Institutional reorientation
The case of Universidade Aberta

PAULO BENTO, HELENA PINTO DE SOUSA & MIGUEL ALMEIDA[1]

ABSTRACT: The goal of this study is to provide guidelines for the restructuring process of Universidade Aberta, which is the Portuguese distance learning university. The external and internal assessments were performed using multiple instruments, of which we highlight a survey with responses from over twenty countries. This survey was analyzed using advanced data mining methods along three dimensions: educational offer, target publics and operating model. The specific guidelines are based on the assumption of a certain status quo in the higher education sector.

Key words: Strategy, Restructuring, Distance Learning, Innovation, Data Mining

TÍTULO: Reorientação institucional – O caso da Universidade Aberta

RESUMO: O presente estudo tem por objetivo fornecer linhas orientadoras para o processo de restruturação da Universidade Aberta, a instituição da rede de ensino superior público vocacionada para o ensino a distância em Portugal. As avaliações externa e interna foram efetuadas com recurso a vários instrumentos, com destaque para um inquérito em mais de vinte países. Este foi explorado através de técnicas avançadas e automatizadas de análise de dados, em torno de três pilares: oferta pedagógica, público-alvo e funcionamento. As linhas concretas de orientação para a redefinição da estratégia têm como pressuposto um certo status quo no setor.

Palavras-chave: Estratégia, Reestruturação, Ensino a Distância, Inovação, Data Mining

JEL: L10; I20

PAULO BENTO (corresponding author)
paulo.bento@alumni.mbs.ac.uk
PhD in Management Sciences (The University of Manchester). Director (Global Economics and Management Review). Deputy director (Department of Marketing, Operations, and Management – ISCTE Business School). Coordinator (Audax-IUL). Researcher (Business Research Unit).
Doutorado em Ciências de Gestão (The University of Manchester). Diretor (Revista Economia Global e Gestão). Subdiretor (Departamento de Marketing, Operações e Gestão Geral – ISCTE Business School). Coordenador (Audax-IUL). Investigador (Business Research Unit).

HELENA PINTO DE SOUSA
hdesousa.mifft2000@london.edu
Master in Finance (London Business School). Invited Assistant Professor (ISCTE Business School).
Mestre em Finanças (London Business School). Professora Auxiliar Convidada (ISCTE Business School).

MIGUEL ALMEIDA
malmeida@lx.it.pt
PhD student (joint program of the Aalto University and the Universidade Técnica de Lisboa). Researcher (Telecommunications Institute and Priberam).
Doutorando (co-tutela da Aalto University e da Universidade Técnica de Lisboa). Investigador (Instituto de Telecomunicações e Priberam).

INTRODUCTION

Distance Learning (DL) is an increasingly powerful educational tool as multiple innovations in Information and Communication Technologies (ICT) have enabled it to radically change how teaching works, making it more democratic and universal.

Portugal is currently going through one of the greatest periods of hardship in its history. This makes DL even more relevant as a tool to effectively increase the population's qualifications. Repeated delays in the restructuring of the public higher education network (PHEN) were inevitable due to successive declines in both the number of higher education candidates and the State's contributions as a percentage of GDP[2]. DL, which costs less per student, may play a leading role in fighting the insufficient number of qualified professionals across multiple fields. Similarly, the introduction of DL in Portugal helped resolve the problem of insufficient teachers resulting from the increase in mandatory schooling until the age of 18.

The history of Universidade Aberta (UAb) is inevitably closely linked to that of DL itself in Portugal; it currently represents 90% of all DL students and therefore must have a say in its future. It is important to review its strategy and to continue the restructuring process that began in 2006. Naturally, this is dependent on the position taken by the PHEN on DL and on UAb itself.

The goal of this work is to suggest ways for UAb's restructuring process to proceed. As it is assumed that in the coming years there will be neither the political goodwill nor cooperation from UAb's peers to bring change to the DL paradigm in Portugal, the approach of this work is explicitly one of continuity.

Previous assessments of UAb and its environment suggest that it is more difficult to define UAb's strategy than that of non-DL higher education institutions (HEIs) and organizations in general. It is more complicated to devise a strategy which leverages the product/service (educational offer) near the client/user (target public), taking into account the activity and internal resources (operating model) largely because:

- Identifying the target public is a greater challenge in DL as potential students may be "anywhere in the world" and their ages, preferences and needs vary greatly;
- It is difficult to design a specific educational course for a potential audience which is so hard to define;
- Opening an educational course involves significant upfront costs because the content is prepared before it is made available and whether or not the course goes ahead;
- The target publics may access and use the DL support tools in very different ways.

Given these challenges, the usual research methods were not considered sufficient. Therefore, focused interviews were conducted at UAb, though not discussed in depth here, and an extensive survey was performed. Even though the main goal of this survey was to provide suggestions on educational offer, target publics and operating model, there were also general questions about DL; thus, the survey was also disseminated among people with no previous or present connection with UAb.

The 67-question survey (omitted here due to space limitations) was made dynamic by advancing in line with questions answered, i.e. some questions could be skipped if irrelevant and therefore not all respondents answered all questions. A total of 4369 answers were obtained, of which 2860 were considered valid after a rigorous selection process; this process was repeated by three different people to ensure that inconsistencies were detected and that the data were robust[3]. Even though a considerable amount of work was done regarding descriptive statistics, the survey is complex and there is potential interconnection between different questions. As a result, advanced automatic data analysis methods, known collectively as data mining, were considered the most suitable way to analyze results.

This introduction is followed by three sections: 1) context, in which the main results of the external and internal assessments of UAb are presented; 2) data mining, which presents some methodological remarks and analyzes the three pillars of the proposed strategy; 3) strategy, which presents specific guidelines for the educational offer, target publics and operating model of UAb.

CONTEXT

This section highlights some aspects of UAb's recent evolution, framed by brief references to its general context. These two aspects will provide the background for the proposed strategy.

External evaluation

The analysis of UAb's context, which is summarized here, is far from complete as it focuses mostly on aspects that are relevant to UAb's strategy and reorientation.

Knowledge and education

Societies have developed different ways of generating, managing and disseminating knowledge over the ages. Recent events have transformed knowledge into a strategic resource for the modern world. The world has become knowledge-intensive and ICT is at the center of this development.

Education should not ignore these transformations; not only is it important to incorporate ICT into what is taught, but the actual teaching process must also be reinvented. Deep changes must be made both in terms of demystification and cooperation, and also to foster flexibility, interactivity and attractiveness. Gone are the days when a small subset of society monopolized the storing and transmission of knowledge in an egocentric way.

While this brings potential dangers for the teaching system, it provides a historic opportunity to truly democratize access to knowledge. DL will have a pivotal role in this process, in stark contrast to its role up to the beginning of this millennium.

Authors such as Simonson et al. (2009) claim that the key to DL's success lies in its structuring, in the approach to its development and in the methodology used to convey knowledge, rather than in geography or in (de)synchrony. They believe that DL is a powerful concept, which may alter the notion of education; however, this will only happen if the DL experience is as gratifying and as complete as that of learning face-to-face.

Portuguese context

Politically, Portugal has enjoyed relative governmental stability in recent years. However, despite some progress, successive governments failed to make the necessary structural reforms over the last decade and this has led to one of the hardest moments in the country's history, illustrated by the need for external financial intervention (from the EU, ECB and IMF).

As far as the EU is concerned, the failure of the Lisbon Strategy stands out[4]. Lacking specific implementation programs for the Member States, several problems prevented the foreseen goals from being attained: in the Portuguese case, the PHEN was not ready to respond to the challenges due for example to insufficient funding, the drawbacks of the binary system, the lack of institutional autonomy, the inefficient and ineffective governance of the system, the low teaching quality, the incipience of R&D and the extremely high levels of inbreeding (OECD, 2007).

DL could have contributed much more to fulfilling PHEN's potential, which led Bielschowsky et al. (2009) to suggesting that it could be positioned as a catalyst for the country's goals. This may be why the government[5] committed itself in 2009 to revitalizing DL in Portugal and the Portuguese-speaking countries, quadrupling the number of student places by 2013. The apparent commitment was formalized in the Higher Education Confidence Contract[6] signed in 2010 with the higher education institutions (14 universities and 19 polytechnic institutes); this contract involved the

transfer of an additional €100 million in funding, which the government ultimately never fulfilled.

In economic terms, the start of the millennium is sometimes called the "lost decade". Unlike the period after Portugal joined the EU, the Portuguese economy performed weakly (6.47% total growth – ahead of only Italy). All things considered, the main international organizations predict that the country should continue with average growth in the medium term, diverging from the EU, which is expected to grow twice as much. The country therefore faces a dilemma: on the one hand, it knows that the population's insufficient qualifications inhibit investment; on the other hand, it does not possess the financial means to seriously restructure the PHEN. DL is the potential answer as it is the best choice in terms of cost per student, but it requires political support.

A social analysis from the educational viewpoint reveals that Portugal has one of the highest high school dropout rates in the OECD (OECD, 2010), despite its decrease from 42.7% to 31.2% in the last decade[7]. As a result, the number of students graduating from high school remains low and the number of college graduates is among the lowest in the EU (United Nations, 2009). Nevertheless, it is not the number of graduates that is key but identifying the areas of teaching which lead to the country's effective development and having the political courage to focus scarce resources there.

In terms of innovation, Portugal had the best performance of the EU in the last decade; however, it is still considered to be among the "moderate", between the "followers" and the "modest" – the group of the "leaders" is composed of Sweden, Denmark, Finland and Germany[8]. Progress can be seen in the proportion of researchers in the active population (already above the EU average), and in the increase in R&D investment as a percentage of GDP (which is still below the EU average)[9]. As for the specific impact of technology in DL, the outcome appears positive if we take the use of computers, internet, and broadband as proxies for the preparation of DL's potential end-users in Portugal. In fact, computer and internet usage grew across all teaching levels (almost 100% in higher education and about 90% in high-school), and the number of households with broadband access has evolved positively (penetration rates rose from 10% to 30% in low population areas, from 15% to 45% on averagely populated areas, and from 25% to 55% in densely populated areas[10]).

Higher education

Like in many EU countries, the PHEN in Portugal consists of a binary system with

a university subsystem and a polytechnic subsystem. Even though the duties of each subsystem are well defined in the Legal Regime of Higher Education Institutes (LRHEI), there is a noticeable academic drift[11] with polytechnics attempting to mimic universities.

Regarding demand, according to data from the Ministry of Science, Technology, and Higher Education, three promising years at the start of the decade were followed by a decline in higher education enrollments. The trend is more pronounced in universities than in polytechnics and more so in private than public institutions. There were also differences between teaching areas, with Education losing 50% of students and Agriculture stagnating. Face-to-face learning clearly dominates, with DL representing about 3% of students (Bielschowsky et al., 2009).

As far as supply is concerned, in 2010 there were 296 HEI, 9.8% fewer than in 2005. In that period, private HEI comprised 42.6% of the total, down 16.0% from 2005 when they made up 45.7% of all HEI. To some extent, this is in line with the reduction in the number of students and the transfer of some of them to the PHEN. In terms of DL, only three HEI offered higher degrees at the start of 2008 and this situation remains almost unchanged due to generally disappointing results. DL students represent about 3% of the total, of which over 90% are from UAb.

Against this backdrop, it is unlikely that the number of students in "bricks and mortar" HEI will rise in the near future. For the same reasons, an increase in higher DL students is also unlikely. Moreover, despite predictable resistance, it is likely that the PHEN will go through a consolidation or at least a rationalization process. Finally, private education is unlikely to regain its share due not only to the unfavorable economic situation, but also to recent scandals.

Internal evaluation

This subsection summarizes the institutional evolution of UAb up to mid-2011, with special emphasis on the strategy and the models of action (educational offer, target publics and operating model).

Strategy and institutional evolution

UAb is the public university for DL. It was set up in 1988 by the Portuguese Institute for Distance Learning and the Multimedia Communication Institute. Going further back, UAb's roots are intertwined with those of "teleschool", which was started when mandatory schooling increased to 6 years in 1964 to compensate for the lack of teachers.

Until 2006 UAb used a self-learning pedagogic model, based on content media such as written manuals, videotapes and audiotapes, which were later complemented with radio and TV. Students could contact their tutors by telephone at prearranged hours and could also benefit from the existing support centers. When students felt ready, they were submitted to an on-site exam. The study process was individual, without the concept of a class.

With the approval of a new strategic plan, 2006 marked the beginning of a restructuring process that included innovation in teaching and the definition of a virtual educational model. Individual learning was not abandoned but the student gained access to a model of collective learning and became part of a virtual class, thus making student-student relationships possible.

The virtual educational model was fully applied in 2007 for the first time; it was in this year that the DL lab was created and that programs were adapted to the Bologna system. Moreover, the LRHEI confirmed UAb's special status and stipulated that higher DL would be the target of special legislation (although more than five years later, this is not yet the case). New statutes for UAb were approved in 2008, giving a new basis for its restructuring; also in 2008, the national network of Local Learning Centers (LLC)[12] replaced the previous centers.

In 2010/11, UAb was operating fully within an educational model based on some of the best international practices; the decentralization process advanced through the consolidation of the LLC network, UAb continued its intervention in the Portuguese-speaking world and most of its programs were accredited or in the process of becoming accredited.

Action model

UAb offers programs in the 1st, 2nd and 3rd cycles as well an increasing variety of non-formal and free courses[13]. Because of its history, its statutes, and the nature of DL itself, it has centered its activity in the areas of Humanities, Social Sciences and Education Sciences, and over the years it has played an important role in teacher training[14]. In the 1st cycle, UAb is not part of the national selection process to access the PHEN and it does not have numerus clausus; however, it only accepts students over the age of 21 (or 18 if they have enjoyed student-worker status since the age of 16)[15].

Regarding target publics, from the outset UAb has assumed the mission of teaching those who have not been able to enroll in or finish a higher degree, while simultaneously trying to target those who want to update or reconvert their education. The

typical UAb student profile in 2010/11 was: a resident in Portugal (about 85%) or in a Portuguese-speaking country (14%), aged slightly under 40, and employed (usually working for organizations in the public sector or equivalent).

Operating model

UAb depends heavily on public funding, which covers most operating costs. This funding has been around 1.1% of total PHEN funding and it corresponds to a little less than 2/3 of UAb's income, thanks to the increase in its own revenue, due mainly to non-formal or free education.

UAb has around 400 staff and faculty working in offices in Lisbon, Porto, and Coimbra, and the LLC. About 25% of non-teaching staff have a university degree, which is remarkable by Portuguese standards. Teaching and student supervision is undertaken by around 150 professors, aided by tutors. The former are always scientifically and pedagogically responsible for the curricular units (CU). Professors and tutors have been specifically trained in DL and e-learning.

The university's premises are spread across six different buildings in Lisbon; the lack of functionality of these buildings hampers the general efficiency of the university and creates problems in terms of culture and identity. However, the outcome of renovations at the LLC is generally positive, although some improvements are still necessary.

The virtual educational model was developed internally; it was evaluated by the International Consulting Counsel, which includes international experts in the field. It is an evolutionary model, which is updated as a result of the monitoring undertaken by LEaD. Although student-centric, where students are active individuals who build their own knowledge, the model allows resources and knowledge to be shared with teachers, tutors and other students. As this requires specific skills from the student, UAb provides a free CU on the virtual model.

The UAb brand is still a weak point despite recent investments in marketing and many initiatives aimed at effectively improving its deliverables.

UAb's statutes require it to strive for openness and cooperation and this continues to be one of its stated priorities. This is corroborated by its role in several international DL organizations (e.g. ATEI, EADTU, EUCEN, EDEN, ICDE and ICEM) and its participation in multiple European programs (for instance Socrates, Leonardo, NOW and Tempos) and in horizontal research networks (for example in the areas of gender studies, migration and multiculturalism). UAb also

has partnerships with HEI (both Portuguese and foreign) and with entities in various areas.

DATA MINING

This section explores the main results of the survey. The survey was conducted in 2010 and obtained answers from 24 countries. Since it is long (67 questions, 14 pages), complex (the sequence of questions is dependent on previous answers) and there may be connections between different questions (some of which had 40 possible answers), it would be naïve to use common data analysis techniques. As such, the choice fell on advanced automatic data analysis methods known collectively as data mining.

Before presenting results, some methodological notes and general information about survey respondents are provided.

Methodological notes

In addition to general questions, the survey contains questions that deal with specific topics. These can be divided into three areas and each of those three areas can be further broken down into several categories (this subdivision is linked to the paper's goal and helps understand the questions considered in data mining):

- Educational offer: level and field of study of interest to respondent – questions 60 to 66; level and area of study of interest to the respondent's acquaintances – questions 12 and 13; modules of UAb programs which the respondent liked or disliked – questions 28 to 30;
- Target Public: level of study desired by the respondent – question 58; professional status of the respondent – questions 4 to 6, 31 and 51; alternatives to UAb – questions 24, 25 and 27; marketing and image – questions 55 and 56; general – questions 1 to 3;
- Operating model: assessment of communication tools – questions 41 and 42; assessment of UAb's infrastructure and equipment – questions 36 and 37; assessment of DL tools – questions 38 and 39; assessment of staff – questions 34 and 35; assessment of student representatives –– questions 46 and 47.

Data mining is a relatively recent field in computer science and engineering and it is growing rapidly in the literature (see, for example, Han et al., 2005). Within this field, the most suitable technique to analyze the results of this survey is hierarchical clustering (HC); unlike classical (partitional) clustering, HC can almost automatically extract the appropriate number of clusters to use in each case.

The final result of HC can be interpreted as a classification of each respondent in one of several respondent types. The HC algorithm will find clusters in such a way that members of the same cluster have survey answers, which are as similar as possible, while members of different clusters will have answers as different as possible.

In this analysis, a HC was performed for each of the previously mentioned categories; the implication of this is that the analysis now involves some dozens of tables, rather than hundreds of crosstabs with potentially thousands of entries.

Throughout the survey, quantitative answers use a scale of 1 to 5, where 1 is the worst value or the lowest frequency ("very bad" or "never") and 5 is the best value or the highest frequency ("very good" or "constantly"). Respondents who answered "don't know / won't answer" (DKWA) are presented separately; while this option involves some loss of information, it allows the information to be condensed into two numbers: the average assessment and the fraction of DKWA answers. Note that with these equivalences, an assessment of 3.0 is neutral; assessments below 3.0 are considered negative and assessments above that threshold are considered positive.

Overview

This subsection presents an overview of the survey data. Its goal is to provide a minimum amount of information to allow progress to data mining with an idea of the respondents' profile (origin, age, professional status and academic degrees) and connection to UAb (reason for choosing UAb, benefits from the degree obtained and developmental objectives).

Despite efforts to obtain answers from different countries, the vast majority of respondents resides in Portugal (91.1%) – as expected, Portuguese-speaking countries account for nearly all respondents.

In terms of age, 36% of those surveyed were between the ages of 31 and 40, while 34% were between 41 and 50 years old. Full-time workers totaled 46% of respondents and student-workers another 40%. Among those who worked, 94% did so for an employer (62% in the public sector or equivalent and 32% in the private sector). Over half of the respondents did not have a higher degree (4% had not graduated from high school, 36% had a high school certificate and 12% had a non-higher post-high school degree) and 31% had a higher degree. The majority of respondents with a previous higher degree were from the scientific field of Social Sciences (25%), more than the next two scientific fields combined: Education Sciences and Management (12% each).

The following reasons were given for choosing UAb: DL (71%), flexibility (59%), indirect costs (31%), direct costs (21%) and UAb's prestige (20%) – this fifth placing of reputation may suggest the need to improve and promote the institution.

Among UAb's former students, and excluding DKWA answers, about 50% stated that the benefits yielded from their UAb experience were equal to or above expectations. Of former students, 14% stated that they did not obtain professional benefits but considered the experience was worth the investment and would make the choice of studying at UAb again; this contrasts with 3% of former students which did not obtain benefits and would not make that choice again.

At the end of the survey, each respondent was asked to make suggestions for UAb's development. Over 700 open answers were compiled into the seven categories presented below. The table is self-explanatory, but highlights are: 1) the limited role given to research, fundamental for the prestige of HEI in general and faculty in particular; 2) almost 15% of respondents gave an egocentric answer, not related to UAb.

TABLE 1
Actions for UAb development

Attribute	Importance	Actions
(Internal) communication, media and content	28.8%	Topics related to: i) teacher-student communication; ii) available learning tools (e-learning, paper manuals, etc.)
Syllabus, assessment and teaching staff	26.3%	Topics related to: i) diversification of courses, syllabuses and curricular internships; ii) grading methods and time taken to produce those grades; iii) quality of the teaching staff
(External) communication and marketing	14.6%	Topics related to the visibility and credibility of UAb and of its courses, from the point of view both of the general society (target demographic) and of employability
Academic/administrative services	11.8%	Topics related to the quality of academic services, in particular response times to the contact attempts (by email or telephone)
Location and equipment	3.9%	Topics related to the increase and diversification of UAb's physical presence, both nationally and abroad
Research	0.4%	Topics related to the promotion and development of research
Not applicable	14.3%	Comments which are irrelevant to this study (e.g. related to the student itself and not UAb)
TOTAL	**100%**	

Educational Offer

The data mining approach for educational offer is based on three topics: interests of the respondent; interests of the respondent's acquaintances; modules which are inadequate or wanted by current and former UAb students.

Degree and field of interest of the respondent

In questions 60-66, the 2192 respondents who were interested in attending DL were asked to specify the degree and field of interest. Due to the large number of possible answers, including open answers, the analysis is not as conclusive as desired; however, it is still worth presenting. The clustering algorithm returned 4 clusters: C1 (7%)[16], C2 (76%), C3 (9%) and C4 (9%).

The results for technological specialization courses (TSC)[17] were inconclusive as answers varied greatly; in addition to 45 possible answer choices, the survey also allowed an open answer.

Regarding lifelong learning (LL)[18], the 4% threshold was chosen to exclude choices. Results reveal significant differences between the clusters; the interest is only clear for C3 and especially for the following programs: "Entrepreneurship and Small Business Management", "Information and Communication Technologies" and "Entrepreneurship, Culture and Development".

For Bachelor degrees, with a threshold of 3%, all C1 members indicated Social Sciences as an area of interest; there is also some association between C3 and Business and Management.

A low threshold (2%) had to be used for Masters and post-graduate degrees; nevertheless, answers were less dispersed than TSC. In both cases, the preference is for Business and Management.

There was a 1.5% threshold for doctoral degrees and, again, this highlights the strong association between C3 and Business and Management.

In post-Doctoral degrees, the threshold had to be lowered to 0.5% and despite the small number of answers, an association can be seen between C3 and Business and Management.

Overall, the following aspects can be highlighted:

- C3 expresses a clear interest in Business and Management, which comprises various academic degrees. The secondary but significant interests in certain LL programs suggest that UAb can perform targeted marketing with minimal costs, for example contacting their (former) students by email;
- C1 is interested in Social Sciences, with some additional interest in Intercultural Relations (post-Masters) and Political Science (Doctoral and post-Doctoral);
- There are some distinctions between C1 and C4, but they are inconclusive.

Degree and field of interest of the respondent's acquaintances

Of the survey respondents, 1258 stated that they knew people interested in DL. Questions 12-13 asked these respondents to specify which degree and field their acquaintances were interested in. The hierarchical clustering algorithm yielded 4 clusters, which are depicted below, for a 4% threshold.

TABLE 2

Respondent's acquaintances – Study level and area of interest

Cluster	Number of people[1]	Main interest[2]	Repres.[3]	Other interests[2]	Degrees of interest[2]
1	201 (16%)	Social Sciences (100%)	81%	Management (12%) Education (5%)	Bachelors (17%) Masters (17%)
2	132 (10%)	Education (100%)	60%		Bachelors (15%) Masters (15%) Post-Graduate (7%)
3	122 (10%)	Management (100%)	49%		Bachelors (18%) Masters (11%) Doctorate (6%) Post-Graduate (6%)
4	89 (7%)	Psychology (93%)	90%	Sociology (11%) Management (9%) Social Sciences (9%)	Bachelors (16%) Masters (11%) LL (6%)
5	74 (6%)	History (100%)	69%	Social Sciences (16%) Psychology (9%)	Bachelors (20%) Masters (15%)
6	73 (6%)	Computer Science (100%)	67%	Education (18%) Social Sciences (10%)	Masters (23%) Bachelors (14%)
7	46 (4%)	Information and Documentation Sciences (100%)	87%		Bachelors (13%) Masters (11%) Doctorate (9%) LL (7%) TSC (4%)
8	521 (41%)	Other			

[1] *The percentage is relative to the number of respondents to this question (1.258);*

[2] *The percentage is relative to the number of respondents in the cluster;*

[3] *Representativeness is defined as the fraction of people with this main interest who are in the cluster. For example, in total, there were 247 people indicating interest in Social Sciences, hence cluster 1 represents 81% (201/247) of those people.*

It can be concluded from Table 2 that programs in Social Sciences, Psychology, History and Computer Sciences (C1, C4, C5 and C6, respectively) should include optional modules from the column marked "other interests". Where there is a stronger association (for example over 10%), new branches of the program might be worth considering.

The interest in Bachelor and Master degrees is transversal to all clusters, although with varying percentages. Other degrees are only of interest to some clusters. For example, only two clusters express an interest in the Doctoral degree: 9% of people interested in Information and Documentation Sciences (C7) and 6% of those interested in Business and Management (C3).

Apart from the results yielded by this particular analysis, it should be noted that UAb should conduct this kind of exercise regularly to ensure that improvements are systematically made to educational programs.

Desired and inadequate CU at UAb

In questions 28-30, 2383 UAb students identified their program, the CUs they considered inappropriate and those they would have liked to have had. The clustering algorithm, which generated the table below, grouped respondents by program and identified the CU considered inadequate or desired. Only programs with more than 50 respondents and CUs with relevance over 3% are presented.

The following conclusions can be drawn from the table:

- The areas of Law (2 CU and a total of 14%) and Economy (3 CU and a total of

TABLE 3

Inadequate and wanted CU at UAb

Course (no. of people)	Inadequate CU (people %)	Wanted CU (people %)
Social Sciences (564)	Introduction to Law (10%) Macroeconomics (7%) Law (4%) Introduction to Economics (3%) Economics (3%) Introduction to Social Sciences (3%)	English (3%) Psychology (3%)
Management (254)	English I (6%) Computer Science in Management (3%)	English (4%)
Education Sciences (151)	Media for Education (8%) Multimedia Tools for Educational Communication (5%)	
History (132)	Computer Science (5%) Physical and Environmental Geography (3%) Information Technologies (3%)	Archeology (6%) History of Portugal (5%)
Information and Documentation Sciences (118)	English I (12%) Portuguese Culture (6%) Information Systems for Libraries (5%) Topics in Computer Science (5%) The Child in Modern Society (7%) Documental Analysis and Language III (3%) Real Estate (3%)	Information and Documentation Sciences (10%) Libraries (4%) Paleography (4%) Animation (3%) Archiving (3%) Conservation (3%) Marketing (3%)
Service Professionalization (96)	Ethics and Education (17%) Education and Society (8%) Principles of Didacticism (7%) Conflict Management (4%) Pedagogic Assessment Models (3%) Information and Communication Practices and Technologies (3%)	Didacticism (5%) Music (4%) School Management (3%) Pedagogics (3%) Psychology (3%)
ICT (66)	Multimedia Systems (8%) Finite Mathematics (6%) Mathematics (5%) COBOL (5%) Infinite Elements Analysis (3%) Physics (3%) General Physics (3%) Multimedia (3%)	ICT (5%) Electronics (3%) Robotics (3%)
European Studies (61)	Regional Economics (16%) Introduction to Law (5%) Current Affairs (3%) History (3%) ICT for the Social Sciences (3%) Introduction to Financial Markets (3%) Introduction to Economics (3%) Macroeconomics (3%) English Culture and Society I (3%)	Spanish(7%) European Studies (3%) English (3%)
Environmental Sciences (50)	Calculus (10%) Physics (6%) Physics for Environmental Sciences (6%)	Environmental Sciences (4%)

13%) are particularly criticized by (former) Social Science students;
- In general, English is a desired CU, although values are relatively low indicating that it should be offered as an elective;
- The most inadequate CUs in Education Sciences are related to Multimedia (13%);
- The CU of Ethics and Education offered in the Service Professionalization program is considered the most inadequate (17%);
- European Studies has the most inadequate CUs (9 modules), which suggests the need for a curricular overhaul.

Target publics

The data analysis on target publics focused on four components: respondent, study level, competition, and marketing.

Professional and academic status, benefits of studying at UAb and reasons to study

In the analysis of the 2383 responses to questions 4-6, 31 and 51, the clustering algorithm generated 5 clusters of (current and former) students: C1 (13%) – student--workers in the private sector; C2 (15%) - full-time workers in the private sector; C3 (13%) – full-time students, part-time workers, unemployed and retired; C4 (29%) – full-time workers in the public sector; C5 (30%) – student-workers in the public sector.

The following conclusions can be drawn from the analysis:
- C4 and C5 are the groups with the lowest and highest academic skills, with 1/3 and over 2/3 with at least a bachelor's degree, respectively;
- Respondents who do not intend to study again are scarce throughout the 5 clusters; however, those who will not return to UAb always outnumber those who will not return to another HEI – the difference is more marked in C2, C3 and C5;
- In all clusters, the main reason given for studying was preference for that field of study; however, the relative importance varies between about 25% (C4) and over 50% (C3);
- When reasons for study are grouped into personal reasons ("personal accomplishment", "improve personal prestige" and "preference for this field of study") and professional reasons (all others except DKWA), C3 leads for personal reasons (about 50%), followed by C1 and C2 (about 40%), with the public sector workers (C4 and C5) last.

Intended level of study

Question 58, which was answered by 2207 people with and without connections to UAb, asked if the respondent an interested in using DL and, if so, for which degree. The clustering algorithm found 7 clusters, of which 6 correspond to people

with a main interest in a specific degree (the post-Doctoral level is not represented in any cluster as it was seldom chosen).

TABLE 4
Degree level wanted by the respondents

Cluster	Number of People[1]	Main Interest[2]	Repres.[3]	Other Interests[2]
C1	210 (10%)	Other		
C2	240 (11%)	TSC (100%)	81%	LL (53%) Bachelors (44%) Masters (26%) Post-Graduate (25%)
C3	389 (18%)	LL (99%)	71%	Masters (31%) Bachelors (21%) Post-Graduate (20%) Doctorate (16%)
C4	270 (12%)	Post-Graduate (100%)	45%	Masters (42%)
C5	343 (16%)	Doctorate (95%)	65%	Masters (39%) Post-Doctorate (21%) Post-Graduate (17%)
C6	404 (18%)	Masters (100%)	40%	
C7	351 (16%)	Bachelors (100%)	47%	

[1] *The percentage is relative to the number of respondents to this question (2207);*
[2] *The percentage is relative to the number of respondents in the cluster;*
[3] *Representativeness is defined as the fraction of people with this main interest who are in the cluster. For example, in total, there were 295 people indicating interest in TSC, hence cluster 2 represents 81% (240/295) of those people.*

The table above summarizes the results (in "other interests" the threshold was 7%) and allows the following conclusions:

- Respondents interested in Bachelors and Masters degrees (C6 and C7) express no appeal for other degrees;
- Although those interested in TSC (C2) show a strong interest in LL (53%), those attracted by LL (C3) express no interest in TSC – there are other pairs of degrees with this asymmetry;
- The previous two points suggest that targeted marketing would bear fruit (for example, those interested in TSC and LL show an interest in many other degrees). Consideration should also be given to some CU of TSC and LL programs giving equivalences for first cycle CUs, thus making attendance more attractive.

Alternatives to UAb

In questions 24-25 and 27, the 2383 students were asked whether UAb had been their first option, which (if any) HEI were considered plausible alternatives, and

whether they had ever studied at another HEI. The clustering algorithm detected 4 clusters: C1 (10%) – did not study at another HEI and UAb was not their first choice; C2 (19%) – studied at another HEI and UAb was not their first choice; C3 (31%) – did not study at another HEI and UAb was their first choice; C4 (40%) – studied at another HEI and UAb was their first choice.

These results allow us to distinguish two types of students:

- Those for whom UAb was the first choice or, for most cases, the only choice (71%: C3 and C4). These may be people who saw DL as the only way to reconcile studying with their specific situation (professional, personal, economic, etc.);
- Those for whom UAb is a fallback solution (29%: C1 and C2). These are probably students without any specific hardships but who simply had no way to access to face-to-face education.

Marketing of UAb

Questions 55-56 asked the 2489 respondents how UAb could promote its image and reach new audiences. Five clusters were found: C1 (16%) – increase the presence in the Portuguese emigrant community, with Portugal and Angola as markets to explore; C2 (13%) – expand operations in Portugal and Portuguese-speaking countries except for Angola and Mozambique, with emigrants in a secondary position; C3 (14%) – DKWA where UAb should increase its presence and show a preference in partnerships with Portuguese HEI; C4 (9%) – DKWA where or how UAb should promote its image; C5 (48%) – different from all other clusters.

It can be concluded from these results that a considerable proportion of respondents (29%: C1 and C2) believe that Portugal, Africa and the Portuguese emigrants present unexplored markets. Interestingly, no cluster shows special preference for Brazil, even though it is the largest Portuguese-speaking country; it is not known how well respondents knew that DL has significantly increased in that country.

Operating Model

Data mining on UAb's operating model includes three components: human resources; infrastructure and equipment; and DL tools.

As previously mentioned, 2006/07 was a turning point for UAb; thus, it was important to account for that event in the opinions of (current and former) students. Therefore, students were divided into two groups: those who concluded their studies before 2006 ("pre-2006", 28% of total) and those who finished after 2006 or who were still studying when the survey was conducted ("post-2007", 72% of total).

In the above-mentioned three components, the clustering algorithm returned the same number of groups for pre-2006 and post-2007 students (2 for human resources, 5 for infrastructures and equipment, 4 for DL tools). Furthermore, across the three cases, there was a strong correspondence between the features of pre-2006 and post--2007 clusters. The distinction between pre-2006 and post-2007 students was therefore dropped, for the benefit of concision and clarity.

Human resources

In questions 34-35 the 2383 students were asked about the availability and quality of UAb staff, divided into categories. The clustering algorithm returned 2 clusters: C1 (26%) usually answers DKWA (especially for tutors); C2 (74%) generally give other answers.

TABLE 5
Assessment of UAb staff

Assessment of UAb Staff		*Cluster* 1		*Cluster* 2	
		Average	% DKWA [1]	Average	% DKWA [1]
Professors	Availability	3.58	24%	3.61	2%
	Quality	4.07	34%	3.93	2%
Tutors	Availability	3.16	86%	3.66	4%
	Quality	3.42	94%	3.87	4%
Academic Services	Availability	3.32	17%	3.40	2%
	Quality	3.39	23%	3.47	2%
Other Professionals	Availability	3.43	54%	3.51	16%
	Quality	3.52	62%	3.57	17%

[1] *The percentage is relative to the number of respondents in the cluster.*

The average opinion of C2 members is more important due to its representativeness; it can be concluded that:

- Although the general evaluation of staff performance is satisfactory, it suggests academic services should be improved, following the example of professors and tutors;
- A higher evaluation is given for quality than for availability without exception, suggesting that the latter should be improved;
- The difference between professors and tutors is minimal, which validates the role played by tutors.

Infrastructure and equipment

In questions 36-37, the 2383 students were asked to indicate the quality and the frequency of use of infrastructure and equipment. The hierarchical clustering algo-

rithm found 5 clusters: C1 (7%) – generally "bad" quality, with occasional "very bad" responses; C2 (27%) – "acceptable" quality; C3 (22%) – "good" or "very good" quality; C4 (9%) – DKWA about quality and, generally, DKWA about frequency of use; C5 (36%) – DKWA about quality and usually answers "never" on frequency of use.

TABLE 6
Frequency of use of infrastructure

Frequency of use of infrastructure	*Cluster* 1		*Cluster* 2		*Cluster* 3		*Cluster* 4		*Cluster* 5	
	Average	% DKWA [1]	Average	% DKWA [1]	Average	% DKWA [1]	Average	% DKWA [1]	Average	% DKWA [1]
Auditorium	1.17	43%	1.31	21%	1.45	19%	1.17	96%	1.03	1%
Library	1.85	25%	1.93	8%	2.26	8%	2.24	83%	1.17	0%
Video library	1.13	36%	1.28	13%	1.54	11%	1.55	91%	1.04	0%
Computer Lab	1.04	39%	1.19	15%	1.38	13%	2.00	97%	1.02	0%
Other Lab	1.05	39%	1.19	15%	1.31	14%	2.00	96%	1.01	0%
Classroom	1.83	31%	1.90	13%	2.38	11%	3.50	87%	1.19	1%
Study room	1.58	35%	1.64	12%	2.05	13%	2.64	89%	1.13	0%
Other	1.54	30%	1.75	13%	2.34	17%	3.35	77%	1.22	2%

[1] *The percentage is relative to the number of respondents in the cluster.*

When considering representativeness in particular, this analysis suggests that:

- Taking account of only the most representative clusters (C2 and C3; C5 is ignored for obvious reasons), there are signs that frequency of use and opinion are positively correlated, although no causality can be inferred;
- The frequency of use of infrastructure is very low, as expected in DL, which limits the conclusions that can be drawn in that respect.

DL tools

Questions 38-39 asked the 2383 students to indicate the quality and frequency of use of several DL tools. The clustering algorithm found 4 clusters: C1 (8%) – generally "bad" quality and in some cases "very bad"; C2 (37%) – "acceptable" quality; C3 (48%) – "good" or "very good" quality; C4 (7%) – DKWA.

Considering the data analysis and the representativeness of each cluster, the following can be concluded:

- The inferences here are clearer than for infrastructure and equipment;
- Teleconference and videoconference were the least used tools (almost never), in contrast with e-learning and paper material (often), which are also the only ones above average;
- The most representative clusters (85%: C2 and C3) are also those that report a more frequent usage and which were evaluated as acceptable, good or very good.

TABLE 7
Frequency of use of DL tools

Frequency of use of DL Tools	*Cluster* 1		*Cluster* 2		*Cluster* 3		*Cluster* 4	
	Average	DKWA[1]	Average	DKWA[1]	Average	DKWA[1]	Average	DKWA[1]
CD / DVD	1.34	41%	1.61	19%	1.76	12%	1.19	12%
e-learning	3.64	11%	3.80	4%	4.18	2%	2.88	6%
Paper-based materials	3.80	7%	3.93	3%	3.85	3%	3.37	6%
Radio	1.24	45%	1.38	26%	1.43	28%	1.07	25%
Telephone	1.85	19%	1.97	8%	2.06	8%	1.69	4%
Television	1.54	29%	1.75	12%	1.82	9%	1.33	10%
Video	1.46	34%	1.66	12%	1.77	9%	1.12	9%
Teleconference	1.19	44%	1.18	19%	1.25	14%	1.00	11%
Videoconference	1.15	45%	1.17	19%	1.30	14%	1.02	9%

[1] *The percentage is relative to the number of respondents in the cluster.*

STRATEGY

It is now time to present guidelines for UAb's strategy for a 3 to 5 year time frame. The suggestions for the three topics under analysis (educational offer, target publics and operating model) are made assuming the status quo is maintained across a number of areas, that is, current legislation remains unchanged, the PHEN continues as it is today and UAb pursues its mission according to the vision of its key stakeholders.

Educational Offer

In the experience of UAb, although the current educational offer is justified, changes are also necessary particularly so as to provide a rapid response to the lack of qualifications among the population in Portugal and other Portuguese-speaking countries.

The cuts in public funding per student in the PHEN also indicate the need for change, as this will force HEI to increase their own revenue and improve performance. These changes to the educational offer may prove a useful way of reducing HEI's dependence on public funding, not only because they can increase revenue by offering programs with higher tuition fees, but also because they may improve the efficiency of resources, notably faculty[19].

Future educational offers, for which several suggestions are given below, should naturally be in compliance with UAb's mission, statutes and resources.

Open learning

UAb should invest in open learning and progressively offer more educational resources within that framework, given that it is:

- a new trend;
- in line with UAb statutes;
- a distinguishing feature (since no Portuguese HEI is yet part of the OpenCourseWare Consortium);
- an appetizer for potential students and a way of showing that it is not the means (DL vs. face-to-face) but the overall learning process that makes a difference. And it
- improves UAb's reputation (because it gives something back to society).

Stagnant CU and Programs

UAb must define an objective procedure for the gradual elimination of programs and CU that have stagnated. This should be based on survey results and on the evolution of employability in each teaching area. Teachers in such programs may replace tutors in other CU or use available time to develop new content, conduct research, participate in the university's management, etc.

New CU and new programs – general public

UAb should offer new programs and CU, depending not only on the expertise of the current faculty, but also on the necessary revitalization to reach new audiences, to have more and better research, to mitigate inbreeding, etc. Once again, these changes should be based on the survey results and on the employability in each teaching area.

New CU and new programs – Portuguese-speaking countries

UAb should offer appealing content, adjusted as far as possible to the needs of the Portuguese-speaking communities; Brazil is an exception as DL is in strong development and showing signs of self-sufficiency in that country. However, prior to this new offer, steps should be taken, including diplomatic work, to ensure that the size and consistency of the projects warrant the investment made and thus do not jeopardize UAb's sustainability.

Developing new sources of revenue

As detailed below, UAb should intensify its presence towards audiences, courses and programs that contribute to an increase in its own income (for example 2nd cycle, LL and executive education[20]).

Target publics

The target publics' strategy should include a focused expansion in line with the educational offer described above, the results of this survey, and those of future surveys.

Even though the typical age of UAb students is close to 40 years, UAb should try to capture younger audiences (respecting legal constraints), which are experiencing increasing employment difficulties (including those employed outside their education area) and who are more familiar with the use of ICT.

UAb should be increasingly pro-active among its traditional client base (workers in the public sector or equivalent and audiences from joint actions with unions and employer organizations) even though the market may be sluggish or shrinking.

UAb should market its programs to (former) students, using information from surveys, analyzed through data mining. Apart from offering higher degree programs, it should market other offers and explore the cross-selling potential between courses and programs.

UAb should seek new clients in other Portuguese HEI, especially to capture students for the 2nd and 3rd cycles. This is actually in line with what top HEI already do; they entice top national students into their programs.

UAb must be more dynamic with private organizations, seeking students for the 2nd cycle, LL and executive education.

As mentioned, UAb should also increase the number of students from Portuguese-speaking countries, as well as Portuguese emigrants, namely through specific content targeted at these communities.

Operating Model

Despite progress made in recent years and its dependence on the available resources, UAb's operating model can be improved in multiple aspects.

Financial resources

It is imperative for UAb to increase its own revenue to compensate for cuts in State funding. This can be achieved in many ways simultaneously, which may have different impacts and success rates. Examples include: 1) increasing programs (in terms of quantity and quality) for 2nd cycle, LL and executive education; 2) increasing the sale of services to organizations in general and HEI in particular; 3) renting equipment and selling corresponding man-hours; 4) obtaining sponsorships from private entities (a common practice in other countries); 5) organizing more congresses, conferences and other revenue-generating events; 6) expanding the limits of the online store to other domains, to be defined in the future.

Human resources

It is a challenge to motivate people who have been going through restructuring processes for a number of years, whether it is faculty (research and teaching) or staff (support activities). Thus, it is important to ensure that tensions and disappointments, which are common in these processes, do not become widespread.

For faculty, it is especially important to: 1) implement a system that allows a better alignment of individual contributions with UAb's mission; 2) ensure that all faculty continue to handle the DL tools efficiently; 3) create ways of increasing (former) students' perception of the availability of professors and, especially, tutors; 4) reduce inbreeding, which is prevalent in UAb and is perhaps the main hindrance of the PHEN's development; 5) boost the level of international publications in the scientific fields covered by UAb (this may require specific incentives); 6) allow for the possible departure of UAb faculty, in case other HEI decide to invest strongly in DL.

For staff, it is necessary to increase mobility and incentives to improve internal processes. People and processes more exposed to external actors, especially academic services, warrant special attention. Finally, in spite of efforts to improve quality, compliance with the statutes is necessary and a Teaching Quality Assessment Group should be formed.

Virtual Educational Model

It is some years since the model was introduced and, despite some improvements, it should be thoroughly re-evaluated using the knowledge meanwhile acquired by the DL Lab and in light of formal or non-formal, internal or external criticisms and suggestions. Possible new paths (t-learning) should be considered as well as what has already been stated regarding educational offer and target publics.

Physical infrastructure

Due to its size, lack of functionality and the state of preservation of UAb's Lisbon infrastructure, this persistent problem needs resolving even if the answer involves institutions other than UAb. Caution should be taken when deciding on the method and criteria for choosing the location; however, it is unlikely that the final result is within the Lisbon Municipality. It is further suggested that the LLC network is consolidated, increasing its proximity to populations and thus its visibility and reputation.

Marketing, Image and Reputation

Despite UAb's recent effort to improve its image and reputation, there is wide margin for progress, as the survey itself indicates. Some guidelines include: 1) increasing

the publicity on the internet and on television; 2) investing in open learning, as already mentioned; 3) setting the short term goal of obtaining international accreditation (associated to efficiency, efficacy and innovation in teaching, which are ever-increasing selection criteria for potential students and employers)[21]; 4) looking for selling points from the survey results in an attempt to improve the reputation of UAb and DL.

Cooperation with other HEI

UAb should further promote its relations with other HEI. For example, it could: 1) develop joint ventures and double degrees with foreign DL universities, anticipating the trend of other Portuguese HEI; 2) offer multiple degrees with national and international non-DL HEI, especially those of Portuguese-speaking countries; 3) create a structure dedicated to the anticipated service needs of national HEI who intend to develop their own DL.

FINAL REMARKS

It should be stressed that the actual methodology is equally or more important than the results presented here. Data mining allowed the timely exploration of survey results and the drawing of conclusions way beyond what would have been possible with common data analysis techniques. Therefore, it is recommended that UAb include this type of method in the analysis of relevant information, already collected or to be collected in the future, in particular in the DL Lab.

NOTES

1. This paper is based on a much broader unpublished study, developed by ISCTE-IUL – University Institute of Lisbon, with the goal of supporting UAb's institutional reorientation and to supply instruments to refound higher distance learning in Portugal. The authors of this paper were also the authors of that study; however, it is important to thank the remaining members of the team, in particular to Pedro Camilo, and Universidade Aberta (UAb), in particular Professor Domingos Caeiro.

2. The continued decrease of public spending in education, as a percentage of GDP, comes from 2002 (http://www.pordata.pt/, 14/3/2011).

3. Henceforth, any reference to respondents will be relative to the 2860 validated answers, or part thereof.

4. http://www.clubofrome.at/events/2006/brussels/files/lisbon-strategy-2000.pdf, 2/9/2010. In the meantime, expectations were transferred to the Europa 2020 strategy, which claims to incorporate the impact of the international crisis (http://ec.europa.eu/eu2020/pdf/1_PT_ACT_part1_v1.pdf, 2/9/2010); however, with progress slow, some are foreseeing another failure.

5. http://www.umic.pt/images/stories/publicacoes/MCTES_compromisso_com_a_ciencia.pdf, 6/6/2010.

6. http://www.mctes.pt/archive/doc/cc_universidades.pdf, 23/3/2010.

7. http://www.ine.pt/xportal/xmain?xpgid=ine_main&xpid=INE, 4/9/2010.

8. http://www.proinno-europe.eu/sites/default/files/docs_EIS2010/IUS_2010_final.pdf, 15/2/2011. The largest contributions come from new doctoral students, international scientific co-publications and the efforts made by SME (in-house innovation, collaboration with third-parties, introduction of product or process innovations, intro-

duction of marketing or organizational innovations, sales associated with innovations which are new to the market or to the company).

9. http://epp.eurostat.ec.europa.eu/portal/page/portal/eurostat/home, 26.10.2010. According to data from the Ministry of Science, Technology, and Higher Education (MHTSE), the partitioning of the R&D effort changed considerably in the last 25 years (approximate values): companies increased from 30% to 50%; the State (including the PHEN) dropped from 65% to 40%. The remainder corresponds to private non-profit institutions.

10. http://www.ine.pt/xportal/xmain?xpgid=ine_main&xpid=INE, 4/9/2010.

11. This phenomenon has been widely studied and is analyzed deeply, for example, in Morphew (2000).

12. These are small nuclei where formal and non-formal educative actions take place, to develop academic, professional, cultural and civic skills, in multiple areas (technical, artistic, cultural, scientific or economic). They originated from cooperation protocols between UAb (which pays for the exams and the coordinating staff) and City Councils (which provide and maintain the physical spaces, as well as the basic equipment) for the Municipalities that host them.

13. http://www.uab.pt/web/guest/estudar-na-uab/oferta-pedagogica/1ciclo, 3/9/2010. First cycle students tend to be slightly above 90% and those of the second cycle are about four times those of the third cycle.

14. Despite this, in the last few years the bet in the management area was clear, already representing over 50% of Social Science students.

15. There is no constraint regarding second and third cycles.

16. This terminology, used throughout the whole paper, means the following: cluster 1, formed by 7% of the respondents.

17. Short duration training (60-90 ECTS), post-high school but not higher, which convey level 5 professional qualifications (in a scale from 1 to 8). Tuition fees are unconstrained except that they may not exceed the minimum defined for Bachelors. http://www.dges.mctes.pt/NR/rdonlyres/BA4CD986-0385-4DAC-BB19-EC8092BA3E6D/-4077/cet6.pdf, 1/10/2010.

18. "Each and every learning activity (formal and informal) with an objective, founded with a continual base and envisioning better knowledge, aptitude and skills.", http://ec.europa.eu/education/lifelong-learning-policy/doc/policy/memo_en.pdf, 7/6/2010.

19. Any HEI that keeps faculty and other resources allocated to stagnant CU and courses is jeopardizing its own sustainability.

20. Executive education could also be an avenue to explore, even though it requires a well-trained teaching staff, which is not always easy to obtain. This is training strongly directed to leaders and managers, to prepare them to new challenges and responsibilities in their respective organizations or to a change in their careers.

21. Within UAb there are those who defend that international accreditation has not received due attention and that it would give an important contribution to national and international reputation, but also to efficiency itself.

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