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The Development of Knowledge in Portugal - a slow and unsustainable progress

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Abstract

Development of knowledge in Portugal occurred late and slowly, mainly as a result of political and institutional factors which persisted with democracy. Amongst knowledge key areas, education, research and development (R&D) and innovation advanced with frequent setbacks. This irregular behaviour induced very negative economic and social consequences given the spillover and multiplier effects arising from those areas. Significant progress took place at the onset of the 21st century, despite the lack of a systematic knowledge strategy that would guarantee consistent articulation between key areas and stakeholders. Important imbalances have thus been taking place which severely challenge knowledge regulation process, in which public policies have played an essential role. However, despite the ratification of EU Strategy 2020, Portuguese Government has drastically been diminishing support to education and R&D over the last years, as a consequence of the austerity programme, thereby leading, with other factors, to the now visibly obvious regression in the development of knowledge.

Key Words: knowledge enhancement; Portugal; education, R&D, innovation; knowledge as a mixed good; knowledge strategy; private knowledge; public policies; pro-cyclic public interventions; Strategy 2020.

J.E.L.: O1; O2; O3; O31, O33, O35, O38.

Introduction

When compared with other European countries, as well as a significant number of OECD ones, Portugal can be considered a relative latecomer in terms of creating the foundations of modern knowledge. We will examine, in brief, the reasons for this delay, showing how the transition from the 20th to the 21st Century was an important moment for Portugal in terms of recuperation in the key areas of the creation and development of knowledge: education, research and development (R&D) and innovation.

This late development naturally meant that the effects of globalisation and the economic and social crisis would be felt even stronger in Portugal, than in other economies with more solid backgrounds in technology and knowledge, as it lacked sufficiently strong scientific and institutional infrastructures and was, to a large degree, dependent on imported technology and knowledge. This could have been avoided if anti-cyclical policies had been adopted in time in the three key areas mentioned above. However this did not occur, mainly on account of the austerity measures.

Whereas in some areas the effects of cutbacks will be less onerous, as they are essentially short-term and bear less spillover effects, the opposite is the case for the development of knowledge. Effectively this process is characterised by the cross effects established over time, by the accumulative nature and self-reinforcement of its results, by the boom and bust repercussions seen in diverse economic sectors and social areas, and also by the fact that most of the ongoing economic and social effects will only be in place in the long-term. As

specialised literature on this subject has shown, delays in terms of educational reforms, for example, have been reflected by an increased negative impact on economic and social growth and development, in terms of time and intensity. The same occurs with research and development and innovation.

A part of these important characteristics of knowledge, when considered as an economic and social good, are described in the Economics of Knowledge, a scientific field that has been almost exclusively providing the theoretical input into this subject. In the meantime, even before the onset of the effects of globalisation and the present crisis, there was a need to consider other complimentary visions or perspectives, such as those represented by Sociology of Knowledge and by Theories of Institutions.

From the point of view of Economics, which we concentrate on more here, we propose to also focus on a pre-requisite which is frequently forgotten and, many times not even verified, during the process of the creation and advancement of knowledge, and that is its systematic nature. That is to say, the adoption of policies in each of the key areas mentioned above, unless they are a result of a previous coordination between the three areas, risks having zero effect, or even of having a negative effect, in the area to which they are applied. What is certain, however, is that such coordination has not proved to be easily achieved in Portugal.

This is essentially due to the absence of an endogenous and sustainable strategy for the advancement of knowledge. Furthermore a paradoxical situation exists in that there is significant divergence between the justification and the implementation of economic measures, as well as the institutional objectives and political issues in European Union rulings and treaties, which Portugal is often one of the first to subscribe to and ratify.

Thus, the benefits from the advancement of knowledge that have been achieved through an important and sustainable investment in education, R&D and innovation, are starting to slip away, after five years' of economic and social crisis and three years' of inconsistency in public policies.

The hare and the tortoise...

The slow progress of the evolution of the foundations of knowledge in Portugal is a result of multiple factors of an economic, social and political nature. These factors extended over the whole period from the 30s to the 70s during the 20th Century, during which the burden of the dictatorship was in evidence, whereby education was solely for the elite, illiteracy took a long time to eradicate, inequality was in evidence in schooling, and educational structures remained rigid and steeped in inertia. Although the Education Minister Veiga Simão had implemented some reforms earlier, it was only with the arrival of democracy in 1974 and the drawing up of the new Constitution in 1976, that profound reforms to education started to take place. Despite multiple laws and regulations were passed in succession, great difficulty was experienced in implementing them, largely on account of the effect of the heavy bureaucratic and administrative processes that were inherited from the previous period (Stoer and others, 2001).

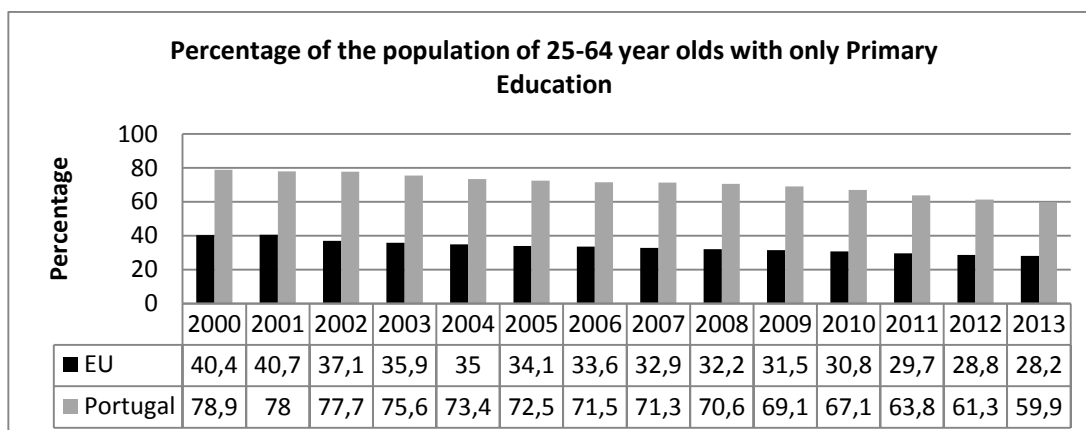
This aspect reveals the influence of institutional factors on the process of building the foundations of knowledge, and was made worse by the considerable economic and budgetary restrictions that were imposed on the country - starting with the colonial wars through to the constitution of the foundations for a democratic economy – which led to the late start and slow evolution of the educational process. Community funds, especially those from the European

Social Fund, were decisive in driving forward the development of Human Resources policies in Portugal, and helped to prepare the process of applying to join the European Community as from 1986 (Romão, 2006). Although this was an important contribution, it was successive changes of Government that led to considerable conceptual and administrative discontinuity, which particularly affected education, and more recently, R&D and innovation.

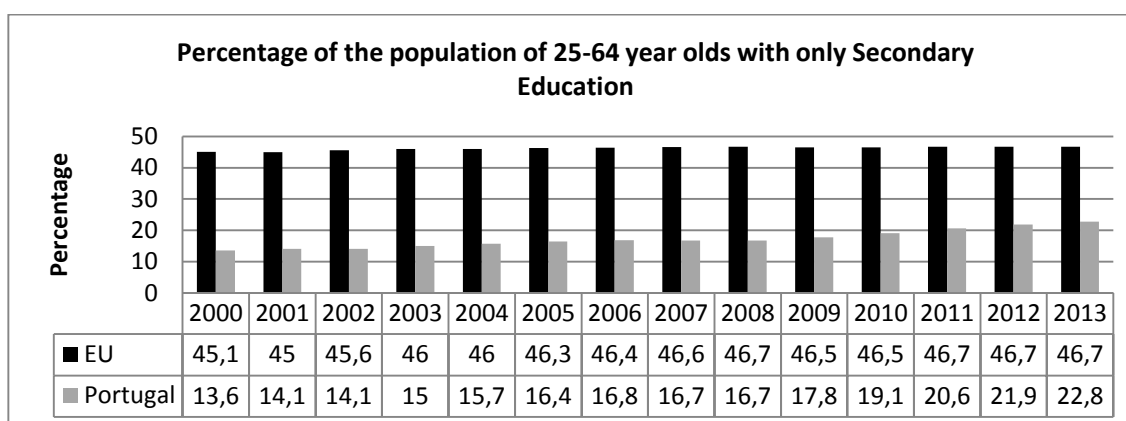
In relation to education, the evolution of some of the most significant indicators can be seen in graphs 1 a), b) and c). These show the large difference between the slow progress of Portugal in all levels of education when compared to the rest of the European Union (EU). Graph 1 a), which represents the proportion of the population with only Primary Education, shows the deterioration in Portugal, in comparison to the European average – which reached a situation in 2013, whereby the percentage in Portugal was more than double that of the average. The percentage of the population with Secondary Education (Graph 1 b)) had a very positive evolution in our country since the start of the present century, even though in 2013 it was barely 22%, as opposed to an average of 46% for the EU. The most significant progress can be seen in the field of Higher Education, although we are still a long way off the 20% reference mark.

Graph 1: The evolution of the main educational indicators in Portugal

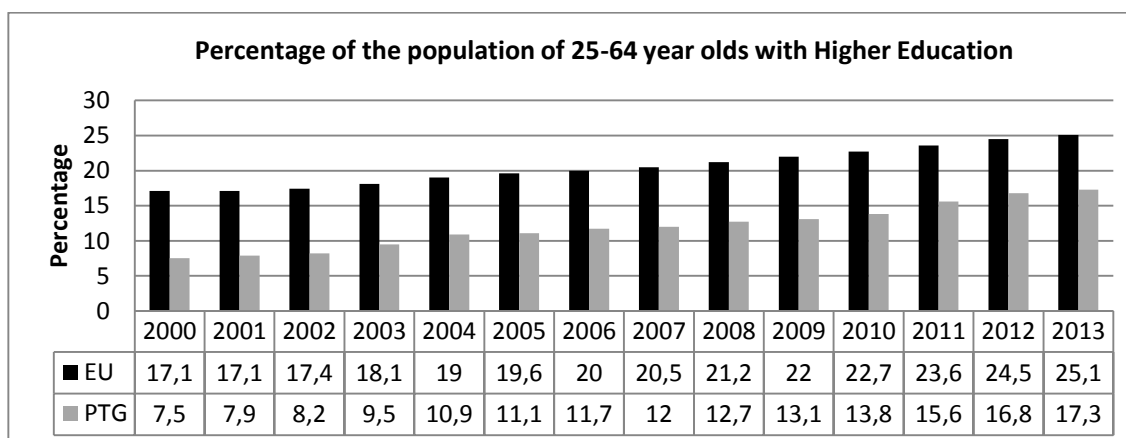
1.a)



1.b)



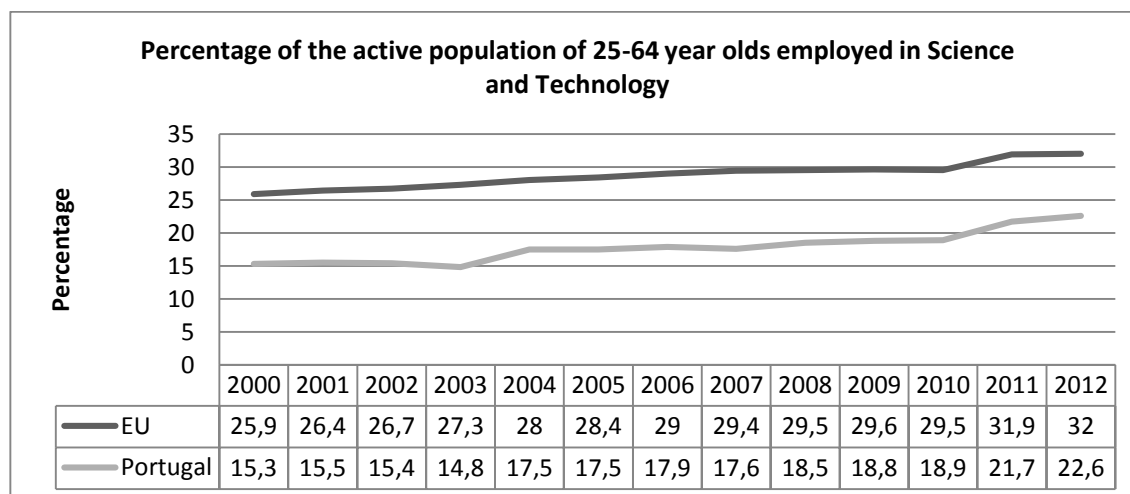
1.c)]



Source: EUROSTAT DATABASE, retrieved on the 3rd of April, 2014 from <http://epp.eurostat.ec.europa.eu/portal/page/portal/education/data/database>.

The panorama for science and technology is not that much different to that of education. In this field, the gap that separates Portugal from the European average in 2013 is exactly the same as that of 2000, as measured by the HRSTO indicator (Human Resources in Science & Technology Occupations):

Graph 2: The evolution of the employment rate in Science and Technology



Source: EUROSTAT DATABASE, retrieved on the 3rd of April, 2014 from <http://appsso.eurostat.ec.europa.eu/nui/submitViewTableAction.do>.

For a start, we can identify two of the vectors for analysis: the first, being the educational results, which support the building of the foundations of knowledge; the second, which is related to the qualifications of the active working population, manifests the use by the economic sector of qualifications and skills that are a product of education (as well as training and professional experience, both of which are aspects that we have not considered at this stage). We are thus faced by the two sides of the same coin; or, in Economic terms, we can see the effect of supply in the first case, and of demand, in the second one, in terms of qualified labour.

In other words, the process of development and build-up of knowledge relies on the market of qualified and skilled labour, where it is difficult to find the correct balance. The unbalance in this market can reach explosive dimensions in times of crisis and as a result of increasing globalisation, leading to high levels of unemployment of highly qualified labour, as can be seen in several countries at the moment, including Portugal.

This aspect necessarily leads us to the question of the role of the regulator/s in such an unbalance, and provokes discussion as to the strengths and weaknesses of the relationship between the Government and the market, the intervention of other institutions and the role of public policies, amongst other factors, which we will now address below.

The essential aspect that we intend to highlight is Portugal’s relatively poor standing in relation to the situation in Europe, not only with regards to the factors that determine the foundations and evolution of knowledge, but also with regards to the productive utilisation of this knowledge. According to the majority of indicators, and leaving aside a few short periods with

more favourable results, the most adequate comparison is that of the race between the hare and the tortoise.

What could be the future effects on the advancement of knowledge in Portugal? Before we try to answer this question, let us synthetically consider the theoretical background of the advancement of knowledge.

An overview of the Economics of Knowledge

Even though even more multi and pluridisciplinary approaches are now being addressed to the advancement of knowledge, the scientific nucleus continues to be Economics, where conflict is evident between the more orthodox and neo-classical line and those more recent approaches, which include the institutionalists (Lundvall, 2003; Schilirò, 2010; Sotarauta & Kosonen, 2003). When applied to the building and advancement of knowledge, Economics has come to use Public Economics essentially.

One of the points on this subject that is most debated, is the very nature of knowledge as an asset. Some of the initial contributions to this debate tended to consider knowledge as purely a public good: whereby the principles of non-exclusion and non-rivalry appear to be evident, as, on one hand, no one can be excluded from gaining knowledge, whilst on the other hand, the fact that one particular individual is denied access to knowledge, doesn't infer that all others are also denied the same access (Dasgupta & David, 1994). It should be added that, ever since the advent of new growth theories, the multiplying effects of knowledge have become well evident, as well as its spillover effects, highlighting knowledge's important contribution to economic and social growth. The study of macroeconomic production functions shows that the key of that contribution lies with the increase brought about by knowledge on isolated and total factors of production' productivity, which lead to significant increases in returns (Lucas, 1988; Romer, 1990; Schleicher, 2006).

This evidence that knowledge has been evermore playing the role of the main factor of production and returns, has led to a progressive and increasing divergence between the common wellbeing and private sector interests. From one point of view, Government, acting in its role as the guardian of economic and social wellbeing, assumes the onus to guarantee free access to knowledge for all, as well as being given the responsibility to create the best conditions possible for the propagation of knowledge. Regarding this last point, it is easy to substantiate that the private sector is little interested in promoting the basic prerequisites, such as: infrastructures for education and training, science and technology parks and enterprise incubators, as these represent considerable investment with a potentially insignificant return and, furthermore, the resulting benefits from knowledge enhancement would have to be shared with others.

There has been an increasing tendency to fall to the temptation to privatise economically significant knowledge, or, at least, knowledge which is relevant for the start-up and development of each specific business. The process of progressively codifying knowledge and thus limiting *de facto* its access to experts, specialists and other shareholders is a good example of this tendency. This codification of knowledge has come to diminish the characteristics of knowledge as a purely public good, progressively transforming it into a mixed good, or even a club good. This has been brought about by not only an economic strategy to limit access as a means of increasing returns, but more so by legal, technical and operational demands. This

situation has been accentuated by the effect of the contribution of patents, royalties and other instruments that restrict access to knowledge (Verspagen, 1992, 1997). It is also necessary to go back to the key areas, or in other words, analyse the key processes that determine the foundations and advancement of knowledge, to search whether it is possible to apply there the principles of the economy of public goods (and services). The following questions need to be asked:

- Is education a public good, even in democratic societies? In other words, can it be guaranteed that no student is excluded from accessing, progressing and succeeding in the educational system (Author, 2013)?

- the same question needs to be asked in relation to the area of research and development (R&D) and also that of innovation, although it does not only apply to postgraduate and PhD students, who are ever more so suffering from the restrictions of scientific policies, but also to businesses that are interested in developing R&D: can small and medium sized businesses easily carry out R&D, especially in societies where there is a weak background in knowledge?

Many other questions such as these could be made, and the most plausible reply in all cases would be, naturally, negative. This has to do with the matter of the regulation of knowledge, especially the consistent interaction between its production, dissemination and incorporation; and also whether it is effected by the role of the market, versus that of Government and the potential and limitations of such intervention and regulation. We will return to this point later on. For now, let us just highlight the relevance of institutions on the process of knowledge.

A fundamental point, which is of prime importance for the objectives of this paper, is the accumulative nature of education and knowledge. Current thinking was expressed by Derek Bok, the ex-President of Harvard University, when he said “If you think that education is expensive, try ignorance” (<http://pensador.uol.com.br/frase/MTQyMg/>). He, as well as those that think alike, are saying that if education is not subject to innovation and reform, based on the excuse that they are expensive, then this will lead to even greater costs over time: correct timing will be lost, as will adequate phases of maturity and the most favourable circumstances; and when finally, change is made, it is most likely that it will not be the most suitable, and that the effects will be less significant, if not even damaging. This also signifies that there is an important path dependence between the various stages of educational reforms and innovation and if this is not respected, then the very sustainability and durability of this process will be compromised. If this is the case with education, then the same can be said about scientific research, policies and programmes of organisational innovation and, consequently, the advancement of knowledge (Schilirò, 2010, op. cit; Schleicher, 2006, op. cit). Amongst others, this is reinforced by Lundvall, who says:

Knowledge production [is] a process of joint production in which innovation is a kind of output and learning and skill enhancement that takes place in the process is another. (Lundvall, 2003 op. cit. p. 8).

Another critical aspect is the need for an adequate interaction between the three drivers of knowledge. The ideal scenario, which would be supported by a holistic concept of knowledge strategy, is a long way off from taking place in most societies, especially those where the advancement of knowledge is taking longer. In most situations, priority is given to qualifications’ and skills’ offer which is considered to be more important than the

corresponding demand from the economic activities, most of times both market sides being almost divorced.

The need for a good interaction between education, research and development and innovation can be easily assimilated if we bear in mind that cycles of progress in technological innovation are evermore becoming shorter, leading to knowledge becoming rapidly obsolete. Because of this, it is important that education and training – initial and continuous - prepare themselves to satisfy the growing need for qualifications and skills to be up-to-date, robust and redirected. On the other hand, it is essential that knowledge circulates, flows and is assimilated, and that demands for an ever increasing proportion of skilled labour, with higher education qualifications, that is prepared and ready to carry on learning; but it is also required that a minimum critical mass of people are inclined to carry out research and advanced studies.

But this is not all. In these times of exacerbated globalisation, the question of the absorption and transfer of knowledge has become even more critical, especially in societies with less capacity for innovation that depend greatly on imported technology. These societies frequently import technology that already incorporates knowledge which is difficult to absorb internally (Author, 2012). Authors such as Holbrook & Godin (2011) insist on the fact that the absorptive capacity of knowledge constitutes a critical and fundamental factor for modern times. It is in this light that innovation – which enables companies and organisations (demand side) to become receptive to technological progress and innovative knowledge – is recognised as being just as important as education and research and development (R&D). With this in mind, Garrouste (2001) also states that the main economic problem related to knowledge is its reproduction and that - on equal terms with its absorption – this requires even more the involvement of intellectually qualified resources.

The social and economic consequences of the weak, or missing, link between the elements of supply and demand in the process of knowledge are manifested dramatically by the unemployment of the high skilled, the difficulties that graduates in advanced studies and scientists have in finding a job, and mass emigration of both (Sutherland, 2012). Another repercussion is the inability of businesses to be competitive. For this reason there is an urgent need to rethink the regulation of the process of knowledge, and to discuss the way that it is interpreted by the institutions involved.

The regulation of knowledge

The evidence that knowledge is not a public good, but a mixed one, is proof of the fact that it has become the stage for conflict and articulation between the common good and individual interests.

The necessity to give the principles of non-rivalry and non-exclusion as much chance as possible to succeed during the process of the access and assimilation of knowledge obliges the public intervention in the democratic societies of today. The attempt to privatise knowledge with the aim of organisations obtaining profit margins, together with the question of the legitimate application of ownership rights and copyright, has led to the implementation of the restrictive measures that have been described above. Such measures, of varying degrees of legitimacy, hold back not only access to knowledge, but also its divulgation and dissemination.

We have also seen that the multiplying and spillover effects of knowledge imply investment in educational, scientific and innovation infrastructures that can only be provided by Government, on account of the lack of motivation and resources within the private sector. Government intervention is also required, in a systematic and sustainable form, to develop better qualified human resources and to facilitate their mobility and insertion into the productive job market. If these initiatives are not achieved, there will be a lack of advancement of knowledge and economic and social development becomes stagnant, or even deteriorates. After considerable debate, that negative outcome has led many authors to propose the utilisation of the term *learning societies*, instead of the widely accepted term of *knowledge based economies*, which stresses the ever increasingly important role of social commitment – and not just economic investment – in carrying forward the development of knowledge (Lundvall, 2003, op. cit; Schleicher, 2006, op. cit).

However, as knowledge results from a process of joint-production, one of the major stimuli for its development occurs after its assimilation and internal adaptation by organisations, when the required skills are present, as well as the necessary technologies and the most adequate organisational models. These prerequisites, together with their efficient implementation and articulation, have been analysed in the literature of *learning organizations* (Nonaka, 1994). The first studies and analyses of the process of organisational learning were based on industry, whereas more recent work has focussed on the services sector, as well as on the impact of individual and organisational experience on the process of learning and creating knowledge (Argote, 2012). This means that any interruption and discontinuity in organizational learning will have a significant negative effect on the development of knowledge. Cases of success of the cooperation between two of the many institutions involved in the process of knowledge – universities and businesses enterprises – are a good illustration of the necessary complementarity amongst institutions: productive organisations can thus access common knowledge, resulting from the indispensable public investment in education and R&D, which enables universities and research centres to carry out their daily work. On the other hand, it is the production process that gains from, and makes socially acceptable, the results of research and advanced studies: by using those results, this process then incorporates them as new operational knowledge, which is then commercialised, and in return, acts as an important financial contribution for R&D (Sotarauta & Kosonen, 2003, op. cit; Mora, 2007). By contributing to this process of *interactive learning*, innovative businesses recruit the most qualified and competent personnel in their line of business and thus contribute to lower qualified unemployment.

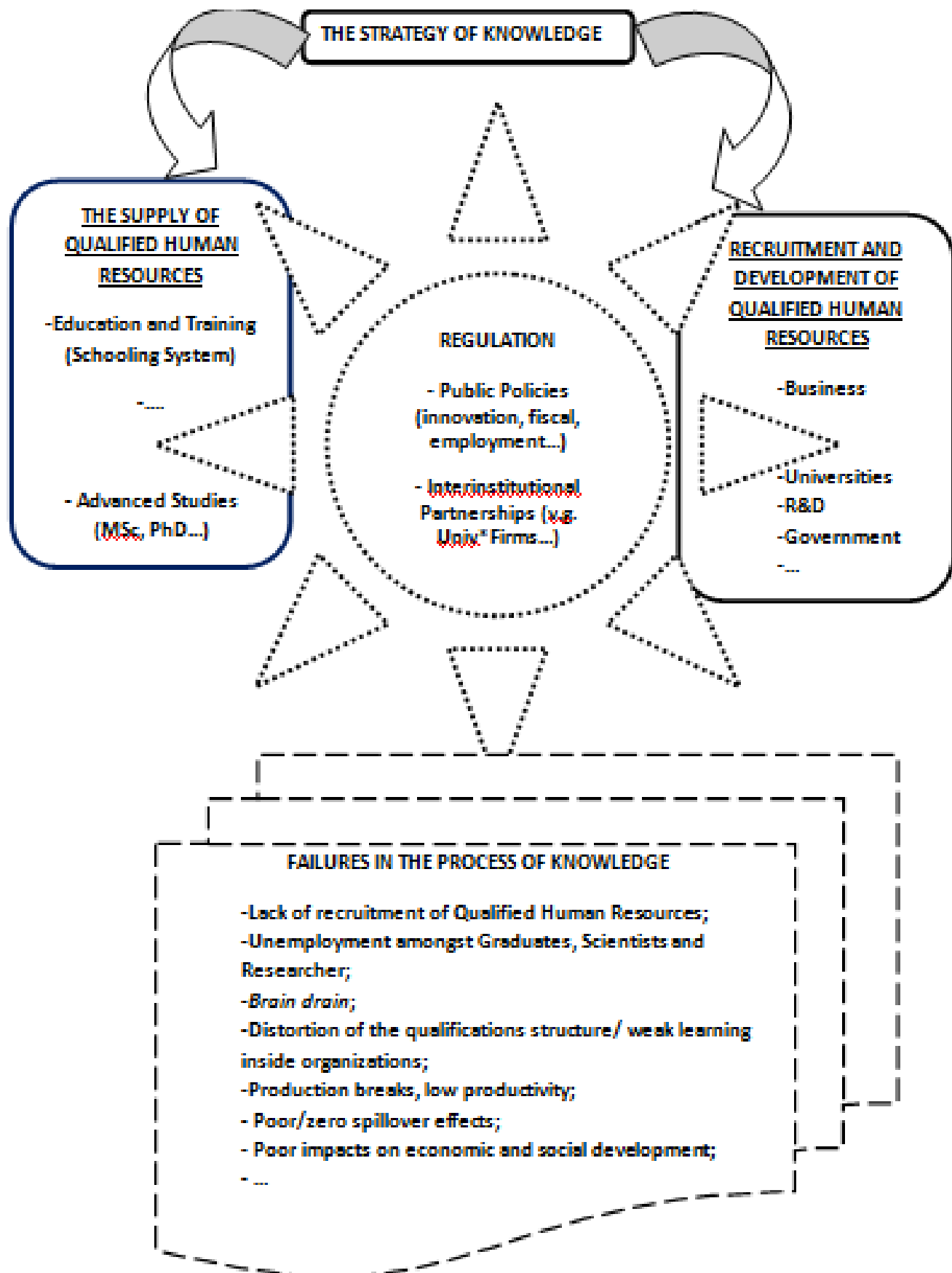
The policy of innovation naturally plays an important role in this process of interaction between institutions. On one hand, it is becoming increasingly clear that the advancement of knowledge in each society should not rely exclusively on KIS' (Knowledge Intensive Sectors) performance kept apart from the rest of the economy and society: the relative failure of Silicon Valley clearly states that. The capacity to generalise and widely absorb knowledge cannot just be restricted to a few isolated cases of spontaneous emergent start-ups in the fields of medium or high technology, which, frequently, live for just a short life-spell. On the contrary, it is fundamental for the Government to implement a policy targeted for the creation and sustainability of a wide base of innovation, which applies to all fields of economic activity and which incorporates ever-increasingly diverse and sophisticated skills. To achieve this goal, it may well be necessary to create incentives and special regimes, as defended, for example, by Schilirò (2010, op. cit).

The importance of a global vision and concept of the process of knowledge is still one of the fundamental reasons for justifying the intervention of the Government in the regulation of that

process. This overall vision is a key condition for supporting the set-up and implementation of a systematic approach to knowledge, especially if the vision keeps to a consistent strategy for the advancement of knowledge, and also guarantees an effective capacity for decision-making for each of the stages and interactions of this process. If it is so, the process provides an indispensable '*tableau de bord*' to record the creation of public policies and private sector interventions in the fields of education and training, research and development and innovation; and thereby it will enhance consistency and help to make those interventions compatible, thus minimising the inevitable waste and imbalances (Author, 2011; Edquist, 1999; Kovács & Author, 2010).

However, in most cases, that is just an optimal scenario of how tendencies should be, as the objectives, concepts and methodologies of the main stakeholders – Government, businesses, universities (both public and private), R&D institutions, etc. - are not wholly compatible. For this reason it is very important to identify and categorise the main points of imbalance and lack of adjustment. In the figure below we try to illustrate the key points of the process of knowledge and its regulation:

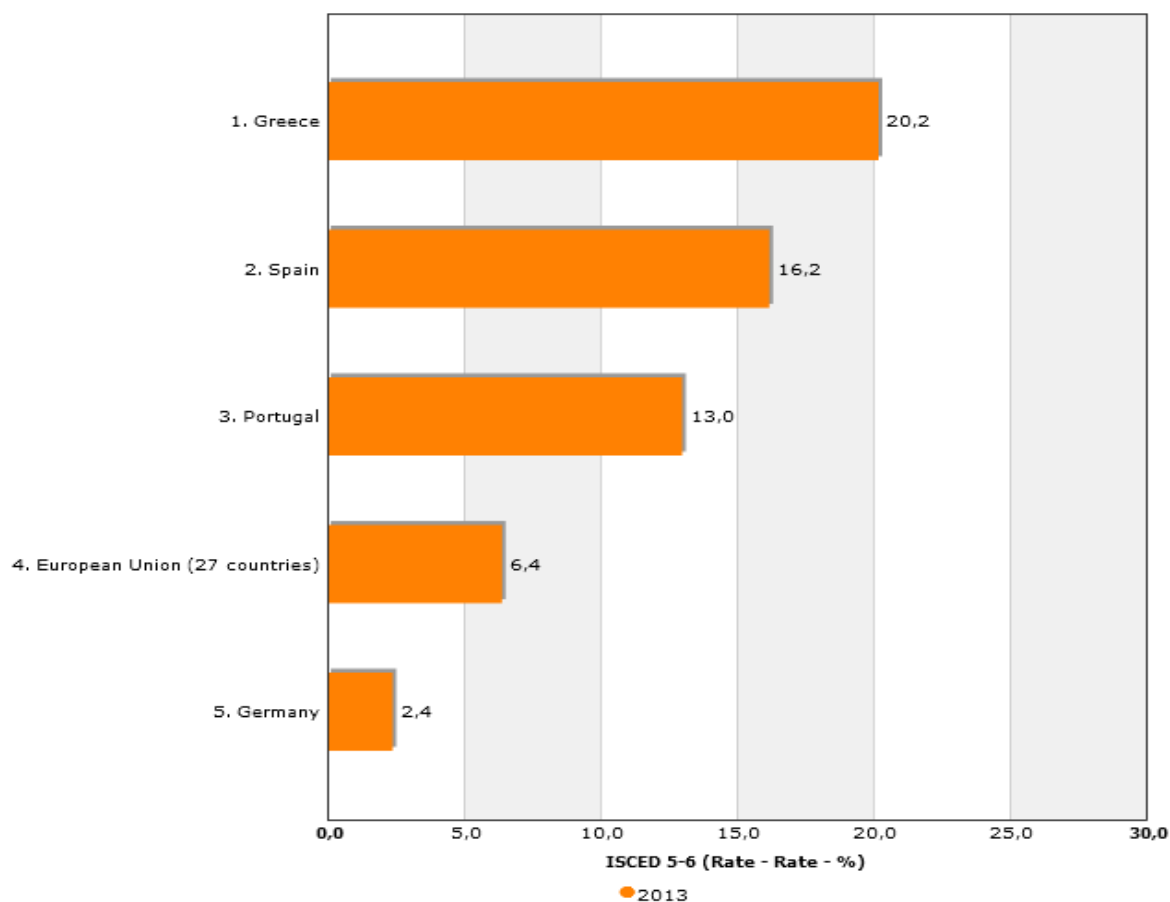
Figure 1: The Process of Knowledge and its Regulation



An analysis of this figure highlights a series of significant points. Regulation is essential to combat the emergence of imbalances and failures in the process of knowledge. The latter factors, which have aggravated effects on the economy and society as a whole, emerge mainly throughout the difficulties of insertion, unemployment and emigration of qualified human resources, such as been seen to a dramatic degree in the case of the Southern European countries, such as Portugal.

Graph 3: Unemployment Rate (15-74 year olds) of Graduates from Higher Education (ISCED 5-6 (a selection of EU Member States)

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Source: EUROSTAT & National information systems in PORDATA (<http://www.pordata.pt/en/Europe/Unemployment>), assessed on 10th April 2014.

As well as creating social trauma, unemployment and the *brain drain* of highly-qualified talent also mean an imbalance between social well-being and private interests, as well as the inefficiency and ill articulation of public policies, essentially in the areas of innovation and institutional research and development. This is verified in a report sponsored by the European Commission and by Schuman Associates:

The strategic analysis shows that Portugal's position in the ranking for innovation out of the EU-27 has significantly improved over the last decade. This improvement has not resulted however in the creation of added value, neither employment, as recent information clearly shows. The process of structural change needs, therefore, to be reinforced through the valorisation of the contribution of innovation and research and development. (Dröge et al, Coord. 2011, pg. 8).

The grave imbalances in the job market for highly skilled professionals have shown that the distortion of the structure of qualifications and professions in Portugal has worsened. As we have pointed out several times, in diverse sectors in Portugal there has been a significant trend for allocating well-qualified human resources to employment in professions that demand much lower qualifications; this has led to a general downgrading of the employment structure, with the lay-off of lower skilled, unemployment and emigration of the better-qualified (Author, 2008, 2011 op. cit.). This phenomenon which we have been referring to as the *chimney effect*, has obviously become more accentuated with the economic difficulties of the recent years.

An important consequence of the process described above occurs in enterprises and other organizations which downgrade recruited competences. Instead of fostering a climate of organisational learning and of the advancement of knowledge, the job mismatch has given rise to demotivation, bottlenecks in the production process and, as a result, persistently low levels of productivity. In such situations the full positive externalities of knowledge are difficult to arise: the multiplying and spillover effects tend to be limited, or non-existent, the dissemination and reproduction of knowledge is compromised and economic and social development tends to die out (Wolbers, 2003).

Thus it is essential to reinforce the implementation of policies and mechanisms that promote innovation. If it so understands, it is the Government that has the best possibility to intervene in this area: through incentives and tax-relief, by facilitating access to venture capital and seed capital and by developing and supporting technological infrastructures, amongst other measures which promote innovation and the development of knowledge in organisations. In addition, there is a need to understand and to put into practice proactive policies to stimulate employment and training that will improve job matches (Martin & Scott, 2000).

The private sector will have too an important role to play in the process of regulation, principally by establishing successful inter-institutional partnerships for the sharing, transfer and reproduction of knowledge, such as occurs with the many agreements negotiated with universities and research centres.

As it is easy to deduct, the crucial factor for the efficient functioning of the system and the process of knowledge is the strength and coherence of the strategy that supports it, and, just as importantly, the effective capacity of the various institutions and, especially, Government, when it comes to implementation. But when slow progress and ill articulation of the knowledge drivers become 'reinforced' by a severe public underinvestment, instead of adequate counter cyclical policies, the resulting backlash is normally huge.

The case of Portugal again

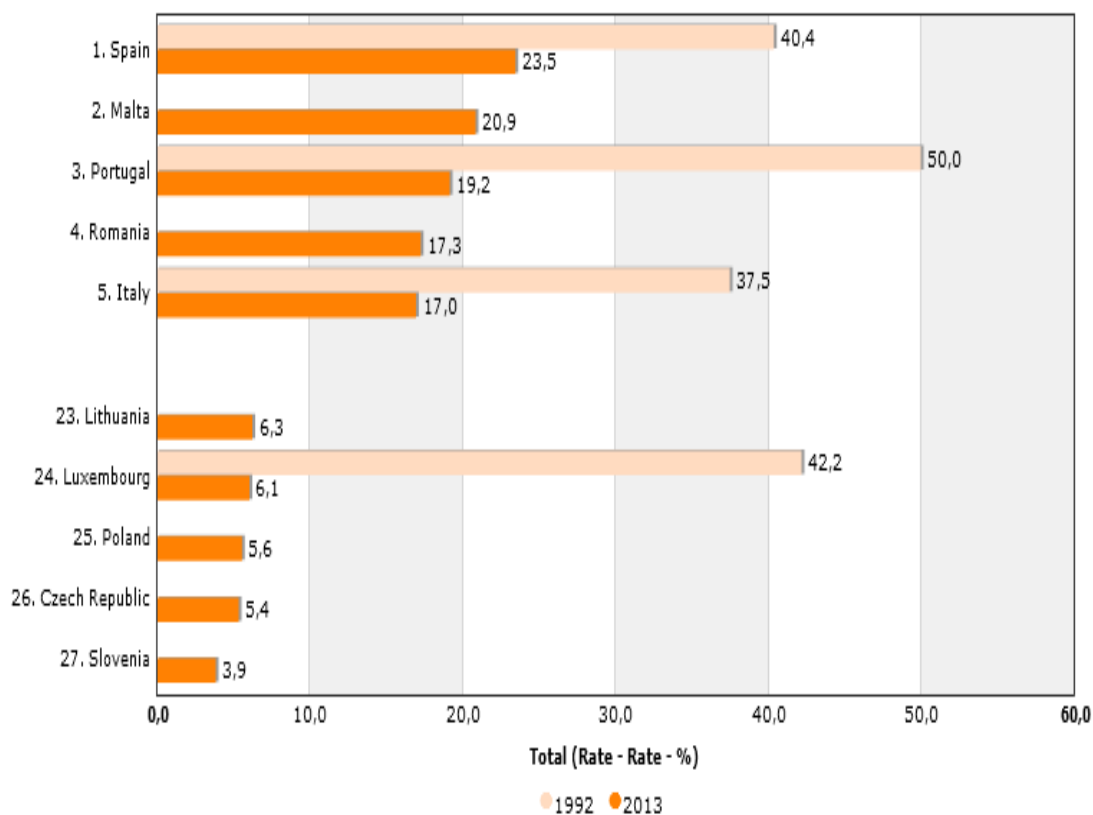
In general, since 2008-2009, public policies for education, R&D and innovation have contributed to worsening the recession effects in Portugal, instead of helping to combat it: early on this was reflected by a cut in Government spending in some of those areas when expressed as a percentage of GDP (which was insufficiently compensated by an increase in investment by the private sector). The underlying argument for this pro-cyclical behavior of public spending is well-known: the priority given to lowering the public deficit - as imposed by the Troika and also by the ideological trend of Portuguese Government - rigidly incorporated most of the public policies in the austerity matrix. It would have been difficult to have been otherwise, unless other options for the same policies had been adopted. But it becomes paradoxical that the options that would have helped the development of knowledge were formally agreed by the Portuguese government when it signed up to the European commitments of the Europe 2020 growth and jobs strategy (Marlier & Natali Eds., 2010).

It is worth remembering some of the proposed objectives that this strategy aimed to achieve:

- reduce early school leaving to a maximum level of 10%;
- guarantee that 40% of 30 to 34 year olds complete a university education;
- ensure that at least 3% of GDP will be invested in R&D.
- ...

With regards to the first of these objectives, despite the enormous progress that has taken place over the past decades, Portugal is still a long way off, with a current level that is almost twice the value of the objective:

Graph 4: Evolution of the rate of early school and training leaving between 1992 and 2013 (EU some selected countries)



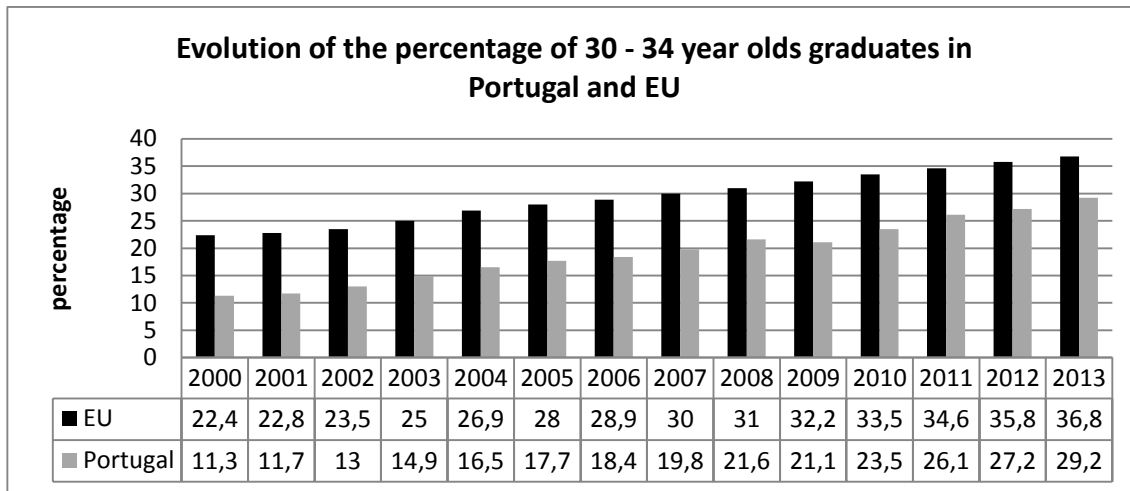
Source: Adapted from EUROSTAT & National information systems in PORDATA (<http://www.pordata.pt/en/Europe/Unemployment>), assessed on 12th April 2014.

For sure, Spain and Malta are in a relatively even worse situation than Portugal in terms of this indicator. Portugal still has six years left to evolve in the right direction, although, obviously, this depends on the implementation of the right measures in terms of educational policies. What has come to pass is that Government has been decreasing investment in this area in a significant form. It has drastically reduced the financing of social support for students as well as grants for all levels of education. At the peak of the crisis, and on account of the drastic reduction in families' disposable income as a result of unemployment and austerity measures, this is making it ever more difficult for many families and students to support the direct costs of education and training. In the case of public higher education, the average value of tuition fees that Portuguese students have to pay is at the high end of the median values for EC members (European Commission, 2012). The combined effect of these factors in Portugal has not only dramatically reduced the quantity of applications for higher education, but has also led to a high percentage of drop-outs and abandonment of studies.

The percentage of 30 to 34 year old graduates in Portugal is still way below the 40% objective set by Europe 2020 growth and jobs strategy. This is partly a result of the factors described above, and also on account of the lack of motivation to study, as the return in terms of finding a

job is ever diminishing and also because many cannot afford to give up salaried work to devote their time to study. The following graph shows that, even though there has been significant improvement in this indicator, Portugal's position is still far away from the European average:

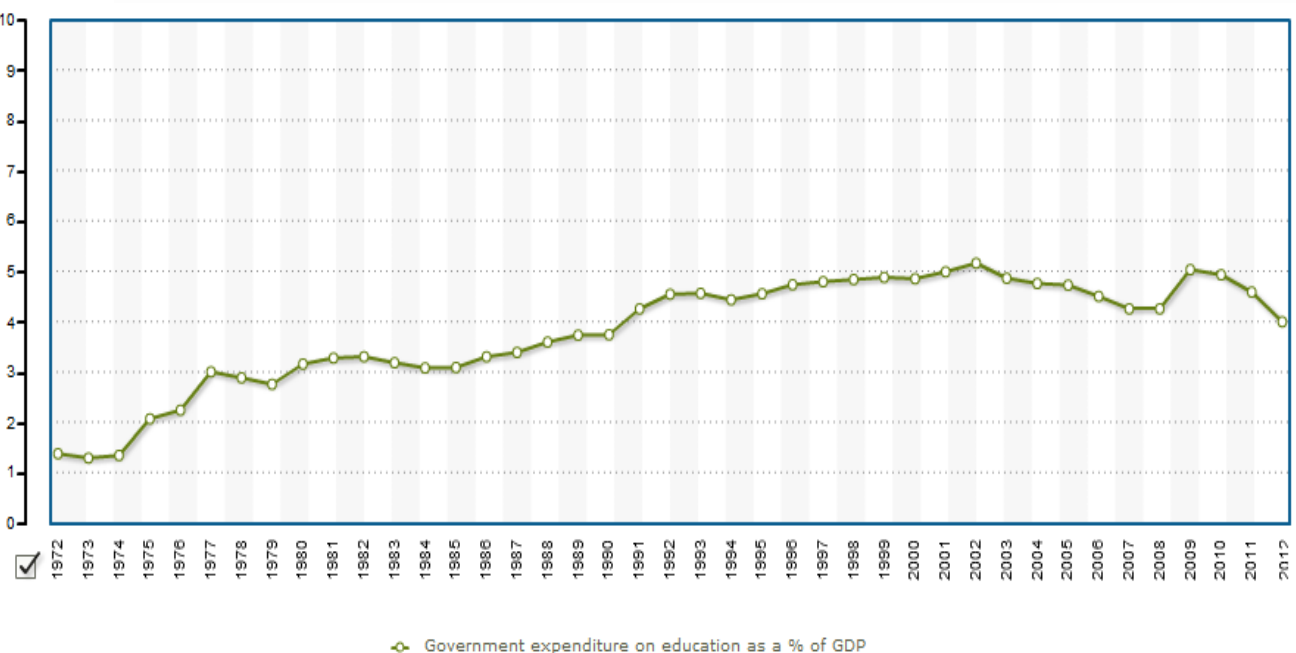
Graph 5: Evolution of the percentage of 30 to 34 year olds graduates



Source: EC, EUROSTAT DATABASE (2014). Retrieved on April 11, 2014, from <http://epp.eurostat.ec.europa.eu/portal/page/portal/education/data/database>.

Frequent references are made to the fact that problems are not solved by simply throwing money at them and the same applies to educational policies. However, as the gaps that need to be filled to attain the declared objectives are so substantial, and, above all, because Portugal still has so much to do to build an inclusive and sustainable knowledge base, it would have been hoped that public investment in education would have been sustained, rather than be considerably reduced, as we have seen over the last years:

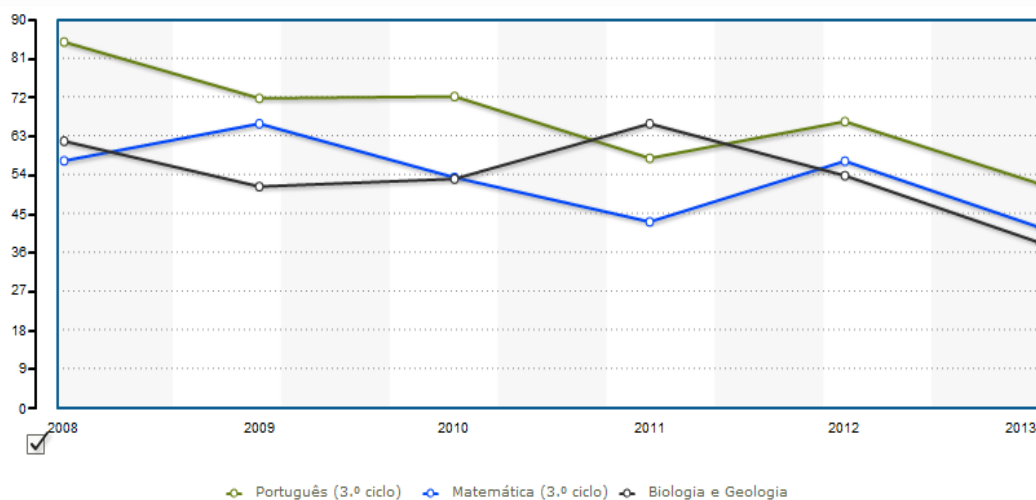
Graph 6: Evolution of Government spending on Education: executed investment as a percentage of GDP



Source: EUROSTAT & National information systems in PORDATA <http://www.pordata.pt/en/Europe/Education>. Accessed on March 29, 2014.

In the section above on the theoretical input, we referred to the fact that educational policies normally take time to bring about visible results. We also highlighted the observation that a multitude of factors generally combine to bring about these same results. In Portugal, there has been a tendency for some of the most critical aspects regarding education to deteriorate over the last years, such as the approval rate in three particularly important science subjects – Portuguese, Mathematics of Lower Secondary (3rd. cycle) and Biology and Geology:

Graph 7: Percentage of Portuguese students with positive marks in final examinations Mathematics (3rd cycle), Portuguese (3rd cycle) and Biology and Geology



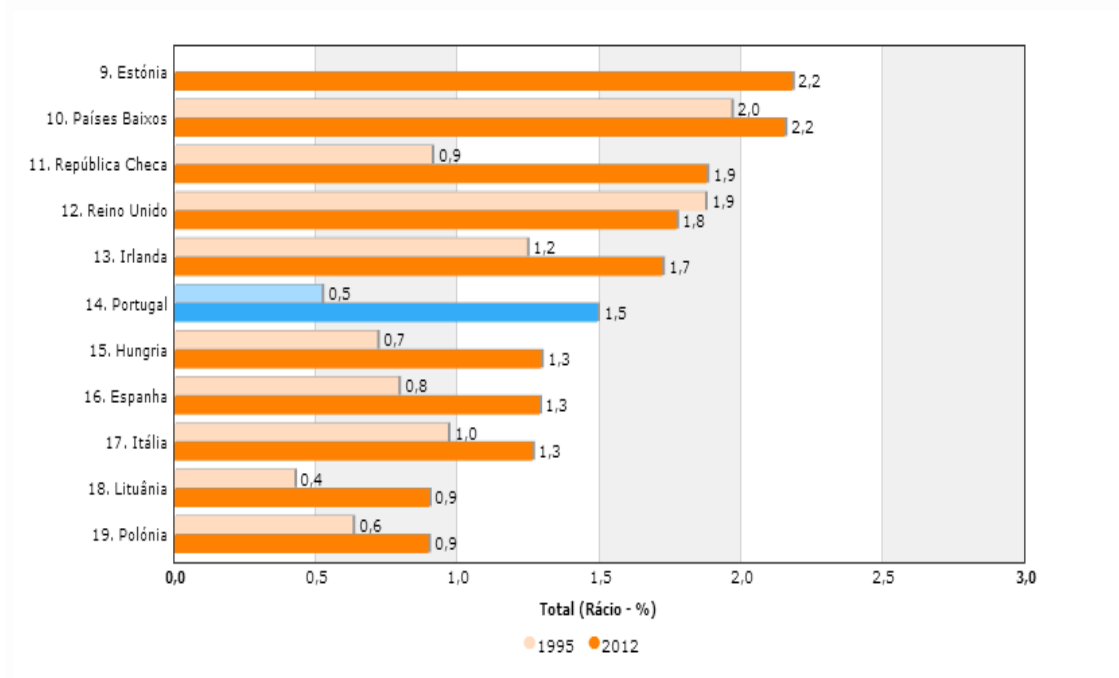
Source: PORDATA (<http://www.pordata.pt/Portugal>), accessed on the 12th of April, 2014

Similarly, the data from PISA 2012 also shows us that there has been a reduction of 4 percentage points in the literacy index (Reading Proficiency score) for Portuguese students in the 3rd cycle (Lower Secondary), when compared to the corresponding value for 2009 (Organization for Economic Co-operation and Development, 2013).

Returning to the previous argument, it cannot be proven that these worse results are a direct or even exclusive consequence of the lack of public investment in education over the last years. What is intended to be stressed is that these results should constitute a main reason for public policies to intervene in a stronger form to combat the effects of the recession, when it is precisely the opposite that is taking place.

Regarding public investment in R&D, there has been a significant recuperation in values over the period between 1995 and 2012, as is shown in Graph 7. However, the value shown in this graph for 2012 is exactly half the value of the objective of the Europe 2020 growth and jobs strategy:

Graph 8: Public spending in R&D as a percentage of GDP – evolution between 1995 and 2012



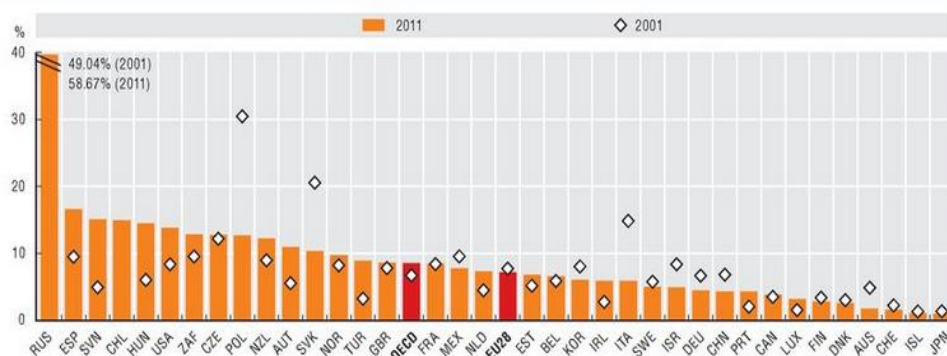
Sources: EUROSTAT & National information systems in PORDATA.

(<http://www.pordata.pt/Portugal/Despesas+do+Estado+em+educacao+execucao+orcamental+em+percentagem+do+PIB-867>), accessed on the 11th April, 2014.

The inadequacy and insufficiency of the most recent policies for R&D can be understood better if we consider the additional facts that the number of public grants for PhD doctorates has been reduced by more than 40% between 2007 and 2012, and that over the same period, unemployment and job instability for MSc. and PhD graduates has continually increased.

The inefficient and maladjusted policies of innovation are demonstrated, amongst other signs, by the *brain-drain* and a high level of unemployment among MSc. and PhD graduates, as well as amongst other highly qualified professionals. With regard to incentives to companies to invest in R&D, the role of the Portuguese Government has been very weak, and indeed, has virtually not increased over the period from 2001 to 2011:

Graph 9: Direct public financing of R&D in companies (as a percentage of all R&D in the business sector)



Source: OECD 2013 (b), (http://stats.oecd.org/Index.aspx?DataSetCode=MSTI_PUB)

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The picture that we have been describing of the state of the present situation regarding the building and development of knowledge in Portugal is incomplete, and could potentially be subject to criticism. Not only do the indicators only reflect a part of the reality of the situation, but the information and methodology upon which they are built have also derived from the formulation of hypotheses that are sometimes highly debatable and highly discussed. As mentioned by Pierre Garrouste, a large part of the indicators on the building and development of knowledge “many times only shows us the tip of the iceberg” (Garrouste, 2001, p. 11), and there are also significant problems regarding measuring, which are difficult to overcome. Some of these problems and difficulties are discussed, as an example, by Holbrook & Godin, who focus especially on the difficulties in measuring the absorptive capacity of innovation (Holbrook & Godin, 2011).

Nevertheless the indicators opted for are those that are most frequently used for the analysis of the progress and regression of the process of the creation and development of knowledge. Moreover, these indicators enable us to clearly evidence our research hypothesis: that there has been significant regression regarding the building and development of knowledge in Portugal, as a result of the discontinued and pro-cyclical public policies for education, research and development (R&D) and innovation.

Conclusions

Although the economy plays an important part in explaining the delay in the development of knowledge in Portugal, we have shown that institutional factors also have a significant influence, behaving frequently under antagonistic and paradoxical forms.

This is evidenced by the latent opposition between the objectives of the Europe 2020 growth and jobs strategy and the impositions of the Troika. In the first case, for as long as it remains a

Member State of the European Union (EU), Portugal has signed up to those objectives and it seemed, for a short time, that it was on the path to achieving them. However, with the onset of the economic and social recession, as from 2007/2008, Portugal became embroiled in serious difficulties, risking bankruptcy and had to ask for a bail out from the EU. The European institutions did not intervene alone in providing aid in the case of Portugal, as was also the case with Greece and Ireland, and the opinion of many is that the EU does not have the structure, resources or experience to act alone. The support intervention was thus provided by three entities. As well as the European Commission and the Central European Bank, the International Monetary Fund (IMF) also had to be involved. Although the European component was important in the formulation of the Troika's policies and dictates, these fundamentally followed the path of austerity which is IMF trademark, and has already been applied in other interventions, such as, for example, in Argentina, which gave rise, once again, to the exaggerations and mistakes of extreme austerity, among them to the increased social injustice.

This led to interest payments for the servicing of the debt becoming greater than public spending on education, health and social security in 2012/2013. At the same time, as the Portuguese Government did not request for any kind of rescheduling of the commitments of the Europe 2020 growth and jobs strategy, these commitments have been held hostage to the austerity measures that were imposed in the name of deficit reduction.

This re-alignment of Portuguese public policy would not have had such drastic consequences if this had not affected factors that have an important accumulative effect over time and spillover and multiplier effects in many economic and social areas. Discontinuity and regression in spending on education, R&D and innovation, leads to the risk of irreversible breakdown in the growth and modernization of knowledge. It is in such times of acute recession that private initiative is confronted by additional difficulties: families and students experience difficulties in paying for higher education and advanced studies, on account of disposable income being drastically cut by unemployment and reductions in social security benefits. Businesses, which experience several reductions in sales and accumulated losses, tend to limit, or even cancel altogether, investment in R&D; they also tend to put on hold partnerships that may have been planned with other institutions which integrate the process of knowledge, such as universities and research centers. Researchers and scientists, working in both the private sector and at public, or semi-private institutions, are increasingly confronted with unemployment and a lack of job security. The negative effect of these difficulties and behavior are accentuated if Government, in its role as regulator, acts contrary to the way it should do in such circumstances, by reducing investment in education, R&D and innovation. By carrying out these pro-cyclical interventions in key areas for the development of knowledge, Portugal has become significantly worse in terms of the indicators for: public spending on education (as a percentage of GDP), where we are now experiencing levels last seen at the beginning of the 1990s; the rate of early school leaving, where we are now in the second-to-last position in the European Union; the number of grants for PhD doctorates at public universities which has dropped to levels the same as those of 2004; public spending in R&D, which has dropped back to pre-recession levels ...

As the country didn't arrive to implement any coherent and sustainable strategy for knowledge enhancement, we are thus divided between signed-up commitments and imposed restrictions, which typifies the antagonisms and contradictions of the very process of constructing Europe.

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