1. Introduction. The European Union’s Approach to Interdisciplinary Research

The European Union made efforts to reduce the economic growth gap as compared to the United States, putting the RDI (research, development and innovation) domain at the core of those efforts. That’s why many programmes and support measures are carried out at EU level in support of knowledge. As for example, the Lisbon Strategy was revised in March 2005, to focus more on growth and employment and to re-affirm Barcelona’s European Council objective (2002) that each member state should aim to spend 3% of GDP on research by 2010. Unfortunately, according to Eurostat, in 2006 the EU states spent, on R&D an average 1.84% of the GDP, the numbers varying between some 0.42%, in Cyprus, and 3.82% in Sweden. Aside from Sweden, Finland and Germany are topping the chart of states that invest in R&D, with 3.45%, and 2.51% respectively. In this rankings, Romania ranked second to last in Europe, with an investment of 0.49% of its gross domestic product in research and development in 2006.

At the heart of the Lisbon Strategy, research is a component of a knowledge triangle (the other two being education and innovation) meant to boost growth and employment in the European Union (EU) in the context of a global economy. The 7th Framework Programme for Research, covering the period 2007 to 2013, comprises all research-
related EU initiatives together, under a common roof, playing a crucial role in reaching the goals of growth, competitiveness and employment. It works along with new Competitiveness and Innovation Framework Programme (CIP), Education and Training programmes, and Structural and Cohesion Funds for regional convergence and competitiveness. **The broad objectives of FP7 have been grouped into four categories:** Cooperation, Ideas, People and Capacities. For each type of objective, there is a specific programme corresponding to the main areas of EU research policy. All specific programmes work together to promote and encourage the creation of European poles of (scientific) excellence.

The specific programme ‘**Ideas**’ aims to reinforce excellence, dynamism and creativity in European research and improve the attractiveness of Europe for the best researchers in “**frontier research**”. In terms of the document, “frontier research pursues questions irrespective of established disciplinary boundaries. It may well involve multi-, inter- or trans-disciplinary research that brings together researchers from different disciplinary backgrounds, with different theoretical and conceptual approaches, techniques, methodologies and instrumentation, perhaps even different goals and motivations”. It should be noted that even if the European Research Council uses the single term “frontier research” instead of multi-, inter- or trans-disciplinary research, concepts are clearly distinct. To Romanian professor George Văideanu, we should recognize the merit of distinguishing between related concepts, in a paper published under UNESCO in 1985: “Transdisciplinarity is a state of complete balance of influence between all relevant participating disciplines at the highest possible level of coordination.” Interdisciplinarity is somewhat weaker than transdisciplinarity in coordination or cross-communication. The
balance of influence, however, of the respective disciplines, is upheld. The total impact of the quantitative and qualitative elements in not strong enough to establish a new discipline. ■ Cross-disciplinarity deviates from interdisciplinarity in both the qualitative and quantitative senses. One discipline dominates the others and is the one that establishes all important premises. ■ Pluri-disciplinarity is characterized by the fact that communication takes places between various disciplines, but the contact may be weaker or more sporadic than in cross-disciplinarity. ■ Multi-disciplinarity is the least developed form of interdisciplinarity. The communication between disciplines is reduced to a maximum. Projects are often complementary to each other. To conclude, „interdisciplinarity is a form of cooperation between disciplines to solve problems that can be solved only through the convergence and prudent combination of different points of views. It implies a certain amount of integration between different areas of knowledge and between different approaches and the development of a common language so as to enable conceptual and methodological exchanges to take place.”\[1\]

2. The Romanian case

The Romanian RDI system went across a very difficult period after 1989: the underinvestment and delayed restructuring only permitted a connection to the global trends in science and technology in isolated cases, and the still fragile enterprise sector in Romania could not exert a real innovation demand. Practically isolated, the R&D system fragmented, as the various components tried to survive with the minimum available resources, mainly by public funding, within mostly formal and autarchic systems. However, the public funding of the Romanian research & development showed a radical changes starting with 2005, together with the first substantial increase in the GDP share
assigned to that field. The CEEX Research of excellence program launched in 2005 by the National Authority for Scientific Research has contributed to direct public expenditures for research towards developing the Romanian Research Area. In the CEEX program, the priorities of the public R&D funding were those from FP7, and the projects focused on the creation of powerful consortia, the \textbf{promotion of interdisciplinary research}, the development of human resources, the international promotion of the Romanian RDI system, and the reinforcement and the development of infrastructures for conformity evaluation and certification.

With the RDI strategy for the period 2007-2013, Romania intends to reach the European average for the basic indicators describing the structure and performance of the research, development and innovation system. The National Plan for Research, Development and Innovation takes into account the significance of fundamental research for knowledge development and the training of highly skilled human resources and emphasizes the excellence, the \textit{interdisciplinarity} and the international visibility.

Complex research in frontier areas and the participation to international excellence research networks are sustained through the programme \textbf{Ideas}. There are several basic research areas of special interest, with potential in Romania namely: biology, genetics and medicine; chemistry, environment and material science; mathematics; physics and technological physics; geology and atmosphere physics. While concentrating the investments in these fields, the Strategy will also support new areas, where Romanian research teams already cooperate at the international level. Social sciences are concerned
too. As for example, in 2007 Grant Competition. 1279 proposals were submitted, 440 being won by 77 institutions (universities and research institutes).

3. Main barriers to interdisciplinary research projects

*Interdisciplinary thinking is rapidly becoming an integral feature of research as a result of four powerful “drivers”: the inherent complexity of nature and society, the desire to explore problems and questions that are not confined to a single discipline, the need to solve societal problems, and the power of new technologies.*

Research&Development projects can be defined, according to Romanian Research Law (324/2003) as „a way to accomplish the objective of a programme, in a specified period of time. It makes use of limited resources and asks for obedience to a clear set of rules”. By extension, an interdisciplinary research project aims to accomplish a certain objective through the cooperation and integration of knowledge coming from different disciplines; it also makes use of planned resources and functions under a set of rules. The management of research projects aims to find the best way to allocate limited resources to the project’s main objective. The management’s task becomes more difficult in interdisciplinary projects. Working with people with different disciplinary backgrounds, in a disciplinary-oriented environment, gives the management a lot of challenges.

Although interdisciplinarity is somewhat weaker than transdisciplinarity in coordination or cross-communication, its level of complexity is also very high because an equilibrium between disciplines should be maintained on a continuous basis. On the other hand, any interdisciplinary project should find a common language that all participants should be
able to use. The task of the manager of an interdisciplinary project is doubled by the obligation to create harmony between participants in the team. That’s why specialists recommend the identification of possible barriers as the starting point in any interdisciplinary research project.³

a. „Disciplinary” barriers

Traditional rivalry between disciplines is one of the most cited barriers: participants in interdisciplinay teams have, in most of the cases, a disciplinary affiliation, they tend to protect against possible „rivals”. This unilateral specialisation leads to the difficulty of finding a common language and to fear of unknown. More than that, usually participants are asked to make use of research methods of their co-workers. The difficulty rises especially where a quantitatively based discipline meets a „softer” discipline. That’s why it is strongly recommended to surpass disciplinary attitudes.

b. Organizational and institutional barriers

There are also some institutional and cognitive constraints in doing interdisciplinay research. Institutions are often disciplinary organised, so they allocate their resources consequently. In the same time, the reward system used especially in Universities is focused on individual performance and the commitment to an interdisciplinary project depends strongly on this system. At most academic institutions, hiring, tenure, and promotion are controlled by departments, and faculty often receive credit only for the teaching and research actually performed in their departments. Faculty teaching in interdisciplinary teams or classes outside the department may receive little or no departmental credit.
c. Resources barriers

Time and resources devoted to facilitating research project are diverted from existing activities. Starting a new program, providing new seed funds, or creating a new center often means closing or reducing an effort in another area. Most of the traditional academic budget is allocated to recurring categories, such as salaries, physical-plant costs, and instructional expenses. Flexible funds tend to be assigned to departments and colleges as operating in interdisciplinary research. Incentive and rewards are usually based on disciplinary rather than interdisciplinary standards. 

4. Other barriers

There are also some important barriers to interdisciplinary research projects: results evaluation is often problematic, because we cannot talk yet about interdisciplinary evaluators; in the same time, there are very few scientific journals/reviews focused on interdisciplinarity, so the dissemination of results can be also problematic.

4. Team Integration, The Biggest Barrier to Interdisciplinary Research

One of the reasons why I think interdisciplinarity is always fighting an uphill struggle is because it is not only multi-vocal, it's not only less certain, but it has a softer feel about it. People who have a narrow disciplinary focus are able to say things they think with great confidence. What can interdisciplinary people say with great confidence?

All interdisciplinary teams, whether in education or medicine, depend on the willingness of individuals to subordinate their individual interest to a common objective. Just as there are not algorithms for interdisciplinary research, there are no prescriptions for building interdisciplinary teams. Nevertheless, experience suggests some lessons:
- familiarity with general systems theory has proven a benefit in some projects;
- research performance, in general, appears positively associated with researcher diversity in terms of professional activities, knowledge of several areas of specialisation, engagement in multiple projects and interdisciplinarity orientation; however, increased intellectual diversity among team members relates to superior research to a point, then diminishes; yet, diversity can be also a source of disharmony;
- interdisciplinary skills include knowing what information to seek, participating effectively in collaborative work, acquiring a working knowledge of the language, concepts, information and analytical skills pertinent to the problem, collating the contribution of individual experts, establishing the adaptability of pertinent materials, and knowing how to confirm or disconfirm the proposed solution.

5. A vision of interdisciplinarity may begin with simple steps and behaviors that nourish the practice of collaboration.⁶

This paper considers all barriers to interdisciplinary research. It agrees with the idea that manager’s first task in interdisciplinary research is to integrate the working team. So, the paper suggests the sociometric technique as a good instrument in facilitating team integration. It brings into study the case of interdisciplinary compatibilities within Constantin Brâncoveanu University. The results of such a study lead to the assessment of each discipline’s prestige and puts into light relational attractions and rejections between disciplines.
6. Research Methodology

This study aims to identify interdisciplinary compatibilities within Constantin Brâncoveanu University, a private educational institution based in Pitești, with branches in Rm. Vâlcea and Brăila. Scientific research at Constantin Brâncoveanu University is carried on through the Department of Scientific Research and through four Chairs: (1) Management – Marketing, (2) Accounting – Finances – Banks, (3) Technico-Economic Sciences, (4) Law and Communication Sciences. The study makes use of sociometric technique to put into light the web of preferences, likes or dislikes within a group of individuals. Sociograms (friendship charts) are graphic representations of social links within a group and result from the application of sociometric technique.

To conduct the study, I made an inventory of disciplines and of full-time teaching staff employed in the University. I came to the conclusion that, in order to include in the study more disciplines, I can make use of 6 teaching staff per each of the groups of disciplines identified previously: Management, Marketing-Tourism, International relations, Accounting, Finances, Merceology-Technology, Statistics-Informatics, Law and Public Administration, Journalism and Communication, Foreign languages (especially French and English). So I asked the 60th teaching staff identified to nominate – from a list – 3 disciplines they think they may have compatibility (+) and 3 disciplines they think they have incompatibility (-) for an interdisciplinary research project. I tabulated and placed the results in a Sociomatrix, then I calculated each discipline’s total Likes (T+), Dislikes (T-) and the Sociometric status. In the end, I drew the Sociogram (Likes/Dislikes) – see Appendix.
The sociometric technique used as follows can help managers of interdisciplinary research projects to know better the members of their teams, their status within the group and the way they relate one to another. It can be a very useful technique for managers who have to set up an interdisciplinary team or for managers that have problems with the team’s structure cohesion.

7. Results and Conclusions

There are 5 groups of disciplines with positive scores (Likes) above the mean:

Management (38+), Marketing-Tourism (30+), International Relations (21+), Finances (20+), Journalism-Communication (19+). The most Dislikes went to, decreasingly: Law-Public Administration (27-), Journalism-Communication (26-), Accounting (25-), Statistics-Mathematics (22-), Finances (22-), Merceology-Technology (19-). It is interesting to observe the case of two groups of disciplines: Journalism-Communication and Finances, which scored highly in both categories (Likes and Dislikes).

The **Status index (Isp)** indicates one discipline’s prestige within the group, taking into account, in the same time, Likes and Dislikes. It is computed from the relation:

\[
Isp = \frac{(T^+)-(T^-)}{N-1}
\]

\[
Isp = \text{Status index}
\]

\[
T(+) = \text{Total Likes}
\]
\[ T (-) = \text{Total Dislikes} \]

\[ N = \text{respondents} \]

In this case, \( N = 60 \Rightarrow 1 = \text{one group} = 6 \text{ respondents} \Rightarrow N-1 = 54 \]

The status index permits the diffusion of scores around 5 categories:

1. **Star** - Management (Isp = 0.58)

2. **Popular** – Marketing-Tourism (Isp = 0.39)
   - International Relations (Isp = 0.26)

3. **Isolated** – Foreign Languages (Isp = -0.02)
   - Finances (Isp = -0.03)

4. **Ignored** – Journalism-Communication (Isp = -0.13)
   - Statistics-Informatics (Isp = -0.2)

5. **Rejected** - Law-Public Administration (Isp = -0.34),
   - Merceology-Technology (Isp = -0.32)
   - Accountability (-0.37)

On the base of the Status Index, the **Sociogram** (See Appendix) is represented by 5 concentric circles, each of them representing a certain distance from the centre where the leader (star) is. The Sociogram helps graphically see not only each discipline’s place in the space of group, but also the nature of relationships between disciplines. Looking at the Sociogram, one (the manager) can easily see how each discipline can be related to others.

- **Management** is, undoubtedly, the leader of the group; it can base any research project because it has the best prestige among disciplines. **Management, Marketing-Tourism and International Relations** form a **clique** (the only one in the study), because all choose each other. As the Sociogram shows, this is the best solution for an interdisciplinary research
team. To note that although Management has the most Likes within the group, *Marketing-Tourism* gained Likes from the big majority of respondents. So *Marketing-Tourism* can easily form interdisciplinary research teams with individuals from all the other chairs: *Journalism-Communication, Foreign Languages/Statistics-Mathematics, Finances/ even Merceology-Technology*.

- The sociogram shows also two **cliques in evolution**: Statistics-Mathematics, Finances, Accountability and Marketing-Tourism, Finances, International Relations. Even they come from different Chairs, they are attractive one to another.

- The main **reciprocal rejections** are: Accountability with Journalism-Communication, Finances with Merceology-Technology, Law-Public Administration with Marketing-Tourism and Law-Public Administration with Statistics-Mathematics.

- **Law and Public Administration** is, as the sociogram displays, the most difficult discipline to be integrated in an interdisciplinary research project, because there is no possibility to combine with 2 other disciplines in the same time.

- **Management and Accountability** and **Management and Statistics-Informatics** are **incompatible pairs**: Management rejected the two, while the two chose Management.

There are also a lot of connections that can be seen in the sociogram. The sociomentric technique used as previous can help managers of interdisciplinary research projects know better the members of their teams, their status within the group and the way they relate one to another. It can be a very useful technique for managers who have to set up an interdisciplinary team or for managers who try to enforce the team’s cohesion.
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APPENDIX

THE SOCIOGRAM (Attractions and Rejections)


