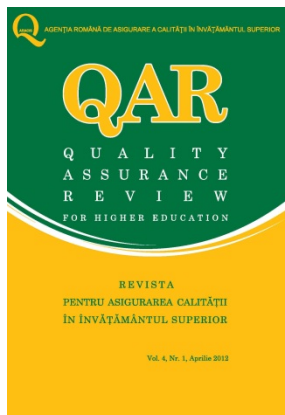




**AGENȚIA ROMÂNĂ DE ASIGURARE A CALITĂȚII ÎN ÎNVĂȚĂMÂNTUL SUPERIOR**  
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## Quality Assurance Review For Higher Education

*Experience in Running a Computer Science Master's Programme in English.  
First Steps towards Internationalization*

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# Experience in Running a Computer Science Master's Programme in English. First Steps towards Internationalization

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**Abstract:** *The main aim of this paper is to analyze several international master's programmes in Computer Science in order to identify their common elements, their strengths and their particularities. Various mobility patterns specific to the case of joint programmes, involving from two up to six partners, are also identified. This information is then used to evaluate the status, with respect to the internationalization potential, of a research master's programme in Artificial Intelligence and Distributed Computing, taught in English, organized at the Department of Computer Science from the West University of Timisoara. The context which motivated the creation of the programme, as well as the main outcomes are discussed with an emphasis on the internationalization related aspects. Finally, some critical elements in ensuring the success of international master's programmes in Computer Science are discussed and the main steps towards internationalization are identified.*

**Keywords:** *internationalization, mobility patterns, joint programmes, quality assessment*

**Rezumat:** *Scopul principal al acestei lucrări este de a analiza câteva programe de master internaționale din domeniul informaticii, cu scopul de a identifica elementele comune, punctele lor tari precum și elementele specifice. Pentru programele organizate în parteneriat, cu un număr de parteneri variind între doi și șase au fost identificate diferite scheme de asigurare a mobilității studenților. Aceste informații au fost ulterior utilizate pentru a evalua starea de fapt, din perspectiva potențialului de internaționalizare, a masterului de cercetare în domeniul Inteligenței Artificiale și a Calculului Distribuțit, predat în engleză, și organizat la Departamentul de Informatică al Universității de Vest din Timișoara. Sunt discutate contextul care a motivat lansarea programului de master precum și principalele realizări obținute până acum, punându-se accent pe aspectele corelate cu procesul de internaționalizare. În final, sunt discutate câteva dintre aspectele critice pentru succesul unui program de master internaționalizat, în domeniul informaticii și sunt identificați principalii pași de urmat în procesul de internaționalizare.*

**Cuvinte cheie:** *internaționalizare, scheme de mobilitate, programe în parteneriat, evaluarea calității.*

## 1. Introduction

It is usually acknowledged that an international experience during the academic studies brings several important benefits both to undergraduate and to graduate students, creating premises for better career opportunities. Studying in an international environment can reinforce adaptability and initiative, improve the problem solving abilities and enhance the collaboration and communication skills (Michel and Stratulat, 2010: 135). In the field of Computer Science the internationalization process should be rather natural, as this is one of the domains which stimulate the globalization process by offering tools which enhance the contact and collaboration between people located at large distances. On the other hand, the interest in studying Computer Science and related topics is

still high, despite some decreasing trends noticed in the last years (Marsan, 2009: 23). Thus, internationalization of master's programmes on topics related to Computer Science answers to an existing request on the academic market. However, it is not easy to design trans-national programs as long as there is still a significant heterogeneity among the education systems, even in Europe. In an ENQUA report (Bitusikova, 2010: 18) is stated that the „master level is not yet stabilised across Europe and varies from country to country” and there are three main types of programmes: professional master programmes, research intensive master programmes and programs containing specialized modules offered to returning learners (designed mainly as re-professionalization programs). In the same report it is stated that the research content of master's programmes varies between different countries and different universities. In the context of internationalisation of studies it is important to identify the common elements of different programmes and to make them compatible without altering their specificities.

Therefore, one of the aims of this paper is to analyze several international master's programmes in Computer Science in order to identify their common elements, their strengths and their particularities. Various mobility schemes in the case of joint programmes are also identified. This information is then used to evaluate the current status, with respect to the internationalization potential, of a research master in Artificial Intelligence and Distributed Computing (AIDC) organized at the Department of Computer Science from the West University of Timisoara.

In another ENQA report (Mulder, 2010: 41) it is stressed out that, as long as the research is the moving force of economies, strong master's programmes oriented toward research are more likely to be attractive for talented international students. Moreover it is emphasized the fact that, at least in the Netherlands, the stakeholders have formulated four perspectives on the research master's programmes. Thus, such a programme could: exclusively prepare for a PhD; prepare for a position in research, but not necessarily a PhD; offer orientation on research, but with an intrinsic value; just offer top education.

The paper is organized as follows. Section two presents the particularities of various types of international master's programmes on topics related to Computer Science, as they were extracted from a comparative study involving fifteen programs. In section three is presented a case study concerning a master's programme taught in English, which is organized at the Department of Computer Science from the West University of Timisoara. The last section discusses some critical elements related to the quality and success of international programmes and analyzes the current status of the AIDC master with respect to the main steps of the internationalization process.

## 2. Particularities of international master's programmes in Computer Science

In order to identify the particularities of successful international master's programmes in Computer Science we conducted a comparative study involving 7 master's programmes organized by universities and professional associations from Europe and 8 European Masters in Computers Science developed in the framework of Erasmus Mundus programme of European Commission. The analysis allowed us to extract some common elements and to identify several models used in designing and conducting an international master's programme.

**Data collection methodology.** The information concerning the international programmes was extracted from public data accessible by web search, the main source being the programmes web pages and the Erasmus Mundus web page<sup>1</sup>. The list of international programmes involving one host university is presented in Table 1 and the list of analyzed Erasmus Mundus master's programmes is presented in Table 2.

<sup>1</sup> Erasmus Mundus Masters Courses [http://eacea.ec.europa.eu/erasmus\\_mundus/results\\_compendia/selected\\_projects\\_action\\_1\\_master\\_courses\\_en.php](http://eacea.ec.europa.eu/erasmus_mundus/results_compendia/selected_projects_action_1_master_courses_en.php)

**Table 1.** International Computer Science related master programme organized by one university

Master Programme	Institution	Web site
International Studies in Informatics	University Johannes Kepler, Linz, Austria	<a href="http://www.isi-hagenberg.at/">http://www.isi-hagenberg.at/</a>
Media Informatics	RWTH Aachen University, Germany	<a href="http://mi.b-it-center.de/">http://mi.b-it-center.de/</a>
Software Systems Engineering	University of Aachen, Germany	<a href="http://dbis.rwth-aachen.de/SSE/">http://dbis.rwth-aachen.de/SSE/</a>
Computational Science and Engineering	Technical University of Munchen, Germany	<a href="http://www.in.tum.de/en/for-prospective-students/master-courses-of-study/computational-science-and-engineering.html">http://www.in.tum.de/en/for-prospective-students/master-courses-of-study/computational-science-and-engineering.html</a>
Information Technology	University of Stuttgart, Germany	<a href="http://www.uni-stuttgart.de/infotech/">http://www.uni-stuttgart.de/infotech/</a>
Computer Science and Networking	University of Pisa, Italy	<a href="http://www.xtreemos.eu/news/international-master-course-in-computer-science-and-networking-university-of-pisa-and-ssup-s-anna">http://www.xtreemos.eu/news/international-master-course-in-computer-science-and-networking-university-of-pisa-and-ssup-s-anna</a>
Computer Science	University of Gottenborg, Sweden	<a href="http://www.itufak.gu.se/english/education/programmes/cs/">http://www.itufak.gu.se/english/education/programmes/cs/</a>

**Table 2.** European masters courses related to Computer Science organized in the framework of Erasmus Mundus Program.

Program	Web site	Number of partners
EuMI - European Master in Informatics	<a href="http://eumi-school.org/">http://eumi-school.org/</a>	3
DESEM - Erasmus Mundus MSc in Dependable Software Systems	<a href="http://www.cs.nuim.ie/courses/desem/">http://www.cs.nuim.ie/courses/desem/</a>	3
EMECS - European Master Embedded Computing Systems	<a href="http://mundus.eit.uni-kl.de">http://mundus.eit.uni-kl.de</a>	3
EMDC - European Master in Distributed Computing	<a href="http://www.kth.se/emdc">http://www.kth.se/emdc</a>	3
European Masters Program in Computational Logic	<a href="http://www.computational-logic.eu">http://www.computational-logic.eu</a>	4
IT4BI - Information Technologies for Business Intelligence	<a href="http://it4bi.univ-tours.fr/">http://it4bi.univ-tours.fr/</a>	5
NORDSECMOB - Master's programme in Security and Mobile Computing	<a href="http://nordsecmob.tkk.fi/">http://nordsecmob.tkk.fi/</a>	5
DMKM - Data Mining & Knowledge Management	<a href="http://www.em-dmkm.eu">http://www.em-dmkm.eu</a>	6

**Common elements.** All analyzed programs are in taught in English, which is natural, as long as the professional language of Computer Science is based on English. In fact English can be considered the lingua franca of computing. Therefore, professional communication barriers are almost

inexistent in the case of Computer Science, making the internationalization of academic programs in this field considerably easier than in other fields, at least with respect to the language issues. Nevertheless, all master's programmes include in the admission requirements the necessity of proving sufficient fluency in English.

Another common point is related to the overall structure of curricula. All programmes offer a mixture of fundamental courses and professional projects distributed over four semesters. The standard curriculum groups the harmonization and core courses in the first semester, the specialization courses in the second and third semesters, while the last semester is usually devoted to internships and master thesis preparation. Despite the technical profile of the programmes, almost all of them offer humanities modules, mainly oriented toward the language and culture of the host university, and also leadership modules.

Another aspect, particularly important in Computer Science programmes, is the emphasis on the teamwork. Thus, all of them include professional projects and stimulate both individual and team work. A critical element is represented by the existence of internships organized at internationally recognized companies. In the case of research masters a similar element is represented by the cooperation with research institutes. For instance, in the case of the Media Informatics programme organized by the University of Aachen the tight collaboration with the Fraunhofer Institutes of Applied Information Technology (FIT) and Intelligent Analysis and Information Systems (IAIS) represents a strong point, which significantly contributed to the attractiveness of this programme for international students. In the programme description is mentioned that the programme attracted, up to now, students from 46 countries.

**Internationalization models.** By analyzing the programmes listed in Tables 1 and 2 it follows that there are several internationalization models. A first classification is that dividing the programs in those organized by a host university and those organized by consortia involving two or more universities and which offer double or, in some cases, even multiple degrees.

**Model 1: One host university.** All programs listed in Table 1 belong to the first category. The main international dimension of programmes organized by one host university is the fact that they attract international students. The goal of attracting international students is not easy to be achieved. There are some critical elements which have an important impact on the success of such programmes: the master's programme should be a strong and competitive one in the field in which it is offered; the host university should have a good international visibility; the programme should offer attractive internships to the students; the programme should be properly advertised. Components addressing other dimensions of the internationalization are related to the mobility offers for students (both local and international) and to the involvement of international teachers. Thus, many of such programmes offer to their students the opportunity to follow some modules at another university, usually in a different country. On the other hand, the strong programmes attract teachers from other universities. Thus the first dimension of internationalization, that ensured by the existence of international students, is enriched by the other two dimensions: international mobility and international teachers.

**Model 2: Two partners universities.** The simplest partnership in organizing a master's programme is that involving two universities which are compatible but, in the same time, at least partially complementary with respect to the resources, academic offer and the research/industrial environment. The simplest example is that involving two universities which offer programmes in the same field but with a different emphasis: one of the programmes excels in the theoretical background provided to the students and the other one excels in the applications part and internship opportunities. Such a program, in Industrial Mathematics, is currently running at the Department of Computer Science from the West University of Timisoara in cooperation with the Technical University of Eindhoven (TUE). The first year, containing harmonization and core courses is organized in Romania where are also hosted the students coming from TUE, while the second year, which focuses on specialization courses, project work and internship, is organized at TUE where the Romanian students

are also enrolled. The advantage of this model is the possibility to exploit the particularities of the partners and to construct a powerful programme by merging two programmes with complementary strengths.

**Model 3: More than two partners.** Partnerships involving more than two partners are specific to Erasmus Mundus master's programmes. The typical number of partners is between 3 and 6, as is illustrated by Table 2, where currently running successful programmes are listed. Most of these programmes offer double degree, given by the universities where the highest number of credits was obtained. The European master's programmes are coherently constructed by combining both common and specific topics currently offered by the partner universities. The main particularity of these programmes is the mobility scheme followed by the students. In the simplest case, all students follow the same mobility scheme, e.g. the first year at University 1, the third semester at University 2 and the thesis preparation at University 3 (in the case of three partners). The current programmes offer a more flexible variant, the student being able to choose his/her own route as long as some requirements concerning the core and specialization courses are satisfied.

One of the simplest schemes is that of the European Master in Informatics (EuMI) involving three partners: University of Trento, RWTH Aachen University and the University of Edinburgh. Three joint curricula involving two universities of the consortium are designed and each student has to choose one of these variants (depending on his/her preferences on the specialization topics offered by the three universities). The student will spend the first year at one university and the second year at one of the remaining two universities. The thesis will be prepared at the university visited in the second year, but it will be jointly supervised and evaluated by two professors, one from each visited universities. Upon the successful completion of the curriculum, the students will be awarded a qualification equivalent to Master's degrees in the two visited universities.

An even more flexible program, also organized by a consortium of three partners (Royal Institute of Technology - KTH in Sweden, Universidad Politècnica de Catalunya - UPC in Spain and Instituto Superior Técnico - IST in Portugal) is the European Master in Distributed Computing. The first year of studies is carried out at one of the universities in Spain and Portugal. The third semester is organized at KTH and the students can choose any of the partners for preparing their master thesis. Such a scheme allows to exploit the strengths of each partner (e.g. UPC and IST are strong on topics related to distributed computing fundamentals while KTH offers expertise in more specialized topics).

There are programmes, as the European Master in Computational Logic, which involves besides European academic partners (in this case four partners: Technische Universitaet Dresden, Free University of Bozen-Bolzano, Universidade Nova de Lisboa, Technische Universitaet Wien), also institutes outside Europe (in this case ICT Australia (NICTA) Research Centre of Excellence) where the students can spend three summer months in a research internship. The mobility scheme is as follows: first semester at the Technische Universitaet Dresden (TUD), the second semester at the Free University of Bozen-Bolzano (FUB), and the second year in one of the 4 partner universities chosen by the student.

As the number of partners increases, the number of possible mobility patterns also increases, allowing the students to personalize their academic trajectory according to their interests. The European Master in Information Technologies for Business Intelligence, involving 5 academic partners and several associated industrial partners, is such a program. The first semester is organized at Université Libre de Bruxelles (ULB) and the courses of the second semester are offered by the Université François Rabelais Tours (UFRT) in France. For the third semester, devoted to specialisation, the students can choose between Ecole Centrale Paris (ECP) in France, Universitat Politècnica de Catalunya (UPC) in Spain, and Technische Universität Berlin (TUB) in Germany. The fourth semester is dedicated to the master's thesis which can be realised either as a placement in industry, or as an internship in a research laboratory at any full or any associated partner. At the end, the graduates will be awarded with a triple degree, the national master's degrees from ULB, UFRT and

from the specialisation of the university. A specific aspect of programmes involving a large number of partners is the fact that the contact between students is limited to the semesters when they are all enrolled at the same university. In order to ensure the contact between all students, some common events (as summer schools or common workshops) are usually organized.

One of the most complex model encountered among the currently running European Master's programmes is that provided by the EU Master in Data Mining and Knowledge Management which involves 6 partners (Universite de Lyon - France, Universite Paris 6 - France, Polytech Nantes - France, University of Piedmont - Italy, Politehnica University of Bucharest - Romania and Politècnica de Catalunya - Spain). The mobility pattern is very flexible: the student can choose any of the universities in France to follow the fundamental courses of the first semester, then he/she can follow the second and third semester at one of the other three partners. Finally, the internship (fourth semester) can be followed at any of the partners or even at an associate partner from a third country. In order to ensure effective communication between the students distributed to different partners, the fundamental courses are offered in common by videoconferencing systems. Another particularity of this program is the fact that each partner offers a specialty in the field of Data Mining and Knowledge Management, and the students can decide which one of the six specialties suits better to them.

Designing a successful joint master's programme involving more than three partners is not an easy task. The EC project EMACS (European Master in Computer Science)<sup>2</sup> proposed a „reusable methodology for identifying coherent combinations of course components from a large set of geographically distributed subjects”. This methodology can be used to design a curriculum for masters' level modules in Computer Science provided by several partner institutions. Usually the teachers are those of the host institution, but a module can be taught by a professor from another institution.

In the programmes presented above the building block (minimal amount of time spent at one institution) consists of one semester. The EMACS project introduced the concept of short modules (modules requiring 1-2 weeks stay at the host university) and proposed a methodology to design a personalized curriculum by combining the building blocks represented by the short modules. The advantage of such short modules is the fact that they can be offered also to companies or to anyone interested for further education in the context of life long learning process.

The key issue in designing a study program is to ensure coherence between the course components. The flexibility is ensured by the possibility of replacing one module with another one, as long as they are equivalent. In the context of the EMACS project, the notion of equivalence is four-fold: thematic (the modules should address similar topics), workload (expressed by the same number of credits), time-compatible (modules offered in the same semester) and language-compatible (the modules should be taught in the same language). There are also some restrictions in the choice of the modules: those included in the first and fourth semester should correspond to the curriculum in the home university (the first and the last semester are followed at the home university). During the second and the third semesters the student has the possibility to visit other partner universities.

The various models presented above illustrate the existence of many facets in the internationalization process and the fact that successful programmes are obtained when the strengths of different partners are adequately exploited.

### **3. Case Study: A Master's Program in Computer Science taught in English**

This section presents the experience of running a master's programme in English at the Department of Computer Science from the West University of Timisoara. The “Artificial Intelligence and Distributed Computing” master's programme has been launched in 2008 and since then 40 students already graduated. The average number of students per year was 25. The particularities of this

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<sup>2</sup>EMACS – European Master in Computer Science (134385-LLp-1-2007-1-PT-ERASMUS-ECDSP)

program are highly influenced by the context represented by the other undergraduate and graduate programmes existing at the Department of Computer Science.

**Context and motivation.** The main motivation of launching the “Artificial Intelligence and Distributed Computing” in English was the existence of an undergraduate Computer Science programme also taught in English with a first series of graduates in 2008. In the same time, a similar master’s programme, taught in Romanian, was already functional. Thus, the context was appropriate: there were graduates interested in continuing their studies in English and also an already well established research master’s programme in Artificial Intelligence and Distributed Computing. The existence of an already validated curriculum and of course materials, initially in Romanian, facilitated a smooth transition toward the program taught in English.

In the same time, since Distributed Computing and Artificial Intelligence are the main research directions at the Computer Science Department, there are several research projects on topics related to the curriculum and also collaborations with research teams from Europe. Thus, there was an environment which stimulated the involvement of master students in the research activity of the local team or in collaboration with international teams. On the other hand, there were several academic agreements with international universities, creating opportunities for student mobility and for attracting teachers from partner universities.

**From initial aims to outcomes.** The main initial aim was to ensure the continuity of the academic trajectory for the graduates of the undergraduate Computer Science in English. The initial expectations were fulfilled, as almost 60% of the graduates of the undergraduate programme in English followed the master’s programme also taught in English. The feedback from graduates is encouraging, as they acknowledge the benefits of following both the undergraduate and the graduate programme in English in obtaining good positions at international companies or in accessing to international PhD programmes.

Another aim was to create opportunities for students to work in an international environment. As outcomes we can mention here the fact that 11 students (representing 17%) benefited of mobility programs at European universities and research institutes. Besides traditional Erasmus mobility programme, the students also participated at research stages at INRIA<sup>3</sup> and at research secondments organized in the framework of the FP7 project SPRERS<sup>4</sup>. Consequently, 6 of the 20 master theses defended in 2011 were prepared during stages at universities and research institutes in Europe (4 in France and 2 in Denmark). Also, during the last two years, 9 students were included in the teams of national and international collaborative research projects.

A third aim was to attract researchers from universities outside Romania to give invited lectures. Since 2008, 2 associate professors taught short modules each year and 23 researchers gave invited talks on topics related to the master program.

Thus the AIDC master satisfies some of the particularities of an international programme: international mobility for students, foreign teachers and involvement of students in international research teams. However, besides a small number of Erasmus students, no other international students were attracted into the programme. Thus the internationalization is partially achieved, being ensured only in one direction: outgoing students (from the West University of Timisoara to other universities in Europe). Efforts should be made now to step toward full internationalization.

#### 4. Steps towards internationalization

There are several pre-conditions which should be satisfied by a master’s programme in Computer Science in order to have chances to become an international one: *competitiveness*, *accessibility*, *visibility* and *attractiveness*.

<sup>3</sup>INRIA (<http://www.inria.fr/en/institute/international-relations>)

<sup>4</sup>SPRERS-Strengthening the Participation of Romania at European R&D in Software Services (<http://sprers.eu>)



By competitiveness we mean that the programme should be compatible and qualitatively comparable with study programmes in the same field offered by other universities. In the same time, it should satisfy the requirements of the international IT (Information Technology) labor market, which is a particularly dynamic one. Unless the program is able to keep up with the technological changes and the latest results of the research in the field, it cannot be a competitive one. This means that the Computer Science curricula should be frequently updated and aligned to the international trends. In this field, the guidelines provided by ACM (Association for Computing Machinery)<sup>5</sup> are particularly useful. By providing recommendations aligned to the up-to-date status of the research and development in computing technologies, the ACM reports help in ensuring the compatibility between different programmes addressing similar topics.

By accessibility we mainly refer to the language aspect. As already mentioned, computer science is one of the privileged domains for which there are no significant linguistic barriers. However, an international master has not only the aim of providing specific knowledge, but also the aim of offering to international students the possibility of a smooth integration in the social and cultural environment of the host university/country. Therefore, the modules on the Romanian language and culture to international students should not be neglected.

There are a few aspects which contribute to the visibility of a master programme. A first important role is played by the visibility of the host university itself. These days, this can be easily ensured by a comprehensive and friendly web site with multilingual support and easy access to information for international students. Another important role is played by the visibility of teachers and researchers. This is mainly ensured by their scientific outcomes included in international publications, their participation to conferences, summer schools and trainings, their involvement in research teams of international projects and their collaboration with international companies. The existence of research and academic collaboration agreements between the host university/team and other universities/teams is important in ensuring the program's visibility and in identifying appropriate mobility schemes.

A Computer Science master's programme is attractive for international students if it offers an up-to-date curriculum and, in the same time, opportunities for internships at highly-placed companies or for research stages in the framework of international projects. Other aspects contributing to the programme's attractiveness are related to the research infrastructure, accommodation facilities, scholarships and opportunities to learn about local language and culture.

In the context of the internationalization process a critical issue is represented by the variability between the quality requirements of different master's programmes (Bitusikova, 2010: 18). Therefore the development of common procedures for quality evaluation is highly desirable. In the framework of EMACS project<sup>6</sup> some quality indicators addressing the evaluation of students, teachers, industrial placements and quality of mobility have been proposed. The indicators which are particularly relevant with respect to the internationalization process are: number of students and teachers that participated to mobility programmes (both out-going and in-going); satisfaction of the students participating in the programme; number of companies and research institutes (local and international) with which there are agreements for work placements; percentage of students who participated in work placements (local or international). In the case of research oriented master's programmes the quality assessment should take into account the particularities of such programmes. Such particularities are: the students should do, at least in the final year, research activities materialized in a master thesis with scientific value; the admission should be highly selective in order to attract outstanding students, able to conduct a research activity and continue with doctoral studies, even if their number is reduced (Mulder, 2010: 41).

The idea of working with small groups of students in order to ensure high standards of quality, especially in the case of research master's programmes, is also emphasized by Andree Surssock

<sup>5</sup> ACM – Association for Computing Machinery (<http://www.acm.org/education/curricula-recommendations>)

<sup>6</sup> EMACS - Erasmus Project 134385-LLP-2007-PT-ERASMUS-ECDSP

who states that „a successful international strategy cannot be simply financial but should be linked to academic concerns with quality, and that this costs rather than brings in money” (2010: 15). Thus, even the most important international players in the academic field can have difficulties unless they accept that studying abroad is a long term investment yielding very little short-term financial gains.

To summarize, the main steps towards internationalization are:

- Develop a strong and competitive master’s programme taught in English.
- Identify academic partners and ensure the compatibility of the study programmes and also of the evaluation and quality assessment procedures.
- Identify attractive IT companies and research institutes for internships and research stages, respectively.
- Ensure participation to international research projects, especially in the case of research oriented master’s programmes.
- Identify funding schemes for financial support to be offered to international students.
- Enhance the visibility of the programme and promote it through various actions and instruments.

These steps are not necessarily sequential, usually they are interrelated. When looking at the status of the Artificial Intelligence and Distributed Computing programme, as it is presented in the previous section, one can see that these steps has been partially made and there are strong reasons to believe that the internationalization goal can be reached. The main reasons for this belief are: the study programme is highly compatible with similar European programmes; there are academic agreements with universities and research institutes from Austria, France, The Netherlands, Japan and Canada; there are agreements with internationally recognized IT companies (e.g. Alcatel Lucent and Continental-Siemens) and with research institutes (e.g. Research Institute for Symbolic Computation – RISC from Linz, Austria and INRIA from France); there are research teams involved in several international projects both at the Department of Computer Science and at the Institute e-Austria (a spin-off developed as a partnership between the Research Institute for Symbolic Computation from Linz, West University of Timisoara and the Politehnica University of Timisoara); there is a research infrastructure of high standards at the High Performance Computing Center of the West University of Timisoara<sup>7</sup>.

Further steps are to be made, especially by increasing the international visibility of the programme and its attractiveness among international students.

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