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Routes of Excellence in Doctoral and Post-Doctoral Academic Research

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Abstract: the paper aims to identify, describe, analyse, and apply a logical general methodology to establish the strategic directions liable to provide sufficient guarantees for research excellence in doctoral and post-doctoral academic programs for the three research basic domains: nature, society, and human being. To this end, firstly, a set of meta-criteria aimed at selecting criteria for master's programs is established, based on which ten criteria are selected. Next, three criteria to design the master's programs are identified, based on which six classes of master's programs are found. The final part of the paper approaches the set of ten criteria aimed at selecting the routes of research excellence in doctoral and post-doctoral academic scientific programs. Consequently, four fundamental routes of research excellence are established, and then 24 strategic directions are identified that could support the "routes of excellence".

Keywords: academic research, doctoral research, post-doctoral research, strategic directions, excellence routes of research.

Introduction

Academic research, in any field of scientific interest, is (must be) fundamental research. Fundamental research, as the name suggests, aims at the logical and epistemological foundation of a field of research, aspiring to identify the principles and general phenomenology, as little contextual as possible, of the state and kinematics of fact (in the fields of research of nature), of the state and kinematics generated by human action (in the fields of research of society), respectively of the state and kinematics of the subjectivity of the human being (in the fields of research called humanities). In this context, academic research must first form a "map" with the main directions and sub-directions of scientific research (Salmi, 2011)), based on obvious criteria (of indisputable character, like axioms), so that the exploration rate (not necessarily of success, because, in knowledge, the negative result of research is always a... positive result) is maximized and the research field in question follows the shortest and most relevant path from question to answer (Creswell, 2009). The article focuses on master's programs, doctoral and post-doctoral academic research, because the enthusiasm and confidence of youth must be helped by a methodology for choosing research topics that is as productive as possible. The study has as institutional benchmark the case of Romanian academic research.

Meta-criteria to select the criteria

The criteria for establishing strategic directions of excellence in doctoral and post-doctoral academic research (Girard *et al.*, 2024) in Romania must be established, in turn, based on some…criteria. We call these criteria meta-criteria. Meta-criteria, in turn, are the discretionary result of some desirability in the matter, functioning, from a conceptual point of view, like axioms. In fact, meta-criteria must be considered as representing the

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quintessence of belief and expectations in the matter of their object, that is, they must be considered foundations. This means that the list of meta-criteria contains, in essence, the entire conception (philosophy) of the strategy for designing and implementing excellent academic, doctoral and post-doctoral, scientific research in Romania. I propose that the list of meta-criteria in question be the following:

- (M1) the previous, exceptional scientific contributions of Romanian scientific research;
- (M2) the appetite of Romanian scientific research for "white" research;[i]
- (M3) the deficient nature of epistemologies and general methodologies in certain cognitive domains;[ii]
- (M4) unexplored or insufficiently (or erroneously) explored cognitive nodes of inter-disciplinary connection;[iii]
- (M5) the pressure of trans-disciplinarity at the border of some disciplinary domains.[iv]

Criteria to select the strategic directions of research

Based on the meta-criteria, we will be able now to establish the criteria that will lead to the choice of strategic directions of excellence in academic doctoral and post-doctoral scientific research in Romania. I propose that the list of criteria in question be as follows:

- based on M1:
  - (C1-1) proven excellence in previous academic scientific research;
  - (C1-2) presumed excellence in future academic scientific research;
- based on M2:
  - (C2-1) the propensity of Romanian researchers of excellence for fundamental approaches;
  - (C2-2) anticipation of the "population" of researchers dedicated to "white" research;
- based on M3:
  - (C3-1) reviewing the epistemological bases of some disciplinary fields;
  - (C3-2) reviewing the general methodological bases of some disciplinary fields;
- based on M4:
  - (C4-1) reviewing the existing nodes of inter-disciplinary cognitive connection;
  - (C4-2) investigating new nodes of inter-disciplinary cognitive connection;
- based on M5:
  - (C5-1) explanatory[v] incompleteness that requires new levels of reality[vi] within the same disciplinary domain (Nicolescu, 1985);
  - (C5-2) explanatory incompletions that require the invention of a new disciplinary domain.[vii]

Qualitative assessment of the criteria

A brief characterization of the logical content of the proposed criteria is provided in the table below—Table 1.

Table 1. The general content of the criteria

M	C	Content of the criterion
M1	C1-1	The criterion will consider the historical contributions of Romanian researchers to fundamental scientific research over a period of approximately 250 years. In this way, it will be possible to make assessments regarding the preponderance of certain cognitive fields in the concerns that have delivered valuable results to humanity.
	C1-2	The criterion will extrapolate the descriptive parameters obtained based on the C1-1 criterion, and will assume the continuation of comparable performances in terms of scientific significance in the

		future. Thus, a "family" of cognitive domains will be outlined in which we can expect excellent academic, doctoral and post-doctoral research to produce results of universal value.
M2	C2-1	The criterion will consider the constraint that Romania has faced for a long time regarding the lack or insufficiency of physical research infrastructure, which determined the orientation of academic scientific research mainly towards cognitive fields that required only "paper and pencil"
	C2-2	The criterion will extrapolate the structure of university specializations in Romania that will "produce" bachelor's, master's, doctoral and post-doctoral students in the cognitive fields that are part of "white" research; it will also continue to operate with the constraint related to the physical research infrastructure.
M3	C3-1	The criterion will inventory the urgent needs for the elaboration, re-elaboration or reconstruction of the epistemologies of disciplinary or interdisciplinary cognitive domains.
	C3-2	he criterion will inventory the urgent needs for the elaboration, re-elaboration or reconstruction of the logical and methodological bases of disciplinary or interdisciplinary cognitive domains.
M4	C4-1	The criterion will "catch" the (evident or less obvious) tendencies to make interdisciplinary leaps in fundamental scientific knowledge, that is, it will identify the interdisciplinary connection nodes that are currently making their interdisciplinary connection pressure felt.
	C4-2	he criterion will anticipate the trends (evident or less obvious) that will manifest themselves in the future in the direction of interdisciplinary leaps in fundamental scientific knowledge, that is, it will identify the interdisciplinary connection nodes that will make their interdisciplinary connection pressure felt in the future.
M5	C5-1	The criterion will identify the needs for trans-disciplinarity of some cognitive domains, as a result of explanatory incompleteness, without leaving the cognitive domain in question (i.e. by moving to an immediately higher level of reality).
	C5-2	The criterion will identify the needs for building/inventing new disciplinary fields, as a result of explanatory incompleteness.

(Source: Author's research)

Master's programs in academic scientific research, doctoral, and post-doctoral

Master's programs of academic research excellence are strategic frameworks of such a type of research, designed to ensure maximum coherence of research efforts in a specific area of fundamental cognitive interest, in a field, in several fields, or in an interdisciplinary intersection of such fields. Master's programs represent logical structures for the coagulation of relatively homogeneous scientific research concerns, converging towards a common general result. Master's programs will form the basis for the design of personal programs of academic scientific research excellence of doctoral supervisors or post-doctoral tutors, within which doctoral students or post-doctoral students will be enrolled.

Criteria to design the master's programs

The design of master's programs requires a set of criteria that identifies the area of cognitive interest that is specific to them and, therefore, defines them. I propose the following list of criteria for designing master's programs in academic scientific research of excellence, doctoral and post-doctoral in Romania:

- (C/o) the *general objective pursued*: this criterion will select/propose master's programs in academic scientific research of excellence, doctoral and post-doctoral, according to the final, long-term, established objective/target;

- (C/m) the *general methodology used*: this criterion will select/propose master's programs in academic scientific research of excellence, doctoral and post-doctoral, according to the logic, methods and instruments used in achieving the long-term, established objective/target;
- (C/a) the *nature of approach*: this criterion will select/propose master's programs in academic scientific research of excellence, doctoral and post-doctoral, according to the type of approach to the research object, more precisely, according to the way in which the research object is constituted for scientific exploration.

Identifying the master's programs

Based on the previous criteria, I will now proceed to identify and briefly describe the master's, doctoral and post-doctoral programs of academic economic scientific research of excellence that could operate in Romania in order to achieve the established vision (Table 2).

Table 2. The list of basic master's programs

Criterion	Code	Denomination of master's program
C/o	MP1	The logical and epistemological foundations of scientific knowledge
	MP2	Methodological foundations of scientific knowledge
C/m	MP3	Theoretical (deductive) research
	MP4	Empirical (abductive)[viii] research
C/a	MP5	Interdisciplinary scientific knowledge
	MP6	Transdisciplinary scientific knowledge

(Source: Author's research)

Nota bene: in the table above appears the master's program "Empirical (abductive) research" although, as I said, we are discussing academic research (knowledge), that is, fundamental. However, there is no inconsistency between academic research (of the fundamental research type) and empirical research: academic research (in the sense that it aims at the foundations of a cognitive field) can be either theoretical or empirical. The antonym of academic research is applied research, and the antonym of empirical research is theoretical research. Therefore, there is theoretical academic research or empirical academic research, just as there is theoretical applied research or empirical applied research. It is immediately noticeable that, from a logical point of view, theoretical and empirical academic research are exclusively disjunctive,[ix] and the same can be said about theoretical and empirical applied research.
If we make the notations: F—academic (fundamental) research; A—applied research; T—theoretical (deductive) research; E—empirical (abductive) research; TF—theoretical academic research; EF—empirical academic research; TA—theoretical applied research; EA: empirical applied research, then the following formalizations can be written:

$$F = TF \cup EF$$
$$A = TA \cup EA$$
$$T = TF \cup TA$$
$$E = EF \cup EF$$
$$TF \cap EF = \emptyset$$
$$TA \cap EA = \emptyset$$
$$C_F TF = EF$$
$$C_F EF = TF$$
$$C_A TA = EA$$
$$C_A EA = TA$$
$$C_T TF = TA$$
$$C_T TA = TF$$
$$C_E EF = EA$$
$$C_E EA = EF$$

Short description of the master's programs

PM1—Logical and Epistemological Foundations of Scientific Knowledge: this master's program will bring together academic, doctoral and post-doctoral research studies, which will aim at the critical evaluation, revision, construction or reconstruction, as appropriate, in selected cognitive domains, of the logical foundations and the epistemological "fabric" of these domains.
PM2—Methodological foundations of scientific knowledge: this master's program will bring together academic, doctoral and post-doctoral research studies, which will aim at the critical evaluation, revision, construction or reconstruction, as appropriate, on selected cognitive domains, of the general methodological foundations of these domains.
PM3—Theoretical (deductive) research: this master's program will bring together academic, doctoral and post-doctoral research studies, which will aim at the development of abstract, a-contextual[x] research, on hypothetical-deductive bases.
PM4—Empirical (abductive) research: this master's program will bring together academic, doctoral and post-doctoral research studies, which will aim at the development of concrete, contextual research, on empirical bases.[xi]
PM5—Interdisciplinary scientific knowledge: this master's program will bring together academic, doctoral and post-doctoral research studies, which will aim at the development of cognitive connections between different disciplinary domains, in an interdisciplinary manner.[xii]
PM6—Scientific knowledge trans-disciplinary: this master's program will bring together academic, doctoral and post-doctoral research studies, which will aim to "invent" new levels of explanatory reality, that is, they will transcend current disciplinary or interdisciplinary fields, building new disciplinary or interdisciplinary fields.

Strategic directions of academic scientific research of excellence, doctoral and post-doctoral

Establishing the list of criteria to choose the routes of excellence

First of all, it is necessary to find the criteria of excellence in academic scientific research. I think the following ten criteria could be considered as relevant and sufficient:

- (CE1) The problem in question is completely new.
- (CE2) The problem in question is conceptually unclear within the scientific community in the field, and the research aims to provide clarification.
- (CE3) The problem in question is conceptually unclear within the scientific community in the field, and the research aims to provide a critical assessment of the situation.
- (CE4) The problem in question is conceptually clarified, but the methodological aspect of the instrumentalization of the concept in question is not clarified, and the paper aims to provide a methodology in this matter.
- (CE5) The problem in question is conceptually clarified, there are also methodological solutions but they are inadequate, and the paper aims to provide a critical assessment of the situation.
- (CE6) The problem in question is conceptually and methodologically clarified, but the paper aims to develop an alternative methodological solution.
- (CE7) The problem in question is clarified conceptually and methodologically, but the paper aims at a conceptual and/or methodological generalization in the matter.
- (CE8) The problem in question is clarified conceptually and methodologically, but the paper aims at a conceptual and/or methodological particularization in the matter.
- (CE9) The problem in question is clarified conceptually and methodologically, but the paper aims at a falsification (in Popper's sense).

– (CE10) The problem in question is clarified conceptually and methodologically; it has already been tested, but the paper aims at a critical analysis of the conditions for the test.

Establishing the routes of excellence

Firstly, the stages/phases of identifying the routes of excellence must be established as follows:

– (P1) identifying and formulating the problem (describing the research object and its positioning in the specialized literature).
– (P2) interrogating the research object (formulating scientific questions).
– (P3) establishing the aspects that will be the subject of the actual research.
– (P4) establishing the general method of scientific approach to the research object.
– (P5) developing new hypotheses (deductively or, as a rule, abductively).
– (P6) critically evaluating existing hypotheses (through conceptual considerations).
– (P7) logical testing of hypotheses (either new or existing).
– (P8) empirical testing of hypotheses (either new or existing).

Secondly, the very routes of excellence must be established. I make the following proposals in this matter:

– (REC): (P1)→(P2)→(P3)→(P4)→(P5): route of excellence in conceptual academic scientific research—it checks the criteria of excellence: CE1, CE2 and CE3;
– (REM): (P1)→(P2)→(P3)→(P4)→(P6): route of excellence in methodological academic scientific research—it checks the criteria of excellence: CE4, CE5 and CE6;
– (REL): (P1)→(P2)→(P3)→(P4)→(P7): route of excellence in logical academic scientific research—it checks the criteria of excellence: CE7, CE8 and CE9;
– (REE): (P1)→(P2)→(P3)→(P4)→(P8): route of excellence in empirical academic scientific research—it checks the criterion of excellence: CE10.

A diagram correlating the criteria for academic excellence in research with the stages along the excellence routes is presented in Figure 1.

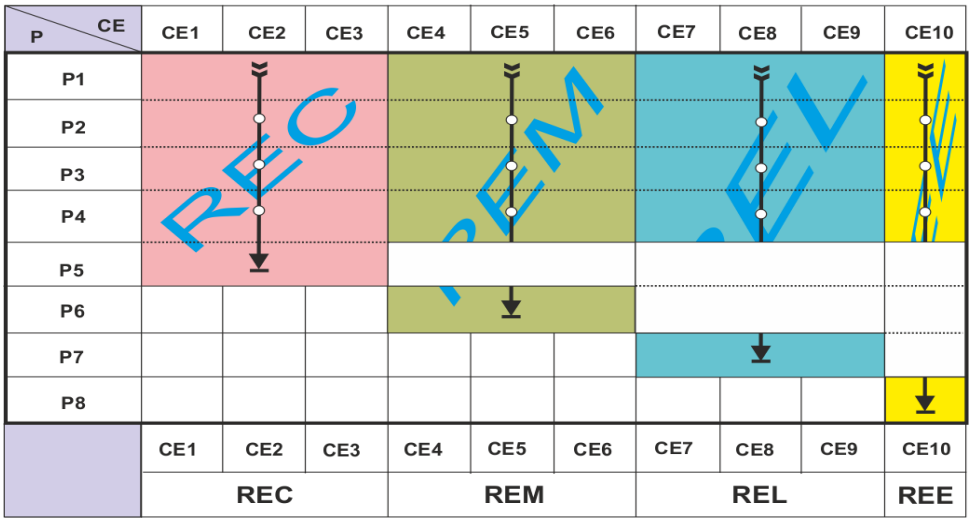

Figure 1. Criteria correlations
(Source: Author's research)

Establishing the strategic directions of research based on routes of excellence

To select the desirable, feasible, viable, reliable, and relevant strategic directions (DS-xyz), I will do that by using the matrix of analysis in Table 3.

Table 3. The matrix of analysis to choose the strategic directions

MPk / Ci-j	PM1	PM2	PM3	PM4	PM5	PM6
C1-1	DS-111	~~DS-211~~	DS-311	DS-411	~~DS-511~~	DS-611
C1-2	DS-112	~~DS-212~~	DS-312	DS-412	~~DS-512~~	DS-612
C2-1	~~DS-121~~	~~DS-221~~	DS-321	~~DS-421~~	~~DS-521~~	~~DS-621~~
C2-2	~~DS-122~~	~~DS-222~~	DS-322	~~DS-422~~	~~DS-522~~	~~DS-622~~
C3-1	DS-131	DS-231	~~DS-331~~	~~DS-431~~	~~DS-531~~	~~DS-631~~
C3-2	DS-132	DS-232	~~DS-332~~	~~DS-432~~	~~DS-532~~	~~DS-632~~
C4-1	DS-141	DS-241	~~DS-341~~	~~DS-441~~	DS-541	~~DS-641~~
C4-2	DS-142	DS-242	~~DS-342~~	~~DS-442~~	DS-542	~~DS-642~~
C5-1	~~DS-151~~	DS-251	~~DS-351~~	~~DS-451~~	~~DS-551~~	DS-651
C5-2	~~DS-152~~	DS-252	~~DS-352~~	~~DS-452~~	~~DS-552~~	DS-652

(Source: Author's research)

Discussion

So, in principle, the ten criteria for identifying strategic directions, focused on the six master's programs, give 60 strategic directions. My task now is to select the strategic directions that are: a) desirable; b) feasible; c) reliable; d) viable; e) relevant. I will carry out this selection analysis based on the content of the criteria for selecting strategic directions, on the one hand, and on the content of the master's programs, on the other hand, as these contents have been described above. The strategic directions must be integrated, based on a specific logic in a strategic plan of research (EC, 2024).

I consider that the following 24 strategic directions regarding academic economic scientific research of excellence, doctoral and post-doctoral, in Romania, can be retained as being simultaneously desirable, feasible, reliable, viable, and relevant for the vision proposed in this report:[xiii]

1. DS-111: logic of natural sciences;
2. DS-112: logic of social sciences;
3. DS-131: epistemology of theoretical (formal) sciences;
4. DS-132: epistemology of empirical sciences;
5. DS-141: theory of interdisciplinarity within natural sciences;
6. DS-142: theory of interdisciplinarity within human and social sciences;[xiv]
7. DS-231: general methodology of theoretical (formal) sciences;
8. DS-232: general methodology of empirical sciences;
9. DS-241: general methodology of interdisciplinarity;
10. DS-242: interdisciplinary methodologies in sciences;
11. DS-251: general methodology of levels of reality in scientific knowledge;
12. DS-252: general methodology of transdisciplinarity in scientific knowledge;
13. DS-311: axiomatizations in natural sciences;
14. DS-312: axiomatizations in the humanities and social sciences;
15. DS-321: invariant structures in the natural sciences;
16. DS-322: invariant structures in the humanities and social sciences;
17. DS-411: evolutionary structures in the natural sciences;
18. DS-412: evolutionary structures in the humanities and social sciences;
19. DS-541: interdisciplinary fields in the natural sciences;
20. DS-542: interdisciplinary fields in the humanities and social sciences;
21. DS-611: local, non-bivalent, finite[xv] and discrete logics in the natural sciences;
22. DS-612: local, non-bivalent, finite and discrete logics in the humanities and social sciences;
23. DS-651: meta-languages on explanatory completeness in the natural sciences;
24. DS-652: meta-languages on explanatory completeness in the humanities and social sciences

Correlation between strategic directions and routes of excellence

Both the strategic directions of doctoral and post-doctoral academic research, and the routes for conducting doctoral and post-doctoral scientific research (both identified and assessed in this report) have a common parameter: *excellence*. As a result, there is a functional[xvi] correlation between the two components (Table 4).

Table 4. Correlations between strategic direction and routes of excellence

Direction \ Route	REC	REM	REL	REE
DS-111			■	
DS-112			■	
DS-131	■			
DS-132	■			
DS-141	■			■
DS-142	■			■
DS-231		■		
DS-232		■		
DS-241	■	■		
DS-242	■	■		
DS-251	■		■	■
DS-252	■		■	■
DS-311	■			
DS-312	■			
DS-321		■	■	■
DS-322		■	■	■
DS-411		■		■
DS-412		■		■
DS-541		■	■	
DS-542		■	■	
DS-611			■	
DS-612			■	
DS-651	■	■	■	
DS-652	■	■	■	

(Source: Author's research).

Results

Ten criteria of excellence in the academic doctoral and post-doctoral research were established, based on which the final strategic directions of research should be inferred.
Six master's programs were identified and described which should prepare the candidates for academic doctoral and post-doctoral research of excellence.
Eight stages to be followed in establishing the routes of excellence in the academic scientific research of doctoral and post-doctoral types were found.
Based on the adequate (logically, and methodologically) combination of the eight stages mentioned, four routes of excellence were established.
Starting from the ten criteria and the four routes of excellence, finally, 24 strategic directions liable to provide the excellence in the academic scientific doctoral and post-doctoral research were extracted.

Conclusions

The doctoral and post-doctoral studies should provide themselves the candidates through the intermediation of master's programs, in the same "philosophy" of scientific research, so that to minimize the gap between the performance level required in that research and the actual level of the potential performance.
The establishing of the strategic directions for academic scientific research of excellence in doctoral and post-doctoral require a logical analysis, not a simple historical or empirical one.
The academic scientific research of excellence at doctoral and post-doctoral level needs to follow established routes, and strategic directions, in order to minimize the effort and to maximise the results.

AI Declaration: I did not use AI in the present paper.

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Notes

[i] "White" research is understood as research that involves a dominance of "paper" research, compared to research that involves a lot of physical research infrastructure (even if it is fundamental research, such as, for example, quantum physics). In general, academic research (i.e., fundamental research) is "white" research: logical, epistemological, methodological aspects; conceptual syntheses; new disciplinary fields; inter-disciplinarity and trans-disciplinarity, etc.
[ii] As an example, this is the case of some social disciplines (especially economics).
[iii] For example, the connection between systems theory and social theory, or the connection between the mathematical theory of stability and the theory of sustainability in economics, etc.
[iv] For example, the need for a discipline that models the emergence of novelty (for the moment, it seems that novelty cannot be the outcome of any conceivable model of rationality).
[v] Explanation means the description of a causality.
[vi] By *level of reality* is meant a meta-level in which it is possible to complete an incomplete explanation in the current level of reality (for example, the logic of the included middle represents a level of reality of an order immediately superior to the level of reality represented by the logic of the excluded middle; another example: the Gödel undecidability in axiomatic systems that include arithmetic can be eliminated in another axiomatic system that allows the elimination of this undecidability). The degree to which the new level of reality includes the old level of reality is a still unexplained issue (for example, the Einsteinian theory of gravity includes the Newtonian theory of gravity, as a particular case, whereas the logic of the included middle, evoked above, does not include the logic of the excluded middle). The level of reality is not of an ontological nature (in this latter case we are talking about levels of order), but of an epistemological nature.
[vii] Do not confuse a new disciplinary field with the refinement of an existing disciplinary field: for example, the theory of nanostructures does not represent a new disciplinary field, just as social

psychology does not represent a new disciplinary field, while thermodynamics represents such a new disciplinary field. A new disciplinary field is guaranteed exclusively by the fundamental hypothesis that establishes it and which must not be able to be found/recognized in the already known/accepted founding hypotheses. Also, border disciplines (which are, *par excellence*, inter-disciplinary—such as, for example, socio-biology or mathematical physics) should not be confused with disciplines that transcend levels of reality and are, therefore, trans-disciplinary.

[viii] Inductive research, the third type of methodological approach, has been ignored here because, practically speaking (leaving aside the epistemological paradoxes to which it leads), it is impossible: it would mean the exhaustion of all the factuals in question, not only actual, but also potential, not only from our Universe but from any possible Universe. Although such cases can also be identified (for example, God, as factual, once investigated, exhausts the factuals in the matter, because it is assumed that, in this case, the actual coincides with the potential; the problem is that here we are dealing with metaphysics and not with science; in the case of science we cannot be certain about the exhaustion of the factuals considered in inductive research).

[ix] Exclusive disjunctiveness means that the components of the disjunction are mutually complementary but, at the same time, their reunion exhausts the object of interest (for example, theoretical and empirical academic research are complementary—no element from the first "set" is part of the second "set"—but if we reunite theoretical and empirical academic research we obtain the entire academic research.

[x] In the most general sense, formal fundamental research, that is, independent of the empirical content of the concepts used.

[xi] In the most general sense, fundamental research that starts from available empirical signals (currently or potentially).

[xii] Interdisciplinarity is not a simple multi-disciplinarity. Therefore, the disciplines involved are not associated in a simple additive way, but in a synergistic way, which requires inter-disciplinary communication (at the conceptual, methodological, instrumental and hermeneutic levels).

[xiii] I will detail strategic directions for all three areas of academic scientific research, not just economics.

[xiv] s is known, the most general classification of sciences, according to the object of research, is the following: a) natural sciences (natural sciences); b) social sciences (social sciences); c) human sciences (humanities/humanistic sciences).

[xv] Here, by *finite logic* we will understand logic with a finite number of truth values, and by *discrete logic* we will understand logic with a countable set of truth values (for example, polyvalent logic). *Nota bene*: *fuzzy logic* (with an uncountable number of truth values) is a (so-called) continuous logic or of the power of the continuous.

[xvi] There are three distinct categories of correlation: a) causal correlation; b) structural correlation; c) functional correlation. Causal correlation concerns the dynamics (not simple kinematics!) of phenomena, structural correlation concerns the invariance of phenomena, and functional correlation concerns the aggregation of phenomena (including from an evolutionary perspective).