vague formulation of problems** and the requirements of a project,
- discussing the **project specification** with the customer in the language of the customer,
- understanding, assessing and integrating **the financial and business implications** of the system,
- **estimating** the required time and effort and planning a budget for the project,
- **organizing and managing** a team of developers,
- **modeling** the problem in the language of mathematics and software
- searching for **relevant literature**, available mathematical algorithms and software tools,
- **designing** the system,
- **inventing** mathematical methods that are not readily available (as a goal of the master study),
- **developing** software system parts that are not available,
- estimating the computational **efficiency** of the system and system parts,
- **integrating** the system,
- **testing and verifying** the system,
- explaining and discussing the system design and system details **in interaction with the customer** in a cyclic development process,
- **documenting** the systems,
- **presenting** the system,
- **training** the users of the system,
- **maintaining** the system,
- **marketing** the system in a competitive environment.

The curriculum of the program proposed is set up in a traditional manner, i.e. by just putting together courses for the main “topics” that have been found useful in computer science. Further improvements of the study programs**, in the light of preparing students for mastering the entire above problem solving cycle**, should address the following issues:

- the **sequence** of courses,
- the **interdependence** of the courses,
- the **role** of the individual courses in the problem / solution cycle,
- the **role** of the individual courses for giving a complete picture of the area of computer science in the context of mathematics,
- the **relative importance** of the individual courses for the jobs and positions of the future graduates,
- the operational goals (**learning outcomes**) of the individual courses,
- the organization of an **introductory phase of motivation** prior to the start of the programs,
- an **introductory motivation part** for each course that explains its importance, relevance, and role in the sequence of courses in the curriculum,

- the organization of **extra courses for general working techniques** (thinking techniques, explanation techniques, discussion techniques, presentation techniques, team organization, project organization, starting companies, techniques of scientific work),
- the space in the curriculum left open for **allowing specialization and flexible adjustment** to new developments in the three programs,
- the **interaction of the students with companies** during the study programs,
- and the **interaction with other academic institutions** in Kosovo and abroad both on the level of staff and students,
- for **increasing the attractiveness of the programs for international cooperation** and for **increasing the job chances** for the graduates, the program should not only include courses for learning English but also realize part of the program (courses, seminars, discussions, projects) in **English as a working language.** (In fact, from the students we met during the on-site visit we got the impression that some of them master English quite well and are highly motivated to acquire good English communication skills on their own effort.)

Also, the design and implementation of a study program should be based on a thorough analysis of **supply-demand context** which comprises the four ingredients:

- the **interests** of students
- the **demand** of the job market
- the capabilities and interests of **available academic staff**
- the potential for **creating new and innovative companies**.

This analysis **should be based on facts and figures**, which must be collected systematically. This analysis is also of upmost importance for controlling the **admission to the program** and – on the other hand – the **drop-out rate**! We found **very little about this in the self-evaluation report** and in the discussion during the on-site visit.

As a special question, it must be argued why and how much the program proposed is **different from a program with the same name in the Faculty of Electrical Engineering** of the UoP. This became clear during the on-site visit. (Namely, the EE computer science master needs EE as a foundation. This may be reasonable for the EE computer science program but it excludes a great number of good and interested candidates for a computer science master!)

Also, very little is discussed about the **difference in content and – mainly in the learning outcomes - between the existing bachelor program and the proposed master's program of computer science**. The difference could be nicely spelled out in the light of the above problem solving cycle! (One

particular, additional, outcome should also be that master's graduates should have the prerequisites of entering a PhD program.)

The role of **internships** is left open in the proposal. Internships fall into two classes:

- **internships organized by the students** in their vacation time etc. for earning money and broadening their practical experience,
- **internships that could and should be part of courses** and the master thesis.

Recommendations for Improvements:

- The academic staff should get together regularly for working out a **convincing mission statement** on the basis of a deep and common understanding of the **problem solving cycle** and the **supply / demand context** of the program.
- **Facts and figures** about the ingredients of the supply / demand context must be collected systematically and must be the basis for **continuous adjustments and improvements of the program** and for controlling the stream of admissions and the drop-out.
- Make sure that the learning outcomes of the program and the individual courses are **clearly distinguished from the contents and learning outcomes of the bachelor** study.
- Provide measures that the master's program **is also a preparation for the PhD study.**
- Allow for greater **flexibility for specialization** and adjustment of the program to future topical developments.
- The use of mathematical **software systems like Mathematica etc., literature access systems, e-learning tools** etc. should be pervasive in all courses and should help to educate the students for self-studying and independent learning.
- Better **integrate the possibilities of internships** and joint projects with the industry into the main stream of the program, in particular in the master thesis stage.
- Increase the **English language skills** of students by teaching some of the courses. Train the teaching staff in order to be able to teach in English.
- The department should plan a **promotion campaign** for motivating talented bachelor graduates from Kosovo and abroad to enroll in the master's program**.**

2.2.2 Staff

Based on the analysis of the CVs of the academic staff involved it is clear the **program proposed can be offered in good (partly very good) quality**. However, since the supply / demand and the admission / drop-out system is only weakly documented and analyzed, it hard to judge whether the **student / staff ratio** is bad, average or good.

Also, there is **no clear policy whether the department wants to give strong motivation to the staff for doing research**. In fact, this would be very important. However, staff members have to cope with quite different living and earning conditions. .

We learned about the **definition of minimum qualifications for assistant, associate, and full professors** (1, 3, and 5 refereed papers minimum, respectively). This needs certainly an adjustment in the near future to compare with international standards.

Recommendations:

- A clear **plan for the development of careers** (in a good balance between research and teaching as well as administrative duties) must be worked out at the department level urgently.
- **Individual professors should be encouraged to play a more active role** in improving research, teaching, and administration. The spirit that universities are essentially shaped by professors and not by an anonymous “administration” must be developed.
- The **qualification standards** for assistant, associate, and full professors should be **gradually adjusted to international standards**. Gradually, also impact as defined by citations, should be considered. Furhermore, teaching performance should be taken into account.
- Also, the **crucial role of PhD students** for educating the next generation of scientists and professors must be urgently discussed as an important means for the further development of the department and the computer science program in particular..
- All staff members should try to **acquire extended expertise in using recent mathematical software systems** like Mathematica, Maple, Matlab, etc. and also teaching software like Geogebra as an overarching methodology of modern mathematics-based computer science and

engineering.

2.2.3 Research and International Co-operation

The involvement of staff in research varies significantly between the individual members. A **strategic research plan** should be set up starting from the currently strong research areas with the aim of making them stronger and, on the other hand, by expanding the spectrum of subjects.

International cooperation, at the moment, seems to happen nearly exclusively on the basis of individual relationships of staff members with researchers outside Kosovo. Efforts should be combined and **a strategic plan for long-term relationships** should be developed taking in consideration joint projects, in particular funded projects, exchange of faculty, exchange of **master and PhD students, attraction of international master and PhD students**.

Of course, all this takes time and effort and cannot be expected from a staff that seems to quite burdened by teaching the many courses in the curriculum. Thus, a serious change in the organization of courses (towards more independent student work and the use of mathematical software, self-study in reading courses etc.) will be necessary in order to spend the time more efficiently for **project work (involving also the students), research, proposal writing, and international cooperation**.

From the information we received, it is very hard to judge how much of the research of the staff feeds back into teaching and the contents of courses. This is also reflected by the fact, that the role and nature of bachelor and master's theses are hardly mentioned in the self-evaluation report.

Recommendations:

- The department should develop a **long-term strategic plan for focus research areas, funded projects acquisition, cooperative research and development with the industry and international cooperation.**

- The plan should also include **the bachelor, master's and PhD theses**, which can help to strengthen focus areas and, conversely, may be mosaic stones in getting strength in the focus areas.

2.2.4 Finances and Infrastructure (Space and Equipment)

It became apparent from the self-evaluation report and the meetings during the on-site visit that the department has basically **no own plan for finances, infrastructure and equipment** but just takes the plans coming from faculty, university and ministry level..

Legally, this may be acceptable but the **department should feel responsible for planning its own budget**. As much as this is possible, this may also lead to focus on certain goals. This will stay theoretical, as long as the entire department does not make a **serious effort to raise own funds from both scientific agency (both national and EU) and from companies**. Even if it may seem that companies in Kosovo normally do not have the necessary funds and appropriate mind-set for joint research and development with the university, serious attempts for raising the interest of companies should be made from the side of the department.

This is a feed-back loop: From successful projects with companies, more and more companies will learn, the mind-set will change and the innovation climate in the country will expand. Also, early contacts with companies will enhance the chances for students on the job market.

We think that, in traditional terms, **the department has sufficient space and also infrastructure in terms of PC labs**. However, today the trend is that **every student should have a powerful laptop** for organizing his study, accessing the web and also having significant math software on it. On the other hand it should be taken into consideration that some poor students need help in buying equipment. The department should focus on attractive **campus licenses** for the necessary software. Also, if for some students it is problem to have a good laptop, the department should think about **special fellowships or loan devices**. We also noticed that on campus **WLAN is not sufficiently powerful for mass use by students.** This should be improved a.s.a.p.

It is highly desirable that the students spend lots of time in the area of the department also in between the courses in order to promote team work, project work, discussion, interaction with the staff. This would need **extra space and / or remodeling part of the corridors as attractive open working space for students.**

The **library** does not seem to be up-to date. Not only because there are only few (modern) books and journals. This is expensive and hard to achieve for a young university. The point is that, anyway, **the methods to access literature changed drastically and will change further**. The internet, web, downloading, direct communication with authors, subscribing to one-line versions of literature, mixture of official literature and spontaneously uploaded

information etc. creates a completely new style of scientific information distribution and access. In fact, **this is a big chance for institutions that struggle for money.** However, in order to exploit the new chances fully, the department must make sure that

- **these possibilities are fully available to all students** (see remarks above about infrastructure),
- in particular money is put into **e-accessing the most relevant official literature,**
- and **intensive training** should be given to the students of how to work with the web for scientific purposes and to understand the notion of quality control in science etc. in the web age; this must not be left to the initiative of the students.

Recommendations:

- The department (the program) should have its own budget plan within the limitations predefined by the faculty and university but together with a serious and significant **endeavor to raise funds** from scientific projects and projects with companies.

- Space should be provided as **open working space for students.**

- Urgently, **WLAN**, support for equipping students with **laptops**, and **campus licences for mathematical software** should be made available.

- The "**library**" – in the broad sense of today's "global library" through the internet must be made accessible to staff and students in a planned approach. The **infrastructure** for this must be installed, **licenses** for the most important literature channels must be purchased, and the students must obtain a **systematic training** in accessing literature in the internet age.

2.2.5 Quality Management

Quality management is foreseen **on the level of course evaluation** by students but there is no evidence how the evaluation is taken into account for course improvement.

Another important aspect of quality management is **staff evaluation and**

career planning, see above. There seems to be little foreseen in the current proposal but this is essential.

Recommendations:

- The **professors** involved in the program **must plan and implement a systematic procedure** that evaluates and improves the appropriateness of the study plan, the performance of students, the performance of staff members, and the development of the entire demand / supply cycle for the program.

3. Evaluation of the Financial Mathematics in Banks and Insurances Bachelor Program

External expert: Prof. Dr. Manfred Deistler

3.1. Summary Recommendation about Accreditation of the Financial Mathematics in Banks and Insurances Bachelor Program

We **recommend accreditation** of the proposed Financial Mathematics in Banks and Insurances Bachelor Program.

This program constitutes an **important step to broaden the tertiary education** in mathematics at the University of Prishtina (and thus in Kosovo).

There is **certainly demand for graduates** from this bachelor's program, both inside and outside of Kosovo; perhaps not so much for large numbers, but for high quality of graduates.

The study program **corresponds in terms of content (curriculum), and extent (ECTS valuation of courses) to European standards**.

The **academic staff involved is capable** of offering the program both in terms of contents as well as in terms of management.

The **available infrastructure is sufficient** for running the program.

For such a program **a permanent discussion of possible improvements** is desirable, taking into account the fast development of the subject and the changes in the market - the latter both for graduates working outside or in academia. Such improvements require the creation of an interface, bringing together academic staff, alumni, institutions potentially interested in hiring graduates and students.

Improvements are suggested below.

Attention: The academic degree conferred by this program should be an **"BSc" (Bachelor of Science)** and not an "Ba" (Bachelor of Arts) as erroneously stated in the self-evaluation report.

3.2. Detailed Evaluation

3.2.1. Academic Program and Student Management

The curriculum proposed basically **covers the subjects typical for similar curricula at other universities in Europe**. It should be emphasized, that both, a solid foundation in mathematics and a thorough introduction to economics and finance has to be provided. This is an ambitious, but viable aim. In a certain sense, this makes the program attractive for a certain group of students. At several other universities, the bachelor's program is common to all mathematicians and the specialization to economics and finance is done in the master's program. In my opinion, both approaches are reasonable.

In the reviewer's opinion it should be seriously considered to **broaden the scope of the program to "Mathematics for Economics and Finance".** The basic elements for doing so, namely courses in macro- and microeconomics (including game theory), econometrics and operations research are already in the present curriculum, but could never-the-less be deepened on costs of courses related to management. Broadening of the scope to economics would broaden the market for graduates, by opening certain areas for them, such as macroeconomic analysis and forecasting, labor market analysis, inventory management or advertising analyses for firms. It would also broaden the market for graduates planning to continue in a master's program abroad.

The reviewer strongly recommends to **put more emphasis in the program on statistical or econometric analysis in the broad sense**, in particular

also in order to **train the students for actually working with data**. Evidence-based results (ranging up to “big data” analysis) are of increasing importance in economics and finance. In order to adapt the program accordingly, for instance, the first courses in statistics should be shifted to the first and second year, probability theory should be shifted accordingly, and econometrics, may be, should be shifted to the second term in second year). Again, deepening of these subjects on costs of courses related to management or English (the latter should be acquired by the students at their own initiative) is recommended. I also recommend to introduce bachelor’s theses, preferably on data-based issues.

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3.2.2. Staff

Here and in the following points, **my analyses and recommendations are completely identical to those of Professor Buchberger for the Computer Science Master’s Program.** Therefore, I will only comment on a few additional issues:

“Also, there is no clear policy whether the department wants to give strong motivation to improve research (Buchberger)” In fact, this would be very important, also given the rapid development of the subjects, both in terms of theory and methods, as well as in terms of fields of application. “However, staff members have to cope with quite different living and earning conditions” this is definitely true. The department should aim at a **policy for fostering sabbatical leaves for research-active academic staff as well as for inviting researches from abroad.**

3.2.3. Research and International Cooperation

The best, say 10- 15 percent of the graduates should be strongly encouraged to apply at master programs abroad. They should be advised by staff members in doing this, who, in turn, should make themselves knowledgeable in this respect. The success rate in these applications would also provide a valuable feedback for the staff.

3.2.4. Finances and Infrastructure (Space and Equipment)

No additional comments.

3.2.5. Quality Management

I strongly recommend to establish an **interface for exchange of information and strategic reasoning concerning the continuous adaption of the bachelor program,** in particular of its focus points on the one hand and concerning the requirements from the market, in- and outside of academia and in- and outside of Kosovo, on the other hand.

I should also add, that the quality of the graduates, both in terms of mathematical “skills” and economic knowledge is essential for the **long-term reputation of the curriculum**. To repeat, a good test for this would be the success rate of graduates applying for master programs outside of Kosovo.

The staff should try to play an active role in placing graduates.

Finally, last but not least, I have to say, that **I was quite impressed by the motivation and the high level of argumentation of the students present** in the hearing on Jun 11, 2015.