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DOCTORAL THESIS

CONTRIBUTIONS TO THE SUPPORT OF ENGINEERING EDUCATION THROUGH THE DEVELOPMENT OF SCHOOL GOVERNANCE

- ABSTRACT -

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KEY WORDS

Recruitment for engineering studies; recruitment for mathematics, sciences and technologies (MST) studies; decentralization of education; intention and reality in education decentralization; governance; school governance; school autonomy; school accountability; educational management; educational leadership; PIRLS results; TIMSS results; learning outcomes; factors that influence learning outcomes.

FOREWORD

*Motto: „I don't think about the future... it comes soon enough”
Albert Einstein*

Argumentation

In the author's opinion, to paraphrase Albert Einstein, 2014 Romania cannot afford **not to think about the future** precisely because **the future comes soon enough**. It is high time we understood, truly and profoundly, that time “has lost its patience”¹ with us, and that our future depends on the education we offer to our children. In a world in which globalization is a reality we cannot ignore, Romania's **economic competitiveness** depends crucially on education. A significant role in Europe and on a global scale, as well as the socio-economic growth are unthinkable without a **well-educated and highly trained human capital**, and this is an axiomatic statement.

After a 28-year career in secondary education, 4 of which working as a deputy principal and 11 as principal of the “Gheorghe Lazăr” National College of Sibiu, holding the office of advisor to the Minister of Education in two distinct periods (2002-2003 and 2009), with numerous participations in national and European projects, the author can say that he has acquired not only in-depth experience and a complex image of the Romanian educational system, but advanced knowledge about other educational systems across Europe as well.

For the past 12 years, due to the activity in the Ministry and then as a high school principal, being at the same time aware of the changes undergone by other European educational systems, the **decentralization of education** has become one of the author's long-lasting concerns. Increasing school autonomy and accountability, and the transition, at least on a theoretical level, from administration to management towards educational leadership – are direct effects of decentralization of education, and **have the potential to influence students' learning achievement**. This is **the first argument** for the present research.

The preoccupation for decentralization of education and its possible effects has overlapped with another interest of the author, declared and sustained over his entire career as physics teacher and as principal of the “Gheorghe Lazăr” National College from Sibiu. Over the 1991-2000 decade, for a high school strongly oriented towards, and having a significant tradition

¹After Marin Preda, *Moromeții*. Here we evoke the idea that it is high time everyone involved in Romanian education left the “sacred and patient time” and instead accepted and understood that we live in the “profane, historical time [...] that is irreversible, ruthless and impatient”.

in the field of natural sciences, the proportion of graduates continuing their studies in mathematics, sciences and technology, engineering included, was very low in the “Gheorghe Lazăr” National College. This was not a peculiar situation, the same being true for many other theoretical high schools with a natural sciences specialization in Romania. Around the year 2000, even the European Commission noticed that students’ recruitment in the fields of mathematics, sciences and technology is worryingly low, and could influence the global competitiveness of the European economy in the long term. It is obvious that the development of the economy, especially of an economy where knowledge is an essential growth factor, is not possible without specialists in natural sciences, without highly qualified engineers. Supporting engineering education is thus a **justified priority for secondary education**, especially for theoretical high schools with natural sciences specialization. This is **the second argument** that determined the author’s choice regarding the doctoral research.

Higher education in Romania, especially in the engineering field, is faced with at least **two** important **threats**, about to become manifest and turn into **long-term challenges**. Since 2009, after a period of significant growth, students’ recruitment rate in Romania started falling, and the demographic evolutions predicted for the next decades justify the hypothesis that this negative trend would continue. This is the first threat/challenge engineering faculties and Romanian universities in general need to address efficiently: the **“quantity threat/challenge”**. The results of the Romanian students in the 2011 PIRLS and TIMSS international studies demonstrate a worrying fact, frequently noticed over the past years by scholars, decision-makers, the public, and the media: the overall performance of the Romanian secondary education is low and is likely to become even lower. What we can see from the results of international studies is that the learning achievement of our students in mathematics and sciences can be labeled as **modest** at best. This is the second threat/challenge engineering faculties and Romanian universities in general must cope with: the **“quality threat/challenge”**.

Demonstrating the existence of this complex situation that engineering faculties are facing, and **identifying possible ways of support from secondary education**, with a focus on **educational management/leadership** in a **decentralized system**, have ultimately become the main purpose of the doctoral research presented in this thesis.

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Liability

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All data presented in this thesis has been collected by the author from public national and/or international databases, mentioned as such in the text, or has been the direct result of the author's investigations. The processing and interpretation of this data belong entirely to the author and do not represent the point of view of any national or international institution or organization, and no national or international institution or organization can be held responsible for this processing and/or interpretation.

RESEARCH OBJECTIVES

The research contained in this doctoral thesis rests on two general questions regarding **higher education in the field of engineering**, and the **upper secondary education** in Romania. These two questions are the result of both the constant preoccupation of the Engineering Faculty within the “Lucian Blaga” University of Sibiu concerning the effectiveness, efficiency, quality and relevance of engineering education, as well as from the extension and strengthening of the relationship between higher and upper secondary education. The two general questions could be formulated as follows:

- A. Which are the most important current threats (challenges) that might affect higher education in the field of engineering in Romania in the long term?**
- B. How can upper secondary education in Romania support higher education in the field of engineering?**

It is obvious that these two „simple” and entirely justified questions have a very large scope and can give rise to a great number of secondary questions, opening just as many possibilities of scientific investigation. The initial qualitative analysis, based on scientific documentation and on the experience and expertise of the scientific coordinator and of the author, have led to the establishment of **priorities** in the attempt to find substantiated answers to these general questions. These priorities are the result of considering common areas of interest for higher and upper secondary education, with special emphasis on educational management, and have led to the **general objectives** of the research:

- A. Analyzing the current situation and evaluating the trends in the manifestation of **threats (challenges)** regarding **student recruitment** for higher education in the field of engineering in Romania, with concrete reference to the **number of students** and to the potential candidates’ **basic training in mathematics and natural sciences**.**
- B. Analyzing the current situation and evaluating the trends regarding **school governance**, considering its fundamental dimensions: **autonomy**, **accountability** and **participation**, as well as the pivotal role of **management/educational leadership**, as an alternative approach in administrating, running and controlling high schools, and in order to support **higher education in the field of engineering**.**

In order to meet the general research objectives **three** different **perspectives** have been used and **five** distinctive **scientific investigations** carried out. The perspectives used (numbered

I, II and III), the labeling of the investigations, the classification within the general objectives, and the objectives established for each investigation respectively, are as follows:

I. General objective A: Investigating the evolution in student recruitment in the fields of mathematics, sciences and technology (MST)

O.I.A.1 Analysis of the 2001-2010/2012 evolution regarding the number of MST students and graduates, including the evolutions regarding gender difference.

O.I.A.2 Evaluation of the influence of engineering education in the evolution of the number of MST students and graduates over 2001-2010/2012.

O.I.A.3 Identifying factors on a national level that may explain the recorded evolutions regarding the number of MST students and graduates.

II. Investigating Romanian students' results in the 2011 PIRLS and TIMSS studies
General objective A: Romanian students' results in the 2011 PIRLS and TIMSS studies

O.II.A.1 Specification of Romanian students' results and comparison with results obtained by students in other countries in reading, mathematics and sciences.

O.II.A.2 Evaluation of tendencies regarding Romanian students' results in reading, mathematics and sciences.

O.II.A.3 Analysis of Romanian students' results in reading, mathematics and sciences as compared with the PIRLS/TIMSS international benchmarks.

General objective B: Factors which may influence learning achievement

O.II.B.1 Analysis of possible influences of some economic factors on learning achievement, including family.

O.II.B.2 Analysis of possible influences of school and teachers' characteristics on learning achievement.

O.II.B.3 Analysis of possible influences of student attitude and motivation on learning achievement.

III. Investigating the decentralization of education in Romania: the intention level and the real level

General objective B: Decentralization of education in Romania – the intention level

O.III.B.1 Evaluation of the intention level regarding the decentralization of education in Romania based on policies in the educational field.

O.III.B.2. Evaluation of the intention level regarding the decentralization of education in Romania on the basis of legislation.

General objective B: Decentralization of education in Romania – the real level

O.III.B.3 Evaluation of the real level of school autonomy.

O.III.B.4 Identifying some key problems that school principals are confronted with in terms of school financing.

O.III.B.5 Evaluation of the level of teachers' and principals' accountability for student results.

O.III.B.6 Identification of educational management priorities.

O.III.B.7 Evaluation of the impact of school governance on student orientation toward higher education in the field of engineering.

OVERVIEW

Higher education, especially in the field of engineering, is faced with some **manifest, concrete threats**, which have already become or are about to become **major challenges** in the very near future. In this thesis we identify, define and analyze two of these threats/challenges, both targeting a process which is fundamental for universities, with major implications over operating and performance: **student recruitment**.

The first of these threats/challenges concerns **quantity**: student recruitment has had a marked positive evolution in the 2001-2009 period, and has started declining between 2010-2012, with similar prospects in future years. Legislation changes, evolutions in economy and on the labor market, economic crisis included, along with the demographic depression explain to a large extent the evolution of recruitment rates. **Universities are alone in facing the “quantity threat/challenge” in student recruitment**. Increasing the attractiveness of the specializations offered, through flexibility and good long-term relevance, meeting quality standards to ensure wider access, including open and distance learning, broadening the partnerships with private sector and secondary education, applying consistently life-long learning principles, and expanding the offer towards age groups beyond the traditional ones, etc. – are all measures within the reach of the decision-makers in universities and faculties. They are, to an almost equal extent, measures that support **good governance in higher education**.

The second threat/challenge concerns the **quality** of the potential future students: it is to be expected that in the very near future, but in the long term too, technical universities would have to cope with students with poor/mediocre **learning achievement** in the fields of **mathematics** and **sciences**. Considering a relatively constant added value over one university cycle (at least in the current higher education curricular and teaching approach), a **poorer** initial level means a **lower** final level – that is, a potential crisis (with good chances of acceleration) of industry **professionals**. Irrefutable proof of the “**quality threat/challenge**” in student recruitment is to be found in **Romanian students’ results** in the PIRLS and TIMSS studies, especially in the 2011 cycles of these studies. The potential future students did not manage to demonstrate acceptable learning achievement in **basic fields**, fundamental and absolutely necessary for their **success** in higher education in general, and in engineering in particular.

Our **fourth grade** students of **2011** (university recruitment +**2020**) demonstrated in both PIRLS and TIMSS **poor/mediocre** competences concerning their ability to understand a written text, or to think logically and solve problems using basic knowledge in mathematics or sciences.

Our **eighth grade** students of **2011** (university recruitment **+2015!**) have demonstrated **poor/very poor** competences in the fields of mathematics, physics, chemistry, biology and geography. The threat/challenge of quality is thus clear: in the following years it is very likely that students come with an increasingly lower level in the basic fields of mathematics and sciences. **In this respect, however, universities are, or at least they should not be facing this threat alone.** It is true, there are methods, already experimented with good results, that have to do exclusively with the **approach of learning in higher education**: one complementary year/semester for increasing the initial level, a flexible curriculum, with varied approaches and teaching methods, etc. All these (and probably others too) are **possibilities** of addressing this threat/challenge, and are, again, entirely up to the decision-makers in universities. On the other hand, what **secondary (i.e., PRE-university)** education should **certainly** undertake, with a good chance of reducing this threat is to ensure engineering higher education candidates with **solid basic training** in mathematics and sciences. *Is secondary education, in its turn, up to this challenge?* We believe and we shall attempt to demonstrate that the answer is an **affirmative** one, and that one of the fields where one may find solid arguments for this is that of **school governance/good school governance.**

Besides the demand from higher education, about to reach “critical mass”: *we want students and we want students with good basic training*, secondary education must currently cope with significant changes, in two interrelated dimensions: **institutional** and **managerial**. Their source is the **decentralization of education**. The transfer of decision-making **authority** towards the school and the local community, (theoretically and one might say, normally) accompanied by the transfer of **accountability** and **resources**, has effects on the entire development, organization and operating of schools. At an institutional level, decentralization means **increasing school autonomy**. At a managerial level it means the conceptual and effective (concrete, practical) transition from **administration** to **educational management** towards **educational leadership**. On the common ground of these two dimensions, decentralization of education means **increasing accountability for students/schools performances (school accountability)**, while **affirming and/or increasing participation** on every level of the classical pyramidal hierarchical structure of the system.

In our opinion, **the triad *autonomy-accountability-participation*, having *educational management/leadership* as its main „engine”, source of energy and progress, is what essentially defines *school governance/good school governance*.**

If we discuss **school governance** as a **viable alternative** to the current approach we must ask ourselves: *Is there any, and if so, which is the degree of school autonomy and accountability? Are there any clear priorities in educational management and leadership, supported by all the actors and mainly oriented towards improving students' performances?* The answers should be looked for on two levels: **intention** and **reality**.

We have been looking for intention behind **educational policies** and in **legal provisions**, and for reality in **schools**. We have analyzed the **level of intention** using our own instrument, and we have evaluated the **real level** by surveying a representative sample of high school principals in Romania. Based on this, we have concluded that there is very good intention in educational policies and good intention in legislation as to the support of school governance as a viable alternative to the hierarchic-formal and bureaucratic approach in administrating, managing and controlling the schools. By surveying high school principals, we have concluded that there is an acceptable level of implementation in terms of autonomy, accountability and participation, as well as adequate capacity in the educational management/leadership dimension. We have added to this the analysis of the factors which can influence learning results, as reflected in the PIRLS and TIMSS international studies, with emphasis on the 2011 cycles of these studies.

The results of the investigations that we have carried out, supported by more recent similar research, make us affirm that not only **can school governance support higher education, especially the field of engineering**, through candidates with **good basic training**, but what is more, to paraphrase a famous quote, **good school governance is, most likely, the most important factor in increasing effectiveness, efficiency, quality and relevance of secondary education in Romania**.

Part I: Current stage of research on decentralization of education, educational management and school governance

1. Structure

The first part of the thesis is dedicated to revising the most important recent results in fields of interest for the objectives of the research, and is structured in four chapters:

- Chapter 1. Decentralization of education (5 sections);
- Chapter 2. The school between educational management and leadership (3 sections);
- Chapter 3. The concept of governance. School governance (3 sections);
- Chapter 4. Production functions used in research in education (4 sections).

The author has deemed necessary to allow for an extended length of this part (68 pages, 24% of the total number of content pages) and for a presentation with a detailed structure for two reasons. Firstly, the research objectives require for a complex approach, including the decentralization of education, educational management, school governance and evaluation methods for the factors that can influence learning results. Secondly, the last 10-15-year period, largely due to the process of decentralization, has registered a great number of research studies in the fields of interest, with different approaches and significant results.

2. Content elements

In the first chapter the author discusses the decentralization of education, specifying the current understanding of the concept, ways and levels of exercising decision-making authority, reasons/rationales for decentralizing education and the fields affected by this process. The chapter ends with a revision of the evolutions in the decentralization of education in the European area. The second chapter is dedicated to the conceptual and practical transition in the running of schools, determined by the decentralization of education: from administration to educational management towards educational leadership. The author has presented theoretical arguments and briefly described 8 models of educational leadership. The third chapter starts from a revision of the key concept of governance, continues with a selective presentation of the principle of governance/good governance, and ends with a detailed analysis of the concept of school governance, including definitions, models and aspects regarding good school governance. Finally, the last chapter starts by discussing basic theoretical concepts of production functions and ends by presenting four empirical models based on educational production functions, models which emphasize possible relationships between learning results and conditions in which learning can take place, including school autonomy and accountability.

3. Perspectives

The decentralization of education, with specific reference to secondary education, represents one of the most important phenomena that has affected educational policies in the last 20 years all over the world, including all European countries and Romania, too. In the large majority of cases, the decentralization of education is part of a general effort of enhancing democracy, of citizens' direct participation in the decisions that affect their lives most. The result is accomplished through a transfer of authority, accountability and resources from central to local administrations, school level included. In terms of key objectives, the decentralization of education aims, in varying degrees of intensity in time and space, for increasing quality while also increasing effectiveness, efficiency and relevance of education.

At school level, institutionally, decentralization means increasing school autonomy. At the level of school management it means a conceptual and effective (concrete, practical) transition from administration to educational management towards educational leadership. Where the two dimensions meet, decentralization of education means increased accountability for student/school performance (school accountability), together with asserting and/or increasing participation in all levels of the system's classical hierarchical pyramid.

Embracing these new conditions opens and supports a new perspective in the approach of the development, organization and operation of schools: school governance. School governance can be regarded as an alternative to the traditional approach, as a possible and viable model for the governance of organizations delivering education, offering the necessary conditions for addressing the „principal-agent” problem caused by increased school autonomy. In the author's opinion, supported by recent approaches, the *autonomy-accountability-participation* triad, having educational leadership as its main „engine”, source of energy and progress, is what essentially defines school governance/good school governance.

The effects produced by decentralization upon students' performances can be evaluated using educational production functions built on the basis of international studies (PISA, PIRLS, TIMSS). The results of the empirical models of the last 10 years indicate the fact that school autonomy can have a beneficial effect on learning results, if two conditions are simultaneously met. Firstly, there must be a significant level of accountability on the part of the teachers, principals and schools in general towards students' results (school accountability). Secondly, and relatively linked to the previous condition, there needs to be a good socio-economic level of development for school autonomy to produce the expected results.

Part II: Investigating the evolutions in student recruitment in the fields of mathematics, sciences and technology (MST)

1. Structure

The second part of the thesis opens the first perspective of research and is dedicated to the first scientific investigation, pursuing the achievement of O.I.A.1, O.I.A.2 and O.I.A.3 objectives. This part has a single chapter (11 pages, 4% of the total number of content pages):

- Chapter 5. Recent developments in MST students' recruitment (4 sections).

2. Content elements

In the context of the Lisbon strategy, there was a common objective set for the education and training systems of the EU for 2010 that is of particular interest for engineering studies: *“Increase of at least 15% in the number of tertiary graduates in Mathematics, Science and Technology (MST), with a simultaneous decrease in the gender imbalance”*. According to the European Commission progress-reports, Romania was one of the best performing European countries in achieving this objective, exceeding by far the benchmark.

Chapter 5 starts from this acknowledgement to analyze, first of all, the number of students and graduates in the fields of mathematics, sciences and technology (MST), with emphasis on engineering, between 2001-2010 and onwards up to 2012. To explain the recorded developments and to evaluate future tendencies, four national-level factors have been analyzed from a qualitative point of view: demographic evolution; specific legislation; economy and labor market; upper secondary education curriculum.

3. Results

Between 2001-2009 the number of students in Romania witnessed a very important growth in all higher education fields (see Figure 1). In the fields of mathematics, sciences and technology, engineering included, the increase has also been a marked one, exceeding average annual growth rates in the European Union.

However, starting 2009, at least until 2012, a decrease in the number of students occurred. The negative tendency was less marked in the fields of mathematics, sciences and technology, with the most important support from engineering (see Figure 2; Eurostat codification: EF4 – sciences, mathematics and computer science; EF5 – engineering, manufacturing and construction; EF4+EF5 – total MST students)

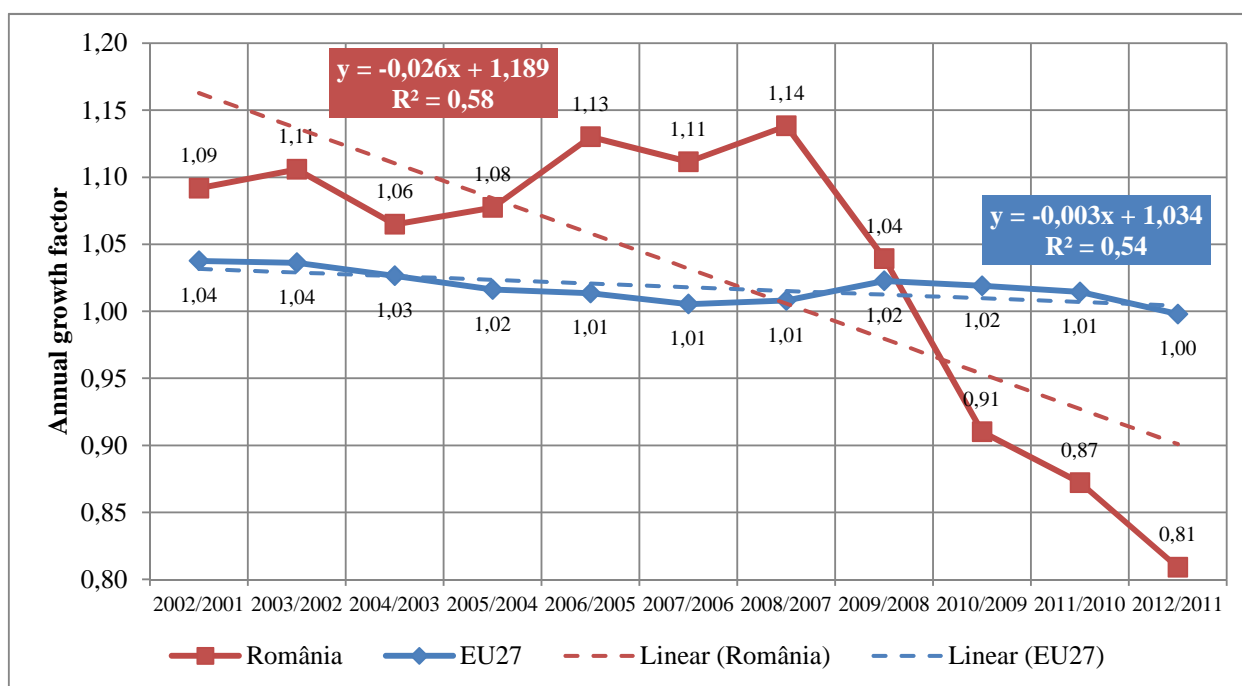


Figure 1 – Annual growth factor for the total number of students (data source: EUROSTAT)

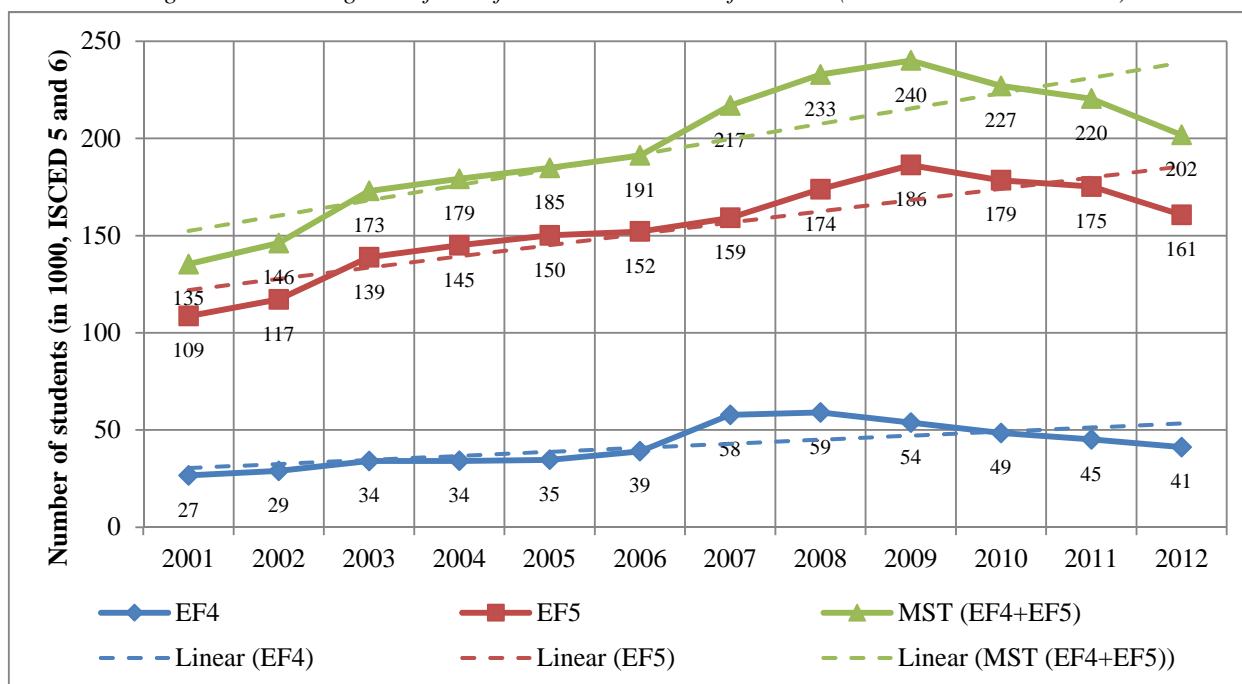


Figure 2 – Number of MST students in Romania (data source: EUROSTAT)

In the analyzed period, the specific legislation evolved from largely permissive to relatively restrictive as regards: the recruitment of fee-paying students in public universities, long-distance learning, and private higher education. The economy and the labor market had positive evolutions until 2008, followed by the decrease caused by the economic crisis. These findings partly explain the positive trend between 2001-2009, and the negative one between 2009-2012, respectively. The negative demographic evolution (decline of the total population and accelerated ageing) estimated for the following decades support the idea that the negative trend recorded since 2009 would continue.

Part III: Investigating the results of Romanian students in the 2011 PIRLS and TIMSS studies

1. Structure

The third part of the thesis opens the second perspective of the research and encompasses two scientific investigations, both focused on the results of the Romanian students in the PIRLS and TIMSS international studies, with emphasis on the 2011 cycle. The two investigations pursue the O.II.A.1, O.II.A.2 and O.II.A.3 objectives, O.II.B.1, O.II.B.2 and O.II.B.3, respectively. Because of the two sets of objectives, this part is accordingly structured in two distinct chapters (68 pages, 24% of the total number of content pages):

- Chapter 6. The results of Romanian students in the 2011 PIRLS and TIMSS (8 sections);
- Chapter 7. Factors that may influence learning outcomes (6 sections).

2. Content elements

PIRLS and TIMSS are studies with very broad international participation and geographical coverage. Over 50 states from all continents have participated in the five TIMSS cycles and three PIRLS cycles organized so far. Romania has taken part in all three PIRLS cycles (2001, 2006, 2011), only in the 2011 TIMSS cycle for fourth grade and in all the five TIMSS cycles for eighth grade (1995, 1999, 2003, 2007, 2011).

The fact that the results are representative for the entire school population in a certain year, the standardized character of the tests, the reference levels which are constant from one cycle to the next – are all essential elements which allow for an estimate of learning achievement in the tested subjects and to establish the tendencies in their evolution. Based on this, in Chapter 6 are

PIRLS and TIMSS are two international studies initiated and carried out periodically by the *International Association for the Evaluation of Educational Achievement* (IEA):

- PIRLS – *Progress in International Reading Literacy Study* measures trends in reading comprehension at the fourth grade;
- TIMSS – *Trends in International Mathematics and Science Study* measures trends in mathematics and science achievement at the fourth and eighth grades.

For both studies, students' assessment is based on standardized written tests. The evaluation result is expressed by estimating the most plausible score on a measurement scale with minimum value 0 and maximum value 1000. Comparing student achievement and estimating trends are possible based on the reference levels of the scales, that are kept constant from one cycle to another:

- The scale center point (500) and
- The international benchmarks: advanced (625), high (550), intermediate (475), and low (400).

In both studies, rich context information is gathered using questionnaires applied to the students (and their parents for the fourth grade), the teachers teaching the students involved, and the principals of the schools where these students learn.

In both PIRLS and TIMSS are used rigorous sampling methods. The results are representative for the entire school population of the corresponding grade in the year in which the study was conducted.

Basic information regarding PIRLS and TIMSS
(source: IEA)

analyzed and presented in detail the results of Romanian students in all PIRLS and TIMSS cycles in which Romania has taken part so far. There is a demonstration of what tendencies there are in the evolution of these results for both PIRLS and TIMSS. The results of the Romanian students are compared with the constant reference levels of the scales: the scale center point, and the four values associated with the international benchmarks respectively. For the 2011 PIRLS and TIMSS common cycle, considered as main object of research for the proposed objectives, are also presented comparisons with international results.

The context questionnaires applied complementarily to the tests lead to finding out valuable and detailed information about the conditions in which learning takes place. Based on this information, Chapter 7 presents and analyses from an international perspective 4 factors which can influence learning. The investigation is entirely focused on the 2011 PIRLS and TIMSS common cycle and uses context scales introduced in 2011 by IEA. The analyzed factors are as follows: (1) level of socio-economic development (including some family characteristics); (2) school as organization (including aspects concerning educational management); (3) characteristics of teachers and teaching approaches; (4) students' attitude and motivation.

3. Results

Analyzing the performance of Romanian students in the PIRLS and TIMSS studies in an international context leads to the results that are presented synthetically hereafter (where necessary, average national scores have been specified within brackets; standard errors are not mentioned to avoid overloading the text).

1. PIRLS (Romania has participated in all 3 cycles)

- 1.1. Out of all participating countries/administrations, according to the average national score, Romania ranked: 25 of 38 in 2001, 38 of 47 in 2006, 37 of 57 in 2011.
- 1.2. In all PIRLS cycles, over 60% of the Romanian students have reached or exceeded the *intermediate* international benchmark (475). Only 3% of the students have reached or exceeded the *advanced* international benchmark (625), while approximately 14% have not reached the *low* international benchmark (400).
- 1.3. All in all, the lowest PIRLS score was recorded in 2006. The average national score in 2011 is higher than the one in 2006, but the difference is not statistically significant at 95% confidence level (see Figure 3).
- 1.4. In the 2011 PIRLS, internationally, the highest performances were recorded for the students from Hong Kong SAR (571), Russian Federation (568), Finland (568), and Singapore (567). The lowest performances were recorded for the students from Kuwait (419), Botswana

(419), Oman (391), and Morocco (310). At European level, the highest performances were recorded for the students from Finland (568), Northern Ireland (558), Denmark (554), and Croatia (553). The lowest performances were recorded for the students from Norway (507), Belgium, French Community (506), Romania (502), and Malta (477).

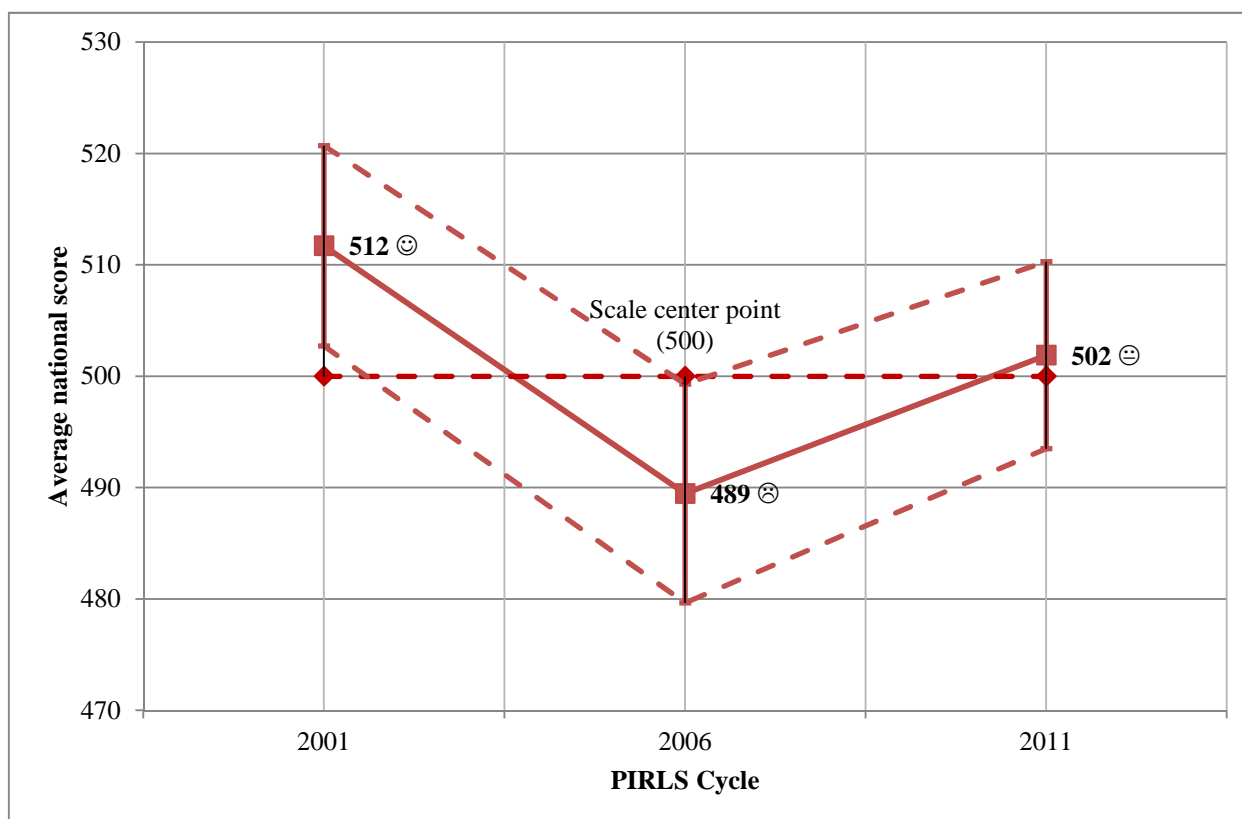


Figure 3 – Average national scores of Romanian students in PIRLS (data source: IEA)

2. TIMSS, 4th Grade, Mathematics (Romania only participated in 2011)

- 2.1. The average national score in mathematics was 482 (statistically significantly lower than the scale center point). Out of all participating countries/administrations, according to the average national score, Romania ranked: 36 of 58.
- 2.2. The majority of Romanian students (57%) reached or exceeded the *intermediate* international benchmark (475). Approximately 7% of students reached or exceeded the *advanced* international benchmark (625), while 21% had results below the *low* international benchmark (400).
- 2.3. Internationally, the highest performances were recorded for the students from Singapore (606), Republic of Korea (605), Hong Kong SAR (602), and China Taipei (591). The lowest performances were recorded for the students from Tunisia (359), Kuwait (342), Morocco (335), and Yemen (248). At European level, the highest performances were recorded for the students from Northern Ireland (562), Belgium, Flemish Community (549), Finland (545), and England (542). The lowest performances were recorded for the students from Croatia (490), Spain (482), Romania (482), and Poland (481).

3. TIMSS, 4th Grade, Science (Romania only participated in 2011)

- 3.1. The average national score obtained in science by Romanian students was 505 (not significantly different from the scale center point). Out of all participating countries/administrations, according to the average national score, Romania ranked: 31 of 58.
- 3.2. The majority of Romanian students (66%) have reached or exceeded the *intermediate* international benchmark (475). The percentage of the students who reached or exceeded the *advanced* international benchmark (625) was relatively high (11%), while 16% scored below the *low* international benchmark (400).
- 3.3. Internationally, the highest performances were recorded for the students from Republic of Korea (587), Singapore (583), Finland (570), and Japan (559). The lowest performances were recorded for the students from Kuwait (347), Tunisia (346), Morocco (264), and Yemen (209). At European level, the highest performances were recorded for the students from Finland (570), the Czech Republic (536), Hungary (534), and Sweden (533). The lowest performances were recorded for the students from Romania (505), Spain (505), Poland (505), Norway (494), and Malta (446).

4. TIMSS, 8th Grade, Mathematics (Romania participated in all 5 cycles)

- 4.1. Out of all participating countries/administrations, according to the average national score, Romania ranked: 29 of 37 in 1995, 25 of 38 in 1999, 31 of 51 in 2003, 32 of 57 in 2007, 26 of 50 in 2011.
- 4.2. In 1995, 1999 and 2003 approximately half of the eighth grade students (51-52%) reached or exceeded the *intermediate* international benchmark (475). Only 4% reached or exceeded the *advanced* international benchmark (625), while approximately 21% scored below the *low* international benchmark (400). In 2007 and 2011 the percentage of students that reached or exceeded the *intermediate* international benchmark (475) went down to 46%, and 44% respectively. Still 4-5% of students reached or exceeded the *advanced* international benchmark (625), while the proportion of those under the *low* international benchmark (400) was approximately 27% in 2007, and 29% in 2011, respectively (see Figure 4).
- 4.3. All in all, one might appreciate that the results of the Romanian eighth grade students in mathematics in 2011 was the lowest compared to all other TIMSS cycles.
- 4.4. In TIMSS 2011, internationally, the highest performances were recorded for the students from Republic of Korea (613), Singapore (611), China Taipei (609), and Hong Kong SAR (586). The lowest performances were recorded for the students from Oman (366), South Africa (352), Honduras (338), and Ghana (331). At European level, the highest performances were recorded for the students from Finland (514), England (507), Hungary

(505), and Slovenia (505). The lowest performances were recorded for the students from Sweden (484), Norway (475), Romania (458), and Macedonia (426).

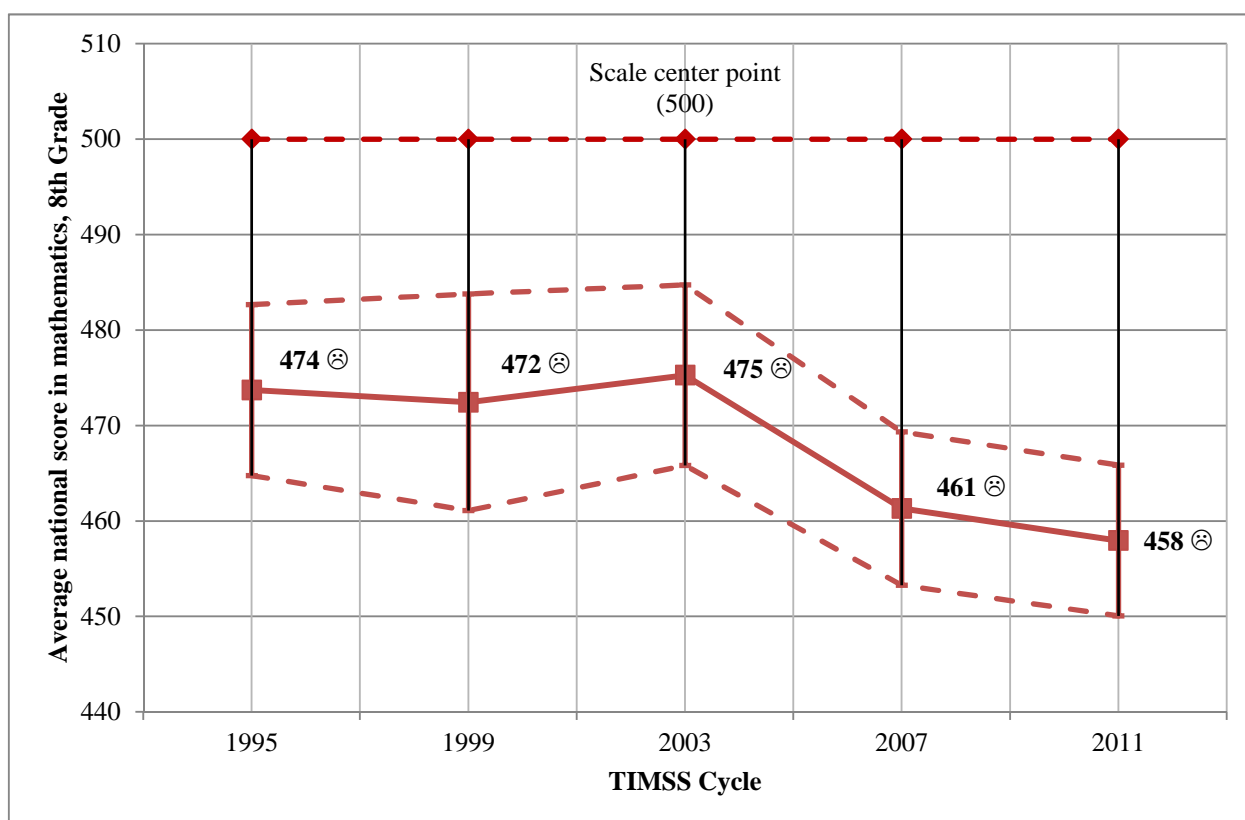


Figure 4 – 8th Grade Romanian students TIMSS average national scores in mathematics (data source: IEA)

5. TIMSS, 8th Grade, Science (Romania participated in all 5 cycles)

- 5.1. Out of all participating countries/administrations, according to the average national score, Romania ranked: 30 of 37 in 1995, 25 of 38 in 1999, 32 of 51 in 2003, 35 of 57 in 2007, 27 of 50 in 2011.
- 5.2. Considering all cycles, approximately half of all eighth grade students (on average 49%) reached or exceeded the *intermediate* international benchmark (475). On average, only 4% reached or exceeded the *advanced* international benchmark (625), and approximately 23% were under the *low* international benchmark (400).
- 5.3. All in all, one can appreciate that there was neither progress nor regress in the results of the Romanian eighth grade students in science from 1995 to 2011 (see Figure 5).
- 5.4. In TIMSS 2011, internationally, the highest performances were recorded for the students from Singapore (590), China Taipei (564), Republic of Korea (560), and Japan (558). The lowest performances were recorded for the students from Morocco (376), Honduras (369), South Africa (332), and Ghana (306). At European level, the highest performances were recorded for the students from Finland (552), Slovenia (543), England (533), and Hungary (522). The lowest performances were recorded for the students from Sweden (509), Italy (501), Norway (494), and Romania (465).

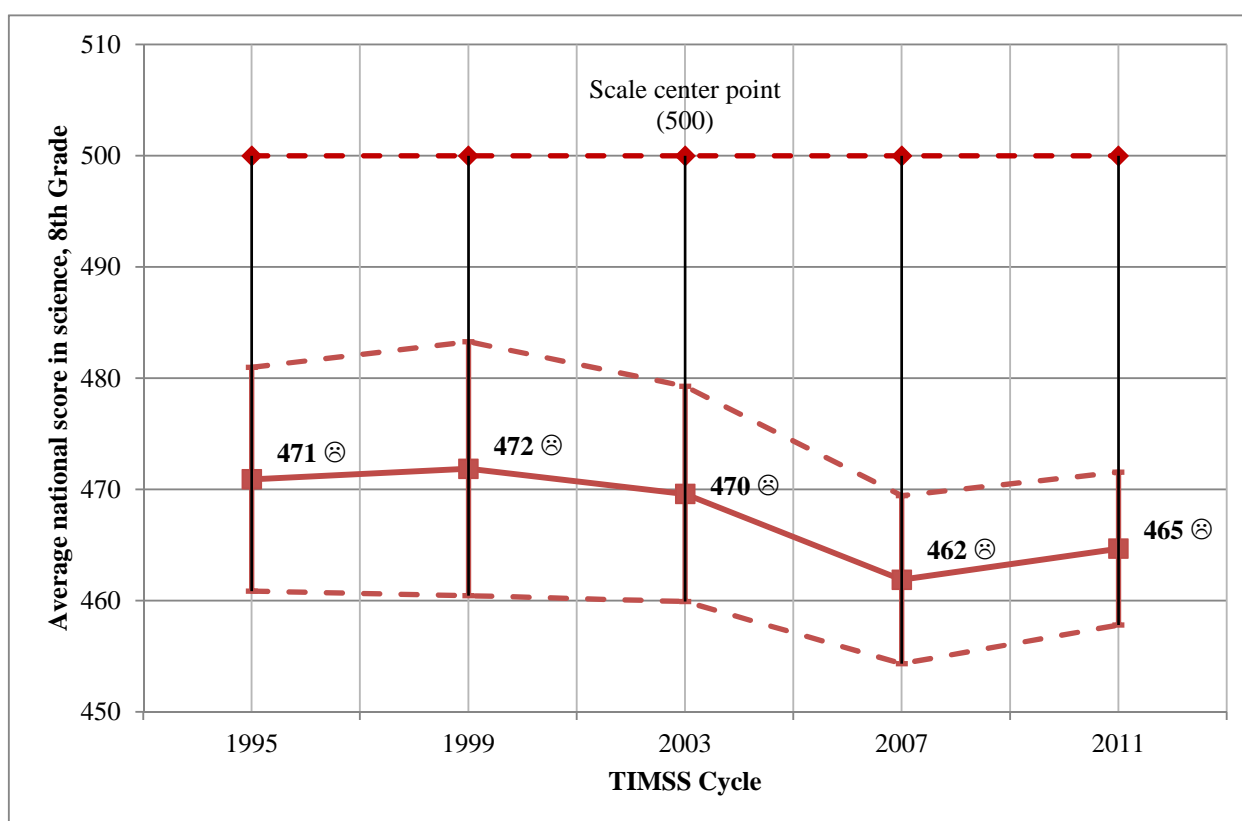


Figure 5 – 8th Grade Romanian students TIMSS average national scores in science (data source: IEA)

Regarding the identification of some factors that can influence learning achievement and highlighting them through statistical analysis, the author has strictly used the data of the 2011 PIRLS and TIMSS common cycle. On the basis of recent approaches in constructing empirical models (educational production functions), benefiting from the introduction by IEA with the 2011-cycle of the new context scales, 4 distinct factors have been analyzed. For each factor, given the results of Romanian students in an international context, it has been demonstrated that there are influences, up to moderate level, *at least* on the results in reading, mathematics and science (and very likely upon overall students' performances). Thus, possible influences of the following factors have been analyzed:

- The socio-economic development level: GDP per capita (see Figure 6); students suffering from lack of basic nutrition; school composition by student economic background; home resources for learning; home educational resources.
- The school as organization: school emphasis on academic success (instructional leadership); order, discipline and safety within school premises.
- Characteristics of teachers and teaching methods.
- Student attitude and motivation: intrinsic motivation; extrinsic motivation; student self-confidence in the evaluated subjects (performance-motivation relationship).

An important aspect recorded in the above-mentioned analysis is the significant importance of the *school emphasis on academic success* (context scale) relative to learning achievement, *at least for* reading, mathematics and science. This influence can be checked both in the context questionnaires administered to principals, as well as in those administered to the teachers. Combining the teachers' and the principals' perspectives, one may conclude that the results are significantly better in reading, mathematics and/or science for students who learn in schools where:

- Teachers understand very well the school's curricular goals,
- Teachers have a high degree of success in implementing the school's curriculum,
- Teachers' have high expectations for student achievement,
- There is a strong parental support for student achievement, and
- Students have a high desire to do well in school.

Fulfilling these conditions is influenced to a great extent by at least three aspects of school governance: accountability, educational management, and parent participation. An approach (in terms of *style* or *priority*) based on "instructional management/leadership" has good chances of leading towards the fulfillment of the above-mentioned conditions, and implicitly to obtaining (better) results. In this approach, the school management/leadership is *primarily* focused on the key-functions of *teaching* and *learning*. The professional learning of the teachers is equally targeted as their behavior in relationship to the students, and the learning process that students go through in school. *Promoting learning* thus becomes the central preoccupation of the school principals, and their main accountability is linked to *learning achievement*.

In terms of the participatory dimension we refer to the existence of high parental support regarding their children results. Parent participation in school governance, in its widest meaning, does not exclusively refer to its possible control role and/or that of assuring accountability. The parents are both indirect beneficiaries of education, as well as stakeholders that have or should have a significant influence in the fulfillment of a schools' key goals.

Finally, one cannot neglect the influence of certain essential characteristics of the school environment: order, discipline, safety. This influence results both from the students' perspective, as well as the teachers' perspective. From the point of view of the school management and accepting a simple management-leadership separation as one between current operation and long-term development, the need for the existence, knowledge and respect for rules and regulations proves essential to the students' learning success.

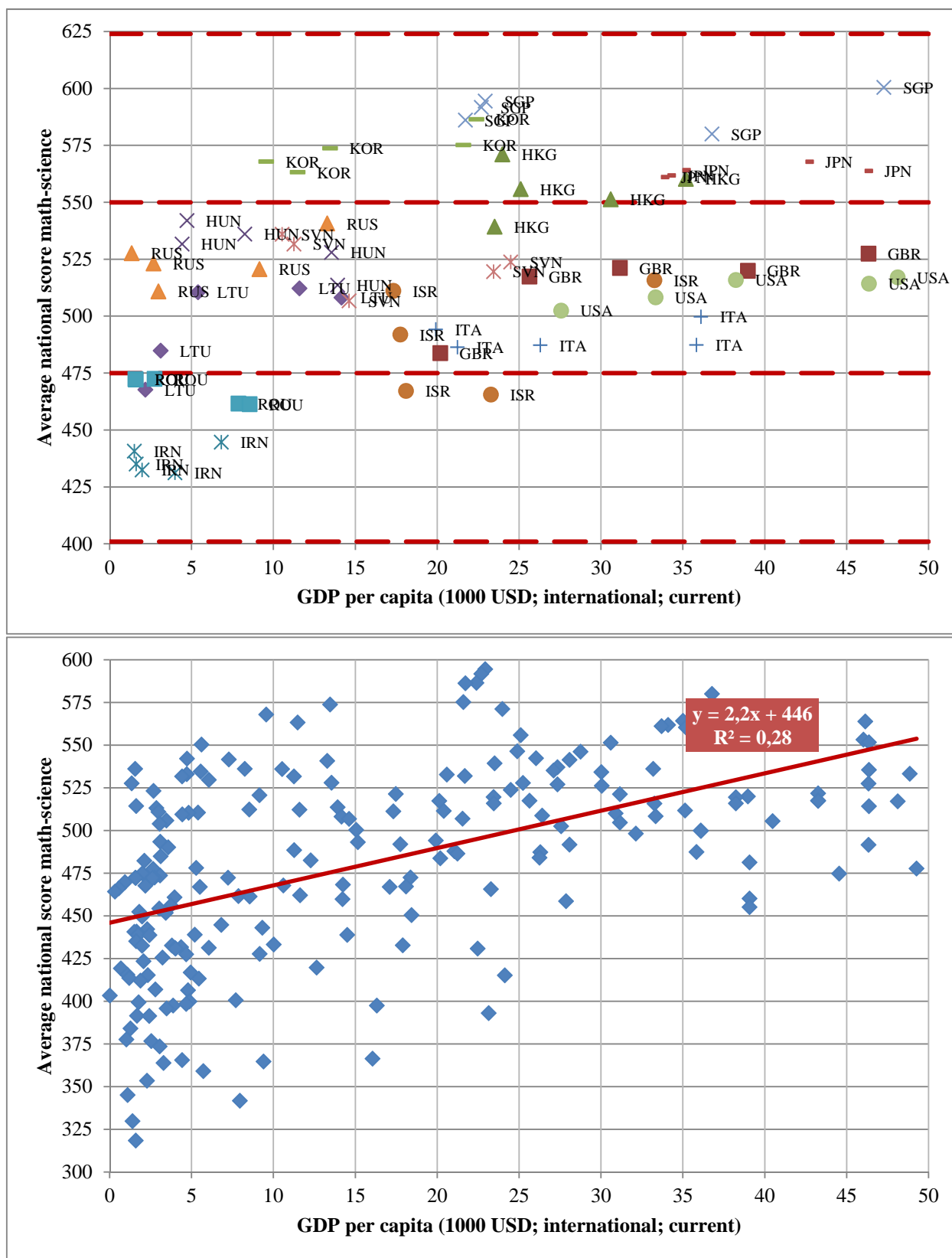


Figure 6 – The possible influence of GDP per capita on students' results (selection; data source: IEA; WB)

Part IV: Investigating the decentralization of education in Romania: the intention level and the real level

1. Structure

The fourth part opens the third and last perspective of the research and includes two scientific investigations on the decentralization of education in Romania: the evaluation of the intention level, and the evaluation of the real level, respectively. In the two investigations are pursued objectives O.III.B.1 and O.III.B.2; O.III.B.3, O.III.B.4, O.III.B.5, O.III.B.6, and O.III.B.7, respectively. Because of the two sets of objectives, this part is also structured in two distinct chapters (105 pages, 37% of the total number of content pages):

- Chapter 8. Decentralization of education in Romania – the intention level (6 sections);
- Chapter 9. Decentralization of education in Romania – the real level (6 sections).

Chapter 9 has the widest expanse in this part and includes the presentation from concept to results of the *Autonomy-Accountability-Management* questionnaire, designed by the author and applied to a representative sample of high school principals in Romania.

2. Content elements

Based on a theoretical background, given the results of recent studies, as well as our own investigations, we have reached the conclusion that the essential elements of school governance are *autonomy*, *accountability*, and *participation*, while *educational management/leadership* has an “engine” role, a source of energy and progress. If school governance can be set up as an alternative solution to current school management in Romania, then decentralizing the educational system in our country should produce the expected results/effects: school autonomy, school accountability, and participation, all supported by educational management/leadership. These are the key elements that shaped the idea of investigating where exactly decentralization of education in Romania lies at the moment, both in terms of the *intention level*, and well as the *real level*.

The intention level is expressed and measured by what educational policies foresee for the decentralization of education, and by what is identifiable in the legislation, respectively. The real level is expressed and measured, obviously, by what really takes place in schools. The well-known complexity of educational systems, the multitude of central and/or local influences, or the translation of legislation into rules for application are only a few acknowledged arguments

why it is accepted that (significant) differences may occur between the level of intention and the reality in schools.

Pursuing these ideas, in Chapter 8 we evaluate the intention level regarding the decentralization of education in Romania. The evaluation from the point of view of educational policies is based on the *Strategy for the Decentralization of Secondary Education in Romania*, a programmatic document adopted through a Memorandum by the Romanian Government, with the intent of putting it to practice in the 2005-2010 period. For the legislation, a specific instrument was designed and applied, taking into consideration Education Law no. 84/1995 (republished) and National Education Law no. 1/2011. The evaluation is made separately for 2008-2010, and for 2011-2012, respectively (as a result of the 2011 change in legislation), and is supported by in-depth qualitative analysis of a number of fields well-known for their importance: curriculum, financing, and human resources.

Chapter 9 is dedicated to the evaluation of the real level of decentralization of education in Romania. This evaluation is based on the *Autonomy-Accountability-Management (AAM)* questionnaire, projected, designed and applied by the author. The questionnaire has been applied to a representative sample of high school principals in Romania: 307 out of a target population of 1514 high schools registered in November 2013 in the National Educational Database (20% sampling fraction). Based on the answers to the 72 questions in the questionnaire, organized around 4 key concepts, the author believes that the study: (1) achieved a complex evaluation of the real level of school autonomy and accountability; (2) identified the most important financing related problems; (3) synthesized educational management/leadership priorities – all in view of drawing an updated picture of current school governance in Romanian high schools.

3. Results

Analyzing educational policy documents of the last 10 years, one can say that the decentralization of secondary education started in Romania between 2002-2003, including internal administrative-financial analyses, consultations with institutional and social partners, debates at political and administrative levels, etc. Based on the initiatives and documents from this period, in 2005 was elaborated the *Strategy for the Decentralization of Secondary Education in Romania* (the author participated in the elaboration of this document, based on the nomination through minister's order at the time), later adopted by the Romanian Government through a Memorandum. The stages proposed in the *Strategy* were the following: “the administrative stage” (2005-2006), “the initial stage” (2007-2008), and “the final stage” (2009-2010). Based on generous principles (public accountability, institutional autonomy, transparency, subsidiarity,

professional ethics), the *Strategy* proposed concrete objectives and fields for decentralization, also outlining the expected impact at every administrative level. On a theoretical and conceptual level we can appreciate that it was an exceptional document of educational policy. Unfortunately, its implementation was marked by very serious deficiencies and we can say that in the period when it should have been in its “final stage” (2009-2010), the *Strategy for the Decentralization of Secondary Education in Romania* was practically abandoned.

In order to evaluate the level of intention based on legal provisions in the field, an appropriate measurement instrument has been elaborated starting from the *School Autonomy and Accountability Scale*, part of the *System Approach for Better Education Results* support programme within the World Bank’s

Field	SENIARS points	Level
1. School network	2	Average
2. Recruitment	2	Average
3. Curriculum	0	Low
4. Time management	0	Low
5. Material resources	10	High
6. Financial resources	10	High
7. Human resources	26	Average
8. Control and evaluation	13	High
Total	63	Average

Table 1 – The level of intention in the decentralization of education in Romania (SENIARS applied to legislation)

Education Strategy 2020. The measurement instrument is called the *Scale for the Evaluation of the Intention Level in School Autonomy and Accountability* (acronym for Romanian original: SENIARS). SENIARS is built to evaluate the level of intention based on *where* decisions are being made among the 4 possible levels (school level, two intermediate levels and the central level), in 8 *main fields of activity*, detailed into 40 *derived sub-fields/activities*. By granting points between 0 (decision at a central level) and 4 (decision at school level) for each sub-field/activity and by using a scoring grid elaborated by the author one can establish the level of intention as *low*, *average* or *high* for each of the 8 fields considered, and for the whole system, respectively. Table 1 presents the evaluation results synthetically, with the mention that notable changes in the wake of the 2011 change in legislation have not been identified (despite the political statements at the time).

The evaluation of the real level of education decentralization, specifically of the real level of school autonomy and accountability, while identifying the main educational management/ leadership priorities, cannot be accomplished without a direct contact with the actors who bear the utmost responsibility in a school: *the principals*. Based on this idea we have chosen to carry out a questionnaire-based investigation having Romanian high school principals as the main target. The target population was hence formed by the principals of the 1514 high schools registered in November 2013 in the National Educational Database (Romanian acronym: BDNE), according to data provided upon request by the Ministry of National Education. The *Autonomy-Accountability-Management* questionnaire has 72 questions, thematically associated

around 4 key concepts: (1) school autonomy, (2) per capita financing, (3) accountability, and (4) educational management/leadership. Two extra sections have been added for specific information about the participating principals and their high schools. The questionnaire has been applied using the CAWI (*Computer-Assisted Web-Interviewing*) method to a representative sample of 307 Romanian high school principals (20% sampling fraction; 95% confidence level). The results obtained from interpreting the answers to the questionnaire are synthesized hereafter.

1. School autonomy

1.1. The real level of school autonomy in Romanian high schools varies across the different fields/activities needed for the organization and operation of the school (see Figure 7):

- The level of school autonomy is at its lowest in the fields of: human resources management – teaching staff, management of financial resources, and management of material resources.
- The level of school autonomy is at its highest in the fields of: recruitment, curriculum, and human resources management – auxiliary and non-teaching staff.

1.2. The real global level (for all fields/activities) of school autonomy in Romanian high schools is estimated as being *average* at most.

1.3. Between the real level of school autonomy as assessed through the results of the investigation based on the ARM questionnaire, and the level of intention, evaluated from legal provisions based on the SENIARS, one can notice the differences specified in Table 2.

Field	Intention level	Real level
1. School network	Average	-/-
2. Recruitment	Average	↑ Between average and high
3. Curriculum	Low	↑↑ Between average and high
4. Time management	Low	-/-
5. Material resources	High	↓↓↓ Between low and average
6. Financial resources	High	↓↓↓ Between low and average
7. Human resources	Average	↓↓↓ Low for the teaching staff
		↑ Between average and high for the auxiliary and non-teaching staff
8. Control and evaluation	High	-/-
Total	Average	↓ Between low and average

Table 2 – Comparison between the intention and the real level in the decentralization of education

1.4. Based on the answers to a set of 6 thematically associated questions, using Principal Component Analysis, it was possible to build a normally distributed *School Autonomy Scale*. This indicates that the set of 6 questions can be used in different contexts and/or at different moments to evaluate the level of school autonomy (as perceived by the principals). Furthermore, the author trusts that it is possible to derive a “school autonomy index” using the Rating Scale Model etc.

2. Per capita financing

- 2.1. The overwhelming majority of high school principals consider that in the last 2 school years they have not had enough funds approved in the initial budget based on standard costs per student to ensure staff and material expenses (see Figure 8; confidence intervals $(71\pm 5)\%$ and $(81\pm 5)\%$ respectively). This (expected) conclusion indicates the fact that there are serious problems with the current financing mechanism (value and/or allocation formula).
- 2.2. Regarding the correspondence between the financing mechanism and the reality in the schools, the principals have, in almost equal measure, negative $[46;57]\%$ and neutral-positive opinions $[43;54]\%$. This is a relatively unexpected result, which could be influenced by a series of objective/subjective factors.
- 2.3. The majority of high school principals $[52;63]\%$ have a neutral-positive opinion regarding the influence of the per capita financing mechanism on school autonomy (regardless of the expense category). Indeed, the per capita financing method is by definition a mechanism dedicated to increasing school autonomy in conditions of economic efficiency: the principals receive an initial budget which depends on the number of students and certain school features, and they autonomously manage it to reach the envisaged objectives.

3. Accountability

- 3.1. The Bacalaureate exam, as a central exam, should ensure a basic level of accountability, relatively uniform and generalized across the system. In reality, the problems determined by the participation rate (below 60% for $[12;20]\%$ of the high schools) and the fact that the assessment concentrates on only 3(4) subjects out of the approximately 14 studied in high school (that is below 30%), determines important variations in applying this basic accountability measure – both at the level of the system and at the level of each high school.
- 3.2. The fact that accountability is not ensured through objective, concrete measures is something most principals admit to. Thus, the proportion of Romanian high school principals that consider increasing accountability as necessary is within the confidence interval $[73;82]\%$. At the same time, the proportion of high school principals that consider that they currently dispose of sufficient managerial instruments to effectively ensure accountability is in a confidence interval with a much more modest central value: $[26;36]\%$
- 3.3. In the opinions expressed by principals concerning the increase (or not) of accountability one can notice a number of important common characteristics. Those who choose the answer NO consider that there are other determining performance factors which are not under the effective control of the school. Among these, the family is the most frequently mentioned, closely followed by the issue of student motivation. In the case of those who

choose YES (the majority), the differentiation in salary appears to be the most frequent concrete measure of increasing accountability. At the same time, in an exceptionally serious approach, and demonstrating full understanding of the system issues, many of the respondents appreciate it is very difficult at present to measure and compare students' performances, especially the added value. We also noticed the linking of a possible increase in accountability to increasing school autonomy, especially regarding the recruitment of the teaching staff.

- 3.4. It has been evaluated how frequently are performed three categories of activities that are important to the existence of a school climate oriented towards accountability: (1) external control; (2) discussing students' results with their parents and (3) internal control carried out by the principal. The obtained results indicate that, to a large extent, current legal provisions are respected. The confidence intervals of the proportion of high schools in which the above-mentioned activities are performed at least once per school semester are: $(75 \pm 5)\%$ regarding external control, $(64 \pm 5)\%$ regarding discussing students' results with their parents, and $(76 \pm 5)\%$ regarding the internal control carried out by the principals, respectively. Although this proportions indicate the fact that in most high schools the above-mentioned activities are carried out with relatively high frequency (at least once per school semester), we consider that the proportion of high schools at the other end of the scale gives cause for concern. This is especially important when it comes to the proportion of high schools in which students' results are discussed with parents annually or even at less frequent intervals. On the other hand, discussing students' results with parents obviously requires the effective involvement of the parents (participation), and in a fairly high number of cases the principals reported this does not happen – hence participation is at a low level.
- 3.5. Accountability is also checked through the image that the school has within the local community. The image of the school can directly influence the teachers' and principals' daily activity. A positive image generally attracts students with better initial training and more motivated. Similar effects can be noticed in terms of teacher recruitment: schools with a better image in the community attract teachers that are better qualified and with a higher degree of professional motivation. On the other hand, the appreciation of a school's image in the community can be made objectively and in an unbiased way only through direct questioning of the local community, which is obviously beyond the size and scope of the present study. Therefore, what has effectively been evaluated is the simple fact of whether high schools actually have an image in their own local communities or not. The key benchmarks of this image are, in the author's opinion, the extent to which *students' and*

teachers' results are known in the community. From the questionnaire we estimate that the proportion of high schools for which results are well or very well-known in the community are in the confidence interval [67;78]% regarding students' results, and [57;67]% regarding teachers' results. This demonstrates that high schools have a certain consecrated image in the community, and this image seems to be better shaped through students' rather than teachers' results (which was to be expected). Again, even if there is an important majority, the exceptions are serious. When students' and/or teachers' results are little known within the community, accountability diminishes. Such situations may be determined by a variety of causes, and some of them are independent of the school and beyond its control.

- 3.6. The conclusions regarding accountability cannot eliminate an aspect which is difficult, if not impossible to measure: *professional conscience*. In many of the freely-expressed opinions, principals link, under one form or another, teachers' accountability to their professional conscience. Not negligible is the fact that there are opinions (again, both explicit and implicit but entirely justified) which show that *salary motivation* and *image issues in society* regarding the teaching profession may undermine the professional conscience. This situation, in its turn, may significantly diminish *the feeling of being accountable* for students' performances.

4. Educational management and leadership

- 4.1. The majority of principals consider that in the next 4 school years more emphasis should be laid upon *strategic development* rather than *day-to-day operation* of the high schools they are running. At the population level, we estimate that the proportion of the principals who share this opinion has a confidence interval with a very high central value: [77;85]%. This result indicates at least the following aspects, estimated at the level of the target population:

- There is a powerful desire for change, for improvement of the situation *and/or*
- There is an established opinion that the current day-to-day operation is within optimal parameters and that there are no serious problems in this respect *and/or*
- There is a strong tendency towards strategic leadership/management and less towards day-to-day operation.

To a large extent these statements are confirmed by the results regarding the importance given to the existence and rigorous application of *internal procedures* of all kinds. It is relatively to be expected that when:

- There are well-established internal procedures, appropriately covering all range of activities concerning day-to-day operation;
- Following procedures is rigorously enforced, and their application is mandatory for all students and staff,

principals can consider that they have no serious problems regarding day-to-day operation, that it is well-established and within the standards required by the legislation and reflected in internal procedures, etc. For the target population, we estimate for the proportion of principals who lay great emphasis on internal procedures, a confidence interval with a very high central value: [70;80]%

- 4.2. A strong emphasis on strategic development, and educational leadership or strategic management, respectively, are both confirmed by the fact that most principals consider that the *vision* and *mission* of the school are “necessary/absolutely necessary” and have “high/very high importance” to them personally and for the schools they are running. The confidence interval for the proportion of principals in this category is [82;90]%. Regarding the awareness of the vision and mission, the conclusion that can be drawn *without any reservations* is the *relative order* of how well these statements are known by teachers, students, and parents, respectively. From the principals’ answers to the questionnaire, the vision and mission seem to be “well/very well known” approximately in the following proportions of the target population: 80% when it comes to teachers, 50% when it comes to students and 40% when it comes to parents. Because of the possible “social desirability effects”, however, we consider that these values are very likely *higher* than the real ones. This is why, as already mentioned, what we retain as correct measurement for the entire population is the relative order: we estimate that at the level of the target population, the vision and mission of the school are better known by the teachers as compared to students, and by the students as compared to their parents, respectively. Similar results are obtained regarding the strategic objectives of the school.
- 4.3. Most principals in the sample have declared that they give high importance to practically all investigated *management functions*. Regarding the distribution of the results and obtaining differentiated images, with different emphases, etc. the result is well below expectations. For each investigated management function, the proportion of those who declare that they give “high/very high importance” to the performance of the respective function is around 90%. Unfortunately, these results can be counted as a lack of success for the investigation. The causes are probably to be found in the overlap between the manner of phrasing the questions (the term “*relative importance*” was not fully understood by respondents) and the respondents’ feeling that *all* management functions “must” be very important (social desirability effect). What would be justified to conclude is that *organizing*, *coordinating* and *motivation* are considered more important by the principals of the target population than *planning* and *control*. *Evaluation*, considered as different from *control* in our approach, occupies a middle position between the two above-mentioned groups.

4.4. The qualitative analysis of the visions and missions of the schools given by the principals participating in the study leads to some worrying conclusions. These conclusions refer strictly to the sample and extrapolation to the level of the entire population is very reserved. The visions and the missions stated by the principals have been analyzed from the point of view of *conciseness, clarity, relevance*, and as far as the vision goes, in terms of its *originality*. The global and personal appreciation is one of *mediocrity*. There is an abundance of long and very long statements (hundreds of words), burdensome, uninspired, with a very high degree of formalism, with plenty of phrases/words considered to be “key” in various educational policies, etc. Commonplace phrasing is frequently used, as well as words/phrases from the new stilted language of education, or quotes from official texts or legislation, or even copied examples from training courses for principals, etc. All in all, the impression is either that the principals do not sufficiently understand the concepts of vision and mission, or that they lack the necessary experience to formulate them adequately, or better yet, that in fact they do not really give much importance to the formulation of these statements that *should* (at least theoretically) be defining for each school and for educational leadership.

4.5. From the strategic objectives cited by the participating principals and their options regarding the most important priority of educational management for the next 4 school years, we deduce the following:

- At the level of strategic objectives, the most frequent to occur are: ensuring/increasing quality of education (19% of answers), improving student results (16% of answers) and adapting the educational offer (15% of answers);
- Regarding the priorities for the next 4 school years, the most frequent answers are: improving students’ results [31;41]% , increasing financial resources [14;23]% , improving school facilities [12;20]% , and adapting the educational offer [10;18]% .

Based on this, we estimate that at the level of the target population there is a high level of preoccupation to ensure and increase the quality of the education offered, and the future strategic developments will mainly aim to improving students’ results, with a better relevance of the educational offer, according to the local/national demand. At the same time, according to the results obtained in the section focused on financing, there is a justified need of adequate financial resources and school facilities development.

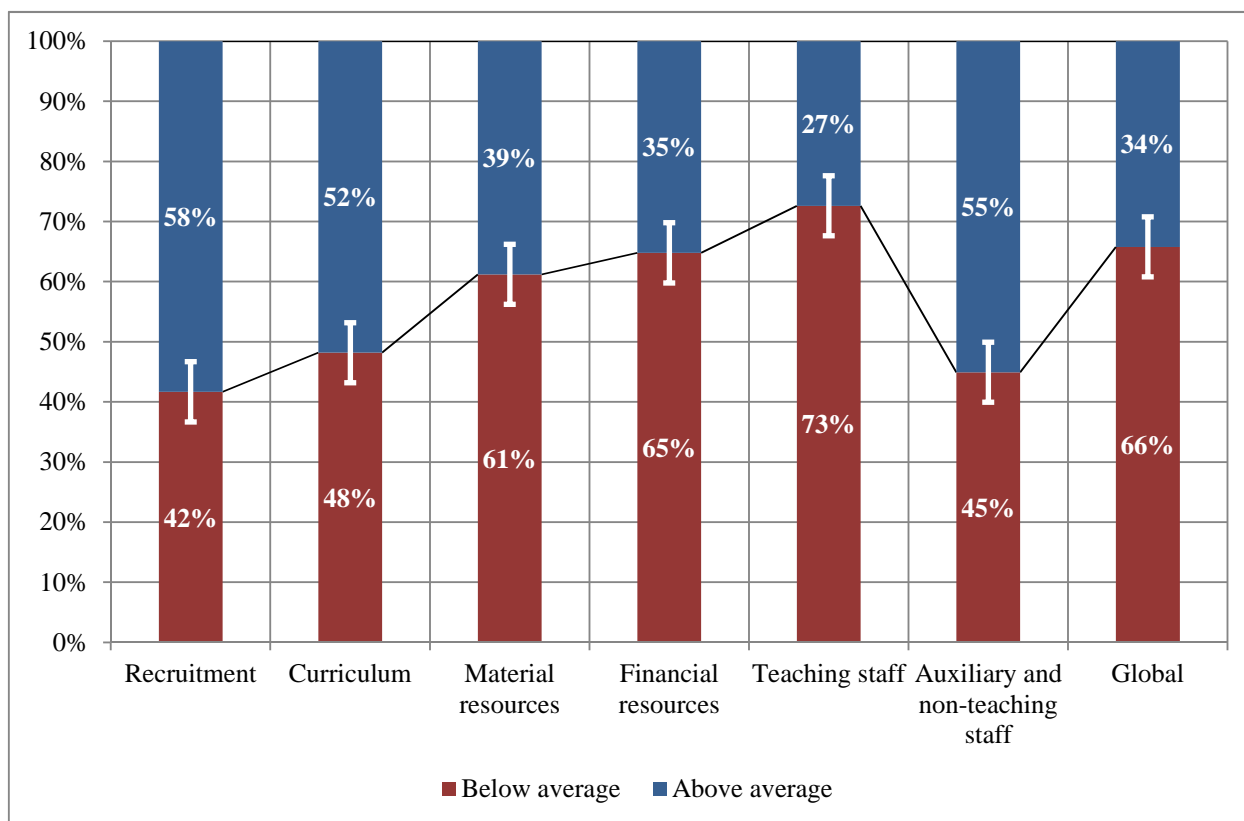


Figure 7 – School autonomy in managing different fields/activities (AAM questionnaire)

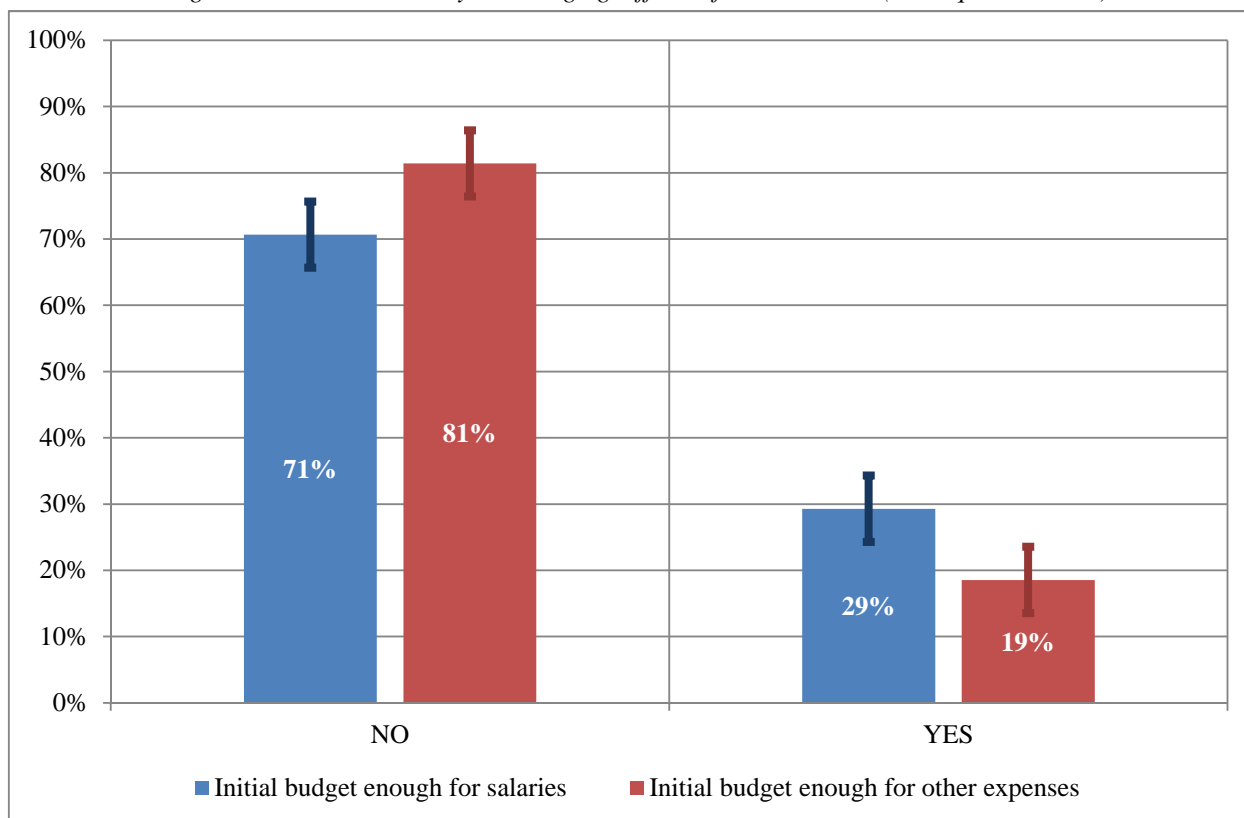


Figure 8 – Financing issues due to the per capita financing mechanism (AAM questionnaire)

Part V: Conclusions and possible further developments

1. Structure

The fifth part has a single chapter, entirely dedicated to the presentation of the results and conclusions of the five investigations carried out along the research (33 pages, 11% of the total number of content pages):

- Chapter 10. Conclusions (4 sections).

The chapter is structured according to the three distinct perspectives used to achieve the general research objectives: the higher education perspective (I), combined perspective of higher and secondary education (II), and the secondary education perspective, respectively (III). For the clarity of the presentation, the results and conclusions are grouped according to the objectives or sets of objectives.

2. Conclusions

The results of the five investigations accomplished along the doctoral research are synthetically presented in the previous sections of this abstract. In the author's opinion, these results support the following conclusions (presented in the order of investigations):

- 1) In the 2001-2009 period the number of students and graduates in the fields of mathematics, sciences and technology (MST), engineering included, has increased from year to year, while witnessing an improvement of gender balance. In the 2009-2012 period there was an important decline in the number of students, both total and MST. This decline has a good chance of continuing in the following years, and constitutes a serious threat/challenge to all universities, particularly to engineering faculties; this situation was defined as the "quantity threat/challenge".
- 2) The increase in the number of students and graduates in the fields of mathematics, sciences and technology between 2001-2009 was positively influenced to a great extent by recruitment for engineering faculties. The decline between 2009-2012 was mitigated by recruitment for engineering faculties. This means that the "quantity threat/challenge" is less important for engineering as compared to other fields, indicating a higher attractiveness of this field to potential candidates.
- 3) Student recruitment has been influenced at least by legislation, economy and the labor market, respectively; a certain positive role can be estimated for secondary school curriculum. The legislation in the field evolved from a "permissive" one (focused on

access to education) towards a more “restrictive” one (focused on quality of education). In the “permissive” period recruitment opportunities increased, at least because of the fee-paying students in public universities, the development of the private sector and the extension of open and distance learning offer. All this was reflected in an increasing number of students. The “restrictive” period (significantly) raised standards in each of these activities, (probably) increasing the quality too, but in so doing implicitly reducing the number of students. The economy and the labor market recorded important growth until 2007/2008. The economic crisis between 2008-2010 (with effects at least until 2012) affected every economic sector, especially the production of goods, and also determined an increase in unemployment. These evolutions had a positive (until 2008), and then a negative (since 2009) influence on student recruitment, MST included. The national curriculum reform for upper secondary education aimed, among other things, to increase emphasis on mathematics, sciences and technology, with an accent on key-competences. These measures may have resulted in an increased attractiveness of mathematics and sciences, with a positive influence on MST student recruitment.

- 4) The modest (at most) results obtained by Romanian students in the PIRLS and TIMSS international studies in reading, mathematics, and science are a clear and alarming indicator for the “quality threat/challenge”. This threat is rapidly evolving into a serious challenge, which Romanian high schools, universities and ultimately employers will have to cope with in the very near future. These threat/challenge must be considered from the perspective of Romania’s economic competitiveness. A significant role in Europe and on a global scale, as well as the socio-economic growth are unthinkable without a well-educated and highly trained human capital.
- 5) The level of socio-economic development, at least by generic family and school factors influence measurable learning outcomes in reading, mathematics and science and very likely influence overall academic performance of students.
- 6) The school, at least by the resources available, the priorities of educational management and essential characteristics of the school environment: order, discipline and safety, influence measurable learning outcomes in reading, mathematics and science and very likely influence overall academic performance of students.
- 7) Teachers, at least through the initial training and teaching experience, the focus on the students’ success in school, and self-confidence in the subjects taught influence measurable learning outcomes in reading, mathematics and science and very likely influence overall academic performance of students.

- 8) The students' attitude and motivation, particularly intrinsic motivation, influence their measurable learning outcomes in reading, mathematics and science and very likely influence their overall academic performance.
- 9) The 2005 *Strategy for the Decentralization of Secondary Education in Romania* was the first and last complete and coherent expression of the level of intention regarding the decentralization of education in national educational policies. It included principles, objectives and fields of education decentralization, evaluating the impact on all administrative levels. It proposed a very high degree of school autonomy, accountability and participation, with high standards for educational management/leadership. With the exception of a pilot stage which has practically never been capitalized on, the *Strategy for the Decentralization of Secondary Education in Romania* has not been implemented.
- 10) The *Scale for the Evaluation of the Intention Level in School Autonomy and Accountability* built by the author and applied to the legal provisions does not indicate important differences between 2008-2010 and 2011-2012 (despite the 2009-2010 political statements). The level of intention regarding school autonomy and accountability varies across the different fields of activity: *low* for the "Curriculum" and "Time management" fields, *average* for the "School network", "Recruitment" and "Human resources" fields, and *high* for the "Material resources", "Financial resources" and "Control and evaluation" fields. The overall level of intention regarding school autonomy and accountability, based on the legal provisions, is estimated as *average*.
- 11) School autonomy in Romanian high schools is *average* at most and there are important variations between different fields, and there are also differences as compared to the level of intention (per fields of activity and overall). The school autonomy is considered the lowest in terms of human resource management, teaching staff category.
- 12) Per capita financing mechanism has serious deficiencies. For the large majority of high schools, at least in the last 2 years, the funds initially approved in the annual budget were not sufficient compared with the necessary for salaries and material expenses.
- 13) There are measures in force to develop and support a climate of accountability at the high schools level. However, most high school principals in Romania appreciate there needs to be an increase in the objective accountability of teachers and principals in relation with students' academic performance. This appreciation is justified by the deficiency and/or low participation and/or the lack of concrete effects regarding accountability at present.
- 14) There is a manifest orientation of high school principals towards strategic development, with an important accent given to educational leadership or strategic management. The

principals are looking to transform the organizations they are leading, mainly to increase the quality and relevance of education and to improve students' results.

- 15) Ideally, students with good basic training should be recruited from high schools where school autonomy limits are exceeded by management/leadership innovative and responsible, with *learning* as top priority, high schools where there is a functional and accepted culture of accountability and the parents are real partners of teachers and management, strongly supporting their children's success in school.

In these circumstances, given the results of the investigations we have carried out and the opinions of other researchers, we conclude that **school governance can support engineering education with candidates with a good basic training**, and:

The triad *autonomy-accountability-participation*, having *educational management/leadership* as its main „engine”, source of energy and progress, is what essentially defines *school governance/good school governance*.

Paraphrasing a famous quote about good governance, we also assert that:

Good school governance is, probably, the most important factor in increasing *effectiveness, efficiency, quality and relevance* of secondary education in Romania.

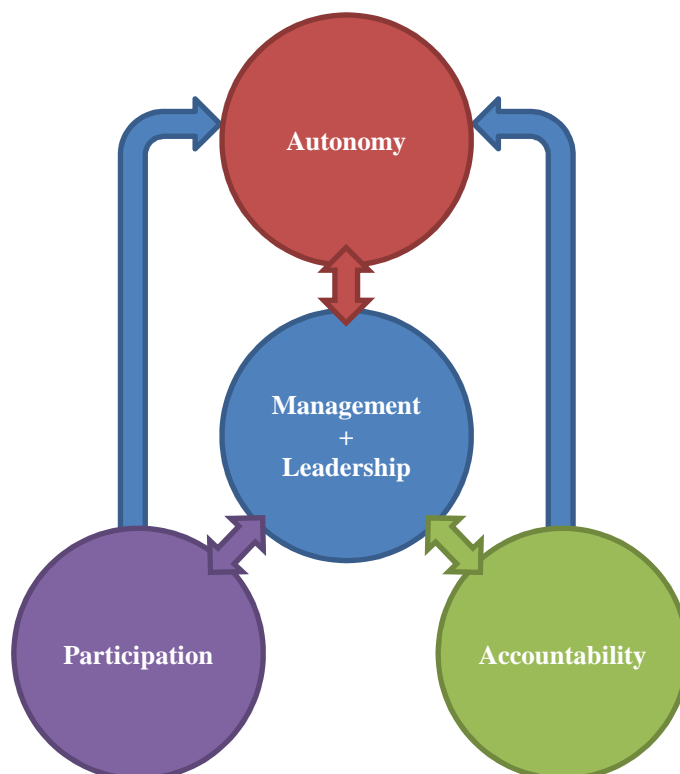


Figure 9 – School governance (authors' opinion)

3. Further developments

In any scientific research there are moments when there comes the (almost irresistible) temptation of opening new investigations, competing with or complementary to the ones already running, in order to find more answers, new arguments, innovative solutions, etc. The current research is no exception to this rule. On the other hand, there are always time and length limits, a measure of what is reasonable, and set priorities, all these leading to what is considered at a given moment as essential in the attempt of answering the key research questions.

During the investigations that have supported the research, analyzing the results and their collateral and/or complementary implications, we have found that there are still important opportunities for exploration. Namely, this refers to the areas that should continue to be studied for in-depth understanding and clarification, and the methods and instruments used that can be further developed. We consider all this as **possible further development** and we will briefly introduce some of the options we consider important for the key objectives of our research.

The motivation for studying engineering. Noting the important positive evolution between 2001-2009 in recruiting students for engineering studies, and the less marked decline after 2009 (as compared to other higher education fields) the following question obviously arises: *Which are the main reasons for high school graduates to choose to study engineering?* To answer this question we believe it is necessary to design and carry out an investigation based on a questionnaire, aimed at two target populations: high school students in the final grades, and first/second year university students in engineering. Such a study is not only of a strictly theoretical interest, its results might concretely support universities in negotiating the “quantity threat/challenge” regarding recruitment.

The analysis of Romanian students’ results in the PISA international study. Together with PIRLS and TIMSS, the international studies used in this doctoral thesis, the PISA international study – *Programme for International Student Assessment*, carried out every 3 years under the coordination of OECD, is also an exceptional source of information regarding learning achievement and the factors which can influence students’ academic performance. The last PISA cycle took place in 2012, and the results were made public in 2013. The analysis of Romanian students’ results in PISA, including evolutions, comparisons, possible influences, etc., may keep providing important information, both from the higher education point of view (basic training of prospective students), and from the point of view of secondary education (learning outcomes and factors which can influence the learning process). Overall, such a study would provide further understanding of the “quality threat/challenge”.

The Scale for the Evaluation of the Intention Level in School Autonomy and Accountability.

This scale has been built by the author (starting from SAAS – *School Autonomy and Accountability Scale* developed by the World Bank) to evaluate the level of intention regarding the decentralization of education, as it results from educational policies, and especially from the legal provisions. The scale has been strictly applied to the educational system in Romania, and the results have been considered to be consistent with those obtained after applying SAAS, with added value concerning the details. To calibrate and possibly correct the scale, with the possibility of using it in different contexts and at different moments, it is necessary to apply it to other educational systems. There are at present enough public data sources for this process of calibration-correction and generalization: Eurydice, OECD, the World Bank, etc. If independently run, the calibration-correction process is a lengthy one because it involves a careful reading of the legislation in different states. On the other hand, the possible elaboration of a questionnaire based on the scale and applying it to decision-makers from other educational systems might considerably reduce the necessary time.

The Autonomy-Accountability-Management Questionnaire. The instrument elaborated and applied to evaluate the real level of school autonomy and accountability, and to identify some priorities of educational management/leadership respectively, can be substantially improved based on the obtained results. For a possible periodic use of this instrument on a national scale, the minimum required changes would be: reducing the number of questions; reconsidering the way in which external educational efficiency is measured; reconsidering the questions regarding accountability (so that a similar scale to the one obtained for school autonomy would result); merging some questions from the section dedicated to educational management; reconsidering the questions referring to the importance given to management functions, avoiding or reducing the possible social desirability effects. The correction of the questionnaire can be achieved, first based on the results obtained in our research. Further on, one may organize in-depth interviews with high school principals and pre-testing for the improvement of the instrument, etc. With these corrections, we consider that the questionnaire can be regarded as a viable instrument for a periodic evaluation of the real level of decentralization or after implementing educational policy or legislative measures. The information obtained may support decision-makers at national level in achieving the general objectives of decentralization and/or in correcting the way the decentralization of education is implemented.



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