CHAPTER 19

Regional Engagement and Sustainability: University of Aveiro in Portugal

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INTRODUCTION

In the framework of the demographic evolution foreseen up to 2050, major issues related to sustainability include: food, natural resources (water in particular) and energy. These "grand societal challenges" affect all aspects of our lives and are not contained within geographical borders or specific scientific disciplines.

Starting from the imbalance in population and riches across the world, this paper concentrates on the European situation where the demographic decline **constitutes the most serious problem** and focuses on the role of universities and possible action in three inter-related areas:

- Research: Carrying out cutting-edge work and making it valuable for the global world and at the same time relevant for local/regional communities.
- Teaching and learning: Paying particular attention to the education mission, including lifelong learning and retraining, within the framework of both ageing population and shifting labour needs.
- Cooperation with society: Universities as promoters of good practices in regional networking for post-secondary education (municipalities, industry, professional and secondary schools) leading to better qualification of the workforce, improving employment and promoting the integration of immigrants.

To illustrate the above, I will present some initiatives, some of which have been taken by the University of Aveiro in Portugal, as an example of a responsible and inclusive institution, a research-oriented university which has managed to became an asset to its region. These examples will show very clearly that institutional autonomy and leadership are fundamental requisites to muster the creativity that is needed to deal with such complex issues.

SETTING THE SCENE

Population imbalance

The 2008 Revision of United Nations' *World Population Prospects* estimates that the world population will reach 7 billion this year (2011) and rise to 9 billion by 2050. The additional 2 billion will come predominantly from developing countries, while the population in developed countries is expected to remain more or less stable due to migration from developing regions, which is expected to occur at a rate of 2.4 million persons per year.

In both developed and developing regions, the workforce (25-60-year-olds) is now about 604 million and 2.4 billion respectively. However, by 2050 the developed regions will have decreased to 528 million while the developing regions will increase continuously, reaching 3.6 billion in 2050 and continuing to rise. While this presents, with great acuity, the problem of employment creation in these regions, some of the developed world will have to face a different set of complex issues, namely ageing and the sustainability of its social model, which needs adequate public policies to help keep the situation under control.

If one takes a closer look at Europe, one of the developed regions, the overall stability of the population is due not so much to immigrants, but to an increase in life expectancy compensated by a decrease in fertility (1.5 in 2010 compared with 2.19 in 1975).

Europe's population, of 732 million in 2010, is expected to register a 6% decrease, and stand at 691 million by 2050, assuming a medium variant of fertility and life expectancy; however, in the same period, the population aged 15-59 years will decrease by 30%, from 459 million to 351 million, while the age group above 60 will increase from 192 to 302 million. That is to say that by 2050 the working population will be about the same size as the senior (over 60) population group (U.N. Dept of Economics and Social Affairs, 2008).

According to the OECD, the ratio of the population 65+ to the population age 20-64 in the E.U., which is already higher than that of the United States and the OECD average, will have doubled its present value, by 2050 (Whiteford).

This constitutes the **major threat** to the sustainability of the European economy and welfare model. It could undermine social cohesion and cause generational tensions. Social security costs (pensions and health care) will skyrocket — as is already happening! — and will place an incredible tax burden on the working-age group. At the same time, welcoming and integrating the *needed* immigrants will require complex and expensive public policies, which will be difficult to explain to the public at large in times of financial scarcity.

Europe is a very diverse region, in demographic terms too, and big differences are observed, which are likely to add to the problem. Eastern Europe faces ageing, as well as huge decreases in the overall population. Countries like Bulgaria, Estonia, Latvia, Lithuania, Poland and Romania present population decline due the cumulative effects of decrease in fertility and emigration that is not compensated by immigration, whereas in Southern Europe (Greece, Italy, Portugal and Spain), the decline in fertility has so far been somewhat compensated by immigration.

Immigrants and social exclusion

In many European countries immigration and international migrants are not seen as a source of dynamism to the economy or to the innovative capacity of the country; on the contrary, they are perceived as competitors for jobs in a low performing market, leading to social tensions. Social exclusion mechanisms affect school performance of second-generation migrants who, therefore, seldom reach university, resulting in a waste of talent. Proper policies of full and responsible integration are generally needed. This in itself is an extremely complex issue very much outside the scope of this paper, hence I will concentrate only on the aspect related to the role of universities in promoting the integration of international migrants and present how the University of Aveiro in Portugal provides access to educational programmes for those who have interrupted their studies and/or have not followed a conventional educational path.

Challenges for higher education in Europe

Due to demographics and directed policies, the levels of participation in tertiary education of students from developing countries are increasing. The world tertiary student population is at the moment 150 million, with European attainment rates being exceeded by Australia, Canada, Japan, Korea and the U.S. China produces more HE graduates than anywhere else in the world, with a growing trend of about 18% in the last decade (Münz *et al.*, 2007). Labour market analysts forecast that by 2020 35% of all EU jobs will require high-level qualifications.

The E.U. 2020 **targets** of having at least 40% of 30-34-year-olds completing tertiary education, of reducing school drop-out rates below 10%, and of having 3% of the E.U.'s GDP invested in R&D&I, which translates into having another million jobs in research, can only be achieved if universities are able to respond on different fronts: as excellent knowledge producers, as education institutions (learning/teaching and behaviour role models), as part of the innovation chain and as public policy *watchers, promoters and drivers*.

Nevertheless, the huge difference in potential higher education student population across Europe is in itself a strong threat to the attainment of those targets and **constitutes the most serious problem** which, nowadays, undermines the economic development of Europe as a whole and threatens its future. In the 27 E.U. states, the 20-24 age group will *decrease* by 23.3% in 2050, but in Eastern Europe figures for that decrease are alarming, and range from 36.2% in Hungary to 60.5% in Bulgaria (Ritzen, 2009). Five countries, only, (Denmark, Luxembourg, the Netherlands, Sweden and the U.K.) have an expected increase in the 20-24 age group population.

Addressing these issues requires a modernized idea of the university as an organization with a segmented mission and clear vision; an institution that recognizes the need for knowledge creation through interaction among the different disciplines, from the hard sciences and technologies to humanities and social sciences, not with the ambition of solving all the problems, but to start addressing them in a more adequate way by pooling resources and drawing expertise from different fields.

Above all it requires institutional autonomy and appropriate incentives enabling universities to organize themselves internally and successfully address the need for reconfiguration of the HE&R&D network, to increase the quality and performance that Europe, again as a whole, needs.

The role of universities

For centuries the mission of the university has been, almost exclusively, to educate the future governing elites and to *search for true knowledge in solitude and freedom* (the Humboldt model). This ideology, which brought much academic success to the European universities, also created in academia strong resistance to interacting with the world outside its walls. Internally, a climate of persistent indifference to the importance and developments in the *other* disciplines, as well as strong competition among them, has contributed to the lack of knowledge integration. These two factors are detrimental to the quality of cutting-edge research, to its relevance and to innovation, contributing also to less efficiency in the use of resources.

Furthermore, only recently did European universities begin to include cooperation with society as a part of their mission and acknowledge the fact accordingly. But it is only through partnership with other private and public players, companies, municipalities, etc. that innovation can be introduced in the knowledge supply chain and strategic advances realized. In 2011, after a tremendous economic crisis, we start acknowledging that it is still not enough; we need to become **really** attractive to students from outside Europe, to welcome national mature cohorts, to support public polices directed to immigrant integration and family protection. The "Grand Societal Challenges" can only be addressed by a truly multidisciplinary approach in research and in education.

The questions in this paper are: i) Can a single institution, the university, respond to the demands of producing high-quality knowledge that would be available and important at global level, but also using that asset locally, contributing to the regional economic development and job creation? ii) Can a single institution educate and train research workers and citizens and, at the same time, have a policy of curriculum development and learning methodologies which responds to the needs of mature students?

The two questions have a positive answer if one is not tied to a set model of the university and if institutions are allowed to be creative in order to deliver high-quality performance in education, research and innovation. **Yes, it is possible to have differentiation within the same institution**, or if one prefers, to have a **segmented mission within a common set of values**, provided that universities are granted the appropriate degree of autonomy and use it accordingly. However, that may not be enough! An appropriate set of incentives is needed to drive change, and to transform Europe, which has some of the better universities in the world, into a vibrant region of learning and knowledge creation where multiculturalism is a reality.

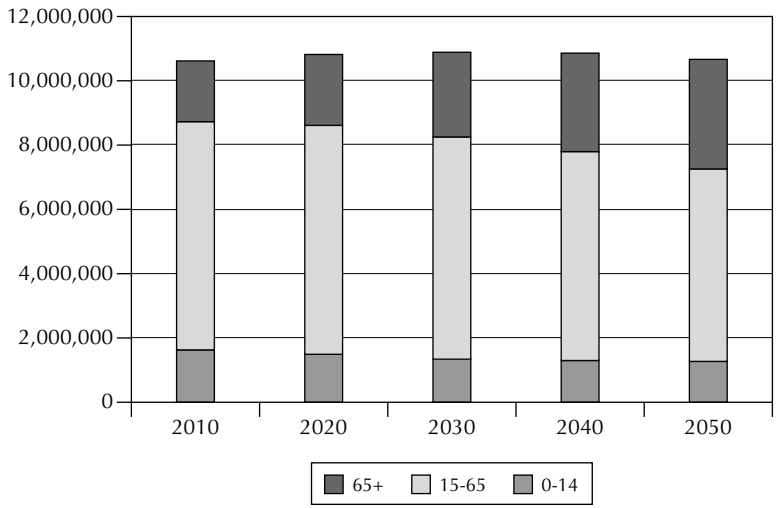
Established universities, research organizations and higher education institutions must recognize the absolute need for reorganization of the landscape, be it through mergers or other, more loosely coupled, forms of association of institutions (not only HE but R&D and business) to enable a higher degree of coordination, thus maximising synergies, achieving the needed critical mass, avoiding waste and guaranteeing highest standard in the delivery of integrated research, education and innovation.

I turn to University of Aveiro (UA), to illustrate how some of the above has been attempted with reasonable success, given the complexity of the issues. To make matters clear from the start, one should emphasize the fact that UA is, in European terms, a research-led university, with 50% of the budget earned in a competitive way from different sources, national and international, and 46% of postgraduate students (Master and Ph.D.)

PORTUGAL AND THE AVEIRO REGION

I begin with the expected evolution of population in Portugal up to 2050 (Pinto). Starting from the actual 10.7 million inhabitants, of which 18% are older than 65, Portugal follows the trend of the rest of Europe: the overall population will be about the same by 2050, but with increasing numbers in the 65+ group, while the 0-14 group is getting smaller (Figure 1).

Figure 1: Population Evolution PT

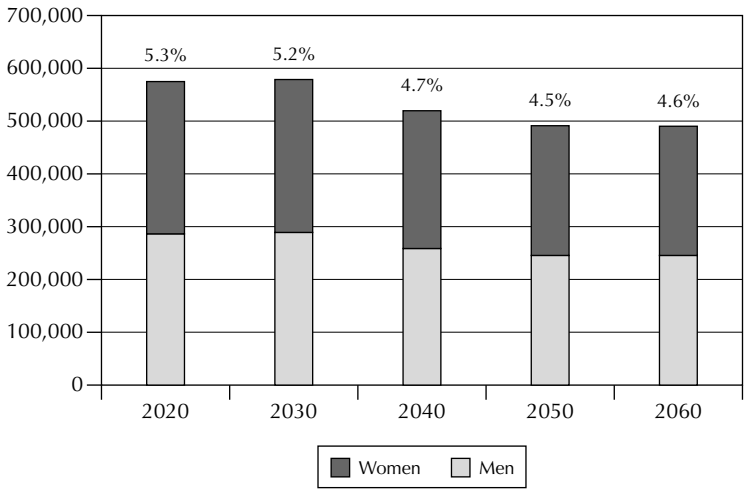


Higher education in Portugal consists of a binary system including universities and polytechnics with different missions. Polytechnics are more professionally oriented, not carrying out fundamental research, and allowed to grant degrees of Bachelor and professional Master only, (in other European countries, these institutions are called Universities of Applied Sciences [Finland] or *Fachochulen* [Germany]). Total enrolment in higher education of the 20-year-old cohort is about 36%, which is similar to the European average, although still lower than that of most industrialized regions. This has resulted mainly from an increase in non-university higher education (polytechnics), which grew at a considerably higher rate than that of university education.

Similarly to what happens in Europe, the 20-24 age group is expected to decrease by from 5.3% (2010) to 4.5% (2050), relative to the total population (Figure 2). In 2008, the Centro of Portugal region accounts, roughly, for 11% of this age group.

The fraction of total graduates aged 30-34 was 21.6% in 2008, which is low when compared to the current European average (31%) and targets (i.e.,

Figure 2: Portugal 20-44 age cohort



40% for 2020). The tertiary qualifications of the Portuguese population aged 25-64 are still below the OECD average. In 2008, 14% of the 25-64-year-old Portuguese population had a tertiary degree, while the OECD average was 28% (Ministry of Science, 2011). Although enrolment in tertiary education of adults aged 30-34 has increased by about 20% over the last three years (2005-2009), it is still relatively low and about 4.1% (2009) of the corresponding age group. Adult enrolment in tertiary education for the 35-49-year-old cohort was as low as 2% in 2009. Hence we face problems with the competitiveness of the country partly due to the low qualification of the working force.

THE UNIVERSITY OF AVEIRO, A DIVERSE INSTITUTION

The University of Aveiro is located mainly in Aveiro, a medium-sized city in Portugal's central region, in the heart of an industrial region and a centre for commerce and services. Integrated in the community and region, UA has a **strong research dimension** and offers a range of university bachelor, master and Ph.D. programmes, but also (since 1993) polytechnic undergraduate programmes, professional masters, and (since 2003) post-secondary vocational programmes.

Having built a profile based on sciences, engineering and technology, it includes today health-related areas including a master's in Medicine. Research-wise, Telecommunications, Electronics, Materials & Nano-sci-

Total n° of registered students (2010/2011)	14768
University:	
Undergraduate (1st cycle)	4567
Integrated masters:	2431
MSc, PhD:	3787
Polytechnic schools:	
Underfraduate 1st cycle:	2424
Post-graduate 2nd cycle (professional)	304
Post-secondary:	1050
Teaching Staff:	1000

ences, Environment & Marine Studies and Education are recognized as areas of excellence.

Why and how such integrated model?

Until the 1990s, only one polytechnic school, ISCA, the Institute for Accountancy and Administration existed in the Aveiro region. However, the available socio-economic indicators pointed to the lack of a polytechnic offer in technology that would cater for the local needs of the industry, while research results had more impact internationally (papers in high-impact factor journals, n° of Ph.D.s, patents etc) than regional relevance. This reality, together with an opening in the framework education law in 1986, led the university to propose the creation and integration in the university of one polytechnic school for Technology and Management located in Águeda, the heart of the industrial region, 50km from Aveiro City. Nowadays the university includes four polytechnic schools which cover the needs of the whole region, including not only technology, management and design, but also the health professions. In the meantime, ISCA asked to be integrated into the UA.

Thus, Aveiro University took on the challenge of becoming more than a node in the Portuguese higher education network: it **became a network in itself**. It embodies university departments, research units, interface units, polytechnic schools and a relevant vocational education network. This enables the construction of individual education paths, from post-secondary vocational education to doctoral programmes, including vocational training, 1st and 2nd cycle degrees, and different kinds of postgraduate specialisations.

In this context, the role of the polytechnic schools is particularly relevant. These schools are vocational training centres within the network and play other important roles regarding cooperation with the region.

We consider this model of integration, within the same institution, of university departments (16 at the moment), research labs (16) and four polytechnic schools, although requiring strong leadership and being a challenge to the management, an asset of the University which gives us the needed instruments to help tackling the serious social problems we face one decade into the 21st century: those of retraining the workforce and so fighting unemployment, responding to shifting needs of the labour market and promoting regional innovation; at the same time ALSO producing knowledge, through interdisciplinary research teams, which may contribute to find answers to, climate change, excessive use of fossil energy production, scarcity of food, etc.

Organization and Profile

The UA does not follow the traditional faculty structure, but is organized in university departments and polytechnic schools in an almost textbook example of a matrix organization (Figure 3). This matrix structure allows it to mobilise for each education programme, research area or line of cooperation with society, the human and material resources from the relevant disciplinary domain, allowing extensive flexibility, fast response and efficiency. This structure enhances the possibility of multidisciplinary approaches in interface areas which are fundamental for tackling the challenges faced by society today.

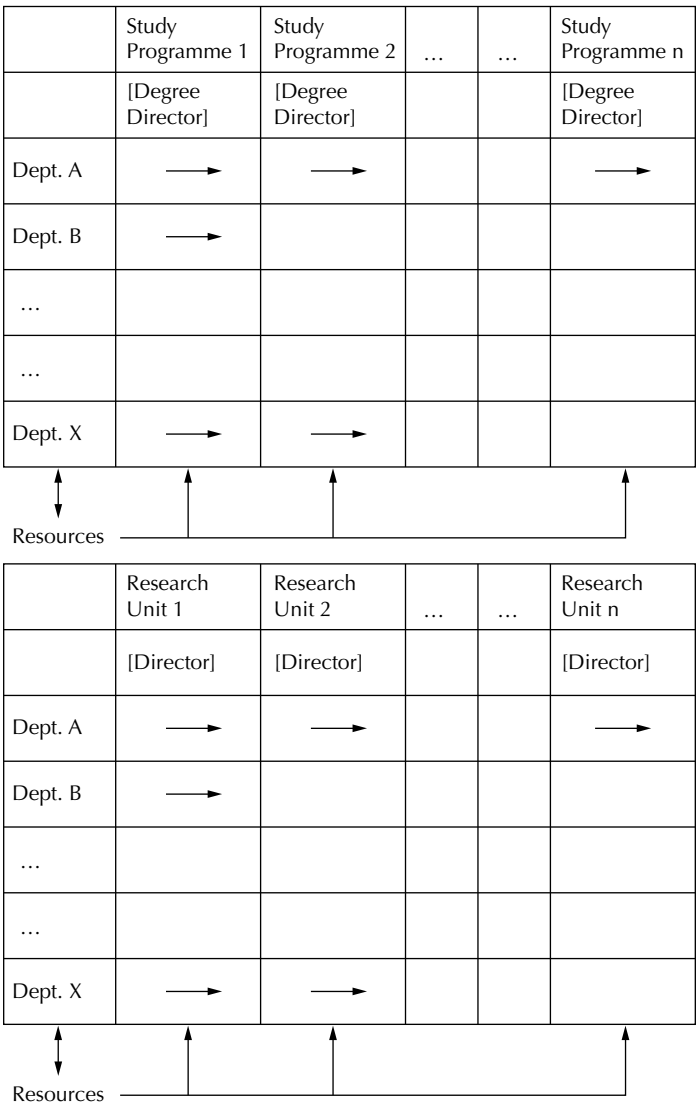
Research

Research has always been and continues to be a central priority. The approach to research has been to focus on innovative fields, taking advantage of transdisciplinarity and **prioritising a small number** of areas.

The high standard of research is visible in achievement through international evaluation. There are now four Associated Laboratories on Campus. These have a special status awarded by the Portuguese Ministry of Science and Technology to large interdisciplinary and exceptional research units: the Centre for Environmental and Marine Studies (CESAM), the Centre for Research in Ceramics and Composite Materials (CICECO), the Telecommunications Institute (IT) and the Institute for Nano-Structures, Nano-Modelling and Nano-Manufacturing (I3N), plus another three research units graded as excellent, Mechanical Engineering, Organic and Food Chemistry and Education.

Inter-institutional agreements with other universities and RPO and protocols with companies for the realization of internships and projects support the transfer of technology, in addition to the development of applied research.

Figure 3: Matrix organisation: a) for study programmes; b) for research units



Several research units function in collaboration with other renowned entities in their field for the benefit of research and technology transfer, in particular: the Telecommunications Institute (*IT*) (of which Portugal Telecom is an associate and shareholder). A strong relationship with companies is an important facet of UA's identity. It participates in numerous associations, programmes and projects in collaboration with business and industry, notably with Portugal Telecom (PT), Nokia-Siemens network and Martifer. The Nokia-Siemens Corporation research and innovation centre (employing about 200 engineers) is located on campus.

The UA is now (2011) once again responding to societal priorities by pooling research assets into coherent work programmes focused on: ageing (IT, I3N and Mechanical Engineering), natural resources and food (CESAM and Organic and Food Chemistry) with a specifically allocation of funds for the next five years.

Interaction with the region, boosting employment through qualification of the workforce: Making use of our polytechnic schools

The "post-secondary education" offered by UA through its polytechnic schools comprises a set of Technological Specialisation programmes (*CETs)*, which are professionally-oriented programmes leading to a level 4 vocational qualification certificate. These programmes promote a training path that combines qualification and professional skills and competences with the possibility of proceeding to higher education. The main focus of each programme is placed on practical training (typically half of the total number of ECTS in each programme is attributed to work experience).

The *CETs* are delivered in partnership with secondary schools, technological centres, professional training centres, entrepreneurial/industrial associations or city councils, among others.

In promoting these programmes, UA seeks to enhance technical and vocational education among young people in areas which lack qualified personnel; to offer a new training opportunity for potential learners who are either not motivated for "academic" education or have left school too early; to encourage the return of mature persons to school (workers or unemployed) for professional re-qualification and technical training; and to modify the negative dominant view about technical education in Portugal.

In so doing, the university is strongly improving its links with the leading economic and political sectors in the region in a variety of ways. Firstly, the choice of programmes and training actions is made in close cooperation with the leading industrial sectors and reflects their priorities in terms of training needs. In addition, curricula are designed by teams involving the university

and industry; programme courses are implemented by teams made up of university lecturers, industry professionals and training experts, and there is always a significant commitment from the local authorities.

In conclusion, the *CET* offer not only constitutes a de-localised educational network but, by the nature of the partnerships it involves, also provides a number of opportunities for dialogue and service-sharing with the region.

UA: LINK IN THE INNOVATION CHAIN

Clusters and other innovation promoting projects

UA is strongly involved in the national programme for the implementation of "Collective efficiency strategies". We have been active agents with firms and other institutions in the setting up inter-institutional dynamics leading to the

creation of clusters in the areas of energy, sea, health, food industry, information technology, communication and electronics, engineering and tooling, petro-chemistry, habitat and creative industries.

UA is currently also acting as leader for the Science and Innovation Park in close proximity to the university campus.

Joint programmes with nearby municipalities: Recently, the University has taken the lead to an innovative approach, in the link with the region, which goes far beyond the traditional focus on technology transfer and spin out activities, enlarging and enhancing the contribution that the university, and indeed research activities and scientific knowledge, can have in shaping (local and regional) public policy and development trajectories. The university and the association of the 11 municipalities of the Aveiro region, with about 375,000 inhabitants, decided to take a bold step by traditional standards: they established a partnership for the design of a regional development programme, going beyond the role of piecemeal consultancy work and aiming at a joint approach to regional development. In fact, rather than hiring a group of academics as consultants, this initiative had a dual aim. The first was to mobilize the diversity of disciplinary knowledge existing in the university to help address the problems and expectations of the different municipalities and the regional community as a whole; the second was to set in motion the process of creating a shared understanding of regional development dynamics and challenges, which indeed could and should lead to a re-interpretation of needs and expectations.

As mutual knowledge and trust were further developed between the local authorities and the university, a wider range of initiatives were taken. At the level of the Association of Local Authorities, a new programme was prepared focused on "Urban Networks for Innovation and Competitiveness", which was built around five selected topics: education, culture, health, climate change and entrepreneurship (including social entrepreneurship). A new relationship between local government, small and medium-sized firms and the university is emerging, integrating local public policy, economic modernisation and revitalisation, and multidisciplinary research activity.

Lifelong learning and tools for widening access: UA provides access to its educational programmes for those who have interrupted their studies and/or have not followed a conventional educational path. By this we mean access under special conditions for students over the age of 23 (+23s) or holding a *CET* diploma to enrol in full 1st cycle programmes. The UA also created conditions for candidates in general to enrol in specific modules or isolated disciplines (at the level of the 1st, 2nd or 3rd cycle).

Both the graduates from the +23s programme and from the *CETs* have contributed significantly to boost employment in the region.

Outside the scope of standard degree programmes, UA created two entities which contribute to the provision of continuing education programmes: the Association for Professional Training and Research (*UNAVE*), legally autonomous but controlled by UA, its main shareholder, and the Integrated Teacher Education Centre (*CIFOP*). *UNAVE* offers short-term professional and vocational programmes for university staff and the general population, while *CIFOP* provides a range of courses and programmes for teachers.

This set of continuing education opportunities is sought by working students in general, company employees who need specific knowledge and professionals of various kinds who are looking for re-qualification or to update their knowledge and skills. Continuing education is recognized through the attribution of a certificate, whether or not it leads to a formal degree.

Lifelong learning is growing and its organization is at present being rethought. Mechanisms for the welcoming and guidance of candidates, as well as for the recognition of prior learning, are being put in place.

CONCLUSION

In difficult times, creativity and initiative are attributes required of all Institutions, Universities are amongst the oldest institutions in Europe. Contrary to the belief that they do not change, I hope to have shown exactly the opposite: Universities not only change, adapting themselves to new circumstances and societal needs, but also and foremost they can lead and be drivers of change.

These changes are not consensual within the academic community. Very often such strong interaction with the outside world, be it from getting involved with high-tech companies in doing applied research (the most accepted form of cooperation) to helping design educational programmes and paths to adult learners (immigrants or nationals), is seen as not within university mission and harmful in different ways. I believe that the 21st century needs a different and more embracing understanding of the university mission.

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